GOVERNMENT COLLEGE OF ENGINEERING, AMRAVATI

DEPARTMENT OF ELECTRONICS ENGINEERING

Curriculum for Final Year

B. Tech. (Electronics and Telecommunication)

2022-2023

Specialization: Electronics and Telecommunication

PROGRAM OBJECTIVES

PO1: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems

PO2: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

PO3: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PO12: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

(B) PROGRAM SPECIFIC OUTCOMES (PSOs)

A Graduate of the Electronics and Telecommunication program will be able to:

PSO1: Apply the concepts of Analog and Digital Electronics, Microprocessors, Signal processing and communication engineering in design and implementation of Engineering Systems.

PSO2: Solve complex problems in the field of Electronics and telecommunication using latest hardware and software tools along with analytical and managerial skills

PSO3: Acquire the social and environmental awareness with ethical responsibility to have successful carrier

GOVERNMENT COLLEGE OF ENGINEERING, AMRAVATI.

Department of Electronics Engineering.

Scheme for B. Tech. (Electronics and Telecommunication)

Semester I

Teaching Scheme							Evaluation Scheme						
Category	**Course Code**	**Course Title**	**Theory**	**Tutorial**	**Practical**		**Theory**			**Practical**		**Total**	**Credits**
			Hrs/week	**Hrs/week**	**Hrs/week**	**Total**	**MSE**	**TA**	**ESE**	**ICA**	**ESE**		
MC	SHU100	Induction Program	Two weeks mandatory audit course										0
BSC	SHU121	Physics	3	1	---	4	30	10	60	---	---	100	4
BSC	SHU122	Calculus and Linear Algebra	3	1	---	4	30	10	60	---	---	100	4
ESC	EEU121	Basic Electrical Engineering	3	---	---	3	30	10	60	---	---	100	3
ESC	CEU121	Engineering Mechanics	3	---	---	3	30	10	60	---	---	100	3
HSMC	SHU123	English	2	---	---	2	---	---	60	---	---	60	2
BSC/LC	SHU124	Physics Lab	---	---	2	2	---	---	---	50	---	50	1
ESC/LC	EEU122	Basic Electrical Engg Lab	---	---	2	2	---	---	---	50	---	50	1
ESC/LC	CEU122	Engineering Mechanics Lab	---	---	2	2	---	---	---	50	---	50	1
HSMC/LC	SHU125	English Lab	---	---	2	2	---	---	---	50	---	50	1
ESC/LC	MEU121	Workshop Practice I	---	---	2	2	---	---	---	50	---	50	1
		Total	14	2	10	26	120	40	300	250	0	710	21

Semester II

Category	Course Code	Course Title	Teaching Scheme Theory Hrs/week	Tutorial Hrs/week	Practical Hrs/week	Total	Evaluation Scheme Theory MSE	TA	ESE	Practical ICA	ESE	Total	Credits
BSC	SHU221	Chemistry	4	--	---	4	30	10	60	---	---	100	4
BSC	SHU222	Integral calculus and differential equations	3	1	---	4	30	10	60	---	---	100	4
ESC	CSU221	Programming for Problem solving	3	---	---	3	30	10	60	---	---	100	3
ESC	MEU221	Engineering Graphics	2	---	---	2	30	10	60	---	---	100	2
ESC	MEU222/ ETU221	Basic Mechanical Engineering/ Basic Electronics Engineering	2	---	---	2	30	10	60	---	---	100	2
BSC/LC	SHU223	Chemistry Lab	---	---	2	2	---	---	---	50	---	50	1
ESC/LC	CSU222	Programming for Problem solving Lab	---	---	4	4	---	---	---	50	---	50	2
ESC/LC	MEU223	Engineering Graphics Lab	---	---	4	4	---	---	---	50	---	50	2
ESC/LC	MEU224	Workshop Practice II	---	---	2	2	---	---	---	50	---	50	1
		Total	14	1	12	27	150	50	300	200	0	700	21

TA: Teacher Assessment **MSE: Mid Semester Examination** **ESE: End Semester Examination** **ICA: Internal Continuous Assessment**

MSE Duration: 1.30 Hrs all courses

Important Note:

MEU222 for only Electrical, Electronics & TC, Computer Science, Information Technology and Instrumentation Engineering branch

ETU221 for only Civil and Mechanical Engineering branch

In Semester I, the students of Civil, Mechanical, Electrical & Instrumentation Engineering shall be offered group A courses, and that of Electronics & TC, Computer Science and Information Technology shall be offered group B courses. In Semester II, vice versa.

In addition following courses are offered

SHU122 and MEU121 for all students in Semester I. SHU222 and MEU224 for all students in Semester II.

MEU222 shall be offered in Semester I for Electronics & TC, Computer Science, Information Technology branch. And it shall be offered in

Semester II for Electrical and Instrumentation Engineering branch

ETU221 shall be offered in Semester II for Civil and Mechanical Engineering branch.

There should be direct correspondence of group A and group B courses.

Sr. No.	Group A Courses		Group B Courses	
	Course Code	**Title of Course**	**Course Code**	**Title of Course**
1	SHU121	Physics	SHU221	Chemistry
2	EEU121	Basic Electrical Engineering	CSU221	Programming for Problem solving
3	CEU121	Engineering Mechanics	MEU221	Engineering Graphics
4	SHU123	English	SHU223	Chemistry Lab
5	SHU124	Physics Lab	CSU222	Programming for Problem solving Lab
6	EEU122	Basic Electrical Engineering Lab	MEU223	Engineering Graphics Lab
7	CEU122	Engineering Mechanics Lab		
8	SHU125	English Lab		

Category of Course	Definition	Credits
BSC	Basic Science Courses	**18**
ESC	Engineering Science Courses	**21**
HSMC	Humanities and Social Sciences including Management Courses	**3**
	Total Credits	**42**

GOVERNMENT COLLEGE OF ENGINEERING, AMRAVATI.
Department of Electronics Engineering.
Scheme for B. Tech. (Electronics and Telecommunication)

SEMESTER-III

Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						Credit
							Theory			Practical		Total	
			Theory Hrs/week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	MSE	ESE	ICA	ESE		
BSC	SHU321C *SHU322C	Transform And Statistical Methods *Integral Calculus And Probability	3	1	0	4	10	30	60	---	---	100	4
PCC	ETU321	Electronic Devices and Circuits	3	1	0	4	10	30	60	---	---	100	4
PCC	ETU322	Signals and Systems	3	0	0	3	10	30	60	---	---	100	3
PCC	ETU323	Digital Electronics	3	0	0	3	10	30	60	---	---	100	3
PCC	ETU324	Network Theory	3	1	0	4	10	30	60	---	---	100	4
MC	SHU323	Introduction to Constitution of India	1	--	--	1	20	---	30	---	---	50	--
PCC	ETU325	Electronics Devices and Circuits Lab.	0	0	2	2	---	---	---	25	25	50	1
PCC	ETU326	Signal and Systems Lab.	0	0	2	2	---	---	---	25	25	50	1
PCC	ETU327	Digital Electronics Lab.	0	0	2	2	---	---	---	25	25	50	1
PCC	ETU328	Computer Programming Lab.	0	0	2	2	---	---	---	25	25	50	1
	Total		**16**	**3**	**8**	**27**	**70**	**150**	**330**	**100**	**100**	**750**	**22**

TA: Teacher Assessment MSE: Mid Semester Examination ESE: End Semester Examination ICA: Internal Continuous Assessment
ESE Duration for Theory: 2.30Hrs.

*For direct second year admitted students

SEMESTER-IV

Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						Credit
							Theory			Practical		Total	
			Theory Hrs/week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	MSE	ESE	ICA	ESE		
PCC	ETU421	Probability Theory and Stochastic Processes	3	0	0	3	10	30	60	---	---	100	3
PCC	ETU422	Analog Communication	3	0	0	3	10	30	60	---	---	100	3
PCC	ETU423	Analog Circuits	3	0	0	3	10	30	60	---	---	100	3
PCC	ETU424	Microprocessors and Microcontrollers	3	1	0	4	10	30	60	---	---	100	4
PCC	ETU425	Digital System Design	3	1	0	4	10	30	60	---	---	100	4
MC	*SHU422	Environmental Studies	1	0	0	1	20	---	30	---	---	50	---
PCC	ETU426	Analog Communication Lab.	0	0	2	2	---	---	---	25	25	50	1
PCC	ETU427	Analog Circuits Lab.	0	0	2	2	---	---	---	25	25	50	1
PCC	ETU428	Microprocessors and Microcontrollers Lab.	0	0	2	2	---	---	---	25	25	50	1
	Total		**16**	**2**	**6**	**24**	**70**	**150**	**330**	**75**	**75**	**700**	**20**

TA: Teacher Assessment MSE: Mid Semester Examination ESE: End Semester Examination ICA: Internal Continuous Assessment

ESE Duration for Theory: 2.30Hrs. * ESE Duration for Theory: 1.30Hrs

Government College Of Engineering, Amravati
Department of Electronics Engineering.
Scheme for B. Tech. (Electronics and Telecommunication)

SEMESTER-V

Category	Course Code	Name of the Course	Teaching Scheme					Evaluation Scheme					Credit
								Theory		Practical		Total	
			Theory Hrs/week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	MSE	ESE	ICA	ESE		
PCC	ETU521	Electromagnetic Waves	3	1	0	4	10	30	60	---	---	100	4
PCC	ETU522	Computer Architecture	3	0	0	3	10	30	60	---	---	100	3
PCC	ETU523	Digital Communication	3	1	0	4	10	30	60	---	---	100	4
PCC	ETU524	Digital Signal Processing	3	1	0	4	10	30	60	---	---	100	4
BSC	SHU523*	Human Values and Ethics	1	0	0	1	20	--	30	---	---	50	--
HSMC	ETU525	Operational Research and Optimization	3	1	0	4	10	30	60	---	---	100	4
PCC	ETU526	Electromagnetic Waves Lab.	0	0	2	2	---	---	---	25	25	50	1
PCC	ETU 527	Computer Architecture Lab.	0	0	2	2	---	---	---	25	25	50	1
PCC	ETU528	Digital Communication Lab.	0	0	2	2	---	---	---	25	25	50	1
PCC	ETU529	Digital Signal Processing Lab.	0	0	2	2	---	---	---	25	25	50	1
	Total		**16**	**4**	**8**	**28**	**70**	**150**	**330**	**100**	**100**	**750**	**23**

TA: Teacher Assessment MSE: Mid Semester Examination ESE: End Semester Examination ICA: Internal Continuous Assessment

ESE Duration for Theory: 2.30Hrs. * ESE Duration for Theory: 1.30Hrs

SEMESTER-VI

Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						Credit
								Theory		Practical		Total	
			Theory Hrs/week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	MSE	ESE	ICA	ESE		
PCC	ETU621	Control Systems	3	0	0	3	10	30	60	---	---	100	3
PCC	ETU622	Communication Networks	3	0	0	3	10	30	60	---	---	100	3
PEC	ETU623	Program Elective – I	3	0	0	3	10	30	60	---	---	100	3
OEC	ETU633	Open Elective-I	3	0	0	3	10	30	60	---	---	100	3
PEC	ETU625	Program Elective –II	3	0	0	3	10	30	60	---	---	100	3
HSMC	ETU626	Human resource and Economics	3	0	0	3	10	30	60	---	---	100	3
PROJ	ETU627	Minor Project	0	0	4	4	---	---	---	25	25	50	2
PCC	ETU628	Communication Networks Lab.	0	0	2	2	---	---	---	25	25	50	1
PCC	ETU629	Electronic Measurement Lab.	0	0	2	2	---	---	---	25	25	50	1
	Total		**18**	**0**	**8**	**26**	**60**	**180**	**360**	**75**	**75**	**750**	**22**

TA: Teacher Assessment MSE: Mid Semester Examination ESE: End Semester Examination ICA: Internal Continuous Assessment

ESE Duration for Theory: 2.30Hrs.

GOVERNMENT COLLEGE OF ENGINEERING, AMRAVATI.
Department of Electronics Engineering.
Scheme for B. Tech. (Electronics and Telecommunication)
SEMESTER-VII

Category	Course Code	Name of the Course	Teaching Scheme					Evaluation Scheme					Credit
								Theory		Practical		Total	
			Theory Hrs/week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	MSE	ESE	ICA	ESE		
PEC	ETU721	Program Elective –III	3	0	0	3	10	30	60	---	---	100	3
PEC	ETU722	Program Elective –IV	3	0	0	3	10	30	60	---	---	100	3
OEC	ETU733	Open Elective-II	3	0	0	3	10	30	60	---	---	100	3
PEC	ETU724	Program Elective –V	3	0	0	3	10	30	60	---	---	100	3
PCC	ETU725	VLSI Design	3	0	0	3	10	30	60	--	--	100	3
PCC	ETU726	Optical Communication	3	0	0	3	10	30	60	---	---	100	3
PROJ	ETU727	Seminar	0	0	2	2	---	---	---	50	---	50	1
	Total		**18**	**0**	**02**	**20**	**60**	**180**	**360**	**50**	**---**	**650**	**19**

TA: Teacher Assessment MSE: Mid Semester Examination ESE: End Semester Examination ICA: Internal Continuous Assessment
ESE Duration for Theory: 2.30Hrs.

SEMESTER-VIII

Category	Course Code	Name of the Course	Teaching Scheme					Evaluation Scheme					Credit
								Theory		Practical		Total	
			Theory Hrs/week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	MSE	ESE	ICA	ESE		
PEC	ETU821	*Program Elective –VI	3	0	0	3	10	30	60	---	---	100	3
PROJ	ETU822	A. Project **OR** **B.** Industry Internship Project	0	0	26	26	--	--	--	200	200	400	13
	Total		**3**	**0**	**26**	**29**	**10**	**30**	**60**	**200**	**200**	**500**	**16**

TA: Teacher Assessment MSE: Mid Semester Examination ESE: End Semester Examination ICA: Internal Continuous Assessment
ESE Duration for Theory: 2.30Hrs.

***Students not present for regular classes have to complete the said course through online platform MOOCs, if available. If not then, students shall prepare with self-study mode and will appear for ESE only. (Total internal marks (MSE+TA) will be awarded proportional to marks scored in ESE), the department will provide the list of equivalent MOOC courses.**

Elective Courses:

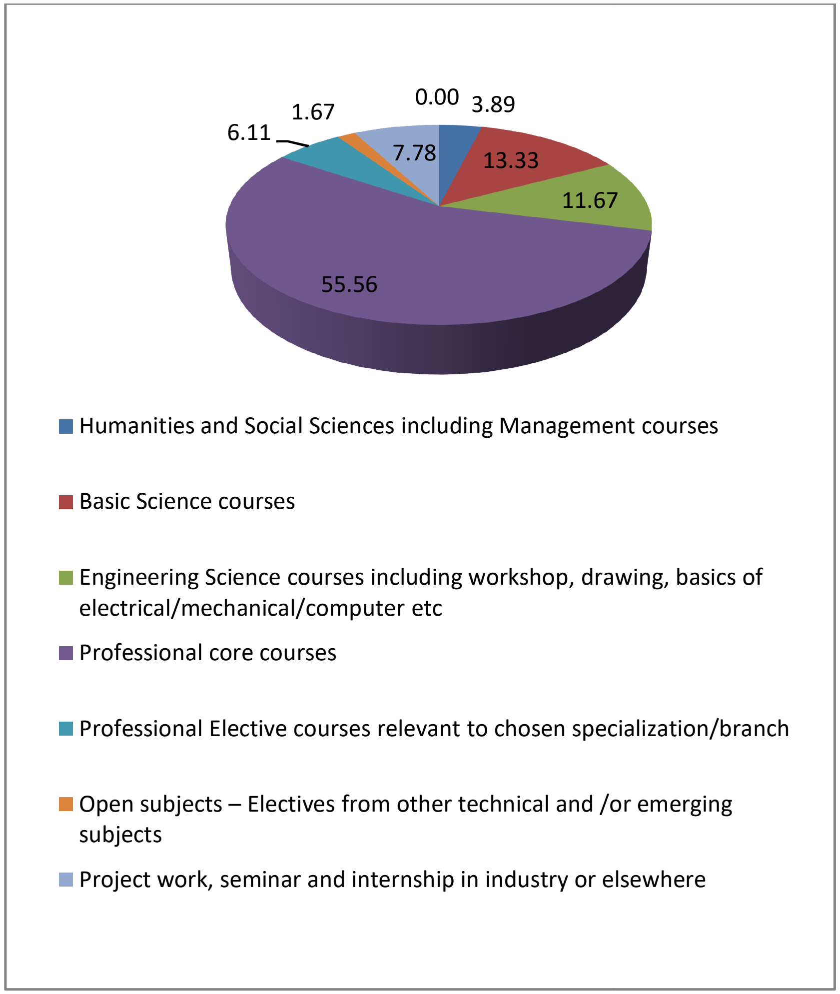
ETU633 Open Elective-I	ETU733 Open Elective-II	ETU623 Program Elective-I	ETU625 Program Elective-II	ETU721 Program Elective-III	ETU722 Program Elective-IV	ETU724 Program Elective-V	ETU821 Program Elective-VI
A) Consumer Electronics	A) Mechatronics	A)Information theory & coding	A) Microwave Engineering	A) Antennas & Wave propagation	A) Wireless Communication	A) Satellite Communication	A) Mobile Communication
B) Industrial Electronics	B) Bioengineering	B) Scientific Computing	B) Wavelets and other Engineering Transforms	B) Multirate DSP	B) Adaptive Signal Processing	B) Image and Video processing	B) Speech Processing
		C) Electronic Design Techniques with HDL	C) Micro-Electro-Mechanical Systems	C) CMOS Design	C) Mixed Signal Design	C) Nanotechnology	C) MEMS Technology
		D) Machine learning	D) Fuzzy Logic	D) Artificial Neural Network	D) Soft Computing tools	D) Pattern Recognition	D) Artificial Intelligence

Abbreviations:

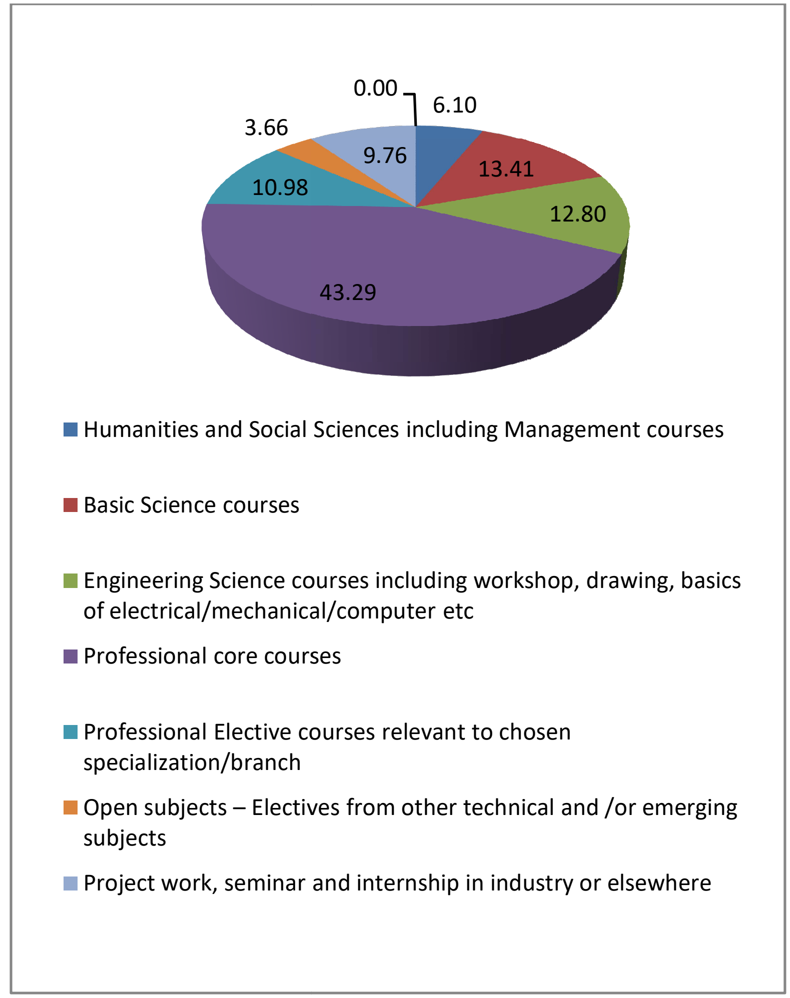
BSC Basic Science Courses
ESC Engineering Science Courses
HSMC Humanities and Social Sciences including Management courses
PCC Professional core courses
PEC Professional Elective courses
OEC Open Elective courses
LC Laboratory course
MC Mandatory courses
SI Summer Industry Internship
PROJ Project

Credit Distribution of Electronics and Telecommunication (Existing and Proposed)

S. No.		Credit Breakup for E & TC (Proposed)	Credit Breakup for E & TC (Existing)	Credit Breakup for E & TC in % (Proposed)	Credit Breakup for E & TC in % (Existing)
1.	Humanities and Social Sciences including Management courses	10	7	6.10	3.89
2.	Basic Science courses	22	24	13.41	13.33
3.	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc	21	21	12.80	11.67
4.	Professional core courses	71	100	43.29	55.56
5.	Professional Elective courses relevant to chosen specialization/branch	18	11	10.98	6.11
6.	Open subjects – Electives from other technical and /or emerging subjects	6	3	3.66	1.67
7.	Project work, seminar and internship in industry or elsewhere	16	14	9.76	7.78
8.	Mandatory Courses [Environmental Sciences, Induction Program, Indian Constitution, Essence of Indian Traditional Knowledge]	(non-credit)	(non-credit)	(non-credit)	(non-credit)
9.	Total	164	180	100.00	100.00



Credit Distribution Chart (Existing)



Credit Distribution Chart (Proposed)

Department of Electronics Engineering
Change in Course Code and Percentage Change in syllabus
Programme Name: -Electronics and Telecommunication

Sr	Course Code and Name (As per New curriculum)		Credit (New)	Equivalent Course Code and Name (As per Old curriculum)		Credit (Old)	Percentage Change in syllabus
1	ETU721A	Antennas & Wave propagation	3	ETU804	Antenna and Radar	03	50
2	ETU721B	Multirate DSP	3	Newly added		--	--
3	ETU721C	CMOS Design	3	Newly added		--	--
4	ETU721D	Artificial Neural Network	3	ETU703D ETU803D	Artificial Intelligence Fuzzy Logic and Neural Network	03 03	45 50
5	ETU722A	Wireless Communication	3	ETU803A	Wireless Communication	03	25
6	ETU722B	Adaptive Signal Processing	3	Newly added		--	--
7	ETU722C	Mixed Signal Design	3	Newly added		--	--
8	ETU722D	Soft Computing tool	3	Newly added		--	--
9	ETU733A	Mechatronics	3	Newly added		--	--
10	ETU733B	Bioengineering	3	Newly added		--	--
11	ETU724A	Satellite Communication	3	ETU804A	Satellite Communication Systems	03	10
12	ETU724B	Image and Video processing	3	ETU804D	Digital Image Processing	03	25
13	ETU724C	Nanotechnology	3	Newly added		--	--
14	ETU724D	Pattern Recognition	3	ETU703D ETU803D	Artificial Intelligence Fuzzy Logic and Neural Network	03 03	15 10
15	ETU725	VLSI Design	3	ETU803B	VLSI Design	03	20
16	ETU726	Optical Communication	3	ETU703A	Fibre Optic Communication	03	20
17	ETU727	Seminar	1	ETU709	Seminar	02	No Change
18	ETU821A	Mobile Communication	3	Newly added		--	--

19	ETU821B	Speech Processing	3	Newly added		--	--
20	ETU821C	MEMS Technology	3	Newly added		--	--
21	ETU821D	Artificial Intelligence	3	ETU703D	Artificial Intelligence	03	40
22	ETU822	A. Project **OR** **B.** Industry Internship Project	13	ETU808	Project	06	No Change

Department of Electronics Engineering
Equivalence Scheme
Programme Name: -Electronics and Telecommunication

Sr. No.	Course code with Name of course (old)		Credit	Course code with Name of course (new)		Credit
1	ETU701	Digital System Design	03	ETU425	Digital System Design	04
2	ETU702	Digital Communication	03	ETU523	Digital Communication	04
3	ETU703A	Fibre optic communication	03	ETU726	Optical Communication	03
4	ETU703B	Embedded system	03	No Equivalence Provided		--
5	ETU703C	System Software	03	No Equivalence Provided		--
6	ETU703D	Artificial Intelligence	03	ETU821D	Artificial Intelligence	03
7	ETU703E	Biomedical Engineering	03	No Equivalence Provided		--
8	ETU704A	Electronics Instruments and Applications	03	No Equivalence Provided		--
9	ETU704B	Industrial Electronics	03	ETU624B	Industrial Electronics	03
10	ETU705	Digital System Design Lab	01	No Equivalence Provided		--
11	ETU706	Digital Communication Lab	01	ETU528	Digital Communication Lab	01
12	ETU707A	Fiber optic communication Lab	01	No Equivalence Provided		--
13	ETU707B	Embedded system Lab	01			
14	ETU707C	System Software Lab	01			
15	ETU707D	Artificial Intelligence Lab	01			
16	ETU707E	Biomedical Engineering Lab	01			
17	ETU708	Project Phase-I	02	ETU822	A. Project **OR** **B.** Industry Internship Project	13
18	ETU709	Seminar	02	ETU727	Seminar	01
19	ETU710	Industrial Training and Visit	01	No Equivalence provided		--
20	ETU711	Industrial Lecture	01	No Equivalence provided		--
21	ETU712	Self Study III	02	No Equivalence provided		--
22	ETU801	Computer Network and Communication	03	ETU622	Communication Networks	03

23	ETU802	Microwave Engineering	03	ETU625A	Microwave Engineering	03
24	ETU803A	Wireless Communication	03	ETU722A	Wireless Communication	03
25	ETU803B	VLSI Design	03	ETU725	VLSI Design	03
26	ETU803C	Open Source Operating System	03	No Equivalence Provided		--
27	ETU803D	Fuzzy logic and Neural Network	03	ETU724D	Pattern Recognition	03
28	ETU803E	Bio Informatics	03	No Equivalence Provided		--
29	ETU804A	Satellite Communications systems	03	ETU724A	Satellite Communication	03
30	ETU804B	Modern Electronics Design Technique	03	No Equivalence Provided		--
31	ETU804C	Antenna and Radar	03	ETU721A	Antennas & Wave propagation	03
32	ETU804D	Digital Image Processing	03	ETU724B	Image and Video processing	03
33	ETU804E	Industrial Automation	03	No Equivalence Provided		--
34	ETU805	Computer Network and Communication Lab	01	ETU628	Communication Networks Lab.	03
35	ETU806	Microwave Engineering Lab	01	No Equivalence Provided		--
36	ETU807	Elective-II and Elective-III Lab	01	No Equivalence Provided		--
37	ETU808	Project	06	ETU822	A. Project **OR** **B.** Industry Internship Project	13
38	ETU809	Self Study-IV	02	No Equivalence Provided		--

- All students promoted to Final year with some backlog courses shall remain in old scheme (184 Credits) with old curriculum.
- All students who failed in second year (DC Students) shall be transferred to new same scheme (164 Credits) but with new curriculum.

ETU721 – PROGRAM ELECTIVE – III

ETU721 (A) ANTENNAS AND WAVE PROPAGATION

Teaching Scheme: 03L **Total: 03** **Credits: 03**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

ESE duration: 2.30hrs

Course Objectives:

Students should be able to

I. Understand the fundamental terms related to antenna.
II. Familiarize with the working principles of various types of antenna
III. Apply knowledge of antenna for wave propagation.

Fundamental Concepts: Physical concept of radiation, Radiation pattern, near-and far-field regions, reciprocity, directivity and gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation, radiation integrals and auxiliary potential functions.
Radiation from Wires and Loops: Infinitesimal dipole, finite-length dipole, linear elements near conductors, dipoles for mobile communication, small circular loop.
Aperture and Reflector Antennas: Huygens' principle, radiation from rectangular and circular apertures, design considerations, Babinet's principle, Radiation from sectoral and pyramidal horns, design concepts, prime-focus parabolic reflector and cassegrain antennas.
Broadband Antennas: Log-periodic and Yagi-Uda antennas, frequency independent antennas, broadcast antennas.
Micro strip Antennas: Basic characteristics of micro strip antennas, feeding methods, methods of analysis, design of rectangular and circular patch antennas.
Antenna Arrays: Analysis of uniformly spaced arrays with uniform and non-uniform excitation amplitudes, extension to planar arrays, synthesis of antenna arrays using Schelkunoff polynomial method, Woodward-Lawson method.
Basic Concepts of Smart Antennas: Concept and benefits of smart antennas, fixed weight beam forming basics, Adaptive beam forming.
Different modes of Radio Wave propagation used in current practice.

Text Books:
1. Antennas, . J. D. Kraus, McGraw Hill, 1988.
2. Antenna Theory - Analysis and Design, C. A. Balanis, John Wiley, 1982.

Reference Books:
1. Antennas and Radio Wave Propagation, R. E. Collin, McGraw Hill, 1985.
2. Antenna Engineering Handbook, R. C. Johnson and H. Jasik, McGraw ill, 1984.
3. Micro Strip Antennas, I. J. Bahl and P. Bhartia, Artech House, 1980.
4. Electromagnetic Waves, R. K. Shevgaonkar,Tata McGraw Hill, 2005

5. Adaptive Antennas, R. E. Crompton, John Wiley

Course Outcomes:

At the end of the course, students will be able to:

ETU721(A).1 Understand the properties and various types of antennas.

ETU721(A).2 Analyze the properties of different types of antennas and their design.

ETU721(A).3 Operate antenna design software tools and come up with the design of the antenna of required specifications.

CO-PO-PSO Mapping

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU721(A).1	2	2	1	1	0	1	1	1	2	1	1	1	1	1	1
ETU721(A).2	3	3	2	3	1	2	2	1	2	1	1	1	3	2	1
ETU721(A).3	2	1	3	2	3	1	2	1	2	1	1	1	2	1	1

0- Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

ETU721(B) MULTIRATE SIGNAL PROCESSING

Teaching Scheme: 03L **Total: 03** **Credits: 03**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

ESE duration: 2.30hrs

Course Objectives

I. Understanding of sampling, reconstruction, sampling rate conversion using multirate
II. Applications of multirate DSP – Filter design, Filterbanks
III. Mathematical framework for Reconstruction Filterbanks
IV. Introduction to Wavelets and Multichannel filter banks
V. To codify multirate DSP concepts and applications.

Introduction, Overview of Sampling and Reconstruction, Review Discrete-Time Systems, digital filters Oversampling techniques, DT processing of continuous time signals Fundamentals of Multi-rate Systems, Basic building blocks – Up sampling, down sampling, aliasing, Mathematical framework

Sampling rate change and filtering, fractional sampling rate change Interconnection of multirate DSP blocks, Multiplexer and Demultiplexer functionality, Polyphase decomposition, Noble Identities, efficient implementation of sampling rate conversion

Applications of Multirate DSP - DFT-based Filterbanks, Interpolated FIR filter design, Cascaded-Integrator-Comb (CIC) filters, Transmultiplexer,

Filterbank interpretation of Spectral analysis using DFT Two channel maximally decimated filter bank, Signal impairments - Aliasing, Magnitude distortion, Phase distortion, Aliasing cancellation

Allpass filters, properties, application in two channel filterbanks, Half-band filters, Power complementary filter pairs, Introduction to wavelets and M-channel perfect reconstruction filterbanks.

Text Books

1. Multirate Systems and Filterbanks, P. P. Vaidyanathan, Pearson, 2004, ISBN 81-297-0685-73.

2. Multirate digital signal processing: multirate systems, filterbanks, wavelets,Norbert Fliege, Wiley, 1994, ISBN 978-04719397645.

Reference Books

1. Discrete-Time Signal Processing by Alan V. Oppenheim, Ronald W. Schafer, 3rd edition, 2016, Pearson, ISBN 978-93-325-3503-92.

2. Filter Bank Transceivers for OFDM and DMT Systems, Lin,hoong & Vaidyanathan, Cambridge University Press, 2011, ISBN 978-1-107-00273-94.

3. Multirate Signal Processing for Communication Systems,Frederic Harris, Prentice Hall, 2004, ISBN 978-0131465114.

Course Outcomes: At the end of this course students will be able to

ETU721(B).1	Realize sampling, reconstruction, sampling rate conversion using multirate building blocks
ETU721(B).2	Analyze framework for Reconstruction Filter banks
ETU721(B).3	Apply multirate DSP in Filter design, Filterbanks, etc
ETU721(B).4	Analyze Wavelets and Multichannel filter banks
ETU721(B).5	Write code/program using MATLAB or similar software tool for multirate DSP principles and applications

Equivalent NPTEL course: Multirate DSP **By Prof. R. David Koilpillai | IIT Madras**
Multirate DSP - Course (nptel.ac.in)
https://onlinecourses.nptel.ac.in/noc21_ee36/preview

CO-PO-PSO Mapping

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU721(B).1	2	2	0	1	0	0	0	0	0	0	0	0	1	0	0
ETU721(B).2	3	3	1	2	0	0	0	0	0	0	0	0	2	0	0
ETU721(B).3	2	0	2	0	0	0	2	0	0	2	0	3	2	2	0
ETU721(B).4	0	0	3	0	2	0	3	0	0	2	0	2	3	3	0
ETU721(B)..5	0	0	3	0	3	0	0	0	0	2	0	3	0	3	0

0- Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

ETU721C CMOS DESIGN

Teaching Scheme: 03L **Total: 03** **Credits: 03**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

ESE duration: 2.30hrs

Course Objectives:

I. To understand fabrication processes
II. To study and analyze different current mirrors used to bias IC amplifiers
III. To understand the frequency response of amplifier designed in integrated circuits

Course Content:

VLSI Technology- NMOS, CMOS, BiCMOS, Introduction to CMOS Circuits CMOS Design Introduction: Flow of circuit design, fabrication process steps, Layout Design rules

CMOS Digital circuits: Inverter, static logic gates, Transmission Gates, Flip flop, Dynamic logic Gates, Memory circuits

BiCMOS Logic gates: Layout of Junction Isolated BJT, Modeling the NPN. BiCMOS Inverter, other BiCMOS logic gates, CMOS and ECL Conversion using BiCMOS

CMOS Analog Circuits: MOS Analog models, Current sources and sinks, References, Amplifier, Differential Amplifier, Operational amplifier

Text Books:

1. CMOS Circuit Design, Layout and Simulation, R. Jacob Baker, Harry W,Li, David E. Boyce, Prentice Hall, 2005
2. CMOS VLSI Design, Neil H. E. Weste, David Harris, Ayan Banerjee,Pearson Education, 2011

Reference Books:

1. Digital Integrated circuits: A Design Jan Rabaey, Anatha Chandrakkasan, Borivoje Nikolic,Perspective, Pearson Education, 2009
2. Modern VLSI Design, Wayne Wolf, Prentice Hall,4th edition 2009
3. Design of Analog CMOS Integrated Circuits, B. Razavi, McGraw Hill, 2011.
4. FPGA Based system Design, Wayne Wolf, Pearson, First Edition 2009

Course Outcomes:

At the end of this course students will be able to

ETU721(C).1 To know fundamental principal of VLSI circuit design flow
ETU721(C).2 Realize CMOS Fabrication Process flow
ETU721(C).3 Analyze and design differential amplifiers using CMOS
ETU721(C).4 Analyze and design active and passive current mirrors using CMOS
ETU721(C).5 Design performance parameters related to operational amplifiers

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU721 (C).1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ETU721 (C).2	0	2	0	0	0	0	0	0	0	0	0	0	0	2	0
ETU721 (C).3	0	0	3	0	0	0	0	0	0	0	0	0	2	0	0
ETU721 (C).4	0	0	0	2	0	0	0	0	0	0	0	0	0	2	0
ETU721 (C).5	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0

0- Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

ETU721(D) ARTIFICIAL NEURAL NETWORKS

Teaching Scheme: 03L+00T **Total: 03** **Credits: 03**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

ESE duration: 2 hrs 30 min.

Course Objectives:

I. To understand the fundamental theory and concepts of Artificial Intelligence.
II. To provide knowledge of artificial neural network modelling, several artificial neural network paradigms, its applications and recent trends.
III. To analyze feed forward and feedback artificial neural networks.
IV. To apply auto associative and recurrent neural networks for pattern storage and retrieve
V. To analyze self-organizing maps

Basics of Artificial Neural Networks: Introduction to biological neural network, artificial model of neuron: Mc-Culloch – Pitts model, Mathematical Preliminaries, Neural Networks and Architectures, characteristics of artificial neural networks, mathematical models of neurons.

Backpropagation networks: Architecture of feed forward network, single layer perceptron, multilayer perceptron, back propagation learning, input - hidden and output layer computation, backpropagation algorithm, applications, selection of tuning parameters in BPN, Numbers of hidden nodes, learning.

Fast learning methods: Conjugate gradient method. Auto associative neural networks, Pattern storage and retrieval, Hopfield model, Radial basis function networks: Regularization theory, RBF networks for function approximation, RBF networks for pattern classification.

Self-organizing maps and recent trends: Pattern clustering, Topological mapping, Kohonen's self-organizing maps, introduction to deep neural networks: convolutional neural networks, recurrent neural networks, long short term memory.

Applications of ANN: Pattern classification, Recognition of printed Characters, Recognition of handwritten characters, English text to speech. Recognition of consonant vowel (CV) segments, texture classification and segmentation.

Text Books:

1. A Classroom Approach, Satish Kumar, Neural Networks,Tata McGraw-Hill, 2003

2. Neural Networks, A Comprehensive Foundation, S.Haykin,Prentice Hall, 1998.
3. Introduction to Artificial Neural Networks, Jacek Zurada, Jaico Publishing House, 1997.

Reference Books:

1. Pattern Recognition and Machine Learning, C.M.Bishop, Springer, 2006.
2. Deep Learning, Ian Goodfellow and Yoshua Bengio and Aaron Courville MIT Press, 2016

Course Outcomes

On successful completion of the course the students will be able to:

ETU721(D).1 know the basic ANN architectures, algorithms, and their limitations.
ETU721(D).2 understand the Various Learning methodologies.
ETU721(D).3 get expertise in the use of different ANN structures and algorithm.
ETU721(D).4 develop ANN based models.

CO-PO-PSO Mapping

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU721(D).1	2	2	1	1	3	1	0	0	0	0	0	0	1	1	1
ETU721(D).2	2	2	1	1	2	1	1	0	0	0	0	0	2	1	1
ETU721(D).3	3	3	2	2	2	1	1	1	0	0	0	0	3	2	1
ETU721(D).4	2	1	3	3	2	1	1	1	0	0	0	0	3	3	1

0- Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

ETU722 – PROGRAM ELECTIVE – IV

(A)WIRELESS COMMUNICATION

Teaching Scheme: 03L **Total: 03** **Credits: 03**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

ESE duration: 2Hrs.30Min.

Course Objectives:

The students shall be able

I. To get introduced to the wireless communication systems
II. To study the multiple access techniques used in wireless communication
III. To study the various system standards used in wireless communication
IV. To study the cordless system and other wireless systems

Introduction: Evolution of Wireless Communication, advantages and disadvantages, Different types of Wireless Systems, Evolution to Next-Generation Wireless Networks, and Applications.

Multiple Access Technique: Frequency division multiple access (FDMA), time division multiple access (TDMA), frequency hop multiple access (FHMA), space division multiple access (SDMA).

Wireless Systems and Standards: Global system for mobile (GSM), system architecture, radio subsystem, channel types, frame structure, signal processing in GSM, code division multiple access CDMA (IS-95), frequency and channel specifications, forward and reverse CDMA channel.

Cordless Systems and WLL: Introduction to cordless systems, cordless telephony standard (CT2) and digital enhanced cordless telecommunication (DECT): standards, architecture, frame format and radio link, operation; IEEE802.16, role of wireless local loop (WLL), propagation considerations for WLL, local multipoint distribution services (LMDS) and multichannel multipoint distribution services (MMDS).

Wireless LAN: Overview, technologies; types: infrared, spread-spectrum, narrow band microwave LAN, mobile data networks, cellular digital packet data (CDPD), global packet for radio service (GPRS), wireless application protocol (WAP), introduction to Bluetooth technology

Text Books

1. Wireless Communications Principles and Practice, T. S. Rappaport, 2nd edition, Pearson Education, 2010
2. Wireless Communications, T.L.Singhal, 4th reprint, Tata McGraw Hill, 2012

Reference Books

1. Mobile Cellular Telecommunications, W. C.Y. Lee, 2nd edition, MGH, 2006
2. Wireless Communications and Networks, W. Stallings, 2nd edition, Pearson Education, 2009
3. Mobile Cellular Communication, G.S.Rao, 1st edition, Pearson Education, 2013

Course Outcomes:

After completing this course, Students shall be able to:

ETU722(A).1 Understand the functioning of wireless communication systems, and their evolution

ETU722(A).2 Demonstrate ability to explain various multiple access techniques for Wireless communication

ETU722(A).3 Compare the various wireless system standards

ETU722(A).4 Understand cordless and wireless local loop concepts

ETU722(A).5 Understand the concept of different wireless networks and Bluetooth technology

CO-PO-PSO Mapping

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU722(A).1	2	1	1	1	2	-	-	-	-	-	-	-	2	1	1
ETU722(A).2	2	2	3	2	2	-	-	-	-	-	-	-	3	2	1
ETU722(A).3	3	3	2	3	2	-	-	-	-	-	-	-	3	2	1
ETU722(A).4	3	3	2	3	2	-	-	-	-	-	-	-	3	2	1
ETU722(A).5	3	3	2	3	2	-	-	-	-	-	-	-	3	2	1

0- Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

ETU722(B) ADAPTIVE SIGNAL PROCESSING

Teaching Scheme: 03L+00T **Total: 03** **Credits: 03**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

ESE duration: 2.30hrs

Course Objectives:

The students shall be able to

I. Understand the need of Adaptive signal processing
II. Study to know the components of ASP
III. Study and use various algorithm for error minimization
IV. Realize importance of orthgonalizaion, linear prediction and autoregressive modelling
V. Encode and simulate the algorithm, processes and applications

Adaptive Signal Processing (ASP), Introduction to Adaptive Filters Introduction to Stochastic Processes, Stochastic Processes, Correlation Structure, FIR Wiener Filter

Steepest Descent Technique, LMS Algorithm, Convergence Analysis, Convergence Analysis (Mean Square), Convergence Analysis (Mean Square), Misadjustment and Excess MSE

Sign LMS Algorithm, Block LMS Algorithm, Fast Implementation of Block LMS Algorithm, Vector Space Treatment to Random Variables

Orthogonalization and Orthogonal Projection, Orthogonal Decomposition of Signal Subspaces, Introduction to Linear Prediction, Lattice Filter, Lattice Recursions, Lattice as Optimal Filter

Linear Prediction and Autoregressive Modeling, Gradient Adaptive Lattice, Gradient Adaptive Lattice, Introduction to Recursive Least Squares, RLS Approach to Adaptive Filters, ,

Text Books

1.Bernard Widrow and Samuel D. Stearns, ―Adaptive Signal Processing‖, Person Education, 1985.

Reference Books:

1. Simon Haykin, ―Adaptive Filter Theory‖, Pearson Education, 2003.

2. John R. Treichler, C. Richard Johnson, Michael G. Larimore, ―Theory and Design of Adaptive Filters‖, Prentice-Hall of India, 2002.

Course Outcomes: At the end of this course students will be able to

ETU722(B).1 Elaborate the importance of signal processing in non-stationary environment.

ETU722(B).2 Interpret and justify various components of Adaptiver signal processing

ETU722(B).3 Explain and compare and the role of adaptive signal processing in communications

ETU722(B).4 Apply the various mathematical models to adaptive signal processing. and minimum error

ETU722(B).5 Write Code and use simulation tools related to the concepts of ASP and applications

Equivalent NPTEL course:
Adaptive Signal Processing Video course in Electronics & Communication Engineering by Prof. Mrityunjoy ChakrabortyIIT Kharagpur--
Url: https://nptel.ac.in/courses/117/105/117105075/#
Link: NPTEL :: Electronics & Communication Engineering - Adaptive Signal Processing

CO-PO-PSO Mapping

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU722(B).1	2	1	0	1	0	0	0	0	0	0	0	0	1	0	0
ETU722(B).2	2	2	2	2	0	0	0	0	0	0	0	0	2	0	0
ETU722(B).3	2	3	2	3	0	0	2	0	0	2	0	2	3	2	0
ETU722(B).4	3	0	3	0	2	0	2	0	0	2	0	2	3	3	0
ETU722(B).5	0	0	3	0	3	0	0	0	0	3	0	3	0	3	0

0- Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

ETU722(C) MIXED SIGNAL DESIGN

Teaching Scheme: 03L **Total: 03** **Credits: 03**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

ESE duration: 2.30hrs

Course Objectives:

I. To understand basics of analog and digital signal VLSI design
II. To understand the inter-conversions between signals
III. To describe mixed signal design using ADC and DAC
IV. To study analog and digital PLL

Analog and discrete-time signal processing, introduction to sampling theory; Analog continuous-time filters: passive and active filters; Basics of analog discrete-time filters.

Switched-capacitor filters: Nonidealities in switched-capacitor filters; Switched-capacitor filter architectures; Switched-capacitor filter applications.

Basics of data converters; Successive approximation ADCs, Dual slope ADCs, Flash ADCs, Pipeline ADCs, Hybrid ADC structures, High-resolution ADCs, DACs.

Mixed-signal layout, Interconnects and data transmission; Voltage-mode signaling and data transmission; Current-mode signaling and data transmission.

Introduction to frequency synthesizers and synchronization; Basics of PLL, Analog PLLs; Digital PLLs; DLLs.

Text Books:

1. CMOS mixed-signal circuit design, R. Jacob Baker, Wiley India, IEEE press, reprint 2008.

Reference books:

1. CMOS circuit design, layout and simulation, R. Jacob Baker, Revised second edition, IEEE press, 2008.
2. Design of analog CMOS integrated circuits, Behzad Razavi, McGraw-Hill, 2003.

Course Outcomes:

At the end of the course, student will demonstrate the ability to

ETU722(C).1	Understand the practical situations where mixed signal analysis is required.
ETU722(C).2	Analyze and handle the inter-conversions between signals.
ETU722(C).3	Analyze the mixed signal design using ADC and DAC
ETU722(C).4	Understand analog and digital PLL.

ETU722(C).5 Design systems involving mixed signals

CO-PO-PSO Mapping

CO	PO/PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU722(C).1	1	2	1	1	1	0	1	0	0	0	1	1	1	1	0
ETU722(C).2	2	3	2	2	3	1	2	1	1	1	2	2	3	3	1
ETU722(C).3	2	3	2	2	3	1	2	1	1	1	2	2	3	3	1
ETU722(C).4	1	3	1	1	3	0	1	0	0	0	1	1	1	1	0
ETU722(C).5	2	2	3	3	2	1	3	2	2	2	2	3	3	3	1

0- Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

ETU722(D) SOFT COMPUTING TOOLS

Teaching Scheme: 03L **Total: 03** **Credits: 03**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

ESE duration: 2.30hrs

Course Objectives:

The students shall be able

I. To provide an introduction to the basic principles, techniques, and applications of Soft Computing.
II. To understand the basic areas of Soft Computing including Artificial Neural Networks, Fuzzy Logic and Genetic Algorithms.
III. To provide the mathematical background for carrying out the optimization associated with Soft Computing.
IV. To develop some complex methods in Soft Computing by working on design project.

Introduction to Soft Computing**:** Soft Computing vs. Hard Computing, various types of Soft Computing Techniques, Fuzzy Computing, Neural Computing, Genetic Algorithms, Applications of Soft Computing.

Fundamentals of Artificial Neural Network : Introduction, Model of Artificial Neuron, Architectures, Learning Methods, Deep learning, Taxonomy of ANN Systems, Single Layer ANN System, Supervised Learning Neural Networks, Perceptrons, Adaline, Backpropagation, Mutilayer Perceptrons, Applications of ANN.

Fuzzy Set Theory & Fuzzy Systems : Fuzzy set theory, Fuzzy set versus crisp set, Crisp relation & fuzzy relations, introduction & features of membership functions, Extension Principle, Fuzzy If-Then Rules, Fuzzification, Defuzzification, Applications.

Genetic Algorithms and Hybrid Systems: Fundamentals of Genetic Algorithms, basic concepts, working principle, encoding, fitness function, reproduction, Genetic Modeling, Research orientation of Soft Computing techniques.

R programming for Data Science: History and Overview of R, Basic features of R, Design of the R system, Limitations of R, Arithmetic Operators, Logical Operations, Functions, variables and data types, Creating Variables, Numeric, Character and Logical Data, Vectors, Data Frames ,Factors ,Sorting Numeric, Character, and Factor Vectors , Special Value.

Text Books:

1. Soft Computing, D. K. Pratihar, Narosa, 2008 .
2. Neural Networks, Fuzzy Logis and Genetic Algorithms: Synthesis, and Applications, S. Rajasekaran, and G. A. Vijayalakshmi Pai, Prentice Hall of India, 2007
3. R Programming for Data Science, Roger D. Peny

Reference Books:

1. Neuro-Fuzzy and soft Computing, J.-S. R. Jang, C.-T. Sun, and E. Mizutani, PHI Learning, 2009.

2. Genetic Algorithms in Search, Optimization And Machine Learning, David E. Goldberg, Pearson Education, 2002

3 Data Science, Wickham, H. & Grolemund, G.,O'Reilly: New York. 2018. Available for free at http://r4ds.had.co.nz

4. R Fundamentals, Sosulski, K, Bookdown: New York.. (2018).
Available at: http:// becomingvisual.com/rfundamentals

Required software:

1. R: http://www.r-project.org/ (FREE)
2. R Studio (additional libraries required): http://www.rstudio.com/ (FREE)

Course Outcomes:

At the end of this course students will be able to

Understand and apply the concept of human intelligence and Artificial Intelligence.

ETU722(D).1 Understand the genetic algorithms and other random search procedures and apply it to find out global optimum solutions in self-learning situations.

ETU722(D).2 Understand the fundamental syntax of R through readings, practice exercises, demonstrations, and writing R code.

ETU722(D).3 Apply critical programming language concepts such as data types, iteration, functions and Boolean operators by writing R programs and through examples.

ETU722(D).4 Solve the complex problems and methods in Engineering using Soft Computing Techniques.

CO-PO-PSO Mapping:

CO	PO/PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU722(D).1	1	1	0	0	3	0	0	0	0	0	0	0	1	0	0
ETU722(D).2	1	2	0	3	2	0	0	0	0	0	0	0	1	2	0
ETU722(D).3	2	2	2	2	3	2	0	0	0	0	0	0	2	1	0
ETU722(D).4	1	2	0	2	2	0	0	0	0	0	0	0	1	2	0
ETU722(D).5	3	3	1	3	2	3	0	0	0	0	0	0	3	3	0

0- Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

ETU733 – OPEN ELECTIVE – II

ETU733(A) MECHATRONICS

Teaching Scheme: 03L **Total: 03** **Credits: 03**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

ESE duration: 2.30hrs

Course Objectives:

The students shall be able

I. To understand the Mechatronics system and its components.
II. To familiarize with the working principles of various sub-systems
III. To apply knowledge of engineering to make a blended system.

Introduction to Mechatronics: Introduction, The Design Process, System Components, Examples of Mechatronic systems.

Sensors and Transducers: Performance Terminology of Sensors, Displacement, Position & Proximity Sensors, Velocity and Motion, Vibration and Acceleration, Force, Fluid Pressure, Liquid Flow Sensors, Temperature, Light sensor.

Signal Conditioning: Introduction to Signal Conditioning, Analog Signal Conditioning, Analog to Digital Converter, Digital to Analog Converter, Multiplexers, Data Acquisition, Controller, Serial and Parallel Data Communication, Communication Interfaces, Fault findings: common hardware faults

Actuators and Mechanisms: Overview of Mechanical Actuation System, Hydraulic & Pneumatic Actuation System, Electrical Actuation System, Data Presentation Systems

Closed Loop Controllers: Proportional control, Integral control, PID Controllers, Digital Controllers

Modeling and System Response: Mechanical System, Electrical System, Fluid System Building Blocks, Dynamic Response of Systems, Transfer Function and Frequency Response.

Design and Mechatronics: Hard Disc Drive system, Myoelectrically Controlled Robotic Arm, Mechatronic Design of a Robotic Walking Machine.

Text Books:

1. Mechatronics: Electronic Control systems in Mechanical and Electrical Engineering, W. Bolton, Pearson Education Limited, 6th edition, 2015
2. Introduction to Mechatronics and Measurement Systems: David G. Alciatore, Michael B. Histand, Tata Mc Graw Hill, 4th edition

References:

1. Mechatronic System Design: Devdas Shetty, Dedas, Richard A. Kolk, Cengage Learning, 2nd edition, 2011
2. The Mechatronic Handbook: Robert H. Bishop; CRC press, 2nd edition, 2008
3. Intelligent Mechatronic Systems: Modeling, Control and Diagnosis, Rochdi Merzouki, Arun Kumar Samantaray, Pushparaj Mani Pathak, Belkacem Ould Bouamama, Springer, London, 1st edition, 2013

NPTEL course on 'Mechatronics' by Prof. Pushpraj Mani Pathak, IIT Roorkee

Course Outcomes:

After completing this course, students will be able to:

ETU733(A).1 Realize the mechatronics systems components.

ETU733(A).2 Understand and Apply the working principle of sensors and transducers.

ETU733(A).3 Understand various signal conditioning, processing and actuator mechanisms.

ETU733(A).4 Demonstrate the working of controllers.

ETU733(A).5 Identify and Select the system components to model and design a mechatronics system.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU733(A).1	2	2	1	1	0	1	1	0	3	1	1	1	2	1	1
ETU733(A)..2	3	3	2	1	1	1	2	0	3	1	1	1	3	1	1
ETU733(A).3	2	2	2	1	1	1	2	0	3	1	1	1	2	1	1
ETU733(A).4	2	2	2	1	1	1	2	0	2	1	1	1	3	1	1
ETU733(A)..5	3	3	3	1	2	2	3	1	3	1	2	3	3	2	2

0- Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

ETU733 – OPEN ELECTIVE – II

ETU733(B) BIOENGINEERING

Teaching Scheme: 03L **Total: 03** **Credits: 03**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

ESE duration: 2Hrs.30Min.

Course Objectives:

The students shall be

I Aware about the conjunction of Biology with Engineering
II Able to get acquainted with multi-disciplinary application fields in bioengineering
III Able to understand the basic concepts of bioinformatics and biosensors
IV Able to acquire basic knowledge about the biomedical engineering

Introduction to Bioinformatics, goal, scope, applications.

Database and its types, biological databases, pitfalls in biological databases, information retrieval from biological database, unique requirements for database searching, Heuristic database searching, Basic Local Alignment Search Tool (BLAST), FastAll (FASTA).

Introduction to Biosensors, basic principle, components of biosensors, types of biosensors – electrochemical, optical.

Brief introduction to human physiology, Biomedical transducers: displacement, velocity, force,
acceleration, flow, temperature, potential, dissolved ions and gases, Bio-electrodes and biopotential amplifiers for ECG, EMG, EEG.

Basic X-ray components and circuits, types of X-ray machines biological effects of X-rays and precautions, computerized axial tomography (CAT), ultrasonic and MRI Techniques: Foetus monitoring, introduction to T-rays.

Text Books

1. Essential Bioinformatics, Jin Xiong, 1st edition, Cambridge University Press, 2006
2. Biosensors: Fundamentals and Applications, Bansidhar Malhotra and Chandra Mouli Pandey, 1st edition, Smithers Rapra Technology Limited, 2017

Reference Books

1. Biomedical Instrumentation and Measurements, L. Cromwell, F.J. Weibell, E.A.Pfeiffer, 2nd edition, PHI Learning, 2011

2. Biomedical Instrumentation, R. S. Khandpur, 6th edition, TMH, 2004

3. Biosensors and Bioelectronics: Chandran Karunakaran, Kalpana Bhargava, Robson Benjamin, 1st edition, Elsevier Publications, 2015

Course Outcomes:

After completing this course, Students will be able to:

ETU733(B).1	Identify the multidisciplinary applications of bioengineering
ETU733(B).2	Understand the basic concepts of application of principles of biology and engineering tools
ETU733(B).3	Understand the technical aspects of existing technologies capable of addressing the biological and medical challenges faced by mankind
ETU733(B).4	Apply the knowledge information extraction databases useful in computer modeling
ETU733(B).5	Apply acquired knowledge to identify usable and cost efficient solutions in bioengineering

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU733(B).1	2	3	1	1	0	0	0	0	0	0	0	0	3	1	2
ETU733(B).2	3	3	2	2	0	0	0	0	0	0	0	0	3	1	2
ETU733(B).3	3	3	2	1	1	3	2	0	0	1	2	1	3	3	2
ETU733(B).4	3	3	2	2	2	1	1	0	0	0	0	0	3	3	1
ETU733(B).5	3	3	2	2	2	2	3	0	0	2	2	1	3	3	1

0- Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

ETU724 – PROGRAM ELECTIVE – V

ETU724(A)SATELLITE COMMUNICATION

Teaching Scheme: 03L **Total: 03** **Credit: 03**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total marks: 100**

ESE duration: 02 Hrs 30 min.

Course Objective:

Students will be able to

I Enable the student to become familiar with satellites and satellite services.
II Study of satellite orbits and launching.
III Gain the knowledge about earth segment and space segment components
IV Learn about the science behind the orbiting satellites, various multiplexing schemes and earth station parameters used for satellite communication

Overview of Satellite Systems: Satellite frequency bands, satellite types, orbit, modulation, transmission and multiplexing, launching and positioning methods, Kepler's law, orbital aspects of satellite communication, orbital period and velocity, effects of orbital inclination, azimuth and elevation, coverage angle and slant range, orbit determination, orbit perturbations, orbital spacing and capacity.

Satellite Construction (Space Segment): Introduction; attitude and orbit control system; telemetry, tracking and command; power systems, communication subsystems, antenna subsystem, equipment reliability and space qualification

Physical Media and Link Components: Microwave bands for satellite communication, Satellite microwave link calculations: general link design equation, system noise temperature, uplink design, downlink design, complete link design, effects of rain, antennas, gain temperature (G/T) ratio.

Modulation Schemes used in Satellite Links: FDMA, TDMA and packet switched systems; spread spectrum techniques and CDMA systems, Satellite systems.

Application of Satellite Communication: Earth station technology and satellite services, earth station design, tracking, equipment for earth station, domestic satellite systems using small earth stations, VSAT, Global positioning system, satellite navigation, direct broadcast satellite television and radio, satellite services and the internet.

Text Books

1. Satellite Communication, D. Roddy, 4 th edition, Tata McGraw Hill, 2008

2. Satellite Communication, P. Timothy, B. W. Charles and J. Allnutt, 2nd edition, Willey International Publication, 2006

Reference Books

1. Satellite communication , Timothy Pratt, Charles Bostian, Jeremy Allnut, John Willey and Sons Inc. Second edition
2. Satellite Communication, R. M. Gagliardi, 1 st edition, CBS publications and Distributors, 2004.
3. Satellite Communication systems engineering, W. L. Pritchard, H. G. Suyderhoud, R. A. Nelson, 2 nd edition, Pearson Education, 2003

Course Outcome:

At the end of the course students will be able to

ETU724(A).1 Apply knowledge about the Satellite communications Principles properties.

ETU724(A).2 Analyze the effects of various parameters on Satellite System performance.

ETU724(A).3 Discuss and understand how analog and digital technologies are used for satellite communication networks.

ETU724(A).4 Design Satellite Earth station antennas and link power budget for satellites.

ETU724(A).5 Understands the applications of Satellite Communication.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU724(A).1	3	1	1	1	3	0	0	0	0	1	1	2	3	1	1
ETU724(A).2	2	1	0	0	1	0	0	0	0	1	1	1	3	2	1
ETU724(A).3	3	2	1	1	1	0	0	0	0	1	2	1	1	1	1
ETU724(A).4	3	1	3	2	1	0	0	0	0	0	0	0	1	2	0
ETU724(A).5	2	2	3	2	2	0	0	0	0	0	1	1	2	0	1

0-Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

ETU724(B) DIGITAL IMAGE AND VIDEO PROCESSING

Teaching Scheme: 03L **Total: 03** **Credits: 03**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

ESE duration: 2.30hrs

Course Objectives:

The student shall be able

I. To understand the fundamentals of digital image and video processing and algorithms for most of the work currently underway in this field.

II. To get a clear impression of the breadth and practical scope of digital image and video processing

III. To develop conceptual understanding which will enable them to undertake further study, research and/or implementation work in this area.

Digital Image Fundamentals: Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Basic Relationships between Pixels – Neighbourhood, Adjacency, Connectivity, Distance Measures. Color image fundamentals-RGB-HSI models

Two Dimensional Transforms: Discrete Fourier Transform, Discrete Cosine Transform, Walsh and Hadamard Transform, Haar Transform, Discrete Wavelet Transform, and its applications.

Image Enhancement Spatial Domain: Point Processing, Digital Negative, Contrast Stretching, Thresholding, Gray Level Slicing, Bit Plane Slicing, Log Transform and Power Law Transform, Histogram Equalization and Specification, Neighbourhood Processing: Averaging Filters, Order Statistics Filters, High Pass Filters and High Boost Filters, Frequency Domain Filtering.

Image Compression-Redundancy–inter-pixel and psycho-visual; Lossless compression – predictive, entropy; Lossy compression- predictive and transform coding. Image compression standards, Application in various fields

Image Segmentation: Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding – Global and Adaptive, Region-Based Segmentation.

Fundamentals of Video Coding, Motion Estimation Techniques, Full Search, Fast Search Strategies, Forward And Backward Motion Prediction

Video Processing: display enhancement, video mixing, video scaling, scan rate conversion, representation of digital video, Spatio-temporal sampling, video compression-motion estimation, intra and interframe prediction, perceptual coding,Elements of a Video Encoder and Decoder; Video Coding Standards – MPEG And H.26X.

Text Books:

1. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Second Edition, Pearson Education, 3rd edition ,2008.
2. Thomas B. Moeslund, Introduction to Video and Image Processing (Building Real Systems and Applications), Springer London Dordrecht Heidelberg New York2012.

Reference Books:

1. Anil Kumar Jain, Fundamentals of Digital Image Processing, Prentice Hall of India.2nd edition 2004
2. Murat Tekalp , Digital Video Processing, Prentice Hall, 2nd edition 2015
3. John W. Woods, "Multidimensional Signal, Image and Video Processing", booksite.elsevier.com, 2^{nd} edition 2011.

Course Outcomes:

At the end of the course, students will be able to

ETU724(B).1 Mathematically represent the various types of images and analyze them.
ETU724(B).2 Explain the need of spatial and frequency domain techniques for image compression.
ETU724(B).3 Process these images for the enhancement of certain properties or for optimized use of the resources.
ETU724(B).4 Understand the colour image processing
ETU724(B).5 Study the fundamentals of video processing and understand the video encoding and decoding.

SWAYAM/NPTEL Course on Digital video and Image processing (IIT KHARAGPUR)
https://nptel.ac.in/courses/117/105/117105079

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU724(B).1	2	3	0	0	0	0	0	0	0	0	0	3	3	0	0
ETU724(B).2	2	2	0	0	0	0	0	0	0	0	0	0	1	3	0
ETU724(B..3	3	2	0	0	0	0	0	0	0	0	0	3	2	3	0
ETU724(B).4	2	3	0	0	0	0	0	0	0	0	0	0	2	3	0
ETU724(B).5	1	2	3	0	0	0	0	0	0	0	0	0	2	0	0

0-Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

ETU724© NANOTECHNOLOGY

Teaching Scheme: 03L **Total: 03** **Credits: 03**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

ESE duration: 2.30hrs

Course Objectives:

I To study various aspects of nanotechnology
II To explain various aspects of nanotechnology and the processes involved in making nano components and material
III To describe advantages of the nano materials and appropriate use in solving practical problems
IV To study the advancements of semiconductor materials for future electronics

Introduction to nanotechnology, meso structures, Basics of Quantum Mechanics: Schrodinger equation, Density of States. Particle in a box concepts, Degeneracy. Band theory of solids. Kronig-Penny Model. Brillouin Zones.

Shrink-down approaches: Introduction, CMOS Scaling, The nanoscale MOSFET, Finfets, Vertical MOSFETs, limits to scaling, system integration limits (interconnect issues etc.),

Resonant Tunneling Diode, Coulomb dots, Quantum blockade, Single electron transistors, Carbon nanotube electronics, Band structure and transport, devices, applications, 2D semiconductors and electronic devices, Graphene, atomistic simulation

Text Books:

1. Introduction to Nanotechnology, C.P. Poole, F. J. Owens, Wiley, 2003
2. Fundamentals of Nanoelectronics, G.W. Hanson, Pearson, 2009

Reference books:

1. Nanoelectronics and Information Technology (Advanced Electronic Material and Novel Devices), W. Ranier, Wiley, 2003.

Course Outcomes:

At the end of the course, students will be able to

ETU724(C).1 Understand various aspects of nanotechnology for making nano components and material.
ETU724(C).2 Study the processes involved in making nano components and material.
ETU724(C).3 Leverage advantages of the nano materials.
ETU724(C).4 Study appropriate use of the nano materials in solving practical problems.
ETU724(C).5 Understand the requirement of futuristic of semiconductor material

CO-PO-PSO Mapping

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU724(C).1	3	3	1	1	1	0	0	0	0	0	0	0	0	0	0
ETU724(C).2	3	3	2	0	0	0	0	0	0	0	0	0	0	0	0
ETU724(C).3	3	1	1	0	0	0	0	0	0	0	0	0	0	0	0
ETU724(C).4	3	2	2	0	1	0	1	0	0	0	1	0	0	1	0
ETU724(C).5	3	2	1	2	2	1	1	0	0	0	1	0	0	1	0

0-Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

ETU724(D)PATTERN RECOGNITION

Teaching Scheme: 03L **Total: 03** **Credits: 03**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

ESE duration: 2.30hrs

Course Objectives:

Students shall be able to

I. understand basic concepts in pattern recognition.
II. gain knowledge about state-of-the-art algorithms used in pattern recognition research.
III. understand pattern recognition theories, such as Bayes classifier, linear discriminate Analysis etc.
IV. apply pattern recognition techniques in practical problems.

Basics of Pattern Recognition: Pattern recognition system, decision boundary and classifier, components of pattern recognition system, design principles, structural approach, Feature of pattern recognition process, phases and activities.

Review of Probability, Random Processes and Linear Algebra: Probability, conditional and joint probability, Bayes theorem Random Processes: Stationary and non-stationary processes, Expectation, Autocorrelation, Cross-Correlation, inner product, outer product, inverses, Eigen values, Eigen vectors, singular values, singular vectors.

Bayes Decision Theory: Minimum-error-rate classification. Classifiers, Discriminant functions, Decision surfaces. Normal density and discriminant functions. Discrete features. Parameter Estimation Methods: Maximum-Likelihood estimation: Gaussian case. Maximum a Posteriori estimation. Bayesian estimation: Gaussian case.

Unsupervised Learning and Clustering: Unsupervised Learning and its applications in clustering using k-means, computational hurdles in clustering algorithms and implementation of clustering algorithms, Hidden Markov Models (HMMs), Nonparametric techniques for density estimation. Parzen-window method. K-Nearest Neighbour method.

Dimensionality Reduction: Principal component analysis - its relationship to Eigen analysis. Fisher discriminant analysis - Generalised Eigen analysis. Eigen vectors/Singular vectors as dictionaries. Factor Analysis, Total variability space - a dictionary learning methods. Nonnegative matrix factorisation - a dictionary learning method.

Non-metric methods and applications of pattern classification: Non-numeric data or nominal data. Decision trees: Classification and Regression Trees (CART), Applications of pattern classifiers in image pattern recognition, speech pattern detection, visual pattern recognition and logical synthesis.

Text Books:

1. Pattern Classification,R.O.Duda, P.E.Hart and D.G.Stork, John Wiley, 2001
2. Pattern Recognition, S.Theodoridis and K.Koutroumbas, 4th Ed., Academic Press, 2009
3. Pattern Recognition and Machine Learning, C.M.Bishop, Springer, 2006

Reference Books:

1. Essentials of pattern recognition : an accessible approach, Jianxin Wu, Cambridge university press, 2020
2. Pattern Recognition: Introduction, Features, Classifiers and Principles, B. Jurgen, R. Matthias, N. Matthias,De Gruyter, 2017
3. Applied Pattern Recognition, H. Bunke, A. Kandel, M. Last, Springer India, 2010
4. Markov Models for Pattern Recognition: from Theory to Application, G.A. Fink, 2nd Ed., Springer, 2014.
5. Pattern Recognition Technologies and Applications: Recent Advances, B. Verma, M. Blumenstein, Scopus, 2008

Course Outcomes

On successful completion of the course the students will be able to:

ETU724(D).1 understand the fundamentals of pattern recognition and its application.
ETU724(D).2 revise the concepts of probability and linear algebra and review them from the viewpoint of ways and means for pattern understanding.
ETU724(D).3 analyze the unsupervised algorithms suitable for pattern Classification.
ETU724(D).4 understand the role of pattern classification in various machine intelligence applications.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU724(D).1	2	2	1	1	1	1	0	0	0	0	0	0	1	1	1
ETU724(D).2	3	2	1	1	2	1	1	0	0	0	0	0	2	1	1
ETU724(D).3	3	3	2	2	2	1	1	0	0	0	0	0	3	2	1
ETU724(D).4	1	1	3	3	2	1	1	0	0	0	0	0	3	3	1

0- Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

ETU725 VLSI DESIGN

Teaching Scheme: 03L **Total: 03** **Credits: 03**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

ESE duration: 2.30hrs

Course Objectives:

I. To learn basic CMOS Circuits.
II. To Learn CMOS device parameters and characteristics.
III. To Learn physical design of logic gates.
IV. To Study Testing and Verification Process.

Introduction to CMOS CIRCUITS: MOS Transistor, CMOS Combinational logic Gates, Multiplexer, Latches, Flip Flops, CMOS Fabrication and Layout, VLSI Design Flow

MOS Transistor theory, ideal I-V and C-V Characteristics, Non-ideal I-V effects, DC transfer Characteristics, switch level RC-delay Model

CMOS technologies, Layout design rules, CMOS process enhancement, Technology related CAD issues

Circuit characterization and Performance estimation, Delay estimation, Logical efforts and Transistor sizing, Power Dissipation, Interconnect, Design margin, Reliability, Scaling.

Testing and Verification: Logic Verification Principals, Manufacturing Test Principals, Design for Testability, Boundary Scan

Test Book:

1. CMOS VLSI Design: a Circuit and System Perspective, Neil H. E. Weste, David Harris, Ayan Banerjee, Pearson Education, 2011

Reference Books:

1. Essentials of VLSI circuits and Systems, Kamran Eshraghian, Douglas A. Pucknell, Sholeh Eshraghian, Prentice Hall, 2005
2. VLSI Design, M. Michael Vai, CRC Press,2017
3. FPGA Based system Design, Wayne Wolf, Perason, First Edition 2009

Course Outcome:

ETU725.1 Realize VLSI Design Flow
ETU725.2 Analyze CMOS Logic

ETU725.3 Implementation Different Combinational logic circuits
ETU725.4 Design layout for CMOS various circuits.
ETU725.5 Analyze testing, Verification.

SWAYAM/NPTEL Course on VLSI Design: Combinational Circuit Simulation
https://nptel.ac.in/courses/108/107/108107129/

IPS Academy, Institute of Engineering & Science, Indore

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU725.1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ETU725.2	0	2	0	0	0	0	0	0	0	0	0	0	2	3	0
ETU725.3	0	0	3	0	0	2	0	0	0	0	0	0	0	0	0
ETU725.4	0	0	0	2	0	0	2	0	0	0	2	0	0	0	0
ETU725.5	0	0	0	0	3	0	0	0	0	0	0	0	0	2	0

0-Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

ETU726 OPTICAL COMMUNICATION

Teaching Scheme: 03L **Total: 03** **Credits: 03**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

ESE duration: 2.30hrs

Course Objective:
The course aims to provide the students to

I Learn about various components used in optical communication.
II Understand the different kind of losses, signal distortion, SM fibers.
III Gain the knowledge of the various optical sources, materials and fiber splicing.
IV Learn the optical receivers and noise performance in photo detector.
V Understand the link budget, WDM, and SONET/SDH network.

Introduction to Optical Communication: Basic opticprinciples, Snell's law, different manufacturing and splicing techniques, and connectors.

Optical Properties: Theory of circular wave guide, modes of optical fibers, numerical aperture (NA), power flow, attenuation, losses, dispersion, nonlinear effects, introduction to Soliton propagation.

Optical Sources and Detectors: Optical sources - LEDs and Lasers, Photo-detectors - pin-detectors, detector responsivity, detector noise characteristics, optical receivers

Principles of Optical Communication: Analog and digital transmission, digital coding, bandwidth occupancy, noise and bit error rate.

Optical Transmitters, Receivers, Fiber Optic Test and Measurement: Optical transmitter, receiver, digital system planning consideration, power penalty, optical link design, power budgeting coherent and non coherent system, modulation and demodulation scheme, multiplexing and demultiplexing, optical switches, measure fiber output power, use of OTDR.

Optical Amplifiers and Networks: Optical fiber amplifier, Semiconductor optical amplifiers, wavelength conversion, optical switches, photonic switching, SONET/SDH, fiber channel, optical interfaces. Introduction to WDM and DWDM systems.

Text Books

1. Optical Fiber Communication and Application, J.M. Senior, 3rd edition, PHI, 2009
2. Optical Fiber Communication, G. Keiser, 4th edition, TMH, 2008

Reference Books

1. Optical Communication System, J. Gowar, 3rd edition, PHI, 2000
2. Fiber optic communication technology, D. F. Mynbaev and L. Scheiner, 6 th Impression, Pearson Education, 2001
3. Fiber Optics Communication, H. Kolimbiris, 2nd edition, Pearson Education, 2004
4. Fiber-Optic Communications Systems, G. P. Agrawal, 3rd, John Wiley and Sons, 2002

Course Outcomes:

At the end of course, student shall be able to:

ETU726.1 Apply the knowledge with basic concepts of Optical Communication.

ETU726.2 Ability to demonstrate optical communication components, assemble them and solve problems on Optical Communication system.

ETU726.3 Ability to design, implements, analyzes and maintains optical communication system.

ETU726.4 Acquaintance of different source of light as well as receiver and their comparative study

ETU726.5 Assess the different techniques to improve the capacity of the system and solve problems on Optical Communication system.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU726.1	3	2	1	2	1	0	0	0	0	0	0	1	3	0	1
ETU726.2	2	2	1	1	2	0	1	0	0	0	1	0	2	1	1
ETU726.3	1	1	3	1	2	0	0	0	0	0	3	0	3	2	0
ETU726.4	2	2	1	1	2	0	0	0	0	0	0	2	2	0	1
ETU726.5	2	2	2	1	1	0	0	0	0	0	0	1	2	0	1

0- Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

ETU727 SEMINAR

Teaching Scheme: 02 P **Total: 02** **Credits: 01**

Evaluation Scheme: 50 ICA **Total Marks: 50**

ESE duration: ----

Course Objectives:

To make the student able to

I. Establish motivation for any topic of interest not covered in curriculum and develop a thought process for technical presentation.
II. Organize a detailed literature survey and build a document with respect to technical publications.
III. Learn effective presentation and improve soft skills.
IV. Make use of new and recent technology for creating technical reports.

The seminar is to be undertaken by single student

1. Student shall select a topic for seminar which is **not covered in curriculum**
2. Topics shall be registered within a month after beginning of VII Semester and shall be approved by the concerned guide and Program Head
3. Students should know the functional and technical details of selected topic after carrying out the conceptual study.
4. Before the end of semester, student shall deliver a seminar and submit the seminar report in following format:
   - Introduction
   - Literature Survey
   - Concept
   - Functional and Technical Details
   - Future scope
   - Applications

Course Outcomes:

After completing this course, Students shall be able:

ETU727.1 To study research papers for understanding of a new field, in the absence of a textbook , to summaries and review them.
ETU727.2 To identify promising new directions of various cutting edge technologies
ETU727.3 To impart skills in preparing detailed report describing the topic and results
ETU727.4 To effectively communicate by making an oral presentation before an evaluation committee

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU727.1	2	3	3	3	1	1	2	3	1	2	2	3	3	3	1
ETU727.2	1	2	1	2	2	2	3	3	1	2	2	3	3	3	1
ETU727.3	1	1	2	2	2	1	1	3	2	1	1	1	0	1	1
ETU727.4	1	1	2	2	2	1	1	3	2	1	1	1	3	1	1

0-Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

ETU821– PROGRAM ELECTIVE – VI

ETU821(A) MOBILE COMMUNICATION

Teaching Scheme: 03L **Total: 03** **Credits: 03**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

ESE duration: 2.30hrs

Course Objective:

The course aims to provide the students to

- I understanding the basic principles of mobile communication systems
- II study the recent trends adopted in cellular systems
- III analysis of mobile communications with the interpretation of the call prints
- IV understanding the operation of mobile communications systems and their generation divisions

Cellular Concept: Cell structure, frequency reuse, frequency and channel assignment, handoff, interface, capacity, power control, teletraffic theory, multiple access technologies; overview of 2G to 7G and future mobile technologies.

Signal Propagation: Signal propagation mechanism, large scale signal propagation and lognormal shadowing. Path loss modelling and signal coverage. Fading in mobile systems.

Antennas: The gain and pattern relationship, Antennas at cell site, Mobile Antennas.

Receiver Structure- Diversity receivers - selection and MRC receivers, RAKE receiver, equalization: linear-ZFE and adaptive, DFE. Transmit diversity: Altamonte scheme.

MIMO and Space Time signal processing, spatial multiplexing, diversity/multiplexing tradeoff.

Performance Measures and system examples: Outage, average SNR, average symbol/bit error rate; GSM, GPRS, CDMA 2000 and WCDMA

Text Book:

1. Mobile Cellular Telecommunications, W. C.Y. Lee, 2nd edition, MGH, 2006.
2. Mobile Wireless Communications, Mischa Schwartz -Cambridge University Press.

Reference Book:

1. Mobile Communications, J. Schiller, 2nd edition, Pearson Education, 2008
2. Introduction to Space-Time Wireless Communication, A. Paulraj, R. Nabar and D. Gore, Cambridge University Press, 2003.
3. Digital Communication over Fading Channels, M. Simon and M. Alouini, 2nd edition, John Wiley and Sons, 2005.
4. Mobile Wireless Communications, Mischa Schwartz-Cambridge University Press.

Course Outcome:
At the end of course, student shall be able to:

Apply the basic principles of mobile communication system

ETU821(A).1 Identify and describe the development and implementation of mobile communication systems
ETU821(A).2 Analyze the Mobile radio propagation, fading, diversity concepts and the channel modeling.
ETU821(A).3 Discuss the cellular system design and technical challenges.
ETU821(A).4 Test mobile communication equipment for the technical functionality.

NPTL Course on Mobile Communication https://nptel.ac.in/courses/117/104/117104099/

CO-PO-PSO Mapping

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU821(A).1	3	2	1	1	1	0	0	0	0	0	1	1	3	1	1
ETU821(A).2	3	3	1	1	1	0	0	0	0	0	1	1	3	1	1
ETU821(A).3	1	2	3	0	1	0	0	0	0	0	0	1	1	2	1
ETU821(A).4	2	2	2	1	0	0	0	0	0	0	0	0	2	1	1
ETU821(A).5	0	0	1	0	1	0	0	0	0	0	0	1	1	0	0

0-Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

ETU821(B)SPEECH PROCESSING

Teaching Scheme: 03L **Total: 03** **Credits: 03**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

ESE duration: 2.30hrs

Course Objectives:

To make the student able

I. To provide an introduction to speech processing oriented to human computer interaction.
II. To understand the basic principles of sound and speech production and perception.
III. To understand the basic principles of speech recognition, synthesis and dialogue systems.
IV. To obtain an introductory overview in the field.

Introduction to speech processing, Digitization and Recording of speech signal, Review of Digital Signal Processing Concepts.

Speech production and modeling : Human Auditory System, General structure of speech coders, Acoustic Phonetics and Articulatory Phonetics, Different categories speech sounds and Location of sounds in the acoustic waveform and spectrograms

Classification of speech coding techniques: Parametric, Waveform and Hybrid, Requirements of speech codecs: quality, coding delays, robustness, Speech Signal Processing, Pitch-period estimation, all-pole and all-zero filters, convolution, Power spectral density, periodogram, autoregressive model, autocorrelation estimation.

Linear Prediction Coding: Block diagram of Simplified Model for Speech Production. Basic Principles of Linear Predictive Analysis- The Auto Correlation Method. The Prediction Error Signal. Digital Speech Processing for Man-Machine Communication by voice. Speaker Recognition Systems- Speaker verification and Speaker Identification Systems. Audio Deep Learning: Automatic Speech Recognition (ASR).

Text Books:

1. “Digital Speech” by A.M.Kondoz, Second Edition (Wiley Students Edition), 2004.
2. Lawrence R Rabiner and Ronald W Schafer, Introduction to Digital Speech Processing (Foundations and Trends in Signal Processing).2007.

Reference Books:

1. “Speech Coding Algorithms: Foundation and Evolution of Standardized Coders”, W.C. Chu, WileyInter science, 2003.

2. “Digital Speech Processing: Synthesis, and recognition”, Sadaoki Furui, Second Edition

Course Outcomes:

At the end of this course students will be able to

ETU821(B).1 Mathematically model the speech signal.
ETU821(B).2 Analyze the quality and properties of speech signal.
ETU821(B).3 Modify and enhance the speech and audio signals.
ETU821(B).4 Design and implement the methods and systems for efficient quantization coding of speech signals.
ETU821(B).5 Solve the problems regarding various methods in speech processing.

SWAYAM/NPTEL course on Digital Speech Processing (IIT Kharagpur): PEC-AI-508 Speech Processing https://nptel.ac.in/courses/117/105/117105145

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU821(B).1	1	1	0	1	2	0	0	3	0	0	0	0	1	2	3
ETU821(B).2	3	1	3	3	0	3	0	0	0	0	0	3	1	3	3
ETU821(B).3	0	1	2	3	3	0	0	0	0	0	0	0	2	2	0
ETU821(B).4	3	2	1	0	3	0	0	0	0	0	0	0	1	2	0
ETU821(B).5	2	2	2	3	0	0	0	0	0	0	0	0	2	1	0

0-Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

ETU821(C) MEMS TECHNOLOGY

Teaching Scheme: 03L **Total: 03** **Credits: 03**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

ESE duration: 2.30hrs

Course Objectives:

To make the student able

I To review the MEM systems and smart materials
II To familiarize with the various MEMS application areas
III To apply the knowledge of MEMS principle and smart materials to make a specialized system

Review of Micro-Electromechanical systems: Need of Miniaturization, Smart Materials, Structures and Systems, Applications of Smart Materials and Microsystems. Micro/Nano Sensors, Actuators and Systems.

MEM Structures and Systems in Industrial and Automotive Applications: General Design Methodology, Techniques for Sensing and Actuation, Passive Micromachined Mechanical Structures, Sensors and Analysis Systems, Actuators and Actuated Microsystems.

MEM Structures and Systems in Photonic Applications: Imaging and Displays, Fiber-Optic Communication Devices.

MEMS Applications in Life Sciences: Microfluidics for Biological Applications, DNA Analysis, Microelectrode Arrays, Advances in Application for Health.

MEM Structures and Systems in RF Applications: Signal Integrity in RF MEMS, Passive Electrical Components, Microelectromechanical Resonators, Switches.

Text Books:

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalkrishnan K. N. Bhat, V. K. Aatre, 'Micro and Smart Systems', Wiley India, 2012.
2. Nadim Maluf, Kirt Williams, 'An Introduction to Microelectromechanical Systems Engineering', 2nd edition, Artech House Inc.

Reference Books:

1. Vikas Choudhary, Krzysztof Iniewski, 'MEMS: Fundamental Technology and Applications', CRC pres.
2. Stephen D. Senturia, Microsystem Design, Kluwer Academic Publishers, 2001.
3. Laurent A. Francis, Krzysztof Iniewski, 'Noval Advances in Microsystems Technologies and their Applications', CRC press, 2014

Course Outcomes:

After completing this course, students will:

ETU821(C)1 Realise the importance of MEM system and smart materials.
ETU821(C)2 Apply the principle of MEM structures in various application fields.

ETU821(C)3 Understand the working of MEM application systems
ETU821(C)4 Demonstrate the principles of MEM to model applications.

SWAYAM/NPTEL or any other platform course on Micro and nano fabrication – MEMS **https://www.edx.org/course/micro-and-nanofabrication-mems**

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU821(C).1	2	2	1	1	0	1	1	1	3	1	1	1	2	1	1
ETU821(C).2	3	3	2	1	1	1	2	1	3	1	1	1	3	1	1
ETU821(C).3	2	2	2	1	1	1	2	1	3	1	1	1	2	1	1
ETU821(C).4	3	3	3	1	2	2	3	1	3	1	2	3	3	2	2

0- Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

ETU821(D) ARTIFICIAL INTELLIGENCE

Teaching Scheme: 03L **Total: 03** **Credits: 03**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

ESE duration: 2.30hrs

Course Objectives: The students shall be able to

I. familiar with basic principles of AI
II. capable of using heuristic searches
III. aware of knowledge-based systems

Fundamentals of Artificial Intelligence: Introduction, A.I. Representation, Non-AI & AI Techniques, Representation of Knowledge, Knowledge Base Systems, State Space Search, Production Systems, Problem Characteristics, types of production systems, Intelligent Agents and Environments, concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation
Uninformed Search Strategies: Formulation of real-world problems, Breadth First Search, Depth First Search, Depth Limited Search, Iterative Deepening Depth First Search, Bidirectional Search, Comparison of Uninformed search Strategies, Searching with partial information, Sensor-less problems, Contingency problems.
Informed Search Strategies: Generate & test, Hill Climbing, Best First Search, A* and AO* Algorithm, Constraint satisfaction, Game playing: Minimax Search, Alpha-Beta Cut-offs, Waiting for Quiescence
Knowledge Representation: Knowledge based agents, Wumpus world. Propositional Logic: Representation, Inference, Reasoning Patterns, Resolution, Forward and Backward Chaining. First order Logic: Representation, Inference, Reasoning Patterns, Resolution, Forward and Backward Chaining.
Uncertain Knowledge and Reasoning: Uncertainty, probability, Bayesian networks, probabilistic reasoning, dynamic Bayesian networks, concepts of probabilistic programming, probabilistic logic.
Applications of Artificial Intelligence: Smart transportation & smart vehicles using ai, smart grid computing & technologies, geographical information system, smart city, security and intrusion detection, future communications and computing.

Text Books:

1. Elaine Rich and Kevin Knight: "Artificial Intelligence." Tata McGraw Hill
2. Stuart Russell & Peter Norvig : "Artificial Intelligence : A Modern Approach", Pearson Education, 2nd Edition.

Reference Books:

1. Eugene, Charniak, Drew Mcdermott: "Introduction to Artificial Intelligence.", Addison Wesley
2. Patterson: Introduction to AI and Expert Systems, PHI
3. Nilsson: Principles of Artificial Intelligence, Morgan Kaufmann.

4. S. Kanimozhi Suguna, M. Dhivya, Sara Paiva, Artificial Intelligence (AI) Recent Trends and Applications, CRC Press, 1st Edition, 2021

Course Outcomes:

On successful completion of the course the students will be able to:

ETU724(D).1 Identify appropriate AI methods to solve given problems.
ETU724(D).2 formulation of real-world problems using search strategies.
ETU724(D).3 Acquire skills on knowledge representation, natural deduction, and dealing with uncertainty.
ETU724(D).4 Implement basic AI algorithms and identify their scale which the state of art AI applications are using.

SWAYAM/NPTEL or any other platform on An Introduction to Artificial Intelligence, IITD https://onlinecourses.nptel.ac.in/noc22_cs56/preview

CO- PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU724(D).1	2	2	1	1	1	1	1	0	0	0	0	0	1	1	1
ETU724(D).2	2	3	2	3	2	1	2	1	0	0	0	0	2	1	1
ETU724(D).3	3	3	2	2	2	3	2	1	0	0	0	0	3	2	1
ETU724(D).4	1	1	3	3	2	1	2	1	0	0	0	0	3	3	1

0- Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

ETU822A). PROJECT OR B). INDUSTRY INTERNSHIP PROJECT

Teaching Scheme: 26P **Total: 26** **Credits: 13**

Evaluation Scheme: 200 ICA + 200 ESE **Total Marks: 400**

ESE duration: ----

Course Objectives:

- **I.** To encourage the students to make a meaningful intellectual commitment to an engineering problem.
- **II.** To help in the development of one of the most important attributes of an engineer - self-discipline.
- **III.** To emphasis the use of fundamental concepts, and use of texts and references.
- **IV.** To emphasis the presentation of technical material by informal summary reports, drawings, formal reports and presentations.
- **V.** To help the students to critically evaluate their own work

Students are expected to complete work pertaining to following aspects:

A) Project

1. In general, a group of 3-6 students should be allowed to complete the project on Approved topic.

2. Preferably more than 25 % projects shall be Industry / Research based / oriented.

3. Exhaustive survey of literature based on a clear definition of the scope and focus of the topic should be carried out by the students.

4. Students should finalize the topic for the project after literature survey in consultation with the Guide.

5. The Synopsis/Abstract on the selected topic should be submitted to the Program Head for approval.

6. On approval of the topic, students should initiate the topic based work.

7. Students should complete implementation of ideas given in synopsis, so that project work should be completed before end of semester.

8. Students shall submit the final project report in proper format as per guidelines given on the college website.

9. For uniform and continuous evaluation, evaluation committee for each group shall be formed by Program Head in which guide must be a member. Internal marks should be awarded by committee at the end of semester based on continuous evaluation.

10. Final examination of project shall include demonstration, presentation of complete work and oral examination based on the project work.

B) Industry Internship Project

1. The aim of Industry Internship Project is to provide the impactful strategy for creating a future talent pool for the industry .This gives a student an opportunity to solve the real industrial problems with innovative solutions
2. The students can work in group / individually decided by the department as per availability of the industry project. Each student / Group of student will have a Industry Mentor in the industry and Faculty guide in the institute.
3. Students /Group select the industry which is ready to provide Industry Internship Project through communication with industry through proper channel or through AICTE internship portal. The student/Group need to submit acceptance letter from Industry stating the approved topic of the project from Industry & Institute. Also students need to accept the institute internship policy if any with proper procedure before joining the internship.
4. Students will not get any financial assistance from the institute but can accept the stipend provided by the industry if given.
5. The meeting with Project guide is once within week/two week at Institute. These meetings typically include assistance in finding solutions recent problems in the projects, technical support on applied software packages, and support with writing the final report.
6. Industry Internship Project includes seminars/presentation to share the experience and knowledge to a larger audience. The Project monitoring will be done by Institute Guide & Industry guide to know whether learning objective is achieved or not.
7. Students undergone the Industry Internship Project will have to submit following documents on the successful completion of Industry Institute Project
   i. Authenticated attendance record from Industry internship project mentor/supervisor/Guide
   ii. Industry internship project signed by Industry Mentor/Guide
   iii. Industry internship project Completion Letter by Industry Mentor/ Guide
   iv. Project evaluation report signed by Industry Mentor/ Guide

Note:

ICA: The Internal Continuous Assessment shall be based on the active participation of the students in the Project work and knowledge / skill acquired. Oral examination shall be conducted on the Project report, by the panel of examiners consisting of Project Guide, Course Coordinator and Expert appointed by Program Head

ESE: The End Semester Examination for Project shall consist of demonstration if any, presentation and oral examinations based on the project report.

Course Outcomes:

On successful completion of the course students will be able to:

ETU822.1 Demonstrate a sound technical knowledge of their selected project topic.
ETU822.2 Undertake problem identification, formulation and solution.
ETU822.3 Design engineering solutions to complex problems utilising a systems approach.
ETU822.4 Conduct an engineering project.
ETU822.5 Demonstrate the knowledge, skills and attitudes of a professional engineer.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU822.1	2	2	1	1	1	1	1	1	3	1	1	1	2	1	1
ETU822.2	3	3	2	1	1	1	2	1	3	1	1	1	3	1	1
ETU822.3	2	2	2	1	1	1	2	1	3	1	1	1	2	1	1
ETU822.4	2	2	2	1	1	1	2	1	2	1	1	1	3	1	1
ETU822.5	3	3	3	1	2	2	3	1	3	1	2	3	3	2	2

0- Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3-Strongly Correlated

Member Secretary **BOS Chairman**

GOVERNMENT COLLEGE OF ENGINEERING, AMRAVATI

DEPARTMENT OF ELECTRONICS ENGINEERING

Curriculum for Third Year

B. Tech. (Electronics and Telecommunication)

2021-2022

Specialization: Electronics and Telecommunication

(A) PROGRAM OUTCOMES (POs)

PO1: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems

PO2: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

PO3: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PO12: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

(B) PROGRAM SPECIFIC OUTCOMES (PSOs)

A Graduate of the Electronics and Telecommunication program will be able to:

PSO1: Apply the concepts of Analog and Digital Electronics, Microprocessors, Signal processing and communication engineering in design and implementation of Engineering Systems.

PSO2: Solve complex problems in the field of Electronics and telecommunication using latest hardware and software tools along with analytical and managerial skills

PSO3: Acquire the social and environmental awareness with ethical responsibility to have successful carrier

GOVERNMENT COLLEGE OF ENGINEERING, AMRAVATI.

Department of Electronics Engineering.

Scheme for B. Tech. (Electronics and Telecommunication)

Semester I

Teaching Scheme							Evaluation Scheme						
Category	**Course Code**	**Course Title**	**Theory Hrs/week**	**Tutorial Hrs/week**	**Practical Hrs/week**	**Total**	**Theory MSE**	**Theory TA**	**Theory ESE**	**Practical ICA**	**Practical ESE**	**Total**	**Credits**
MC	SHU100	Induction Program	Two weeks mandatory audit course										0
BSC	SHU121	Physics	3	1	---	4	30	10	60	---	---	100	4
BSC	SHU122	Calculus and Linear Algebra	3	1	---	4	30	10	60	---	---	100	4
ESC	EEU121	Basic Electrical Engineering	3	---	---	3	30	10	60	---	---	100	3
ESC	CEU121	Engineering Mechanics	3	---	---	3	30	10	60	---	---	100	3
HSMC	SHU123	English	2	---	---	2	---	---	60	---	---	60	2
BSC/LC	SHU124	Physics Lab	---	---	2	2	---	---	---	50	---	50	1
ESC/LC	EEU122	Basic Electrical Engg Lab	---	---	2	2	---	---	---	50	---	50	1
ESC/LC	CEU122	Engineering Mechanics Lab	---	---	2	2	---	---	---	50	---	50	1
HSMC/LC	SHU125	English Lab	---	---	2	2	---	---	---	50	---	50	1
ESC/LC	MEU121	Workshop Practice I	---	---	2	2	---	---	---	50	---	50	1
		Total	14	2	10	26	120	40	300	250	0	710	21

SST

PKD

Semester II

Teaching Scheme							Evaluation Scheme						
Category	Course Code	Course Title	Theory	Tutorial	Practical		Theory			Practical		Total	Credits
			Hrs/week	Hrs/week	Hrs/week	Total	MSE	TA	ESE	ICA	ESE		
BSC	SHU221	Chemistry	4	--	---	4	30	10	60	---	---	100	4
BSC	SHU222	Integral calculus and differential equations	3	1	---	4	30	10	60	---	---	100	4
ESC	CSU221	Programming for Problem solving	3	---	---	3	30	10	60	---	---	100	3
ESC	MEU221	Engineering Graphics	2	---	---	2	30	10	60	---	---	100	2
ESC	MEU222/ ETU221	Basic Mechanical Engineering/ Basic Electronics Engineering	2	---	---	2	30	10	60	---	---	100	2
BSC/LC	SHU223	Chemistry Lab	---	---	2	2	---	---	---	50	---	50	1
ESC/LC	CSU222	Programming for Problem solving Lab	---	---	4	4	---	---	---	50	---	50	2
ESC/LC	MEU223	Engineering Graphics Lab	---	---	4	4	---	---	---	50	---	50	2
ESC/LC	MEU224	Workshop Practice II	---	---	2	2	---	---	---	50	---	50	1
		Total	14	1	12	27	150	50	300	200	0	700	21

TA: Teacher Assessment **MSE: Mid Semester Examination** **ESE: End Semester Examination** **ICA: Internal Continuous Assessment**

MSE Duration: 1.30 Hrs all courses

Important Note:

MEU222 for only Electrical, Electronics & TC, Computer Science, Information Technology and Instrumentation Engineering branch

ETU221 for only Civil and Mechanical Engineering branch

In Semester I, the students of Civil, Mechanical, Electrical & Instrumentation Engineering shall be offered group A courses, and that of Electronics & TC, Computer Science and Information Technology shall be offered group B courses. In Semester II, vice versa.

In addition following courses are offered

SHU122 and MEU121 for all students in Semester I. SHU222 and MEU224 for all students in Semester II.

MEU222 shall be offered in Semester I for Electronics & TC, Computer Science, Information Technology branch. And it shall be offered in Semester II for Electrical and Instrumentation Engineering branch

ETU221 shall be offered in Semester II for Civil and Mechanical Engineering branch.

There should be direct correspondence of group A and group B courses.

Sr. No.	Group A Courses		Group B Courses	
	Course Code	**Title of Course**	**Course Code**	**Title of Course**
1	SHU121	Physics	SHU221	Chemistry
2	EEU121	Basic Electrical Engineering	CSU221	Programming for Problem solving
3	CEU121	Engineering Mechanics	MEU221	Engineering Graphics
4	SHU123	English	SHU223	Chemistry Lab
5	SHU124	Physics Lab	CSU222	Programming for Problem solving Lab
6	EEU122	Basic Electrical Engineering Lab	MEU223	Engineering Graphics Lab
7	CEU122	Engineering Mechanics Lab		
8	SHU125	English Lab		

Category of Course	Definition	Credits
BSC	Basic Science Courses	18
ESC	Engineering Science Courses	21
HSMC	Humanities and Social Sciences including Mgt. Courses	3
	Total Credits	42

SST

PRD

GOVERNMENT COLLEGE OF ENGINEERING, AMRAVATI.
Department of Electronics Engineering.
Scheme for B. Tech. (Electronics and Telecommunication)

SEMESTER-III

Category	Course Code	Name of the Course	Teaching Scheme					Evaluation Scheme					Credit
								Theory		Practical		Total	
			Theory Hrs/week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	MSE	ESE	ICA	ESE		
BSC	SHU321C *SHU322C	Transform And Statistical Methods *Integral Calculus And Probability	3	1	0	4	10	30	60	---	---	100	4
PCC	ETU321	Electronic Devices and Circuits	3	1	0	4	10	30	60	---	---	100	4
PCC	ETU322	Signals and Systems	3	0	0	3	10	30	60	---	---	100	3
PCC	ETU323	Digital Electronics	3	0	0	3	10	30	60	---	---	100	3
PCC	ETU324	Network Theory	3	1	0	4	10	30	60	---	---	100	4
MC	SHU323	Introduction to Constitution of India	1	--	--	1	20	---	30	---	---	50	--
PCC	ETU325	Electronics Devices and Circuits Lab.	0	0	2	2	---	---	---	25	25	50	1
PCC	ETU326	Signal and Systems Lab.	0	0	2	2	---	---	---	25	25	50	1
PCC	ETU327	Digital Electronics Lab.	0	0	2	2	---	---	---	25	25	50	1
PCC	ETU328	Computer Programming Lab.	0	0	2	2	---	---	---	25	25	50	1
	Total		**16**	**3**	**8**	**27**	**70**	**150**	**330**	**100**	**100**	**750**	**22**

TA: Teacher Assessment MSE: Mid Semester Examination ESE: End Semester Examination ICA: Internal Continuous Assessment
ESE Duration for Theory: 2.30Hrs.

*For direct second year admitted students

SST

SEMESTER-IV

Category	Course Code	Name of the Course	Teaching Scheme					Evaluation Scheme					Credit
								Theory		Practical		Total	
			Theory Hrs/week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	MSE	ESE	ICA	ESE		
PCC	ETU421	Probability Theory and Stochastic Processes	3	0	0	3	10	30	60	---	---	100	3
PCC	ETU422	Analog Communication	3	0	0	3	10	30	60	---	---	100	3
PCC	ETU423	Analog Circuits	3	0	0	3	10	30	60	---	---	100	3
PCC	ETU424	Microprocessors and Microcontrollers	3	1	0	4	10	30	60	---	---	100	4
PCC	ETU425	Digital System Design	3	1	0	4	10	30	60	---	---	100	4
MC	*SHU422	Environmental Studies	1	0	0	1	20	---	30	---	---	50	---
PCC	ETU426	Analog Communication Lab.	0	0	2	2	---	---	---	25	25	50	1
PCC	ETU427	Analog Circuits Lab.	0	0	2	2	---	---	---	25	25	50	1
PCC	ETU428	Microprocessors and Microcontrollers Lab.	0	0	2	2	---	---	---	25	25	50	1
	Total		**16**	**2**	**6**	**24**	**70**	**150**	**330**	**75**	**75**	**700**	**20**

TA: Teacher Assessment MSE: Mid Semester Examination ESE: End Semester Examination ICA: Internal Continuous Assessment

ESE Duration for Theory: 2.30Hrs. * ESE Duration for Theory: 1.30Hrs

SST

Government College Of Engineering, Amravati
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Scheme for B. Tech. (Electronics and Telecommunication)

SEMESTER-V

Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						Credit
							Theory			Practical		Total	
			Theory Hrs/week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	MSE	ESE	ICA	ESE		
PCC	ETU521	Electromagnetic Waves	3	1	0	4	10	30	60	---	---	100	4
PCC	ETU522	Computer Architecture	3	0	0	3	10	30	60	---	---	100	3
PCC	ETU523	Digital Communication	3	1	0	4	10	30	60	---	---	100	4
PCC	ETU524	Digital Signal Processing	3	1	0	4	10	30	60	---	---	100	4
BSC	SHU525*	Human Values and Ethics	1	0	0	1	20	--	30	---	---	50	--
HSMC	ETU525	Operational Research and Optimization	3	1	0	4	10	30	60	---	---	100	4
PCC	ETU526	Electromagnetic Waves Lab.	0	0	2	2	---	---	---	25	25	50	1
PCC	ETU 527	Computer Architecture Lab.	0	0	2	2	---	---	---	25	25	50	1
PCC	ETU528	Digital Communication Lab.	0	0	2	2	---	---	---	25	25	50	1
PCC	ETU529	Digital Signal Processing Lab.	0	0	2	2	---	---	---	25	25	50	1
	Total		**16**	**4**	**8**	**28**	**70**	**150**	**330**	**100**	**100**	**750**	**23**

TA: Teacher Assessment MSE: Mid Semester Examination ESE: End Semester Examination ICA: Internal Continuous Assessment
ESE Duration for Theory: 2.30Hrs. * ESE Duration for Theory: 1.30Hrs

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PRD

SEMESTER-VI

Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						Credit
							Theory			Practical		Total	
			Theory Hrs/week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	MSE	ESE	ICA	ESE		
PCC	ETU621	Control Systems	3	0	0	3	10	30	60	---	---	100	3
PCC	ETU622	Communication Networks	3	0	0	3	10	30	60	---	---	100	3
PEC	ETU623	Program Elective – I	3	0	0	3	10	30	60	---	---	100	3
OEC	ETU624	Open Elective-I	3	0	0	3	10	30	60	---	---	100	3
PEC	ETU625	Program Elective –II	3	0	0	3	10	30	60	---	---	100	3
HSMC	ETU626	Human resource and Economics	3	0	0	3	10	30	60	---	---	100	3
PROJ	ETU627	Minor Project	0	0	4	4	---	---	---	25	25	50	2
PCC	ETU628	Communication Networks Lab.	0	0	2	2	---	---	---	25	25	50	1
PCC	ETU629	Electronic Measurement Lab.	0	0	2	2	---	---	---	25	25	50	1
	Total		**18**	**0**	**8**	**26**	**60**	**180**	**360**	**75**	**75**	**750**	**22**

TA: Teacher Assessment MSE: Mid Semester Examination ESE: End Semester Examination ICA: Internal Continuous Assessment

ESE Duration for Theory: 2.30Hrs.

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GOVERNMENT COLLEGE OF ENGINEERING, AMRAVATI.
Department of Electronics Engineering.
Scheme for B. Tech. (Electronics and Telecommunication)
SEMESTER-VII

Category	Course Code	Name of the Course	Teaching Scheme					Evaluation Scheme					Credit
								Theory		Practical		Total	
			Theory Hrs/week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	MSE	ESE	ICA	ESE		
PEC	ETU721	Program Elective –III	3	0	0	3	10	30	60	---	---	100	3
PEC	ETU722	Program Elective –IV	3	0	0	3	10	30	60	---	---	100	3
OEC	ETU723	Open Elective-II	3	0	0	3	10	30	60	---	---	100	3
PEC	ETU724	Program Elective –V	3	0	0	3	10	30	60	---	---	100	3
PCC	ETU725	VLSI Design	3	0	0	3	10	30	60	--	--	100	3
PCC	ETU726	Optical Communication	3	0	0	3	10	30	60	---	---	100	3
PROJ	ETU727	Seminar	0	0	2	2	---	---	---	50	---	50	1
	Total		**18**	**0**	**02**	**20**	**60**	**180**	**360**	**50**	**---**	**650**	**19**

TA: Teacher Assessment MSE: Mid Semester Examination ESE: End Semester Examination ICA: Internal Continuous Assessment
ESE Duration for Theory: 2.30Hrs.

SEMESTER-VIII

Category	Course Code	Name of the Course	Teaching Scheme					Evaluation Scheme					Credit
								Theory		Practical		Total	
			Theory Hrs/week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	MSE	ESE	ICA	ESE		
PEC	ETU821	*Program Elective –VI	3	0	0	3	10	30	60	---	---	100	3
PROJ	ETU824	A. Project **OR** **B.** Industry Internship Project	0	0	26	26	--	--	--	200	200	400	13
	Total		**3**	**0**	**26**	**29**	**10**	**30**	**60**	**200**	**200**	**500**	**16**

TA: Teacher Assessment MSE: Mid Semester Examination ESE: End Semester Examination ICA: Internal Continuous Assessment
ESE Duration for Theory: 2.30Hrs.

***Students not present for regular classes have to complete the said course through online platform MOOCs, if available. If not then, students shall prepare with self-study mode and will appear for ESE only. (Total internal marks (MSE+TA) will be awarded proportional to marks scored in ESE), the department will provide the list of equivalent MOOC courses.**

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Elective Courses:

ETU624 **Open Elective-I**	ETU7[illegible]3 **Open Elective-II**	ETU623 **Program Elective-I**	ETU625 **Program Elective-II**	ETU721 **Program Elective-III**	ETU722 **Program Elective-IV**	ETU724 **Program Elective-V**	ETU821 **Program Elective-VI**
A) Consumer Electronics	A) Mechatronics	A)Information theory & coding	A) Microwave Engineering	A) Antennas & Wave propagation	A) Wireless Communication	A) Satellite Communication	A) Mobile Communication
B) Industrial Electronics	B) Bioengineering	B) Scientific Computing	B) Wavelets and other Engineering Transforms	B) Multirate DSP	B) Adaptive Signal Processing	B) Image and Video processing	B) Speech Processing
		C) Electronic Design Techniques with HDL	C) Micro-Electro-Mechanical Systems	C) CMOS Design	C) Mixed Signal Design	C) Nanotechnology	D) MEMS Technology
		D) Machine learning	D) Fuzzy Logic	D) Artificial Neural Network	D) Soft Computing too	D) Pattern Recognition	D) Artificial Intelligence

Abbreviations:

BSC Basic Science Courses
ESC Engineering Science Courses
HSMC Humanities and Social Sciences including Management courses
PCC Professional core courses
PEC Professional Elective courses
OEC Open Elective courses
LC Laboratory course
MC Mandatory courses
SI Summer Industry Internship
PROJ Project

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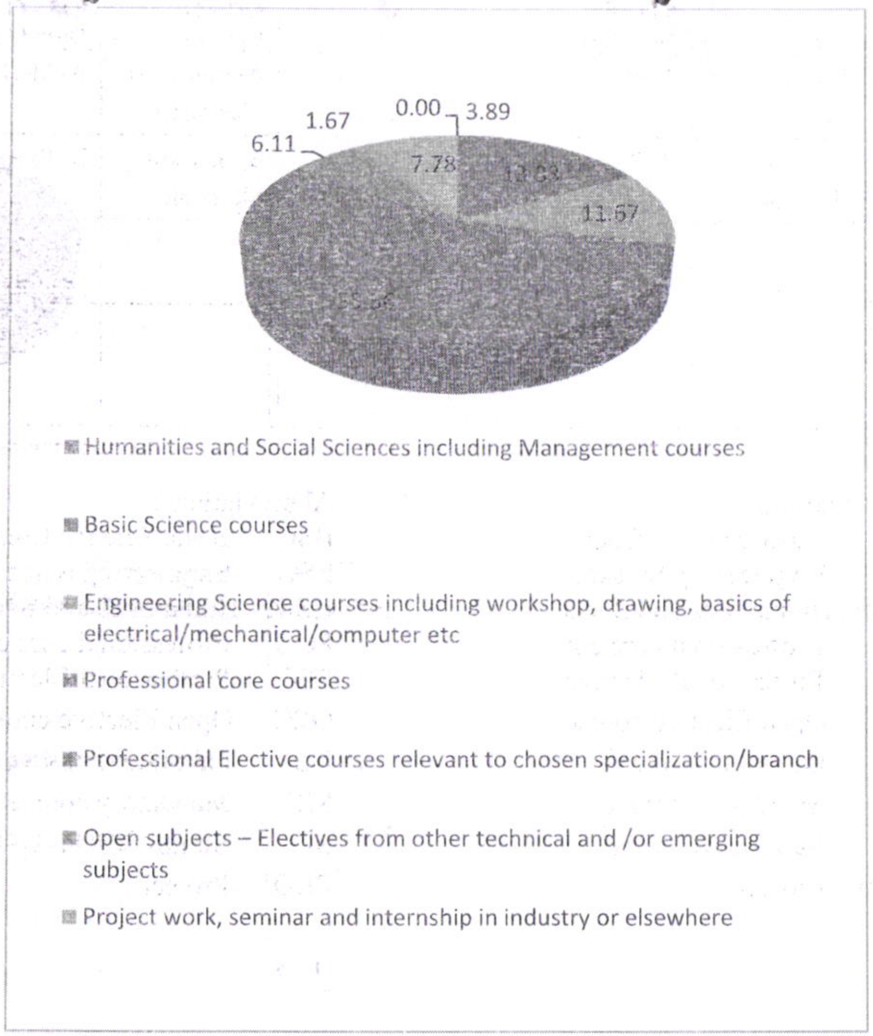
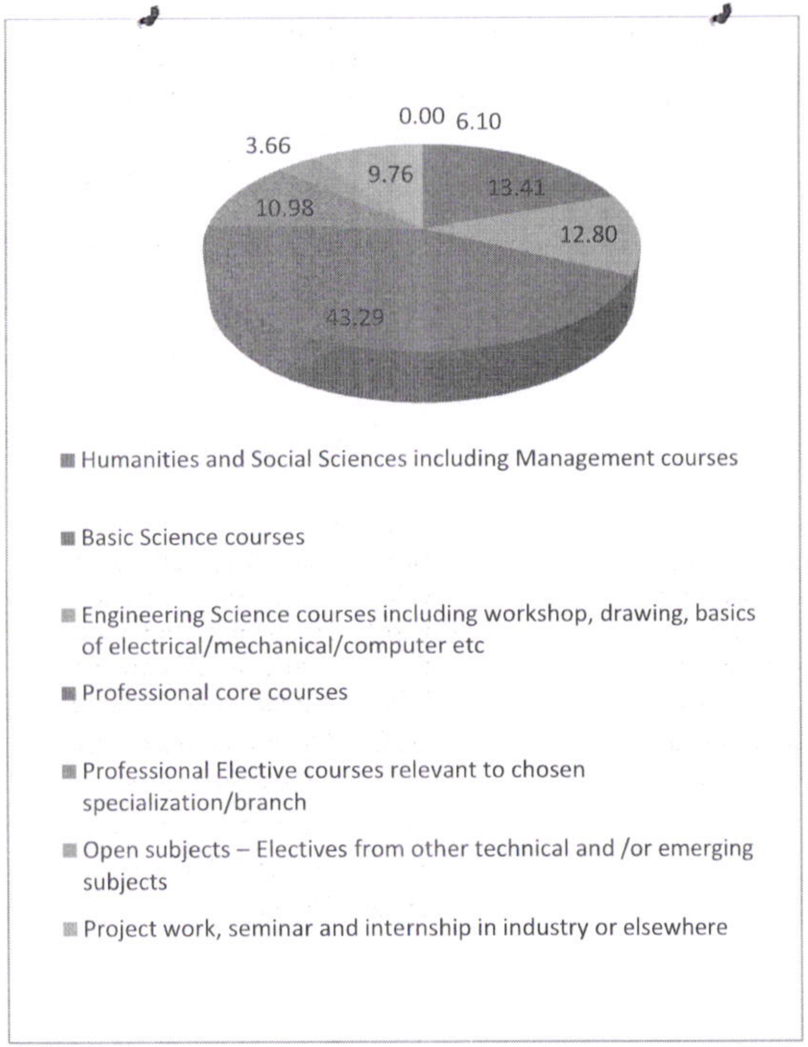
Credit Distribution of Electronics and Telecommunication (Existing and Proposed)

S. No.		Credit Breakup for E & TC (Proposed)	Credit Breakup for E & TC (Existing)	Credit Breakup for E & TC in % (Proposed)	Credit Breakup for E & TC in % (Existing)
1.	Humanities and Social Sciences including Management courses	10	7	6.10	3.89
2.	Basic Science courses	22	24	13.41	13.33
3.	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc	21	21	12.80	11.67
4.	Professional core courses	71	100	43.29	55.56
5.	Professional Elective courses relevant to chosen specialization/branch	18	11	10.98	6.11
6.	Open subjects – Electives from other technical and /or emerging subjects	6	3	3.66	1.67
7.	Project work, seminar and internship in industry or elsewhere	16	14	9.76	7.78
8.	Mandatory Courses [Environmental Sciences, Induction Program, Indian Constitution, Essence of Indian Traditional Knowledge]	(non-credit)	(non-credit)	(non-credit)	(non-credit)
9.	Total	164	180	100.00	100.00



Credit Distribution Chart (Existing)



Credit Distribution Chart (Proposed)

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FRD

Department of Electronics Engineering
Equivalence Scheme
Programme Name: -Electronics and Telecommunication

Sr. No.	Course code with Name of course(old) with total 184 credits		Credit	Course code with Name of course(new)with total 122 credits		Credit
1	ETU501	Linear Integrated Circuits	3	No Equivalence Provided		
2	ETU502	Analog Communication	3	No Equivalence Provided		
3	ETU503	Power Electronics	3	No Equivalence Provided		
4	ETU504	Microcontroller and its application	3	No Equivalence Provided		
5	ETU601	Electromagnetic Fields	3	ETU521	Electromagnetic Waves	4
6	No Equivalence Provided			ETU522	Computer Architecture	3
7	ETU702	Digital Communication	4	ETU523	Digital Communication	4
8	ETU604	Digital Signal Processing	3	ETU524	Digital Signal Processing	4
9	ETU505	Humanities and Economics	3	SHU525*	Human Values and Ethics	--
10	ETU605	Industrial Management and Operational Research	3	ETU525	Operational Research and Optimization	4
11	ETU506	Linear Integrated Circuits Lab	1	No Equivalence Provided		
12	ETU507	Analog Communication Lab	1	No Equivalence Provided		
13	ETU508	Power Electronics Lab	1	No Equivalence Provided		
14	No Equivalence Provided			ETU526	Electromagnetic Waves Lab.	1
15	ETU509	Microcontroller and Its Applications Lab	1	No Equivalence Provided		
16	No Equivalence Provided			ETU527	Computer Architecture	1

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					Lab.	
17	ETU510	Data Structure Lab	2	No Equivalence Provided		
18	ETU706	Digital Communication Lab.	1	ETU528	Digital Communication Lab.	1
19	ETU511	Self Study – I	2	No Equivalence Provided		
20	ETU608	Digital Signal Processing Lab	1	ETU529	Digital Signal Processing Lab.	1
21	ETU602	Audio Video Engineering	3	No Equivalence Provided		
22	ETU603	Electronics Measurement	3	No Equivalence Provided		
23	No Equivalence Provided			ETU621	Control Systems	3
24	ETU801	Computer Networks and Communications	3	ETU622	Communication Networks	3
25	No Equivalence Provided			ETU623	Program Elective –I A)Information theory & coding	3
26	No Equivalence Provided			ETU623	B) Scientific Computing	3
27	ETU804	B)Electronic Design Techniques	3	ETU623	C) Electronic Design Techniques with HDL	3
28	ETU703	D)Artificial Intelligence	3	ETU623	D) Machine learning	3
29	No Equivalence Provided			ETU624	Open Elective-I A) Consumer Electronics	3
30	ETU704	B) Industrial Electronics	3	ETU624	B) Industrial Electronics	3
31	ETU802	Microwave Engineering	3	ETU625	Program Elective –II A) Microwave Engineering	3
32	No Equivalence Provided			ETU625	B) Wavelets and other Engineering Transforms	3
33	No Equivalence Provided			ETU625	C) Micro-Electro-	3

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					Mechanical Systems	
34	ETU803	D) Fuzzy Logic and Neur Networks	3	ETU625	D) Fuzzy Logic	3
35	No Equivalence Provided			ETU626	Human resource and Economics	3
36	ETU610	Mini Project	2	ETU627	Minor Project	2
37	ETU606	Audio & Video Engineering Lab	1	No Equivalence Provided		
38	ETU805	Computer Networks and Communications Lab.	3	ETU628	Communication Networks Lab.	1
39	ETU607	Electronics Measurement Lab	1	ETU629	Electronic Measurement Lab.	1
40	ETU609	Circuit Simulation Lab	2	No Equivalence Provided		
41	ETU611	Self Study – II	2	No Equivalence Provided		
42	ETU612	Industrial Lecture – I	-	No Equivalence Provided		

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ETU521 ELECTROMAGNETIC WAVES

Teaching Scheme: 03L+01T **Total: 04** **Credits: 04**
Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**
ESE duration: 2.30hrs

Course Objectives:
To make the student able

I. To introduce students with different coordinate systems.
II. To familiarize the students with the different concepts of electrostatic, magneto static and time varying electromagnetic systems.
III. To expose the students to the ideas of electromagnetic waves
IV. To identify, formulate and solve fields and electromagnetic waves propagation problems

Vector Analysis: Review of Scalars and Vectors, Vector Algebra. The Coordinate System: Rectangular, Cylindrical and Spherical. Scalar and Vector Fields, Differential Elements of Length, Surface and Volume.

Electrostatics: Introduction to Coulomb's Law, Electric Field Intensity, Flux Density, Field of Line Charges, Field of Surface Charges, Gauss's Law, Divergence, Divergence Theorem, Maxwell's First Equation, Electric Potential and Potential Gradient.

Magneto statics: Current and Current Density, Continuity Equation, Biot-Savart Law, Ampere's Circuital Law and Applications, Curl, Stokes's Theorem, Magnetic Flux and Flux Density, Scalar and Vector Magnetic Potentials. Maxwell's Equations: Steady Field, Boundary Conditions, Time Varying Fields, Electric and Magnetic Boundary Conditions.

Electromagnetic Waves: Electromagnetic Wave Equation, Wave Propagation in Free Space, in a Perfect Dielectric, and Perfect Conductor, Skin Effect, Poynting Vector and Poynting Theorem, Reflection and Refraction of Uniform Plane Wave at Normal Incidence Plane, Reflection at Oblique Incident Angle.

Waveguides: Introduction, Wave Equation in Cartesian Coordinates, Rectangular Waveguide, Transverse Electric (TE), Transverse Magnetic (TM), Transverse Electromagnetic (TEM) Waves in Rectangular Guides, Wave Impedance, Impedance Discontinuities and Standing Waves, Loses in Wave Guide, Introduction to Circular Waveguide.

Radiation: Retarded Potential, Electric and Magnetic Fields Due to Oscillating Dipole (Alternating Current Element), Power Radiated and Radiation Resistance, Application to Short Monopole and Dipole, Basic Antenna Principles.

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Text Books:

1. Engineering Electromagnetic, W. H. Hayt. and J. A. Buck, 7th edition, Tata McGraw Hill, 2006.
2. Electromagnetic Waves and Radiating System, E. C. Jordan and K. C. Balamin, 2nd edition, Prentice Hall of India Private Limited, 1985.
3. Elements of Engineering Electromagnetic, Nannapaneni Narayana Rao, 6th edition, Pearson Education, 2006.

Reference Books:

1. Field and Wave Electromagnetic, David K. Cheng, 2nd Edition, Prentice Hall
2. Electromagnetic, J. D. Krauss, 3rd edition, Mc-Graw Hill, 1984.

Course Outcomes:

At the end of this course students will demonstrate the ability to

ETU521.1 Apply the knowledge of Engineering Mathematics to solve the numerical, analyse and evaluate various scalar and vectors quantities of electrostatics, magneto statics.

ETU521.2 Understand the concept of electrostatics, magneto statics behavior and wave propagation.

ETU521.3 Describe, select and apply various laws and theorems to evaluate electrostatics and magneto statics quantities.

ETU521.4 Analyze and evaluate EM wave propagation parameters in different media

ETU521.5 Understand principle of radiation and radiation characteristics of an antenna

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU521.1	3	2	0	0	0	1	1	1	3	2	1	1	1	2	1
ETU521.2	2	3	1	1	1	2	2	0	3	2	2	2	1	2	1
ETU521.3	3	2	1	0	1	0	1	1	3	2	2	2	1	2	1
ETU521.4	3	2	2	1	0	1	1	1	3	2	1	2	2	3	1
ETU521.5	3	3	2	0	1	1	2	1	3	2	2	2	2	3	1

0- Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

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ETU522 COMPUTER ARCHITECTURE

Teaching Scheme: 03L **Total: 03** **Credits: 03**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

ESE duration: 2Hrs.30Min.

Course Objectives:

To make the student able

I. To describe the fundamental architecture and organization of basic computer

II. To understand the structure, function and characteristics of the computer functional units

III. To learn the concept of memory organization

IV. To acquire knowledge of micro programming, pipelining and parallelism

Introduction: Types of computers, functional units, operational concepts, computer components – top level view, bus interconnection structure, performance equation, CISC Vs RISC, types of instructions, instruction sequencing, stack, queues and subroutine.

Arithmetic and Logic Unit: Data representation, computer arithmetic, addition / subtraction logic unit, fast adder design, multiplication, Booth algorithm, division, simple ALU design.

Input/output Organization: Accessing I/O devices, Direct Memory Access, interrupts, buses, multi-level bus architecture, interface circuits – parallel and serial ports, standard I/O interfaces – PCI and USB.

Memory Organization: Internal memory organization, system memory, cache memory, performance considerations of cache, virtual memory, memory management, external memory.

Processing unit: Fundamental concept, instruction execution cycle, hardwired control, micro programmed control.

Pipelining and Parallel processing: Introduction to Pipelining, hazards, data path control considerations, performance considerations. Architecture of 8086 microprocessor, concurrent operation of EU and BIU, introduction to parallelism, on-chip parallelism, case study of Pentium 4 processor.

Text Books:

1. Computer Organization, Carl Hamacher, ZvonkoVrenesic, SafwatZaky, 5th edition, McGraw Hill Education, 2002.
2. Computer Organization and Architecture – Designing for Performance, William Stalling, 7th edition, Prentice Hall, 2009.

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Reference books:

1. Structured Computer Organization, Andrew S. Tanenbaum, Todd Austin, 6th edition, Pearson India.
2. Computer Architecture and Organization, John P. Hayes, 3rd edition, McGraw Hill Education, 1998.
3. Computer System Architecture, Morris M. Mano, Peter Abel, 5th edition, Pearson Education Ltd., 2005

Course Outcomes:

After completing this course, Students shall be able to:

ETU522.1 Understand the working of the computer components and analyze the performance

ETU522.2 Illustrate the system memory hierarchy and memory management hardware

ETU522.3 Discuss the pipelining and parallelism in computer system

ETU522.4 Apply the knowledge of combinational and sequential logic circuits to design simple ALU

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU522.1	3	1	1	2	1	1	2	2	2	1	2	2	3	1	0
ETU522.2	2	0	0	1	2	0	2	1	2	1	2	2	3	1	0
ETU522.3	3	0	0	1	2	0	2	1	2	1	3	2	3	1	0
ETU522.4	2	0	0	1	2	1	2	1	2	1	2	2	3	1	0

0- Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

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ETU523 DIGITAL COMMUNICATION

Teaching Scheme: 03L+01T **Total: 04** **Credit: 04**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total marks: 100**

ESE duration: 02 Hrs 30 min.

Course Objectives:

The course aims to provide the students

I. Understanding the key modules of digital communication systems with emphasis on digital modulation techniques.
II. To get introduced to the concept and basics of information theory, source and channel coding/decoding
III. Learn about theoretical bounds on the rates of digital communication system and represent a digital signal using several modulation methods.
IV. Draw signal space diagrams, compute spectra of modulated signals and apply redundancy for reliable communication.

Pulse Modulation Techniques: Sampling theory, uniform and non-uniform quantization in pulse code modulation PCM, μ-law and A-law PCM, DPCM, DM/ADM, bandwidth requirement of PAM, PPM, PWM, PCM, TDM, FDM and CDMA.

Digital Communication System: Introduction, elements of digital communication system, importance of digital system.

Information Theory and Channel Capacity: Measure of information, encoding of the source output, Shannon's encoding algorithm, Huffman encoding algorithm, discrete communication channel and its capacity, Shannon's theorem on channel capacity.

Baseband Data Transmission: Baseband binary PAM system, inter symbol interference, Nyquist's criteria for distortion less baseband binary transmission, correlative coding, duobinary signaling, modified duobinary technique, equalization, eye diagram, synchronization.

Digital Carrier Modulation and Demodulation Schemes: Coherent and noncoherent: binary ASK, PSK, FSK, probability of errors, comparison of digital modulation schemes, basics of DPSK and QPSK, M-ary signaling schemes and synchronization method.

Error Control Coding: Introduction, methods, types, linear block codes, error- detecting and correcting capability, cyclic code, convolutional codes and viterbi decoding algorithm.

Spread Spectrum Techniques: Direct Sequence Spread Spectrum modulation, Frequency-hop Spread Spectrum modulation - Processing gain and jamming margin.

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Text Books:

1. Digital and Analog Communication Systems, K. S. Shanmugam, 2nd edition, John Wiley and Sons, 1996
2. Digital Communication, S. Haykin, 4th edition, John Wiley and Sons, reprint 2009

Reference Books:

1. Digital Communication, J. K. Proakis, 5nd edition, Mc-Graw Hill Book Co., New York, 2008
2. Principles of Communication Systems, H. Taub, D. L. Schilling, G. Saha, 3rd edition, Mc-Graw Hill Publication Co. Ltd., 2008
3. Digital Communications Fundamentals and Applications, B. Sklar, 2nd edition, Pearson Education, 2006

Course Outcomes:

At the end of course, student shall be able to:

ETU523.1 Understand the principles of digital communications systems.

ETU523.2 Apply the knowledge of signals and system and evaluate the performance of digital communication system in the presence of noise.

ETU523.3 Analyze the performance of advance modulation techniques.

ETU523.4 Explain importance and use of channel coding in digital communication.

ETU523.5 Analyze the performance of spread spectrum communication system.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU523.1	3	1	2	0	1	0	2	1	3	2	2	3	3	2	1
ETU523.2	3	2	2	0	2	1	3	2	2	1	2	3	3	2	1
ETU523.3	2	2	2	1	2	1	2	1	2	1	1	3	3	2	1
ETU523.4	3	1	2	0	1	0	2	1	2	2	2	2	3	2	1
ETU523.5	2	2	2	1	2	1	2	1	2	1	1	3	3	2	1

0- Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

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ETU524 DIGITAL SIGNAL PROCESSING

Teaching scheme: 03 L + 01T **Total: 04** **Credit: 04**

Marking scheme: 30 MSE + 10TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2Hrs.30 Min

Course Objectives:
The objectives of offering this course are

I. To make strong foundation of discrete time signals and discrete systems.
II. To strengthen ability of students to analyze discrete time signals and Discrete Time systems.
III. To provide a study, implementation, and applications of DSP algorithms.
IV. To make familiar with design of digital filters and its implementation on DSP processor.
V. To understand working of different processors and apply them in system design.

Discrete Fourier transform: DTFT and DFT relationship and their inverses, Properties, Fast Fourier transform (FFT), Decimation in time and frequency, Computation of the DFT of real sequences, Linear and Circular convolution using DFT.

Implementation of Discrete Time Systems: Structures for FIR systems, Structures for IIR systems, Representation of numbers, Errors resulting from Rounding and Truncation.

Design of Digital Filters: Design of linear-phase FIR filter using windows (rectangular, Blackman, Bartlett, Hamming, etc.), frequency sampling method, pole zero placements, IIR filter design techniques: approximation of derivatives, impulse invariant, Bilinear transformation, Characteristics of commonly used analog filters.

Introduction to Multirate Digital Signal Processing: Decimation and interpolation, sampling rate conversion, applications of multirate signal processing, digital filter banks.

DSP Processors and Applications: Study of DSP chip architecture and its features, comparison with similar digital signal processors.

Text Books:

1. Digital Signal Processing, J. G. Proakis and D. G. Monolakis, 4rth edition, Pearson Education, 2006
2. Digital Signal Processing, A. V. Oppenheim, R. W. Schafer, 3rd edition, McGraw Hill International, 2006

Reference Books:

1. Digital Signal Processing, S. K. Mitra, 3rdedition, Tata McGraw Hill, 1998
2. Digital Signal Processing- A practical approach, E. C. Ifeachor, B. W. Jarvis, 2nd edition, Prentice Hall, 2002
3. Digital Signal Processor: Architecture, Programming and Applications, B. Venkatramani and M. Bhaskar, 2nd edition Tata McGraw Hill, 2011

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4. Digital Signal Processing, S. Salivahanan and C. Gnanapriya, 2nd edition, Tata McGraw Hill, reprint 2011

Course Outcomes:

On the successful completion of this course; student shall be able

ETU524.1	To represent and analyze discrete systems in time domain.
ETU524.2	To analyze discrete signals and systems in frequency domain using DTFT, DFT.
ETU524.3	To design FIR and IIR filters and realize them in direct form, cascade form and parallel form.
ETU524.4	To implement architecture of DSP processor in various applications.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU524.1	2	1	2	2	3	1	1	1	1	2	2	2	3	3	1
ETU524.2	2	0	2	2	3	0	1	1	1	2	1	2	3	2	0
ETU524.3	2	1	2	2	3	0	1	0	1	2	1	2	3	2	0
ETU524.4	3	1	2	2	3	1	1	2	2	2	2	3	3	3	1

0- Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

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SHU525 HUMAN VALUES AND ETHICS

Teaching Scheme: 01Th+ 00Tut = 01 **Total Credits: 00**
Evaluation Scheme: 20 TA + 30 ESE **Total Marks: 50**

Course Objectives:

I. To develop the importance of moral virtue through spiritual and yoga activities which leads to professional experience of students
II. To understand the dimension of professional ethics.
III. To learn engineering ethics through theories which develop moral judgment among technical students.
IV. To understand the global ethical issues and its dimension this leads to moral leadership

Human Values
Morals, values and Ethics, Integrity, Work ethic, Service learning, Civic virtue, Respect for others, Living peacefully, Caring, Sharing, Honesty, Courage, Valuing time, Cooperation, Commitment, Empathy, Self-confidence, Character, Spirituality, Introduction to yoga and meditation for professional excellence and stress management.

Professional Ethics
Definition of Ethics, Professional Ethics, Business Ethics, Corporate Ethics, Engineering Ethics, Personal Ethics; Profession, Professionalism, Professional Responsibility, Professional Ethics; Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistle blowing, protected disclosures.

Engineering Ethics
Senses of 'Engineering Ethics', Variety of moral issues, Types of inquiry, Moral dilemmas, Moral Autonomy, Kohlberg's theory, Gilligan's theory, Consensus and Controversy, Models of professional roles, Theories about right action, Self-interest, Customs and Religion, Uses of Ethical Theories

Global Issues
Multinational Corporations, Environmental Ethics, Computer Ethics, Weapons Development, Engineers as Managers, Consulting Engineers, Engineers as Expert Witnesses and Advisors, Moral Leadership, Code of Conduct, Corporate Social Responsibility

Text books:

1. "Ethics in Engineering", Mike W. Martin and Roland Schinzinger, Tata McGraw Hill, New Delhi, 2003.
2. "Engineering Ethics", Govindarajan M, Natarajan S, Senthil Kumar V. S, Prentice Hall of India, New Delhi, 2004.

Reference books:

1. "Engineering Ethics", Charles B. Fleddermann, Pearson Prentice Hall, New Jersey,

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2004.
3. "Engineering Ethics – Concepts and Cases", Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, Cengage Learning, 2009
4. "Ethics and the Conduct of Business", John R Boatright, Pearson Education, New Delhi,2003
5. "Fundametals of Ethics for Scientists and Engineers", Edmund G Seebauer and Robert L Barry, Oxford University Press, Oxford, 2001
6. "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Laura P. Hartman and Joe Desjardins, Mc Graw Hill education, India Pvt. Ltd.,New Delhi 2013.
7. "Value Education", World Community Service Centre, Vethathiri publications, Erode, 2011

Course Outcomes:
After the successful completion of the course the student shall be able to

SHU525.1 Make work life balance and found himself or herself with sound mindset at workplace.

SHU525.2 Incorporate professional ethics at work place.

SHU525.3 Manage moral dilemmas and conflicts at workplace.

SHU525.4 Develop global perspective for ethical issues.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
SHU525.1	3	0	0	1	1	2	3	2	3	2	2	3	3	3	3
SHU525.2	3	0	1	1	2	2	3	2	3	3	3	3	3	3	3
SHU525.3	2	1	1	2	1	2	2	2	3	3	2	3	3	3	3
SHU525.4	1	1	1	2	2	2	2	2	3	3	2	3	3	3	3

0- Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

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ETU525 OPERATIONAL RESEARCH AND OPTIMIZATION

Teaching Scheme: 03L+01T **Total: 04** **Credit: 04**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2 Hrs.30 min.

Course Objectives:

The objectives of offering this course are

I. Introduction to operation research and optimization techniques using both linear and non-linear programming.
II. The focus of the course for optimization though various techniques using dynamic programming etc.
III. To design operation research problem in various area of resource minimization,
IV. Students will learn to frame engineering minima maxima problems in the framework of optimization problems

Operation Research (OR) modeling approach (Problem identification, modeling, finding solution, testing etc.), scope and limitations of OR. Introduction to optimization, Statement, Classification of an Optimization Problem with Historical Development and application to Engineering

Linear Programming (LP): Assumption and formulation of LP model, solution by graphical method, simplex and two-phase simplex method, dual simplex method and sensitivity analysis, Transportation problem with IBFS and MODI method.

Non-Linear Programming: Introduction, types, constrained and unconstrained. Optimization method, one variable and multivariable, Indirect Search (Descent) Methods steepest descent, conjugate gradient and Newton's method.

Dynamic Programming: Introduction and characteristics, recursion in dynamic programming, investment problem, production scheduling problem, and stage coach problem, equipment replacement.

Machine Sequencing Problems: n jobs through two machines, n jobs through three machines, n jobs through machines, two jobs through m machines sequencing problem.

Project Management: CPM and PERT, finding critical path, time-cost trade off, resource smoothing and resource leveling

Text Books :

1. Introduction to Operation Research (1st edition), by B. E. Gillet, McGraw-Hill,
2. Introduction to Optimization (3rd edition), by S. S. Rao, Prentice Hall of India

Reference Books :

1. Introduction to Operation Research, by H. A. Taha, Prentice Hall of India.
2. Operation Research (1st edition), by Tiwari and Shandilya, Prentice Hall of India.
3. Computer Aided Project Management (2nd edition), by P. B. Mahapatra Prentice Hall of India
4. Operation Research (8th edition), by Natrajan, Balsubramani, Pearson Education
5. Introduction to Operation Research, Concepts and Cases (8th edition, 2004), by Hillier and Liberman, McGraw-Hill.

Course Outcomes:

By the end of the course, students should be able to

ETU525.1 Cast engineering minima/maxima problems into optimization framework.

ETU525.2 Learn efficient computational procedures to solve constrained and unconstrained optimization

ETU525.3 Solve operation research problems in field of machine sequencing and project development

ETU525.4 Program in Matlab/Python to implement important optimization methods.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU525.1	3	2	1	1	1	0	1	1	1	2	1	3	3	2	1
ETU525.2	3	2	1	1	2	1	1	1	1	1	0	2	2	1	0
ETU525.3	3	2	1	1	2	1	1	0	1	1	0	2	2	2	0
ETU525.4	2	1	1	0	1	0	0	0	0	1	0	1	3	1	1

0-Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

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ETU526 ELECTROMAGNETIC WAVES LAB

Teaching Scheme: 02 **Total: 02** **Credits: 01**

Evaluation Scheme: 25 ICA+25 ESE **Total Marks: 50**

Course Objectives:

To make the student able

I. To understand and verify various laws of Electric Field and Magnetic field.
II. To demonstrate or to visualize the propagation of EM waves within the waveguides.
III. To fabricate printed antenna and analyze its performance using Network Analyzer.
IV. To simulate and analyze the antenna using antenna designing software.

Minimum eight experiments shall be performed to achieve course outcomes.

It is a representative list of practical/exercises. The instructor may choose experiments to fulfill the course outcomes.

List of Experiments

1. To study and verify Gauss's law.
2. To study and verify Biot-Savart law.
3. To study and verify Ampere Circuital law.
4. Verify the relationship between wavelength of an EM wave in air and inside a rectangular waveguide.
5. Visualize and study various mode of rectangular waveguide.
6. Measurement of Transmission line parameters.
7. Make any printed antenna using $FeCl_3$ and tape on a substrate and then test it (using a Network Analyzer).
8. Make any antenna using CAD-FEKO software and test it.

Course Outcomes:

At the end of this course students will demonstrate the ability to

ETU526.1	Demonstrate various laws of Electric Field and Magnetic field.
ETU526.2	Understand the propagation of EM waves within the waveguides.
ETU526.3	Fabricate printed antenna and analyze its performance using Network Analyzer.
ETU526.4	Design, simulate and analyze the antenna using antenna designing software.

Note:

ICA – The Internal Continuous Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continues assessment format A and B.

ESE – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions.

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CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU526.1	2	2	2	3	0	2	1	1	2	1	2	2	1	2	0
ETU526.2	2	1	1	2	1	2	1	1	2	2	1	2	1	2	0
ETU526.3	2	1	1	3	0	1	1	1	2	1	1	2	1	2	0
ETU526.4	2	2	3	3	1	2	2	1	2	2	1	2	1	2	0

0-Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

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ETU527 COMPUTER ARCHITECTURE LAB

Teaching Scheme: 02P **Total: 02** **Credits: 01**

Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**

Course Objectives:

To make student able

I. To learn the functional units of ALU
II. To understand the design concept arithmetic circuits
III. To understand concept of memory design
IV. To develop ALU for small computer system

Minimum eight experiments shall be performed to achieve course outcomes.

It is a representative list of practical/exercises. The instructor may choose experiments to fulfill the course outcomes.

List of Experiments :

To simulate

1. Ripple carry adder
2. Carry-look-ahead adder
3. Flip-flops
4. Registers and counters
5. Combinational multipliers
6. Booth's multiplier
7. ALU
8. Memory design
9. Associative cache design
10. CPU design

Course Outcomes:

After completing this course, Students shall be able to:

ETU527.1 Learn the different circuits of ALU
ETU527.2 Implement circuits to form processing unit
ETU527.3 Design memory for a computer system
ETU527.4 Simulate small microcomputer system

ICA – The Internal Continuous Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continues assessment format A and B.

ESE – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions.

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CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU527.1	3	1	3	2	1	1	2	2	2	1	2	2	3	1	0
ETU527.2	2	0	2	1	2	0	2	1	2	1	2	2	3	1	0
ETU527.3	3	0	3	0	2	0	2	1	2	1	3	2	3	1	0
ETU527.4	2	0	2	1	2	1	2	1	2	1	2	2	3	1	0

0- Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

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ETU528 DIGITAL COMMUNICATION LAB

Teaching Scheme: 02	**Total: 02**	**Credits: 01**
Evaluation Scheme: 25Internal + 25 External		**Total Marks: 50**

Course Objective:

I. Knowledge in digital communication systems at the practical level and familiarize the students with basic digital communication systems.

II. Integrate theory with experiments so that the students appreciate the knowledge gained from the theory course, e.g., ASK, FSK, PSK…

III. Identify and measure factors which hamper communication systems.

IV. Understand fundamental concepts on TDM, source coding techniques and Error-control coding techniques.

V. Identify and measure factors which hamper communication systems.

Minimum eight experiments shall be performed to achieve course outcomes.

It is a representative list of practical/exercises. The instructor may choose experiments to fulfill the course outcomes.

List of Experiments

1. Verify sampling theorem
2. Verify different pulse modulation techniques
3. Verify time division multiplexing and de-multiplexing
4. Analyze pulse code modulation (PCM) for uniform and non-uniform quantization
5. Measure signal to noise ratio for pulse code modulation (PCM) system with uniform quantization
6. Compare delta modulation and adaptive delta modulation systems
7. Generate phase shift keying and its spectral analysis
8. Spectral analysis of line codes
9. Generation and detection of direct spread spectrum (DS-SS) binary shift keying (BPSK)
10. Simulation of any digital communication system using MATLAB
11. Implementing Convolution Encoder/Decoder using MATLAB.
12. Implementing Viterbi Algorithm using MATLAB.

Course Outcomes:

On completion of this lab course the students shall be able to:

ETU528.1 Able to understand basic theories of digital communication system in practical.

ETU528.2 Able to design and implement different modulation and demodulation techniques.

ETU528.3 Able to analyze digital modulation techniques by using MATLAB tools.

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ETU528.4 Able to identify and describe different techniques in modern digital communications, in particular in source coding using MATLAB tools.

ETU528.5 Able to demonstrate the error detection and error correction in linear convolution codes.

ICA – The Internal Continuous Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continues assessment format A and B.

ESE – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU528.1	3	1	2	0	1	0	2	1	3	2	2	3	3	2	1
ETU528.2	3	2	2	0	2	0	3	2	2	1	2	3	3	2	1
ETU528.3	2	2	2	1	2	0	2	1	2	1	1	3	3	2	1
ETU528.4	3	1	2	0	1	0	2	1	2	2	2	2	3	2	1
ETU528.5	2	2	2	1	2	0	2	1	2	1	1	3	3	2	1

0-Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

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ETU529 DIGITAL SIGNAL PROCESSING LAB

Teaching Scheme: 02P **Total: 02** **Credit: 01**

Evaluation Scheme: 50 ICA **Total Marks: 50**

Course Objectives:

The objectives of offering this course are

I. To make strong foundation of discrete time signals and discrete systems
II. To strengthen ability of students to analyze discrete time signals and discrete time linear time invariant (DTLTI) systems in time domain and frequency domain
III. To make students familiar with design of digital filters
IV. To strengthen ability of students in digital filters implementation on DSP processor .

Minimum eight experiments shall be performed to achieve course outcomes.

It is a representative list of practical/exercises. The instructor may choose experiments to fulfill the course outcomes.

List of Experiments

1. Prove the Nyquist criteria with the help of Fourier transform. Also suggest the practical sampling rate for undistorted signals using Mentor DSP Software Tool.
2. To study Convolution sum /correlation.
3. To study Discrete Fourier transform and its properties.
4. To design Pole zero plot of a transfer function.
5. To solve the difference equation and find the system response using Z transform (for non-relaxed LTI system).
6. To design FIR filter using window and frequency sampling method.
7. To design IIR filter (Butterworth and Chebyshev Approximation).
8. To study Effect of coefficient quantization on the impulse response of the filter using direct form I and II realization and cascade realization (theory assignment) .
9. To study Interfacing DSP processor.
10. To Verify FIR filter on DSP processor.
11. To verify IIR filter on DSP processor.
12. With the help of Fourier series, to make a square wave from sine and cosine waves. using Mentor DSP Software Tool.
13. To verify different windowing techniques using Mentor DSP Software Tool (Rectangular, Blackman and Hamming) for square wave as an input. Which window will give good results?

Course Outcomes:

On the successful completion of this course; student shall be able to

ETU529.1	Analyze discrete systems in time domain.
ETU529.2	Analyze discrete systems in frequency domain using DFT.
ETU529.3	Design FIR / IIR filters and implement on software platform.
ETU529.4	Implement FIR / IIR filters on digital signal processor.

ICA – The Internal Continuous Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continues assessment format A and B.

ESE – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU529.1	2	1	2	2	3	1	1	1	1	2	2	2	3	3	1
ETU529.2	2	0	2	2	3	0	1	1	1	2	1	2	3	2	0
ETU529.3	2	1	2	2	3	0	1	0	1	2	1	2	3	2	0
ETU529.4	3	1	2	2	3	1	1	2	2	2	2	3	3	3	1

0- Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

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PTS

ETU 621 CONTROL SYSTEMS

Teaching Scheme: 03L **Total: 03** **Credits: 03**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

ESE duration: 2 Hrs 30 Min

Course Objectives:

To make student able

I. To learn modeling of a physical system
II. To understand the concept of stability of system
III. To understand the systems in time and frequency domain
IV. To understand the state space modeling and its analysis

Introduction to control problem: Industrial Control examples, Transfer function, System with dead time, System response, Control hardware and their models: potentiometers, synchros, LVDT, dc and ac servomotors, tacho-generators, electro hydraulic valves, hydraulic servomotors, electro pneumatic valves, and pneumatic actuators. Closed-loop systems, Block diagram and signal flow graph analysis.

Feedback control systems: Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness, proportional, integral and derivative systems, Feed-forward and multi-loop control configurations, stability concept, relative stability, Routh stability criterion. Time-response of second order systems, steady-state errors and error constants, Performance specifications in time domain, Root locus method of design, Lead and lag compensation.

Frequency-response analysis: Polar plots, Bode plot, stability in frequency domain, Nyquist plots, Nyquist stability criterion, Performance specifications in frequency-domain, Frequency-domain methods of design, Compensation and their realization in time and frequency domain, Lead and Lag compensation, Op-amp based and digital implementation of compensators, Tuning of process controllers, State variable formulation and solution.

State variable Analysis: Concepts of state, state variable, state model, state models for linear continuous time functions, diagonalization of transfer function, solution of state equations, concept of controllability and observability. Introduction to optimal control and nonlinear control, optimal control problem, regulator problem, output regulator, trekking problem, nonlinear system: Basic concept & analysis.

Text Book:

1. Gopal. M., "Control Systems: Principles and Design", Tata McGraw-Hill, 1997.

Reference Books:

1. Kuo, B.C., "Automatic Control System", Prentice Hall, sixth edition, 1993.
2. Ogata, K., "Modern Control Engineering", Prentice Hall, second edition, 1991.
3. Nagrath & Gopal, "Modern Control Engineering", New Age International, New Delhi

Course Outcomes:

ETU621.1 Model a physical system by means of block diagrams, mathematical model and transfer functions
ETU621.2 Investigate stability of a system using different tests
ETU621.3 Analyse the systems in time and frequency domain
ETU621.4 Model and analyse the control systems using state space analysis

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU621.1	3	2	3	2	1	1	0	1	2	2	2	3	3	2	1
ETU621.2	3	2	2	3	1	1	1	0	2	1	2	2	3	2	1
ETU621.3	2	2	2	3	2	1	1	1	2	2	2	2	3	2	1
ETU621.4	2	2	3	3	2	1	0	1	2	2	2	3	3	2	1

0- Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

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PPD

ETU622 COMMUNICATION NETWORKS

Teaching Scheme	**: 03 L**	**Total: 03**	**Credit: 03**
Evaluation Scheme	**: 30 MSE +10 TA+ 60 ESE**		**Total Marks: 100**
Duration of ESE	**: 2 Hrs.30 min.**		

Course Objectives:

To make student able to

I. Describe the general principles of data communication.
II. Describe how computer networks are organized with the concept of layered approach.
III. Describe how signals are used to transfer data between nodes.
IV. Implement a simple LAN with hubs, bridges and switches.

Introduction to Data Communication and Networking: Uses of Computer Networks, Network Hardware, Network Software Internet Reference Models (OSI and TCP/IP), Switching.

Physical Layer: Basis for Data Communication, Guided Transmission Media, Wireless Transmission Medium

Data Link Layer and its Protocols: Piggybacking, multiple access protocol: channel allocation, random access methods: Additive Links On-line Hawaii (ALOHA), slotted ALOHA, carrier sense multiple access (CSMA), CSMA with collision detection (CSMA/CD), controlled access methods: polling, token bus and token ring

TCP/IP Protocols: Overview of transfer control protocol (TCP) / internet protocol (IP), user datagram protocol (UDP), IP addressing and related issues, IP address resolution techniques, IP datagram and forwarding.

Networking Devices and Routing algorithms: Hubs, repeaters, bridges, routers, gateways, switches, routing algorithms: Distance Vector, Link State, Dijkstra's algorithm.

Applications: X.25, Frame Relay, Asynchronous Transfer Mode (ATM), Integrated Services Digital Network (ISDN)

Text Books:

1. B. A. Forouzan, "Data Communications and Networking", Tata McGraw Hill, 4th Edition
2. J.F. Kurose and K. W. Ross, "Computer Networking – A top down approach featuring the Internet", Pearson Education, 5th Edition

Reference Books:

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1. L. Peterson and B. Davie, "Computer Networks – A Systems Approach" Elsevier Morgan Kaufmann Publisher, 5th Edition.
2. T. Viswanathan, "Telecommunication Switching System and Networks", Prentice Hall
3. Andrew Tanenbaum, "Computer networks", Prentice Hall,4th Edition
4. D. Comer, "Computer Networks and Internet/TCP-IP", Prentice Hall ,3rd Edition
5. William Stallings, "Data and computer communications", Prentice Hall

Course Outcomes:

After completion of the course, the students will be able to

ETU622.1	Describe the components and infrastructure that form the basis for most computer networks
ETU622.2	Describe the technical aspects of data communications on the Internet
ETU622.3	Design the network by using the concepts of layered architecture
ETU622.4	Understand the concepts of networking thoroughly.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU622.1	1	1	3	0	2	1	1	1	2	2	2	3	3	2	1
ETU622.2	1	1	2	0	2	1	1	1	3	2	3	3	3	2	1
ETU622.3	2	1	2	1	2	2	1	1	3	2	3	3	3	2	0
ETU622.4	2	1	3	1	2	1	1	1	3	2	3	3	3	2	0

0- Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

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PROGRAM ELECTIVE-I
ETU623A INFORMATION THEORY AND CODING

Teaching Scheme	**: 03 L**	**Total: 03**	**Credit: 03**
Evaluation Scheme	**: 30 MSE +10 TA+ 60 ESE**		**Total Marks: 100**
Duration of ESE	**: 2 Hrs.30 min.**		

Course Objectives:

To make students able to

I. Define and apply the basic concepts of information theory (entropy, channel capacity etc.)
II. Learn the principles and applications of information theory in communication systems
III. Study various data compression methods and describe the most common such methods
IV. Understand the theoretical framework upon which error-control codes are built

Prerequisite for this course: ETU523 Digital Communication.

Information Theory: Introduction, Uncertainty and Information, Average Mutual Information and Entropy, Information Measures for continuous random variables.

Channel Capacity and Coding: Channel Models, Channel Capacity, Channel Coding, Channel Capacity Using the Noise Matrix, Shannon Capacity, Memory Sources (Markov Sources) ,Finite and Homogeneous Markov Chains.

Source Coding: Types of Codes, Prefix Codes, Source Coding Theorem, Binary Codes Used in Data Transmission, Storage or computing, Coding Efficiency: Compression Ratio, Lossless Compression Algorithms, Run Length Coding (RLC),Dictionary Techniques, Lempel-Ziv Type Algorithms, Arithmetic Coding, Lossy Compression in Differential Coding.

Cryptography Basics, Cryptosystems: Role and Classification, Cryptanalytic Attacks and Algorithms Security, Modern Symmetric (Conventional) Cryptography , Block Ciphers, DES (Data Encryption Standard) , Public Key Cryptography.

Error Control Coding: The Hamming Codes, Burst Error Correcting Codes: Burst Errors, Interleaved Codes, and BCH Codes.

Text Books:

1. R. Bose, Information Theory, Coding and Cryptography, Second Edition, Tata McGraw Hill, Reprint 2012.
2. Monika Borada, Fundamentals in Information theory and coding, Springer, Scientific Publishing Services Pvt. Ltd., Chennai, India.2011.

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Reference Books:

1. R. Togneri, C.J.S deSilva, Fundamentals of Information Theory and Coding Design, Taylor and Francis.2011
2. T. M. Cover, J. A. Thomas, Elements of Information Theory, Wiley.
3. N. Abramson, Information and Coding, McGraw Hill, 1963.
4. M. Mansurpur, Introduction to Information Theory, McGraw Hill, 1987.
5. R.B. Ash, Information Theory, Prentice Hall, 1970.

Course Outcomes:

After completion of the course, the students will be able to

ETU623A.1 Quantify the notion of information in a mathematically sound way.

ETU623A.2 Calculate entropy and channel capacity of a system.

ETU623A.3 Differentiate between lossy and lossless compression techniques.

ETU623A.4 Apply coding techniques.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU623A.1	3	2	2	1	1	2	2	1	2	2	1	2	2	2	1
ETU623A.2	3	2	2	1	2	0	2	2	2	2	2	2	2	1	0
ETU623A.3	2	2	1	0	1	1	2	1	2	2	2	2	2	2	1
ETU623A.4	3	2	2	1	2	1	2	3	3	2	2	3	3	3	2

0- Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

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ETU623B SCIENTIFIC COMPUTING

Teaching Scheme	**: 03 L**	**Total: 03**	**Credit: 03**
Evaluation Scheme	**: 30 MSE +10 TA+ 60 ESE**		**Total Marks: 100**
Duration of ESE	**: 2 Hrs.30 min.**		

Course Objectives:
Students will

I. Learn the necessary mathematical concepts of linear and non-linear equation.
II. Understand the scientific techniques of data analysis using Interpolation and Numerical Integration.
III. Comprehend fundamental concepts of scientific programming using suitable computing platform viz. Matlab, Python, R programming etc..
IV. To solve initial and boundary value problems.

System of liner equations: Linear Systems, Solving Linear Systems, Gaussian elimination, Pivoting, Gauss-Jordan, Norms and Condition Numbers, Symmetric Positive Definite Systems and Indefinite System, Iterative Methods for Linear Systems.

Linear least squares: Data Fitting, Linear Least Squares, Normal Equations Method, Orthogonalization Methods, QR factorization, Rank Deficiency, and Column Pivoting.

Nonlinear equations: Fixed Point Iteration, Newton's Method, and Inverse Interpolation Method.

Optimization: One-Dimensional Optimization, Multidimensional Unconstrained Optimization, and Nonlinear Least Squares.

Interpolation: Purpose for Interpolation, Choice of Interpolating, Function, Polynomial Interpolation, Piecewise Polynomial Interpolation.

Numerical Integration and Differentiation: Quadrature Rule, Newton-Cotes Rule, Gaussian Quadrature Rule, Finite Difference Approximation.

Initial Value Problems for ODEs: Euler's Method, Taylor Series Method, Runga-Kutta Method, Extrapolation Methods, Boundary Value Problems For ODEs, Finite Difference Methods, Finite Element Method.

Text Books:

1. Heath Michael T., "Scientific Computing: An Introductory Survey", McGraw-Hill, 2nd Ed., 2002

Reference Books:

1. Press William H., Saul A. Teukolsky, Vetterling William T and Brian P. Flannery, "Numerical Recipes: The Art of Scientific Computing", Cambridge University Press, 3rd Ed., 2007

2. Xin-she Yang (Ed.)., "Introduction To Computational Mathematics", World Scientific Publishing Co., 2nd Ed., 2008

3. Kiryanov D. and Kiryanova E., "Computational Science", Infinity Science Press, 1st Ed., 2006

4. Quarteroni, Alfio, Saleri, Fausto, Gervasio and Paola, "Scientific Computing With MATLAB And Octave", Springer, 3rd Ed., 2010

Course Outcomes:

After completion of the course, the students will be able to –

ETU623B.1 Understand the significance of computing methods, their strengths and application areas.

ETU623B.2 Perform the computations on various data using appropriate computation tools.

ETU623B.3 Apply these methods to academic and simple practical instances.

ETU623B.4 Modeling and solving real time application using ODE.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU623B.1	3	2	3	0	2	2	2	1	3	3	2	2	3	3	3
ETU623B.2	3	2	3	3	2	2	2	1	3	3	2	0	3	3	0
ETU623B.3	2	2	3	3	2	3	2	1	0	3	2	2	0	3	3
ETU623B.4	3	2	3	3	2	3	0	1	3	3	2	2	3	3	3

0- Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

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ETU 623C ELECTRONIC DESIGN TECHNIQUES WITH HDL

Teaching Scheme: 03L **Total:03** **Credits:03**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

ESE duration: 2 Hrs 30 Min

Course Objectives: Students will

I. To design combinational and sequential circuits using Verilog HDL
II. To understand behavioral and RTL modeling of digital circuits
III. To simulate and synthesize the program on a development board
IV. To make the students exposed to Front end VLSI CAD tools

Introduction to Verilog HDL, Structural, Dataflow and behavioral modeling of combinational and sequential logic circuits.

Hardware modeling with the verilog HDL. Encapsulation, modeling primitives, different types of description.

Logic system, data types and operators for modeling in verilog HDL. Verilog Models of propagation delay and net delay, path delays and simulation, inertial delay effects and pulse rejection.

HDL-based synthesis - technology-independent design, styles for synthesis of combinational and sequential logic, synthesis of finite state machines, synthesis of gated clocks, design partitions and hierarchical structures.

System Verilog- Introduction, Design hierarchy, Data types, Operators and language constructs. Functional coverage, Assertions, Interfaces and test bench structures.

Text Books:

1. S. Palnitkar, "Verilog HDL – A Guide to Digital Design and Synthesis", Pearson, 2003
2. J Bhaskar, "A Verilog HDL Primer", 3 rd Edition, Kluwer, 2005.

Reference books:

1. S.Brown and Z.Vranesic, "Fundamentals of Digital Logic with Verilog Design", Tata Mc-Graw Hill, 2008
2. M.D.Ciletti, "Modeling, Synthesis and Rapid Prototyping with the Verilog HDL", PHI, 1999.
3. S.Sutherland, S. Davidmann, P. Flake, "System Verilog for Design", (2/e), Springer, 2006.

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Course Outcomes:

At the end of the course student will be able to

ETU623C.1 Simulate the basic concepts of verilog HDL
ETU623C.2 Model digital systems in verilog HDL at different levels of abstraction
ETU623C.3 Analyze the design flow from simulation to synthesizable version
ETU623C.4 Execute the special features of VLSI front end CAD tools.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU623C.1	1	0	2	3	2	1	0	2	2	1	0	3	3	2	2
ETU623C.2	2	0	2	3	2	1	0	2	2	2	1	3	3	2	2
ETU623C.3	1	2	1	3	2	1	1	2	2	2	1	3	3	2	2
ETU623C.4	1	1	1	3	2	1	0	2	2	1	0	3	3	2	2

0- Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

SST

ETU623D MACHINE LEARNING

Teaching Scheme: 03L+00T **Total: 03** **Credits: 03**

Evaluation Scheme: 30MSE + 10TA+ 60ESE **Total Marks: 100**

ESE duration: 2Hrs 30min

Course Objectives:
To make the student able

I. To understand the fundamentals of Supervised and Unsupervised learning.
II. To compare and contrast the concepts of Bayesian Decision Theory and Parametric Methods.
III. To interpret and explain the concept of Multivariate Methods, Dimensionality Reduction, Clustering and Nonparametric Methods.
IV. To illustrate usage of Decision Trees, Linear Discrimination, Multilayer Perceptron's, and Local Models.

Introduction to: Linear Algebra, Linear Algebra and Machine Learning, Examples of Linear Algebra in Machine Learning;
Introduction to Probability axioms, probability distributions, probability moments, Bayes theorem, joint, marginal and conditional probability; Introduction to Machine Learning

Examples of Machine Learning Applications: Learning Associations, Classification, Regression, Unsupervised Learning, Reinforcement Learning, Supervised Learning.

Bayesian Decision Theory: Introduction, Classification, Losses and Risks, Discriminate Function, Association Rules, Parametric Methods: Introduction, Maximum Likelihood Estimation, Evaluating an Estimator: Bias and Variance.

Multivariate Methods: Multivariate Data, Parameter Estimation, Estimation of Missing Values, Multivariate Normal Distribution, Multivariate Classification, Tuning Complexity, Discrete Features, Multivariate Regression, Dimensionality Reduction: Introduction, Subset Selection, Principal Component Analysis.

Clustering: Introduction, Mixture Densities, k-Means Clustering, Expectation-Maximization Algorithm, Mixtures of Latent Variable Models, Supervised Learning after Clustering, Spectral Clustering, Hierarchical Clustering, Choosing the Number of Clusters; Introduction to Nonparametric Methods.

Decision Trees: Introduction, Univariate Trees, Pruning, Rule Extraction for Trees, Learning Rule from Data, Multivariate Trees, Gradient Descent, Logistic Discrimination, Discrimination by Regression, Learning to Rank.

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Multilayer Perceptron: Introduction, Training, Learning Boolean Functions, MLP as a Universal Approximator, Back propagation Algorithm; Introduction to Competitive Learning and Radial Basis Functions.

Text Book:

1.Ethem Alpaydin, "Introduction to Machine Learning", 3rdedition, 2014, MIT Press

Reference Book:

1. Shai Shalev-Shwartz and Shai Ben-David, "Understanding Machine Learning", 1stedition, 2014, CambridgeUniversity Press.
2. Jason Bell, "Machine Learning", 4th edition,2015, John Wiley& Sons.
3. Subramanian Chandramouli, Saikat Dutt and Amit Kumar Das, "Machine Learning", 1st edition,2018, Pearson India Education Services Pvt. Ltd.
4. Kevin P. Murphy, "Machine Learning A Probabilistic Perspective", 1st edition, 2012, MIT Press.
5. Jason Brownlee, "Basics of Linear Algebra for Machine Learning", 1st edition, 2018, Machine Learning Mastery.

Course Outcomes:

After completing this course, Students shall be able:

ETU623D.1 To differentiate between Supervised and Unsupervised learning and able to select model and perform generalization.

ETU623D.2 To investigate and apply Bayesian Decision Theory to calculate the probabilities of classes and different Parametric Methods for estimation of probabilities.

ETU623D.3 To comprehend and apply the concept of Multivariate Methods, Dimensionality Reduction, Clustering and Nonparametric Methods.

ETU623D.4 To implement usage of Decision Trees, Linear Discrimination, Multilayer Perceptron's, and Local Models both for classification and regression.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU623D.1	2	3	2	2	3	1	1	1	0	0	2	2	1	2	1
ETU623D.2	3	3	2	2	3	1	1	1	0	0	2	2	3	2	1
ETU623D.3	3	3	3	2	3	1	1	1	0	0	2	2	3	2	1
ETU623D.4	3	3	2	2	3	1	1	1	0	0	2	3	3	2	1

0- Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

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OPEN ELECTIVE - I

ETU624A CONSUMER ELECTRONICS

Teaching Scheme: 03L+00T **Total: 03** **Credit:03**
Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total marks:100**
ESE duration: 02 Hrs 30 min.

Course Objectives:

The course aims to provide the students with

I. Knowledge of audio amplifiers, microphones and speakers.
II. Knowledge of public address system.
III. Television (TV) fundamentals and TV transmitter and receiver.
IV. Identify the need of preventive maintenance in various electronic appliances.
V. To understand working principle of various home appliances.

Audio System: Microphone, loudspeaker, acoustics, mono, stereo, quad, binaural and dichotic, amplifying system, equalizers and mixers synthesizers, theater sound system.

Video Systems and Displays: Video system standards, display devices, smart TV, Direct-To Home (DTH- Set Top Box), video telephone and video conferencing.

Sensors and Actuators: Introduction to IOT sensors and actuators, its software platform and application in IOT systems.

Smart Domestic and Consumer Appliances: Washing machines, microwave ovens, air-conditioners and refrigerators, mobile radio system, solar system, power supplies SMPS/UPS and remote controls, bar codes, RFID. Case studies: Case studies on introduction to evolution in technology of consumer electronics products. For example e- learning initiatives, Mobile phone industry

Product Compliance: Product safety and liability issues; standards related to electrical safety and fire hazards.

Text Books:

1. Consumer Electronics, S. P. Bali 1st edition, Pearson Education, 2005
2. The Electronics Hand Book, J. C. Whitaker, IEEE Press 3. Multimedia Communications, F. Halsal, Pearson Education

Reference Books:

1. Modern Television Practice, R. R. Gulati, 3rd edition New Age International Publishers, 2006
2. Sensors and Actuators, Clarence W. de Silva, 2nd edition, CRC Press, 2015
3. Consumer Electronics; J.S. Chitode; Technical Publications, Pune

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Course Outcomes:

At the end of the course, the student shall be able to:

ETU624A.1	Troubleshoot different types of microphones and speakers.
ETU624A.2	Maintain audio systems.
ETU624A.3	Troubleshoot smart TV receivers
ETU624A.4	Maintain various consumer/home electronics appliances
ETU624A.5	Understand product safety, compliance standards and techniques associated with electronic products

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU624A.1	2	1	1	1	2	2	0	1	3	0	2	3	3	3	3
ETU624A.2	1	0	0	1	1	2	2	1	3	1	2	2	1	2	2
ETU624A.3	2	1	1	1	2	2	1	1	3	0	2	3	3	3	3
ETU624A.4	1	0	0	1	1	2	2	1	3	1	2	2	3	2	2
ETU624A.5	2	0	0	1	2	3	2	1	3	2	2	2	2	3	3

0- Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

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ETU624B INDUSTRIAL ELECTRONICS

Teaching Scheme: 03L **Total: 03** **Credits: 03**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

ESE duration: 2Hrs.30Min.

Course Objectives:
To make the student able

a. To learn the switching characteristics of power switching devices
b. To understand the working principle of various converter circuits
c. To acquire basic knowledge of programmable logic controllers
d. To learn the motor speed control methods using choppers

Power switching Devices: SCR, UJT, MOSFET, IGBT, GTO - principle of working, VI characteristics, switching characteristics and applications.

Power supplies: Power supply and its performance parameters; Phase controlled converters, four quadrant operation, regulated power supply, SMPS.

Amplifiers and Timers: Differential amplifier, current mirror circuit, linear and non-linear applications of operational amplifiers, IC555: timer, multivibrator and its applications.

Introduction to Inverters, Choppers, dual converter, cyclo converter, and AC to DC converters

Programmable Logic Controller: Introduction, advantages over relay logic, block diagram of PLC, basics of PLC Programming Languages, basic arithmetic and logic operations.
Speed control of industrial motors using choppers.

Text books:

1. Industrial Electronics, Biswanath Paul, Prentice Hall India, 3rd edition, 2014
2. Power Electronics, M.D.Singh, K.B.Khanchandani, 2nd edition (3rd reprint), McGraw Hill Education, 2008
3. Programmable Logic Controllers, Frank D. Petruzela, Tata McGraw Hill, 3rd edition, 2010

Reference books:

1. In Operational Amplifiers and Linear Integrated circuits, Ramakant A. Gaykwad, Prentice Hall, New Delhi, 3rd edition, 2007
2. Programmable Logic Controllers, W. Bolton, Elsevier Ltd., 6th edition, 2015
3. Power Electronics, Converter, Application and Design, N. Mohan, T. M. Undeland and W. P. Robbins, 3rd edition, John Willey and Sons, 2004
4. Power Electronics, circuits, Devices and Applications, M. H. Rashid, Pearson, 2002.

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Course Outcomes:

After completing this course, students shall be able to:

ETU624B.1	Analyze the performance of power supplies
ETU624B.2	Implement the control circuits using power switching devices for industrial applications
ETU624B.3	Implement timer and control circuits using operational amplifiers
ETU624B.4	Program PLC for basic arithmetic and logical operations

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU624B.1	0	2	1	2	1	2	0	2	2	2	3	3	3	2	2
ETU624B.2	1	2	0	0	2	2	1	2	2	2	2	3	3	3	2
ETU624B.3	1	2	0	0	2	2	1	2	2	2	2	3	3	3	2
ETU624B.4	2	2	0	1	1	2	0	2	2	2	3	3	3	2	2

0- Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

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PROGRAM ELECTIVE-II

ETU625A MICROWAVE ENGINEERING

Teaching Scheme: 03L **Total: 03** **Credits: 03**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

ESE duration: 2.30hrs

Course Objectives:
To make the student able

I. To know about microwave frequency bands.
II. To Analysis the Transmission lines and waveguides at microwave frequencies
III. To understand the behavior of various microwaves tubes.
IV. To analysis and study characteristics of microwave semiconductor devices and passive devices.
V. To learn designing methods for microwave resonators and filters

Introduction to Microwaves: History of Microwaves, Microwave Frequency Bands, Applications of Microwaves.

Transmission Lines and Waveguides: Concept of modes, General solutions for TEM, TE, TM waves, Concept of modes, Rectangular Waveguides, Circular Waveguides, Coaxial Lines, Stripline, Microstrip Line, and Losses associated with Microwave transmission

Microwave Tubes: Limitations of conventional tubes at microwave frequencies. Two Cavity Klystrons, Reflex Klystrons, Helix Travelling Wave Tubes, Magnetron.

Microwave Semiconductor Devices: Microwave BJT, Tunnel Diodes, Gunn diode, Read Diode, IMPATT diode, TRAPATT diode.

Microwave Passive Devices: Attenuator, Phase Changer, Directional Coupler, Hybrid Junctions, Devices employing Faraday rotation: Isolator, Circulator, scattering matrix.

Microwave Resonators and filter: Series and parallel RLC resonators, Transmission line Resonators, Waveguide Resonators. RF filter design: Image Impedance method, Insertion Loss method, Filter Transformation, Filter Implementation.

Text Books:

1. Microwave Engineering, D. M. Pozar, 3rd edition, John Willey and Sons, 2007
2. Microwave Devices and Circuits, S. Y. Liao, 3rd edition, PHI, 2003

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References Books:

1. Foundations for Microwave Engineering, R.E. Collin, 2nd edition, John Wiley, 2007
2. Microwave Engineering Passive Circuits, P. A. Rizzi, 1st edition, PHI, reprint 2009

Course Outcomes:

After completing this course, students will demonstrate the ability to:

ETU625A.1	Understand and analyze various components of Microwave System.
ETU625A.2	Evaluate the performance parameters of microwave Transmission lines and waveguides
ETU625A.3	Understand structure and working of microwave tubes, various microwave active and passive components.
ETU625A.4	Design and implement resonators and filters at microwave frequencies.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU625A.1	2	2	1	3	2	2	3	1	2	2	3	2	3	2	2
ETU625A.2	3	3	2	3	2	2	1	2	3	2	3	3	3	3	2
ETU625A.3	2	3	2	1	2	2	3	1	2	2	3	2	3	2	2
ETU625A.4	2	3	3	2	2	2	2	3	3	2	3	3	3	3	2

Not Correlated   1-Weakly Correlated   2- Moderately Correlated   3- Strongly Correlated

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ETU625 B WAVELETS AND OTHER ENGINEERING TRANSFORMS

Teaching scheme: 03 L + 0T **Total: 03** **Credit: 03**

Marking scheme: 30 MSE+ 10TA + 60 ESE **Total Marks:100**

Duration of ESE: 2Hrs.30 Min

Course Objective:

To make the student able

I. To motivate students for studying different types of transform.
II. To expose the students to the basics of wavelet theory.
III. To illustrate the use of wavelet transform for image, speech and other processing.
IV. To apply the concept of wavelets to solve practical problems.

Introduction to wavelet: Wavelets and Other Reality Transforms , History of Wavelet from Morlet to Daubechies, Different Communities and families of Wavelets, Vector Space , Functions and Function Spaces.

Continuous Wavelet and Short Time Fourier Transform: Continuous Time-Frequency Representation of Signals, The Windowed Fourier Transform (Short Time Fourier Transform) The Uncertainty Principle and Time Frequency Tiling , Properties of Wavelets Used in Continuous Wavelet Transform , Continuous Versus Discrete Wavelet Transform .

Discrete Wavelet Transform: Introduction, Haar Scaling Functions and Function Spaces, Nested Spaces, Haar Wavelet function, Orthogonality, Normalization of Haar Bases at Different Scales, Support of a Wavelet System, introduction to Daubechies Wavelets.

Orthogonal wavelet systems: Restrictions on Filter Coefficients, Designing Daubechies Orthogonal Wavelet System Coefficients, Design of Coiflet wavelets. Discrete Wavelet Transform and Relation to Filter Banks: signal decomposition (analysis) and reconstruction. Perfect Matching Filters, Computing Initial Coefficients.

Biorthogonal Wavelets: Biorthogonality in Vector Space, Biorthogonal Wavelet Systems, Signal Representation Using Biorthogonal Wavelet System, Biorthogonal Analysis, Biorthogonal Synthesis-From Coarse Scale to Fine Scale , Construction of Biorthogonal Wavelet System.

Designing Wavelets-Frequency Domain Approach: Introduction, Basic, properties of Filter Coefficients, Choice of Wavelet Function Coefficients, Vanishing Moment Conditions in Fourier Domain, Derivation of Daubechies Wavelets.

Text Books

1. K.P.Soman ,K.I.Ramchandran,N.G.Resmi Insight into wavelets,from theory to practice , 3rd edition 2010 , PHI Private Limited,New Dehli.

Reference Books

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1. C. Sidney Burrus, Ramesh A. Gopinath, and ,Haitao Guo Introduction to Wavelets and Wavelet Transforms, 2015 by Prentice-Hall, Inc.
2. PatrikJ. Van Fleet University of St. Thomas Discrete Wavelets transformations, An Elementary Approach with Applications ,2007a John Wiley & Sons, Inc., Publication.
3. A.Teolis, Computational Signal Processing with Wavelets, Birkhauser, 1998.
4. J.C. Goswami & A.K. Chan, Fundamentals of Wavelets, John Wiley, 1999.
5. Alexander D.Poularikar ,Transforms and Applications Handbook, Third Edition, CRC Press
6. L.Prasad&S.S.Iyengar, Wavelet Analysis with Applications to Image Processing, CRC Press, 1997.

Course outcomes:

At the end of the course student will be able

ETU625B1 To observe windowed Fourier transform and difference between windowed Fourier transform and wavelet transform.

ETU625B2 To design wavelet basis and characterize continuous and discrete wavelet transform.

ETU625B3 To verify multi resolution analysis and identify various wavelets and evaluate their time frequency resolution properties.

ETU625B4 To implement discrete wavelet transforms with multirate digital filters.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU625B.1	1	0	2	3	2	3	3	2	3	2	1	1	3	2	2
ETU635B.2	2	2	3	3	1	3	2	2	3	2	2	3	3	2	2
ETU625B.3	2	1	2	3	2	2	2	2	2	2	2	3	3	2	2
ETU625B.4	2	2	2	3	2	2	3	2	3	2	3	3	3	2	2

0- Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

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PTD

ETU625C MICRO-ELECTROMECHANICAL SYSTEMS

Teaching Scheme	**: 03 L**	**Total: 03**	**Credit: 03**
Evaluation Scheme	**: 30 MSE +10 TA+ 60 ESE**		**Total Marks: 100**
Duration of ESE	**: 2 Hrs.30 min.**		

Course Objectives:
Students will be able to

I. Introduce the technology for development of micro electromechanical systems.
II. Learn principles of Microsystems.
III. Exposed to micro system fabrication process and manufacturing.
IV. Trained with MATLAB environment for simulation and modelling of MEMS.

Introduction and Historical Background, Scaling Effects: Need of Miniaturization, Microsystems versus MEMS, Need of Microfabrication, Smart Materials, Structures and Systems, Integrated Microsystems, Applications of Smart Materials and Microsystems.

Micro/Nano Sensors, Actuators and Systems overview: Case studies: Silicon Capacitive Accelerometer, Piezoresistive Pressure Sensor, Conduct metric Gas Sensor, An Electrostatic Comb-Drive, A Magnetic Microrelay, Portable Blood Analyzer, Piezoelectric Inkjet Print Head, Micromirror Array for Video Projection, Smart Materials and Systems.

Review of Basic MEMS fabrication modules: Oxidation, Deposition Techniques, Lithography (LIGA), Etching, Silicon as a Material for Micromachining, Specialized Materials for Microsystems, Advanced Processes for Microfabrication.

Micromachining: Surface Micromachining, sacrificial layer processes, Stiction; Bulk Micromachining, Isotropic Etching and Anisotropic Etching, Wafer Bonding.

Mechanics of solids in MEMS: Stresses, Strain, Hookes's law, Poisson effect, Linear Thermal Expansion, Bending; Energy methods, Overview of Finite Element Method, Modelling of Coupled Electromechanical Systems.

Modelling of Micro-Scale Electromechanical Systems and Devices: Introduction to Modelling, Analysis, and Simulation, Basic Electromagnetics with Applications to MEMS, Model Developments of Micro-actuators Using Electromagnetics, Classical Mechanics and Its Application to MEMS, Simulation of MEMS in the MATLAB Environment with Examples, Induction Micromachines, Synchronous Micromachines, Permanent-Magnet Stepper Micromotors, Piezo-transducers.

Text Books:

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalkrishnan K. N. Bhat, V. K. Aatre, Micro and Smart Systems, Wiley India, 2012.

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2. S. E. Lyshevski, Nano-and Micro-Electromechanical systems: Fundamentals of Nano-and Microengineering, Vol. 8. CRC press, 2005.

Reference Books:

1. S. D. Senturia, Microsystem Design, Kluwer Academic Publishers, 2001.
2. M.H. Bao, Micromechanical Transducers: Pressure sensors, accelerometers, and Gyroscopes, Elsevier, New York, 2000.
3. G. Kovacs, Micromachined Transducers Sourcebook, McGraw-Hill, Boston, 1998.
4. M. Madou, Fundamentals of Microfabrication, CRC Press, 1997.

Course Outcomes:

After completion of the course, the students will be able to

- ETU625C.1 Review MEMS technology, micro sensors, micro-actuators, their types and applications.
- ETU625C.2 Interpret the fabrication process of MEMS.
- ETU625C.3 Estimation of forces, displacements and other mechanical concepts is paramount when fabricating MEMS devices.
- ETU625C.4 Model and simulate the MEM systems.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU625C.1	1	0	0	3	1	3	3	2	3	2	1	1	3	2	2
ETU635C.2	2	3	3	3	1	3	2	2	3	2	2	3	3	2	2
ETU625C.3	2	1	2	3	2	2	2	2	2	2	2	3	3	2	2
ETU625C.4	2	3	3	3	2	2	3	2	3	2	3	3	3	2	2

0- Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

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ETU625D FUZZY LOGIC

Teaching Scheme: 03L+00T **Total: 03** **Credits: 03**
Evaluation Scheme: 30MSE + 10TA+ 60ESE **Total Marks: 100**
ESE duration: 2Hrs 30min

Course Objectives:
To make the students able

I. To understand the fundamentals of classical Relation and Fuzzy Relation their properties, Fuzzification and Defuzzification.
II. To understand the concept of automated Methods and simulation of Fuzzy Systems.
III. To understand the concepts of Bayesian Decision Theory and Fuzzy Classification.
IV. To understand the application of Fuzzy logic and usage of Matlab in implementing Fuzzy Logic.

Fuzzy System: Introduction, imprecision, uncertainty, limitation, fuzzy sets and membership, chance versus fuzziness, sets as a point in hypercube.

Classical Sets and Fuzzy Sets: operations, properties, mapping and alternative operation. Classical Relation and Fuzzy Relation: Cartesian Product, Crisp Relations, Fuzzy Relations, Tolerance and Equivalence Relations, Fuzzy Tolerance and Equivalence Relations, Value Assignments, Other Forms of the Composition Operation.
Properties of Membership Functions, Fuzzification, and Defuzzification: Features of the Membership Function, Various Forms, Fuzzification, Defuzzification to Crisp Sets, λ-Cuts for Fuzzy Relations, Defuzzification to Scalars.

Logic and Fuzzy Systems: Classical Logic, Proof, Fuzzy Logic, Approximate Reasoning, Other Forms of the Implication Operation; Natural Language, Linguistic Hedges, Fuzzy (Rule-Based) Systems, Graphical Techniques of Inference

Development of Membership Functions: Membership Value Assignments (Intuition, Inference, Rank Ordering, Neural Networks, Genetic Algorithms, Inductive Reasoning).

Automated Methods for Fuzzy Systems: Definitions, Batch Least Squares Algorithm, Recursive Least Squares Algorithm, Gradient Method, Clustering Method, etc.; Introduction to Fuzzy Systems Simulation with examples

Decision Making with Fuzzy Information: Decision Making Under Fuzzy States and Fuzzy Actions; Fuzzy Classification: Classification by different methods mostly used.
Applications of Fuzzy Logic: Fuzzy logic application in various areas; Fuzzy Logic Projects with Matlab

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Textbook :

1. Timothy J. Ross, "Fuzzy Logic with Engineering Application",3rd edition, 2010, Wiley.
2. S.N. Sivanandam, S. Sumathi and S.N. Deepa, "Introduction to Fuzzy Logic using MATLAB", 1st edition,2007, Springer.

Reference Book :

1. George J. Klir and Bo Yuan,"Fuzzy Sets & Fuzzy Logic",1st Indianedition,2015,Pearson India Education Services Pvt. Ltd.
2. Gaunrong Chen and Trung Tat Pham, "Fuzzy Sets, Fuzzy Logic and Fuzzy Control System",1st edition, 2001,CRC Press.

Course Outcome:

After completing this course, Students shall be able:

ETU625D.1	To differentiate between Classical Relation and Fuzzy Relation.
ETU625D.2	To investigate automated Methods and simulation of Fuzzy Systems.
ETU625D.3	To comprehend the concept of Bayesian Decision Theory and Fuzzy Classification.
ETU625D.4	To identify usage of Fuzzy logic and usage of Matlab in implementing Fuzzy Logic in different applications.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU625D.1	2	3	2	2	3	1	1	1	0	0	2	3	3	2	1
ETU635D.2	2	3	2	2	3	1	1	1	0	0	2	3	3	2	1
ETU625D.3	2	3	2	2	3	1	1	1	0	0	2	3	3	2	1
ETU625D.4	2	3	2	2	3	1	1	1	0	0	2	3	3	2	1

0- Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

ETU626 HUMAN RESOURCE AND ECONOMICS

Teaching Scheme: 03L + 0T **Total: 03** **Credits: 03**

Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**

ESE Duration: 2 Hrs. 30 min.

Course Objectives:

To make the students able

I. Understand principles for balancing social, economic and environmental dimensions of development.
II. To learn to establish link between HRD practice and organizational strategy.
III. To acquaint Microeconomics, Production planning and control in manufacturing and services to take business decisions
IV. To know functioning of banking, its products and Investment science.

Sustainable development: sustainability, Factors, governing determinants, and future of sustainable development

Behavioral science: Importance of science and technology in culture of civilization, Industrial Psychology, consumer behavior, social responsibility of business.

Human needs: Motivation, MASLAW's need hierarchy theory, importance of humanities to engineer, Constitution of India rights and duties

Human Resource Development: HRD-Concept & Goals, Assessing HRD Needs, Meaning and necessity of Benchmarking, Performance Management System.

Organization Development: Organization change and development, manpower planning, man power development, career management.

Economics: Importance, Demand Analysis, elasticity of demand, Laws of supply and Supply analysis, laws of return.

Production: Nature, scope and operations management, planning & Control, factor, Cost, break even analysis, cost benefit analysis of Production

Banking and taxations: Banking System in India, its function and roles in development, type of taxation, GST and other taxes.

Investment Science: Meaning, Objectives and Significance & Mechanism of Investments, Investment Markets and Intermediaries, Money Market, Stock Market,

Globalization: Economics and globalization, foreign collaboration, joint ventures, impact of globalization on small-scale industries.

SST

Text Book:

1. Koontz, H and Wechrich,H., Essentials of Management - An International, Innovation and Leadership Perspective – 11 Edition, Chennai, McGraw Hill Education (India) Pvt. Ltd. 2020.
2. Gordon-Natrajan, Banking Theory, Law and Practice, Himalaya Publishing House

Reference Books:

1. Mujumdar Ramanuj, Consumer Behaviour – Insights from Indian Market, Bew Delhi, PHI Learning Pvt. Ltd., 2010
2. Maheshwari, B L. & Sinha, Dharni P. Management of Change Through HRD. New Delhi, Tata McGraw Hill, 1991.
3. Preeti Singh, Investment Management, Himalaya Publishing House.

Course Outcomes:

After completing this course, student shall be able to:

ETU626.1	Apply the sustainable development principles during the planning and development of various engineering activities.
ETU626.2	Develop the understanding of the concept of human resource management, their needs & relevance in organizations.
ETU626.3	To manage with Economics, production in today's market structures
ETU626.4	To implement taxation system in India along with globalization.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU626.1	3	0	0	1	1	2	3	2	3	2	2	3	3	3	3
ETU626.2	3	0	1	1	2	2	3	2	3	3	3	3	3	3	3
ETU626.3	2	1	1	2	1	2	2	2	3	3	2	3	3	3	3
ETU626.4	1	1	1	2	2	2	2	2	3	3	2	3	3	3	3

0- Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

ETU627 MINOR PROJECT

Teaching Scheme	**: 02P**	**Total: 02**	**Credit: 02**
Evaluation Scheme	**: 25 ICA+25 ESE**		**Total Marks: 50**
Duration of ESE	**: 3 Hrs.**		

Course Objectives:

I. To provide students for knowledge of Electronics Components and soldering techniques and its package information for electronics circuit design.

II. Knowledge for the assembling of electronics circuit with components on PCB (Printed Circuit Board) of circuit design.

III. Design and development of Small electronic project based on hardware and software for electronics systems.

The Minor project is undertaken by single students.

Students are expected to complete work pertaining to following aspects:

1. The selected problem by the student should have at least 20 to 25 components.
2. The Student should understand testing of various components.
3. Soldering of components should be carried out by the student.
4. The Student should develop a necessary PCB for the circuit.
5. The Student should see that final circuit submitted by them is in working condition.
6. The report on this work is to be submitted.
7. Single student can be permitted to work on a single minor project.
8. The minor project must have hardware part. The software part is optional.
9. The Course Coordinator may arrange demonstration with poster presentation of all minor projects developed by the students at the end of semester.

Course Outcomes:

ETU627.1 Students will be able to practice acquired knowledge within the chosen area of technology for project development.

ETU627.2 Identify, discuss and justify the technical aspects of the chosen project with a comprehensive and systematic approach.

ETU627.3 Work as an individual with implementation of overall knowledge acquired in a program in development of technical projects.

ETU627.4 Communicate and report effectively project related activities.

ICA – The Internal Continuous Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continues assessment format A and B.

SST

ESE – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU627.1	3	3	3	3	3	2	3	2	3	3	3	3	3	3	2
ETU627.2	3	3	3	3	3	2	2	2	2	3	3	3	3	3	2
ETU627.3	2	3	2	2	3	2	2	2	3	3	3	3	3	3	2
ETU627.4	2	3	2	1	3	2	2	3	2	3	3	3	3	3	2

0- Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

SST

ETU628 COMMUNICATION NETWORKS LAB

Teaching Scheme	**: 02P**	**Total: 02**	**Credit: 01**
Evaluation Scheme	**: 25 ICA+25 ESE**		**Total Marks: 50**
Duration of ESE	**: 3 Hrs.**		

Course Objectives:

To make students able to

I. Understand the working principle of various communication protocols.
II. Analyze the various routing algorithms.
III. Know the concept of data transfer between nodes.

Minimum eight experiments shall be performed to achieve course outcomes.

It is a representative list of practical/exercises. The instructor may choose experiments to fulfill the course outcomes.

List

1. Build a local area network (LAN) using any one topology
2. Build wireless LAN and troubleshoot the connectivity and file sharing
3. Socket programming for client/server application
4. Set up a dial up connection (wired phones and mobile) for internet access
5. Set up a broad band connection using wired / wireless fidelity (Wi-Fi) modem
6. Build LAN and configure TCP/IP protocol suite
7. Build LAN using sub netted IP address
8. Build LAN using classless inter domain routine (CIDR) and CIDR IP addresses
9. Install dynamic host configuration protocol (DHCP) server in an active directory domain of windows operating system (configure DHCP service and troubleshooting)
10. Write a program for frame sorting technique used in buffer
11. Write a program for implementation of Shortest Path algorithm

Course Outcomes:

After completion of the course, the students will be able to

ETU628.1	Understand fundamental underlying principles of computer networking
ETU628.2	Understand details and functionality of layered network architecture.
ETU628.3	Analyze performance of various communication protocols.
ETU628.4	Compare routing algorithms

CST

ICA – The Internal Continuous Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continues assessment format A and B.

ESE – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU628.1	3	2	3	2	2	1	2	2	2	2	2	3	3	2	2
ETU628.2	2	3	2	2	2	1	1	2	3	2	3	3	3	2	2
ETU628.3	2	3	2	2	2	2	2	2	3	2	3	3	3	2	2
ETU628.4	2	2	3	1	2	1	1	2	3	2	3	3	3	2	2

0- Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

SST

17/7

ETU629 ELECTRONIC MEASUREMENTS LAB.

Teaching Scheme: 02 **Total: 02** **Credits: 01**

Evaluation Scheme: 25 Internal + 25 External **Total Marks: 50**

Course Objectives:

To make students able to

I. Design DC and AC bridges
II. Understand dynamic response and the calibration of few instruments
III. Study various measurement devices, their characteristics, operation and limitations
IV. Study statistical data analysis

Minimum eight experiments shall be performed to achieve course outcomes.

It is a representative list of practical/exercises. The instructor may choose experiments to fulfill the course outcomes.

1. Designing DC bridge for Resistance Measurement (Quarter, Half and Full bridge)
2. Designing AC bridge Circuit for capacitance measurement
3. Designing signal Conditioning circuit for Pressure Measurement
4. Designing signal Conditioning circuit for Temperature Measurement
5. Designing signal Conditioning circuit for Torque Measurement
6. Designing signal Conditioning circuit for Strain Measurement
7. Experimental study for the characteristics of ADC and DAC
8. Error compensation study using Numerical analysis using MATLAB (regression)
9. Characterize the temperature sensor (RTD, Thermocouple)
10. Simulate the performance of Biosensor
11. Characterize the strain gauge sensor
12. Characterize of LVDT

Course Outcomes:

ETU629.1 Design and validate DC and AC bridges
ETU629.2 Analyze the dynamic response and the calibration of few instruments
ETU629.3 Classify various measurement devices, their characteristics, operation and limitations
ETU629.4 Analyze statistical data analysis

ICA – The Internal Continuous Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continues assessment format A and B.

ESE – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions.

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CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU629.1	3	2	3	1	2	3	2	1	3	3	2	2	3	2	2
ETU629.2	3	2	3	3	2	2	2	1	3	3	2	2	3	2	2
ETU629.3	2	2	3	3	2	3	2	1	2	3	2	2	1	2	2
ETU629.4	3	1	3	3	2	3	0	1	3	3	2	2	3	2	2

0- Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

SST

ELECTRICAL ENGINEERING DEPARTMENT

ETU631ELECTRONIC DESIGN LABORATORY

Teaching Scheme: 02 **Total: 02** **Credits: 01**

Evaluation Scheme: 25 Internal + 25 External **Total Marks: 50**

Course Objectives:

To make students able

I. To study various measurement devices, their characteristics, operation and limitations

II. To simulate and synthesize the program on a hardware development board

III. To study statistical data analysis

Minimum eight experiments shall be performed to achieve course outcomes.

It is a representative list of practical/exercises. The instructor may choose experiments to fulfill the course outcomes.

1. To study biasing of transistor by following method:
   a. Fixed bias. b. Voltage divider bias.
2. Measurement and study of output characteristics of JFET.
3. Measurement and study of output characteristics of MOSFET
4. Simulate frequency response of single stage BJT CE / FET CS amplifier.
   (Effect of coupling and bypass capacitors.)
5. Design and simulate LC and RC oscillators.
   (Compare practical and theoretical oscillation frequency.)
6. Design and simulate active filters
7. Experimental study for the characteristics of ADC and DAC
8. FPGA implementation of any combinational digital logic design
9. FPGA implementation of any sequential digital logic design
10. Stepper motor control using microcontroller
11. Temperature control using microcontroller
12. Serial communication between microcontroller and PC

Course Outcomes:

After completion of the course, the students will be able to

ETU 631.1 Learn about various measurement devices, their characteristics, operation and limitations

ETU 631.2 Understand the implementation on hardware development board

SST

ETU 631.3 Understand statistical data analysis

ICA – The Internal Continuous Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continues assessment format A and B.

ESE – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETU631.1	3	2	3	0	2	2	0	2	3	3	2	2	3	3	2
ETU631.2	3	2	3	1	2	2	1	2	3	3	2	2	3	3	2
ETU631.3	2	1	3	3	2	2	1	1	1	3	2	2	2	3	2
ETU631.4	3	2	3	1	2	2	1	2	3	3	2	2	3	3	2

0- Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

SST

GOVERNMENT COLLEGE OF ENGINEERING, AMRAVATI

DEPARTMENT OF ELECTRONICS ENGINEERING

Curriculum for Second Year

B. Tech. (Electronics and Telecommunication)

2020-2021

Specialization: Electronics and Telecommunication

PROGRAM OBJECTIVES

PO1: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems

PO2: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

PO3: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PO12: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

(B) PROGRAM SPECIFIC OUTCOMES (PSOs)

A Graduate of the Electronics and Telecommunication program will be able to:

PSO1: Apply the concepts of Analog and Digital Electronics, Microprocessors, Signal processing and communication engineering in design and implementation of Engineering Systems.

PSO2: Solve complex problems in the field of Electronics and telecommunication using latest hardware and software tools along with analytical and managerial skills

PSO3: Acquire the social and environmental awareness with ethical responsibility to have successful carrier

GOVERNMENT COLLEGE OF ENGINEERING, AMRAVATI.
Department of Electronics Engineering.
Scheme for B. Tech. (Electronics and Telecommunication)

SEMESTER-III

Category	Course Code	Name of the Course	Teaching Scheme					Evaluation Scheme					Credit
								Theory		Practical		Total	
			Theory Hrs/week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	MSE	ESE	ICA	ESE		
BSC	SHU321C *SHU322C	Transform And Statistical Methods *Integral Calculus And Probability	3	1	0	4	10	30	60	---	---	100	4
PCC	ETU321	Electronic Devices and Circuits	3	1	0	4	10	30	60	---	---	100	4
PCC	ETU322	Signals and Systems	3	0	0	3	10	30	60	---	---	100	3
PCC	ETU323	Digital Electronics	3	0	0	3	10	30	60	---	---	100	3
PCC	ETU324	Network Theory	3	1	0	4	10	30	60	---	---	100	4
MC	SHU323	Introduction to Constitution of India	1	--	--	1	20	---	30	---	---	50	--
PCC	ETU325	Electronics Devices and Circuits Lab.	0	0	2	2	---	---	---	25	25	50	1
PCC	ETU326	Signal and Systems Lab.	0	0	2	2	---	---	---	25	25	50	1
PCC	ETU327	Digital Electronics Lab.	0	0	2	2	---	---	---	25	25	50	1
PCC	ETU328	Computer Programming Lab.	0	0	2	2	---	---	---	25	25	50	1
	Total		16	3	8	27	70	150	330	100	100	750	22

TA: Teacher Assessment MSE: Mid Semester Examination ESE: End Semester Examination ICA: Internal Continuous Assessment

ESE Duration for Theory: 2.30Hrs.

*For direct second year admitted students

SST

SEMESTER-IV

Category	Course Code	Name of the Course	Teaching Scheme					Evaluation Scheme					Credit
								Theory		Practical		Total	
			Theory Hrs/week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	MSE	ESE	ICA	ESE		
PCC	ETU421	Probability Theory and Stochastic Processes	3	0	0	3	10	30	60	---	---	100	3
PCC	ETU422	Analog Communication	3	0	0	3	10	30	60	---	---	100	3
PCC	ETU423	Analog Circuits	3	0	0	3	10	30	60	---	---	100	3
PCC	ETU424	Microprocessors and Microcontrollers	3	1	0	4	10	30	60	---	---	100	4
PCC	ETU425	Digital System Design	3	1	0	4	10	30	60	---	---	100	4
MC	*SHU422	Environmental Studies	1	0	0	1	20	---	30	---	---	50	---
PCC	ETU426	Analog Communication Lab.	0	0	2	2	---	---	---	25	25	50	1
PCC	ETU427	Analog Circuits Lab.	0	0	2	2	---	---	---	25	25	50	1
PCC	ETU428	Microprocessors and Microcontrollers Lab.	0	0	2	2	---	---	---	25	25	50	1
	Total		16	2	6	24	70	150	330	75	75	700	20

TA: Teacher Assessment MSE: Mid Semester Examination ESE: End Semester Examination ICA: Internal Continuous Assessment

ESE Duration for Theory: 2.30Hrs. * ESE Duration for Theory: 1.30Hrs

Government College Of Engineering, Amravati
Department of Electronics Engineering.
Scheme for B. Tech. (Electronics and Telecommunication)

SEMESTER-V

Category	Course Code	Name of the Course	Teaching Scheme					Evaluation Scheme					Credit
								Theory		Practical		Total	
			Theory Hrs/week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	MSE	ESE	ICA	ESE		
PCC	ETU521	Electromagnetic Waves	3	1	0	4	10	30	60	---	---	100	4
PCC	ETU522	Computer Architecture	3	0	0	3	10	30	60	---	---	100	3
PCC	ETU523	Digital Communication	3	1	0	4	10	30	60	---	---	100	4
PCC	ETU524	Digital Signal Processing	3	1	0	4	10	30	60	---	---	100	4
BSC	SHU523*	Human Values and Ethics	1	0	0	1	20	--	30	---	---	50	--
HSMC	ETU525	Operational Research and Optimization	3	1	0	4	10	30	60	---	---	100	4
PCC	ETU526	Electromagnetic Waves Lab.	0	0	2	2	---	---	---	25	25	50	1
PCC	ETU 527	Computer Architecture Lab.	0	0	2	2	---	---	---	25	25	50	1
PCC	ETU528	Digital Communication Lab.	0	0	2	2	---	---	---	25	25	50	1
PCC	ETU529	Digital Signal Processing Lab.	0	0	2	2	---	---	---	25	25	50	1
	Total		16	4	8	28	70	150	330	100	100	750	23

TA: Teacher Assessment MSE: Mid Semester Examination ESE: End Semester Examination ICA: Internal Continuous Assessment
ESE Duration for Theory: 2.30Hrs. * ESE Duration for Theory: 1.30Hrs

SHU525

SEMESTER-VI

Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						Credit
							Theory			Practical		Total	
			Theory Hrs/week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	MSE	ESE	ICA	ESE		
PCC	ETU621	Control Systems	3	0	0	3	10	30	60	---	---	100	3
PCC	ETU622	Communication Networks	3	0	0	3	10	30	60	---	---	100	3
PEC	ETU623	Program Elective – I	3	0	0	3	10	30	60	---	---	100	3
OEC	ETU624	Open Elective-I	3	0	0	3	10	30	60	---	---	100	3
PEC	ETU625	Program Elective –II	3	0	0	3	10	30	60	---	---	100	3
HSMC	ETU626	Human resource and Economics	3	0	0	3	10	30	60	---	---	100	3
PROJ	ETU627	Minor Project	0	0	4	4	---	---	---	25	25	50	2
PCC	ETU628	Communication Networks Lab.	0	0	2	2	---	---	---	25	25	50	1
PCC	ETU629	Electronic Measurement Lab.	0	0	2	2	---	---	---	25	25	50	1
	Total		**18**	**0**	**8**	**26**	**60**	**180**	**360**	**75**	**75**	**750**	**22**

TA: Teacher Assessment MSE: Mid Semester Examination ESE: End Semester Examination ICA: Internal Continuous Assessment

ESE Duration for Theory: 2.30Hrs.

GOVERNMENT COLLEGE OF ENGINEERING, AMRAVATI.
Department of Electronics Engineering.
Scheme for B. Tech. (Electronics and Telecommunication)
SEMESTER-VII

Category	Course Code	Name of the Course	Teaching Scheme					Evaluation Scheme					Credit
								Theory		Practical		Total	
			Theory Hrs/week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	MSE	ESE	ICA	ESE		
PEC	ETU721	Program Elective –III	3	0	0	3	10	30	60	---	---	100	3
PEC	ETU722	Program Elective –IV	3	0	0	3	10	30	60	---	---	100	3
OEC	ETU723	Open Elective-II	3	0	0	3	10	30	60	---	---	100	3
PEC	ETU724	Program Elective –V	3	0	0	3	10	30	60	---	---	100	3
PCC	ETU725	VLSI Design	3	0	0	3	10	30	60	--	--	100	3
PCC	ETU726	Optical Communication	3	0	0	3	10	30	60	---	---	100	3
PROJ	ETU727	Seminar	0	0	2	2	---	---	---	50	---	50	1
	Total		**18**	**0**	**02**	**20**	**60**	**180**	**360**	**50**	---	**650**	**19**

TA: Teacher Assessment MSE: Mid Semester Examination ESE: End Semester Examination ICA: Internal Continuous Assessment
ESE Duration for Theory: 2.30Hrs.

SEMESTER-VIII

Category	Course Code	Name of the Course	Teaching Scheme					Evaluation Scheme					Credit
								Theory		Practical		Total	
			Theory Hrs/week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	MSE	ESE	ICA	ESE		
PEC	ETU821	*Program Elective –VI	3	0	0	3	10	30	60	---	---	100	3
PROJ	ETU824	A. Project **OR** **B.** Industry Internship Project	0	0	26	26	--	--	--	200	200	400	13
	Total		**3**	**0**	**26**	**29**	**10**	**30**	**60**	**200**	**200**	**500**	**16**

TA: Teacher Assessment MSE: Mid Semester Examination ESE: End Semester Examination ICA: Internal Continuous Assessment
ESE Duration for Theory: 2.30Hrs.

***Students not present for regular classes have to complete the said course through online platform MOOCs, if available. If not then, students shall prepare with self-study mode and will appear for ESE only. (Total internal marks (MSE+TA) will be awarded proportional to marks scored in ESE), the department will provide the list of equivalent MOOC courses.**

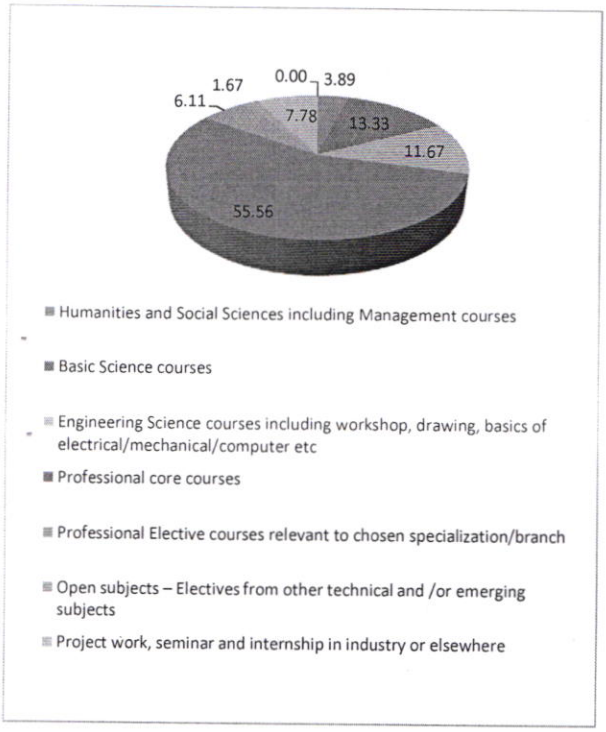
Elective Courses:

ETU624 Open Elective-I	ETU723 Open Elective-II	ETU623 Program Elective-I	ETU625 Program Elective-II	ETU721 Program Elective-III	ETU722 Program Elective-IV	ETU724 Program Elective-V	ETU821 Program Elective-VI
A) Consumer Electronics	A) Mechatronics	A)Information theory & coding	A)Microwave Engineering	A)Antennas & Wave propagation	A)Wireless Communication	A)Satellite Communication	A)Mobile Communication
B) Industrial Electronics	B) Bioengineering	B) Scientific Computing	B) Wavelets and other Engineering Transforms	B) Multirate DSP	B) Adaptive Signal Processing	B) Image and Video processing	B) Speech Processing
		C)Electronic Design Techniques with HDL	C)Micro-Electro-Mechanical Systems	C)CMOS Design	C)Mixed Signal Design	C) Nanotechnology	D)MEMS Technology
		D)Machine learning	D)Fuzzy Logic	D)Artificial Neural Network	D)Soft Computing tool	D) Pattern Recognition	D) Artificial Intelligence

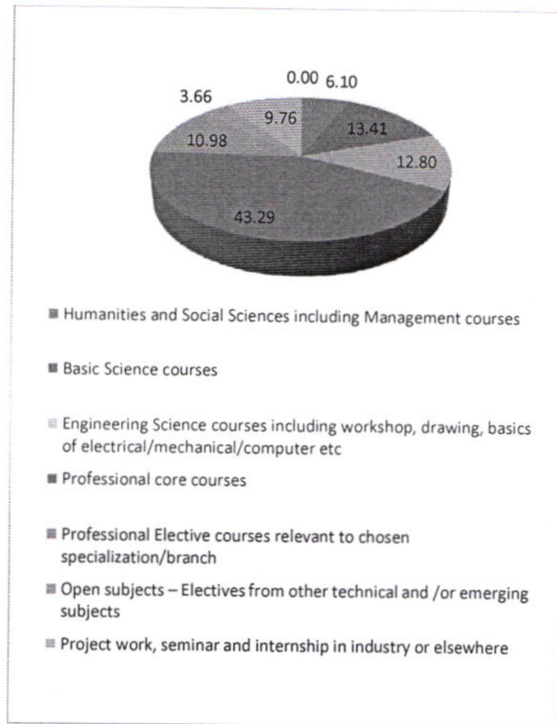
BSC Basic Science Courses
ESC Engineering Science Courses
HSMC Humanities and Social Sciences including Management courses
PCC Professional core courses
PEC Professional Elective courses
OEC Open Elective courses
LC Laboratory course
MC Mandatory courses
SI Summer Industry Internship
PROJ Project

Credit Distribution of Electronics and Telecommunication (Existing and Proposed)

S. No.		Credit Breakup for E &TC (Proposed)	Credit Breakup for E&TC (Existing)	Credit Breakup for E&TC in % (Proposed)	Credit Breakup for E&TC in % (Existing)
1.	Humanities and Social Sciences including Management courses	10	7	6.10	3.89
2.	Basic Science courses	22	24	13.41	13.33
3.	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc	21	21	12.80	11.67
4.	Professional core courses	71	100	43.29	55.56
5.	Professional Elective courses relevant to chosen specialization/branch	18	11	10.98	6.11
6.	Open subjects – Electives from other technical and /or emerging subjects	6	3	3.66	1.67
7.	Project work, seminar and internship in industry or elsewhere	16	14	9.76	7.78
8.	Mandatory Courses [Environmental Sciences, Induction Program, Indian Constitution, Essence of Indian Traditional Knowledge]	(non-credit)	(non-credit)	(non-credit)	(non-credit)
9.	Total	164	180	100.00	100.00



Credit Distribution Chart (Existing)



Credit Distribution Chart (Proposed)

Department of Electronics Engineering
Equivalence Scheme
Programme Name: -Electronics and Telecommunication

Sr. No.	Course code with Name of course(old) with total 184 credits		Credit	Course code with Name of course(new)with total 164 credits		Credit
1	SHU 302	Engineering Mathematics - III	3	SHU321C	Transform And Statistical Methods	4
2	ETU303	Electronics Devices and Circuits	4	ETU321	Electronic Devices and Circuits	4
3	ETU 401	Signals and Systems	4	ETU322	Signals and Systems	3
4	ETU 304	Digital Electronics	3	ETU323	Digital Electronics	3
5	ETU301	Network analysis	3	ETU324	Network Theory	4
6	SHU 205	General Proficiency I	2	No Equivalence Provided		--
7	No Equivalence Provided		--	SHU323	Introduction to Constitution of India	--
8	ETU307	Electronics Devices and Circuits Lab	1	ETU325	Electronics Devices and Circuits Lab	1
9	ETU 406	Signals and Systems Lab	1	ETU326	Signal and Systems Lab	1
10	ETU 308	Digital Electronics Lab	1	ETU327	Digital Electronics Lab	1
11	ETU302	Component Devices and instrument Technology	4	No Equivalence Provided		---
12	No Equivalence Provided		-	ETU328	Computer Programming Lab	1

13	ETU306	Component Devices and instrument Technology Lab	1	No Equivalence Provided		-
14	No Equivalence Provided		-	ETU421	Probability Theory and Stochastic Processes	3
15	ETU 404	Control System Engineering	3	No Equivalence Provided		-
16	No Equivalence Provided		-	ETU422	Analog Communication	3
17	ETU 402	Analog Circuits	4	ETU423	Analog Circuits	3
18	ETU 403	Microprocessor and its Interfacing	3	ETU424	Microprocessors and Microcontrollers	4
19	No Equivalence Provided		-	ETU425	Digital System Design	4
20	ETU 405	Object Oriented Programming Lab	2	No Equivalence Provided		-
21	No Equivalence Provided		-	SHU422	Environmental Studies	-
22	ETU 409	Control System Engineering Lab	1	No Equivalence Provided		-
23	No Equivalence Provided		-	ETU426	Analog Communication Lab.	1
24	ETU 407	Analog Circuits Lab	1	ETU427	Analog Circuits Lab.	1
25	ETU 408	Microprocessor and its Interfacing Lab	1	No Equivalence Provided		-
26	No Equivalence Provided		-	ETU428	Microprocessors and Microcontrollers Lab.	1

- All students promoted to third year with some backlog courses shall remain in old scheme (184 Credits) with old curriculum.
- All students who failed in second year (DC Students) shall be transferred to new same scheme (164 Credits) but with new curriculum.
- Important notes for * courses

i) All courses of old curriculum shall be offered during the academic year (2020-2021) for back logger students.
ii) In the academic year 2021-22and onward all students shall register for courses as revised curriculum

Equivalence Scheme for online courses

Sr. No.	Course code with Name of course(old/new)		Credit	Course code with Name of course (online)	Name of Online platform	Credit
1.	ETU321	Electronic Devices and Circuits	4	1. NPTEL course on **Semiconductor Devices and Circuits** 2. NPTEL course on **Fundamental of Semiconductor Devices**	NPTEL	
2.	ETU322	Signals and Systems	3	1. NPTEL course on **Principles of Signals and Systems** 2. NPTEL course on **Signals and Systems**	NPTEL	
3.	ETU323	Digital Electronics	3	1. NPTEL course on **Digital Circuits and Systems** 2. NPTEL course on **Digital Electronic Circuits** 3. NPTEL course on **Digital Circuits**	NPTEL	
4.	ETU324	Network Theory	4	1.1 NPTEL course on **Network Analysis** 1.2 NPTEL course on **Networks and Systems** **(These two courses have covered 100**	NPTEL	

Sr. No.	Course code with Name of course(old/new)		Credit	Course code with Name of course (online)	Name of Online platform	Credit
				percent syllabus)		
5.	ETU501	Linear Integrated Circuits and Applications	3	1. NPTEL course on **OP-AMP Practical Applications: Design, Simulation and Implementation** 2. NPTEL course on **Integrated Circuits, MOSFETs, Op-Amps and their Applications** 3. NPTEL course on **Electronic Modules For Industrial Applications Using Op-Amps**	NPTEL	
6.	ETU502	Analog Communication	3	1. NPTEL course on **Principle of Communication Systems-Part1** 2*. NPTEL course on **Communication Engineering** **3.** NPTEL course on **Analog Communication**	NPTEL	
7.	ETU503	Power Electronics	3	1. NPTEL course on **Power Electronics** 2. NPTEL course on **Advanced Power Electronics and Control** 3. NPTEL course on **Fundamental of Power Electronics**	NPTEL	
8.	ETU504	Microcontroller and Its Applications	3	1. NPTEL course on **Microprocessors and Microcontrollers**	NPTEL	

Sr. No.	Course code with Name of course(old/new)		Credit	Course code with Name of course (online)	Name of Online platform	Credit
9.	ETU505	Humanities and Economics	3	Same course contents are not available in NPTEL/NOC but some topics are approx 30% align	NPTEL	
10.	ETU701	Digital System Design	3	1. NPTEL course on **Digital Electronic Circuits** 2. NPTEL course on **Digital Circuits and Systems**	NPTEL	
11.	ETU702	Digital Communications	3	1. NPTEL course on **Principles of Digital Communications** (IITB) 2. NPTEL course on **Modern Digital Communication Techniques**	NPTEL	
12.	ETU703-I(A)	Fiber Optic Communications	3	1. NPTEL course on **Fiber Optic Communication Technology** 2. NPTEL course on **Fiber Optic Communication Systems and Techniques** 3. NPTEL course on **Optical Communications**	NPTEL	
13.	ETU703-I(B)	Embedded Systems	3	1*. NPTEL course on **Embedded Systems** 2. NPTEL course on **Embedded System Design** 3. NPTEL course on **Embedded**	NPTEL	

Sr. No.	Course code with Name of course(old/new)		Credit	Course code with Name of course (online)	Name of Online platform	Credit
				Systems-Design Verification and Test		
14.	ETU703-I(D)	Artificial Intelligence	3	1. NPTEL course on **Fuzzy Logic Neural Networks**	NPTEL	
15.	ETU704-II(B)	Industrial Electronics	3	1. NPTEL course on **Power Electronics**	NPTEL	

Equivalence B. Tech. Second Year SH Courses A.Y. 2020-21

S.N.	Course in old scheme			Equivalent course in new Scheme		
	Course Code	Course name	No. of Credits	Course Code	Course name	No. of Credits
1	SHU301	Engineering Mathematics- III	03	SHU321A	Differential Equations And Probability	03
2		No Equivalence		SHU322A	Integral Calculus And Probability	03
3	SHU304	Engineering Mathematics- III	03	SHU321B	Transform And Linear Algebra	04
4		No Equivalence		SHU322B	Differential Equation And Transform	04
5	SHU303	Engineering Mathematics- III	03	SHU321C	Transform And Statistical Methods	04
6		No Equivalence		SHU322C	Integral Calculus And Probability	04
7		No Equivalence		SHU323	Introduction To Constitution Of India	00
8		No Equivalence		SHU324	Effective Technical Communication	03
9		No Equivalence		SHU325	Human Values And Ethics	00
10	SHU203	Environmental Studies	03	SHU422	Environmental Studies	00
11		No Equivalence		SHU425	Human Values And Ethics	00
12		No Equivalence		SHU525	Human Values And Ethics	00
13		No Equivalence		SHU725	Human Values And Ethics	00
14	SHU305	General Proficiency- II	2		No Equivalence	
15	SHU401	Engineering Mathematics- IV	3		No Equivalence	
16	SHU402	Engineering Mathematics Lab	2		No Equivalence	
17	SHU403	Engineering Mathematics Lab	2		No Equivalence	

Gulhane
F/ Head, Mathematics

Patil
Member secretary
BoS Science & Humanities

S.V. Shinde
Chairman
BoS Science & Humanities

ELPO/EXTC//INSTRU

SHU321C TRANSFORM AND STATISTICAL METHODS

Teaching Scheme:03L+01T **Total: 04** **Credit:04**

Evaluation Scheme:30 MSE + 10 TA + 60 ESE **Total marks:100**

ESE duration:2 Hrs 30 min

Course Objectives:

I. To study method solution of partial differential equations and apply it to solve wave and heat equations.

II. To learn Laplace transform and its properties. Apply it to solve differential equation and to calculate stability of LTI system.

III. To equip students with the foundations of probabilistic and statistical analysis mostly used in varied applications in engineering and science.

Partial differential equations: (10 hours)

Definition, order, degree, classification, formation of partial differential equation, method of separation of variables, first and second order one dimensional wave equation, heat equation and two dimensional Laplace equation.

Laplace Transform: (10 hours)

Laplace Transform, Properties of Laplace Transform, Laplace transform of causal periodic signals, Analysis and Characterization of LTI systems using the Laplace Transform, The transfer function and differential equation, Impulse response and Step response, Causality, Stability, Stability of a causal LTI system

Random variables and Probability Distributions: (10 hours)

Basic concepts of probability and its properties; Conditional probability and independent events; Random variables, discrete and continuous random variables, Mean and variance of Binomial, Poisson and Normal distributions and applications.

Sampling Distributions and Interval of Estimation: (08 hours)

Sampling Distributions: t-distribution, Chi-square distribution, Interval of estimation.

Text books:

1. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers,2020, 44th edition.
2. Advanced Engineering Mathematics, H.K.Das, S.Chand & Company Pvt.Ltd,2014.
3. A text book of Engineering Mathematics,N.P. Bali and Manish Goyal, Laxmi Publications, Reprint, 2010.

Reference books:

1. Advanced Engineering Mathematics,Erwin Kreyszig, 9th Edition, John Wiley & Sons, 2006.
2. Higher Engineering Mathematics, B.V,Ramana,Tata Mc Graw Hill Publishing company Ltd.,New Delhi,2008, 6th edition.
3. A First Course in Probability, S. Ross, 6th Ed., Pearson Education India, 2002.
4. An Introduction to Probability and Statistics,V. K. Rohatgi and A.K. Md. Ehsanes Saleh, 2nd Edition.
5. Applied Statistics and Probability for Engineers, D. C. Montgomery and G.C. Runger, 5th edition, John Wiley & Sons, (2009).
6. Introductory Statistics, P. S. Mann, Wiley Publications, 7th edition (2013).
7. I. N. Sneddon, Elements of Partial Differential Equations, Dover Publications, Inc. Mineola New York.

Course Outcomes:

After the successfully completion of the course the student will able to

SHU321(C).1	To solve partial differential equations and also to solve wave and heat equations.
SHU321(C).2	To use knowledge of Laplace Transform and to solve differential equation and to calculate stability of LTI system.
SHU321(C).3	Tackle problems related to continuous and discrete probability distributions.

ELPO/EXTC//INSTRU **(DSY)**

SHU322C INTEGRAL CALCULUS AND PROBABILITY

Teaching Scheme:03L+01T **Total: 04** **Credit:04**

Evaluation Scheme:30 MSE + 10 TA + 60 ESE **Total marks:100**

ESE duration:2 Hrs 30 min

Course Objectives:

I. To study method solution of partial differential equations and apply it to solve wave and heat equations.
II. To learn Laplace transform and its properties. Apply it to solve differential equation and to calculate stability of LTI system.

III. To equip students with the foundations of probabilistic and statistical analysis mostly used in varied applications in engineering and science.

Ordinary differential equations of higher orders: (08hours)

Linear differential equation with constant coefficient, complementary function, particular integral, complete solution; method of variation of parameters.

Integral Calculus: (08 hours)

Beta and Gamma functions and their properties; Evaluation of double integrals (Cartesian & polar), change of order of integration.

Partial differential equations: (08 hours)

Definition, order, degree, classification, formation of partial differential equation, method of separation of variables, first and second order one dimensional wave equation, heat equation

Laplace Transform:(08 hours)

Laplace Transform, Properties of Laplace Transform, Laplace transform of causal periodic signals, Analysis and Characterization of LTI systems using the Laplace Transform, The transfer function and differential equation, Impulse response and Step response,

Random variables and Probability Distributions: (08 hours)

Basic concepts of probability and its properties; Conditional probability and independent events; Random variables, discrete and continuous random variables, Mean and variance of Binomial, Poisson and Normal distributions and applications.

Text books:

1. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers, 2020, 44th edition.
2. Advanced Engineering Mathematics, H.K.Das, S.Chand & Company Pvt.Ltd, 2014.
3. A text book of Engineering Mathematics, N.P. Bali and Manish Goyal, Laxmi Publications, Reprint, 2010.

Reference books:

1. Advanced Engineering Mathematics,Erwin Kreyszig, 9th Edition, John Wiley & Sons, 2006.
2. Higher Engineering Mathematics, B.V,Ramana,Tata Mc Graw Hill Publishing company Ltd.,New Delhi,2008, 6th edition.
3. A First Course in Probability, S. Ross, 6th Ed., Pearson Education India, 2002.
4. An Introduction to Probability and Statistics,V. K. Rohatgi and A.K. Md. Ehsanes Saleh, 2nd Edition.
5. Applied Statistics and Probability for Engineers , D. C. Montgomery and G.C. Runger, 5th edition, John Wiley & Sons, (2009).
6. Introductory Statistics, P. S. Mann, Wiley Publications, 7th edition (2013).
7. I. N. Sneddon, Elements of Partial Differential Equations, Dover Publications, Inc. Mineola New York.

Course Outcomes:

After the successfully completion of the course the student will able to

SHU322(C).1	To solve partial differential equations and also to solve wave and heat equations.
SHU322(C).2	To use knowledge of Laplace Transform and to solve differential equation and to calculate stability of LTI system.
SHU322(C).3	Tackle problems related to continuous and discrete probability distributions.

ETU 321 ELECTRONIC DEVICES AND CIRCUITS

Teaching Scheme:03L+01T **Total: 04** **Credit:04**

Evaluation Scheme:30 MSE + 10 TA + 60 ESE **Total marks:100**

ESE duration: 2 Hrs 30 min

Course Objectives:

I. To introduce semiconductor devices and their properties.
II. To understand the behavior of semiconductor devices under the application of DC and AC signals.
III. To study MOSFET and BJT amplifier design process
IV. To introduce MOS Technology and related circuits.

Energy bands in intrinsic and extrinsic silicon; Carrier transport: diffusion current, drift current, mobility and resistivity; Generation and recombination of carriers; Poisson and continuity equation

P-N junction characteristics, I-V characteristics and small signal equivalent circuits of diodes, simple diode circuits: clipping, clamping and rectifiers, Zener diode

Bipolar transistors: Bipolar Junction Transistor, I-V characteristics and Ebers-Moll model; LED, photodiode and solar cell

Field Effect Devices: JFET/HFET, JFET characteristics, MIS structures, concept of accumulation, depletion and inversion, MOSFET operation, I-V characteristics, C-V characteristics, MOS capacitor and small signal models

Amplifier models: Voltage amplifier, current amplifier, trans-conductance amplifier and trans-resistance amplifier. Biasing schemes for BJT and FET amplifiers, bias stability, various configurations (such as CE/CS, CB/CG, CC/CD) and their features, small signal analysis, low frequency transistor models, estimation of voltage gain, input resistance, output resistance etc., low frequency analysis of multistage amplifiers

Text Books:

1. J. Millman, C. Halkias and Satyabrata jit, "Electronic Devices and Circuits," 2nd edition, Tata McGraw Hill, 2008.
2. D. R. Cheruku and B. T. Krushna, "Electronic Devices and Circuits," 2nd edition, Pearson Education, 2008.

Reference Books:

1. G. Streetman, and S. K. Banerjee, "Solid State Electronic Devices," 7th edition, Pearson,2014.
2. N.H.E. Weste and D.M. Harris, CMOS VLSI design: A Circuits and Systems Perspective, 4th Edition, Pearson Education India, 2011
3. Y. Tsividis and M. Colin, "Operation and Modeling of the MOS Transistor," Oxford Univ.Press, 2011.

Course Outcomes: At the end of this course students will demonstrate the ability to

ETU 321.1 Understand the principles of semiconductor Physics

ETU 321.2 Be familiar with electronic devices, and their applications to circuits

ETU 321.3 Be able to link knowledge of biasing and other characteristics with circuit operation

ETU 321.4 Realize simple amplifier circuits using BJT and FET.

ETU 322 SIGNALS AND SYSTEMS

Teaching Scheme: 03L **Total: 03** **Credits: 03**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

ESE duration: 2 Hrs 30 min

Course Objectives: Students undergoing this course are expected to

I. Know types of signals, their representations for signal processing

II. Know type of systems required for communication and control system.

III. Know Fourier representation and Fourier transform of continuous and discrete time periodic signals

IV. Understand concept of region of convergence(ROC) of Laplace transform and Z-Transform

V. Know the significance of sampling theorem.

Introduction to signals and system: Continuous and discrete time signals, transformation of signals, unit impulse and unit step functions. System - continuous & discrete time system, continuous and discrete LTI system, properties of LTI system. Causal LTI system described by differential and difference equation.

Fourier series representation: Fourier Series Representation of Periodic Signal, properties of Continuous and Discrete -Time Fourier Series. Parseval's Relation of Periodic Signal.

Fourier Transform: continuous-time and discrete time Fourier Transform for Periodic Signals, Properties of the Fourier Transform. Discrete time Fourier transform (DTFT),Magnitude and Phase response, properties of DTFT such as convolution, multiplication and duality.

Review of Laplace and Z- transform: Introduction to Laplace and Z-transforms, properties of Laplace and Z-Transform. The Inverse Laplace and Z-Transform, Pole- zero plot, , Analysis and Characterization of LTI Systems, System function algebra and block diagram representation.

Sampling: The sampling theorem, sampling of continuous time signals, digitization and reconstruction of a signal, ideal interpolator, effect of under sampling: aliasing, discrete time processing of continuous time signals.

Text Books:

1. Oppenheim, A.V.,Willsky, A.S. and Nawab, S.H., "Signals & Systems", 2nd1997Ed., Prentice-Hall of India.
2. Haykin, S. and Van Been, B., "Signals and Systems" 2nd 2003Ed., John Wiley & Sons.

Reference books:

1. Roberts, M.J., "Fundamentals of Signals & Systems", Tata McGraw-Hill.2007
2. Ziemer, R.E., Tranter, W.H. and Fannin, D.R., "Signals and Systems: Continuous and Discrete", 4th2001Ed., Pearson Educat4.Lath
3. Lathi, B. P., "Linear Systems and Signals", 2nd2006 Ed., Oxford University press.

Course Outcomes:

At the end of this course students will demonstrate the ability to

ETU 322.1 Analyze different types of signals

ETU 322.2 Represent continuous and discrete systems in time and frequency domain using different transforms.

ETU 322.3	Investigate whether the system is stable
ETU 322.4	Analyze signals in terms of Z and Laplace transform.
ETU 322.5	Sampling and reconstruction of a signal

ETU323 DIGITAL ELECTRONICS

Teaching Scheme: 03L **Total: 03** **Credits: 03**

Evaluation Scheme: 30 MSE +10 TA + 60 ESE **Total Marks: 100**

ESE duration:2 Hrs 30 min

Course Objectives:

I. To acquire the basic knowledge of digital logic circuit components which is the back bone for digital computers
II. To implement minimization techniques and Boolean algebra for circuit minimization
III. To understand, analyze and design combinational logic circuits using gates and MSIs
IV. To study various components and design sequential circuits and study semiconductor memories

Number system and codes: Positional number system – Binary, octal, decimal, hexadecimal, general conversions, arithmetic operations on unsigned and signed numbers, 1's, 2's, 9's, 10's complement method, negative number representation, BCD codes, gray codes, ASCII codes, error detection and correction codes. Overview and comparison of various logic families

Boolean algebra and logic circuits: Logic gates – basic, derived and universal gates, theorems and properties of Boolean algebra, DeMorgan's theorem, canonical and standard SOP and POS forms, simplification and synthesis of Boolean functions using gates, Boolean theorems, K-Map ,don't care condition (up to four variables) and Quine McCluskey method (up to 6 variables), Implementation of Boolean expressions using universal gates.

Combinational logic circuit design- adders, subtractors, BCD adder, ripple carry look ahead adders, parity generator, decoders, encoders, multiplexers, demultiplexers, Realization of Boolean expressions- using decoders-and multiplexers.

Sequential circuits – latches, flip flops, edge triggering, asynchronous inputs. Shift registers, Universal shift register, applications. Binary counters – Synchronous and asynchronous up/down counters, mod-N counter, Counters for random sequence.

Semiconductor memories: RAM, ROM, PROM, EPROM, CCD and flash memories. Introduction to PLDs, PLA and FPGA.

Text Books:

1. Digital Design by Morris Mano, Pearson education, 2018

2. Digital Principles And Logic Design By A. Saha N. Manna By Infinity Science Press LLC, 2007

Reference Books:

1. T. L. Floyd "Digital Fundamentals", 11th ed., Pearson Education, 2018.
2. Wakerly J F, "Digital Design: Principles and Practices, Prentice-Hall", 5th Ed., 2018.
3. Roth C.H., "Fundamentals of Logic Design", Jaico Publishers. V Ed., 2009.

Course outcomes

At the end of the course student will be able

ETU323.1	Optimize the digital circuits by applying the applying the Boolean algebra and other minimization techniques
ETU323.2	Examine and design the combinational circuits using gates and MSIs
ETU323.3	Realize the sequential circuits suing flip-flops counters and shift registers.
ETU323.4	Design and realize the digital logic circuits using SSI and MSIs.

ETU324 NETWORK THEORY

Teaching Scheme: 03L+01T **Total: 04** **Credits: 04**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

ESE duration: 2.30hrs

Course Objectives:

To make the student able

I. To understand the basics electrical circuits.
II. To apply electrical network theorems and to solve related numerical.
III. To apply Laplace Transform for steady state and transient analysis.
IV. To determine different network functions.

Node and Mesh Analysis: Node and mesh equation, Matrix approach of network containing voltage and current sources, Source transformation and Duality.

Network theorems: Superposition, Reciprocity, Thevenin's, Norton's, Maximum power Transfer, Compensation and Tallegen's theorem as applied to ac circuits.

Steady state response of a network to non-sinusoidal periodic inputs, Introduction to A.C circuits, Power factor, power calculations, Introduction to three phase a.c. circuit and power calculation.

Laplace transforms and properties: Partial fractions, Singularity functions, Waveform synthesis, Analysis of RC, RL, and RLC networks with and without initial conditions with Laplace transforms, evaluation of initial conditions.

Transient behavior, Concept of complex frequency, driving points and transfer functions, Concept of poles and zeros, their properties, Sinusoidal response from pole-zero locations, Convolution theorem. Behaviors of series and parallel resonant circuits.

Text Books:

1. Network analysis: Van Valkenburg, 3rd edition, Prentice Hall of India, 2000
2. Networks and Systems: D Roy Choudhury, 1st edition, New Age International (P) Limited,1998, reprint 2005

Reference Books:

1. Circuits and Networks: Sudhakar, A., Shyammohan S. P., 3rdedition,Tata McGraw-Hill, New Delhi, 2007
2. Engineering Circuit Analysis: William Hayt, 8th edition, McGraw-Hill Education, 2013

Course Outcomes:

After completing this course, students will demonstrate the ability to:

ETU324.1	Understand basics electrical circuits with nodal and mesh analysis.
ETU324.2	Appreciate electrical network theorems.
ETU324.3	Apply Laplace Transform for steady state and transient analysis.
ETU324.4	Determine different network functions.
ETU324.5	Appreciate the frequency domain techniques.

SHU 323 Introduction to Constitution of India

Teaching Scheme: 1 L | **Credit: 00**
Evaluation scheme: 60 ESE | **Total Marks: 60**

Course Objectives:

To acquaint students about constitution of India, Fundamental rights, fundamental duties, electoral process and role of central, state and local government and its administration.

Unit I: Introduction to Constitution of India
Salient features of the Constitution of India, Preamble of the Constitution, fundamental rights and fundamental duties, Directive Principles of State Policy and relevance of directive principles. Parliamentary Form of Government in India- President, Vice-President, Prime Minister along with council of Minister, Parliament, Supreme court, Electoral process in India. Amendment Procedure.

Unit II: State executives Governor, chief minister, state legislature, high courts of state,

Unit III: Role and functions of local self government- Municipalities in India, with special reference to 73rd amendment. Panchayat Raj in India with special reference to 74th amendment.

Reference Books:

1. An Introduction to Constitution of India, M.V.Pylee, Vikas Publishing, 2002
2. Constitution of India, Dr. B. R. Ambedkar, Government of India Publication

3. Latest Publications of Indian Institute of Human Rights, New Delhi

Course outcomes:

On the successful completion of this course, Students shall be able to-

SHU323.1 Understand and remember the knowledge of basic information about Indian Constitution.

SHU323.2 Apply the knowledge of fundamental rights and fundamental duties.

ETU325 ELECTRONICS DEVICES AND CIRCUITS LAB

Teaching Scheme: 02 **Total: 02** **Credits: 01**
Evaluation Scheme: 25Internal + 25 External **Total Marks:50**

Course Objectives:

I. To understand operation of semiconductor devices

II. To understand input, output characteristics and application of semiconductor diodes and transistors

III. To understand the devices in detail to use this devices for various application

IV. To verify the theoretical concepts through circuit simulation package

The instructor may choose experiments as per his/her requirements, so as to cover entire course contents of ETU321. Minimum 8 experiments should be performed.

The list given below is just a guideline.

1. Simple diode circuits: clipping, clamping and rectifiers
2. Zener diode Characteristics and Zener diode as Voltage Regulator
3. Input and output Characteristics of BJT in CE configuration (find h parameters from the characteristics)
4. Single stage BJT CE amplifier (Find performance parameters - Av, Ri and Ro)
5. Comparison of CE, CC, CB configurations for Av, Ri, and Ro
6. Transfer and drain characteristics of JFET. (find gm, rd and μ from characteristics.)
7. Simulate frequency response of single stage BJT CE / FET CS amplifier. (effect of coupling and bypass capacitors)
8. Output and transfer characteristic of n-channel MOSFET
9. Output and transfer characteristic of p-channel MOSFET

Course Outcomes:

ETU325.1 Plot the characteristics of semiconductor diodes and transistors to understand their behavior

ETU325.2 Understanding the input and output characteristics and application of these devices.

ETU325.3 To study and understand the devices in detail to use this devices for various application.

ETU325.4 Simulate a few of the circuit applications using appropriate Circuit Simulation package.

Note :

□ ICA – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continues assessment format A and B.

□ ESE – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions.

ETU326 SIGNALS AND SYSTEMS LAB

Teaching Scheme: 02P	**Credits : 01**	**Evaluation Scheme : 25 ICA+25 ESE**
Total Marks: 50		**ESE Duration: 3.00 Hrs**

The term work shall include minimum 10 experiments based on theory syllabus signal and systems as per sample list given below, using MATLAB or equivalent MATHCAD, LAB VIEW etc application software packages.

Course Objectives:

The objectives of this course are to

I. Provide learning practical implementation of the basic principles of signals

II. Acquire knowledge regarding types of system and their properties

III. Verify the concept of DFT, Z- transform and Laplace transform in the laboratory.

IV. Verify the concepts and applications of sampling and aliasing in the laboratory.

V. Provide practical exposure to random variables and processes.

Sample list is given below but any experiment related to signals and systems can be included

List of Experiments

1. To demonstrate generation of various types of signal representation.

2. To explore the effect of transformation of signal parameters (amplitude-scaling, and time shifting).

3. To verify different properties of a given system as linear or non-linear, causal or non-causal, stable or unstable etc.

4. Verification of Parseval's theorem associated with Fourier series analysis for a periodic square wave sampled using appropriate sampling frequency.

5. To study Fourier Transform and inverse Fourier Transform.

6. Verification of Multiplication property associated with Fourier series analysis for a periodic triangular wave sampled using appropriate sampling frequency.

7. Verification of shifting property associated with Fourier series analysis for a periodic square wave sampled using appropriate sampling frequency.

8 .To study Laplace transform and inverse Laplace Transform.

9. To study Z transform and inverse Z transform.

10. To study sampling, aliasing of discrete and continuous signals.

Course Outcomes: Student shall be able to

ETU326.1	Remember basic concepts of signals and systems.
ETU326.2	Analyzing signal and systems in time and frequency domain.
ETU326.3	Apply discrete Fourier transformation of signals.
ETU326.4	Understand need and concept of Z transform
ETU326.5	Evaluate energy and power spectral density of random variables and processes.

Note :

□ ICA – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continues assessment format A and B.

□ ESE – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions.

ETU327 DIGITAL ELECTRONICS LAB

Teaching Scheme: 02 **Total: 02** **Credits: 01**
Evaluation Scheme: 25Internal + 25 External **Total Marks:50**

Course Objectives:

I. To acquire the hands-on experience of digital component, circuit realization using bread board
II. To realize combinational logic circuits using gates and MSIs
III. To realize sequential circuits using gates and MSIs

The instructor may choose experiments as per his/her choice, so as to cover entire course contents of ETU323. Minimum 8 experiments should be performed.

Following list of laboratory experiments is indicative but not limited to following topics

1. Combinational Logic design using basic gates (Code Converters, Comparators, etc).
2. Combinational Logic design using decoders and MUXs.
3. Arithmetic circuits - Half and full address and subtractors.
4. Arithmetic circuits – design using adder ICs, BCD adder.
5. Flip flop circuit (RS latch, JK & master slave) using basic gates.
6. Asynchronous Counters
7. Synchronous counters, Johnson & Ring counters.
8. Sequential Circuit designs (sequence detector circuit).

Course Outcomes:

ETU327.1 To apply concepts and methods of digital system design techniques introduced in ETU323 through experimentation.
ETU327.2 To design, analyze, synthesize and realize combinational circuits using components and ICs
ETU327.3 To design and realize sequential circuits.
ETU327.4 To write clear and concise lab journal and reports.

Note :

 ICA – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continues assessment format A and B.

 ESE – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions.

ETU328 COMPUTER PROGRAMMING LAB

Teaching Scheme: 02 **Total: 02** **Credits: 01**
Evaluation Scheme: 25Internal + 25 External **Total Marks: 50**

Course Objectives:
Students will be able to

I. Comprehend the difference between MATLAB and PYTHON
II. Study MATLAB as a scientific computing language with powerful computational built in functions and dynamic variable arrays with unbounded dimensions
III. Study Python as a Open source and huge community developed high level language with available various packages, useful for current era of big-data, cloud computing, web designing, natural language processing and data analytics
IV. Choose the suitable programming language for solving specific problems.

Lab contents: Minimum eight experiments shall be performed to cover entire curriculum of course out of following representative list.

1. Compare MATLAB and Python Programming Languages on the basis of their key features.
2. Write a MATLAB program for matrix manipulations like addition, substation, multiplication of two matrices, a matrix and a scalar variable.
3. Write a MATLAB program to read images, perform basic operations like changing brightness, adding, subtracting them and writing them. Use the imtool image viewer to perform the same operations on image.
4. Write a MATLAB program to perform logical operations; Create user defined functions to do the same logical operations.
5. Use Signal Generator block of MATLAB Simulink to produce Sine, square, triangle and random signals.
6. Write a Python program for calculating sum, average, mean, mode, median, standard deviation of elements in an array.
7. Write a Python program that will find minimum and maximum numbers in a List, compute average of these two and find the sum of differences of all the elements in the list from this average.
8. Write a Python program used to find all the words (substrings separated by a space) which are greater than given length k in a given String.
9. Write a Python program to find grades of the students. The test grade is an average of the respective marks scored in assignments, tests and lab-works using Dictionaries.
10. Write a Python program to sort the list of tuples by the second item of each tuple.
11. Write a python program to read contents of a file and copy only the content of odd lines into new file.

Course Outcomes:

ETU328.1	Understand the concept of MATLAB and PYTHON programming
ETU328.2	Acquire programming skills for MATLAB and PYTHON
ETU328.3	Applying MATLAB for interactive computations
ETU328.4	Develop ability to use PYTHON as a scripting language and write database applications

Note :

□ ICA – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continues assessment format A and B.

□ ESE – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions.

ETU421 PROBABILITY THEORY AND STOCHASTIC PROCESSES

Teaching Scheme: 03L+00T **Total: 03** **Credits: 03**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

ESE duration:2 Hrs 30 min

Course Objectives:

To make the student able

I. To understand the fundamentals of probability.
II. To understand the concepts of random variables.
III. To understand the concept of sequence and series of random variables.
IV. To understand theorems in random process, stochastic processes and its applications, its spectral representation and its spectrum estimation.
V. To understand Markov chains, Markov processes, Power spectral density and random variable in linear systems.

Set, sample sets, operation with sets, various relation, indicator; Probability theory, experiments, sample spaces and events; Axiom of probability; Assigning probability; Joints and Conditional probability; Bayes theorem; Independence.

Discrete random variables, cumulative distributed function; probability density function; Gaussian random variable and introduction to other important random variables; Conditional distribution and density ; reliability and failure rates;

Expected value of a random variable; expected value of function of a random variable; moments; central moments; conditional expected value; transformations of random variables; characteristic functions; ,probability generating functions; moment generating functions; evaluating tail probabilities, Markov's inequality, Chebyshev's inequality, Chernoff bound.

Random sequences and series; independent and identically distributed random variables; convergence modes of random sequences; law of large numbers; central limit theorem; confidence interval; random sum of random variables.

Random process its definition and classification of processes; mathematical tools for studying random processes; stationary and Ergodic random processes; properties of the autocorrelation function; Gaussian random processes; Poisson processes.

Definition and examples of Markov processes; calculating transition and state probabilities in Markov chain; characterization of Markov chain; continuous time Markov processes; Definition of power spectral density; Wiener-Khintchine-Einstein theorem; bandwidth of random process; spectral estimation; thermal noise ; introduction to random process in linear system.

Text Books:

1. Henry Stark and John W. Woods, "Probability and Random Processes with Applications to Signal Processing", 3rd edition, 2001, Pearson Education.
2. Athanasios Papoulis and S. Unnikrishna Pillai, "Probability, Random Variables and Stochastic Processes", 4th edition, 2002, McGraw Hill.

Reference Books:

1. Kai Lai Chung and Farid AitSahlia, "Elementary Probability Theory", 4th edition, 2007, Springer.
2. Simon Haykin, "Communication Systems", 4th edition, 2000, John Wiley & Sons.
3. Uwe Hassler, " Stochastic Processes and calculus", 1st edition, 2016, Springer.
4. Achim Klenke, " Probability Theory", 2nd edition, 2014, Springer.

Course Outcomes:

After completing this course, Students shall be able to learn:

ETU421.1 Representation of probability and random variables.

ETU421.2 Investigate characteristics of probability, random variables.

ETU421.3 Investigate the random sequence and series.

ETU421.4 Make use of theorems related to random variables, stochastic processes, its applications, its spectral representation and its spectrum estimation.

ETU421.5 Markov chains, Markov processes, Power spectral density and random variables in linear system.

ETU422 ANALOG COMMUNICATION

Teaching Scheme: 03L + 0T **Total: 03** **Credits: 03**
Evaluation Scheme: 30MSE + 10 TA + 60 ESE **Total Marks: 100**
ESE duration: 2.30hrs

Course Objective:

The course aims to provide the students with

I. The concepts of analogue communication systems.
II. The various issues related to analogue communication such as modulation, demodulation, transmitters and receivers and noise performance.
III. The techniques for generating and demodulating narrow-band and wide-band frequency and phase modulated signals
IV. Various radio receivers with their parameters.
V. Basic introduction to antennas, their principal of operation also introduce to wave propagation.

Introduction to communication systems: The communication process, Sources of information, Communication networks, communication channels, Electromagnetic frequency spectrum, communication systems, need of modulation and its types, bandwidth requirement.

Noise: Sources of noise and its types signal to noise ratio, noise factor, noise figure, definition of noise figure, calculation of noise figure, noise figure from equivalent noise resistance, noise temperature and noise equivalent temperature.

Amplitude (Linear)Modulation and Demodulation: Amplitude modulation (AM), double side band (DSB), double side band suppressed carrier (DSB-SC), single side band (SSB), vestigial side band modulation (VSB): generation, demodulation; independent side band (ISB) transmission, modulation index, frequency spectrum, power requirement of these systems, super heterodyne radio receiver. Noise in AM receivers using coherent detection and envelop detection. Signal-to-noise ratio (SNR) calculations for amplitude modulation (AM) for low noise conditions

Angle (Exponential) Modulation and Demodulation: Generalized concept and features of angle modulation; Frequency modulation (FM): modulation index, power requirement, frequency spectrum, bandwidth, phasor comparison of narrowband FM and AM waves, generation of FM, demodulation, interference in FM system, pre-emphasis and de-emphasis techniques, FM receiver, noise in FM receiver. Signal-to-noise ratio (SNR) calculations for frequency modulation (FM) for low noise conditions

Phase modulation (PM): modulation index, power requirement, frequency spectrum, bandwidth analysis of narrow band FM, wide band FM and PM, interference in angle modulated system.

Signal-to-noise ratio (SNR) calculations for amplitude modulation (AM) and frequency modulation (FM) for low noise conditions

Antenna and Wave propagation:

Antenna: Introduction, Basic Antenna system, Antenna parameters, Yagi Uda antenna, Dish antenna

Wave propagation: Fundamentals of electromagnetic waves, Ground wave propagation, sky wave, space wave, tropospheric scatter, Extraterrestrial propagation.

Ionosphere: Structure, layers of Ionosphere, critical frequency, MUF, skip distance and virtual height.

Text Books:

1. Modern Digital and Analog Communication Systems, B. P. Lathi, 4rd edition, Oxford University press, 2009
2. Electronic communication systems, G. Kennedy and B. Davis, 5th edition, Tata McGraw Hill, 2012.

Reference Books:

1. Communication System, S. Haykin, 5th edition, John Wiley and sons, 2009.
2. Electronic communications, R. Dennis and J. Coolen, 4th edition, Prentice Hall
3. Communication Electronics Principles and Application, "Frenzel", Tata McGraw Hill, 3rd Edition

Course Outcome:

ETU422.1	Interpret the basic concept of communication systems and gain the knowledge of components of analogue communication system.
ETU422.2	Understand the analog modulation transmission and reception and achieve Knowledge in various methods of analog and digital communication, including amplitude Modulation (AM), Frequency Modulation (FM) and Phase Modulation (PM)
ETU422.3	Illustrate how the mathematical concepts bend the analog communication process.
ETU422.4	Analyze the effect of noise on various transmission systems and learn wave propagation.
ETU422.5	Illustrate techniques for antenna parameter measurements.

ETU423 ANALOG CIRCUITS

Teaching Scheme: 03L+00T **Total: 03** **Credits: 03**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

ESE duration: 2 Hrs.30Min

Course Objectives:

To make the student able to

I. Study negative feedback and power amplifier circuits
II. Study various Oscillators circuits
III. Develop the skill to build, test, diagnose and rectify the OP-AMP based electronic circuits.
IV. Study various active filters

Feedback Amplifier : Classification of amplifier, concept of feedback, types of feedback (positive and negative feedback), general characteristics of negative feedback amplifier - transfer gain, input resistance and output resistance, negative feedback amplifier - analysis of voltage series, current series, voltage shunt and current shunt negative feedback amplifier

Large Signal Amplifier : High frequency transistor models, frequency response of single stage and multistage amplifiers, cascode amplifier. Various classes of operation (Class A, B, AB, C etc.), their power efficiency and linearity issues.

Oscillators : Review of the basic concept, Barkhausen criterion, RC oscillators (phase shift, Wien bridge etc.), LC oscillators (Hartley, Colpitt, Clapp etc.), non-sinusoidal oscillators. Multivibrator : astable, bistable and monostable multivibrator.

OPAMP, inverting, non-inverting, differential amplifier configurations, Input offset voltage, input bias and offset current, Thermal drift, CMRR, PSRR.

OP-AMP applications: review of inverting and non-inverting amplifiers, integrator and differentiator, summing amplifier, precision rectifier, Schmitt trigger and its applications. Active filters: Low pass, high pass, band pass and band stop, design guidelines.

Text Books:

1.Millman's Electronic Devices and Circuits, J. Millman, C. C. Halkias, S. Jit, 3rd edition, McGraw-Hill Education (India) Private Limited, 2010 .

2. Tobey, Graeme ,Huelsman , Operational amplifiers, Design and applications, McGraw Hills, Edition

Reference Books:

1. Adel S. Sedra and K. C. Smith, "Microelectronic Circuits," 6th Ed. Oxford University Press India, 2010

2. Electronics Devices and Circuits, S. Salivahanan, N. Sureshkumar, 3rd edition, McGrew Hill Education (India) Private Limited, 2012

3. Ramakant A Gayakwad, "Op-Amps and Linear Integrated Circuits", PHI, 4th edition

4. D.Roy Choudhary, Shail Jain, "Linear Integrated Circuits", New Age Int.

Course Outcomes:

At the end of this course students will demonstrate the ability to :

ETU423.1	Analyze negative feedback amplifier and power amplifiers
ETU423.2	Understand various oscillator circuits
ETU423.3	Understand the functioning of OP-AMP and design OP-AMP based circuits
ETU423.4	Troubleshoot various linear applications of OP-AMP
ETU423.5	Helps students to know about active filter design

ETU424 MICROPROCESSORS AND MICROCONTROLLERS

Teaching Scheme: 03L+01T **Total: 04** **Credits: 04**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

ESE duration: 2Hrs.30Min.

Course Objectives:

To make the student able

I. To learn the fundamentals of microprocessors and microcontrollers
II. To understand the concepts of Assembly Language Programming
III. To understand the basic hardware interfacing
IV. To develop application based systems using microprocessors and microcontrollers with efficient programming

8-bit Microprocessors: Block diagram and operation of microcomputer system, Introduction to Intel's 8085 Architecture and its description along with functional pin diagram, organization of Memory in microcomputer system. Flag structure, Addressing Modes & Instruction set of 8085.

Assembly Language Programming: Assembly language Programming and timing diagram of instructions; Concept of Interrupts and its structure and programming in 8085 & Interrupt service routines, timer/counter; Serial communication basics in 8085.

Microcontrollers: Introduction to MCS51 family, microprocessor and microcontroller comparison, architecture of 8051, pin configuration and description, register organization, input/output port structure, timer structure and their modes, interrupts and serial port modes, Addressing modes, instruction set, bit and byte level logical operations, programming of serial and parallel ports, timer/counters, and interrupts..

Interfacing with 8051: Interfacing of LED, Seven segment, LCD, ADC, DAC, memory, DC and Stepper motor.

Introduction to Advanced Microcontrollers: ARM and PIC

Text Books:

1. Microprocessor, Architecture, Programming and Applications with 8085, Ramesh S. Gaonkar, 5th edition, Penram International Publication, 2004.
2. The 8051 microcontroller, Kenneth Ayala, 3rd edition, Delmar Cengage Learning, 2005.
3. 8051 Microcontroller and Embedded System, Muhammad Ali Mazidi, 2nd edition, Prentice Hall, 2000

Reference books:

1. 0000 to 8085 – Introduction to Microprocessor for Engineers and Scientists, P. R. Sridhar and P. K. Ghosh, 2nd edition, Prentice Hall India Ltd, 2005.
2. Introduction to Microprocessor, Aditya P. Mathur, 3rd edition, Tata McGraw-Hill,2004.
3. Advanced microprocessors and Peripherals, A.K.Ray and K.M.Bhurchandi, 2nd edition, Tata McGraw Hill, 2008
4. Design with PIC microcontrollers, John B. Peatman, 1st edition, PHI, 1998

Course Outcomes:

After completing this course, Students shall be able to:

ETU424.1 Understand Microprocessor and Microcontrollers basics

ETU424.2 Develop and implement Assembly language programs

ETU424.3 Understand the hardware interfaces required to develop a simple microcomputer system

ETU424.4 Develop simple application based projects.

ETU425 DIGITAL SYSTEM DESIGN

Teaching Scheme: 03L+01T **Total: 04** **Credits: 04**

Evaluation Scheme: 30MSE + 10 TA + 60 ESE **Total Marks: 100**

ESE duration: 2 hrs 30 min.

Course Objectives:
Student shall be

I. Able to perform the analysis and design of various digital electronic circuits.

II. Able to design and analyze a given combinational and sequential circuit.

II. Able to understand the logic design of programmable devices, including SPLDs, CPLDs and FPGAs.

III. Able to synthesize and simulate with hardware description language (VHDL)

Recapitulation of digital logic and minimization techniques.

Introduction to VHDL, design units, data objects, data types, concurrent and sequential statements.

Subprograms: Function, Procedures, attributes, generic, generate, package, IEEE std logic library, file I/O, test bench, component declaration, instantiation, configuration

Combinational logic circuit design and its VHDL implementation: Multiplexers, De-multiplexer, Encoders, Decoders, Comparators, Code converters, Priority encoders, Parity generator/checker.
Read only memory (ROM), Programmable Logic Array (PLA), Programmable array logic (PAL), Complex Programmable Logic Devices (CPLD) and field programmable gate array (FPGA).

Synchronous Sequential Circuit Design and its VHDL implementation: Design of shift registers and counters, analysis of clocked sequential networks, Finite state machines, Mealy and Moore, derivation of state graph and tables, state assignments.

Asynchronous sequential circuit design – primitive flow table, concept of race, critical race and hazards, design issues like metastability, synchronizers, clock skew and timing considerations. Introduction to place & route process.

Text Books:

1. Roth C.H., "Fundamentals of Logic Design", Jaico Publishers. V Ed., 2009.
2. Digital Circuit and Logic Design, S.C. Lee, 3rd edition, Prentice Hall of India Pvt. Ltd, 2002
3. M. M. Mano, "Digital Design", 6th ed., Pearson Education, Delhi, 2018.

4. VHDL: Analysis and Modeling of Digital Systems, Z. Navabi, McGraw Hill International Ed. 1998
5. A VHDL Primer, J. Bhasker, 1st Edition, PTR Prentice Hall, Englewood Cliffs, New Jersey, 1991

Reference Books :

1. Modern Digital Electronics, R. P. Jain , 4th edition, TMH Publication, 2009
2. T. L. Floyd "Digital Fundamentals", 11th ed., Pearson Education, 2018.
3. Wakerly J F, "Digital Design: Principles and Practices, Prentice-Hall", 5th Ed., 2018.
4. D. D. Givone, "Digital Principles and Design", Tata Mc-Graw Hill, New Delhi, 2003.
5. S.Brown and Z.Vranesic, "Fundamentals of Digital Logic with VHDL Design", Tata Mc-Graw Hill, 2013.
6. VHDL – 3rd Edition – Douglas Perry – TMH

Course Outcomes:

At the end of the course student shall be able to

ETU425.1 Design and Analysis of Combinational Logic circuits.

ETU425.2 Design and Analysis of Modular Combinational Logic circuits using MUX/DEMUX, Encoder/Decoder, PLDS.

ETU425.3 Design and Analysis of Sequential Logic circuits.

ETU425.4 Write a VHDL code to implement a particular design/block.

SHU422 Environmental Studies

Teaching Scheme: Th-01 **Credit: 00**
Evaluation scheme: 20TA + 30 ESE **Total Marks: 50**
ESE duration: 1Hr.30Min

Course objectives: The objectives of offering this course are to-

I. Be aware of various environmental factors and there preservation.

II. Teach them how to protect Environment and natural resources.

III. How to make equitable use of energy resources.

Course Content

The Multidisciplinary Nature of Environmental Studies: Definition, scope and importance, Need for public awareness.

Social issues and Environment: From Unsustainable to sustainable development, urban problems related to energy, Water conservation, rainwater harvesting, and watershed management Resettlement and rehabilitation of people, problems.

Environmental ethics: Issues and possible solution, Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, Wasteland reclamation. Consumerism and Waste products, Environment protection act, Air (prevention & control) act, Water (prevention and control) act, Wildlife protection act, Forest conservation act, Issues involved in enforcement of environmental legislation.

Human population and environment: Environment and human health, Human rights, Role of Information Technology in Environment and human health, Public awareness.

Natural Recourses: Conventional energy resources: definition, classification, composition, energy content types: coal, petroleum, natural gases, hydrogeothermal, nuclear, environmental implication of energy uses. Non conventional energy resources: solar energy, wind energy, tidal energy, geothermal energy, hydropowers and biogas.

Ecosystem and Biodiversity: Concept of ecosystem, Structure and function of ecosystem, Producer, consumer, decomposers. Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of following ecosystem: Forest ecosystem, Grass land ecosystem, Desert ecosystem Aquatic ecosystem (Rivers and ocean).

Introduction- definition: genetics, species and ecosystem, diversity.

Biogeographically classification of India. Conservation of biodiversity- In-situ and Ex-situ conservation of Biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts. Endangered and endemic species of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, national and local level. India as mega diversity nation. Hot spot of biodiversity.

Environmental Pollution: Definition, Causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Noise pollution, Thermal pollution, Nuclear hazards, Solid waste, Management, Causes effects and control measures, Role of individual in prevention of pollution, Hazardous waste management, Biomedical waste management, Disaster management: floods, earthquake, cyclone and landslides.

Course outcomes: After studying the course, the students will be able to:-

SHU422.1 Convey the Environmental awareness among peoples.

SHU422.2 Apply Conservation of various natural resources and environmental factors.

SHU422.3 Aware about social and environmental issues.

Recommended Books:

1) The Biodiversity of India, Bharucha Erach ,Marin Publishing Pvt. Ltd., Ahmedabad
2) Brunner R.C., 1989,Hazardous Waste Incineration, McGraw Hill Inc.
3) Marine pollution, Clark R.S., Clanderson Press Oxford (TB)
4) Environmental Chemistry, De A.K. Wiley Estern Lmt.
5) Environmental Chemistry, Sharma B.K., 2001 Goel Publ., House, Meerat.
6) Environmental Management, Wagner K.D., 1998, W.B. Saunders Co., Philadel phia, USA
7) Environmental Studies, Benny Joseph, 1st edition,2005,Tata Mcgraw-Hill Publ

ETU426 ANALOG COMMUNICATION LAB

Teaching Scheme: 02 **Total: 02** **Credits: 01**
Evaluation Scheme: 25Internal + 25 External **Total Marks: 50**

Course Objective:

I. Familiarize the students with basic analog communication systems.
II. Integrate theory with experiments so that the students appreciate the knowledge gained from the theory course, e.g., amplitude and frequency modulation, pulse modulation.
III. Understand Modulation and demodulation techniques of AM, FM.
IV. Know Characteristics of AM and FM receivers.

Minimum eight experiments shall be performed to cover entire curriculum of course ETU422. The list is just a guide line.

List

1. To Study Noise Spectral density.

2. AM modulation: Calculation of Modulation Index.

3. FM modulation: Calculation of Modulation Index.

4. Pre-emphasis and De-emphasis.

5. FM Modulation using PLL.

6. Demodulation of AM and FM.

7. Effect of noise on AM and FM

8. Pulse Amplitude Modulation and Demodulation.

9. Generation of double side band suppressed carrier.

10. To study SSB modulation and de-modulation.

11. Observe and plot radiation pattern of Omni-directional and directional antenna.

Course Outcomes:

ETU426.1	To develop practical knowledge about theories of analog communication.
ETU426.2	Evaluate analog modulated waveform in time /frequency domain and also find modulation index.
ETU426.3	Develop understanding about performance of analog communication systems.
ETU426.4	Analyze performance of noise on AM and FM.
ETU426.5	Illustrate techniques for antenna parameter measurements and analyze the performance of radiation pattern.

Note :

 ICA – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continues assessment format A and B.

 ESE – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions.

ETU427ANALOG CIRCUITS LAB

Teaching Scheme: 02 **Total: 02** **Credits: 01**
Evaluation Scheme: 25Internal + 25 External **Total Marks:50**

The instructor may choose experiments as per his/her requirements, so as to cover entire course contents of ETU423.Minimum 10 experiments should be performed.

At the end of the laboratory work, students will demonstrate the ability to:

I. Design, build, test and analyze performance of various amplifier circuits.
II. Analyze and design various applications of OP-AMP
III. Simulate a few of the circuit applications using appropriate Circuit Simulation package.

Design Experiments

1. Single stage BJT CE amplifier.

(Find performance parameters - Av, Ri, Ro & Bandwidth for BJT CE amplifier.)

2. Voltage series feedback amplifier

3. Voltage shunt feedback amplifier

4.Class A power amplifier with resistive load

5. Multivibrator - astable, monostable bistable

6.OP-AMPapplications- Integrator, Differentiators.

7. OP-AMP applications- Schmitt trigger.

8. filter Design.

Simulation Based Experiments

1. Simulate frequency response of single stage BJT CE / FET CS amplifier.

(Effect of coupling and bypass capacitors.)

2.Design and simulate LC and RC oscillators.

(Compare practical and theoretical oscillation frequency.)

3. Design and simulate active filters

Note :

- ICA – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continues assessment format A and B.

- ESE – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions.

ETU428 MICROPROCESSORS AND MICROCONTROLLERS LAB

Teaching Scheme: 02P **Total: 02** **Credits: 02**

Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**

ESE duration: 3.00hrs

Course Objectives:

To make student able

I. To learn the instruction set of microprocessor and microcontroller
II. To understand the concept of Assembly Language Programming
III. To understand the interfacing of peripheral devices and their programming
IV. To develop application based programs

Minimum eight experiments shall be performed to cover entire curriculum of course ETU424. The list given below is just a guideline.

List:

To write Assembly Language Program (ALP) using 8085 and 8051

1. To develop programs on data transfer operations such as block move, exchange, sorting
2. To implement arithmetic operations (8-bit and 16-bit) like addition, subtraction, multiplication, division, square, cube using look-up tables, multi byte arithmetic operations
3. To implement logical operations such as Boolean & logical instructions bit manipulations.
4. To find largest/smallest element in an array,
5. To arrange the array elements in ascending/descending order using bubble sorting.
6. To understand the concept of Stack and Subroutine.
7. To understand the concept of serial communication.
8. To write delay subroutines using timer/counter.
9. Interfacing of
    a. Relays for controlling operations,
    b. Generation of various types of waveforms using ADC/DAC,
    c. Interfacing basic output devices like LED, LCD, keyboard, 7-segment display, DIP switches, Push button switches
    d. Implementation of stepper and DC motor control.
10. To implement a simple microcontroller based application system like temperature control etc.

Course Outcomes:

After completing this course, Students shall be able to:

ETU424.1 Understand Microprocessor and Microcontrollers basics
ETU424.2 Develop Assembly language programs
ETU424.3 Learn the hardware interfaces required to develop a simple microcomputer system
ETU424.4 Develop simple application based projects

Note :

□ ICA – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continues assessment format A and B.

□ ESE – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions.

ETU331C Analog Electronic Circuits

Teaching Scheme	**: 03 L Total: 03**	**Credit: 03**
Evaluation Scheme	**: 15 CT1 + 15 CT2 +10 TA+ 60 ESE**	**Total Marks: 100**
Duration of ESE	**: 2 Hrs.30 min.**	

Module 1: Diode circuits (4 Hours)

P-N junction diode, I-V characteristics of a diode; review of half-wave and full-wave rectifiers, Zener diodes, clamping and clipping circuits.

Module 2: BJT circuits (8 Hours)

Structure and I-V characteristics of a BJT; BJT as a switch. BJT as an amplifier: small-signal model, biasing circuits, current mirror; common-emitter, common-base and common-collector amplifiers; Small signal equivalent circuits, high-frequency equivalent circuits

Module 3: MOSFET circuits (8 Hours)

MOSFET structure and I-V characteristics. MOSFET as a switch. MOSFET as an amplifier: small-signal model and biasing circuits, common-source, common-gate and common-drain amplifiers; small signal equivalent circuits - gain, input and output impedances, trans-conductance, high frequency equivalent circuit.

Module 4: Differential, multi-stage and operational amplifiers (8 Hours)

Differential amplifier; power amplifier; direct coupled multi-stage amplifier; internal structure of an operational amplifier, ideal op-amp, non-idealities in an op-amp (Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product)

Module 5: Linear applications of op-amp (8 Hours)

Idealized analysis of op-amp circuits. Inverting and non-inverting amplifier, differential amplifier, instrumentation amplifier, integrator, active filter, P, PI and PID controllers and lead/lag compensator using an op-amp, voltage regulator, oscillators (Wein bridge and phase shift).Analog to Digital Conversion.

Module 6: Nonlinear applications of op-amp (6 Hours)

Hysteretic Comparator, Zero Crossing Detector, Square-wave and triangular-wave generators. Precision rectifier, peak detector. Monoshot.

Text/References:

A. S. Sedra and K. C. Smith, "Microelectronic Circuits", New York, Oxford University Press, 1998.

1. J.V.Wait, L.P. Huelsman and G.A.Korn, "Introduction to Operational Amplifier theory and applications", McGraw Hill U. S., 1992.
2. J. Millman and A. Grabel, "Microelectronics", McGraw Hill Education, 1988.
3. P. Horowitz and W. Hill, "The Art of Electronics", Cambridge University Press, 1989.
4. P. R. Gray, R. G. Meyer and S. Lewis, "Analysis and Design of Analog Integrated Circuits"John Wiley & Sons, 2001.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

ETU331(C).1	Understand the characteristics of transistors.
ETU331(C).2	Design and analyze various rectifier and amplifier circuits.
ETU331(C).3	Design sinusoidal and non-sinusoidal oscillators.
ETU331(C).4	Understand the functioning of OP-AMP and design OP-AMP based circuits

ETU332C Analog Electronic Circuits Lab

Teaching Scheme	**: 02 P**	**Total: 02**	**Credit: 01**
Evaluation Scheme	**: 50 ICA**		**Total Marks: 50**

Minimum eight hands-on experiments related to the course contents of ETU331C Analog Electronic Circuits **shall be performed.**

The representative list of experiment is as follows.

1. To study and compare V-I characteristics of PN- junction diode and Zener diode.
2. To Study of diode as clipper and clamper.
3. To study half wave & full wave rectifier without filter and to calculate its ripple factor
4. To study bridge full wave rectifier without filter and to calculate its ripple factor.
5. To study half wave & full wave rectifier with filter and to calculate its ripple factor
6. To study bridge full wave rectifier with filter and to calculate its ripple factor.
7. To study the input and output characteristics of a given transistor in CE configuration.
8. To Study of CE amplifier- current & power gains and input, output impedances.
9. To study biasing of transistor by following method:
a. Fixed bias. b. Voltage divider bias.
10. To study the frequency response of RC coupled amplifier.
11. Measurement and study of output characteristics of JFET.
12. Measurement and study of output characteristics of MOSFET.
13. To study Hartley oscillator.
14. To study the different types of negative feedback in two stage amplifier and to observe its effects upon the amplifier parameters.
15To study biasing of transistor by following method:
a. Fixed bias. b. Voltage divider bias.

Course Outcomes:

After completion of the course, the students will be able to

ETU332(C).1	Set up a bias point in a transistor.
ETU332(C).2	Verify the working of diodes, transistors and their applications.
ETU332(C).3	Build a common emitter/base/collector amplifier and measure its voltage gain.
ETU332(C).4	Explore the operation and advantages of feedback amplifiers.
ETU332(C).5	Learn to design different types of filters and apply the same to oscillators and amplifiers.

ICA - Internal Continuous Assessment shall be based on the practical record and knowledge /skills acquired. The performance shall assess experiment wise by using continuous assessment formats, A and B.

ETU431C Digital Electronics

Teaching Scheme : 03 L Total: 03 **Credit: 03**
Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE : 2 Hrs.30 min.

Module 1:Fundamentals of Digital Systems and logic families (7Hours)
Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, number systems-binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes, characteristics of digital ICs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-statelogic.

Module 2: Combinational Digital Circuits (7Hours)
Standard representation for logic functions, K-map representation, simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, seria ladder, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices, Q-M method of function realization.

Module 3: Sequential circuits and systems (7Hours)
A 1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop, J- K-TandD-types flipflops, applications of flipflops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple(Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of counters.

Module 4: A/D and D/A Converters (7Hours)
Digital to analog converters: weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, examples of D/A converter ICs, sample and hold circuit, analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters, example of A/D converter ICs

Module 5: Semiconductor memories and Programmable logic devices. (7Hours)

Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, read only memory (ROM), read and write memory(RAM), content addressable memory (CAM), charge de coupled device memory (CCD), commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic, complex Programmable logic devices (CPLDS), Field Programmable Gate Array (FPGA).

Text/References:

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.
3. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

ETU431(C).1 Understand working of logic families and logic gates.

ETU431(C).2 Design and implement Combinational and Sequential logic circuits.

ETU431(C).3 Understand the process of Analog to Digital conversion and Digital to Analog conversion.

ETU431(C).4 Be able to use PLDs to implement the given logical problem.

ETU432C Digital Electronics Lab

Teaching Scheme **: 02 P** **Total: 02** **Credit: 01**
Evaluation Scheme **: 25 ICA + 25 ESE** **Total Marks: 50**

Minimum Eight hands-on experiments related to the course contents of ETU 431C Digital Electronics to be performed. Representative list is as follows:

1. To verify truth table of different logic gates.
2. NOR gate as universal gate: Realization of AND/ OR/ NAND/ NOT/ EX-OR gates using NOR gates only
3. NAND gate as universal gate: Realization of AND/ OR/ NOR / NOT/ EX-OR gates using NAND gates only
4. Realization of half adder using gates
5. Realization of half subtractor using gates
6. Implementation of full Adder circuit using gates
7. To study Flip-Flops (Realization of RS/ T/ D/ JKMS flip-flops using logic gates)
8. To study counters: Up counter/ down counter/ up-down counter/ decade counter
9. To study shift registers: Left shift/ right shift register
10. To study analog to digital converter
11. To study digital to analog converter

Course Outcomes:

After completion of the course, the students will be able to –

ETU432(C).1 Analyze and design simple logic circuits using gates

ETU432(C).2 Construct the circuits for experiments and take readings/ observations

ETU432(C).3 Derive conclusions on the basis of the readings/ observations in context of digital electronics

ETU432(C).4 Explain the working principle of various combinational and sequential logic circuits

ETU432(C).5 Explain the working principle of ADC and DAC

Note:

ICA - Internal Continuous Assessment shall be based on the practical record and knowledge /skills acquired. The performance shall assess experiment wise by using continuous assessment formats, A and B.

ESE - The End Semester Exam for practical shall be based on performance in one of experiments and may be followed by sample questions.

GOVERNMENT COLLEGE OF ENGINEERING, AMRAVATI

DEPARTMENT OF ELECTRONICS ENGINEERING

Proposed Curriculum for Second Year

B. Tech. (Electronics and Telecommunication)

2020-2021

Specialization: Electronics and Telecommunication

PROGRAM OBJECTIVES

PO1: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems

PO2: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

PO3: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PO12: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

(B) PROGRAM SPECIFIC OUTCOMES (PSOs)

A Graduate of the Electronics and Telecommunication program will be able to:

PSO1: Apply the concepts of Analog and Digital Electronics, Microprocessors, Signal processing and communication engineering in design and implementation of Engineering Systems.

PSO2: Solve complex problems in the field of Electronics and telecommunication using latest hardware and software tools along with analytical and managerial skills

PSO3: Acquire the social and environmental awareness with ethical responsibility to have successful carrier

GOVERNMENT COLLEGE OF ENGINEERING, AMRAVATI.
Department of Electronics Engineering.
Scheme for B. Tech. (Electronics and Telecommunication)

SEMESTER-III

Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						Credit
							Theory			Practical		Total	
			Theory Hrs/week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	MSE	ESE	ICA	ESE		
BSC	SHU321C *SHU322C	Transform And Statistical Methods *Integral Calculus And Probability	3	1	0	4	10	30	60	---	---	100	4
PCC	ETU321	Electronic Devices and Circuits	3	1	0	4	10	30	60	---	---	100	4
PCC	ETU322	Signals and Systems	3	0	0	3	10	30	60	---	---	100	3
PCC	ETU323	Digital Electronics	3	0	0	3	10	30	60	---	---	100	3
PCC	ETU324	Network Theory	3	1	0	4	10	30	60	---	---	100	4
MC	SHU322	Introduction to Constitution of India	1	--	--	1	---	---	60	---	---	60	--
PCC	ETU325	Electronics Devices and Circuits Lab.	0	0	2	2	---	---	---	25	25	50	1
PCC	ETU326	Signal and Systems Lab.	0	0	2	2	---	---	---	25	25	50	1
PCC	ETU327	Digital Electronics Lab.	0	0	2	2	---	---	---	25	25	50	1
PCC	ETU328	Computer Programming Lab.	0	0	2	2	---	---	---	25	25	50	1
	Total		**16**	**3**	**8**	**27**	**50**	**150**	**360**	**100**	**100**	**760**	**22**

TA: Teacher Assessment MSE: Mid Semester Examination ESE: End Semester Examination ICA: Internal Continuous Assessment
ESE Duration for Theory: 2.30Hrs.

*For direct second year admitted students

SEMESTER-IV

Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						Credit
								Theory		Practical		Total	
			Theory Hrs/week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	MSE	ESE	ICA	ESE		
PCC	ETU421	Probability Theory and Stochastic Processes	3	0	0	3	10	30	60	---	---	100	3
PCC	ETU422	Analog Communication	3	0	0	3	10	30	60	---	---	100	3
PCC	ETU423	Analog Circuits	3	0	0	3	10	30	60	---	---	100	3
PCC	ETU424	Microprocessors and Microcontrollers	3	1	0	4	10	30	60	---	---	100	4
PCC	ETU425	Digital System Design	3	1	0	4	10	30	60	---	---	100	4
MC	SHU424	Environmental Studies	1	0	0	1	---	---	---	---	60	60	---
PCC	ETU426	Analog Communication Lab.	0	0	2	2	---	---	---	25	25	50	1
PCC	ETU427	Analog Circuits Lab.	0	0	2	2	---	---	---	25	25	50	1
PCC	ETU428	Microprocessors and Microcontrollers Lab.	0	0	2	2	---	---	---	25	25	50	1
	Total		**16**	**2**	**6**	**24**	**50**	**150**	**300**	**75**	**135**	**710**	**20**

TA: Teacher Assessment MSE: Mid Semester Examination ESE: End Semester Examination ICA: Internal Continuous Assessment

ESE Duration for Theory: 2.30Hrs.

BSC Basic Science Courses
ESC Engineering Science Courses
HSMC Humanities and Social Sciences including Management courses
PCC Professional core courses
PEC Professional Elective courses
OEC Open Elective courses
LC Laboratory course
MC Mandatory courses
SI Summer Industry Internship
PROJ Project

Department of Electronics Engineering

Equivalence Scheme

Programme Name: -Electronics and Telecommunication

Sr. No.	Course code with Name of course(old) with total 184 credits		Credit	Course code with Name of course(new)with total 164 credits		Credit
1	SHU 302	Engineering Mathematics - III	3	SHU321C	Transform And Statistical Methods	4
2	ETU303	Electronics Devices and Circuits	4	ETU321	Electronic Devices and Circuits	4
3	ETU 401	Signals and Systems	4	ETU322	Signals and Systems	3
4	ETU 304	Digital Electronics	3	ETU323	Digital Electronics	3
5	ETU301	Network analysis	3	ETU324	Network Theory	4
6	SHU 205	General Proficiency I	2	No Equivalence Provided		--
7	No Equivalence Provided		--	SHU322	Introduction to Constitution of India	--
8	ETU307	Electronics Devices and Circuits Lab	1	ETU325	Electronics Devices and Circuits Lab	1
9	ETU 406	Signals and Systems Lab	1	ETU326	Signal and Systems Lab	1
10	ETU 308	Digital Electronics Lab	1	ETU327	Digital Electronics Lab	1
11	ETU302	Component Devices and instrument Technology	4	No Equivalence Provided		---

12	No Equivalence Provided		-	ETU328	Computer Programming Lab	1
13	ETU306	Component Devices and instrument Technology Lab	1	No Equivalence Provided		-
14	No Equivalence Provided		-	ETU421	Probability Theory and Stochastic Processes	3
15	ETU 404	Control System Engineering	3	No Equivalence Provided		-
16	No Equivalence Provided		-	ETU422	Analog Communication	3
17	ETU 402	Analog Circuits	4	ETU423	Analog Circuits	3
18	ETU 403	Microprocessor and its Interfacing	3	ETU424	Microprocessors and Microcontrollers	4
19	No Equivalence Provided		-	ETU425	Digital System Design	4
20	ETU 405	Object Oriented Programming Lab	2	No Equivalence Provided		-
21	No Equivalence Provided		-	SHU422	Environmental Studies	-
22	ETU 409	Control System Engineering Lab	1	No Equivalence Provided		-
23	No Equivalence Provided		-	ETU426	Analog Communication Lab.	1
24	ETU 407	Analog Circuits Lab	1	ETU427	Analog Circuits Lab.	1
25	ETU 408	Microprocessor and its Interfacing Lab	1	No Equivalence Provided		-
26	No Equivalence Provided		-	ETU428	Microprocessors and Microcontrollers Lab.	1

- All students promoted to third year with some backlog courses shall remain in old scheme (184 Credits) with old curriculum.
- All students who failed in second year (DC Students) shall be transferred to new same scheme (164 Credits) but with new curriculum.
- Important notes for * courses
  i) All courses of old curriculum shall be offered during the academic year (2020-2021) for back logger students.
  ii) In the academic year 2021-22and onward all students shall register for courses as revised curriculum

Equivalence Scheme for online courses

Sr. No.	Course code with Name of course(old/new)		Credit	Course code with Name of course (online)	Name of Online platform	Credit
1.	ETU321	Electronic Devices and Circuits	4	1. NPTEL course on **Semiconductor Devices and Circuits** 2. NPTEL course on **Fundamental of Semiconductor Devices**	NPTEL	
2.	ETU322	Signals and Systems	3	1. NPTEL course on **Principles of Signals and Systems** 2. NPTEL course on **Signals and Systems**	NPTEL	
3.	ETU323	Digital Electronics	3	1. NPTEL course on **Digital Circuits and Systems** 2. NPTEL course on **Digital Electronic Circuits**	NPTEL	

Sr. No.	Course code with Name of course(old/new)		Credit	Course code with Name of course (online)	Name of Online platform	Credit
				3. NPTEL course on **Digital Circuits**		
4.	ETU324	Network Theory	4	1.1 NPTEL course on **Network Analysis** 1.2 NPTEL course on **Networks and Systems** (**These two courses have covered 100 percent syllabus**)	NPTEL	
5.	ETU501	Linear Integrated Circuits and Applications	3	1. NPTEL course on **OP-AMP Practical Applications: Design, Simulation and Implementation** 2. NPTEL course on **Integrated Circuits, MOSFETs, Op-Amps and their Applications** 3**.** NPTEL course on **Electronic Modules For Industrial Applications Using Op-Amps**	NPTEL	
6.	ETU502	Analog Communication	3	1. NPTEL course on **Principle of Communication Systems-Part1** 2*. NPTEL course on **Communication Engineering** **3.** NPTEL course on **Analog Communication**	NPTEL	
7.	ETU503	Power Electronics	3	1. NPTEL course on **Power Electronics**	NPTEL	

Sr. No.	Course code with Name of course(old/new)		Credit	Course code with Name of course (online)	Name of Online platform	Credit
				2. NPTEL course on **Advanced Power Electronics and Control** 3. NPTEL course on **Fundamental of Power Electronics**		
8.	ETU504	Microcontroller and Its Applications	3	1. NPTEL course on **Microprocessors and Microcontrollers**	NPTEL	
9.	ETU505	Humanities and Economics	3	Same course contents are not available in NPTEL/NOC but some topics are approx 30% align	NPTEL	
10.	ETU701	Digital System Design	3	1. NPTEL course on **Digital Electronic Circuits** 2. NPTEL course on **Digital Circuits and Systems**	NPTEL	
11.	ETU702	Digital Communications	3	1. NPTEL course on **Principles of Digital Communications** (IITB) 2. NPTEL course on **Modern Digital Communication Techniques**	NPTEL	
12.	ETU703-I(A)	Fiber Optic Communications	3	1. NPTEL course on **Fiber Optic Communication Technology** 2. NPTEL course on **Fiber Optic Communication Systems and**	NPTEL	

Sr. No.	Course code with Name of course(old/new)		Credit	Course code with Name of course (online)	Name of Online platform	Credit
				Techniques 3. NPTEL course on **Optical Communications**		
13.	ETU703-I(B)	Embedded Systems	3	1*. NPTEL course on **Embedded Systems** 2. NPTEL course on **Embedded System Design** 3. NPTEL course on **Embedded Systems-Design Verification and Test**	NPTEL	
14.	ETU703-I(D)	Artificial Intelligence	3	1. NPTEL course on **Fuzzy Logic Neural Networks**	NPTEL	
15.	ETU704-II(B)	Industrial Electronics	3	1. NPTEL course on **Power Electronics**	NPTEL	

ELPO/EXTC//INSTRU

SHU321C TRANSFORM AND STATISTICAL METHODS

Teaching Scheme:03L+01T **Total: 04** **Credit:04**

Evaluation Scheme:30 MSE + 10 TA + 60 ESE **Total marks:100**

ESE duration:2 Hrs 30 min

Course Objectives:

I. To study method solution of partial differential equations and apply it to solve wave and heat equations.
II. To learn Laplace transform and its properties. Apply it to solve differential equation and to calculate stability of LTI system.
III. To equip students with the foundations of probabilistic and statistical analysis mostly used in varied applications in engineering and science.

Partial differential equations: (10 hours)

Definition, order, degree, classification, formation of partial differential equation, method of separation of variables, first and second order one dimensional wave equation, heat equation and two dimensional Laplace equation.

Laplace Transform: (10 hours)

Laplace Transform, Properties of Laplace Transform, Laplace transform of causal periodic signals, Analysis and Characterization of LTI systems using the Laplace Transform, The transfer function and differential equation, Impulse response and Step response, Causality, Stability, Stability of a causal LTI system

Random variables and Probability Distributions: (10 hours)

Basic concepts of probability and its properties; Conditional probability and independent events; Random variables, discrete and continuous random variables, Mean and variance of Binomial, Poisson and Normal distributions and applications**.**

Sampling Distributions and Interval of Estimation: (08 hours)

Sampling Distributions: t-distribution, Chi-square distribution, Interval of estimation.

Text books:

1. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers,2020, 44^{th} edition.
2. Advanced Engineering Mathematics, H.K.Das, S.Chand & Company Pvt.Ltd,2014.
3. A text book of Engineering Mathematics,N.P. Bali and Manish Goyal, Laxmi Publications, Reprint, 2010.

Reference books:

1. Advanced Engineering Mathematics,Erwin Kreyszig, 9^{th} Edition, John Wiley & Sons, 2006.
2. Higher Engineering Mathematics, B.V,Ramana,Tata Mc Graw Hill Publishing company Ltd.,New Delhi,2008, 6^{th} edition.
3. A First Course in Probability, S. Ross, 6th Ed., Pearson Education India, 2002.
4. An Introduction to Probability and Statistics,V. K. Rohatgi and A.K. Md. Ehsanes Saleh, 2nd Edition.
5. Applied Statistics and Probability for Engineers, D. C. Montgomery and G.C. Runger, 5th edition, John Wiley & Sons, (2009).
6. Introductory Statistics, P. S. Mann, Wiley Publications, 7th edition (2013).
7. I. N. Sneddon, Elements of Partial Differential Equations, Dover Publications, Inc. Mineola New York.

Course Outcomes:

After the successfully completion of the course the student will able to

SHU321(C).1	To solve partial differential equations and also to solve wave and heat equations.
SHU321(C).2	To use knowledge of Laplace Transform and to solve differential equation and to calculate stability of LTI system.
SHU321(C).3	Tackle problems related to continuous and discrete probability distributions.

ELPO/EXTC//INSTRU **(DSY)**

SHU322C INTEGRAL CALCULUS AND PROBABILITY

Teaching Scheme:03L+01T **Total: 04** **Credit:04**

Evaluation Scheme:30 MSE + 10 TA + 60 ESE **Total marks:100**

ESE duration:2 Hrs 30 min

Course Objectives:

I. To study method solution of partial differential equations and apply it to solve wave and heat equations.

II. To learn Laplace transform and its properties. Apply it to solve differential equation and to calculate stability of LTI system.
III. To equip students with the foundations of probabilistic and statistical analysis mostly used in varied applications in engineering and science.

Ordinary differential equations of higher orders: (08hours)

Linear differential equation with constant coefficient, complementary function, particular integral, complete solution; method of variation of parameters.

Integral Calculus: (08 hours)
Beta and Gamma functions and their properties; Evaluation of double integrals (Cartesian & polar), change of order of integration.

Partial differential equations: (08 hours)

Definition, order, degree, classification, formation of partial differential equation, method of separation of variables, first and second order one dimensional wave equation, heat equation

Laplace Transform:(08 hours)

Laplace Transform, Properties of Laplace Transform, Laplace transform of causal periodic signals, Analysis and Characterization of LTI systems using the Laplace Transform, The transfer function and differential equation, Impulse response and Step response,

Random variables and Probability Distributions: (08 hours)

Basic concepts of probability and its properties; Conditional probability and independent events; Random variables, discrete and continuous random variables, Mean and variance of Binomial, Poisson and Normal distributions and applications**.**

Text books:

1. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers, 2020, 44th edition.
2. Advanced Engineering Mathematics, H.K.Das, S.Chand & Company Pvt.Ltd, 2014.
3. A text book of Engineering Mathematics, N.P. Bali and Manish Goyal, Laxmi Publications, Reprint, 2010.

Reference books:

1. Advanced Engineering Mathematics,Erwin Kreyszig, 9th Edition, John Wiley & Sons, 2006.
2. Higher Engineering Mathematics, B.V,Ramana,Tata Mc Graw Hill Publishing company Ltd.,New Delhi,2008, 6th edition.
3. A First Course in Probability, S. Ross, 6th Ed., Pearson Education India, 2002.
4. An Introduction to Probability and Statistics,V. K. Rohatgi and A.K. Md. Ehsanes Saleh, 2nd Edition.
5. Applied Statistics and Probability for Engineers , D. C. Montgomery and G.C. Runger, 5th edition, John Wiley & Sons, (2009).
6. Introductory Statistics, P. S. Mann, Wiley Publications, 7th edition (2013).
7. I. N. Sneddon, Elements of Partial Differential Equations, Dover Publications, Inc. Mineola New York.

Course Outcomes:

After the successfully completion of the course the student will able to

SHU322(C).1	To solve partial differential equations and also to solve wave and heat equations.
SHU322(C).2	To use knowledge of Laplace Transform and to solve differential equation and to calculate stability of LTI system.
SHU322(C).3	Tackle problems related to continuous and discrete probability distributions.

ETU 321 ELECTRONIC DEVICES AND CIRCUITS

Teaching Scheme:03L+01T **Total: 04** **Credit:04**

Evaluation Scheme:30 MSE + 10 TA + 60 ESE **Total marks:100**

ESE duration: 2 Hrs 30 min

Course Objectives:

I. To introduce semiconductor devices and their properties.
II. To understand the behavior of semiconductor devices under the application of DC and AC signals.
III. To study MOSFET and BJT amplifier design process
IV. To introduce MOS Technology and related circuits.

Energy bands in intrinsic and extrinsic silicon; Carrier transport: diffusion current, drift current, mobility and resistivity; Generation and recombination of carriers; Poisson and continuity equation

P-N junction characteristics, I-V characteristics and small signal equivalent circuits of diodes, simple diode circuits: clipping, clamping and rectifiers, Zener diode

Bipolar transistors: Bipolar Junction Transistor, I-V characteristics and Ebers-Moll model; LED, photodiode and solar cell

Field Effect Devices: JFET/HFET, JFET characteristics, MIS structures, concept of accumulation, depletion and inversion, MOSFET operation, I-V characteristics, C-V characteristics, MOS capacitor and small signal models

Amplifier models: Voltage amplifier, current amplifier, trans-conductance amplifier and trans-resistance amplifier. Biasing schemes for BJT and FET amplifiers, bias stability, various configurations (such as CE/CS, CB/CG, CC/CD) and their features, small signal analysis, low frequency transistor models, estimation of voltage gain, input resistance, output resistance etc., low frequency analysis of multistage amplifiers

Text Books:

1. J. Millman, C. Halkias and Satyabrata jit, "Electronic Devices and Circuits," 2nd edition, Tata McGraw Hill, 2008.
2. D. R. Cheruku and B. T. Krushna, "Electronic Devices and Circuits," 2nd edition, Pearson Education, 2008.

Reference Books:

1. G. Streetman, and S. K. Banerjee, "Solid State Electronic Devices," 7th edition, Pearson,2014.
2. N.H.E. Weste and D.M. Harris, CMOS VLSI design: A Circuits and Systems Perspective, 4th Edition, Pearson Education India, 2011
3. Y. Tsividis and M. Colin, "Operation and Modeling of the MOS Transistor," Oxford Univ.Press, 2011.

Course Outcomes: At the end of this course students will demonstrate the ability to

ETU 321.1 Understand the principles of semiconductor Physics

ETU 321.2 Be familiar with electronic devices, and their applications to circuits

ETU 321.3 Be able to link knowledge of biasing and other characteristics with circuit operation

ETU 321.4 Realize simple amplifier circuits using BJT and FET.

ETU 322 SIGNALS AND SYSTEMS

Teaching Scheme: 03L **Total: 03** **Credits: 03**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

ESE duration: 2 Hrs 30 min

Course Objectives: Students undergoing this course are expected to

I. Know types of signals, their representations for signal processing
II. Know type of systems required for communication and control system.
III. Know Fourier representation and Fourier transform of continuous and discrete time periodic signals
IV. Understand concept of region of convergence(ROC) of Laplace transform and Z-Transform
V. Know the significance of sampling theorem.

Introduction to signals and system: Continuous and discrete time signals, transformation of signals, unit impulse and unit step functions. System - continuous & discrete time system, continuous and discrete LTI system, properties of LTI system. Causal LTI system described by differential and difference equation.

Fourier series representation: Fourier Series Representation of Periodic Signal, properties of Continuous and Discrete -Time Fourier Series. Parseval's Relation of Periodic Signal.

Fourier Transform: continuous-time and discrete time Fourier Transform for Periodic Signals, Properties of the Fourier Transform. Discrete time Fourier transform (DTFT),Magnitude and Phase response, properties of DTFT such as convolution, multiplication and duality.

Review of Laplace and Z- transform: Introduction to Laplace and Z-transforms, properties of Laplace and Z-Transform. The Inverse Laplace and Z-Transform, Pole- zero plot, , Analysis and Characterization of LTI Systems, System function algebra and block diagram representation.

Sampling: The sampling theorem, sampling of continuous time signals, digitization and reconstruction of a signal, ideal interpolator, effect of under sampling: aliasing, discrete time processing of continuous time signals.

Text Books:

1. Oppenheim, A.V.,Willsky, A.S. and Nawab, S.H., “Signals & Systems”, 2nd1997Ed., Prentice-Hall of India.
2. Haykin, S. and Van Been, B., “Signals and Systems” 2nd 2003Ed., John Wiley & Sons.

Reference books:

1. Roberts, M.J., “Fundamentals of Signals & Systems”, Tata McGraw-Hill.2007
2. Ziemer, R.E., Tranter, W.H. and Fannin, D.R., “Signals and Systems: Continuous and Discrete”, 4th2001Ed., Pearson Educat4.Lath
3. Lathi, B. P., “Linear Systems and Signals”, 2nd2006 Ed., Oxford University press.

Course Outcomes:

At the end of this course students will demonstrate the ability to

ETU 322.1 Analyze different types of signals

ETU 322.2 Represent continuous and discrete systems in time and frequency domain using different transforms.

ETU 322.3 Investigate whether the system is stable

ETU 322.4 Analyze signals in terms of Z and Laplace transform.

ETU 322.5 Sampling and reconstruction of a signal

ETU323 DIGITAL ELECTRONICS

Teaching Scheme: 03L **Total: 03** **Credits: 03**

Evaluation Scheme: 30 MSE +10 TA + 60 ESE **Total Marks: 100**

ESE duration:2 Hrs 30 min

Course Objectives:

I. To acquire the basic knowledge of digital logic circuit components which is the back bone for digital computers
II. To implement minimization techniques and Boolean algebra for circuit minimization
III. To understand, analyze and design combinational logic circuits using gates and MSIs
IV. To study various components and design sequential circuits and study semiconductor memories

Number system and codes: Positional number system – Binary, octal, decimal, hexadecimal, general conversions, arithmetic operations on unsigned and signed numbers, 1's, 2's, 9's, 10's complement method, negative number representation, BCD codes, gray codes, ASCII codes, error detection and correction codes. Overview and comparison of various logic families

Boolean algebra and logic circuits: Logic gates – basic, derived and universal gates, theorems and properties of Boolean algebra, DeMorgan's theorem, canonical and standard SOP and POS forms, simplification and synthesis of Boolean functions using gates, Boolean theorems, K-Map ,don't care condition (up to four variables) and Quine McCluskey method (up to 6 variables), Implementation of Boolean expressions using universal gates.

Combinational logic circuit design- adders, subtractors, BCD adder, ripple carry look ahead adders, parity generator, decoders, encoders, multiplexers, demultiplexers, Realization of Boolean expressions- using decoders-and multiplexers.

Sequential circuits – latches, flip flops, edge triggering, asynchronous inputs. Shift registers, Universal shift register, applications. Binary counters – Synchronous and asynchronous up/down counters, mod-N counter, Counters for random sequence.

Semiconductor memories: RAM, ROM, PROM, EPROM, CCD and flash memories. Introduction to PLDs, PLA and FPGA.

Text Books:

1. Digital Design by Morris Mano, Pearson education, 2018
2. Digital Principles And Logic Design By A. Saha N. Manna By Infinity Science Press LLC, 2007

Reference Books:

1. T. L. Floyd ”Digital Fundamentals”, 11th ed., Pearson Education, 2018.
2. Wakerly J F, “Digital Design: Principles and Practices, Prentice-Hall”, 5th Ed., 2018.
3. Roth C.H., “Fundamentals of Logic Design”, Jaico Publishers. V Ed., 2009.

Course outcomes

At the end of the course student will be able

ETU323.1 Optimize the digital circuits by applying the applying the Boolean algebra and other minimization techniques

ETU323.2 Examine and design the combinational circuits using gates and MSIs

ETU323.3 Realize the sequential circuits suing flip-flops counters and shift registers.

ETU323.4 Design and realize the digital logic circuits using SSI and MSIs.

ETU324 NETWORK THEORY

Teaching Scheme: 03L+01T **Total: 04** **Credits: 04**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

ESE duration: 2.30hrs

Course Objectives:

To make the student able

I. To understand the basics electrical circuits.

II. To apply electrical network theorems and to solve related numerical.

III. To apply Laplace Transform for steady state and transient analysis.

IV. To determine different network functions.

Node and Mesh Analysis: Node and mesh equation, Matrix approach of network containing voltage and current sources, Source transformation and Duality.

Network theorems: Superposition, Reciprocity, Thevenin’s, Norton’s, Maximum power Transfer, Compensation and Tallegen's theorem as applied to ac circuits.

Steady state response of a network to non-sinusoidal periodic inputs, Introduction to A.C circuits, Power factor, power calculations, Introduction to three phase a.c. circuit and power calculation.

Laplace transforms and properties: Partial fractions, Singularity functions, Waveform synthesis, Analysis of RC, RL, and RLC networks with and without initial conditions with Laplace transforms, evaluation of initial conditions.

Transient behavior, Concept of complex frequency, driving points and transfer functions, Concept of poles and zeros, their properties, Sinusoidal response from pole-zero locations, Convolution theorem. Behaviors of series and parallel resonant circuits.

Text Books:

1. Network analysis: Van Valkenburg, 3rd edition, Prentice Hall of India, 2000
2. Networks and Systems: D Roy Choudhury, 1st edition, New Age International (P) Limited,1998, reprint 2005

Reference Books:

1. Circuits and Networks: Sudhakar, A., Shyammohan S. P., 3rdedition,Tata McGraw-Hill, New Delhi, 2007
2. Engineering Circuit Analysis: William Hayt, 8th edition, McGraw-Hill Education, 2013

Course Outcomes:

After completing this course, students will demonstrate the ability to:

ETU324.1	Understand basics electrical circuits with nodal and mesh analysis.
ETU324.2	Appreciate electrical network theorems.
ETU324.3	Apply Laplace Transform for steady state and transient analysis.
ETU324.4	Determine different network functions.
ETU324.5	Appreciate the frequency domain techniques.

SHU 322 Introduction to Constitution of India

Teaching Scheme: 1 L **Credit: 00**

Evaluation scheme: 60 ESE **Total Marks: 60**

Course Objectives:

To acquaint students about constitution of India, Fundamental rights, fundamental duties, electoral process and role of central, state and local government and its administration.

Unit I: Introduction to Constitution of India

Salient features of the Constitution of India, Preamble of the Constitution, fundamental rights and fundamental duties, Directive Principles of State Policy and relevance of directive principles. Parliamentary Form of Government in India- President, Vice-President, Prime Minister along with council of Minister, Parliament, Supreme court, Electoral process in India. Amendment Procedure.

Unit II: State executives Governor, chief minister, state legislature, high courts of state,

Unit III: Role and functions of local self government- Municipalities in India, with special reference to 73rd amendment. Panchayat Raj in India with special reference to 74th amendment.

Reference Books:

1. An Introduction to Constitution of India, M.V.Pylee, Vikas Publishing, 2002
2. Constitution of India, Dr. B. R. Ambedkar, Government of India Publication
3. Latest Publications of Indian Institute of Human Rights, New Delhi

Course outcomes:

On the successful completion of this course, Students shall be able to-

SHU322.1	Understand and remember the knowledge of basic information about Indian Constitution.
SHU322.2	Apply the knowledge of fundamental rights and fundamental duties.

ETU325 ELECTRONICS DEVICES AND CIRCUITS LAB

Teaching Scheme: 02 **Total: 02** **Credits: 01**
Evaluation Scheme: 25Internal + 25 External **Total Marks:50**

Course Objectives:

I. To understand operation of semiconductor devices

II. To understand input, output characteristics and application of semiconductor diodes and transistors

III. To understand the devices in detail to use this devices for various application

IV. To verify the theoretical concepts through circuit simulation package

The instructor may choose experiments as per his/her requirements, so as to cover entire course contents of ETU321. Minimum 8 experiments should be performed.

The list given below is just a guideline.

1. Simple diode circuits: clipping, clamping and rectifiers
2. Zener diode Characteristics and Zener diode as Voltage Regulator
3. Input and output Characteristics of BJT in CE configuration (find h parameters from the characteristics)
4. Single stage BJT CE amplifier (Find performance parameters - Av, Ri and Ro)
5. Comparison of CE, CC, CB configurations for Av, Ri, and Ro
6. Transfer and drain characteristics of JFET. (find gm, rd and μ from characteristics.)
7. Simulate frequency response of single stage BJT CE / FET CS amplifier. (effect of coupling and bypass capacitors)

8. Output and transfer characteristic of n-channel MOSFET
9. Output and transfer characteristic of p-channel MOSFET

Course Outcomes:

ETU325.1 Plot the characteristics of semiconductor diodes and transistors to understand their behavior

ETU325.2 Understanding the input and output characteristics and application of these devices.

ETU325.3 To study and understand the devices in detail to use this devices for various application.

ETU325.4 Simulate a few of the circuit applications using appropriate Circuit Simulation package.

Note :

 ICA – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continues assessment format A and B.

 ESE – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions.

ETU326 SIGNALS AND SYSTEMS LAB

Teaching Scheme: 02P **Credits : 01** **Evaluation Scheme : 25 ICA+25 ESE**
Total Marks: 50 **ESE Duration: 3.00 Hrs**

The term work shall include minimum 10 experiments based on theory syllabus signal and systems as per sample list given below, using MATLAB or equivalent MATHCAD, LAB VIEW etc application software packages.

Course Objectives:
The objectives of this course are to

I. Provide learning practical implementation of the basic principles of signals
II. Acquire knowledge regarding types of system and their properties
III. Verify the concept of DFT, Z- transform and Laplace transform in the laboratory.
IV. Verify the concepts and applications of sampling and aliasing in the laboratory.
V. Provide practical exposure to random variables and processes.

Sample list is given below but any experiment related to signals and systems can be included

List of Experiments

1. To demonstrate generation of various types of signal representation.

2. To explore the effect of transformation of signal parameters (amplitude-scaling, and time shifting).

3. To verify different properties of a given system as linear or non-linear, causal or non-causal, stable or unstable etc.

4. Verification of Parseval's theorem associated with Fourier series analysis for a periodic square wave sampled using appropriate sampling frequency.

5. To study Fourier Transform and inverse Fourier Transform.

6. Verification of Multiplication property associated with Fourier series analysis for a periodic triangular wave sampled using appropriate sampling frequency.

7. Verification of shifting property associated with Fourier series analysis for a periodic square wave sampled using appropriate sampling frequency.

8 .To study Laplace transform and inverse Laplace Transform.

9. To study Z transform and inverse Z transform.

10. To study sampling, aliasing of discrete and continuous signals.

Course Outcomes: Student shall be able to

ETU326.1	Remember basic concepts of signals and systems.
ETU326.2	Analyzing signal and systems in time and frequency domain.
ETU326.3	Apply discrete Fourier transformation of signals.
ETU326.4	Understand need and concept of Z transform
ETU326.5	Evaluate energy and power spectral density of random variables and processes.

Note :

 ICA – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continues assessment format A and B.

 ESE – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions.

ETU327 DIGITAL ELECTRONICS LAB

Teaching Scheme: 02 **Total: 02** **Credits: 01**
Evaluation Scheme: 25Internal + 25 External **Total Marks:50**

Course Objectives:

I. To acquire the hands-on experience of digital component, circuit realization using bread board
II. To realize combinational logic circuits using gates and MSIs
III. To realize sequential circuits using gates and MSIs

The instructor may choose experiments as per his/her choice, so as to cover entire course contents of ETU323. Minimum 8 experiments should be performed.

Following list of laboratory experiments is indicative but not limited to following topics

1. Combinational Logic design using basic gates (Code Converters, Comparators, etc).
2. Combinational Logic design using decoders and MUXs.
3. Arithmetic circuits - Half and full address and subtractors.
4. Arithmetic circuits – design using adder ICs, BCD adder.
5. Flip flop circuit (RS latch, JK & master slave) using basic gates.
6. Asynchronous Counters
7. Synchronous counters, Johnson & Ring counters.
8. Sequential Circuit designs (sequence detector circuit).

Course Outcomes:

ETU327.1 To apply concepts and methods of digital system design techniques introduced in ETU323 through experimentation.
ETU327.2 To design, analyze, synthesize and realize combinational circuits using components and ICs
ETU327.3 To design and realize sequential circuits.
ETU327.4 To write clear and concise lab journal and reports.

Note :

- ICA – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continues assessment format A and B.

- ESE – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions.

ETU328 COMPUTER PROGRAMMING LAB

Teaching Scheme: 02 **Total: 02** **Credits: 01**
Evaluation Scheme: 25Internal + 25 External **Total Marks: 50**

Course Objectives:
Students will be able to

I. Comprehend the difference between MATLAB and PYTHON
II. Study MATLAB as a scientific computing language with powerful computational built in functions and dynamic variable arrays with unbounded dimensions
III. Study Python as a Open source and huge community developed high level language with available various packages, useful for current era of big-data, cloud computing, web designing, natural language processing and data analytics
IV. Choose the suitable programming language for solving specific problems.

Lab contents: Minimum eight experiments shall be performed to cover entire curriculum of course out of following representative list.

1. Compare MATLAB and Python Programming Languages on the basis of their key features.
2. Write a MATLAB program for matrix manipulations like addition, substation, multiplication of two matrices, a matrix and a scalar variable.
3. Write a MATLAB program to read images, perform basic operations like changing brightness, adding, subtracting them and writing them. Use the imtool image viewer to perform the same operations on image.
4. Write a MATLAB program to perform logical operations; Create user defined functions to do the same logical operations.
5. Use Signal Generator block of MATLAB Simulink to produce Sine, square, triangle and random signals.
6. Write a Python program for calculating sum, average, mean, mode, median, standard deviation of elements in an array.
7. Write a Python program that will find minimum and maximum numbers in a List, compute average of these two and find the sum of differences of all the elements in the list from this average.
8. Write a Python program used to find all the words (substrings separated by a space) which are greater than given length k in a given String.
9. Write a Python program to find grades of the students. The test grade is an average of the respective marks scored in assignments, tests and lab-works using Dictionaries.
10. Write a Python program to sort the list of tuples by the second item of each tuple.
11. Write a python program to read contents of a file and copy only the content of odd lines into new file.

Course Outcomes:

ETU328.1 Understand the concept of MATLAB and PYTHON programming

ETU328.2 Acquire programming skills for MATLAB and PYTHON

ETU328.3 Applying MATLAB for interactive computations

ETU328.4 Develop ability to use PYTHON as a scripting language and write database applications

Note :

 ICA – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continues assessment format A and B.

 ESE – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions.

ETU421 PROBABILITY THEORY AND STOCHASTIC PROCESSES

Teaching Scheme: 03L+00T **Total: 03** **Credits: 03**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

ESE duration:2 Hrs 30 min

Course Objectives:

To make the student able

I. To understand the fundamentals of probability.
II. To understand the concepts of random variables.
III. To understand the concept of sequence and series of random variables.
IV. To understand theorems in random process, stochastic processes and its applications, its spectral representation and its spectrum estimation.
V. To understand Markov chains, Markov processes, Power spectral density and random variable in linear systems.

Set, sample sets, operation with sets, various relation, indicator; Probability theory, experiments, sample spaces and events; Axiom of probability; Assigning probability; Joints and Conditional probability; Bayes theorem; Independence.

Discrete random variables, cumulative distributed function; probability density function; Gaussian random variable and introduction to other important random variables; Conditional distribution and density ; reliability and failure rates;

Expected value of a random variable; expected value of function of a random variable; moments; central moments; conditional expected value; transformations of random variables; characteristic functions; ,probability generating functions; moment generating functions; evaluating tail probabilities, Markov's inequality, Chebyshev's inequality, Chernoff bound.

Random sequences and series; independent and identically distributed random variables; convergence modes of random sequences; law of large numbers; central limit theorem; confidence interval; random sum of random variables.

Random process its definition and classification of processes; mathematical tools for studying random processes; stationary and Ergodic random processes; properties of the autocorrelation function; Gaussian random processes; Poisson processes.

Definition and examples of Markov processes; calculating transition and state probabilities in Markov chain; characterization of Markov chain; continuous time Markov processes; Definition of power spectral density; Wiener-Khintchine-Einstein theorem; bandwidth of random process; spectral estimation; thermal noise ; introduction to random process in linear system.

Text Books:

1. Henry Stark and John W. Woods, "Probability and Random Processes with Applications to Signal Processing", 3rd edition, 2001, Pearson Education.
2. Athanasios Papoulis and S. Unnikrishna Pillai, "Probability, Random Variables and Stochastic Processes", 4th edition, 2002, McGraw Hill.

Reference Books:

1. Kai Lai Chung and Farid AitSahlia, "Elementary Probability Theory", 4th edition, 2007, Springer.
2. Simon Haykin, "Communication Systems", 4th edition, 2000, John Wiley & Sons.
3. Uwe Hassler, " Stochastic Processes and calculus", 1st edition, 2016, Springer.
4. Achim Klenke, " Probability Theory", 2nd edition, 2014, Springer.

Course Outcomes:

After completing this course, Students shall be able to learn:

ETU421.1 Representation of probability and random variables.

ETU421.2 Investigate characteristics of probability, random variables.

ETU421.3 Investigate the random sequence and series.

ETU421.4 Make use of theorems related to random variables, stochastic processes, its applications, its spectral representation and its spectrum estimation.

ETU421.5 Markov chains, Markov processes, Power spectral density and random variables in linear system.

ETU422 ANALOG COMMUNICATION

Teaching Scheme: 03L + 0T **Total: 03** **Credits: 03**
Evaluation Scheme: 30MSE + 10 TA + 60 ESE **Total Marks: 100**
ESE duration: 2.30hrs

Course Objective:
The course aims to provide the students with

I. The concepts of analogue communication systems.
II. The various issues related to analogue communication such as modulation, demodulation, transmitters and receivers and noise performance.
III. The techniques for generating and demodulating narrow-band and wide-band frequency and phase modulated signals
IV. Various radio receivers with their parameters.
V. Basic introduction to antennas, their principal of operation also introduce to wave propagation.

Introduction to communication systems: The communication process, Sources of information, Communication networks, communication channels, Electromagnetic frequency spectrum, communication systems, need of modulation and its types, bandwidth requirement.

Noise: Sources of noise and its types signal to noise ratio, noise factor, noise figure, definition of noise figure, calculation of noise figure, noise figure from equivalent noise resistance, noise temperature and noise equivalent temperature.

Amplitude (Linear)Modulation and Demodulation: Amplitude modulation (AM), double side band (DSB), double side band suppressed carrier (DSB-SC), single side band (SSB), vestigial side band modulation (VSB): generation, demodulation; independent side band (ISB) transmission, modulation index, frequency spectrum, power requirement of these systems, super heterodyne radio receiver. Noise in AM receivers using coherent detection and envelop detection. Signal-to-noise ratio (SNR) calculations for amplitude modulation (AM) for low noise conditions

Angle (Exponential) Modulation and Demodulation: Generalized concept and features of angle modulation; Frequency modulation (FM): modulation index, power requirement, frequency spectrum, bandwidth, phasor comparison of narrowband FM and AM waves, generation of FM, demodulation, interference in FM system, pre-emphasis and de-emphasis techniques, FM receiver, noise in FM receiver. Signal-to-noise ratio (SNR) calculations for frequency modulation (FM) for low noise conditions

Phase modulation (PM): modulation index, power requirement, frequency spectrum, bandwidth analysis of narrow band FM, wide band FM and PM, interference in angle modulated system.
Signal-to-noise ratio (SNR) calculations for amplitude modulation (AM) and frequency modulation (FM) for low noise conditions

Antenna and Wave propagation:
Antenna: Introduction, Basic Antenna system, Antenna parameters, Yagi Uda antenna, Dish antenna
Wave propagation: Fundamentals of electromagnetic waves, Ground wave propagation, sky wave, space wave, tropospheric scatter, Extraterrestrial propagation.
Ionosphere: Structure, layers of Ionosphere, critical frequency, MUF, skip distance and virtual height.

Text Books:

1. Modern Digital and Analog Communication Systems, B. P. Lathi, 4rd edition, Oxford University press, 2009
2. Electronic communication systems, G. Kennedy and B. Davis, 5th edition, Tata McGraw Hill, 2012.

Reference Books:

1. Communication System, S. Haykin, 5th edition, John Wiley and sons, 2009.
2. Electronic communications, R. Dennis and J. Coolen, 4th edition, Prentice Hall
3. Communication Electronics Principles and Application, "Frenzel", Tata McGraw Hill, 3rd Edition

Course Outcome:

ETU422.1 Interpret the basic concept of communication systems and gain the knowledge of components of analogue communication system.
ETU422.2 Understand the analog modulation transmission and reception and achieve Knowledge in various methods of analog and digital communication, including amplitude Modulation (AM), Frequency Modulation (FM) and Phase Modulation (PM)
ETU422.3 Illustrate how the mathematical concepts bend the analog communication process.
ETU422.4 Analyze the effect of noise on various transmission systems and learn wave propagation.
ETU422.5 Illustrate techniques for antenna parameter measurements.

ETU423 ANALOG CIRCUITS

Teaching Scheme: 03L+00T **Total: 03** **Credits: 03**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

ESE duration: 2 Hrs.30Min

Course Objectives:

To make the student able to

I. Study negative feedback and power amplifier circuits
II. Study various Oscillators circuits
III. Develop the skill to build, test, diagnose and rectify the OP-AMP based electronic circuits.
IV. Study various active filters

Feedback Amplifier : Classification of amplifier, concept of feedback, types of feedback (positive and negative feedback), general characteristics of negative feedback amplifier - transfer gain, input resistance and output resistance, negative feedback amplifier - analysis of voltage series, current series, voltage shunt and current shunt negative feedback amplifier

Large Signal Amplifier : High frequency transistor models, frequency response of single stage and multistage amplifiers, cascode amplifier. Various classes of operation (Class A, B, AB, C etc.), their power efficiency and linearity issues.

Oscillators : Review of the basic concept, Barkhausen criterion, RC oscillators (phase shift, Wien bridge etc.), LC oscillators (Hartley, Colpitt, Clapp etc.), non-sinusoidal oscillators. Multivibrator : astable, bistable and monostable multivibrator.

OPAMP, inverting, non-inverting, differential amplifier configurations, Input offset voltage, input bias and offset current, Thermal drift, CMRR, PSRR.

OP-AMP applications: review of inverting and non-inverting amplifiers, integrator and differentiator, summing amplifier, precision rectifier, Schmitt trigger and its applications. Active filters: Low pass, high pass, band pass and band stop, design guidelines.

Text Books:

1.Millman's Electronic Devices and Circuits, J. Millman, C. C. Halkias, S. Jit, 3rd edition, McGraw-Hill Education (India) Private Limited, 2010 .

2. Tobey, Graeme ,Huelsman , Operational amplifiers, Design and applications, McGraw Hills, Edition

Reference Books:

1. Adel S. Sedra and K. C. Smith, "Microelectronic Circuits," 6th Ed. Oxford University

Press India, 2010

2. Electronics Devices and Circuits, S. Salivahanan, N. Sureshkumar, 3rd edition, McGrew Hill Education (India) Private Limited, 2012

3. Ramakant A Gayakwad, "Op-Amps and Linear Integrated Circuits", PHI, 4th edition

4. D.Roy Choudhary, Shail Jain, "Linear Integrated Circuits", New Age Int.

Course Outcomes:

At the end of this course students will demonstrate the ability to :

ETU423.1	Analyze negative feedback amplifier and power amplifiers
ETU423.2	Understand various oscillator circuits
ETU423.3	Understand the functioning of OP-AMP and design OP-AMP based circuits
ETU423.4	Troubleshoot various linear applications of OP-AMP
ETU423.5	Helps students to know about active filter design

ETU424 MICROPROCESSORS AND MICROCONTROLLERS

Teaching Scheme: 03L+01T **Total: 04** **Credits: 04**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

ESE duration: 2Hrs.30Min.

Course Objectives:

To make the student able

I. To learn the fundamentals of microprocessors and microcontrollers
II. To understand the concepts of Assembly Language Programming
III. To understand the basic hardware interfacing
IV. To develop application based systems using microprocessors and microcontrollers with efficient programming

8-bit Microprocessors: Block diagram and operation of microcomputer system, Introduction to Intel's 8085 Architecture and its description along with functional pin diagram, organization of Memory in microcomputer system. Flag structure, Addressing Modes & Instruction set of 8085.

Assembly Language Programming: Assembly language Programming and timing diagram of instructions; Concept of Interrupts and its structure and programming in 8085 & Interrupt service routines, timer/counter; Serial communication basics in 8085.

Microcontrollers: Introduction to MCS51 family, microprocessor and microcontroller comparison, architecture of 8051, pin configuration and description, register organization, input/output port structure, timer structure and their modes, interrupts and serial port modes, Addressing modes, instruction set, bit and byte level logical operations, programming of serial and parallel ports, timer/counters, and interrupts..

Interfacing with 8051: Interfacing of LED, Seven segment, LCD, ADC, DAC, memory, DC and Stepper motor.

Introduction to Advanced Microcontrollers: ARM and PIC

Text Books:

1. Microprocessor, Architecture, Programming and Applications with 8085, Ramesh S. Gaonkar, 5th edition, Penram International Publication, 2004.
2. The 8051 microcontroller, Kenneth Ayala, 3rd edition, Delmar Cengage Learning, 2005.
3. 8051 Microcontroller and Embedded System, Muhammad Ali Mazidi, 2nd edition, Prentice Hall, 2000

Reference books:

1. 0000 to 8085 – Introduction to Microprocessor for Engineers and Scientists, P. R. Sridhar and P. K. Ghosh, 2nd edition, Prentice Hall India Ltd, 2005.
2. Introduction to Microprocessor, Aditya P. Mathur, 3rd edition, Tata McGraw-Hill,2004.
3. Advanced microprocessors and Peripherals, A.K.Ray and K.M.Bhurchandi, 2nd edition, Tata McGraw Hill, 2008
4. Design with PIC microcontrollers, John B. Peatman, 1st edition, PHI, 1998

Course Outcomes:

After completing this course, Students shall be able to:

ETU424.1 Understand Microprocessor and Microcontrollers basics

ETU424.2 Develop and implement Assembly language programs

ETU424.3 Understand the hardware interfaces required to develop a simple microcomputer system

ETU424.4 Develop simple application based projects.

ETU425 DIGITAL SYSTEM DESIGN

Teaching Scheme: 03L+01T **Total: 04** **Credits: 04**

Evaluation Scheme: 30MSE + 10 TA + 60 ESE **Total Marks: 100**

ESE duration: 2 hrs 30 min.

Course Objectives:
Student shall be

I. Able to perform the analysis and design of various digital electronic circuits.

II. Able to design and analyze a given combinational and sequential circuit.

II. Able to understand the logic design of programmable devices, including SPLDs, CPLDs and FPGAs.

III. Able to synthesize and simulate with hardware description language (VHDL)

Recapitulation of digital logic and minimization techniques.

Introduction to VHDL, design units, data objects, data types, concurrent and sequential statements.

Subprograms: Function, Procedures, attributes, generic, generate, package, IEEE std logic library, file I/O, test bench, component declaration, instantiation, configuration

Combinational logic circuit design and its VHDL implementation: Multiplexers, De-multiplexer, Encoders, Decoders, Comparators, Code converters, Priority encoders, Parity generator/checker.
Read only memory (ROM), Programmable Logic Array (PLA), Programmable array logic (PAL), Complex Programmable Logic Devices (CPLD) and field programmable gate array (FPGA).

Synchronous Sequential Circuit Design and its VHDL implementation: Design of shift registers and counters, analysis of clocked sequential networks, Finite state machines, Mealy and Moore, derivation of state graph and tables, state assignments.

Asynchronous sequential circuit design – primitive flow table, concept of race, critical race and hazards, design issues like metastability, synchronizers, clock skew and timing considerations. Introduction to place & route process.

Text Books:

1. Roth C.H., "Fundamentals of Logic Design", Jaico Publishers. V Ed., 2009.
2. Digital Circuit and Logic Design, S.C. Lee, 3rd edition, Prentice Hall of India Pvt. Ltd, 2002

3. M. M. Mano, “Digital Design”, 6th ed., Pearson Education, Delhi, 2018.
4. VHDL: Analysis and Modeling of Digital Systems, Z. Navabi, McGraw Hill International Ed. 1998
5. A VHDL Primer, J. Bhasker, 1st Edition, PTR Prentice Hall, Englewood Cliffs, New Jersey, 1991

Reference Books :

1. Modern Digital Electronics, R. P. Jain , 4th edition, TMH Publication, 2009
2. T. L. Floyd ”Digital Fundamentals”, 11th ed., Pearson Education, 2018.
3. Wakerly J F, “Digital Design: Principles and Practices, Prentice-Hall”, 5th Ed., 2018.
4. D. D. Givone, “Digital Principles and Design”, Tata Mc-Graw Hill, New Delhi, 2003.
5. S.Brown and Z.Vranesic, “Fundamentals of Digital Logic with VHDL Design”, Tata Mc-Graw Hill, 2013.
6. VHDL – 3rd Edition – Douglas Perry – TMH

Course Outcomes:

At the end of the course student shall be able to

ETU425.1 Design and Analysis of Combinational Logic circuits.

ETU425.2 Design and Analysis of Modular Combinational Logic circuits using MUX/DEMUX, Encoder/Decoder, PLDS.

ETU425.3 Design and Analysis of Sequential Logic circuits.

ETU425.4 Write a VHDL code to implement a particular design/block.

SHU424 Environmental Studies

Teaching Scheme: Th-01 **Credit: 00**
Evaluation scheme: 60 ESE **Total Marks: 60**
ESE duration: 2Hrs.30Min

Course objectives: The objectives of offering this course are to-

I. Be aware of various environmental factors and there preservation.
II. Teach them how to protect Environment and natural resources.
III. How to make equitable use of energy resources.

Course Content

The Multidisciplinary Nature of Environmental Studies: Definition, scope and importance, Need for public awareness.

Social issues and Environment: From Unsustainable to sustainable development, urban problems related to energy, Water conservation, rainwater harvesting, and watershed management Resettlement and rehabilitation of people, problems.

Environmental ethics: Issues and possible solution, Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, Wasteland reclamation. Consumerism and Waste products, Environment protection act, Air (prevention & control) act, Water (prevention and control) act, Wildlife protection act, Forest conservation act, Issues involved in enforcement of environmental legislation.

Human population and environment: Environment and human health, Human rights, Role of Information Technology in Environment and human health, Public awareness.

Natural Recourses: Conventional energy resources: definition, classification, composition, energy content types: coal, petroleum, natural gases, hydrogeothermal, nuclear, environmental implication of energy uses. Non conventional energy resources: solar energy, wind energy, tidal energy, geothermal energy, hydropowers and biogas.

Ecosystem and Biodiversity: Concept of ecosystem, Structure and function of ecosystem, Producer, consumer, decomposers. Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of following ecosystem: Forest ecosystem, Grass land ecosystem, Desert ecosystem Aquatic ecosystem (Rivers and ocean).

Introduction- definition: genetics, species and ecosystem, diversity.

Biogeographically classification of India. Conservation of biodiversity- In-situ and Ex-situ conservation of Biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts. Endangered and endemic species of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, national and local level. India as mega diversity nation. Hot spot of biodiversity.

Environmental Pollution: Definition, Causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Noise pollution, Thermal pollution, Nuclear hazards, Solid waste, Management, Causes effects and control measures, Role of individual in prevention of pollution, Hazardous waste management, Biomedical waste management, Disaster management: floods, earthquake, cyclone and landslides.

Course outcomes: After studying the course, the students will be able to:-

SHU424.1	Convey the Environmental awareness among peoples.
SHU424.2	Apply Conservation of various natural resources and environmental factors.
SHU424.3	Aware about social and environmental issues.

Recommended Books:

1) The Biodiversity of India, Bharucha Erach ,Marin Publishing Pvt. Ltd., Ahmedabad
2) Brunner R.C., 1989,Hazardous Waste Incineration, McGraw Hill Inc.
3) Marine pollution, Clark R.S., Clanderson Press Oxford (TB)
4) Environmental Chemistry, De A.K. Wiley Estern Lmt.

5) Environmental Chemistry, Sharma B.K., 2001 Goel Publ., House, Meerat.
6) Environmental Management, Wagner K.D., 1998, W.B. Saunders Co., Philadel phia, USA
7) Environmental Studies, Benny Joseph, 1st edition,2005,Tata Mcgraw-Hill Publ

ETU426 ANALOG COMMUNICATION LAB

Teaching Scheme: 02 **Total: 02** **Credits: 01**
Evaluation Scheme: 25Internal + 25 External **Total Marks: 50**

Course Objective:

I. Familiarize the students with basic analog communication systems.
II. Integrate theory with experiments so that the students appreciate the knowledge gained from the theory course, e.g., amplitude and frequency modulation, pulse modulation.
III. Understand Modulation and demodulation techniques of AM, FM.
IV. Know Characteristics of AM and FM receivers.

Minimum eight experiments shall be performed to cover entire curriculum of course ETU422. The list is just a guide line.

List

1. To Study Noise Spectral density.

2. AM modulation: Calculation of Modulation Index.

3. FM modulation: Calculation of Modulation Index.

4. Pre-emphasis and De-emphasis.

5. FM Modulation using PLL.

6. Demodulation of AM and FM.

7. Effect of noise on AM and FM

8. Pulse Amplitude Modulation and Demodulation.

9. Generation of double side band suppressed carrier.

10. To study SSB modulation and de-modulation.

11. Observe and plot radiation pattern of Omni-directional and directional antenna.

Course Outcomes:

ETU426.1 To develop practical knowledge about theories of analog communication.
ETU426.2 Evaluate analog modulated waveform in time /frequency domain and also find modulation index.
ETU426.3 Develop understanding about performance of analog communication systems.
ETU426.4 Analyze performance of noise on AM and FM.
ETU426.5 Illustrate techniques for antenna parameter measurements and analyze the performance of radiation pattern.

Note :

- ICA – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continues assessment format A and B.

- ESE – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions.

ETU427ANALOG CIRCUITS LAB

Teaching Scheme: 02 **Total: 02** **Credits: 01**
Evaluation Scheme: 25Internal + 25 External **Total Marks:50**

The instructor may choose experiments as per his/her requirements, so as to cover entire course contents of ETU423.Minimum 10 experiments should be performed.

At the end of the laboratory work, students will demonstrate the ability to:

I. Design, build, test and analyze performance of various amplifier circuits.
II. Analyze and design various applications of OP-AMP
III. Simulate a few of the circuit applications using appropriate Circuit Simulation package.

Design Experiments

1. Single stage BJT CE amplifier.

(Find performance parameters - Av, Ri, Ro & Bandwidth for BJT CE amplifier.)

2. Voltage series feedback amplifier

3. Voltage shunt feedback amplifier

4.Class A power amplifier with resistive load

5. Multivibrator - astable, monostable bistable

6.OP-AMPapplications- Integrator, Differentiators.

7. OP-AMP applications- Schmitt trigger.

8. filter Design.

Simulation Based Experiments

1. Simulate frequency response of single stage BJT CE / FET CS amplifier.

(Effect of coupling and bypass capacitors.)

2.Design and simulate LC and RC oscillators.

(Compare practical and theoretical oscillation frequency.)

3. Design and simulate active filters

Note :

 ICA – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continues assessment format A and B.

 ESE – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions.

ETU428 MICROPROCESSORS AND MICROCONTROLLERS LAB

Teaching Scheme: 02P **Total: 02** **Credits: 02**

Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**

ESE duration: 3.00hrs

Course Objectives:

To make student able

I. To learn the instruction set of microprocessor and microcontroller
II. To understand the concept of Assembly Language Programming
III. To understand the interfacing of peripheral devices and their programming
IV. To develop application based programs

Minimum eight experiments shall be performed to cover entire curriculum of course ETU424. The list given below is just a guideline.

List:

To write Assembly Language Program (ALP) using 8085 and 8051

1. To develop programs on data transfer operations such as block move, exchange, sorting
2. To implement arithmetic operations (8-bit and 16-bit) like addition, subtraction, multiplication, division, square, cube using look-up tables, multi byte arithmetic operations
3. To implement logical operations such as Boolean & logical instructions bit manipulations.
4. To find largest/smallest element in an array,
5. To arrange the array elements in ascending/descending order using bubble sorting.
6. To understand the concept of Stack and Subroutine.
7. To understand the concept of serial communication.
8. To write delay subroutines using timer/counter.
9. Interfacing of
    a. Relays for controlling operations,
    b. Generation of various types of waveforms using ADC/DAC,
    c. Interfacing basic output devices like LED, LCD, keyboard, 7-segment display, DIP switches, Push button switches
    d. Implementation of stepper and DC motor control.
10. To implement a simple microcontroller based application system like temperature control etc.

Course Outcomes:

After completing this course, Students shall be able to:

ETU424.1 Understand Microprocessor and Microcontrollers basics
ETU424.2 Develop Assembly language programs
ETU424.3 Learn the hardware interfaces required to develop a simple microcomputer system
ETU424.4 Develop simple application based projects

Note :

 ICA – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continues assessment format A and B.

- ESE – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions.

GOVT. COLLEGE OF ENGINEERING, AMRAVATI

(An Autonomous Institute of Government of Maharashtra)

B. Tech. (Electronics and Telecommunication)

VII and VIII Semester CURRICULUM

Department of Electronics and Telecommunication

2016-17

GOVERNMENT COLLEGE OF ENGINEERING, AMRAVTI

Department of Electronics and Telecommunication Engineering

Scheme for B. Tech. (Electronics and Telecommunication)

SEM VII

Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
						Theory				Practical		Total	
		Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	CT1	CT2	ESE	ICA	ESE		
ETU701	Digital System Design	3	---	---	3	10	15	15	60	---	---	100	3
ETU702	Digital Communication	3	---	---	3	10	15	15	60	---	---	100	3
ETU703	Elective - I	3	---	---	3	10	15	15	60	---	---	100	3
ETU704	Interdisciplinary Elective	3	---	---	3	10	15	15	60	---	---	100	3
ETU705	Digital System Design Lab	---	---	2	2	---	---	---	---	25	25	50	1
ETU706	Digital Communication Lab	---	---	2	2	---	---	---	---	25	25	50	1
ETU707	Elective - I Lab	---	---	2	2	---	---	---	---	25	25	50	1
ETU708	Project Phase - I	---	---	4	4	---	---	---	---	50	--	50	2
ETU709	Seminar	---	---	2	2	---	---	---	---	25	25	50	2
ETU710	Industrial Training/ Visit	---	---	---	---	---	---	---	---	50	---	50	1
ETU711	Industrial Lecture - II	1	---	---	1	---	---	---	---	25	---	25	1**
ETU712	Self Study - III	---	---	---	----	25	---	---	---	---	---	25	2
Total		13	---	12	25	65	60	60	240	225	100	750	23

1) ETU712 Self Study - III is based on one class test each on the basis of 20 % curriculum of the courses ETU701 to ETU703 declared by respective course coordinator at the beginning of semester. One faculty member shall be appointed as course coordinator for self study and his/her teaching workload shall be considered one hour/week

2) Credit shall be awarded on the basis of combined assessment of ETU612 Industrial Lecture - I and ETU711 Industrial Lecture - II

3) Students of this department shall select any one Interdisciplinary Elective offered by other department. Interdisciplinary Elective shown below will be offered to students of other department.

SEM VIII

Course	Name of the Course	Teaching Scheme	Evaluation Scheme	Credits

Code						Theory				Practical			
		Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	CT1	CT2	ESE	ICA	ESE	Total	
ETU801	Computer Network and Communication	3	---	---	3	10	15	15	60			100	3
ETU802	Microwave Engineering	3	---	---	3	10	15	15	60	---	---	100	3
ETU803	Elective - II	3	---	---	3	10	15	15	60	---	---	100	3
ETU804	Elective - III	3	---	---	3	10	15	15	60	---	---	100	3
ETU805	Computer Network and Communication Lab	---	---	2	2	---	---	---	---	25	25	50	1
ETU806	Microwave Engineering Lab	---	---	2	2	---	---	---	---	25	25	50	1
ETU807	ELECTIVE II and Elective - III Lab	---	---	2	2	---	---	---	---	25	25	50	1
ETU808	Project	---	---	6	6	---	---	---	---	75	100	175	6
ETU809	Self Study - IV	---	---	---	---	25	---	---	---	---	----	25	2
Total		12	---	12	24	65	60	60	240	150	175	750	23

ETU809 Self Study - IV is based on one class test each on the basis of 20 % curriculum of the courses ETU801 to ETU804 declared by respective course coordinator at the beginning of semester. One faculty member shall be appointed as course coordinator for self study and his/her teaching workload shall be considered one hour/week

TA :Teacher Assessment CT: Class Tests ESE: End Semester Examination ICA : Internal Contineous Assessment ESE Duration for Th: 2Hrs 30Min

ETU704 Interdisciplinary Elective

1. Electronics Instruments and Applications
2. Industrial Electronics
3. System Engineering

ETU703 Elective - I

A. Fiber Optic Communication
B. Embedded System
C. System Software
D. Artificial Intelligence
E. Bio Medical Engineering

ETU803 Elective - II

A. Wireless Communication
B. VLSI Design
C. Open Source Operating system
D. Fuzzy Logic and Neural Network
E. Bio Informatics

ETU804 Elective - III

A. Sattelite Communication Systems
B. Modern Electronic Design Technique
C. Antenna and Radar
D. Digital Image Processing
E .Industrial Automation

ETU701 DIGITAL SYSTEM DESIGN

Teaching Scheme: 03L+ 00T **Total: 03** **Credits: 03**
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**
ESE Duration: 2 Hrs. 30 Min.

Combinational Logic: Recapitulation of digital logic and minimization techniques, combinational logic design, binary parallel adders, Look-ahead carry adder, multiplexers, demultiplexer, multiplexer trees, encoders, decoders, comparators, code converters, priority encoders, parity generator/checker.

Programmable Logic Devices: Read Only Memory (ROM) as Programmable Logic Devices (PLD), Programmable Logic Array (PLA): block diagram, input, output buffers, AND, OR, INVERT and NON-INVERT matrix, Programmable Array Logic (PAL): combinational, registered and configurable PALs, Complex Programmable Logic Devices (CPLD): block diagram, programming, packaging, Field Programmable Gate Array (FPGA): basic architecture, process technologies.

Synchronous Sequential Circuits: Design of shift registers and counters, analysis of clocked sequential networks, general models of sequential machines, Mealy and Moore machine, equivalence and minimization networks, derivation of state graph and tables, reduction of state assignments.

Asynchronous Sequential Circuits: Analysis of asynchronous sequential circuits, derivation and reduction of primitive flow tables, state assignments and realization of flow tables, hazards, asynchronous sequential circuit design.

Fault Detection and Location: Fault detection and location in combinational circuits, path sensitizing method, equivalent-normal-form (ENF) method and Two-level fault detection

Hardware Description Language: Entity Declaration, Architecture Body, Modeling Styles: Structural, Dataflow, Behavioral and Mixed, Configuration Declaration, Package Declaration, Package Body, Model Analysis, Simulation, Test Bench.

Text Books

1. Fundamental of Logic Design, C. H. Roth Jr., 4th edition, Jaico Publication, 2003
2. Digital Circuit and Logic Design, S.C. Lee, 3rd edition, Prentice Hall of India Pvt. Ltd, 2002
3. A VHDL Primer, J. Bhasker, 3rd edition, Prentice Hall, Englewood Cliffs, New Jersey, 1998

Reference Books

1. Modern Digital Electronics, R. P. Jain, 4th edition, TMH Publication, 2009
2. Digital Electronic Circuits and Systems, N.M. Morris., 1st edition, Tata McGraw-Hill,1997
3. Circuit Design with VHDL – V. A. Pedroni, 1st edition, MIT Press, 2004
4. Digital Design, John. F. Wakerly, 4th edition, Pearson Publication, 2008

ETU702 DIGITAL COMMUNICATION

Teaching Scheme: 03L+ 00T Total: 03 Credits: 03
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
ESE Duration: 2 Hrs. 30 Min.

Pulse Modulation Techniques: Sampling theory, uniform and non-uniform quantization in pulse code modulation (PCM), μ-law and A-law PCM, differential PCM, delta modulation and adaptive delta modulation (DM/ADM), bandwidth requirement of pulse amplitude modulation (PAM), pulse position modulation (PPM), pulse width modulation (PWM), pulse code modulation (PCM), time division multiplexing (TDM), frequency division multiplexing (FDM) and code division multiple access (CDMA).
Digital Communication System: Introduction, elements of digital communication system, source encoder, decoder, channel encoder, decoder, modulator and demodulator, importance of digital system.
Information Theory and Channel Capacity: Measure of information, entropy and information rate of independent and dependent sequences, source encoding, Shannon's encoding algorithm, Huffman encoding algorithm, discrete communication channel and its capacity, Shannon's theorem on channel capacity.
Baseband Transmission: Discrete PAM signals, power spectra of discrete PAM signals, baseband binary data transmission system, inter symbol interference, Nyquist's criteria for distortionless baseband binary transmission, correlative coding, duobinary signaling, modified duobinary technique, equalization, eye diagram, self synchronization for baseband PAM system, scrambler and unscrambler.
Digital Modulation Techniques: Digital carrier modulation schemes: binary amplitude shift keying (ASK), phase shift keying (PSK), frequency shift keying (FSK), coherent scheme, probability of errors, comparison of digital modulation systems, basics of differential phase shift keying (DPSK) and quadrature phase shift keying (QPSK), M-ary shift keying (MSK) and synchronization: carrier synchronization, symbol synchronization.
Error Control Coding: Introduction, methods, types, linear block codes and its matrix description, error detection and correction capabilities of linear block code, cyclic code.
Spread Spectrum Techniques: Introduction, pseudo noise (PN) sequences, direct sequence spread spectrum signals, processing gain, probability of error, frequency hop spread spectrum signals.

Text Books

1. Digital and Analog Communication Systems, K. S. Shanmugam, 2^{nd} edition, John Wiley and Sons, 1996
2. Digital Communication, S. Haykin, 4^{th} edition, John Wiley and Sons, reprint 2009

Reference Books

1. Digital Communication, J. K. Proakis, 5^{nd} edition, Mc-Graw Hill Book Co., New York, 2008
2. Principles of Communication Systems, H. Taub, D. L. Schilling, G. Saha, 3^{rd} edition, Mc-Graw Hill Publication Co. Ltd., 2008
3. Digital Communications fundamentals and Applications, B. Sklar, P. K. Ray, 2^{nd} edition, Pearson Education, 2009

ETU703 Elective I
(A) FIBER OPTIC COMMUNICATION

Teaching Scheme: 03L+ 00T   Total: 03   Credits: 03
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE   Total Marks: 100
ESE Duration: 2 Hrs. 30 Min.

Introduction to Fiber Optic: Basic optic principles, Snell's law, different manufacturing and splicing techniques, and connectors.
Optical Fiber Properties: Theory of circular wave guide, modes of optical fibers, numerical aperture (NA), power flow, attenuation, losses: absorption, bending, scattering, dispersion: intra modal, intermodal, nonlinear effects, introduction to Soliton propagation.
Optical Sources and Detectors: Optical emission from semiconductors, light emitting diode (LED), double heterojunction LED, power efficiency, basic concept of LASERS, semiconductor injection LASERS, optical detection principle, absorption, quantum efficiency, responsivity, positive intrinsic negative (PIN) photodiode, detector noise characteristics, avalanche photodiode(APD) and noise in photodiode, mid-infrared and far-infrared photodiodes, phototransistors, metal semiconductor metal (MSM) photo-detectors.
Principles of Fiber Optic Communication: Analog and digital transmission, digital coding, electrical and optical bandwidth, dispersion effects, bandwidth and data rate, dynamic range, noise and bit error rate.
Optical Transmitters, Receivers, Fiber Optics Test and Measurement: Optical transmitter, receiver, digital system planning consideration, power penalty, optical link design, power budgeting coherent and non coherent system, modulation and demodulation scheme, multiplexing and demultiplexing, optical switches, measure fiber output power, use of optical time domain reflectometer (OTDR).
Optical Amplifiers and Networks: Semiconductor optical amplifiers, fiber and wave guide amplifiers, wavelength conversion, wavelength conversion, optical switches, photonic switching, optical– synchronous optical network/ synchronous digital hierarchy (SONET/SDH), fiber channel, local area network (LAN) standard, optical interfaces.

Text Books
1. Optical Fiber Communication and Application, J.M. Senior, 3rd edition, PHI, 2009
2. Optical Fiber Communication, G. Keiser, 4th edition, TMH, 2008

Reference Books
1. Optical Communication System, J. Gowar, 3rd edition, PHI, 2000
2. Fiber optic communication technology, D. F. Mynbacv and L. Scheiner, 6th Impression, Pearson Education, 2001
3. Fiber Optics Communication, H. Kolimbiris, 2nd edition, Pearson Education, 2004
4. Fiber-Optic Communications Systems, G. P. Agrawal, 3rd, John Wiley and Sons, 2002

ETU703 Elective I
(B) EMBEDDED SYSTEM

Teaching Scheme: 03L+ 00T   Total: 03   Credits: 03
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE   Total Marks: 100
ESE Duration: 2 Hrs. 30 Min.

Introduction to Embedded Systems: Design challenge - optimizing design metrics, Processor technology, IC technology, Design Technolgy, Tradeoffs- Design productivity gap.
Embedded System Architecture: Complex instruction set computer (CISC) and reduced instruction set (RISC) architectures, basic embedded microcontroller architecture, CISC examples: Motorola (68HC11) examp8051, RISC example ARM, DSP processors Harvard architecture, PIC, memory system architecture, I/0 sub-system, co-processors and hardware accelerators, processor performance enhancement, pipelining, super-scalar execution, CPU power consumption.
Designing Embedded Computing Platform : Bus protocols, organization, memory and I/O devices: characteristics and its interfacing; timers and counters, watchdog timers, interrupt controllers, DMA controllers, A/D and D/A converters, displays, keyboards, infrared devices interfacing; communication protocols: General purpose interface bus (GPIB), FireWire, universal serial bus (USB), inter-integrated circuit connect (I^2C), internet protocol (IP).
Embedded Control Applications: Open-loop and closed loop control systems, software coding of a PID controller, fuzzy logic controller; applications: washing machine, automotive systems, digital camera, and air-conditioner.
Embedded System Development: Design methodologies, architectural design, hardware-software partitioning and integration, design examples, fault-tolerance and reliability evaluation techniques.

Text Books

1. Embedded Systems Architecture, Programming and Design, R. Kamal, 3rd reprint, Tata Mc- Hill, 2009.
2. An Embedded Software Primer, D. E. Simon, 8th Indian Reprint, Pearson Education, 2009.

Reference Books

1. Embedded Systems Design, S. Heath, 2nd edition, Newnes Pub. , 2003.
2. Embedded Systems Design – A unified Hardware /Software Introduction, F. Vahid ,T. Givargis, 3rd edition, John Wiley and Sons, 2009.

ETU703 Elective I
(C) SYSTEM SOFTWARE

Teaching Scheme: 03 L+00T **Total-03** **Credits: 03**
Evaluation Scheme: 15 CT1 + 15 CT2 +10 TA+ 60 ESE **Total Marks: 100**
ESE Duration: 2 Hrs. 30 Min.

Evolution of Components of Programming System: Introduction**,** assemblers, loaders, compilers, macros, pseudo codes, machine language, assembly language and higher level languages, evolution of operating system, functions of batch control language, facilities, machine structure.
Design of Assemblers: One-pass, two-pass algorithms, symbol table construction and processing, searching and sorting, microinstructions, features of macro facility, implementation of single and two pass algorithms, macro calls within macros.
Linker and Loader: Concept of static and dynamic relocation, external symbol, design of linker.
Compilers: General model of a compiler, various phases of compiler.
Run Time System: Storage organization, activation tree, activation record, parameter passing symbol table, dynamic storage allocation.
Features of High Level Language: Functional modularity, asynchronous operation and multitasking.

Text Books

1. System programming, J. J. Donovan, 1st edition, Tata McGraw Hill, 2001
2. Introduction to Systems Software, D. M. Dhamdhere, 2nd edition, Tata Mc-Graw Hill, 2009

Reference Books

1. Compilers: Principles, Techniques, and Tools, A.V. Aho, R. Sethi, J. D. Ulman, M. Lam, 2nd edition, Addison Wesley Publication,2007

ETU703 Elective I
(D) ARTIFICIAL INTELLIGENCE

Teaching Scheme : 03L + 00T Total: 03 Credits : 03
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
ESE Duration: 2 Hrs. 30 Min.

Introduction to Artificial Intelligence: Intelligent agents and its classes, problem solving by searching, search methods: informed and uninformed, knowledge representation: syntax, semantics and terminologies, reasoning.
Neural Networks: Biological neurons and artificial neurons, characteristics, artificial neural network (ANN) terminology, model of a neuron, topologies and activation functions used in ANNs.
Mathematical Foundations and Learning: Types of learning: supervised, unsupervised, re-inforcement, basic learning laws, learning methods, multilayered perceptron, back propagation networks, counter propagation networks, Hop field model, Kohonen`s feature maps, Radial basis function, K-means clustering algorithm.
Application of Neural Network: Pattern recognition, hand written and printed characters recognition networks, associative memories, neural network control application.
Neurofuzzy Modeling: Background of fuzzy sets and logic, Basics: fuzzification, fuzzy rules, defuzzification and inference, adaptive inference system, control system design, cognitive modeling, and applications.

Text Books
1. Neural Networks: A comprehensive foundation, S. Hykin, 2nd edition, Pearson Education Asia, 2002
2. Neural Network Fundamentals, N. K. Bose, P. Lling, 1st edition, Tata McGraw Hill,1998

Reference Books
1. Neural Networks: A classroom approach, S. Kumar, 2nd edition, McGraw Hill, 20012
2. Introduction to Artificial Neural Systems, J. M. Zurada,1st edition, Jaico Books, 1999
3. Fuzzy Logic with Engineering Applications, T. J. Ross, 3rd edition, wiley india, 2011
4. Fuzzy Engineering, B. Kasko, 1st edition, PHI, 1996

ETU703 Elective I
(E) BIOMEDICAL ENGINEERING

Teaching Scheme : 03L + 00T Total: 03 Credits : 03
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
ESE Duration: 2 Hrs. 30 Min.

Anatomy and Physiology: Elementary ideas of cell structure, action potential, propagation, heart and circulatory system, central nervous system, muscle-skeletal system, respiratory system, and reproductive system.
Biomedical Signals and Equipment: Bioelectric signals (electro cardio gram (ECG), EMG, EOG and ERG) and their characteristics, electrodes: types, interface issues, diagnostic, therapeutic and clinical laboratory equipment, electric safety: micro and macro shocks, grounding.
Transducers for Biomedical Application: Resistive transducers - muscle force and stress (strain gauge), spirometry (potentiont), humidity (gamstrers), respiration (thermistor)**,** inductive transducers: flow measurements, muscle movement (LVDT), capacitive transducers: heart sound measurement, pulse pickup, photoelectric transducers: pulse transducers, blood pressure, oxygen analyses, piezoelectric transducers: pulse pickup, ultrasonic blood flow meter, chemical transducer-Ag-alfalfa (electrodes, pH electrode).
Signal Recording and Patient Monitoring System: Physiological pre-amplifier and specialized amplifiers, electrode systems and machines: ECG, EMG, and EEG; measurements: heart rate, pulse rate, respiration rate, blood pressure, computerized aided ECG analysis, computerized catheterization, audiometer and audiometric tests, microprocessor applications in patient monitoring, artificial respirator, defibrillators and pacemakers.
Scanning Techniques: Basic X-ray components and circuits, types of X-ray machines e.g. general purpose, dental image intensifier system, table shooting and maintenance of X- ray machine, gross current, micro current shock, safety standards (rays) and considerations, safety, testing instruments, biological effects of X-rays and precautions, operation and function of all the controls of dental X-ray machine, computerized axial tomography (CAT), ultrasonic and MRI Techniques: Fetus monitoring and other, introduction to T-rays.

Text Books

1. Biomedical instrumentation and measurements, L. Cromwell, F. J. Weibell, E. A. Pfeiffer 2^{nd} edition, PHI Learning, 2011
2. Biomedical Instrumentation and Measurement, J. J. Carr, J. M. Brown, 3^{rd} edition, Pearson Education, 1996

Reference Books

1. Hand book of Medical instruments R.S. Khandpur, 6^{th} edition, TMH, 2004
2. Principles of Applied Biomedical Instrumentation, Goddes and Baker, 4^{th} edition, John Wiley, 1986.
3. Biomedical Instruments, D. S. Chaudhari, 1999
4. Medical Instrumentation, John. G. Webster, 2nd edition, John Wiley, 2006.
5. Principles of Medical Electronics and Biomedical Instrumentation, C. Raja Rao, S. K. Guha,1st edition, Universities Press, 2001

ETU704 Elective II

(A) ELECTRONICS INSTRUMENTS AND APPLICATIONS

Teaching Scheme: 03L + 0 0 T Total: 03 Credits: 03
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
ESE Duration: 2 Hrs. 30 Min.

Digital Time Measurement Technique: Vernier technique for small time interval measurement, Measurement of periodic time, Measurement of phase, capacitance, quality factor, time constant and decibel.
Digital Frequency Measurement Techniques: Measurement of ratio, product and difference between two frequencies, high frequency measurement, peak frequency measurement, fast low frequency measurement, time reciprocating circuit.
Signal Analyzers: Spectrum analyzer, network analyzer, wave analyzer, distortion analyzer, logic analyzer, protocol analyzer.
Automated Measurement System: Need and requirement of automatic test equipment (ATE), computer based and computer controlled ATE switches, ATE for printed circuit board (PCB), component testing, IEEE-488 electronic instrument bus standard, field bus application, and instrumentation in a hazardous area.
Data acquisition system: Introduction to smart sensors, digital sensors, case studies of real time PC based instrumentation systems, virtual instruments, intelligent instruments and role of software.
Computer control: Hierarchy of computer control for industry, direct digital control, distributed computer control: system architecture and implementation concepts, buses and communication networks of distributed computer control system (DCCS) , supervisory control data acquisition(SCADA) system.

Text Books

1. Electronic Instruments Handbook, 3rd edition, McGraw Hill, 1997.
2. Applied Electronic Instrumentation and Measurement McLachlan and Buchla, 1st edition, Prentice Hall International, 1992.

Reference Books

1. Digital Measurement Techniques, T.S. Rathore, 3rd edition, Narosa Publishers, New Delhi, 2004.
2. Handbook of Bio-medical Instrumentation, R.S. Khandpur, 2nd edition, TMH, 2003.

ETU704 Elective II
(B) INDUSTRIAL ELECTRONICS

Teaching Scheme: 03L + 0 0 T Total: 03 Credits: 03
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
ESE Duration: 2 Hrs. 30 Min.

Solid State Devices: Metal oxide semiconductor field effect transistor (MOSFETs), insulated gate bipolar transistor (IGBT), gate turn off (GTO), integrated gate commutated thyristor (IGCT), etc., power modules, intelligent power modules, gating circuits, thermal design, protection,
Converters and Control: Phase controlled converters, four quadrant operation, choppers, AC to DC converters.
Electric Drives: Introduction, classification, requirements and applications of electric drives; DC Motor Drives**:** Speed-torque characteristics of DC shunt, permanent magnet direct current (PMDC), series motors and induction motor, speed and position control methods.
Inverters: Voltage source, current source; pulse width modulation (PWM) techniques: sinusoidal, selected harmonic elimination, hysteresis current controllers, space vector.
AC Motor Drives: d-q model of induction motor, constant flux speed control structure, vector control model, vector control structure.
Industrial Applications: Rolling mill, paper mill, textile mill drives.

Text books

1. Modern Power Electronics and AC Drives, B. K. Bose, Prentice Hall India, 1st edition, 2005
2. Thyristor Control of Electric Drives, V. Subramanyam, McGraw Hill Education, India, 1st edition, 1987

Reference books

1. Electric Drives, N. K. De, P. K. Sen, 12th reprint, PHI Learning Pvt. Ltd., 2009
2. Foundation of Electric Drives, G. K. Dubey, 2nd edition, Alpha Science International Ltd., 2002
3. Power Electronics, Converter, Application and Design, N. Mohan, T. M. Undeland and W. P. Robbins, 3rd edition, John Willey and Sons, 2004
4. Power Electronics, circuits, Devices and Applications, M. H. Rashid, Pearson, 2002.
5. Power Electronics and Variable Frequency Drive, B. K. Bose, Standard Publishers Distributors, 2000

ETU703 Elective I
(C) SYSTEM SOFTWARE

Teaching Scheme: 03 L+00T **Total-03** **Credits: 03**
Evaluation Scheme: 15 CT1 + 15 CT2 +10 TA+ 60 ESE **Total Marks: 100**
ESE Duration: 2 Hrs. 30 Min.

Evaluation of Components of Programming System: Introduction**,** assemblers, loaders, macros, compilers, evaluation of operating system, functions of batch control language, facilities, machine structure, machine language and assembly language.
Design of Assemblers: One-pass, two-pass algorithms, symbol table construction and processing, searching and sorting, microinstructions, features of macro facility, implementation of single and two pass algorithms, macro calls within macros.
Linker and Loader: Concept of static and dynamic relocation, external symbol, design of linker, design of object file for different loading schemes.
Compilers: Introduction to compiler, general model of a compiler, various phases of compiler.
Type Checking: Type system, type expressions, structural and name equivalence of types, type conversion, overloaded functions and operators, polymorphic functions.
Run Time System: Storage organization, activation tree, activation record, parameter passing symbol table, dynamic storage allocation.
Features of High Level Language: Functional modularity, asynchronous operation, multitasking.

Text Books

3. System programming, J. J. Donovan, 1st edition, Tata McGraw Hill, 2000
4. Introduction to Systems Software, D. M. Dhamdhere, 1st edition, Tata Mc-Graw Hill, 1996

Reference Books

2. Compilers: Principles, Techniques, and Tools, A.V. Aho, R. Sethi, J. D. Ulman, 1st edition, Addison Wesley Publication,1986

ETU705 DIGITAL SYSTEM DESIGN LAB

Teaching Scheme: 02P Total: 02 Credit: 01
Evaluation Scheme: 25 Internal + 25 External Total Marks: 50
Duration of ESE: 3Hrs

Minimum eight experiments shall be performed to cover entire curriculum of course ETU701. The list given below is just a guideline.

List

1. Design and realize 4-bit binary subtractor using IC
2. Design and realize full adder using 4:1 multiplexers
3. Design and realize 5-bit comparator using IC
4. Design and realize 4-bit even parity checker using EX-OR gates
5. Design and realize a BCD to seven segment decoder based one-digit display
6. Design and realize a 3-bit asynchronous counter with seven segment display
7. Introduction to VHDL coding
8. To implement basic Gates, combinational circuits using VHDL

Note

- **ICA** – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A and B

- **ESE** – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions

ETU706 DIGITAL COMMUNICATION LAB

Teaching Scheme: 02P **Total: 02** **Credit: 01**
Evaluation Scheme: 25 Internal + 25 External **Total Marks: 50**
Duration of ESE: 3Hrs

Minimum eight experiments shall be performed to cover entire curriculum of course ETU702. The list given below is just a guideline.

List

1. Verify sampling theorem
2. Verify different pulse modulation techniques
3. Verify time division multiplexing and de-multiplexing
4. Analyze pulse code modulation (PCM) for uniform and non-uniform quantization
5. Measure signal to noise ratio for pulse code modulation (PCM) system with uniform quantization
6. Compare delta modulation and adaptive delta modulation systems
7. Generate phase shift keying and its spectral analysis
8. Spectral analysis of line codes
9. Detection of digital baseband signal using matched filter in the presence of noise
10. Generation and detection of direct spread spectrum (DS-SS) binary shift keying (BPSK)
11. Simulation of any digital communication system using COMPSIM/MATLAB

Note

- **ICA** – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A and B

- **ESE** – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions

ETU707 ELECTIVE I
(A) FIBER OPTIC COMMUNICATION LAB

Teaching Scheme: 02P **Total: 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
Duration of ESE: 3Hrs

Minimum eight experiments shall be performed to cover entire curriculum of course ETU703 (A). The List given below is just a guideline.

List

1. Verify analog and digital fiber optic link
2. Intensity modulation technique using analog and digital input signal
3. Verify frequency modulation
4. Verify pulse width modulation
5. Verify propagation loss and bending loss in optical fiber
6. Measure optical power at 660 nm and 950 nm
7. Measure propagation loss in optical fiber using power meter
8. Measure numerical aperture of optical fiber
9. Verify characteristic of electrical to optical converter
10. Verify characteristics of fiber optic communication link

Note

- **ICA** – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A and B

- **ESE** – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions

ETU707 ELECTIVE I
(B) EMBEDDED SYSTEM LAB

Teaching Scheme: 02P **Total: 02** **Credits: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
Duration of ESE: 3Hrs

Minimum eight experiments shall be performed to cover entire curriculum of course ETU703 (B). The List given below is just a guideline.

Simulation can be performed using suitable software.

List

1. Interface liquid crystal display (LCD) and keypad to ARM microcontroller
2. Interface on-chip ADC using interrupt and LCD display
3. Multitasking in µCOS-II RTOS using min 4 tasks (LED, LCD, SERIAL, KEYPAD)
4. Semaphore as signaling and Synchronizing on ARM
5. Mailbox implementation for message passing on ARM

Write a program to

6. use of semaphore using µCOS-II RTOS on ARM processor
7. message queue implementation using µCOS-II RTOS on ARM processor
8. mail box implementation using µCOS-II RTOS on ARM processor
9. demonstrate shared data problem using µCOS-II RTOS on ARM processor
10. demonstrate priority inversion problem using µCOS-II RTOS on ARM processor

Note

- **ICA** – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A and B

- **ESE** – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions

ETU707 ELECTIVE I
(C) SYSTEM SOFTWARE LAB

Teaching Scheme: 02 P **Total 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
Duration of ESE: 3Hrs

Minimum eight experiments shall be performed to cover entire curriculum of ETU703 (C). The List given below is just a guideline.

List

Write a program to

1. generate machine op-code table, symbol table and pseudo op-code table during first pass assembler
2. generate machine op- code table using two pass assembler
3. generate macro name table, macro definition table and argument list array during pass one of two pass macro
4. generate expanded source in pass two of two pass macro
5. process binary files of various types: structure and processing.
6. maintain data structures in files (e.g. b-tree, Linux directories), Object and executable files (demonstrated through ELF files), linking and loading, dynamic loading. Issues in program development
7. verify on run time linking
8. generate expanded source using one pass assembler
9. implement ascending and descending sorting

Note

- **ICA** – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A and B

- **ESE** – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions

ETU707 ELECTIVE I
(D) ARTIFICIAL INTELLIGENCE LAB

Teaching Scheme: 02 P **Total 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
Duration of ESE: 3Hrs

Minimum eight experiments shall be performed to cover entire curriculum of ETU703 (D). The List given below is just a guideline.

List

Write a program to

1. generate activation functions used in neural networks
2. illustrate different generalized bell functions
3. illustrate different membership functions
4. realize t-norm operators
5. realize t-conorm operators
6. illustrate various training algorithms
7. create neural network models of different logic gates
8. create neural network models for illustration of different operations like union, intersection and difference

Note

- **ICA** – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A and B

- **ESE** – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions

ETU707 ELECTIVE I
(E) BIOMEDICAL ENGINEERING LAB

Teaching Scheme: 02 P **Total 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
Duration of ESE: 3Hrs

Minimum eight experiments shall be performed to cover entire curriculum of ETU703 (E). The List given below is just a guideline.

List

1. Implement ECG pre-amplifier
2. Implement EEG pre-amplifier
3. Implement EMG pre-amplifier
4. Implement filters for EEG signal
5. Implement low energy charging and discharging circuit (related to defibrillator)
6. Implement pure tone sine wave (audiometer)
7. Verify blood pressure parameters
8. Verify various parameters using ECG machine
9. Verify various parameters using EEG machine

Note

- **ICA** – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A and B

- **ESE** – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions

ETU708 PROJECT PHASE I

Teaching Scheme: 04 P **Total 04** **Credit: 02**
Evaluation Scheme: 50 ICA **Total Marks: 50**

1. In general, a group of 3-6 students should be allowed to complete the project on Approved topic.
2. Preferably more than 25 % projects shall be Industry / Research based / oriented.
3. Exhaustive survey of literature based on a clear definition of the scope and focus of the topic should be carried out by the students.
4. Students should finalize the topic for the project after literature survey in consultation with the Guide.
5. The **Synopsis/Abstract** on the selected topic should be submitted to the Program Head for approval.
6. On approval of the topic, students should initiate the topic based work.
7. Approximately more than 30% work(of the total quantum) should be completed by the end of VII semester.
8. At the end of semester, each batch should submit the progress report in following format:
   Title
   Introduction
   Concept
   Work completed
   Work to be completed
   References
9. For uniform and continuous evaluation, the Evaluation Committee comprising of the Guide, Project Course Coordinator and Expert appointed by the Program Head will award the marks based on the work completed by the end of semester and the presentation based on the project work.

Note:

- **ICA:** The Internal Continuous Assessment shall be based on the active participation of the students in the Project work and knowledge / skill acquired. Oral examination shall be conducted by the panel of examiners.

ETU709 SEMINAR

Teaching Scheme: 02 P **Total 02** **Credit: 02**
Evaluation Scheme: 50 ICA **Total Marks: 50**

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1. Student shall select a topic for seminar which is **not covered in curriculum**.
2. Topics shall be registered within a month after beginning of VII Semester and shall be approved by the concerned guide and Program Head.
3. Students should know the functional and technical details of selected topic after carrying out the conceptual study.
4. Before the end of semester, student shall deliver a seminar and submit the seminar report in following format:

Introduction
Literature Survey
Concept
Functional and Technical Details
Future scope
Applications
Comparison with similar topics / methods
References

5. Student shall deliver a seminar based on submitted report. The presentation and oral examination on selected seminar topic shall be assessed by panel of examiners

Note:

- **ICA:** The Internal Continuous Assessment shall be based on the active participation of the students in the Seminar Topic and the knowledge acquired. The seminar shall be assessed by the examiner panel consisting of Project Guide, Course Coordinator Seminar and Expert appointed by Program Head.

ETU710 INDUSTRIAL TRAINING/VISIT

Teaching Scheme: 00 **Total 00** **Credit: 01**
Evaluation Scheme: 50 ICA **Total Marks: 50**

Industrial Training shall have an option of Industrial Visit.
Industrial Training: List of renowned industries shall be prepared by the Departmental Coordinator of T & P Cell for the course. After approval from the Principal and with the consultation of Industry personnel, 02 weeks trainings shall be arranged during the vacations (after the VI semester). The students may be permitted to undergo the trainings of 02 weeks as per their choices for which all the official formalities will be completed by the students under the guidance of course coordinator. The students shall submit the report based on the Industrial training to the course coordinator which will be evaluated during the VII semester
Industrial Visit: An Industry Visits to minimum three industries shall be arranged for the students unable to complete the Industrial Training. The visit shall be arranged preferably during the vacation period. However in non-availability of permission for the visit during vacation period, same may be arranged during the regular VII semester. The students will be required to submit the report based on the Industrial Visit which will be evaluated by the course coordinator

Note:

- **ICA:** The Internal Continuous Assessment shall be based on the active participation of the students in the training/visits and knowledge / skill acquired. The technical report submitted by the students shall be assessed, by the panel of examiners consisting of Project Guide, Course Coordinator and Expert appointed by the Program Head.

ETU711 INDUSTRIAL LECTURE-II

Teaching Scheme: 01 **Total 01** **Credit: 01**
Evaluation Scheme: 25 ICA **Total Marks: 25**

List of renowned persons from industry shall be prepared by the Departmental Coordinator of T & P Cell for the course. After approval from the Principal, Minimum twelve Industrial lectures shall be arranged, preferably once a week, which shall be delivered by the experts/Officials from Industries/Govt. organizations/ Private Sectors/Public Sectors covering the various aspects.
The assignments based on the Industry Lecture-I and Industry Lecture-II will be evaluated during VII semester
Topics of Industrial Lectures shall be Technical in nature and should not be the specific contents from the curriculum.
Students shall submit the report based on lectures.

Note:

- **ICA:** The Internal Continuous Assessment shall be based on the active participation of the students in the lectures and knowledge acquired. The technical report submitted by the students shall be assessed, by the panel of examiners consisting of Project Guide, Course Coordinator and Expert appointed by the Program Head.

ETU712 Self Study- III

Teaching Scheme: 00 **Total 00** **Credit: 02**
Evaluation Scheme: 25 TA **Total Marks: 25**

ETU712 Self Study - III is based on one class test each, on the basis of 20 % curriculum of the courses ETU701, ETU702 and ETU703(A-E) as applicable, shall be declared by respective course coordinator at the beginning of semester. After CT-II test, a test shall be conducted separately for each course and marks of all such tests shall be converted to out of 25. One faculty member shall be appointed as course coordinator for self study and his/her teaching workload shall be considered one hour/week.

ETU801 COMPUTER NETWORK AND COMMUNICATION

Teaching Scheme: 03L+ 00T Total: 03 Credits: 03
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
ESE Duration: 2 Hrs. 30 Min.

Introduction: Communication network, data communication and its components, data representation and data flow, types of communication: local area network (LAN), metropolitan area network (MAN), wide area network (WAN) and LAN topologies: bus, ring, star; OSI model, various layers in details; circuit switching, packet switching, message switching.

Data Link Control and Protocols: Piggybacking, multiple access protocol: channel allocation, random access methods: ALOHA, slotted ALOHA, carrier sense multiple access (CSMA), CSMA with collision detection (CSMA/CD), controlled access methods: polling, token bus and token ring

TCP/IP Protocols: Overview of transfer control protocol (TCP) / internet protocol (IP), user datagram protocol (UDP), IP addressing and related issues, IP address resolution techniques, IP datagram and forwarding.

Networking Devices and Routing Techniques: Hubs, repeaters, bridges, routers, gateways, switches, routing algorithms: fixed, random, flooding and adaptive.

Applications: Integrated services digital network (ISDN), broadband integrated services digital network (BISDN), synchronous optical network (SONET), synchronous digital hierarchy (SDH), electronic mail, asynchronous transfer mode (ATM) technology.

Text Books

1. Data communication and Networking, B. A. Foruzan, 4th edition, Tata McGraw-Hill, 2006
2. Computer Networks, A. S. Tannenbaum, Pearson Education, 4th edition, 2003

Reference Books

1. Computer Networking: A Topdown Approach Featuring, J. F. Kurose and W. Rouse, 3rd edition, Pearson Education, 2007
2. Computer Networks: A Systems Approach, L. L. Peterson and B. S. Davie, 5th edition, ELSEVIER Publication, 2012
3. Adhoc Wireless Networks – Architecture and Protocols, C.S. Murthy, B. S. Manoj, 1st edition, Pearson Education, 2008
4. Guide to Networking Essentials G. Tomshon, E. Tittel, D. Johnson, 5th edition, Thomson India Learning, 2007
5. Data and Computer Communication, W. Stallings, 8th edition, Pearson Education, 2007

ET802 MICROWAVE ENGINEERING

Teaching Scheme: 03L+00T Total: 03 Credits: 03
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
ESE duration: 2 hrs 30 min.

Microwave Communication: Introduction, microwave spectrum and bands, applications of microwaves.
Waveguides: Rectangular and circular: solutions of wave equations in rectangular coordinates, transverse electric (TE) and transverse magnetic (TM) modes, power transmission and losses, excitations of modes.
Microstrip Lines: Introduction, characteristics impedance, losses, quality factor.
Microwave Linear Beam Tubes: Limitations of conventional tubes at microwave frequencies, microwave tubes – O type and M type classifications, O-type tubes, two cavity klystrons: Velocity modulation process, bunching process, output power and efficiency, multi-cavity klystron amplifier: Beam current density, output current and output power of two cavity klystron, reflex klystrons: Velocity modulation, power output and efficiency, electronic admittance, helix travelling wave tubes: Slow wave structures, amplification process, convection current, axial electric field, wave modes, gain consideration.
Microwave Crossed Field Tubes: Introduction, cross-field effects, magnetrons – different types, eight cavity cylindrical travelling wave magnetron, Hull cut-off conditions, π mode operation; linear magnetron: Hull cut-off conditions, Hartree conditions.
Microwave Active Components: Transferred Electron Devices: Introduction, Gunn effect diodes-GaAs diode, RWH theory, modes of operation, LSA diodes, avalanche transit time devices: introduction, Read diode, IMPATT and TRAPATT diodes, parametric devices, microwave tunnel diodes: principle of operation, microwave characteristics.
Microwave Passive Components: Terminator, attenuator, phase changer, directional coupler, hybrid junction, microwave propagation in ferrites, devices employing Faraday rotation, scattering matrix, formulation for N port junction.
Microwave Resonators and Filters: Basic resonant circuits RLC, transmission line resonators, rectangular and circular cavities and their quality factor (Q), transmission line filter, quarter wave and direct coupled cavity filter.

Text Books

1. Microwave Devices and Circuits, S. Y. Liao, 3rd edition, PHI, 2003
2. Microwave Engineering, D. M. Pozar, 3rd Edition, John Willey and Sons, 2007

Reference Books

1. Microwave Engineering Passive Circuits, P. A. Rizzi, 1st edition, PHI, reprint 2009
2. Foundations for Microwave Engineering, R.E. Collin, 2nd edition, John Wiley, 2007

ET803 ELECTIVE II
(A) WIRELESS COMMUNICATION

Teaching Scheme: 03L+ 00T **Total: 03** **Credits: 03**
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**
ESE duration: 2 hrs 30 min.

Cellular Communications: Introduction, frequency reuse, multiple access technologies, cellular processes - call setup, handover, etc., teletraffic theory, cellular traffic modeling and blocking probability, power control operation of cellular systems, example of cellular calls.
Cellular System Design Fundamentals: Frequency assignments, channel assignment strategies, co-channel and non-co-channel interference, cellular system capacity, performance criteria, trucking and grade of service, improving coverage and capacity in cellular system.
Multiple Access Technique: Frequency division multiple access (FDMA), time division multiple access (TDMA), frequency hop multiple access (FHMA), space division multiple access (SDMA), packet radio, mobile radio propagation and antennas, radio propagation mechanism, path loss modeling and signal coverage, fading in mobile systems, antennas at cell site, mobile antenna, diversity.
Wireless Systems and Standards: Global system for mobile **(**GSM), system architecture, radio subsystem, channel types, frame structure, signal processing in GSM, code division multiple access CDMA (IS-95), frequency and channel specifications, forward and reverse CDMA channel.
Cordless Systems and WLL: Introduction to cordless systems, cordless telephony standard (CT2) and digital enhanced cordless telecommunication (DECT): standards, architecture, frame format and radio link, operation; IEEE802.16, role of wireless local loop (WLL), propagation considerations for WLL, local multipoint distribution services (LMDS) and multichannel multipoint distribution services (MMDS).
Wireless LAN: Overview, technologies; types: infrared, spread-spectrum, narrow band microwave LAN, mobile data networks, cellular digital packet data (CDPD), global packet for radio service (GPRS), wireless application protocol (WAP).

Text Books

1. Mobile Cellular Telecommunications, W. C.Y. Lee, 2nd edition, MGH, 2006
2. Wireless Communications Principles and Practice, T. S. Rappaport, 2nd edition, Pearson Education, 2010

Reference Books

1. Wireless Communications and Networks, W. Stallings, 2nd edition, Pearson Education, 2009
2. Principles of Wireless Networks, K. Pahlavan and P. Krishnamurthy, 1st edition, Pearson Education, 2009
3. Mobile Communications, J. Schiller, 2nd edition, Pearson Education, 2008
4. The Essential Guide to Wireless Communication Applications, A. Dornan, 2nd edition, Prentice Hall Education, 2002

ETU803 ELECTIVE II
(B) VERY LARGE SCALE INTEGRATION DESIGN

Teaching Scheme: 03L+ 00T **Total: 03** **Credits: 03**
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**
ESE duration: 2 hrs 30 min.

Introduction: Metal oxide semiconductor (MOS) transistor switch, complementary metal oxide semiconductor (CMOS) circuits and logic design; realization of universal gates, compound gates, tristates, multiplexers, latches using MOS transistors; VLSI design flow.
Design Flow: Design methodology: top-down, bottom-up, verilog test bench, counter, non-retriggerable monoshot, right shift register, parallel to serial converter; finite state machine model.
MOS Transistor Theory and Modeling: Ideal I-V characteristics, C-V characteristics, MOS capacitance models, non-ideal I-V effects, DC transfer characteristics.
CMOS Processing Technology: CMOS fabrication and layout**,** CMOS inverter, fabrication process, layout design rules, wafer formation, well and channel formation, contacts and metallization, design rules, interconnects, circuit elements, design rule checking (DRC), manufacturing issues.
Circuit Characterization and Performance Estimation: Resistance, capacitance and inductance estimation, delay estimation and models, transistor sizing, static and dynamic power dissipation, low power design, reliability issues.
CMOS Logic Design: Basic physical design of simple logic gates, design of CMOS NAND gate, adder cell, comparator circuit, RS latch, clock divider, shift registers, analog cells using CMOS layout design tool.
VLSI Testing Process: Role, testing: digital and analog, effect of technology trends, chip level, types, functional and structural defects; automatic test equipment (ATE), errors, faults and fault modeling.

Text Books

1. CMOS VLSI Design: A circuits and Systems Perspective, N. Weste, D. Harris, A. Banerjee, 3rd edition, Pearson Education, 2006
2. Basics of CMOS Cell Design, E. Sicard, S. Bendhia, 1st edition, TMH Publications, 2005

Reference Books

1. CMOS Analog Circuit Design, P. E. Allen and R. Douglas, 3rd edition, Holberg Oxford University Press Publication, USA, 2011
2. VLSI Digital Signal Processing Systems Design and Implementation, K. K. Parhi, 1st edition, John Wiley and Sons, 2007
3. Verilog HDL: A Guide to Digital Design and Synthesis, S. Palnitkar, 2nd edition, Prentice Hall, 2003
4. Essentials of Electronic Testing for Digital, Memory and Mixed-Signal Circuits, M. L. Bushnell and V. D. Agrawal, 3rd reprint, Kluwer Academic Publishers Group, 2004

ETU803 Elective II
(C) OPEN SOURCE OPERATING SYSTEM

Teaching scheme: 03 L+ 00T Total: 03 Credits: 03
Marking scheme: 15CT1 + 15CT2 + 100TA + 60 ESE Total Marks: 100
Duration of ESE: 2Hrs.30 Min

Operating System: History, architecture, objectives and functions, interaction, hardware architecture and evolution, batch, multiprogramming, multitasking, multiuser, parallel, distributed and real-time operating system (OS), system calls, OS shell, Linux shell commands, shell programming.

Processes, Scheduling and Deadlocks : Process states, description, control, threads, mutual exclusion and synchronization, principle of concurrency, hardware/software approaches, semaphores, monitors, principle of deadlock, prevention, avoidance, detection, scheduling: types, algorithms, multiprocessor and real time.

Memory Management: Requirements, memory partitioning, memory allocation: contiguous and non-contiguous, virtual memory, paging, page table structure, demand paging, page replacement policies, thrashing and segmentation.

Input Output and Files Management: Overview, input output (I/O) devices, organization of the I/O function, operating system design issues, Linux I/O system, file organization, file directories, file sharing, security, Linux file system.

Text Books

1. Operating System Concepts and Principles, A. Silberschatz and P.B. Galvin, 8th edition, Wiley India, 2009
2. Modern Operating System, A. S. Tanenbaum, 3rd edition, Prentice Hall India, 2009

Reference Books

1. Operating Systems: Internals and design Principles, W. Stallings, 6th edition, Pearson Education, 2009
2. Design of Linux Operating system, M.J. Bach, 1st edition, PHI, 2012

ETU803 ELECTIVE II
(D) FUZZY LOGIC AND NEURAL NETWORKS

Teaching Scheme : 03L + 00T Total: 03 Credits : 03
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
ESE duration : 2 hrs 30 min.

Fuzzy Sets: Introduction, uncertainty, imprecision, partial truth and fuzziness; fuzzy sets: basic concepts, operations, properties; fuzzy relations: basic concepts, operations, properties; value assignment approaches.

Membership functions: Features, fuzzification: membership value assignments, fuzzy rule based systems, graphical technique of inference, defuzzification: lambda-cuts and other defuzzification methods; fuzzy relations.

Introduction of Neurons: Biological neurons and their artificial models, introduction to neural computing, components of artificial neuron, input and output weights, thresholds, weight factors, transfer functions.

Learning Methods: Supervised: single layer network, perceptron, training algorithm and limitations; multilayer network: architecture of feed forward network, learning rule, generalized delta rule, back propagation algorithm; unsupervised: counter propagation networks, Kohonen's self organizing maps, Hopfield networks.

Applications: Fuzzy logic: fuzzy classification, pattern recognition: single sample identification, multi feature recognition, simple fuzzy logic control system design; neural networks: pattern recognition, characters recognition, associative memories, control applications, robot kinematics, anti-lock breaking system (ABS).

Text Books

1. Fuzzy Logic with Engineering Applications, T. Ross, 3rd edition, Wiley, 2011
2. Introduction to Artificial Neural Systems, J. M. Zurada, 1st edition, Jaico Publishing House, 2004

Reference Books

1. Neuro-Fuzzy and Soft Computing, J.S.R. Jang, T. Sun, E. Mizutani, 1st edition, Pearson Education, 2004
2. Neural Networks, Fuzzy Logic, and Genetic Algorithms Synthesis and Applications, S. Rajasekaran, G. A. Vijayalakshmi Pai, 1st edition, PHI, 2009
3. Neural Networks in Computer Intelligence, Limin Fu, 1st edition, Tata McGraw Hill, 2003
4. Neural Networks and Fuzzy systems, B. Kosko, 1st edition, PHI, reprint 2009

ETU803 ELECTIVE II
(E) BIOINFORMATICS

Teaching Scheme : 03L + 00T Total: 03 Credits : 03
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
ESE duration : 2 hrs 30 min.

Introduction to Cell Biology and Genetics: Cell concept, cell cycle, genetic code, structure and properties of deoxyribonucleic acid (DNA) and ribonucleic acid (RNA), DNA replication signal transduction, prokaryotic and eukaryotic genomes, gene structure, genetic code (GC) content, gene density, open reading frames, gene expression, repetitive elements.
Introduction to Bioinformatics: Definition and history, internet and bioinformatics, introduction to data mining, applications of data mining and applications of bioinformatics.
Data Searches, Pairwise Alignments and Substitution Patterns: Dotplots, simple alignments, gaps, scoring matrices, Needleman and Wunsch algorithm, global and local alignments, database searches, pattern of substitution with genes, estimating substitution numbers, variations in evolutionary rates between genes, molecular clocks, organelles.
Distance Based and Character Based Methods of Phylogenetics: Advantages, phylogenetic trees, distance matrix methods, maximum likelihood approaches, multiple sequence alignments, parsimony and strategies for faster searches, tree confidence and molecular phylogenies.

Markov Chains and Applications: Machine learning methods, hidden Markov models (HMM), applications of HMM in gene identification and profiles HMMS, neural networks and support vector machines.
Analysis Tools: Bioinformatics programming tool kit, proteome analysis through Liquid chromatography–mass spectrometry (LC-MS), nuclear magnetic resonance (NMR), microscopic image analysis, x-ray crystallographic analysis, and automated gel analysis, network pathway analysis and metabolomics software, facilities in bioconductor.

Text Books

1. Bioinformatics: Concepts, Skills and Applications, S.C. Rastogi, N. P. Mendiratta, P. Rastogi, 2nd edition, CBS Publishers and Distributors, New Delhi, 2011
2. Introduction to Bioinformatics, A. M. Lesk, 3rd edition, Oxford University Press, 2009

Reference Books

1. Fundamental Concepts in Bioinformatics, D. E. Krane, M. L. Raymer, 1st edition, Pearson Education, 2003
2. Introduction to Bioinformatics, Pearson Education, K Attwood, D. J. parry-Smith, 1st edition, 11th Reprint, 2005
3. Cell and Molecular Biology, G. Karp, 1st edition, John Wiley, 2010
4. Bioinformatics: The Machine Learning Approach, P. Baldi, S. Brunak, 2nd edition, MIT Press, 2001

ETU804 ELECTIVE III
(A) SATELLITE COMMUNICATION SYSTEM

Teaching Scheme: 03L + 00T **Total: 03** **Credits: 03**
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**
Duration of ESE: 2Hrs. 30 Min.

Overview of Satellite Systems: Introduction to frequency bands, types: lower earth orbit (LEO), medium earth orbit (MEO), geosynchronous earth orbit (GEO) and highly elliptical orbit (HEO); communication system, orbits, modulation, transmission and multiplexing, national progress - a brief history.
Orbits and Launching Methods: Kepler's law, orbital aspects of satellite communication, orbital period and velocity; effects of orbital inclination, azimuth and elevation, coverage angle and slant range, orbit determination, orbit perturbations, orbital effects in communication system performance; launching and positioning, satellite drift and station keeping; launch vehicles and propulsion.
Satellite Channel and Links: Radio wave propagation, polarization, depolarization, frequency reuse, antennas, atmospheric losses, effects of rain, receiver noise, carrier to noise ratio; satellite link analysis: general link design equation, system noise temperature, uplink, downlink and complete link design.
Satellite Construction and Transponder: Introduction, attitude and orbit control system; telemetry, tracking and command, power systems, communication and antenna subsystems, equipment reliability and space qualification, the transponder model, satellite front end, RF filtering of digital carriers, satellite signal processing, transponder limiting, nonlinear satellite amplifier.
The Space Segment Access and Utilization: Introduction, space segment access methods, time division multiple access (TDMA), frequency division multiple access (FDMA), code division multiple access (CDMA), space division multiple access (SDMA), assignment methods.
Application of Satellite Communication: Earth station: subsystem, types, design, technology and satellite services, domestic satellite systems using small earth stations, very small aperture terminal (VSAT), global positioning system (GPS), satellite navigation, direct broadcast satellite television and radio, satellite services and the internet, satellite based mobile communication.

Text Books

1. Satellite Communication, D. Roddy, 4th edition, Tata McGraw Hill, 2008
2. Satellite Communication, P. Timothy, B. W. Charles and J. Allnutt, 2nd edition, Willey International Publication, 2006

Reference Books

1. Satellite Communication, R. M. Gagliardi, 1st edition, CBS publications and Distributors, 2004
2. Satellite Communication systems engineering, W. L. Pritchard, H. G. Suyderhoud, R. A. Nelson, 2nd edition, Pearson Education, 2003
3. www.isro.org

ETU804 ELECTIVE III
(B) MODERN ELECTRONIC DESIGN TECHNIQUE

Teaching Scheme: 03L+ 00T Total: 03 Credits: 03
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
ESE Duration: 2 Hrs. 30 min.

Design of Sequential Systems: Asynchronous state machine (ASM) charts, hardware description language and control sequence method, reduction of state tables, state assignments; design of logic circuits using read only memory (ROM), programming logic arrays (PLA), complex programmable logic device (CPLD), field programmable gate array (FPGA).
HDL Modeling of Combinational Circuits: Introduction, levels of abstraction, realization of combinational circuits, behavioral, data flow and structural realization of multiplexers, demultiplexers, adders, magnitude comparator.
Fault Modeling: Fault classes and models: stuck at faults, bridging faults, transition and intermittent faults, test generation: fault diagnosis of combinational circuits by conventional methods – path sensitization technique, Boolean difference method, Kohavi algorithm, fault diagnosis in sequential circuits**:** State identification and fault detection experiment, machine identification, design of fault detection experiment.
Programming Logic Arrays: Design using PLA's, minimization and folding, PLA testing: fault models, test generation and testable PLA design.
Asynchronous Sequential Machine: Fundamental mode model, flow table, state reduction, minimal closed covers, races, cycles and hazards.

Text Books

1. Switching and finite Automata Theory, Z. Kohavi, N. K. Jha, 3rd edition, TMH, 2011
2. Logic Design Theory, N. N. Biswas, 1st edition, PHI, 2010

Reference Books

1. Digital Logic Design Principles, N. Balabanian, B. Calson, 1st edition, Wiley Student edition 2011
2. Digital System Testing and Testable Design, M. Abramovici, M. A. Breuer, A. D. Friedman, IEEE Computer Society Press, 1994
3. Fundamental of Logic Design, C. H. Roth Jr., 4th edition, Jaico Publication, 2003
4. Computer Aided Logic Design, F. J. Hill and G. R. Peterson, John Wiley and Sons, 4th edition, 1993

ETU804 ELECTIVE III
(C) ANTENNA AND RADAR

Teaching Scheme: 03L+00T **Total: 03** **Credits: 03**
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 **ESE Total Marks: 100**
Duration of ESE: 2 Hrs.30 min.

Antenna: Introduction, parameters: radiation patterns, beam area, radiation intensity, beam efficiency, directivity, gain, resolution, antenna aperture, effective height.

Point Sources and arrays: definition, patterns: power, field, phase; arrays of two isotropic sources: Same amplitude and phase, same amplitude and opposite phase; continuous array, array of two driven $\lambda/2$ elements: broad side and end fire.

Microstrip Antennas: Basic characteristics, feeding methods, analysis methods, design of rectangular and circular patch antennas, concept and benefits of smart antennas.

Radar: Basic principles: Fundamentals, radio detection and ranging (RaDAR) performance factors, continuous wave and frequency modulated radar Doppler effect, frequency modulated continuous wave (FMCW) RaDAR, moving target indicator (MTI) and Doppler radar-delay lines canceller and characteristic, blind speed, douplet cancellation; MTI radar with power amplifier and oscillator.

Tracking Techniques: Target detection, scanning, tracking technique-sequential lobing, conical scan monopulse, tracking in range, acquisition; tracking performance, radar receivers, mixer amplifiers, receiver noise, duplexers, displays.

Text books

1. Antennas for All Applications, J. D. Kraus, R. J. Marhefka, A. S. Khan, Tata McGraw Hill, 3rd edition, 2003
2. Introduction to RaDAR Systems, M. I. Skolnik, 3rd edition, 2005

Reference books

1 Antenna Theory and Design W. L. Stutzman, G. A. Thiele, 2nd edition, John Wiley and Sons, 1998
2. Antenna Theory and Design, C. A. Balanis, 3rd edition, John Wiley and Sons, 2005

ETU804 ELECTIVE III
(D) DIGITAL IMAGE PROCESSING

Teaching Scheme : 03L + 00T Total: 03 Credit : 03
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
ESE duration : 2 hrs 30 min.

Introduction: Image fundamentals, components of image processing system, image model, sampling and quantization, basic relationships between pixels, imaging geometry, gray scale image representation.

Image Transforms: Introduction to the Fourier transform, discrete Fourier transform (DFT), properties of two dimensional Fourier transform, fast Fourier transform (FFT), Hadamard, Haar, discrete cosine transform (DCT), Slant transform, image enhancement: point processing, spatial filtering; enhancement in frequency domain, histogram based processing, homomorphic filtering.

Image Restoration: Degradation model, diagonalisation concept, algebraic approach to restoration, inverse filtering, Weiner filtering, restoration in spatial domain, basic morphological concept, morphological principles, binary morphology, basic concepts of erosion and dilation.

Image Compression: Fundamentals, models, elements of information theory, lossy and predictive methods, vector quantization, and lossless compression, Huffman coding, run length encoding (RLE), Limpel-Ziv-Welch (LZW) encoding, image compression standards.

Image Segmentation: Detection of discontinuities, edge linking and boundary detection, thresholding, region based segmentation.

Text Books

1. Digital Image Processing, R. C. Gonzalez and R.E. Woods, 2nd edition, Prentice Hall, 2005
2. Digital Image Processing, A. K. Jain, 2nd edition, PHI, 2004

Reference Books

1. Digital Image Processing, W. K. Pratt, 3rd edition, John Wiley, 2005
2. Digital Image Processing and Computer Vision, R. J. Schalkoff, John Wiley and Son, 1988

ETU804 ELECTIVE III
(E) INDUSTRIAL AUTOMATION

Teaching Scheme : 03L + 00T Total: 03 Credit : 03
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
ESE duration : 2 hrs 30 min.

Programmable Logic Controllers: Introduction**,** architecture, operation; definition of discrete process control, ladder diagrams: elements, programming and features, programming examples of typical processes.
Hierarchical control: Hierarchical control, overall tasks of the system, task listing, lower and higher level computer tasks, centralized control and its features, personal computers in process control, direct digital control, distributed process control.
Supervisory Control and Data Acquisition: Introduction, objectives and features, building blocks for mimic diagrams, data transfers to programmable logic controllers (PLC), selection criteria and applications to process control systems.
DCS Configurations: Functional block diagram of distributed control systems (DCS), supervisory computer displays, software configurations, control technique, communication between components, algorithms, attributes, study of Tata Honeywell's TDC-3000.
Data Highways: Introduction**,** field buses, multiplexers and remote sensing terminal units.
System Integration: PLC and computer (Hybrid control system), input output (I/O) hardware, set point stations, network protocols, manufacturing automation protocol/technical office protocol (MAP/TOP).
Computer Integrating Process, communication hierarchy, international organization for standardization / open system interconnection (ISO/OSI) reference model, MAP/TOP application; study of Yokogawa and Rosemount distributed control systems.

Text Books

1. Process Control Instrument Engineers Handbook, B. G. Liptak, 3rd edition, Butterworth Heinemann Company, 1999
2. Introduction to Programmable Logic Controllers, G. Dunning, 2nd edition, Thomson Delmar Learning, 2002

Reference Books

1. Process Control Instrumentation Technology, C. D. Johnson, 7th edition, Pearson Education, New Delhi, 2003
2. Instrument Engineers Handbook, Process Measurement And Analysis**,** B. G. Liptak, 3rd edition, Elsevier India, 2012
3. Programmable Controllers: Principles and Applications, J. W. Webb, Mergy publishing co. 1988
4. Computer Based Industrial Control, Krishankant, 7th edition, PHI, 2005

ETU805 COMPUTER NETWORK AND COMMUNICATION LAB

Teaching Scheme: 02P **Total: 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
ESE Duration: 3 Hours

Minimum eight experiments shall be performed to cover entire curriculum of course ETU801. The list given below is just a guideline.

List

1. Build a local area network (LAN) using any one topology
2. Build wireless LAN and troubleshoot the connectivity and file sharing
3. Socket programming for client/server application
4. Set up a dial up connection (wired phones and mobile) for internet access
5. Set up a broad band connection using wired / wireless fidelity (Wi-Fi) modem
6. Build LAN and configure TCP/IP protocol suite
7. Build LAN using sub netted IP address
8. Build LAN using classless inter domain routine (CIDR) and CIDR IP addresses
9. Install dynamic host configuration protocol (DHCP) server in an active directory domain of windows operating system (configure DHCP service and troubleshooting)
10. Write a program for frame sorting technique used in buffer
11. Write a program for implementation of Shortest Path algorithm

Note

- **ICA** – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A and B

- **ESE** – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions

ETU806 MICROWAVE ENGINEERING LABORATORY

Teaching Scheme: 02P **Total: 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
ESE Duration: 3 Hours

Minimum eight experiments shall be performed to cover entire curriculum of course ETU802. The list given below is just a guideline.

List

1. Verify the characteristics of the reflex klystron
2. Measure frequency and wavelength for TE10 mode
3. Determine standing wave ratio and reflection coefficient
4. Analyze the working of magic tee
5. Analyze the working of directional coupler
6. Analyze the working of isolator
7. Analyze the working of circulator and attenuator
8. Verify I–V characteristics of Gunn diode
9. Verify characteristics of microstrip ring resonator
10. Verify characteristics of microstrip LPF, HPF, Band Pass and Band Stop Filter

Note

- **ICA** – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A and B

- **ESE** – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions

ETU807 ELECTIVE II
(A) WIRELESS COMMUNICATION LAB

Teaching Scheme: 02P **Total: 02** **Credits: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
ESE Duration: 3Hrs.

Minimum eight experiments shall be performed to cover entire curriculum of course ETU803(A). The list given below is just a guideline.

List

1. Analyze concept of cordless system
2. Design the adaptive linear equalizer and its implementation
3. a. Design the multipath code division multiple access (CDMA)
   b. Design the multiuser code division multiple access (CDMA)
4. Analyze global system for mobile communication (GSM)
5. Verify direct signal spread spectrum – DSSS modulation and demodulation
6. Simulate free space propagation – path loss model
7. Simulate link budget equation for satellite communication
8. Simulate carrier to noise ratio in satellite communication
9. Compute wireless path loss in indoor and outdoor the handover system
10. Analyze Bluetooth technology and its parameters

Note

- **ICA** – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A and B

- **ESE** – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions.

ETU807 ELECTIVE II
(B) VERY LARGE SCALE INTEGRATION DESIGN LAB

Teaching Scheme: 02P **Total: 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
ESE Duration: 3 Hours

Minimum eight experiments shall be performed to cover entire curriculum of course ETU803(B). The list given below is just a guideline.

List
Write a HDL code and its test bench for

1. AND, Ex-OR, NOR and NAND gate
2. 4:1 and 8:1 multiplexer
3. Arithmetic and logic unit (ALU)
4. Full adder
5. D-Flip Flow

Use microwind to design and verify

6. 4:1 and 8:1 multiplexer
7. arithmetic and logic unit (ALU)
8. Full adder
9. D-Flip Flop

Note

- **ICA** – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A and B

- **ESE** – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions

ETU807 ELECTIVE II
(C) OPEN SOURCE OPERATING SYSTEM LAB

Teaching Scheme: 02P **Total: 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
ESE Duration: 3 Hours

Minimum eight experiments shall be performed to cover entire curriculum of course ETU803(C). The list given below is just a guideline.

List

Write a program to

1. verify parent process – child process relationship
2. implement the process scheduling algorithms: first come first serve, shortest remaining job first, round robin, preemptive priority scheduling
3. verify variable sharing using semaphore
4. implement producer consumer problem
5. implement Banker's algorithm for a multiple resources
6. simulate Dinning Philosopher's problem
7. simulate all page replacement algorithms
8. implement file management system calls: Creating a file, copying one file to another, linking a file, deleting a file
9. verify inter-process communication
10. simulate bounded buffer problem

Case studies

11. Linux operating system
12. Android operating system

Note

- **ICA** – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A and B

- **ESE** – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions

ETU807 ELECTIVE II
(D) FUZZY LOGIC AND NEURAL NETWORKS LAB

Teaching Scheme: 02P **Total: 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
ESE Duration: 3 Hours

Minimum eight experiments shall be performed to cover entire curriculum of course ETU803(D). The list given below is just a guideline.

List

Write program to

1. generate activation functions used in Neural Networks
2. verify different generalized bell functions
3. verify different membership functions
4. realize t-norm operators
5. realize t-conorm operators
6. verify linguistic variables and their values
7. create neural network models of different logic gates
8. verify different fuzzy operations like AND, OR and NOR
9. verify different operations like union, intersection and difference on fuzzy variables
10. verify lambda cuts of the fuzzy variables

Note

- **ICA** – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A and B

- **ESE** – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions

ETU807 ELECTIVE II
(E) BIOINFORMATICS LAB

Teaching Scheme: 02P **Total: 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
ESE Duration: 3 Hours

Minimum eight experiments shall be performed to cover entire curriculum of course ETU803(E). The list given below is just a guideline.

List

Write a program to

1. calculate and visualizing Sequence Statistics
2. aligning pairs of sequences
3. working with whole genome data
4. comparing whole genomes
5. assessing the significance of an alignment
6. using scoring matrices to measure evolutionary distance
7. using HMMs for profile analysis of a protein family
8. building a phylogenetic tree for the hominidae species
9. investigating the bird flu virus
10. bootstrapping phylogenetic trees

Note

- **ICA** – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A and B

- **ESE** – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions

ETU807 Elective III
(A) SATELLITE COMMUNICATION SYSTEMS LAB

Teaching Scheme: 02P **Total: 02 Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
ESE Duration: 3 Hours

Minimum eight experiments shall be performed to cover entire curriculum of course ETU804(A). The list given below is just a guideline.

List

1. Verify active and passive satellite communication link and study their difference
2. Measure the base-band analog (voice) signal parameters in the satellite link
3. Measure carrier to noise ratio in satellite communication link
4. Measure the digital baseband signal parameters in satellite communication link
5. Establish link to transmit and receive telemetry data
6. Set PC to PC satellite communication link using RS-232 port
7. Measure the propagation delay of signal in satellite communication link
8. Measure the parameters in an analog FM/FDM TV satellite communication link
9. Measure the Signal to Noise ratio in satellite communication link
10. Calculate the figure of merit and FM deviation

Note

- **ICA** – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A and B

- **ESE** – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions

ETU807 Elective III
(B) MODERN ELECTRONIC DESIGN TECHNIQUE LAB

Teaching Scheme: 02P **Total: 02 Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
ESE Duration: 3 Hours

Minimum eight experiments shall be performed to cover entire curriculum of course ETU804(B). The list given below is just a guideline.

List

Write HDL code and its test bench for
1. AND, Ex-OR, NOR and NAND gate
2. 4:1 and 8:1 Mux
3. Arithmetic Logic Unit
4. Full adder
5. D-Flip Flop

Write program to
6. model BJT or FET
7. design Butterworth filter
8. design Bessel filter
9. design IIR and FIR filters
10. design Steepest descent adaptive filter

Note

- **ICA** – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A and B

- **ESE** – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions

ETU807 ELECTIVE III
(C) ANTENNA AND RADAR LAB

Teaching Scheme: 02P **Total: 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
ESE Duration: 3 Hours

Minimum eight experiments shall be performed to cover entire curriculum of course ETU804(C). The list given below is just a guideline.

List

1. Measure gain and directivity of half wave dipole antenna
2. Verify reciprocity theorem using wired antenna
3. Verify the radiation pattern of micro strip omnidirectional antenna
4. Verify the radiation pattern of micro strip directional antenna
5. Verify the effect of conductor thickness on bandwidth of dipole
6. Verify the radiation pattern of endfire and broadside array
7. Analyse RaDAR signal to noise ratio against target detection range for different values of target RaDAR cross section
8. Analyse RaDAR SNR against target detection range for different values of RaDAR peak power

Note

- **ICA** – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A and B

- **ESE** – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions

ETU807 ELECTIVE III
(D) DIGITAL IMAGE PROCESSING LAB

Teaching Scheme: 02P **Total: 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
ESE Duration: 3 Hours

Minimum eight experiments shall be performed to cover entire curriculum of course ETU804(D). The list given below is just a guideline.

List

Write a program for

1. image arithmetic and point processing
2. image enhancement by adjusting contrast and brightness of image
3. linear filtering using convolution and correlation
4. implementation of dilation and erosion
5. image Analysis: a) Edge detection b) Boundary tracing c) Line detection
6. region based processing: specifying a region of interest and filtering region
7. image compression standards
8. implementation of clustering algorithm

Note

- **ICA** – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A and B

- **ESE** – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions

ETU807 ELECTIVE III
(E) INDUSTRIAL AUTOMATION LAB

Teaching Scheme: 02P **Total: 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
ESE Duration: 3 Hours

Minimum eight experiments shall be performed to cover entire curriculum of course ETU804(E). The list given below is just a guideline.

List

1. Develop ladder diagram for controlling motor operation
2. Develop ladder diagram for temperature control system
3. Develop ladder diagram for bottling plant
4. Develop mimic diagram for a particular process using SCADA software
5. Construct PLC program using the bit logic instructions
6. Construct sequencer using bit logic instructions only
7. Process control using PLC counters and timers
8. Process control using jump and subroutine

Note

- **ICA** – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A and B

- **ESE** – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by

ETU808 PROJECT PHASE- II

Teaching Scheme: 06P **Total: 06** **Credit: 06**
Evaluation Scheme: 75 ICA + 100 ESE **Total Marks: 175**

1. Project work decided in VII semester shall be continued.
2. Students should complete implementation of ideas given in synopsis, so that project work should be completed before end of semester.
3. Students shall submit the final project report in proper format as per guidelines given on the college website which shall include the work of both semesters.
4. For uniform and continuous evaluation, evaluation committee for each group shall be formed by Program Head in which guide must be a member. Internal marks should be awarded by committee at the end of semester based on continuous evaluation.
5. Final examination of project shall include demonstration, presentation of complete work and oral examination based on the project work.

Note:
ICA: The Internal Continuous Assessment shall be based on the active participation of the students in the Project work and knowledge / skill acquired. Oral examination shall be conducted on the Project report, by the panel of examiners consisting of Project Guide, Course Coordinator and Expert appointed by Program Head.
ESE: The End Semester Examination for Project shall consist of demonstration if any, presentation and oral examinations based on the project report.

ETU809 SELF STUDY- IV

Teaching Scheme: 00 **Total: 00** **Credit: 02**
Evaluation Scheme: 25 TA **Total Marks: 25**

ETU809 Self Study - III is based on one class test each, on the basis of 20 % curriculum of the courses ETU801, ETU802 and ETU803(A-E), ETU804(A-E) as applicable, shall be declared by respective course coordinator at the beginning of semester. After CT-II test, a test shall be conducted separately for each course and marks of all such tests shall be converted to out of 25. One faculty member shall be appointed as course coordinator for self study and his/her teaching workload shall be considered one hour/week.

GOVT. COLLEGE OF ENGINEERING, AMRAVATI

(An Autonomous Institute of Government of Maharashtra)

B. Tech. (Electronics and Telecommunication)

VII and VIII Semester CURRICULUM

Department of Electronics and Telecommunication

2013-14

GOVERNMENT COLLEGE OF ENGINEERING, AMRAVATI

Department of Electronics and Telecommunication Engineering

Scheme for B. Tech. (Electronics and Telecommunication)

SEM III

Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
						Theory				Practical			
		Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	CT1	CT2	ESE	ICA	ESE	Total	
SHU303	Engineering Mathematics - III	3	--	---	3	10	15	15	60	---	---	100	3
ETU301	Network analysis	3	---	---	3	10	15	15	60	---	---	100	3
ETU302	Components, Devices and Instruments Technology	3	1	---	4	10	15	15	60	---	---	100	4
ETU303	Electronics Devices and Circuits	3	1	---	4	10	15	15	60	---	---	100	4
ETU304	Digital Electronics	3	---	---	3	10	15	15	60	---	---	100	3
SHU305	General Proficiency - II	1	---	2	3	---	---	---	---	25	25	50	2
ETU305	Network Analysis Lab	---	---	2	2	---	---	---	---	25	25	50	1
ETU306	Components, Devices and Instruments Technology Lab	---	---	2	2	---	---	---	---	25	25	50	1
ETU307	Electronics Devices and Circuits Lab	---	---	2	2	---	---	---	---	25	25	50	1
ETU308	Digital Electronics Lab	---	---	2	2	---	---	---	---	25	25	50	1
Total		**16**	**2**	**10**	**28**	**50**	**75**	**75**	**300**	**125**	**125**	**750**	**23**

SEM IV

Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
						Theory				Practical			
		Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	CT1	CT2	ESE	ICA	ESE	Total	
SHU401	Engineering Mathematics - IV	3	--	---	3	10	15	15	60	---	---	100	3
ETU401	Signals and Systems	3	1	---	4	10	15	15	60	---	---	100	4
ETU402	Analog Circuits	3	1	---	4	10	15	15	60	---	---	100	4
ETU403	Microprocessor and its Interfacing	3	---	---	3	10	15	15	60	---	---	100	3
ETU404	Control System Engineering	3	---	---	3	10	15	15	60	---	---	100	3
ETU405	Object Oriented Programming Lab	1	---	2	3	---	---	---	---	50	-	50	2
ETU406	Signals and Systems Lab	---	---	2	2	---	---	---	---	25	25	50	1
ETU407	Analog Circuits Lab	---	---	2	2	---	---	---	---	25	25	50	1
ETU408	Microprocessor and its Interfacing Lab	---	---	2	2	---	---	---	---	25	25	50	1
ETU409	Control System Engineering Lab	---	---	2	2	---	---	---	---	25	25	50	1
Total		**16**	2	**10**	**28**	**50**	**75**	**75**	**300**	**150**	**100**	**750**	**23**

TA :Teacher Assessment CT: Class Tests ESE: End Semester Examination ICA : Internal Continuous Assessment ESE Duration for Th: 2Hrs 30Min

GOVERNMENT COLLEGE OF ENGINEERING, AMRAVATI
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Scheme for B. Tech. (Electronics and Telecommunication)

SEM V

Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
						Theory				Practical			
		Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	CT1	CT2	ESE	ICA	ESE	Total	
ETU501	Linear Integrated Circuits and Applications	3	---	---	3	10	15	15	60	---	---	100	3
ETU502	Analog Communication	3	---	---	3	10	15	15	60	---	---	100	3
ETU503	Power Electronics	3	---	---	3	10	15	15	60	---	---	100	3
ETU504	Microcontroller and Its Applications	3	---	---	3	10	15	15	60	---	---	100	3
ETU505	Humanities and Economics	3	---	---	3	10	15	15	60	---	---	100	3
ETU506	Linear Integrated Circuits and Applications Lab	---	---	2	2	---	---	---	---	25	25	50	1
ETU507	Analog Communication Lab	---	---	2	2	---	---	---	---	25	---	25	1
ETU508	Power Electronics Lab	---	---	2	2	---	---	---	---	25	25	50	1
ETU509	Microcontroller and Its Applications Lab	---	---	2	2	---	---	---	---	25	25	50	1
ETU510	Data Structure Lab	1	---	2	3	---	---	---	---	25	25	50	2
ETU511	Self Study - I	---	---	----	---	25	---	---	---	---	---	25	2
Total		**16**	---	10	**26**	**75**	**75**	**75**	**300**	**125**	**100**	**750**	**23**

ETU511 Self Study- I is based on one class test each on the basis of 20 % curriculum of the courses ETU501 to ETU504 declared by respective course coordinator at the beginning of semester. One faculty member shall be appointed as course coordinator for self study and his/her teaching workload shall be considered one hour/week

SEM VI

Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
						Theory				Practical			
		Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	CT1	CT2	ESE	ICA	ESE	Total	
ETU601	Electromagnetic Fields	3	--	---	3	10	15	15	60	---	---	100	3
ETU602	Audio and Video Engineering	3	---	---	3	10	15	15	60	---	---	100	3
ETU603	Electronic Measurements	3	---	---	3	10	15	15	60	---	---	100	3
ETU604	Digital Signal Processing	3	---	---	3	10	15	15	60	---	---	100	3
ETU605	Industrial Management and Operation Research	3	---	---	3	10	15	15	60	---	---	100	3
ETU606	Audio and Video Engineering Lab	---	---	2	2	---	---	---	---	25	25	50	1
ETU607	Electronic Measurements Lab	---	---	2	2	---	---	---	---	25	---	25	1
ETU608	Digital Signal Processing Lab	---	---	2	2	---	---	---	---	25	25	50	1
ETU609	Circuit Simulation Lab	---	---	2	2					25	25	50	1
ETU610	Mini Project	----	----	2	2	---	----	---	----	25	25	50	2
ETU611	Self Study - II	---	---	----	---	25	---	---	---	---	---	25	2
ETU612	Industrial Lecture - I	1	---	----	1	---	---	---	---	---	---	---	---
Total		**16**	**---**	10	**26**	**75**	**75**	**75**	**300**	**125**	**100**	**750**	**23**

1) ETU611 Self Study- II is based on one class test each on the basis of 20 % curriculum of the courses ETU601 to ETU604 declared by respective course coordinator at the beginning of semester. One faculty member shall be appointed as course coordinator for self study and his/her teaching workload shall be considered one hour/week

2) Assessment of ETU612 Industrial Lecture- I is scheduled in VII semester with ETU711 Industrial Lecture- II

TA :Teacher Assessment CT: Class Tests ESE: End Semester Examination ICA : Internal Continuous Assessment ESE Duration for Th: 2Hrs 30Min

GOVERNMENT COLLEGE OF ENGINEERING, AMRAVTI
Department of Electronics and Telecommunication Engineering
Scheme for B. Tech. (Electronics and Telecommunication)
SEM VII

Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
						Theory				Practical		Total	
		Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	CT1	CT2	ESE	ICA	ESE		
ETU701	Digital System Design	3	---	---	3	10	15	15	60	---	---	100	3
ETU702	Digital Communications	3	---	---	3	10	15	15	60	---	---	100	3
ETU703	Elective - I	3	---	---	3	10	15	15	60	---	---	100	3
ETU704	Interdisciplinary Elective	3	---	---	3	10	15	15	60	---	---	100	3
ETU705	Digital System Design Lab	---	---	2	2	---	---	---	---	25	25	50	1
ETU706	Digital Communications Lab	---	---	2	2	---	---	---	---	25	25	50	1
ETU707	Elective - I Lab	---	---	2	2	---	---	---	---	25	25	50	1
ETU708	Project Phase - I	---	---	4	4	---	---	---	---	50	--	50	2
ETU709	Seminar	---	---	2	2	---	---	---	---	50	--	50	2
ETU710	Industrial Training/ Visit	---	---	---	---	---	---	---	---	50	---	50	1
ETU711	Industrial Lecture - II	1	---	---	1	---	---	---	---	25	---	25	1**
ETU712	Self Study - III	---	---	---	----	25	---	---	---	---	---	25	2
Total		13	---	12	25	65	60	60	240	250	75	750	23

1) ETU712 Self Study - III is based on one class test each on the basis of 20 % curriculum of the courses ETU701 to ETU703 declared by respective course coordinator at the beginning of semester. One faculty member shall be appointed as course coordinator for self study and his/her teaching workload shall be considered one hour/week

2) ** Credit shall be awarded on the basis of combined assessment of ETU612 Industrial Lecture - I and ETU711 Industrial Lecture - II

3) Students of this department shall select any one INTERDISCIPLINARY ELECTIVE offered by other department. INTERDISCIPLINARY ELECTIVE shown below will be offered to students of other department.

SEM VIII

Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
						Theory				Practical			
		Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	CT1	CT2	ESE	ICA	ESE	Total	
ETU801	Computer Networks and Communications	3	---	---	3	10	15	15	60			100	3
ETU802	Microwave Engineering	3	---	---	3	10	15	15	60	---	---	100	3
ETU803	Elective - II	3	---	---	3	10	15	15	60	---	---	100	3
ETU804	Elective - III	3	---	---	3	10	15	15	60	---	---	100	3
ETU805	Computer Networks and Communications Lab	---	---	2	2	---	---	---	---	25	25	50	1
ETU806	Microwave Engineering Lab	---	---	2	2	---	---	---	---	25	25	50	1
ETU807	Elective - II Lab	---	---	2	2	---	---	---	---	25	25	50	1
ETU808	Project Phase- II	---	---	6	6	---	---	---	---	75	100	175	6
ETU809	Self Study - IV	---	---	---	---	25	---	---	---	---	----	25	2
Total		12	---	12	24	65	60	60	240	150	175	750	23

ETU809 Self Study - IV is based on one class test each on the basis of 20 % curriculum of the courses ETU801 to ETU804 declared by respective course coordinator at the beginning of semester. One faculty member shall be appointed as course coordinator for self study and his/her teaching workload shall be considered one hour/week

TA :Teacher Assessment CT: Class Tests ESE: End Semester Examination ICA : Internal Continuous Assessment ESE Duration for Th: 2Hrs 30Min

ETU704 Interdisciplinary Elective

A) Electronic Instruments and Applications
B) Industrial Electronics

ETU703 Elective - I

A) Fiber Optic Communications
B) Embedded Systems
C) System Software
D) Artificial Intelligence
E) Biomedical Engineering

ETU803 Elective - II

A) Wireless Communications
B) Very Large Scale Integration Design
C) Open Source Operating Systems
D) Fuzzy Logic and Neural Networks
E) Bioinformatics

ETU804 Elective - III

A) Satellite Communication Systems
B) Electronic Design Techniques
C) Antenna and Radar
D) Digital Image Processing
E) Industrial Automations

ETU701 DIGITAL SYSTEM DESIGN

Teaching Scheme: 03L+00T Total: 03 Credits: 03
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
ESE duration: 2 hrs 30 min.

Combinational Logic: Recapitulation of digital logic and minimization techniques, combinational logic design, binary parallel adders, look-ahead carry adder, multiplexers, demultiplexer, multiplexer trees, encoders, decoders, comparators, code converters, priority encoders, parity generator/checker.

Programmable Logic Devices: Read only memory (ROM) as programmable logic devices (PLD), Programmable Logic Array (PLA): block diagram, input, output buffers, AND, OR, INVERT and NON-INVERT matrix, programmable array logic (PAL): combinational, registered and configurable PALs, complex programmable logic devices (CPLD): block diagram, programming, packaging, field programmable gate array (FPGA): basic architecture, process technologies.

Synchronous Sequential Circuits: Design of shift registers and counters, analysis of clocked sequential networks, general models of sequential machines, Mealy and Moore machine, equivalence and minimization networks, derivation of state graph and tables, reduction of state assignments.

Asynchronous Sequential Circuits: Analysis of asynchronous sequential circuits, derivation and reduction of primitive flow tables, state assignments and realization of flow tables, hazards, asynchronous sequential circuit design.

Fault Detection and Location: Fault detection and location in combinational circuits, path sensitizing method, equivalent-normal-form (ENF) method, Two-level fault detection, fault detection and location in sequential circuits using circuit test approach.

Text Books

1. Fundamental of Logic Design, C. H. Roth Jr., 4th edition, Jaico Publication, 2003
2. Digital Circuit and Logic Design, S.C. Lee, 3rd edition, Prentice Hall of India Pvt. Ltd, 2002

Reference Books

1. Modern Digital Electronics, R. P. Jain , 4th edition, TMH Publication, 2009
2. Digital Electronic Circuits and Systems, N.M. Morris., 1st edition, McMillan Press, London
3. Fault Tolerant and Fault Testable Hardware Design, P. K. Lala, 1st edition, BS Publications, 2006

ETU702 DIGITAL COMMUNICATIONS

Teaching Scheme: 03L+00T **Total: 03** **Credits: 03**
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**
ESE duration: 2 hrs 30 min.

Pulse Modulation Techniques: Sampling theory, uniform and non-uniform quantization in pulse code modulation (PCM), μ-law and A-law PCM, differential PCM, delta modulation and adaptive delta modulation (DM/ADM), bandwidth requirement of pulse amplitude modulation (PAM), pulse position modulation (PPM), pulse width modulation (PWM), pulse code modulation (PCM), time division multiplexing (TDM), frequency division multiplexing (FDM) and code division multiple access (CDMA).

Digital Communication System: Introduction, elements of digital communication system, source encoder, decoder, channel encoder, decoder, modulator and demodulator, importance of digital system.

Information Theory and Channel Capacity: Measure of information, entropy and information rate of independent and dependent sequences, source encoding, Shannon's encoding algorithm, Huffman encoding algorithm, discrete communication channel and its capacity, Shannon's theorem on channel capacity.

Baseband Transmission: Discrete PAM signals, power spectra of discrete PAM signals, baseband binary data transmission system, inter symbol interference, Nyquist's criteria for distortionless baseband binary transmission, correlative coding, duobinary signaling, modified duobinary technique, equalization, eye diagram, self synchronization for baseband PAM system, scrambler and unscrambler.

Digital Modulation Techniques: Digital carrier modulation schemes: binary amplitude shift keying (ASK), phase shift keying (PSK), frequency shift keying (FSK), coherent scheme, probability of errors, comparison of digital modulation systems, basics of differential phase shift keying (DPSK) and quadrature phase shift keying (QPSK), M-ary shift keying (MSK) and synchronization: carrier synchronization, symbol synchronization.

Error Control Coding: Introduction, methods, types, linear block codes and its matrix description, error detection and correction capabilities of linear block code, cyclic code.

Spread Spectrum Techniques: Introduction, pseudo noise (PN) sequences, direct sequence spread spectrum signals, processing gain, probability of error, frequency hop spread spectrum signals.

Text Books

1. Digital and Analog Communication Systems, K. S. Shanmugam, 2nd edition, John Wiley and Sons, 1996
2. Digital Communication, S. Haykin, 4th edition, John Wiley and Sons, reprint 2009

Reference Books

1. Digital Communication, J. K. Proakis, 5nd edition, Mc-Graw Hill Book Co., New York, 2008
2. Principles of Communication Systems, H. Taub, D. L. Schilling, G. Saha, 3rd edition, Mc-Graw Hill Publication Co. Ltd., 2008
3. Digital Communications Fundamentals and Applications, B. Sklar, 2nd edition, Pearson Education, 2006

ETU703 ELECTIVE-I
(A) FIBER OPTIC COMMUNICATIONS

Teaching Scheme: 03L+00T Total: 03 Credits: 03
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
ESE duration: 2 hrs 30 min.

Introduction to Fiber Optic: Basic optic principles, Snell's law, different manufacturing and splicing techniques, and connectors.

Optical Fiber Properties: Theory of circular wave guide, modes of optical fibers, numerical aperture (NA), power flow, attenuation, losses: absorption, bending, scattering, dispersion: intra modal, intermodal, nonlinear effects, introduction to Soliton propagation.

Optical Sources and Detectors: Optical emission from semiconductors, light emitting diode (LED), double heterojunction LED, power efficiency, basic concept of LASERS, semiconductor injection LASERS, optical detection principle, absorption, quantum efficiency, responsivity, positive intrinsic negative (PIN) photodiode, detector noise characteristics, avalanche photodiode(APD) and noise in photodiode, mid-infrared and far-infrared photodiodes, phototransistors, metal semiconductor metal (MSM) photo-detectors.

Principles of Fiber Optic Communication: Analog and digital transmission, digital coding, electrical and optical bandwidth, dispersion effects, bandwidth and data rate, dynamic range, noise and bit error rate.

Optical Transmitters, Receivers, Fiber Optic Test and Measurement: Optical transmitter, receiver, digital system planning consideration, power penalty, optical link design, power budgeting coherent and non coherent system, modulation and demodulation scheme, multiplexing and demultiplexing, optical switches, measure fiber output power, use of optical time domain reflectometer (OTDR).

Optical Amplifiers and Networks: Semiconductor optical amplifiers, fiber and wave guide amplifiers, wavelength conversion, wavelength conversion, optical switches, photonic switching, optical– synchronous optical network/ synchronous digital hierarchy (SONET/SDH), fiber channel, local area network (LAN) standard, optical interfaces.

Text Books
1. Optical Fiber Communication and Application, J.M. Senior, 3rd edition, PHI, 2009
2. Optical Fiber Communication, G. Keiser, 4th edition, TMH, 2008

Reference Books

1. Optical Communication System, J. Gowar, 3rd edition, PHI, 2000
2. Fiber optic communication technology, D. F. Mynbaev and L. Scheiner, 6th Impression, Pearson Education, 2001
3. Fiber Optics Communication, H. Kolimbiris, 2nd edition, Pearson Education, 2004
4. Fiber-Optic Communications Systems, G. P. Agrawal, 3rd, John Wiley and Sons, 2002

ETU703 ELECTIVE-I
(B) EMBEDDED SYSTEMS

Teaching Scheme: 03L+00T Total: 03 Credits: 03
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
ESE duration: 2 hrs 30 min.

Introduction to Embedded Systems: Design challenge - optimizing design metrics, Processor technology, IC technology, Design technology, Tradeoffs- Design productivity gap.

Embedded System Architecture: Complex instruction set computer (CISC) and reduced instruction set (RISC) architectures, basic embedded microcontroller architecture, CISC examples: Motorola (68HC11) examp8051, RISC example ARM, DSP processors Harvard architecture, PIC, memory system architecture, I/0 sub-system, co-processors and hardware accelerators, processor performance enhancement, pipelining, super-scalar execution, CPU power consumption.

Designing Embedded Computing Platform : Bus protocols, organization, memory and I/O devices: characteristics and its interfacing; timers and counters, watchdog timers, interrupt controllers, DMA controllers, A/D and D/A converters, displays, keyboards, infrared devices interfacing; communication protocols: General purpose interface bus (GPIB), FireWire, universal serial bus (USB), inter-integrated circuit connect (I^2C), internet protocol (IP).

Embedded Control Applications: Open-loop and closed loop control systems, software coding of a PID controller, fuzzy logic controller; applications: washing machine, automotive systems, digital camera, and air-conditioner.

Embedded System Development: Design methodologies, architectural design, hardware-software partitioning and integration, design examples, fault-tolerance and reliability evaluation techniques.

Text Books

1. Embedded Systems Architecture, Programming and Design, R. Kamal, 3rd reprint, Tata McGraw- Hill, 2009.
2. An Embedded Software Primer, D. E. Simon, 8th Indian Reprint, Pearson Education, 2009.

Reference Books

1. Embedded Systems Design, S. Heath, 2nd edition, Newnes Pub. , 2003
2. Embedded Systems Design – A unified Hardware /Software Introduction, F. Vahid, T. Givargis, 3rd edition, John Wiley and Sons, 2009

ETU703 ELECTIVE-I
(C) SYSTEM SOFTWARE

Teaching Scheme: 03L+00T **Total: 03** **Credits: 03**
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**
ESE duration: 2 hrs 30 min.

Evolution of Components of Programming System: Introduction**,** assemblers, loaders, compilers, macros, pseudo codes, machine language, assembly language and higher level languages, evolution of operating system, functions of batch control language, facilities, machine structure.

Design of Assemblers: One-pass, two-pass algorithms, symbol table construction and processing, searching and sorting, microinstructions, features of macro facility, implementation of single and two pass algorithms, macro calls within macros.

Linker and Loader: Concept of static and dynamic relocation, external symbol, design of linker.

Compilers: General model of a compiler, various phases of compiler.

Run Time System: Storage organization, activation tree, activation record, parameter passing symbol table, dynamic storage allocation.

Features of High Level Language: Functional modularity, asynchronous operation and multitasking.

Text Books
1. System programming, J. J. Donovan, 1st edition, Tata McGraw Hill, 2001
2. Introduction to Systems Software, D. M. Dhamdhere, 2nd edition, Tata Mc-Graw Hill, 2009

Reference Books
1. Compilers: Principles, Techniques, and Tools, A.V. Aho, R. Sethi, J. D. Ulman, M. Lam, 2nd edition, Addison Wesley Publication, 2007

ETU703 ELECTIVE-I
(D) ARTIFICIAL INTELLIGENCE

Teaching Scheme: 03L+00T **Total: 03** **Credits: 03**
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**
ESE duration: 2 hrs 30 min.

Introduction to Artificial Intelligence: Intelligent agents and its classes, problem solving by searching, search methods: informed and uninformed, knowledge representation: syntax, semantics and terminologies, reasoning.

Neural Networks: Biological neurons and artificial neurons, characteristics, artificial neural network (ANN) terminology, model of a neuron, topologies and activation functions used in ANNs.

Mathematical Foundations and Learning: Types of learning: supervised, unsupervised, reinforcement, basic learning laws, learning methods, multilayered perceptron, back propagation networks, counter propagation networks, Hop field model, Kohonen`s feature maps, Radial basis function, K-means clustering algorithm.

Application of Neural Network: Pattern recognition, hand written and printed characters recognition networks, associative memories, neural network control application.

Neurofuzzy Modeling: Background of fuzzy sets and logic, Basics: fuzzification, fuzzy rules, defuzzification and inference, adaptive inference system, control system design, cognitive modeling, and applications.

Text Books

1. Neural Networks: A comprehensive foundation, S. Hykin, 2nd edition, Pearson Education Asia, 2002
2. Neural Network Fundamentals, N. K. Bose, P. Lling, 1st edition, Tata McGraw Hill,1998

Reference Books

1. Neural Networks: A classroom approach, S. Kumar, 2nd edition, McGraw Hill, 20012
2. Introduction to Artificial Neural Systems, J. M. Zurada,1st edition, Jaico Books, 1999
3. Fuzzy Logic with Engineering Applications, T. J. Ross, 3rd edition, Wiley India, 2011
4. Fuzzy Engineering, B. Kasko, 1st edition, PHI, 1996

ETU703 ELECTIVE-I
(E) BIOMEDICAL ENGINEERING

Teaching Scheme: 03L+00T Total: 03 Credits: 03
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
ESE duration: 2 hrs 30 min.

Anatomy and Physiology: Elementary ideas of cell structure, action potential, propagation, heart and circulatory system, central nervous system, muscle-skeletal system, respiratory system, and reproductive system.

Biomedical Signals and Equipment: Bioelectric signals electrocardiogram (ECG), electromyogram (EMG), electrooculogram (EOG) and electroretinogram (ERG) and their characteristics, electrodes: types, interface issues, diagnostic, therapeutic and clinical laboratory equipment, electric safety: micro and macro shocks, grounding.

Transducers for Biomedical Application: Resistive transducers - muscle force and stress - strain gauge, spirometry - potentiometer, humidity - gamstrers, respiration - thermistor**,** inductive transducers: flow measurements, muscle movement - LVDT, capacitive transducers: heart sound measurement, pulse pickup, photoelectric transducers: pulse transducers, blood pressure, oxygen analyses, piezoelectric transducers: pulse pickup, ultrasonic blood flow meter, chemical transducer-silver (Ag)-silver chloride (AgCl) electrodes, pH electrode.

Signal Recording and Patient Monitoring System: Physiological pre-amplifier and specialized amplifiers, electrode systems and machines: ECG, EMG, and EEG; measurements: heart rate, pulse rate, respiration rate, blood pressure, computerized aided ECG analysis, computerized catheterization, audiometer and audiometric tests, microprocessor applications in patient monitoring, artificial respirator, defibrillators and pacemakers.

Scanning Techniques: Basic X-ray components and circuits, types of X-ray machines e.g. general purpose, dental image intensifier system, table shooting and maintenance of X- ray machine, gross current, micro current shock, safety standards (rays) and considerations, safety, testing instruments, biological effects of X-rays and precautions, operation and function of all the controls of dental X-ray machine, computerized axial tomography (CAT), ultrasonic and MRI Techniques: Fetus monitoring and other, introduction to T-rays.

Text Books

1. Biomedical instrumentation and measurements, L. Cromwell, F. J. Weibell, E. A. Pfeiffer 2nd edition, PHI Learning, 2011
2. Biomedical Instrumentation and Measurement, J. J. Carr, J. M. Brown, 3rd edition, Pearson Education, 1996

Reference Books

1. Biomedical Instrumentation, R.S. Khandpur, 6th edition, TMH, 2004
2. Principles of Applied Biomedical Instrumentation, Goddes and Baker, 4th edition, John Wiley, 1986
3. Biomedical Instruments, D. S. Chaudhari, 1999
4. Medical Instrumentation, John. G. Webster, 2nd edition, John Wiley, 2006
5. Principles of Medical Electronics and Biomedical Instrumentation, C. S. R. Rao, S. K. Guha,1st edition, Universities Press, 2001

ETU704 INTERDISCIPLINARY ELECTIVE
(A) ELECTRONIC INSTRUMENTS AND APPLICATIONS

Teaching Scheme: 03L+00T **Total: 03** **Credits: 03**
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**
ESE duration: 2 hrs 30 min.

Digital Time Measurement Techniques: Vernier technique for small time interval measurement, Measurement of periodic time, Measurement of phase, capacitance, quality factor, time constant and decibel.

Digital Frequency Measurement Techniques: Measurement of ratio, product and difference between two frequencies, high frequency measurement, peak frequency measurement, fast low frequency measurement, time reciprocating circuit.

Signal Analyzers: Spectrum analyzer, network analyzer, wave analyzer, distortion analyzer, logic analyzer, protocol analyzer.

Automated Measurement System: Need and requirement of automatic test equipment (ATE), computer based and computer controlled ATE switches, ATE for printed circuit board (PCB), component testing, IEEE-488 electronic instrument bus standard, field bus application, and instrumentation in a hazardous area.

Data acquisition system: Introduction to smart sensors, digital sensors, case studies of real time PC based instrumentation systems, virtual instruments, intelligent instruments and role of software.

Computer control: Hierarchy of computer control for industry, direct digital control, distributed computer control: system architecture and implementation concepts, buses and communication networks of distributed computer control system (DCCS), supervisory control data acquisition (SCADA) system.

Text Books

1. Electronic Instruments Handbook, 3rd edition, McGraw Hill, 1997
2. Applied Electronic Instrumentation and Measurement McLachlan and Buchla, 1st edition, Prentice Hall International, 1992

Reference Books

1. Digital Measurement Techniques, T.S. Rathore, 3rd edition, Narosa Publishers, New Delhi, 2004
2. Handbook of Bio-medical Instrumentation, R.S. Khandpur, 2nd edition, TMH, 2003

ETU704 INTERDISCIPLINARY ELECTIVE
(B) INDUSTRIAL ELECTRONICS

Teaching Scheme: 03L+00T **Total: 03** **Credits: 03**
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**
ESE duration: 2 hrs 30 min.

Solid State Devices: Metal oxide semiconductor field effect transistor (MOSFETs), insulated gate bipolar transistor (IGBT), gate turn off thyristor (GTO), integrated gate commutated thyristor (IGCT), etc., power modules, intelligent power modules, gating circuits, thermal design, protection,

Converters and Control: Phase controlled converters, four quadrant operation, choppers, AC to DC converters.

Electric Drives: Introduction, classification, requirements and applications of electric drives

DC Motor Drives: Speed-torque characteristics of DC shunt, permanent magnet direct current (PMDC): series motors, speed and position control methods.

Inverters: Voltage source, current source; pulse width modulation (PWM) techniques: sinusoidal, selected harmonic elimination, hysteresis current controllers, space vector.

AC Motor Drives: Induction motor, speed and position control methods, d-q model, constant flux speed control structure, vector control model, vector control structure; synchronous motor, speed control methods.

Industrial Applications: Rolling mill, paper mill, textile mill drives.

Text books

1. Modern Power Electronics and AC Drives, B. K. Bose, Prentice Hall India, 1st edition, 2002
2. Thyristor Control of Electric Drives, V. Subramanyam, McGraw Hill Education, India, 1st edition, 1987

Reference books

1. Electric Drives, N. K. De, P. K. Sen, 12th reprint, PHI Learning Pvt. Ltd., 2009
2. Fundamentals of Electric Drives, G. K. Dubey, 2nd edition, Alpha Science International Ltd., 2002
3. Power Electronics, Converter, Application and Design, N. Mohan, T. M. Undeland and W. P. Robbins, 3rd edition, John Willey and Sons, 2004
4. Power Electronics, circuits, Devices and Applications, M. H. Rashid, Pearson, 2002.
5. Power Electronics and Variable Frequency Drive, B. K. Bose, Standard Publishers Distributors, 2000

ETU705 DIGITAL SYSTEM DESIGN LAB

Teaching Scheme: 02P **Total: 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
ESE duration: 3 Hrs.

Minimum eight experiments shall be performed to cover entire curriculum of course ETU701. The list given below is just a guideline.

List

1. Design and realize 4-bit binary subtractor using IC
2. Design and realize full adder using 4:1 multiplexers
3. Design and realize 5-bit comparator using IC
4. Design and realize 4-bit even parity checker using EX-OR gates
5. Design and realize a BCD to seven segment decoder based one-digit display
6. Design and realize a 3-bit asynchronous counter with seven segment display
7. Introduction to VHDL coding
8. To implement basic Gates, combinational circuits using VHDL

Note

- **ICA** – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A and B

- **ESE** – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions

ETU706 DIGITAL COMMUNICATIONS LAB

Teaching Scheme: 02P **Total: 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
ESE duration: 3 Hrs.

Minimum eight experiments shall be performed to cover entire curriculum of course ETU702. The list given below is just a guideline.

List

1. Verify sampling theorem
2. Verify different pulse modulation techniques
3. Verify time division multiplexing and de-multiplexing
4. Analyze pulse code modulation (PCM) for uniform and non-uniform quantization
5. Measure signal to noise ratio for pulse code modulation (PCM) system with uniform quantization
6. Compare delta modulation and adaptive delta modulation systems
7. Generate phase shift keying and its spectral analysis
8. Spectral analysis of line codes
9. Detection of digital baseband signal using matched filter in the presence of noise
10. Generation and detection of direct spread spectrum (DS-SS) binary shift keying (BPSK)
11. Simulation of any digital communication system using COMPSIM/MATLAB

Note

- **ICA** – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A and B

- **ESE** – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions

ETU707 ELECTIVE-I Lab
(A) FIBER OPTIC COMMUNICATIONS LAB

Teaching Scheme: 02P **Total: 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
ESE duration: 3 Hrs.

Minimum eight experiments shall be performed to cover entire curriculum of course ETU703 (A). The List given below is just a guideline.

List

1. Verify analog and digital fiber optic link
2. Intensity modulation technique using analog and digital input signal
3. Verify frequency modulation
4. Verify pulse width modulation
5. Verify propagation loss and bending loss in optical fiber
6. Measure optical power at 660 nm and 950 nm
7. Measure propagation loss in optical fiber using power meter
8. Measure numerical aperture of optical fiber
9. Verify characteristic of electrical to optical converter
10. Verify characteristics of fiber optic communication link

Note

- **ICA** – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A and B
- **ESE** – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions

ETU707 ELECTIVE-I Lab
(B) EMBEDDED SYSTEMS LAB

Teaching Scheme: 02P **Total: 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
ESE duration: 3 Hrs.

Minimum eight experiments shall be performed to cover entire curriculum of course ETU703 (B). The List given below is just a guideline.

Simulation can be performed using suitable software.

List

1. Interface liquid crystal display (LCD) and keypad to ARM microcontroller
2. Interface on-chip ADC using interrupt and LCD display
3. Multitasking in µCOS-II RTOS using min 4 tasks (LED, LCD, SERIAL, KEYPAD)
4. Semaphore as signaling and Synchronizing on ARM
5. Mailbox implementation for message passing on ARM

Write a program to

6. use of semaphore using µCOS-II RTOS on ARM processor
7. message queue implementation using µCOS-II RTOS on ARM processor
8. implement mail box using µCOS-II RTOS on ARM processor
9. demonstrate shared data problem using µCOS-II RTOS on ARM processor
10. demonstrate priority inversion problem using µCOS-II RTOS on ARM processor

Note

- **ICA** – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A and B

- **ESE** – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions

ETU707 ELECTIVE-I Lab
(C) SYSTEM SOFTWARE LAB

Teaching Scheme: 02P **Total: 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
ESE duration: 3 Hrs.

Minimum eight experiments shall be performed to cover entire curriculum of ETU703 (C). The List given below is just a guideline.

List

Write a program to

1. generate machine op-code table, symbol table and pseudo op-code table during first pass assembler
2. generate machine op- code table using two pass assembler
3. generate macro name table, macro definition table and argument list array during pass one of two pass macro
4. generate expanded source in pass two of two pass macro
5. process binary files of various types: structure and processing.

6. maintain data structures in files (e.g. b-tree, Linux directories), Object and executable files (demonstrated through ELF files), linking and loading, dynamic loading. Issues in program development
7. verify on run time linking
8. generate expanded source using one pass assembler
9. implement ascending and descending sorting

Note

- **ICA** – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A and B

- **ESE** – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions

ETU707 ELECTIVE-I Lab
(D) ARTIFICIAL INTELLIGENCE LAB

Teaching Scheme: 02P **Total: 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
ESE duration: 3 Hrs.

Minimum eight experiments shall be performed to cover entire curriculum of ETU703 (D). The List given below is just a guideline.

List

Write a program to

1. generate activation functions used in neural networks
2. illustrate different generalized bell functions
3. illustrate different membership functions
4. realize t-norm operators
5. realize t-conorm operators
6. illustrate various training algorithms
7. create neural network models of different logic gates
8. create neural network models for illustration of different operations like union, intersection and difference

Note

- **ICA** – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A and B

- **ESE** – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions

ETU707 ELECTIVE-I Lab
(E) BIOMEDICAL ENGINEERING LAB

Teaching Scheme: 02P **Total: 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
ESE duration: 3 Hrs.

Minimum eight experiments shall be performed to cover entire curriculum of ETU703 (E). The List given below is just a guideline.

List

Implement

1. ECG pre-amplifier
2. EEG pre-amplifier
3. EMG pre-amplifier
4. filters for EEG signal
5. low energy charging and discharging circuit (related to defibrillator)
6. pure tone sine wave (audiometer)

Verify

7. Verify blood pressure parameters
8. Verify various parameters using ECG machine
9. Verify various parameters using EEG machine

Note

- **ICA** – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A and B

- **ESE** – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions

ETU708 PROJECT PHASE I

Teaching Scheme: 04P **Total: 04** **Credits: 02**
Evaluation Scheme: 50 ICA **Total Marks: 50**

1 In general, a group of 3-6 students should be allowed to complete the project on Approved topic.

2 Preferably more than 25 % projects shall be Industry / Research based / oriented.
3 Exhaustive survey of literature based on a clear definition of the scope and focus of the topic should be carried out by the students.
4 Students should finalize the topic for the project after literature survey in consultation with the Guide.
5 The **Synopsis/Abstract** on the selected topic should be submitted to the Program Head for approval.
6 On approval of the topic, students should initiate the topic based work.
7 Approximately more than 30% work(of the total quantum) should be completed by the end of VII semester.
8 At the end of semester, each batch should submit the progress report in following format:
Title
Introduction
Concept
Work completed
Work to be completed
References
9 For uniform and continuous evaluation, the Evaluation Committee comprising of the Guide, Project Course Coordinator and Expert appointed by the Program Head will award the marks based on the work completed by the end of semester and the presentation based on the project work.

Note:
ICA: The Internal Continuous Assessment shall be based on the active participation of the students in the Project work and knowledge / skill acquired. Oral examination shall be conducted by the panel of examiners.

ETU709 SEMINAR

Teaching Scheme: 02P **Total: 02** **Credits: 02**
Evaluation Scheme: 50 ICA **Total Marks: 50**

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1. Student shall select a topic for seminar which is **not covered in curriculum**.
2. Topics shall be registered within a month after beginning of VII Semester and shall be approved by the concerned guide and Program Head.
3. Students should know the functional and technical details of selected topic after carrying out the conceptual study.
4. Before the end of semester, student shall deliver a seminar and submit the seminar report in following format:
Introduction
Literature Survey
Concept
Functional and Technical Details
Future scope
Applications

Comparison with similar topics / methods
References

5. Student shall deliver a seminar based on submitted report. The presentation and oral examination on selected seminar topic shall be assessed by panel of examiners

Note:
ICA: The Internal Continuous Assessment shall be based on the active participation of the students in the Seminar Topic and the knowledge acquired. The seminar shall be assessed by the examiner panel consisting of Project Guide, Course Coordinator Seminar and Expert appointed by Program Head.

ETU710 INDUSTRIAL TRAINING/VISIT

Teaching Scheme: 00	**Total: 00**	**Credit: 01**
Evaluation Scheme: 50 ICA		**Total Marks: 50**

Industrial Training shall have an option of Industrial Visit.

Industrial Training: List of renowned industries shall be prepared by the Departmental Coordinator of T & P Cell for the course. After approval from the Principal and with the consultation of Industry personnel, 02 weeks trainings shall be arranged during the vacations (after the VI semester). The students may be permitted to undergo the trainings of 02 weeks as per their choices for which all the official formalities will be completed by the students under the guidance of course coordinator. The students shall submit the report based on the Industrial training to the course coordinator which will be evaluated during the VII semester

Industrial Visit: An Industry Visits to minimum three industries shall be arranged for the students unable to complete the Industrial Training. The visit shall be arranged preferably during the vacation period. However in non-availability of permission for the visit during vacation period, same may be arranged during the regular VII semester. The students will be required to submit the report based on the Industrial Visit which will be evaluated by the course coordinator

Note:
ICA: The Internal Continuous Assessment shall be based on the active participation of the students in the training/visits and knowledge / skill acquired. The technical report submitted by the students shall be assessed, by the panel of examiners consisting of Project Guide, Course Coordinator and Expert appointed by the Program Head.

ETU711 INDUSTRIAL LECTURE-II

Teaching Scheme: 01	**Total: 01**	**Credit: 01**
Evaluation Scheme: 25 ICA		**Total Marks: 25**

List of renowned persons from industry shall be prepared by the Departmental Coordinator of T & P Cell for the course. After approval from the Principal, Minimum twelve Industrial lectures

shall be arranged, preferably once a week, which shall be delivered by the experts/Officials from Industries/Govt. organizations/ Private Sectors/Public Sectors covering the various aspects.
The assignments based on the Industry Lecture-I and Industry Lecture-II will be evaluated during VII semester

Topics of Industrial Lectures shall be Technical in nature and should not be the specific contents from the curriculum.

Students shall submit the report based on lectures.

Note:
ICA: The Internal Continuous Assessment shall be based on the active participation of the students in the lectures and knowledge acquired. The technical report submitted by the students shall be assessed, by the panel of examiners consisting of Project Guide, Course Coordinator and Expert appointed by the Program Head.

ETU712 Self Study- III

Teaching Scheme: 00 **Total: 00** **Credits: 02**
Evaluation Scheme: 25 TA **Total Marks: 25**

ETU712 Self Study - III is based on one class test each, on the basis of 20 % curriculum of the courses ETU701, ETU702 and ETU703(A-E), ETU704(A-E) as applicable, shall be declared by respective course coordinator at the beginning of semester. After CT-II test, a test shall be conducted separately for each course and marks of all such tests shall be converted to out of 25. One faculty member shall be appointed as course coordinator for self study and his/her teaching workload shall be considered one hour/week.

ETU801 COMPUTER NETWORKS AND COMMUNICATIONS

Teaching Scheme: 03L+00T **Total: 03** **Credits: 03**
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**
ESE duration: 2 hrs 30 min.

Introduction: Communication network, data communication and its components, data representation and data flow, types of communication: local area network (LAN), metropolitan area network (MAN), wide area network (WAN) and LAN topologies: bus, ring, star; OSI model, various layers in details; circuit switching, packet switching, message switching.

Data Link Control and Protocols: Piggybacking, multiple access protocol: channel allocation, random access methods: ALOHA, slotted ALOHA, carrier sense multiple access (CSMA), CSMA with collision detection (CSMA/CD), controlled access methods: polling, token bus and token ring

TCP/IP Protocols: Overview of transfer control protocol (TCP) / internet protocol (IP), user datagram protocol (UDP), IP addressing and related issues, IP address resolution techniques, IP datagram and forwarding.

Networking Devices and Routing Techniques: Hubs, repeaters, bridges, routers, gateways, switches, routing algorithms: fixed, random, flooding and adaptive.

Applications: Integrated services digital network (ISDN), broadband integrated services digital network (BISDN), synchronous optical network (SONET), synchronous digital hierarchy (SDH), electronic mail, asynchronous transfer mode (ATM) technology.

Text Books

1. Data communication and Networking, B. A. Forouzan, 4th edition, Tata McGraw-Hill, 2006
2. Computer Networks, A. S. Tannenbaum, Pearson Education, 4th edition, 2003

Reference Books

1. Computer Networking: A Topdown Approach Featuring, J. F. Kurose and W. Rouse, 3rd edition, Pearson Education, 2007
2. Computer Networks: A Systems Approach, L. L. Peterson and B. S. Davie, 5th edition, ELSEVIER Publication, 2012
3. Adhoc Wireless Networks – Architecture and Protocols, C.S. Murthy, B. S. Manoj, 1st edition, Pearson Education, 2008
4. Guide to Networking Essentials G. Tomshon, E. Tittel, D. Johnson, 5th edition, Thomson India Learning, 2007
5. Data and Computer Communication, W. Stallings, 8th edition, Pearson Education, 2007

ETU802 MICROWAVE ENGINEERING

Teaching Scheme: 03L+00T **Total: 03** **Credits: 03**
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**
ESE duration: 2 hrs 30 min.

Microwave Communication: Introduction, microwave spectrum and bands, applications of microwaves.

Waveguides: Rectangular and circular: solutions of wave equations in rectangular coordinates, transverse electric (TE) and transverse magnetic (TM) modes, power transmission and losses, excitations of modes.

Microstrip Lines: Introduction, characteristics impedance, losses, quality factor.

Microwave Linear Beam Tubes: Limitations of conventional tubes at microwave frequencies, microwave tubes – O type and M type classifications, O-type tubes, two cavity klystrons: Velocity modulation process, bunching process, output power and efficiency, multi-cavity klystron amplifier: Beam current density, output current and output power of two cavity klystron, reflex klystrons: Velocity modulation, power output and efficiency, electronic admittance, helix travelling wave tubes: Slow wave structures, amplification process, convection current, axial electric field, wave modes, gain consideration.

Microwave Crossed Field Tubes: Introduction, cross-field effects, magnetrons – different types, eight cavity cylindrical travelling wave magnetron, Hull cut-off conditions, π mode operation; linear magnetron: Hull cut-off conditions, Hartree conditions.

Microwave Active Components: Transferred Electron Devices: Introduction, Gunn effect diodes- GaAs diode, RWH theory, modes of operation, LSA diodes, avalanche transit time devices: introduction, Read diode, impact ionization avalanche transit time (IMPATT) and trapped plasma avalanche triggered transit time (TRAPATT) diodes, parametric devices, microwave tunnel diodes: principle of operation, microwave characteristics.

Microwave Passive Components: Terminator, attenuator, phase changer, directional coupler, hybrid junction, microwave propagation in ferrites, devices employing Faraday rotation, scattering matrix, formulation for N port junction.

Microwave Resonators and Filters: Basic resonant circuits RLC, transmission line resonators, rectangular and circular cavities and their quality factor (Q), transmission line filter, quarter wave and direct coupled cavity filter.

Text Books

1. Microwave Devices and Circuits, S. Y. Liao, 3rd edition, PHI, 2003
2. Microwave Engineering, D. M. Pozar, 3rd Edition, John Willey and Sons, 2007

Reference Books

1. Microwave Engineering Passive Circuits, P. A. Rizzi, 1st edition, PHI, reprint 2009
2. Foundations for Microwave Engineering, R.E. Collin, 2nd edition, John Wiley, 2007

ETU803 ELECTIVE-II
(A) WIRELESS COMMUNICATIONS

Teaching Scheme: 03L+00T **Total: 03** **Credits: 03**
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**
ESE duration: 2 hrs 30 min.

Cellular Communications: Introduction, frequency reuse, multiple access technologies, cellular processes - call setup, handover, etc., teletraffic theory, cellular traffic modeling and blocking probability, power control operation of cellular systems, example of cellular calls.

Cellular System Design Fundamentals: Frequency assignments, channel assignment strategies, co-channel and non-co-channel interference, cellular system capacity, performance criteria, trucking and grade of service, improving coverage and capacity in cellular system.

Multiple Access Technique: Frequency division multiple access (FDMA), time division multiple access (TDMA), frequency hop multiple access (FHMA), space division multiple access (SDMA), packet radio, mobile radio propagation and antennas, radio propagation mechanism, path loss modeling and signal coverage, fading in mobile systems, antennas at cell site, mobile antenna, diversity.

Wireless Systems and Standards: Global system for mobile **(**GSM), system architecture, radio subsystem, channel types, frame structure, signal processing in GSM, code division multiple access CDMA (IS-95), frequency and channel specifications, forward and reverse CDMA channel.

Cordless Systems and WLL: Introduction to cordless systems, cordless telephony standard (CT2) and digital enhanced cordless telecommunication (DECT): standards, architecture, frame format and radio link, operation; IEEE802.16, role of wireless local loop (WLL), propagation considerations for WLL, local multipoint distribution services (LMDS) and multichannel multipoint distribution services (MMDS).

Wireless LAN: Overview, technologies; types: infrared, spread-spectrum, narrow band microwave LAN, mobile data networks, cellular digital packet data (CDPD), global packet for radio service (GPRS), wireless application protocol (WAP).

Text Books

1. Mobile Cellular Telecommunications, W. C.Y. Lee, 2nd edition, MGH, 2006
2. Wireless Communications Principles and Practice, T. S. Rappaport, 2nd edition, Pearson Education, 2010

Reference Books

1. Wireless Communications and Networks, W. Stallings, 2nd edition, Pearson Education, 2009
2. Principles of Wireless Networks, K. Pahlavan and P. Krishnamurthy, 1st edition, Pearson Education, 2009
3. Mobile Communications, J. Schiller, 2nd edition, Pearson Education, 2008
4. The Essential Guide to Wireless Communication Applications, A. Dornan, 2nd edition, Prentice Hall Education, 2002

ETU803 ELECTIVE-II
(B) VERY LARGE SCALE INTEGRATION DESIGN

Teaching Scheme: 03L+ 00T **Total: 03** **Credits: 03**
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**
ESE duration: 2 hrs 30 min.

Introduction: Metal oxide semiconductor (MOS) transistor switch, complementary metal oxide semiconductor (CMOS) circuits and logic design; realization of universal gates, compound gates, tristates, multiplexers, latches using MOS transistors; VLSI design flow.

Design Flow: Design methodology: top-down, bottom-up, Verilog test bench, counter, non-retriggerable monoshot, right shift register, parallel to serial converter; finite state machine model.

MOS Transistor Theory and Modeling: Ideal I-V characteristics, C-V characteristics, MOS capacitance models, non-ideal I-V effects, DC transfer characteristics.

CMOS Processing Technology: CMOS fabrication and layout**,** CMOS inverter, fabrication process, layout design rules, wafer formation, well and channel formation, contacts and metallization, design rules, interconnects, circuit elements, design rule checking (DRC), manufacturing issues.

Circuit Characterization and Performance Estimation: Resistance, capacitance and inductance estimation, delay estimation and models, transistor sizing, static and dynamic power dissipation, low power design, reliability issues.

CMOS Logic Design: Basic physical design of simple logic gates, design of CMOS NAND gate, adder cell, comparator circuit, RS latch, clock divider, shift registers, analog cells using CMOS layout design tool.

VLSI Testing Process: Role, testing: digital and analog, effect of technology trends, chip level, types, functional and structural defects; automatic test equipment (ATE), errors, faults and fault modeling.

Text Books

1. CMOS VLSI Design: A circuits and Systems Perspective, N. Weste, D. Harris, A. Banerjee, 3rd edition, Pearson Education, 2006
2. Basics of CMOS Cell Design, E. Sicard, S. Bendhia, 1st edition, TMH Publications, 2005

Reference Books

1. CMOS Analog Circuit Design, P. E. Allen and R. Douglas, 3rd edition, Holberg Oxford University Press Publication, USA, 2011
2. VLSI Digital Signal Processing Systems Design and Implementation, K. K. Parhi, 1st edition, John Wiley and Sons, 2007
3. Verilog HDL: A Guide to Digital Design and Synthesis, S. Palnitkar, 2nd edition, Prentice Hall, 2003
4. Essentials of Electronic Testing for Digital, Memory and Mixed-Signal Circuits, M. L. Bushnell and V. D. Agrawal, 3rd reprint, Kluwer Academic Publishers Group, 2004

ETU803 ELECTIVE-II
(C) OPEN SOURCE OPERATING SYSTEMS

Teaching Scheme: 03L+ 00T **Total: 03** **Credits: 03**
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**
ESE duration: 2 hrs 30 min.

Operating System: History, architecture, objectives and functions, interaction, hardware architecture and evolution, batch, multiprogramming, multitasking, multiuser, parallel, distributed and real-time operating system (OS), system calls, OS shell, Linux shell commands, shell programming.

Processes, Scheduling and Deadlocks : Process states, description, control, threads, mutual exclusion and synchronization, principle of concurrency, hardware/software approaches, semaphores, monitors, principle of deadlock, prevention, avoidance, detection, scheduling: types, algorithms, multiprocessor and real time.

Memory Management: Requirements, memory partitioning, memory allocation: contiguous and non-contiguous, virtual memory, paging, page table structure, demand paging, page replacement policies, thrashing and segmentation.

Input Output and Files Management: Overview, input output (I/O) devices, organization of the I/O function, operating system design issues, Linux I/O system, file organization, file directories, file sharing, security, Linux file system.

Text Books

1. Operating System Concepts and Principles, A. Silberschatz and P.B. Galvin, 8th edition, Wiley India, 2009
2. Modern Operating System, A. S. Tanenbaum, 3rd edition, Prentice Hall India, 2009

Reference Books

1. Operating Systems: Internals and design Principles, W. Stallings, 6th edition, Pearson Education, 2009
2. Design of Linux Operating system, M.J. Bach, 1st edition, PHI, 2012

ETU803 ELECTIVE-II
(D) FUZZY LOGIC AND NEURAL NETWORKS

Teaching Scheme: 03L+ 00T **Total: 03** **Credits: 03**
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**
ESE duration: 2 hrs 30 min.

Fuzzy Sets: Introduction, uncertainty, imprecision, partial truth and fuzziness; fuzzy sets: basic concepts, operations, properties; fuzzy relations: basic concepts, operations, properties; value assignment approaches.

Membership functions: Features, fuzzification: membership value assignments, fuzzy rule based systems, graphical technique of inference, defuzzification: lambda-cuts and other defuzzification methods; fuzzy relations.

Introduction of Neurons: Biological neurons and their artificial models, introduction to neural computing, components of artificial neuron, input and output weights, thresholds, weight factors, transfer functions.

Learning Methods: Supervised: single layer network, perceptron, training algorithm and limitations; multilayer network: architecture of feed forward network, learning rule, generalized delta rule, back propagation algorithm; unsupervised: counter propagation networks, Kohonen's self organizing maps, Hopfield networks.

Applications: Fuzzy logic: fuzzy classification, pattern recognition: single sample identification, multi feature recognition, simple fuzzy logic control system design; neural networks: pattern recognition, characters recognition, associative memories, control applications, robot kinematics, anti-lock breaking system (ABS).

Text Books

1. Fuzzy Logic with Engineering Applications, T. Ross, 3rd edition, Wiley, 2011
2. Introduction to Artificial Neural Systems, J. M. Zurada, 1st edition, Jaico Publishing House, 2004

Reference Books

1. Neuro-Fuzzy and Soft Computing, J.S.R. Jang, T. Sun, E. Mizutani, 1st edition, Pearson Education, 2004
2. Neural Networks, Fuzzy Logic, and Genetic Algorithms Synthesis and Applications, S. Rajasekaran, G. A. Vijayalakshmi Pai, 1st edition, PHI, 2009
3. Neural Networks in Computer Intelligence, Limin Fu, 1st edition, Tata McGraw Hill, 2003
4. Neural Networks and Fuzzy systems, B. Kosko, 1st edition, PHI, reprint 2009

ETU803 ELECTIVE-II
(E) BIOINFORMATICS

Teaching Scheme: 03L+ 00T **Total: 03** **Credits: 03**
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**
ESE duration: 2 hrs 30 min.

Introduction to Cell Biology and Genetics: Cell concept, cell cycle, genetic code, structure and properties of deoxyribonucleic acid (DNA) and ribonucleic acid (RNA), DNA replication signal transduction, prokaryotic and eukaryotic genomes, gene structure, genetic code (GC) content, gene density, open reading frames, gene expression, repetitive elements.

Introduction to Bioinformatics: Definition and history, internet and bioinformatics, introduction to data mining, applications of data mining and applications of bioinformatics.

Data Searches, Pairwise Alignments and Substitution Patterns: Dotplots, simple alignments, gaps, scoring matrices, Needleman and Wunsch algorithm, global and local alignments, database searches, pattern of substitution with genes, estimating substitution numbers, variations in evolutionary rates between genes, molecular clocks, organelles.

Distance Based and Character Based Methods of Phylogenetics: Advantages, phylogenetic trees, distance matrix methods, maximum likelihood approaches, multiple sequence alignments, parsimony and strategies for faster searches, tree confidence and molecular phylogenies.

Markov Chains and Applications: Machine learning methods, hidden Markov models (HMM), applications of HMM in gene identification and profiles HMMS, neural networks and support vector machines.

Analysis Tools: Bioinformatics programming tool kit, proteome analysis through Liquid chromatography–mass spectrometry (LC-MS), nuclear magnetic resonance (NMR), microscopic image analysis, x-ray crystallographic analysis, and automated gel analysis, network pathway analysis and metabolomics software, facilities in bioconductor.

Text Books

1. Bioinformatics: Concepts, Skills and Applications, S.C. Rastogi, N. P. Mendiratta, P. Rastogi, 2nd edition, CBS Publishers and Distributors, New Delhi, 2011
2. Introduction to Bioinformatics, A. M. Lesk, 3rd edition, Oxford University Press, 2009

Reference Books

1. Fundamental Concepts in Bioinformatics, D. E. Krane, M. L. Raymer, 1st edition, Pearson Education, 2003
2. Introduction to Bioinformatics, Pearson Education, K Attwood, D. J. parry-Smith, 1st edition, 11th Reprint, 2005
3. Cell and Molecular Biology, G. Karp, 1st edition, John Wiley, 2010
4. Bioinformatics: The Machine Learning Approach, P. Baldi, S. Brunak, 2nd edition, MIT Press, 2001

ETU804 ELECTIVE-III
(A) SATELLITE COMMUNICATION SYSTEM

Teaching Scheme: 03L + 00T **Total: 03** **Credits: 03**
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**
ESE duration: 2Hrs. 30 Min.

Overview of Satellite Systems: Introduction to frequency bands, types: lower earth orbit (LEO), medium earth orbit (MEO), geosynchronous earth orbit (GEO) and highly elliptical orbit (HEO); communication system, orbits, modulation, transmission and multiplexing, national progress - a brief history.

Orbits and Launching Methods: Kepler's law, orbital aspects of satellite communication, orbital period and velocity; effects of orbital inclination, azimuth and elevation, coverage angle and slant range, orbit determination, orbit perturbations, orbital effects in communication system performance; launching and positioning, satellite drift and station keeping; launch vehicles and propulsion.

Satellite Channel and Links: Radio wave propagation, polarization, depolarization, frequency reuse, antennas, atmospheric losses, effects of rain, receiver noise, carrier to noise ratio; satellite link analysis: general link design equation, system noise temperature, uplink, downlink and complete link design.

Satellite Construction and Transponder: Introduction, attitude and orbit control system; telemetry, tracking and command, power systems, communication and antenna subsystems, equipment reliability and space qualification, the transponder model, satellite front end, RF filtering of digital carriers, satellite signal processing, transponder limiting, nonlinear satellite amplifier.

The Space Segment Access and Utilization: Introduction, space segment access methods, time division multiple access (TDMA), frequency division multiple access (FDMA), code division multiple access (CDMA), space division multiple access (SDMA), assignment methods.

Application of Satellite Communication: Earth station: subsystem, types, design, technology and satellite services, domestic satellite systems using small earth stations, very small aperture terminal (VSAT), global positioning system (GPS), satellite navigation, direct broadcast satellite television and radio, satellite services and the internet, satellite based mobile communication.

Text Books

1. Satellite Communication, D. Roddy, 4th edition, Tata McGraw Hill, 2008
2. Satellite Communication, P. Timothy, B. W. Charles and J. Allnutt, 2nd edition, Willey International Publication, 2006

Reference Books

1. Satellite Communication, R. M. Gagliardi, 1st edition, CBS publications and Distributors, 2004
2. Satellite Communication systems engineering, W. L. Pritchard, H. G. Suyderhoud, R. A. Nelson, 2nd edition, Pearson Education, 2003
3. www.isro.org

ETU804 ELECTIVE-III
(B) ELECTRONIC DESIGN TECHNIQUES

Teaching Scheme: 03L+ 00T **Total: 03** **Credits: 03**
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**
ESE duration: 2 hrs 30 min.

Design of Sequential Systems: Asynchronous state machine (ASM) charts, hardware description language and control sequence method, reduction of state tables, state assignments; design of logic circuits using read only memory (ROM), programming logic arrays (PLA), complex programmable logic device (CPLD), field programmable gate array (FPGA).

HDL Modeling of Combinational Circuits: Introduction, levels of abstraction, realization of combinational circuits, behavioral, data flow and structural realization of multiplexers, demultiplexers, adders, magnitude comparator.

Fault Modeling: Fault classes and models: stuck at faults, bridging faults, transition and intermittent faults, test generation: fault diagnosis of combinational circuits by conventional methods – path sensitization technique, Boolean difference method, Kohavi algorithm, fault diagnosis in sequential circuits**:** State identification and fault detection experiment, machine identification, design of fault detection experiment.

Programming Logic Arrays: Design using PLA's, minimization and folding, PLA testing: fault models, test generation and testable PLA design.

Asynchronous Sequential Machine: Fundamental mode model, flow table, state reduction, minimal closed covers, races, cycles and hazards.

Text Books

1. Switching and finite Automata Theory, Z. Kohavi, N. K. Jha, 3rd edition, TMH, 2011
2. Logic Design Theory, N. N. Biswas, 1st edition, PHI, 2010

Reference Books

1. Digital Logic Design Principles, N. Balabanian, B. Calson, 1st edition, Wiley Student edition 2011
2. Digital System Testing and Testable Design, M. Abramovici, M. A. Breuer, A. D. Friedman, IEEE Computer Society Press, 1994
3. Fundamental of Logic Design, C. H. Roth Jr., 4th edition, Jaico Publication, 2003
4. Computer Aided Logic Design, F. J. Hill and G. R. Peterson, John Wiley and Sons, 4th edition, 1993

ETU804 ELECTIVE-III
(C) ANTENNA AND RADAR

Teaching Scheme: 03L+ 00T **Total: 03** **Credits: 03**
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**
ESE duration: 2 hrs 30 min.

Antenna: Introduction, parameters: radiation patterns, beam area, radiation intensity, beam efficiency, directivity, gain, resolution, antenna aperture, effective height.

Point Sources and arrays: definition, patterns: power, field, phase; arrays of two isotropic sources: Same amplitude and phase, same amplitude and opposite phase; continuous array, array of two driven $\lambda/2$ elements: broad side and end fire.

Microstrip Antennas: Basic characteristics, feeding methods, analysis methods, design of rectangular and circular patch antennas, concept and benefits of smart antennas.

Radar: Basic principles: Fundamentals, radio detection and ranging (RaDAR) performance factors, continuous wave and frequency modulated radar Doppler effect, frequency modulated continuous wave (FMCW) RaDAR, moving target indicator (MTI) and Doppler radar-delay lines canceller and characteristic, blind speed, douplet cancellation; MTI radar with power amplifier and oscillator.

Tracking Techniques: Target detection, scanning, tracking technique-sequential lobing, conical scan monopulse, tracking in range, acquisition; tracking performance, radar receivers, mixer amplifiers, receiver noise, duplexers, displays.

Text books

1. Antennas for All Applications, J. D. Kraus, R. J. Marhefka, A. S. Khan, Tata McGraw Hill, 3rd edition, 2003
2. Introduction to RaDAR Systems, M. I. Skolnik, 3rd edition, 2005

Reference books

1 Antenna Theory and Design W. L. Stutzman, G. A. Thiele, 2nd edition, John Wiley and Sons, 1998
2. Antenna Theory and Design, C. A. Balanis, 3rd edition, John Wiley and Sons, 2005

ETU804 ELECTIVE-III
(D) DIGITAL IMAGE PROCESSING

Teaching Scheme: 03L+ 00T **Total: 03** **Credits: 03**
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**
ESE duration: 2 hrs 30 min.

Introduction: Image fundamentals, components of image processing system, image model, sampling and quantization, basic relationships between pixels, imaging geometry, gray scale image representation.

Image Transforms: Introduction to the Fourier transform, discrete Fourier transform (DFT), properties of two dimensional Fourier transform, fast Fourier transform (FFT), Hadamard, Haar, discrete cosine transform (DCT), Slant transform, image enhancement: point processing, spatial filtering; enhancement in frequency domain, histogram based processing, homomorphic filtering.

Image Restoration: Degradation model, diagonalisation concept, algebraic approach to restoration, inverse filtering, Weiner filtering, restoration in spatial domain, basic morphological concept, morphological principles, binary morphology, basic concepts of erosion and dilation.

Image Compression: Fundamentals, models, elements of information theory, lossy and predictive methods, vector quantization, and lossless compression, Huffman coding, run length encoding (RLE), Limpel-Ziv-Welch (LZW) encoding, image compression standards.

Image Segmentation: Detection of discontinuities, edge linking and boundary detection, thresholding, region based segmentation.

Text Books

1. Digital Image Processing, R. C. Gonzalez and R.E. Woods, 2nd edition, Prentice Hall, 2005
2. Digital Image Processing, A. K. Jain, 2nd edition, PHI, 2004

Reference Books

1. Digital Image Processing, W. K. Pratt, 3rd edition, John Wiley, 2005
2. Digital Image Processing and Computer Vision, R. J. Schalkoff, John Wiley and Son, 1988

ETU804 ELECTIVE-III
(E) INDUSTRIAL AUTOMATIONS

Teaching Scheme: 03L+ 00T **Total: 03** **Credits: 03**
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**
ESE duration: 2 hrs 30 min.

Programmable Logic Controllers: Introduction**,** architecture, operation; definition of discrete process control, ladder diagrams: elements, programming and features, programming examples of typical processes.

Hierarchical control: Hierarchical control, overall tasks of the system, task listing, lower and higher level computer tasks, centralized control and its features, personal computers in process control, direct digital control, distributed process control.

Supervisory Control and Data Acquisition: Introduction, objectives and features, building blocks for mimic diagrams, data transfers to programmable logic controllers (PLC), selection criteria and applications to process control systems.

DCS Configurations: Functional block diagram of distributed control systems (DCS), supervisory computer displays, software configurations, control technique, communication between components, algorithms, attributes, study of Tata Honeywell's TDC-3000.

Data Highways: Introduction**,** field buses, multiplexers and remote sensing terminal units.

System Integration: PLC and computer (Hybrid control system), input output (I/O) hardware, set point stations, network protocols, manufacturing automation protocol/technical office protocol (MAP/TOP).

Computer Integrating Process: Communication hierarchy, international organization for standardization / open system interconnection (ISO/OSI) reference model, MAP/TOP application; study of Yokogawa and Rosemount distributed control systems.

Text Books

1. Process Control Instrument Engineers Handbook, B. G. Liptak, 3rd edition, Butterworth Heinemann Company, 1999
2. Introduction to Programmable Logic Controllers, G. Dunning, 2nd edition, Thomson Delmar Learning, 2002

Reference Books

1. Process Control Instrumentation Technology, C. D. Johnson, 7th edition, Pearson Education, New Delhi, 2003
2. Instrument Engineers Handbook, Process Measurement And Analysis**,** B. G. Liptak, 3rd edition, Elsevier India, 2012
3. Programmable Controllers: Principles and Applications, J. W. Webb, Mergy publishing co. 1988
4. Computer Based Industrial Control, Krishankant, 7th edition, PHI, 2005

ETU805 COMPUTER NETWORKS AND COMMUNICATIONS LAB

Teaching Scheme: 02P **Total: 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
ESE Duration: 3Hrs.

Minimum eight experiments shall be performed to cover entire curriculum of course ETU801. The list given below is just a guideline.

List

1. Build a local area network (LAN) using any one topology
2. Build wireless LAN and troubleshoot the connectivity and file sharing
3. Socket programming for client/server application
4. Set up a dial up connection (wired phones and mobile) for internet access
5. Set up a broad band connection using wired / wireless fidelity (Wi-Fi) modem
6. Build LAN and configure TCP/IP protocol suite
7. Build LAN using sub netted IP address
8. Build LAN using classless inter domain routine (CIDR) and CIDR IP addresses
9. Install dynamic host configuration protocol (DHCP) server in an active directory domain of windows operating system (configure DHCP service and troubleshooting)
10. Write a program for frame sorting technique used in buffer
11. Write a program for implementation of Shortest Path algorithm

Note

- **ICA** – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A and B

- **ESE** – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions

ETU806 MICROWAVE ENGINEERING LAB

Teaching Scheme: 02P **Total: 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
ESE Duration: 3Hrs.

Minimum eight experiments shall be performed to cover entire curriculum of course ETU802. The list given below is just a guideline.

List

1. Verify the characteristics of the reflex klystron
2. Measure frequency and wavelength for TE10 mode
3. Determine standing wave ratio and reflection coefficient
4. Analyze the working of magic tee
5. Analyze the working of directional coupler
6. Analyze the working of isolator
7. Analyze the working of circulator and attenuator
8. Verify I–V characteristics of Gunn diode
9. Verify characteristics of microstrip ring resonator
10. Verify characteristics of microstrip LPF, HPF, Band Pass and Band Stop Filter

Note

- **ICA** – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A and B

- **ESE** – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions

ETU807 ELECTIVE-II Lab
(A) WIRELESS COMMUNICATIONS LAB

Teaching Scheme: 02P **Total: 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
ESE Duration: 3Hrs.

Minimum eight experiments shall be performed to cover entire curriculum of course ETU803(A). The list given below is just a guideline.

List

1. Analyze concept of cordless system
2. Design the adaptive linear equalizer and its implementation
3. a. Design the multipath code division multiple access (CDMA)
   b. Design the multiuser code division multiple access (CDMA)
4. Analyze global system for mobile communication (GSM)
5. Verify direct signal spread spectrum – DSSS modulation and demodulation
6. Simulate free space propagation – path loss model
7. Simulate link budget equation for satellite communication
8. Simulate carrier to noise ratio in satellite communication
9. Compute wireless path loss in indoor and outdoor the handover system
10. Analyze Bluetooth technology and its parameters

Note

- **ICA** – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A and B

- **ESE** – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions.

ETU807 ELECTIVE-II Lab
(B) VERY LARGE SCALE INTEGRATION DESIGN LAB

Teaching Scheme: 02P **Total: 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
ESE Duration: 3Hrs.

Minimum eight experiments shall be performed to cover entire curriculum of course ETU803(B). The list given below is just a guideline.

List

Write a HDL code and its test bench for

1. AND, Ex-OR, NOR and NAND gate
2. 4:1 and 8:1 multiplexer
3. arithmetic and logic unit (ALU)

4. Full adder
5. D-Flip Flow

Use Microwind to design and verify

6. 4:1 and 8:1 multiplexer
7. arithmetic and logic unit (ALU)
8. Full adder
9. D-Flip Flop

Note

- **ICA** – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A and B

- **ESE** – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions

ETU807 ELECTIVE-II Lab
(C) OPEN SOURCE OPERATING SYSTEMS LAB

Teaching Scheme: 02P **Total: 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
ESE Duration: 3Hrs.

Minimum eight experiments shall be performed to cover entire curriculum of course ETU803(C). The list given below is just a guideline.

List

Write a program to

1. verify parent process – child process relationship
2. implement the process scheduling algorithms: first come first serve, shortest remaining job first, round robin, preemptive priority scheduling
3. verify variable sharing using semaphore
4. implement producer consumer problem
5. implement Banker's algorithm for a multiple resources
6. simulate Dinning Philosopher's problem
7. simulate all page replacement algorithms
8. implement file management system calls: Creating a file, copying one file to another, linking a file, deleting a file
9. verify inter-process communication

10. simulate bounded buffer problem

Case studies

11. Linux operating system
12. Android operating system

Note

- **ICA** – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A and B

- **ESE** – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions

ETU807 ELECTIVE-II Lab
(D) FUZZY LOGIC AND NEURAL NETWORKS LAB

Teaching Scheme: 02P **Total: 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
ESE Duration: 3Hrs.

Minimum eight experiments shall be performed to cover entire curriculum of course ETU803(D). The list given below is just a guideline.

List

Write program to

1. generate activation functions used in Neural Networks
2. verify different generalized bell functions
3. verify different membership functions
4. realize t-norm operators
5. realize t-conorm operators
6. verify linguistic variables and their values
7. create neural network models of different logic gates
8. verify different fuzzy operations like AND, OR and NOR
9. verify different operations like union, intersection and difference on fuzzy variables
10. verify lambda cuts of the fuzzy variables

Note

- **ICA** – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A and B

- **ESE** – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions

ETU807 ELECTIVE-II Lab
(E) BIOINFORMATICS LAB

Teaching Scheme: 02P **Total: 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
ESE Duration: 3Hrs.

Minimum eight experiments shall be performed to cover entire curriculum of course ETU803(E). The list given below is just a guideline.

List

Write a program to

1. calculate and visualizing Sequence Statistics
2. aligning pairs of sequences
3. working with whole genome data
4. comparing whole genomes
5. assessing the significance of an alignment
6. using scoring matrices to measure evolutionary distance
7. using HMMs for profile analysis of a protein family
8. building a phylogenetic tree for the hominidae species
9. investigating the bird flu virus
10. bootstrapping phylogenetic trees

Note

- **ICA** – The Internal Continues Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A and B

- **ESE** – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions

ETU808 PROJECT PHASE- II

Teaching Scheme: 06P **Total: 06** **Credits: 06**
Evaluation Scheme: 75 ICA + 100 ESE **Total Marks: 175**

1. Project work decided in VII semester shall be continued.
2. Students should complete implementation of ideas given in synopsis, so that project work should be completed before end of semester.
3. Students shall submit the final project report in proper format as per guidelines given on the college website which shall include the work of both semesters.
4. For uniform and continuous evaluation, evaluation committee for each group shall be formed by Program Head in which guide must be a member. Internal marks should be awarded by committee at the end of semester based on continuous evaluation.
5. Final examination of project shall include demonstration, presentation of complete work and oral examination based on the project work.

Note:
ICA: The Internal Continuous Assessment shall be based on the active participation of the students in the Project work and knowledge / skill acquired. Oral examination shall be conducted on the Project report, by the panel of examiners consisting of Project Guide, Course Coordinator and Expert appointed by Program Head.

ESE: The End Semester Examination for Project shall consist of demonstration if any, presentation and oral examinations based on the project report.

ETU809 SELF STUDY- IV

Teaching Scheme: 00 **Total: 00** **Credits: 02**
Evaluation Scheme: 25 TA **Total Marks: 25**

ETU809 Self Study - III is based on one class test each, on the basis of 20 % curriculum of the courses ETU801, ETU802 and ETU803(A-E), ETU804(A-E) as applicable, shall be declared by respective course coordinator at the beginning of semester. After CT-II test, a test shall be conducted separately for each course and marks of all such tests shall be converted to out of 25. One faculty member shall be appointed as course coordinator for self study and his/her teaching workload shall be considered one hour/week.

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SEM III

		Teaching Scheme				Evaluation Scheme							
						Theory				Practical			
Course Code	Name of the Course	Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	CT1	CT2	ESE	ICA	ESE	Total	Credits
SHU303	**Engineering Mathematics - III**	**3**	**--**	**---**	**3**	**10**	**15**	**15**	**60**	**---**	**---**	**100**	**3**
ETU301	Network analysis	3	---	---	3	10	15	15	60	---	---	100	3
ETU302	Components ,Devices and Instruments Technology	3	1	---	4	10	15	15	60	---	---	100	4
ETU303	Electronics Devices and Circuits	3	1	---	4	10	15	15	60	---	---	100	4
ETU304	Digital Electronics	3	---	---	3	10	15	15	60	---	---	100	3
SHU305	General Proficiency - II	1	---	2	3	---	---	---	---	25	25	50	2
ETU305	Network analysis Lab	---	---	2	2	---	---	---	---	50	---	50	1
ETU306	Components ,Devices and InstrumentsTechnology Lab	---	---	2	2	---	---	---	---	25	25	50	1
ETU307	Electronics Devices and Circuits Lab	---	---	2	2	---	---	---	---	25	25	50	1
ETU308	Digital Electronics Lab	---	---	2	2	---	---	---	---	25	25	50	1
Total		**16**	**2**	**10**	**28**	**50**	**75**	**75**	**300**	**150**	**100**	**750**	**23**

SEM IV

		Teaching Scheme				Evaluation Scheme							
						Theory				Practical			
Course Code	Name of the Course	Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	CT1	CT2	ESE	ICA	ESE	Total	Credits
SHU401	Engineering Mathematics - IV	3	--	---	3	10	15	15	60	---	---	100	3
ETU401	Signals and Systems	3	1	---	4	10	15	15	60	---	---	100	4
ETU402	Analog Circuits	3	1	---	4	10	15	15	60	---	---	100	4
ETU403	Microprocessor and its Interfacing	3	---	---	3	10	15	15	60	---	---	100	3
ETU404	Control System Engineering	3	---	---	3	10	15	15	60	---	---	100	3
ETU405	Object Oriented Programming Lab	1	---	2	3	---	---	---	---	50	-	50	2
ETU406	Signals and Systems Lab	---	---	2	2	---	---	---	---	25	25	50	1
ETU407	Analog Circuits Lab	---	---	2	2	---	---	---	---	25	25	50	1
ETU408	Microprocessor and its Interfacing Lab	---	---	2	2	---	---	---	---	25	25	50	1

ETU409	Control System Engineering Lab	---	---	2	2	---	---	---	---	25	25	50	1
Total		**16**	2	**10**	**28**	**50**	**75**	**75**	**300**	**150**	**100**	**750**	**23**

TA :Teacher Assessment CT: Class Tests ESE: End Semester Examination ICA : Internal Contineous Assessment ESE Duration for Th: 2Hrs 30Min

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SEM V

		Teaching Scheme				Evaluation Scheme							
						Theory				Practical			
Course Code	**Name of the Course**	**Theory Hrs /week**	**Tutorial Hrs/week**	**Practical Hrs/week**	**Total**	**TA**	**CT1**	**CT2**	**ESE**	**ICA**	**ESE**	**Total**	**Credits**
ETU501	Linear Integrated Circuits &Applications	3	---	---	3	10	15	15	60	---	---	100	3
ETU502	Analog Communication	3	---	---	3	10	15	15	60	---	---	100	3
ETU503	Power Electronics	3	---	---	3	10	15	15	60	---	---	100	3
ETU504	Microcontroller and Its Applications	3	---	---	3	10	15	15	60	---	---	100	3
ETU505	Humanities and Economics	3	---	---	3	10	15	15	60	---	---	100	3
ETU506	Linear Integrated Circuits &Applications Lab	---	---	2	2	---	---	---	---	25	25	50	1
ETU507	Analog CommunicationLab	---	---	2	2	---	---	---	---	25	---	25	1
ETU508	Power Electronics Lab	---	---	2	2	---	---	---	---	25	25	50	1
ETU509	Microcontroller and Its Applications Lab	---	---	2	2	---	---	---	---	25	25	50	1
ETU510	Data Sructure Lab	1	---	2	3	---	---	---	---	25	25	50	2
ETU511	Self Study - I	---	---	----	---	---	---	---	---	25	---	25	2
Total		**16**	---	10	**26**	**50**	**75**	**75**	**300**	**150**	**100**	**750**	**23**

ETU511 Self Study- I is based on one class test each on the basis of 20 % curriculum of the courses ETU501 to ETU504 declared by respective course coordinator at the beginning of semester.One faculty member shall be appointed as course coordinator for self study and his/her teaching workload shall be considered one hour/week

SEM VI

		Teaching Scheme				Evaluation Scheme							
						Theory				Practical			
Course Code	**Name of the Course**	**Theory Hrs /week**	**Tutorial Hrs/week**	**Practical Hrs/week**	**Total**	**TA**	**CT1**	**CT2**	**ESE**	**ICA**	**ESE**	**Total**	**Credits**
ETU601	Electromagnetic Fields	3	--	---	3	10	15	15	60	---	---	100	3

ETU602	Audio & Video Engineering	3	---	---	3	10	15	15	60	---	---	100	3
ETU603	Electronics Measurement	3	---	---	3	10	15	15	60	---	---	100	3
ETU604	Digital Signal Processing	3	---	---	3	10	15	15	60	---	---	100	3
ETU605	Industrial Management and Operation Research	3	---	---	3	10	15	15	60	---	---	100	3
ETU606	Audio & Video Engineering Lab	---	---	2	2	---	---	---	---	25	25	50	1
ETU607	Electronics Measurement Lab	---	---	2	2	---	---	---	---	25	---	25	1
ETU608	Digital Signal Processing Lab	---	---	2	2	---	---	---	---	25	25	50	1
ETU609	Circuit Simulation Lab	---	---	2	2					25	25	50	1
ETU610	Mini Project	----	----	2	2	---	----	---	----	25	25	50	2
ETU611	Self Study - II	---	---	----	---	---	---	---	---	25	---	25	2
ETU612	Industrial Lecture - I	1	---	----	1	---	---	---	---	---	---	---	---
Total		**16**	---	10	**26**	**50**	**75**	**75**	**300**	**150**	**100**	**750**	**23**

1) ETU611 Self Study- II is based on one class test each on the basis of 20 % curriculum of the courses ETU601 to ETU604 declared by respective course coordinator at the beginning of semester . One faculty member shall be appointed as course coordinator for self study and his/her teaching workload shall be considered one hour/week

2) Assessment of ETU612 Industrial Lecture- I is scheduled in VIIth semester with ETU711 Industrial Lecture- II

TA :Teacher Assessment CT: Class Tests ESE: End Semester Examination ICA : Internal Contineous Assessment ESE Duration for Th: 2Hrs 30Min

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SEM VII

Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
						Theory				Practical		Total	
		Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	CT1	CT2	ESE	ICA	ESE		
ETU701	Digital System Design	3	---	---	3	10	15	15	60	---	---	100	3
ETU702	Digital Communication	3	---	---	3	10	15	15	60	---	---	100	3
ETU703	Elective - I	3	---	---	3	10	15	15	60	---	---	100	3
ETU704	Interdisciplinary Elective	3	---	---	3	10	15	15	60	---	---	100	3
ETU705	Digital System Design Lab	---	---	2	2	---	---	---	---	25	25	50	1
ETU706	Digital Communication Lab	---	---	2	2	---	---	---	---	25	25	50	1
ETU707	Elective - I Lab	---	---	2	2	---	---	---	---	25	25	50	1
ETU708	Project Phase - I	---	---	4	4	---	---	---	---	50	--	50	2

ETU709	Seminar	---	---	2	2	---	---	---	---	25	25	50	2
ETU710	Industrial training/ Visit	---	---	---	---	---	---	---	---	50	---	50	1
ETU711	Industrial Lecture - II	1	---	---	1	---	---	---	---	25	---	25	1**
ETU712	Self Study - III	---	---	---	----	---	---	---	---	25	---	25	2
Total		13	---	12	25	40	60	60	240	250	100	750	23

1) ETU712 Self Study - III is based on one class test each on the basis of 20 % curriculum of the courses ETU701 to ETU703 declared by respective course coordinator at the beginning of semester. One faculty member shall be appointed as course coordinator for self study and his/her teaching workload shall be considered one hour/week
2) Credit shall be awarded on the basis of combined assessment of ETU612 Industrial Lecture - I and ETU711 Industrial Lecture - II
3) Students of this department shall select any one Interdisciplinary Elective offered by other department. Interdisciplinary Elective shown below will be offered to students of other department.

SEM VIII

Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
						Theory				Practical		Total	
		Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	CT1	CT2	ESE	ICA	ESE		
ETU801	Computer Network and Communication	3	---	---	3	10	15	15	60			100	3
ETU802	Microwave Engineering.	3	---	---	3	10	15	15	60	---	---	100	3
ETU803	Elective - II	3	---	---	3	10	15	15	60	---	---	100	3
ETU804	Elective - III	3	---	---	3	10	15	15	60	---	---	100	3
ETU805	Computer Network and Comm. Lab	---	---	2	2	---	---	---	---	25	25	50	1
ETU806	Microwave Engineering. Lab	---	---	2	2	---	---	---	---	25	25	50	1
ETU807	Elective - II and Elective - III Lab	---	---	2	2	---	---	---	---	25	25	50	1
ETU808	Project	---	---	6	6	---	---	---	---	75	100	175	6
ETU809	Self Study - IV	---	---	---	---	---	---	---	---	25	----	25	2
Total		12	---	12	24	40	60	60	240	175	175	750	23

ETU809 Self Study - IV is based on one class test each on the basis of 20 % curriculum of the courses ETU801 to ETU804 declared by respective course coordinator at the beginning of semester. One faculty member shall be appointed as course coordinator for self study and his/her teaching workload shall be considered one hour/week

TA :Teacher Assessment CT: Class Tests ESE: End Semester Examination ICA : Internal Contineous Assessment ESE Duration for Th: 2Hrs 30Min

ETU704 Interdisciplinary Elective	**ETU703 Elective - I**	**ETU803 Elective - II**	**ETU804 Elective - III**
A.Electronics Instruments and Applications	A.Fibre Optic Communication	A. Wireless Communication	A. Sattelite Communication Systems
B.Industrial Electronics	B.Embedded System	B. VLSI Design	B. Modern Electronic Design Technique
	C.System Software	C. Open Source Operating system	C. Antenna and Radar
	D.Artificial Intelligence	D .Fuzzy Logic and Neural Network	D. Digital Image Processing
	E.Bio Medical Engineering	E. Bio Informatics	E .Industrial Automation

SHU303 ENGINEERING MATHEMATICS-III

Teaching Scheme: 03 L TOTAL 03 Credit : 03
Marking scheme: 15CT1 + 15CT2 + 10TA + 60 ESE Total Marks :100
Duration of ESE : 2Hrs.30min

Linear Differential Equations with constant coefficients:

General solution to L.D.E. of n^{th} order with constant coefficients, rules for finding Complementary function., General method for finding Particular integral, P.I. of some standard functions, Method of Variation of Parameters, Cauchy's and Legendre's L.D.E., simultaneous linear differential equations .

Partial Diff. Equations:

Definition, formation of P.D.E., complete solution of PDE, Linear and non-linear PDE of types (i) f(p, q)= 0, (ii)f(p, q, z)= 0, (iii)f(p, q, x, y)= 0,(iv)f(p, q, x, y, z)= 0 ie Lagrange's form Pp+Qq=R and Clairaut's form z = px + qy + f(p, q), (v)Equations reducible to above forms. Complete solution of PDE of first and second order by method of separation of variables.

Vector Calculus:

Scalar and vector point functions, Differentiation of a vector function, Tangent and normal components of velocity and acceleration, orthogonal curves, Operator delta, Gradient of scalar point function& their physical meaning . Divergence and Curl of vector point function & their physical meaning. vector identities, solenoidal and conservative fields. Line integral, work done by force.

Functions of complex variables:

Analytic function, C-R equations(Cartesian & polar), Harmonic function, Milne Thompson method for finding analytic function, Conformal mappings, Bilinear transformation.

Text Books :

1. Text book of applied Mathematics, P.N.Wartikar and J.N.Wartikar, Pune Vidyarthi Griha, Pune, 2001.
2. .Higher Engineering Mathematics, B.S.Grewal, 6th edition, Khanna publication, New Delhi, 1976.

Reference Books:

1. Advanced Engineering Mathematics, Kreyzig, 9th edition, John Wiley & sons 1995.
2. Advanced Engineering Mathematics, John bird 5th edition, Elsevier publication 2007.
3. Higher Engineering mathematics, C.R.Wiley, 8th edition, John Wiley and sons 1999.

ETU301 NETWORK ANALYSIS

Teaching Scheme: 03L **Total: 03** **Credits: 03**
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**
ESE Duration: 2Hrs. 30 min.

Basic analysis techniques and theorems: V-I relationship for inductance and capacitance, network graphs matrices associated with graphs, incidence, fundamental cut set and fundamental circuit matrices, Nodal analysis, mesh analysis, linearity and superposition theorem, source transformations - Thevenin's theorem, Norton's theorem, Maximum power transfer theorem.
Two port networks: Characteristic impedance, propagation constant, image and iterative impedance, conversion between T and Π sections, two port networks-characterizations in terms of impedance, admittance, hybrid and transmission parameters, inter relationships among parameter sets, reciprocity theorem, and inter-connection of two port networks: series, parallel and cascade
Filters and attenuators: Filters fundamentals, pass and stop band, constant K prototype-low pass filter, high pass filter, band pass filter, band stop filter, m-derived filters, composite filters.
Attenuators: Definition and units of attenuation, symmetrical T and Π attenuator, asymmetrical L section, T and Π attenuator, ladder attenuator.
Time domain analysis of circuits: Linear differential equations for series RC, parallel RC, series RL, parallel RL, series RLC, parallel RLC and coupled circuits, complete solution for step/impulse/sinusoid voltage/current inputs, natural response-transient response-time constant-rise and fall times-concept of d.c. steady state and sinusoidal steady state, frequency response of simple circuits from steady state solution, solution of two mesh circuits by differential equation method-determination of initial conditions.
Transformation of a circuit into s-domain: Transformed equivalent of inductance, capacitance and mutual inductance -impedance and admittance in the transform domain - node analysis and mesh analysis of the transformed circuit - nodal admittance matrix and mesh impedance matrix in the s-domain.
Sinusoidal steady state analysis and resonance : Introduction, characteristics of sinusoids, forced response to sinusoidal functions, the complex forcing function, The phasor relationships for R L C, impedance and admittance, condition for resonance, various properties of series resonance and anti resonance, figure of merit.

Text Book:

1. Network Analysis, M. E. Van Valkenburg, 3rd edition, Prentice Hall of India,1995.
2. Networks, Lines and Fields, John Ryder, 2nd edition, Prentice Hall of India, 1995.

Reference Books:

1. Circuits and Networks, Sudhakar and M. Shyam, 3rd edition,Tata McGraw-Hill, 2007.
2. Transmission Lines and Networks, Umesh Sinha, 1st edition, Satya Prakashan, New Delhi,1993.

ETU302 COMPONENTS, DEVICES AND INSTRUMENTS TECHNOLOGY

Teaching Scheme: 03L+01T Total: 04 Credits: 04
Evaluation Scheme: 15 CT1 +15 CT1+ 10 TA + 60 ESE Total Marks: 100
ESE Duration: 2Hrs. 30 min.

Components: Resistors, capacitors, inductors, transformers - types, construction, specifications, applications and testing. Switches, relays, fuses, cables and connectors - types, construction, specifications, applications and testing. Heat sinks.
Formation of P-N junction: Alloying, diffusion, epitaxy and ion implantation, significance and formation of ohmic contact by welding (electric and ultrasonic welding) and thermo compression bonding, protection of p-n junction by oxidation and desiccants.
Integrated circuits fabrication and characteristic: Integrated circuit technology, basic monolithic integrated circuits, epitaxial growth, masking and etching, diffusion of impurities, transistors for monolithic circuits, monolithic diodes, integrated resistors, integrated capacitors and inductors, monolithic circuits layout, additional isolation methods large scale and medium scale integration (LSI and MSI), metal semiconductor contact.
Measurement and bridge measurement: Accuracy and precision, significant figures, types of errors, system of units, electric and magnetic units, international system of unit, electrical standards.
Kelvin bridge, AC bridges and their application, Maxwell bridge, Hay bridge, Schering bridge, unbalance conditions, Wien bridge, Wagner ground connection.
Measuring instruments: DC ammeters, DC voltmeter, series and shunt ohmmeter, multimeter, calibration of DC instruments, alternating-current indicating instruments, electrodynamometers in power measurements, watt-hour meter, power- factor meters, AC voltmeter using rectifiers, true rms-responding voltmeter, electronic multimeter, digital voltmeter, oscilloscopes - block diagram, operation, front panel, application.
Transducer: Classification of transducers, strain gages, displacement transducers, temperature measurements.

Text Books:

1. Modern Electronic Equipment, R. S. Khandpur, 1st edition, Tata Mc Graw Hill, 1999.
2. Electronic Instrumentation and Measurement Techniques, A. D. Helfrick and W. D. Cooper ,Eastern Economy Edition, PHI Learning Pvt. Ltd., New Delhi, 2008.

Reference Books:

1. Integrated Electronics, J. Millman, C. Halkias, 3rd edition, Tata McGraw Hill, 2006.

ETU303 ELECTRONIC DEVICES AND CIRCUITS

Teaching Scheme: 03L + 1T **Total: 04** **Credits: 04**
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**
ESE Duration: 2Hrs. 30 min.

Diode, special diodes and applications: Diode as a rectifiers (analysis of single phase rectifiers), analysis of C, L, LC and π- filter, small signal equivalent circuits of diodes, clipping and clamping circuits. Zener diode as a voltage regulator, opto-coupler. Schottkey diode, tunnel diode, varactor diode, PIN diode – construction, operation and applications.

Transistor characteristics and biasing: Overview of construction, working and V-I characteristics of BJT, methods of biasing- analysis and synthesis, d. c. load line, a. c. load line stability and stability factor.

FET-characteristics, biasing and modeling: Types, overview of construction, working and V-I characteristics of JFET and MOSFET, parameters, biasing, small signal model of JFET and MOSFET, CS and CD amplifiers.

Small signal low frequency BJT amplifier: Transistor hybrid model for CE, CB and CC configuration, determination of h-parameters from the characteristics, conversion formulas for the h-parameters of CE, CB and CC configuration, analysis of transistor amplifier circuit using h-parameter.

Study of Darlington emitter follower, bootstrap emitter follower, RC coupled amplifier, transformer coupled amplifier, direct coupled amplifier

Large signal amplifiers: Classification, analysis of class A, B, AB power amplifier – calculation of power gain, efficiency, power dissipation and distortion. Tuned amplifiers - single tuned, double tuned amplifiers.

Oscillators: Barkhausen criteria, RC oscillators - Wein bridge and phase shift, LC oscillators- hartley, colpitt's, clapp and crystal oscillators.

Text Books:

1. Electronic Devices and Circuits, J. Millman, C. Halkias and Satyabrata jit, 2nd edition, Tata McGraw Hill, 2008.
2. Electronic Devices and Circuits, D. R. Cheruku and B. T. Krushna, 2nd edition, Pearson Education, 2008.

Reference Books:.

1. Electronics Devices and Circuits Theory, R. Boylestad and L. Nashelsky, 9th edition, Prentice Hall India, 2007.
2. Electronic Principles, A. P. Malvino, 3rd edition, Tata Mc-Graw Hill, 1993.

ETU304 DIGITAL ELECTRONICS

Teaching Scheme: 03L **Total: 03** **Credits: 03**
Evaluation Scheme: 15 CT1 + 15 CT2 +10 TA + 60 ESE **Total Marks: 100**
ESE Duration: 2Hrs. 30 min.

Number system and codes: Positional number system – Binary, octal, decimal, hexadecimal, general conversions, arithmetic operations on unsigned and signed numbers, 1's, 2's, 9's, 10's complement method, negative number representation, BCD codes, gray codes, ASCII codes, error detection and correction codes.
Boolean algebra and logic circuits: Logic gates – basic, derived and universal gates, theorems and properties of Boolean algebra, DeMorgan's theorem, canonical and standard SOP and POS forms, simplification and synthesis of Boolean functions using gates, Boolean theorems, K-Map ,don't care condition and Quine Mc Cluskey method (up to 4 variables).
Digital logic families: Characteristics of digital ICs, BJT and MOSFET as a switch, detailed analysis of TTL, CMOS logic family, study of RTL, DTL, ECL, I^2L logic families, tristate logic.
Combinational logic design: Arithmetic circuits as half and full adder and subtractor, 4-bit adder / subtractor, IC 7483, BCD adder, digital comparator, multiplexer, de-multiplexer, encoder, decoder.
Sequential logic design: One-bit memory cell, S-R, clocked S-R, J-K, master slave J-K, T-type, D-type flip-flops, shift registers, synchronous and asynchronous counters, up/down counters, ripple counters, MOD-n counters.
Semiconductor memories: RAM, ROM, PROM, EPROM, CCD and flash memories. Introduction to CPLD and FPGA.

Text Books:

1. Modern Digital Electronics, R.P. Jain, 3rd edition, Tata Mc-Graw Hill, 2005.
2. Digital Electronics-Circuits and Systems, V. K. Puri, 1st edition, Tata McGraw Hill Publications, 2003
3. Digital Principles and Application, A. P. Malvino, D. P. Leach, 6th edition, Tata Mc-Graw Hill, 2006.

Reference Books:

1. Digital Electronics, W. H. Gothman, 2nd edition, Prentice Hall India, 2006.
2. Digital Logic and Computer Design, M. Morris Mano, 3rd edition, Prentice Hall India Ltd, 2005.
3. Digital Principles and Design, D. Givone, 1st edition, Tata Mc-Graw Hill, 2002.

SHU305 GENERAL PROFICIENCY – II

Teaching Scheme: 01L+02P Total : 03 **Credit : 02**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**

Presentation Skill:
Communication boosters – aura words, pronunciation, body language – voice, posture and gesture, eye contact, dress codes.
Function of culture code in presentation – planning, preparing and delivering a presentation, etiquettes, clarity and aliveness of delivery.
General communication skill for presentation – content matching and language matching for specific audience, tone, hummer poise- listener/speaker sensitivity.
Specific communication skill for presentation – icebreaker, small talk dialogue, debate, turn taking, effective and defensive handling of question.
Models of presentation – Public speaking, academic and professional presentation, group discussion, personal interview, technical report writing (IEEE standards).

Managerial skill:
Time management - advantages, time wasters – procrastination, time management tips and strategies.
Stress management- stress and its disadvantages, stress coping ability and stress inoculation training, management of various types of fear, depression and anger.
Conflict management -types of conflict, conflict stimulation and conflict resolution technique for conflict for effective conflict management, effective ways of dealing with people, significance of body language in communication and assertiveness training.
Interpersonal skills -concept of team, advantages of teamwork, promotion of team spirit, team building techniques, nurturing leadership qualities, negotiation skills.

Topics for assignments/practicals:
Minimum eight assignments/practicals based on above topics. The representative list is given below

1. Collection of new words concerning various technical and professional subjects
2. Listening of audiocassette or lecture or watching videocassette (based on the topics
   of managerial skill) followed by speech/seminar by students.
3. Listening of audiocassette or lecture or watching videocassette (based on the topics
   of managerial skill) followed by group discussion of students.
4. Collecting the information related to the topics of managerial skill using Internet, books,
   Magazines etc. and its power point presentation or seminar/lecture.
5. Power point presentation on topic related to any subject of programme.
6. Preparing a technical paper in IEEE format.

7. Management games.
8. Personal interview.
9. Extempore elocution, debate.

Note :

- **ICA** – The Internal Continuous Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A&B.
- **ESE** – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions.

ETU305 NETWORK ANALYSIS LAB

Teaching Scheme: 02P **Total: 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
ESE Duration: 3Hrs.

Minimum eight experiments shall be performed to cover entire curriculum of course ETU301. The list given below is just a guideline.

List:

1. To find self inductance of two coils, mutual inductance between the coils and coefficient of coupling.
2. To verify Maximum Power Transfer theorem.
3. To verify Compensation theorem.
4. To find Z parameters of two port networks.
5. To find Y parameters of two port networks.
6. To find transmission parameters of two port networks.
7. To study the response of RL series circuit to sinusoidal input and dc input.
8. To study the response of RC series circuit to sinusoidal input and dc input.
9. To design and implement constant 'K' of low pass filter.
10. To design and implement constant 'K' of high pass filter
11. To plot the frequency response of series resonance circuit.
12. To plot the frequency response of parallel resonance circuit.
13. To design and implement symmetrical / asymmetrical T-attenuator.
14. To design and implement symmetrical / asymmetrical π-attenuator.

Note :

- **ICA** – The Internal Continuous Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A&B.
- **ESE** – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions.

ETU306 COMPONENTS, DEVICES AND INSTRUMENTS TECHNOLOGY LAB

Teaching Scheme: 02P **Total: 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
ESE Duration: 3Hrs.

Minimum eight experiments shall be performed to cover entire curriculum of course ETU302. The list given below is just a guideline.

List:

1. To study and calculate the values of resistor, capacitor, inductor.
2. To study different types of switches (SPDT, SPST, DPST, DPDT) and measure the value of resistance for open circuit and short circuit.
3. To study relays and measure the voltage.
4. Measurement of unknown resistance using Kelvin bridge.
5. Measurement of unknown capacitance using Schering bridge.
6. Measurement of unknown inductance using Hay bridge.
7. Measurement of weight using strain gauge load cell.
8. Measurement of force using strain gauge.
9. Measurement of displacement using LVDT.
10. Measurement of temperature using RTD.
11. Measurement of pressure using silicon pressure sensor.
12. Use of dc bridge for temperature measurement- Design and implementation..

Note :

- **ICA** – The Internal Continuous Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A&B.
- **ESE** – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions.

ETU307 ELECTRONIC DEVICES AND CIRCUITS LAB

Teaching Scheme: 02P **Total: 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
ESE Duration: 3Hrs.

Minimum eight experiments shall be performed to cover entire curriculum of course ETU303. The list given below is just a guideline.

List:

1. To design and implement voltage regulator using zener diode.
2. To draw V-.I characteristics of light emitting diode & observe LED as a switch**.**
3. To calculate ripple factor and PIV rating of half wave & full wave rectifier without filter.
4. To calculate ripple factor of half wave / full wave rectifier with C, LC-filters at resistive loads.
5. To calculate ripple factor of bridge rectifier with $\pi -$ filter at resistive loads.
6. To draw and observe the input and output characteristics of the transistor in common emitter configuration.
7. To understand operation of bipolar junction transistor as a amplifier.
8. To measure h-parameters of the transistor in common emitter configuration.
9. To observe the voltage divider biasing circuit operation of the transistor.
10. To determine the A_v, A_i and f_c of RC coupled amplifier.
11. To determine the A_v, A_i and f_c of Transformer coupled amplifier.
12. Measurement and study of output characteristics of JFET.
13. Measurement and study of output characteristics of MOSFET.

Note :

- **ICA** – The Internal Continuous Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A&B.
- **ESE** – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions.

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ETU308 DIGITAL ELECTRONICS LAB

Teaching Scheme: 02P **Total: 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
ESE Duration: 3Hrs.

Minimum eight experiments shall be performed to cover entire curriculum of course ETU304. The list given below is just a guideline.

List:

1. Study and verification of truth tables of basic and derived logic gates.
2. Implementation of basic and derived logic gates using only universal gates.
3. Design and implementation of adders and subtractors using logic gates.
4. Design and implementation of Binary-to-Excess-3 code converter.
5. Design and implementation of binary-to-gray / gray-to-binary decoder using logic gates.
6. Design and implementation of 4-bit binary adder/subtractor and BCD adder using IC 7483.
7. Design and implementation of 2-bit magnitude comparator using logic gates, 8-bit magnitude comparator using IC 7485.
8. Design and implementation of 16-bit odd/even parity checker/ generator using IC 74180.
9. Design and implementation of multiplexer and de-multiplexer using logic gates and study of IC 74150 and IC 74154.
10. Design and implementation of encoder and decoder using logic gates and study of IC 7445 and IC 74147.
11. Design and implementation of BCD to 7-segment decoder using logic gates.
12. Design and implementation of flip-flop circuit using logic gates.
13. Study and verification of truth tables of flip-flop ICs.
14. Construction and verification of 4-bit ripple counter and Mod-10/Mod-12 ripple counter.
15. Design and implementation of 3-bit synchronous up/down counter.
16. Implementation of SISO, SIPO, PISO and PIPO shift registers using flip-flops.

Note :

- **ICA** – The Internal Continuous Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A&B.
- **ESE** – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions.

SHU401 ENGINEERING MATHEMATICS-IV

Teaching Scheme: 03L Total: 03 Credits: 03
Evaluation Scheme: 15 CT1 + 15 CT2 +10 TA + 60 ESE Total Marks: 100
ESE Duration: 2 Hrs. 30 min.

Complex integration: Line and contour integration, singular points, expansion of functions in Taylor's and Laurent's series, Cauchy's integral theorem and integral formula, residue theorem, evaluation of real integrals using residue theorem.
Vector spaces: Vector spaces and subspaces, null spaces, column spaces and linear transformations, linearly independent sets, bases, coordinate systems, dimensions of vector space, change of bases ,application to difference equations.
Orthogonality and least squares: Inner product, length and orthogonality, orthogonal sets, orthogonal projections, Gram-Schmidt process, least square problems, inner product spaces.
Probability: Introduction to random processes, probability distributions i.e. discrete and continuous distributions, probability density function, Binomial, Poisson, Normal distributions.

Text Books:

1. Text book of applied Mathematics, P. N. Wartikar, J. N. Wartikar, , Pune Vidyarthi Griha, Pune 2001.
2. Linear algebra and its applications, D. C. Lay, 3th edition, Addison Wesley, 2004.
3. Probability & Statistics for Engineers & Scientists, R. E. Walpole, R. H. Myers, S. L. Myers and Keying Ye, 7th edition, Pearson Education, 2005.

Reference Books:

1. Advanced Engineering Mathematics, John bird, 5th edition, Elsevier publication, 2007.
2. Advanced Engineering Mathematics, Kreyzig, 9th edition, John Wiley Publication, 1995.
3. Linear Algebra with applications, Nicolson, Mc Graw Hill, 2004.
4. Probability, Random Variables and Stochastic Processes, Athanasios Papoulis, S Pillai, McGraw Hill, 2002.
5. Probability, Random Variables and Random Signal Principles, Peyton Z. Peebles, 2nd edition, McGraw Hill, 1987.

ETU401 SIGNALS AND SYSTEMS

Teaching Scheme: 03L+01T **Total: 04** **Credits: 04**
Evaluation Scheme: 15 CT1 +15 CT1+ 10 TA + 60 ESE **Total Marks: 100**
ESE Duration: 2Hrs. 30 min.

Introduction to signals & system: Signals - continuous and discrete time signals, transformation in independent variable, exponential and sinusoidal signals, unit impulse and unit step functions. Systems - continuous & discrete time system, basic system properties: causality, stability, time invariance, linearity.
Linear time invariant system : Discrete time LTI system, continuous time LTI system, properties of LTI system - commutative, distributive, associative, LTI system with and without memory, inevitability, causality, stability, unit step response of LTI system, causal LTI system described by differential & difference equation, singularity function.
Fourier transform: The continuous time Fourier transform, Fourier transform for periodic signal, properties of continuous time Fourier transform, convolution property, multiplication properties.
The discrete time Fourier transform, Fourier transform for periodic signal, properties of discrete time Fourier transform, convolution properties, multiplication properties.
Sampling: The sampling theorem, reconstruction of a signal from its sample using interpolation the effect of under sampling: aliasing, discrete time processing of continuous time signals, sampling of discrete time signals.
Laplace transforms: The Laplace transform, region of convergence, inverse Laplace transform, properties of Laplace transform, analysis and characterization of LTI system, system function algebra and block diagram representation, unilateral Laplace transform.
Z-transforms: The Z-transform, region of convergence, inverse Z-transform, properties of Z-transform, analysis and characterization of LTI system, system function algebra and block diagram representation, unilateral Z-transform.

Text Books:

1. Signals & Systems, Oppenheim, 2nd edition, Prentice Hall of India, 1997.
2. Signals And Systems, S. Haykin, 2nd edition, John Wiley And Sons, 1999

Reference Book:

1. Signal Processing and Linear Systems, B P Lathi, 1st edition, Oxford Press, 1998.
2. Digital Signal Processing, S. Salivahanan, 2nd edition, TMH, 2005.

ETU402 ANALOG CIRCUITS

Teaching Scheme: 03L+01T Total: 04 Credits: 04
Evaluation Scheme: 15 CT1 + 15 CT1 + 10 TA + 60 ESE Total Marks: 100
ESE Duration: 2Hrs. 30 min.

Feedback amplifiers: The feedback concept, transfer gain with feedback, general characteristics of negative feedback amplifiers, input resistance, output resistance, method of analysis of a feedback amplifier, voltage series feedback, current series feedback, current shunt feedback, voltage shunt feedback.
The high frequency transistor: The high frequency T model, common- base short-circuit-current frequency response, alpha cut-off frequency, common-emitter short-circuit-current frequency response, hybrid pi (π) common-emitter transistor model, hybrid pi (π) conductance, hybrid pi (π) capacitances, validity of hybrid pi (π) model, variation of hybrid pi (π) parameters, CE short circuit current gain, current gain with resistive load, single stage transistor amplifier response with and without source resistance, gain- bandwidth product, emitter follower at high frequencies.
Frequency response of amplifiers: Classification of amplifiers, distortion in amplifiers, frequency response of an amplifier, bode plots, step response of an amplifier, bandpass of cascaded stages, RC coupled amplifier, low frequency of an RC coupled stage, effect of an emitter bypass capacitor on low frequency response, high frequency response of two cascaded CE transistor stages, multistage CE amplifier cascade at high frequencies, noise.
Multi-vibrators and sweep generators: Bistable multivibrators (BMV) - fixed bias, self bias, commutating capacitor, methods of improving resolution, symmetrical and unsymmetrical triggering, direct connected BMV, Schmitt trigger, emitter coupled BMV, monostable multivibrator (MMV) - collector coupled, emitter coupled MMV, triggering of MMV, astable multivibrator (AMV) - collector coupled, emitter coupled AMV. General features of a time base signal, exponential sweep circuit- UJT relaxation oscillator, transistor constant current sweep generator, miller and bootstrap sweep generator.
Differential amplifiers: Introduction, differential amplifier circuit configurations-DIBO- ac and dc analysis, DIUO, SIBO, SIUO, techniques to improve CMRR, biasing circuits-constant current sources, reference voltage sources, cascaded differential amplifier stages, level translator.

Text Books:

1. Integrated Electronics, Jacob Millman, Christos C. Halkias, 3rd edition, Tata McGraw Hill, 2006..
2. Pulse Digital and Switching Waveforms, Jacob Millman, Herbert Taub, Mothiki S Prakash Rao, 2nd edition, Tata McGraw Hill, 2007.

Reference Books:

1. Electronic Devices and Circuits, D. R. Cheruku and B. T. Krushna, 2nd edition, Pearson, 2008.
2. Op-Amps and Linear Integrated Circuits, Ramakant A. Gayakwad, 4th edition, Prentice Hall of India Learning, 2009.

ETU403 MICROPROCESSOR AND IT'S INTERFACING

Teaching Scheme: 03L **Total: 03** **Credits: 03**
Evaluation Scheme: 15 CT1 + 15 CT2 +10 TA + 60 ESE **Total Marks: 100**
ESE Duration: 2 Hrs. 30 min.

8085 Microprocessor architecture & microcomputer system: Block diagram and operation of microcomputer system, architecture and operation of 8085µP, pin diagram of 8085 µP.
8085 Instructions: Addressing modes, classification of 8085 µP instructions, instruction set, assembly language programming, counters and time delays, stack and subroutines, instruction timing diagrams.
Interfacing techniques: De-multiplexing of lower order address bus, generating control signals, memory organization, memory map, memory mapped I/O and I/O mapped I/O, address decoding techniques, interfacing of memory and I/O devices with 8085 µP.
I/O data transfer techniques: Interrupt system of 8085 µP, data transfer schemes, serial data transfer through SID and SOD lines, introduction to DMA data transfer scheme.
Microprocessor peripherals: Internal architecture, programming and interfacing with 8085 µP of 8255-Programmable Peripheral Interface, 8259-Priority Interrupt Controller, 8279-Programmable keyboard/display interface, 8237-Programmable DMA Controller, 8253-Progammable Interval Timer/Counter and 8251 USART.
Data conversion: Principle of data conversion- Analog-to-Digital and Digital-to-Analog, case study of ADC 0809 and DAC 0808, interfacing each with 8085 µP, application of ADC in temperature measurement etc.

Text Books:
1. Microprocessor, Architecture, Programming and Applications with 8085, Ramesh S. Gaonkar, 5th edition, Penram International Publication, 2004.
2. 8085 Microprocessor: Programming and Interfacing, N. K. Srinath, 1st edition, Prentice Hall India Ltd, 2005.

Reference Books:
1. 0000 to 8085 – Introduction to Microprocessor for Engineers and Scientists, P. R. Sridhar and P. K. Ghosh, 2nd edition, Prentice Hall India Ltd, 2005.
2. Introduction to Microprocessor, Aditya P. Mathur, 3rd edition, Tata McGraw-Hill, 2004.
3. Advanced Microprocessors and Peripherals, A. K. Ray and K. M. Bhurchandi, 2nd edition, Tata McGraw-Hill, 2008.

ETU404 CONTROL SYSTEM ENGINEERING

Teaching Scheme: 03L **Total: 03** **Credits: 03**
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**
ESE Duration: 2 Hrs. 30 min.

Introduction to automatic control system: Open Loop and closed loop control system, servo mechanism, mathematical modeling of physical system, transfer function block diagram reduction technique, signal flow graph, effect of feed back on sensitivity and reduction of noise.
Control system components: DC servo motor, AC servo motor, AC tachometer, potentiometer, incremental encoder, absolute encoder, synchros, AC position control system, AC and DC control system, stepper motor.
Time response analysis: Standard test signals, time response of first-order systems, time response of second-order systems, steady-state errors and error constants, effect of adding a zero to a system, design specification of second-order systems, design consideration for higher-order systems, performance indices.
Stability of control system: The concept of stability, necessary condition for stability, Hurwitz stability criterion, Routh stability criterion, relative stability analysis, the root locus concepts, construction root loci, root contours, sensitivity of the roots of the characteristic equation.
Frequency response analysis and stability in frequency domain : Frequency domain specifications of the prototype second order system, correlation between time and frequency response, polar plots, Bode plots, all-pass and minimum-phase systems, Nyquist stability criterion, assessment of relative stability using Nyquist criterion, closed-loop frequency response, sensitivity analysis in frequency domain.
State variable analysis and design: Concepts of state, state variable and state model, state models for linear continuous-time systems, state variables and linear discrete-time systems, diagonalization, concept of controllability and observability,
Controller Study : Controller configurations-proportional, integral, derivative, PI, PD and PID controllers;.

Text Books:

1. Control System Engineering, I. J. Nagrath, l M. Gopal, 5th edition, Wiley Eastern, 2007.
2. Control System Theory and Application, Ghosh, 1st edition, Pearson Education, 2006.

References Books:

1. Modern Control Systems, K. Ogata, 4th edition, Prentice Hall of India, 2002.
2. Feedback Control System, C. L. Philips and R. D. Harbour, 4th edition, Prentice

Hall of India, 2000.

ETU405 OBJECT ORIENTED PROGRAMMING LAB

Teaching Scheme: 01L + 02P **Total: 03** **Credits: 02**
Evaluation Scheme: 50 ICA **Total Marks: 50**

Object oriented paradigm: Introduction to structured versus object oriented development, concept and advantages of OOP's, elements of OOP's – objects, classes, encapsulation, inheritance, polymorphism, basic, derived and user defined data type operators, control statements, structure of C++ programming.
Functions and classes: Class specification, class objects, class definition, public/private classes, member access, defining member functions, constructors and destructors, virtual and friend functions, function and operator overloading.
Inheritance and polymorphism: Defining derived classes, forms of inheritance, inheritance and member accessibility.
Applications: Applications in GUI design.
Minimum eight program shall be performed to cover above entire curriculum.

Text Books:

1. Object Oriented Programming with C++, E. Balagurusamy, 2nd edition, Tata McGraw Hill Publications, New Delhi, 2003.
2. Teach Yourself C++, Herbert Schildt, 3rd edition, Tata McGraw Hill, 2005.

Reference Books:

1. Mastering C++, K. R. Venugopal, 1st edition, Tata McGraw Hill, 2000.
2. Object Oriented Programming in C++, K. R. Shukla, 1st edition, Wiley India Pvt. Ltd, 2008.

Note :

- **ICA** – The Internal Continuous Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A&B.

ETU406 SIGNALS AND SYSTEMS LAB

Teaching Scheme: 02P **Total: 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
ESE Duration: 3Hrs.

Minimum eight experiments shall be performed to cover entire curriculum of course ETU401. The list given below is just a guideline.

List:

1. Introduction to MATLAB.
2. To study signal processing toolbox.
3. To study system identification toolbox.
4. Write a program to plot the following functions: a) impulse function b) unit step
   c) unit ramp d) exponential e) sinusoidal
5. Study the aliasing effect by using a sinusoidal signal. Show the plots of continuous time.
6. Study sampled signal and reconstructed signals by using subplot.
7. Write a program to plot real, imaginary phase and magnitude of exponential function.
8. Write a program for pole-zero plot of Z-transform

Note :

- **ICA** – The Internal Continuous Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A&B.
- **ESE** – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions.

ETU407 ANALOG CIRCUITS LAB

Teaching Scheme: 02P **Total: 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
ESE Duration: 3Hrs.

Minimum eight experiments shall be performed to cover entire curriculum of course ETU402. The list given below is just a guideline.

List:

1. Implement voltage shunt feedback amplifier and calculate various parameters
2. Simulate by using multisim, voltage-series, current-series and current-shunt feedback topologies and measure various parameters.
3. High frequency response of common emitter stage.
4. High frequency response of cascaded amplifier.
5. To study step response of amplifier and find out delay time and tilt.
6. To find out f_L and f_H from square wave testing of amplifier.
7. To measure voltage and current levels at stable state of BMV.
8. Design and implement MMV
9. Design and implement AMV.
10. Simulate by using multisim, BMV, MMV, AMV and compare their results with implemented one.
11. Implement Schmitt trigger and calculate LTP and UTP.
12. Design and implement UJT relaxation oscillator.
13. Design and implement any one constant current source.
14. Design and implement level shifting network.
15. Implement DIBO differential amplifier and measure its parameters.

Note :

- **ICA** – The Internal Continuous Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A&B.
- **ESE** – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions.

ETU408 MICROPROCESSOR AND IT'S INTERFACING LAB

Teaching Scheme: 02P **Total: 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
ESE Duration: 3Hrs.

Minimum eight experiments shall be performed to cover entire curriculum of course ETU403. The list given below is just a guideline.

List:

1. Write an assembly language program to subtract larger number from smaller number (8 bit) using 8085 and verify the result.
2. Write an assembly language program to add two 16 bit numbers using 8085 and verify the result.
3. Write an assembly language program to find greatest number among the series using 8085.
4. Write an assembly language program to arrange the numbers in descending order using 8085.
5. Write an assembly language program to find the sum of given numbers in an array.
6. Write an assembly language program and conversion subroutine to convert packed BCD number into equivalent binary number.
7. Write an assembly language program to perform memory to memory data transfer using 8085.
8. Write an assembly language program for arranging the array of numbers.
9. Write an assembly language program to perform multiple precision operations such as 24-bit addition, 16-bit complement etc.
10. Write an assembly language program to perform multiplication by shift & add method.
11. Interfacing of
    a. 8255 operations in various modes with some typical applications such as key-pad / LED bank
    b. ADC and DAC.
    c. Sine, square and triangular wave generator.

Note :

- **ICA** – The Internal Continuous Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A&B.
- **ESE** – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions.

ETU409 CONTROL SYSTEM ENGINEERING LAB

Teaching Scheme: 02P **Total: 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
ESE Duration: 3Hrs.

Minimum eight experiments (Minimum six from group A and minimum two from group B) shall be performed to cover entire curriculum of course ETU404. The list given below is just a guideline.

List:
Group A:

1. To study potentiometer as error detector and find its transfer function.
2. To Study AC Servomotor and determine its transfer function.
3. To Study DC Servomotor and determine its transfer function.
4. To Study stepper motor and determine its transfer function.
5. To study and observe control process using PI controller.
6. To study and observe control process using PID controller.
7. To study synchros and obtain output verses input characteristics.
8. To study and observe response of RC first order system.
9. To study and observe response of RLC second order system.

Group B: (Software based experiment using MATLAB)

1. To determine transfer function into state space form and vice-versa.
2. To plot root locus diagram of an open loop transfer function and determine range of gain 'K' filter stability.
3. To plot bode diagram of an open loop transfer function.
4. To draw Nyquist plot of an open loop transfer function and examine the stability of the close loop system.

Note :

- **ICA** – The Internal Continuous Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed experiment wise using continuous assessment format A&B.

- **ESE** – The End Semester Exam for practical shall be based on performance in one of the experiments and followed by sample questions.
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Department of Electronics & Telecommunication

Seconr Year B.Tech.(Electronics & Telecommunication)

Equivalence of courses :

Sr. No	Course in old scheme (212 credits)			Course in new scheme (184 credits)			Remarks
	Course Code	**Name of the Course**	**No of credits**	**Course Code**	**Name of the Course**	**No of credits**	
1	ET301	Engineering. Maths III	**4**	SHU 302	Engineering Mathematics - III	**3**	
2	ET303	Electrical Engineering *	**4**	**No Equivalent**			
3	ET304	Electronics Devices and Circuits	**5**	ETU 303	Electronics Devices and Circuits	**4**	
4	ET302	Component Devices and Technology *	**4**	ETU 302	Component ,Devices and Instrument Technology	**4**	
5	ET305	Instrumentation *	**4**				
6	ET306	General Proficiency I	**2**	SHU 205	General Proficiency I	**2**	
7	ET308	Electrical Engineering. Laboratory *	**1**	**No Equivalent**			
8	ET309	Electronics Devices and Circuits Laboratory	**1**	ETU 307	Electronics Devices and Circuits Lab	**1**	
9	ET307	Component Devices and Technology Laboratory *	**1**	ETU 306	Component ,Devices and Instrument Technology Lab	**1**	
10	ET310	Instrumentation Laboratory *	**1**				
11	ET401	Engineering. Maths	**4**	SHU	Engineering	**3**	

		IV		401	Mathematics - IV		
12	ET402	Fundamentals of communication *	**5**	**No Equivalent**			
13	ET403	Digital Electronics	**4**	ETU 304	Digital Electronics	**3**	
14	ET404	Network analysis	**4**	ETU 301	Network analysis	**3**	
15	ET405	Humanities and Economics *	**4**	**No Equivalent**			
16	ET406	General Proficiency II	**2**	SHU 303	General Proficiency - II	**2**	
17	ET407	Engineering. Maths IV Laboratory	**1**	ETU 406	Signals and Systems Lab	**1**	
18	ET408	Fundamentals of communication Laboratory *	**1**	**No Equivalent**			
19	ET409	Digital Electronics Laboratory	**1**	ETU 308	Digital Electronics Lab	**1**	
20	ET410	Network analysis Laboratory	**1**	ETU 305	Network analysis Lab	**1**	
21	**No Equivalence**			ETU 401	Signals and Systems	**4**	
22	**No Equivalence**			ETU 402	Analog Circuits	**4**	
23	**No Equivalence**			ETU 403	Microprocessor and its Interfacing	**3**	
24	**No Equivalence**			ETU 404	Control System Engineering	**3**	
25	**No Equivalence**			ETU 405	Object Oriented Programming Lab	**2**	
26	**No Equivalence**			ETU	Signals and Systems	**1**	

		406	Lab		
27	**No Equivalence**	ETU 407	Analog Circuits Lab	**1**	
28	**No Equivalence**	ETU 408	Microprocessor and its Interfacing Lab	**1**	
29	**No Equivalence**	ETU 409	Control System Engineering Lab	**1**	

Note:

- All students promoted to third year with some backlog courses shall remain in old scheme (212 credits) .
- All students who failed in second year (DC Students) shall be transferred to new scheme (184 Credits) .
- Important notes for * courses

i) These courses of old scheme shall be offered during the academic year (2011 – 12) including summer term for back logger students.

ii) In the academic year 2012-13 and onward all students shall register for courses as per revised curriculum (New scheme).

iii) If a DC student has passed any one subject out of ET302 and ET305 then option shall be given to a student to register and pass the other subject as per old curriculum to claim exemption in ETU302 or register the subject ETU302 as per revised curriculum.

iv) If a DC student has passed any one subject out of ET307 and ET310 then option shall be given to a student to register and pass the other subject as per old curriculum to claim exemption in ETU306 or register the subject ETU306 as per revised curriculum.

Government College of Engineering Amravati

(An Autonomous Institute of Government of Maharshtra)

Curriculum for V and VI semester Electronics and Telecommunication

Department of Electronics and Telecommunication
2009-2010

DEPARTMENT OF ELECTRONICS and TELECOMMUNICATION
SCHEME FOR B.TECH.

Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
						Theory				Practical		Total	
		Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	CT1	CT2	ESE	Internal	External		
Sem III													
ET301	Engineering. Maths III	4	---	---	4	10	15	15	60	---	---	100	4
ET302	Component Devices andTechnology	4	---	---	4	10	15	15	60	---	---	100	4
ET303	Electrical Engineering.	4	---	---	4	10	15	15	60	---	---	100	4
ET304	Electronics Devices and Circuits	4	1	---	5	10	15	15	60	---	---	100	5
ET305	Instrumentation	4	---	---	4	10	15	15	60	---	---	100	4
ET306	General Proficiency I		---	**2**	2	---	---	---	---	50	---	50	2
ET307	Component Devices andTechnology Laboratory	---	---	2	2	---	---	---	---	25	25	50	1
ET308	Electrical Engineering. Laboratory	---	---	2	2	---	---	---	---	25	25	50	1
ET309	Electronics Devices and Circuits Laboratory	---	---	2	2	---	---	---	---	25	25	50	1
ET310	Instrumentation Laboratory	---	---	2	2	---	---	---	---	25	25	50	1
Total		**20**	**1**	**10**	**31**	**50**	**75**	**75**	**300**	**150**	**100**	**750**	**27**
Sem IV													
ET401	Engineering. Maths IV	4		---	4	10	15	15	60	---	---	100	4
ET402	Fundamentals of communication	4	1	---	5	10	15	15	60	---	---	100	5
ET403	Digital Electronics	4	---	---	4	10	15	15	60	---	---	100	4
ET404	Network analysis	4	---	---	4	10	15	15	60	---	---	100	4
ET405	Humanities and Economics	4	---	---	4	10	15	15	60	---	---	100	4
ET406	General Proficiency II	---	---	2	2	---	---	---	---	50	---	50	2
ET407	Engineering. Maths IV Laboratory	---	---	2	2	---	---	---	---	25	25	50	1
ET408	Fundamentals of communication Laboratory	---	---	2	2	---	---	---	---	25	25	50	1
ET409	Digital Electronics Laboratory	---	---	2	2	---	---	---	---	25	25	50	1
ET410	Network analysis Laboratory	---	---	2	2	---	---	---	---	25	25	50	1
Total		**20**	**1**	**10**	**31**	**50**	**75**	**75**	**300**	**150**	**100**	**750**	**27**

TA :Techer Assesment **CT: Class Tests** **ESE: End Sem.Examination : Duration two hours thirty minutes**

DEPARTMENT OF ELECTRONICS and TELECOMMUNICATION

PROPOSED SCHEME FOR B.TECH.

Sem V													
Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
						Theory				Practical		Total	
		Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	CT 1	CT 2	ESE	Internal	External		
ET501	Electromagnetic fields	4	---	---	4	10	15	15	60	---	---	100	4
ET502	Consumer electronics	4	---	---	4	10	15	15	60	---	---	100	4
ET503	Power Electronics	4	---	---	4	10	15	15	60	---	---	100	4
ET504	Analog Circuits	4	1	---	5	10	15	15	60	---	---	100	5
ET505	Control System Engineering.	4	---	---	4	10	15	15	60	---	---	100	4
ET506	Electromagnetic fields Laboratory	---	---	2	2	---	---	---	---	25	25	50	1
ET507	Consumer electronics Laboratory	---	---	2	2	---	---	---	---	25	25	50	1
ET508	Power Electronics Laboratory	---	---	2	2	---	---	---	---	25	25	50	1
ET509	Analog Circuits Laboratory	---	---	2	2	---	---	---	---	25	25	50	1
ET510	* Laboratory I	---	---	2	2	---	---	---	---	25	25	50	2
Total		**20**	**1**	**8**	**31**	**50**	**75**	**75**	**300**	**125**	**125**	**750**	**27**
Sem VI													
ET601	Linear Integrated Circuits	4	---	---	4	10	15	15	60	---	---	100	4
ET602	Communication Engineering	4	---	---	4	10	15	15	60	---	---	100	4
ET603	Microprocessor and its Interfacing	4	1	---	5	10	15	15	60	---	---	100	5
ET604	Computer Oriented Operation Research	4	---	---	4	10	15	15	60	---	---	100	4
ET605	Industrial Management and Quality Control	4	---	---	4	10	15	15	60	---	---	100	4
ET606	Linear Integrated Circuits Laboratory	---	---	2	2	---	---	---	---	25	25	50	1
ET607	Communication Engineering Laboratory	---	---	2	2	---	---	---	---	25	25	50	1
ET608	Microprocessor and its Interfacing Laboratory	---	---	2	2	---	---	---	---	25	25	50	1
ET609	Computer Oriented Operation Research Laboratory	---	---	2	2	---	---	---	---	25	25	50	1
ET610	Minor Project	---	---	2	2	---	---	---	---	25	25	50	2
Total		**20**	**1**	**10**	**31**	**50**	**75**	**75**	**300**	**125**	**125**	**750**	**27**

TA :Techer Assesment CT: Class Tests ESE: End Sem.Examination : Duration two hours thirty minutes

*** Laboratory-I -Experiments will be based on all subjects**

DEPARTMENT OF ELECTRONICS and TELECOMMUNICATION

PROPOSED SCHEME FOR B.TECH.

Sem VII														
Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
						Theory				Practical		Total	
		Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	CT1	CT2	ESE	Internal	External		
ET701	Digital Communication	4	----	---	5	10	15	15	60	---	---	100	4
ET702	Digital Signal Processing	4	---	---	4	10	15	15	60	---	---	100	4
ET703	Electronics Circuit Design	4	---	---	4	10	15	15	60	---	---	100	4
ET704	Fibre Optics Communication	4	----	---	4	10	15	15	60	---	---	100	4
ET705	Elective I 1.Microprocessor and Microcontroller, 2.Biomedical Engineering. , 3.Fuzzy Logic and Neural Network , 4.Computer Organization and Architecture	4	----	---	4	10	15	15	60	---	---	100	4
ET706	Digital Signal Processing Laboratory	----	---	2	2	---	---	---	---	25	25	50	1
ET707	Electronics Circuit Design Laboratory	----	----	2	2	---	---	---	---	25	25	50	1
ET708	Fibre Optics Communication Laboratory	----	----	2	2	---	---	---	---	25	25	50	1
ET709	Project and seminar	---	---	4	4	---	---	---	---	50	50	100	4
Total		20	2	10	31	50	75	75	300	125	125	750	27
Sem VIII													
ET801	Digital System Design	4	---	---	4	10	15	15	60	---	---	100	4
ET802	Microwave Engineering.	4	---	---	4	10	15	15	60	---	---	100	4
ET803	Elective - II 1.Wireless Communication, 2. Satellite Communication, 3. Communication Network, 4.Speech processing	4	---	---	4	10	15	15	60	---	---	100	4
ET804	Elective - III 1.Digital Image Processing, 2.Very Large Scale Integration Design, 3.System Software4.Bioinformatics,	4	---	---	4	10	15	15	60	---	---	100	4
ET805	Digital System Design Laboratory	----	---	2	2	---	---	---	---	25	25	50	1
ET806	Microwave Engineering. Laboratory	---	---	2	2	---	---	---	---	25	25	50	1
ET807	* * Laboratory II	---	---	2	2	---	---	---	---	25	25	50	1
ET808	Project and seminar	---	---	6	6	---	---	---	---	100	100	200	8
Total		16	---	12	28	40	60	60	240	175	175	750	27

TA :Techer Assesment CT: Class Tests ESE: End Sem.Examination : Duration two hours thirty minutes

**** Laboratory-II -Experiments will be based on Elective III**

ET501 ELECTROMAGNETIC FIELD

Teaching Scheme: 04L Total: 04 Credit: 04
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
Duration of ESE : 2 Hrs.30 min.

Vector analysis: Review of scalars and vectors, vector algebra. The coordinate system: rectangular, cylindrical and spherical. Scalar and vector fields, differential elements of length, surface and volume.

Electrostatics: Introduction to Coloumb's law, electric field intensity, flux density, Field of line charges, field of surface charges, Gauss's law, divergence, divergence theorem, Maxwell's first equation, electric potential and potential gradient**.**

Magnetostatics: Current and current density, continuity equation, Biot-Savart's law, Ampere's circuital law and applications, Curl, Stock's theorem, magnetic flux and flux density, scalar and vector magnetic potentials. Maxwell's equations for steady field.
Maxwell's equations and boundary conditions: Maxwell's equations for time varying fields, electric and magnetic boundary conditions.
Electromagnetic waves: Electromagnetic wave equation, wave propagation in free space, in a perfect dielectric, and perfect conductor, skin effect, Poynting vector and Poynting theorem, reflection and refraction of uniform plane wave at normal incidence plane, reflection at oblique incident angle.
Waveguides: Introduction, wave equation in Cartesian coordinates, Rectangular waveguide, TE, TM, TEM waves in rectangular guides, wave impedance, loses in wave guide, introduction to circular waveguide.
Radiation: Retarded potential, Electric and magnetic fields due to oscillating dipole (alternating current element), power radiated and radiation resistance, application to short monopole and dipole.

Text Books

1. Engineering Electromagnetics (7th edition, 2006), by W.H Hayt. and J.A. Buck, Tata Mc-Graw Hill.
2. Electromagnetic Waves and Radiating System (2nd edition, 1985), by E.C. Jordan and K.C. Balamin Prentice Hall of India Private Limited.

Reference Books

1. Elements of Engineering Electromagnetics, by Rao (6th edition, 2006), Pearson education
2. Electromagnetics (3rd edition, 1984), by J.D Krauss, Mc-Graw Hill.
3. Fields and Waves in Communication Electronics (3rd edition), by S. Ramo and R. Whinnery, John Wiley and Sons.
4. Fundamental of Electromagnetic with MATLAB (1st edition, 2008), by K. E. Lonngren and S. V. Savov, Prentice Hall of India.

ET502 CONSUMER ELECTRONICS

Teaching Scheme: 04L Total: 04 Credit: 04
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
Duration of ESE : 2 Hrs.30 min.

Electroacoustic transducers : Microphone: types, characteristics, construction and principle of operation of carbon, condenser, electric, moving coil, tie-clip, wireless microphone, loudspeakers : types, construction and operation of horn type, moving coil, woofer, tweeter, column speakers, head phones and hearing aids, cross over network, loud speaker baffles and enclosures, Room acoustics

Audio recording and reproduction : Sound recording, magnetic recording, optical recording; sound reproduction, hi-fi system, stereo phony and quadraphonic, equalizers, distortions in tape equipment, noise reduction, active tone control circuit, FM stereo multiplex system,CA810 audio power amplifier, music synthesizers, Dolby system, compact disc recording and reproduction

Video recording : Tape recording**,** slant azimuth system, color recording, video cassette recorder; optical disc recording, video high density (VHD), video disc recording system, ultrasonic remote control transmitter, frequency signal encoding

Camera tubes and TV receiver : Introduction, monochrome TV Camera, Principles of photoelectric effects, different camera tubes, characteristics of camera tubes, color TV Camera, colorplexed composite video signal, color signal generation and encoding. TV receiver tuners, video IF amplifier, video detector, sound and video amplifier, picture tubes, color TV tubes, color TV Receiver, color signal decoding and matrixing

Digital television: Transmission and reception, signal quantization and encoding, digital satellite television, direct-to-home (DTH) television, high definition television (HDTV), flat panel display TV receivers, plasma television screen, plasma color receiver, LCD color receiver, digital Light Processing (DLP) projection system

Telecommunication systems and electronic appliances: Telephone signaling and switching system, stored program control, optical fiber cable, local distribution network, wireless local loop (WLL), cellular communication system, Operation and working of facsimile, xerography, microwave oven, washing machine, refrigerators, Bar code scanner and decoder

Text Book

1. Consumer Electronics, (1st edition, 2005) by S. P. Bali, Pearson Education

Reference Books

1. Modern Television Practice, (3rd edition, 2006), by R. R. Gulati, New Age International Publishers
2. Television Engineering, (2nd edition, 1889), by A. M. Dhake, Prentice Hall of India

ET503 POWER ELECTRONICS

Teaching Scheme: 04L Total: 04 Credit: 04
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
Duration of ESE : 2 Hrs.30 min.

Power semiconductor devices: Structure, operation and characteristics of power transistor, SCR, DIAC, TRIAC, MOSFET, IGBT, GTO and its ratings, two transistor analogy for SCR, Turning on and off mechanism with its dynamic characteristics, thyristor firing circuits, *dv*/*dt* and *di*/*dt* protection.

Equalising circuits: Series and parallel operation of SCR's, static and dynamic equalising circuit, equalisation of current in parallel connected SCR's, string efficiency, derating factor, protection of SCR's against *di*/*dt*, *dv*/*dt*, radiofrequency interference, over voltage, over current.

Phase controlled rectifiers: Principle of phase control, natural and line commutation, single phase half and full controlled bridge rectifier with *R* and *RL* load, derivation for output voltage and current, Three phase Half and fully controlled bridge rectifier with highly inductive load with its circuit diagram, operation and waveform, derivation of average and rms load voltage, effect of free wheeling diode, single phase dual converters.

Ch**opper, inverter and converters:** Basic principle of chopper, step - down and step– up chopper, continuous and discontinuous conduction, time ratio control, current limit control, AC chopper, voltage commutated chopper circuits, Jone's chopper, Series inverter, improved series inverter, Parallel inverters, output voltage and waveform control, principle of operation for three phase bridge inverter in 120^0 and 180^0 mode, basic principle of cycloconverters, single phase to single phase cycloconverter.

Applications: Uninterrupted power supply (UPS) – operation and configuration, battery-Ah, back up time and battery charger rating calculations, speed control of DC shunt motor using phase controlled rectifiers, speed control of three phase induction motor by stator voltage control, v/f control and slip power recovery scheme, static circuit breaker, fan speed regulator, principle of soft start circuit, zero voltage switch.

Text Books

1. Power Electronics Circuits, Devices and Applications (3rd edition , 2004), by M. H. Rashid , Prentice Hall of India
2. Power Electronics, Converters, Application, and Design (3rd edition , 2003), by N. Mohan, T. M. Undeland and W. P. Robbins, John Willey and Sons

Reference Books

1. Power Electronics (2004), by M. S. Jamil Asghar Prentice Hall of India
2. Industrial Electronics and Control, by S. Bhattacharya, S. Chatterjee,Tata Mc-Graw Hill
3. Power Electronics (3rd edition, 1993), by C. W. Lander, Mc-Graw Hill International
4. Introduction to Power Electronics (1st edition, 2004), by Jaganathan, Prentice Hall of India
5. Modern Power Electronics and AC Drives (1st edition, 2003), by B. K. Bose, Pearson Education

ET504 ANALOG CIRCUIT

Teaching Scheme: 04L+1T Total: 05 Credit: 05
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
Duration of ESE : 2 Hrs.30 min.

Feedback amplifiers and its response: Feedback concept, transfer gain, general characteristics of negative feedback amplifier, input resistance and output resistance, methods of feedback amplifier and their effects. Effect of feedback on bandwidth, stability, tests for stability.
Frequency response of amplifiers: Characteristics, step response of amplifier, high frequency response of common emitter stage, gain bandwidth product, frequency response of cascaded stages, cascode (CE-CB) amplifier.
Transistorized circuits and its analysis: Astable, monostable and bistable multivibrators, Time base generators and sweep generators, Schmitt trigger.
High frequency transistor and its analysis: High-frequency T model, common base short-circuit and common emitter short-circuit current, frequency response, alpha cut-off frequency, hybrid- pi (□) common emitter transistor model, current gain with resistive load, transistor amplifier response.
Linear wave shaping using RC and RL circuits: Analysis and calculations of RC low pass and high pass filters, analysis of clipping and clamping circuits using diodes.
Introduction to SPICE: Circuit element sources in SPICE/PSPICE, DC Circuit analysis, transient analysis, A.C. circuit analysis for R, L, C circuits modeling, analysis of diode, BJT and FET circuits, simulation of transistorised and RC/RL circuits.

Text Books

1. Integrated Electronics (3rd edition, 2006), by J. Millman, C. Halkias, Tata McGraw Hill,
2. Electronic Devices and Circuits (1st edition, 2000), by D. Churuku, B. T. Krushna, Pearson Education

Reference Books

1. Pulse Digital and Switching Waveforms (2nd edition, 2003), by J. Millman and H. Taub, McGraw Hill Company.
2. Electronic Devices and Circuits (5th edition, 2002), by R. Boylestad, Prentice Hall of India
3. Electronics Devices and Integrated Circuits (1st edition, 2006) by Singh, Pearson Education
4. SPICE for Circuits and Electronics using PSPICE (2nd edition, 2003), by M. H. Rashid, Prentice Hall of India

ET505 CONTROL SYSTEM ENGINEERING

Teaching Scheme: 04L Total: 04 Credit: 04
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
Duration of ESE : 2 Hrs.30 min.

Introduction to automatic control system: Open Loop and closed loop control system and servomechanism mathematical modeling of physical system transfer function Block diagram reduction technique signal flow graph effect of feed back on sensitivity and reduction of noise

Introduction to time response analysis first and second order systems: Standard test signals time response specifications Error analysis and error constants Steady state errors P-I-D controllers

Stability of control system: Routh-Hurwitz stability criterion error criterion relative stability Root locus technique procedure to plot the root locus problems on root locus effect of addition of pole and zeros stability analysis from root locus

Frequency response of linear systems: Specifications Bode plot derivation of transfer function (T.F.) from Bode plot, polar plot Nyquist criterion stability analysis from Nyquist plot

State space representation of system: Conversion of state variable model to T. F., Conversion of T.F. to state variable model, solution of state equations, concept of controllability and observability

Z transform: Representation of sampled data, review of Z transform, sample and hold circuit, solution of difference equation by Z transform, pulse transform function of open loop and closed loop system with different sampler location, digital controller and its T.F., stability analysis of discrete time system using bilinear transformation

Text Book

1. Control System Engineering (2nd edition, 1982), by I.J. Nagrath, L. M. Gopal, Wiley Eastern

Reference Books

1. Automatic Control Systems (7th edition), by B.C. Kuo, Prentice Hall of India
2. Modern Control Systems (4th edition, 1996), by K. Ogata, Prentice Hall of India
3. Control System Theory and Application, (1st edition, 2006), by S. Ghosh, Pearson Education

ET506 ELECTROMAGNETIC FIELD LABORATORY

Teaching Scheme: 02P Total: 02 Credit: 01
Evaluation Scheme: 25 Internal + 25 External Total Marks: 50

Minimum eight experiments shall be performed from the list given below. The experiments to be carried shall cover entire curriculum and the list is just a guideline

List

A) Simulation and verification of

1. Coulomb's law.
2. Gauss's law.
3. Ampere's circuital law.
4. Maxwell's Equation for time varying field.
5. Stroke's theorem.
6. Divergence, gradient and curl.
7. Wave equation in perfect conductor.

8. Wave equation in lossy medium.

B) Modes in rectangular waveguide.

ET507 CONSUMER ELECTRONICS LABORATORY

Teaching Scheme: 02P Total: 02 Credit: 01
Evaluation Scheme: 25 Internal + 25 External Total Marks: 50

Minimum eight experiments shall be performed from the list given below. The experiments to be carried shall cover entire curriculum of this semester and the list is just a guideline:

List

1. Cross-over networks.
2. Active tone control circuit.
3. Audio power amplifier (CA810).
4. Tape recorder transport mechanism.
5. Public address system.
6. Monochrome television receiver.
7. Wireless liquid crystal display unit.
8. Local telecommunication switching system.
9. Photocopying/Xerography unit.
10. Bar code scanning and decoding unit.
11. Microwave oven.
12. Washing machine unit.

ET508 POWER ELECTRONICS LABORATORY

Teaching Scheme: 02P Total: 02 Credit: 01
Evaluation Scheme: 25 Internal + 25 External Total Marks: 50

Minimum eight experiments shall be performed from the list given below. The experiments to be carried shall cover entire curriculum and the list is just a guideline.

List

1. V-I characteristics of (i)SCR (ii) TRIAC (iii) MOSFET (iv) IGBT (v) DIAC.
2. Jones chopper.
3. Step up/down chopper.
4. Single-phase full controlled rectifiers using SCRs.
5. Three phase full controlled converters.
6. Series inverter.
7. Parallel inverter.
8. Speed control of DC motor.

ET509 ANALOG CIRCUITS LABORATORY

Teaching Scheme: 02P Total: 02 Credit: 01
Evaluation Scheme: 25 Internal + 25 External Total Marks: 50

Minimum eight experiments shall be performed from the list given below. The experiments to be carried shall cover entire curriculum and the list is just a guideline.

List

1. Feedback amplifier.
2. High frequency response of common emitter stage, cascaded and cascode amplifier.
3. Step response of amplifier.
4. Transistor as multivibrator.
5. Sweep generator and Schmitt trigger.
6. Clipping, clamping, RC high pass and low pass filter.

7-10. Minimum 4 experiments based on PSPICE.

ET510 LABORATORY I

Teaching Scheme: 02P Total: 02 Credit: 02
Evaluation Scheme: 25 Internal + 25 External Total Marks: 50

Minimum eight experiments shall be performed from the list given below. The experiments to be carried shall cover entire curriculum and the list is just a guideline.

1. Scope of MATLAB (matrix manipulation).
   a. Symbolic mathematics tool box (solving ordinary differential equation).
   b. Communication tool box (modulation and demodulation).
   c. DSP tool box (convolution).
   d. Ordinary differential equation tool box (solving ordinary differential equation).
   e. Control system tool box (block diagram)
   f. Communication tool box (simulation of communication circuit).
2. PCADD (design of antenna).
3. MULTISIM (circuit design).
4. ULTIBOARD (PCB design).
5. Simulink.

Some experiments which are not covered in other laboratories may also be conducted in laboratory 1 or report based on industrial visit

ET601 LINEAR INTEGRATED CIRCUITS

Teaching Scheme: 04L Total: 04 Credit: 04
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
Duration of ESE : 2 Hrs.30 min.

Differential amplifier: Introductory concepts and fundamentals like Decibel, Bode plot, circuit simulations, etc. Differential amplifier fundamentals, transisterised configurations DC and AC analysis (detailed analysis of any one configuration), transfer characteristics, common mode rejection ratio (CMRR), input and output impedances, constant current bias, current mirror

Operational amplifier (op-amp): Ideal op-amp characteristics; schematic development stages of op-amp: current sources and active loads, difference, intermediate and output stages including Miller capacitors for frequency computation; operational amplifier parameters, features, data sheet interpretation; effects of real operational amplifier parameters on circuit performance, frequency response and stability, frequency and phase compensation techniques

Op-amp applications: Inverting and non-inverting, voltage follower, differential and bridge amplifiers, summer, integrator, differentiator; analog computation, basic building blocks, basic linear differential equation; voltage-to-current and current-to-voltage converters, analog multipliers, dividers, sample and hold circuits; peak detectors, precision rectifiers; instrumentation and isolation amplifiers, current and voltage sources, active filters: response and analysis of first and second order Butterworth filters, response of Chebyshev, Elliptic filters; comparators, Schmitt trigger, clippers and clampers; precision rectifiers; logarithmic amplifiers, multifunction circuits and true rms converters; phase lock loop (PLL), PLL as amplitude and frequency modulation detection, frequency shift keying (FSK) decoder, frequency synthesiser.

Waveform generation: Sinusoidal feedback oscillators, feedback topologies and analysis for discrete transistor amplifiers, stability of feedback circuits using Barkhausen criteria. Relaxation oscillators, square-triangle oscillators; astable and monostable multivibrators and their design; timer circuit and its use and design as multivibrator

Analog and digital interface circuits: analog to digital (A/D) and digital to analog (D/A) converters, sample and hold circuits and multiplexers.

Text Books

1. Op-amps and Linear Integrated Circuits (4th edition 2008), by R. A. Gayakwad, Prentice Hall of India
2. Design with Operational Amplifiers and Analog Integrated Circuits (3rd edition, 2002), by S. Franco, Tata McGraw Hill

Reference Books

1. Introduction to Operational Amplifier Theory and Applications (2nd edition 1991), by J. V. Wait, L. P. Huelsman and G. A. Korn, McGraw Hill
2. Op-amp and Linear Integrated Circuits Theory and Applications (1st edition, 2001), by J. M. Fiore. Delmar Thompson Learning
3. The Art of Electronics (2nd edition, 1989), by P. Horowitz and W. Hill, Cambridge University Press
4. Operational Amplifiers and Linear Integrated Circuits (1st edition, 2006), Pearson Education

ET 602 COMMUNICATION ENGINEERING

Teaching Scheme: 04L Total : 05 Credit: 04
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
Duration of ESE : 2 Hrs.30 min.

Amplitude Modulation: Amplitude modulation (AM), DSB-SC, SSB, VSB and ISB transmissions, mathematical Analysis, modulation index, frequency spectrum, power requirement of these systems, generation of AM signal.

Angle Modulation: Frequency modulation (FM), mathematical analysis, modulation index, frequency spectrum, power requirement of FM, narrowband and wideband FM, noise triangle in FM, pre-emphasis and de-emphasis techniques, phase modulation, power contents of the carrier and the sidebands in angle modulation, noise reduction characteristics of angle modulation, generation of FM signals, comparison between AM and FM. **Receivers:** Basic receiver (TRF), super heterodyne receiver, performance parameters for receiver such as sensitivity, selectivity, fidelity, image frequency rejection etc., AGC technique, AM detectors, FM discriminators, AFC technique, double-spotting effect, details of each block of AM and FM receiver.

Formalizing signals and analysis: Energy and power signals, signal properties: periodicity, absolute integrability, determinism and stochastic character, some special signals of importance: unit step, unit impulse, sinusoid, complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals, representation of periodic signal using Fourier series, representation of arbitrary functions using Fourier transform, time-domain and frequency domain representation of signals, Fourier transforms of some useful functions, singularity functions, properties of Fourier transform, energy and power density spectra, correlation functions.

Probability theory and random signal: Basics of probability, random variables, transformation of variables, statistical averages, some useful probability models, introduction to random processes, ensemble averages, system with random signal excitation, spectral densities, Gaussian process.

Sampling theorem: Uniform and non-uniform quantization in pulse code modulation (PCM), μ-law and A-law PCM, differential PCM, delta modulation and adaptive delta modulation (DM/ADM), bandwidth requirement of PAM, PPM, PWM, PCM, and TDM.

Noise performance of various communication systems: Noise performance of linearly modulated signals: envelope detector and coherent detector, noise performance of FM, noise performance of PCM.

Text Books

1. Principles of Communication Systems (3rd edition 1995) by Taub, Schilling and G. Saha, McGraw-Hill
2. Communication Systems (4th edition, 2000) by S. Haykin, John wiley & Sons

Reference Books

1. Fundamental of Communication System (1st edition, 2006),by J. G. Proakis, Pearson Education
2. Electronic Communication (4th edition) by Roddy and Coolen, Prentice Hall of India.
3. Electronic Communication System a Complete Course (4th edition) by Schweber, Prentice Hall of India.
4. Electronic Communication Systems (4th edition 1999) by D. Kennedy, Tata McGraw-Hill

ET603 MICROPROCESSOR AND ITS INTERFACING

Teaching Scheme: 04L+1T Total: 05 Credit: 05
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
Duration of ESE : 2 Hrs.30 min.

Microcomputer block diagram and its working, evolution of microprocessors, comparison of 4, 8, 16, 32, 64-bit microprocessors, 8085 microprocessor architecture and its operation, memory orgnisation, memory map, 8085-pin diagram, instruction timings and operation status.
Demultiplexing the low order bus, generating control signals, memory mapped I/O, I/O mapped I/O, address decoding techniques.
Addressing modes, instruction set of 8085, programs using data transfer, arithmetic, logical, branch operation, counter and time delays, stack and subroutines.
Interrupt system of 8085, data transfer schemes, synchronous, asynchronous and interrupt driven data transfer schemes, introduction to DMA data transfer schemes, serial data transfer through SOD and SID pins.
Internal architecture, programming and interfacing of 8255, 8259 and 8279 peripherals
Block diagram of 8086, advantage of segment registers, internal operation, addressing modes, instruction formats, instruction execution timing.
Instruction set of 8086 microprocessor, data transfer, arithmetic, branch, logical, shift, and rotate instructions, assembler directives and operators, stack and subroutine, string instructions.

Text Books

1. Microprocessor, Architecture, Programming and Applications with 8085(5th edition, 2004), by R. S. Gaonkar, Penram International Publication.
2. Microprocessor System 8086/8088 Family (2nd edition, 1996), by G. A. Gibson, Y. C. Liu, Prentice Hall of India.

Reference Books

1. Microprocessor and Interfacing, Programming and Hardware (2nd edition, 2005), by D. V. Hall, Tata McGraw-Hill.
2. Introduction to Microprocessor (3rd edition, 2004), by A. P. Mathur, Tata McGraw-Hill.
3. Microprocessors Principles and Application (2nd edition, 2005), by M. C. Gilmore, Tata McGraw-Hill.

ET604 COMPUTER ORIENTED OPERATION RESEARCH

Teaching Scheme: 04L Total: 04 Credit: 04
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
Duration of ESE : 2 Hrs.30 min.

Operation Research (OR) modeling approach (Problem identification, modeling, finding solution, testing etc.), scope and limitations of OR.
Linear Programming (LP): Assumption and formulation of LP model, solution by graphical method, simplex and two phase simplex method, use of Excel to solve LP model, dual simplex method and sensitivity analysis, transportation and assignment models.
Project Management: CPM and PERT, finding critical path, time-cost trade off, resource smoothing and resource leveling.
Dynamic Programming: Introduction and characteristics, recursion in dynamic programming, investment problem, production scheduling problem, stage coach problem, equipment replacement, budget allocation problem , shortest route models and cargo loading.
Non-Linear Programming: Introduction, types, constrained and unconstrained optimization method, one variable and multivariable, steepest descent method, quadratic programming.
Decision Theory and Game Theory: Introduction, minmax decision procedure, Bays decision procedure with and without data, regret function versus loss function.
minmax and maxmin strategies, expected payoffs, solution of $m \times n$ games, Brown algorithm
Machine Sequencing Problems: *n* jobs through two machines, *n* jobs through three machines, *n* jobs through m machines, two jobs through m machines sequencing problem

Text Books

1. Introduction to Operation Research (1st edition), by B. E. Gillet, McGraw-Hill,
2. Introduction to Operation Research, by H. A. Taha, Prentice Hall of India.
3. Introduction to Operation Research, Concepts and Cases (8th edition, 2004), by Hillier and Liberman, McGraw-Hill.

Reference Books

1. Operation Research (1st edition), by Tiwari and Shandilya, Prentice Hall of India.
2. Introduction to Optimization (3rd edition), by S. S. Rao, Prentice Hall of India
3. Computer Aided Project Management (2nd edition), by P. B. Mahapatra Prentice Hall of India
4. Operation Research (8th edition), by Natrajan, Balsubramani, Pearson Education

ET605 INDUSTRIAL MANAGEMENT AND QUALITY CONTROL

Teaching Scheme: 04L Total: 04 Credit: 04
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
Duration of ESE : 2 Hrs.30 min.

Principles and Techniques of Management: Meaning, difference among business, management, administration and organization; Principles of management, Functions of management (Planning, direction, co-ordination, control, motivation, delegation and decentralization, communication, leadership and decision making), Organization structure and relationships,

Materials Management: Marketing strategy, market research, consumer behaviour, advertising and sales promotion, channels of distribution, pricing of products. classes of material, scope of material control, scope of purchasing department, purchasing procedures, order procedures, inventory control, production planning and control.

Personnel Management: Functions of personnel management (recruitment, selection, promotion, wages payment plans, training and development), Maslow needs, functions and scope of trade unions in Indian industries. Welfare of labour, problems of labour turn over and retention, human attitude, motivation theories, conflict management.

Financial Management: Project report, preparation of profit and loss statement and balance sheet, ratio analysis. Break even analysis, variance analysis, meaning and application of various budgets, types of budgets and their importance, principles of costing, cost sheet preparation.

Quality Control: Concept of quality and quality control, elements of quality, factors controlling quality of design and conformance, on-line and off-line quality control (tools and techniques) process control, process capability, inspection planning and scheduling, vendor rating, sampling inspection, sampling plans, online Taguchi approach.

Quality Management: Quality assurance, seven quality control techniques, concepts and applications of Kaizen, fish-bone diagram, failure mode and effect analysis (FMEA), PDCA cycle, six sigma, zero defect, ISO 9000 series, QS 14000, total quality management, elements of TQM, quality circles, quality audit system.

Text Books

1. Principles of Management, by H. Koontz, O. Donnel C. and Whierich, Tata McGraw Hill
2. Managing for total quality, (3rd edition) by Logothetics, Prentice Hall of India
3. Statistical Quality control, by Grant and Leavenworth, Tata McGraw-Hill

Reference Books

1. Total Quality Management, by S. M. Mody, D. L. Shah and Trust
2. Industrial Management and Managerial Economics, by P.B. Gupta and P. B. Sharma, Ratnasagar
3. Quality Control Systems, J R Taylor, McGraw-Hill
4. Principles of Management, P C Tripathi, P N Reddy, Tata McGraw-Hill
5. Financial Management (6th edition), by P Chandra, Tata McGraw-Hill

ET606 LINEAR INTEGRATED CIRCUITS LABORATORY

Teaching Scheme: 02P Total: 02 Credit: 01
Evaluation Scheme: 25 Internal + 25 External Total Marks: 50

Minimum eight experiments shall be performed from the list given below. The experiments to be carried shall cover entire curriculum and the list is just a guideline.

List

1. Measurement of op-amp parameters (IC 741).
2. Op-amp as voltage follower, adder, etc.
3. Op-amp as an inverting and non-inverting amplifier.
4. Op-amp as an integrator and differentiator.
5. Multivibrator using op-amp.
6. Filter using op-amp.
7. Instrumentation amplifier using op-amp.
8. Multivibrator using IC 555.
9. Phase lock loop parameters, AM and FM detector (IC 565).

ET607 COMMUNICATION ENGINEERING

Teaching Scheme: 02P Total: 02 Credit : 01
Evaluation Scheme: 25 Internal + 25 External Total Marks: 50

Minimum eight experiments shall be performed from the list given below. The experiments to be carried shall cover entire curriculum and the list is just a guideline.

List

1. Amplitude modulation.
2. Frequency modulation.
3. AM transmitter/receiver.
4. FM transmitter/receiver.
5. Noise spectral density.
6. Pulse Amplitude Modulation (PAM).
7. Pulse Position modulation (PPM).
8. Pulse Width Modulation (PWM).
9. Delta Modulation/Adaptive delta modulation (DM/ADM).
10. Time Division Multiplexing (TDM).
11. Five experiment based on Commsim software.

ET608 MICROPROCESSOR AND ITS INTERFACING LABORATORY

Teaching Scheme: 02P Total: 02 Credit: 01
Evaluation Scheme: 25 Internal + 25 External Total Marks: 50

Minimum eight programs shall be performed from the list given below. The programs to be carried shall cover entire curriculum and the list is just a guideline.

List

1. Subtract larger number from smaller number (8 bit) using 8085 and verify the result. Also add two 16 bit numbers.
2. Find greatest number among the series using 8085.
3. Arrange the numbers in descending order using 8085.
4. Find the sum of given numbers in an array.
5. Write a main program and conversion subroutine to convert packed BCD number into equivalent binary number.
6. Perform memory to memory data transfer using 8085.
7. Different modes of 8255 PPI.
8. Addition and subtraction of two 16 bit numbers using 8086.
9. Find greater of two 16 bit numbers using 8086.
10. Transfer block of data from source to destination using string Instructions.

ET609 COMPUTER ORIENTED OPERATION RESEARCH LABORATORY

Teaching Scheme: 02P Total: 02 Credit: 01
Evaluation Scheme: 25 Internal + 25 External Total Marks: 50

Minimum eight programs shall be performed from the list given below. The programs to be carried shall cover entire curriculum and the list is just a guideline.

List

Write a computer program for

1. Two Machine sequencing.
2. Three machine sequencing.
3. Traveling salesman problem.
4. Investment problem.
5. Linear programming.
6. Dual simplex.
7. Two phase simplex.
8. Transportation problem.
9. Critical path method/ programme evaluation review technique.
10. Inventory model (deterministic/probabilistic).

Note: Practical may be performed with any computer programming language, following languages/ packages are suggested
MATLAB/C/C++

ET610 MINOR PROJECT

Teaching Scheme: 02P Total: 02 Credit: 01
Evaluation Scheme: 25 Internal + 25 External Total Marks: 50

- Design, fabrication and testing of electronic circuits
- Learning of detailed electronic circuit design
- Submission of report

GOVT. COLLEGE OF ENGINEERING, AMRAVATI

(An Autonomous Institute of Government of Maharashtra)

B.Tech. (Electronics and Telecommunication)

Curriculum for VII and VIII semester

Department of Electronics and Telecommunication
2009-2010

Approved in Academic Board (Senate) meeting held on 22-05-09

Govt. College of Engineering, Amravati

DEPARTMENT OF ELECTRONICS and TELECOMMUNICATION

DEPARTMENT OF ELECTRONICS and TELECOMMUNICATION

SCHEME FOR B.TECH.

Sem III													
Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
						Theory				Practical		Total	
		Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	CT1	CT2	ESE	Internal	External		
ET301	Engineering. Maths III	4	---	---	4	10	15	15	60	---	---	100	4
ET302	Component Devices andTechnology	4	---	---	4	10	15	15	60	---	---	100	4
ET303	Electrical Engineering.	4	---	---	4	10	15	15	60	---	---	100	4
ET304	Electronics Devices and Circuits	4	1	---	5	10	15	15	60	---	---	100	5
ET305	Instrumentation	4	---	---	4	10	15	15	60	---	---	100	4
ET306	General Proficiency I		---	**2**	2	---	---	---	---	50	---	50	2
ET307	Component Devices andTechnology Laboratory	---	---	2	2	---	---	---	---	25	25	50	1
ET308	Electrical Engineering. Laboratory	---	---	2	2	---	---	---	---	25	25	50	1
ET309	Electronics Devices and Circuits Laboratory	---	---	2	2	---	---	---	---	25	25	50	1
ET310	Instrumentation Laboratory	---	---	2	2	---	---	---	---	25	25	50	1
Total		**20**	**1**	**10**	**31**	**50**	**75**	**75**	**300**	**150**	**100**	**750**	**27**
Sem IV													
ET401	Engineering. Maths IV	4		---	4	10	15	15	60	---	---	100	4
ET402	Fundamentals of communication	4	1	---	5	10	15	15	60	---	---	100	5
ET403	Digital Electronics	4	---	---	4	10	15	15	60	---	---	100	4
ET404	Network analysis	4	---	---	4	10	15	15	60	---	---	100	4
ET405	Humanities and Economics	4	---	---	4	10	15	15	60	---	---	100	4
ET406	General Proficiency II	---	---	2	2	---	---	---	---	50	---	50	2
ET407	Engineering. Maths IV Laboratory	---	---	2	2	---	---	---	---	25	25	50	1
ET408	Fundamentals of communication Laboratory	---	---	2	2	---	---	---	---	25	25	50	1
ET409	Digital Electronics Laboratory	---	---	2	2	---	---	---	---	25	25	50	1
ET410	Network analysis Laboratory	---	---	2	2	---	---	---	---	25	25	50	1
Total		**20**	**1**	**10**	**31**	**50**	**75**	**75**	**300**	**150**	**100**	**750**	**27**

TA :Teacher Assessment **CT: Class Tests** **ESE: End Semester Examination : Duration two hours thirty minutes**

Approved in Academic Board (Senate) meeting held on 22-05-09

Sem V

Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
						Theory				Practical		Total	
		Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	CT 1	CT 2	ESE	Internal	External		
ET501	Electromagnetic fields	4	---	---	4	10	15	15	60	---	---	100	4
ET502	Consumer electronics	4	---	---	4	10	15	15	60	---	---	100	4
ET503	Power Electronics	4	---	---	4	10	15	15	60	---	---	100	4
ET504	Analog Circuits	4	1	---	5	10	15	15	60	---	---	100	5
ET505	Control System Engineering.	4	---	---	4	10	15	15	60	---	---	100	4
ET506	Electromagnetic fields Laboratory	---	---	2	2	---	---	---	---	25	25	50	1
ET507	Consumer electronics Laboratory	---	---	2	2	---	---	---	---	25	25	50	1
ET508	Power Electronics Laboratory	---	---	2	2	---	---	---	---	25	25	50	1
ET509	Analog Circuits Laboratory	---	---	2	2	---	---	---	---	25	25	50	1
ET510	* Laboratory I	---	---	2	2	---	---	---	---	25	25	50	2
Total		**20**	**1**	**8**	**31**	**50**	**75**	**75**	**300**	**125**	**125**	**750**	**27**

Sem VI

Course Code	Name of the Course	Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	CT 1	CT 2	ESE	Internal	External	Total	Credits
ET601	Linear Integrated Circuits	4	---	---	4	10	15	15	60	---	---	100	4
ET602	Communication Engineering	4	---	---	4	10	15	15	60	---	---	100	4
ET603	Microprocessor and its Interfacing	4	1	---	5	10	15	15	60	---	---	100	5
ET604	Computer Oriented Operation Research	4	---	---	4	10	15	15	60	---	---	100	4
ET605	Industrial Management and Quality Control	4	---	---	4	10	15	15	60	---	---	100	4
ET606	Linear Integrated Circuits Laboratory	---	---	2	2	---	---	---	---	25	25	50	1
ET607	Communication Engineering Laboratory	---	---	2	2	---	---	---	---	25	25	50	1
ET608	Microprocessor and its Interfacing Laboratory	---	---	2	2	---	---	---	---	25	25	50	1
ET609	Computer Oriented Operation Research Laboratory	---	---	2	2	---	---	---	---	25	25	50	1
ET610	Minor Project	---	---	2	2	---	---	---	---	25	25	50	2
Total		**20**	**1**	**10**	**31**	**50**	**75**	**75**	**300**	**125**	**125**	**750**	**27**

TA :Teacher Assessment CT: Class Tests ESE: End Semester Examination : Duration two hours thirty minutes

*** Laboratory-I -Experiments will be based on all subjects**

Sem VII

Course	Name of the Course	Teaching Scheme	Evaluation Scheme	Credits

Code						Theory				Practical		Total	
		Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	CT1	CT2	ESE	Internal	External		
ET701	Digital Communication	4	1	---	5	10	15	15	60	---	---	100	4
ET702	Digital Signal Processing	4	---	---	4	10	15	15	60	---	---	100	4
ET703	Electronics Circuit Design	4	---	---	4	10	15	15	60	---	---	100	4
ET704	Fiber Optics Communication	4	----	---	4	10	15	15	60	---	---	100	4
ET705	Elective I	4	----	---	4	10	15	15	60	---	---	100	4
ET706	Digital Signal Processing Laboratory	----	---	2	2	---	---	---	---	25	25	50	1
ET707	Electronics Circuit Design Laboratory	----	----	2	2	---	---	---	---	25	25	50	1
ET708	Fiber Optics Communication Laboratory	----	----	2	2	---	---	---	---	25	25	50	1
ET709	Project and seminar	---	---	4	4	---	---	---	---	100	--	100	4
Total		20	1	10	31	50	75	75	300	175	75	750	27
Sem VIII													
ET801	Digital System Design	4	---	---	4	10	15	15	60	---	---	100	4
ET802	Microwave Engineering.	4	---	---	4	10	15	15	60	---	---	100	4
ET803	Elective - II	4	---	---	4	10	15	15	60	---	---	100	4
ET804	Elective -III	4	---	---	4	10	15	15	60	---	---	100	4
ET805	Digital System Design Laboratory	----	---	2	2	---	---	---	---	25	25	50	1
ET806	Microwave Engineering. Laboratory	---	---	2	2	---	---	---	---	25	25	50	1
ET807	* * Laboratory II	---	---	2	2	---	---	---	---	25	25	50	1
ET808	Project	---	---	6	6	---	---	---	---	100	100	200	8
Total		16	---	12	28	40	60	60	240	175	175	750	27

TA :Teacher Assessment **CT: Class Tests** **ESE: End Semester Examination : Duration two hours thirty minutes**

** Laboratory-II -Experiments will be based on Elective III

Elective I

A. Microprocessor peripherals and Microcontrollers
B. Biomedical Engineering. ,
C. Fuzzy Logic and Neural Network ,
D. Computer Organization and Architecture

Elective - II

A. Wireless Communication
B. Satellite Communication
C. Computer Network and communication
D. Speech processing

Elective - III

A. Digital Image Processing,
B. Very Large Scale Integration Design
C. System Software
D. Bioinformatics

Approved in Academic Board (Senate) meeting held on 22-05-09

ET701 DIGITAL COMMUNICATION

Teaching Scheme : 04L Total: 04 Credit : 04
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
ESE duration : 2 hrs 30 min.

Digital communication system: Introduction to digital signal, difference between analog and digital system, advantage of digital system over analog, elements of digital communication system, source encoder, decoder, channel encoder, decoder, modulator, and demodulator.

Information and channel capacity: Measure of information, entropy and Information rate of independent and dependent sequences, source encoding , Shannon's encoding algorithm, Huffman encoding algorithm, discrete communication channel, capacity of discrete communication channel. Shannon's theorem on channel capacity.

Base band transmission: Discrete PAM signals, power spectra of discrete PAM signals, baseband binary data transmission system, inter symbol interference, Nyquist's criteria for distortionless baseband binary transmission, correlative coding, duobinary signaling, modified duobinary technique, equalization, eye diagram, self synchronization for baseband PAM system, scrambler and unscrambler.

Digital modulation techniques : Digital carrier modulation schemes, binary ASK, PSK, FSK coherent scheme, probability of errors, comparison of digital modulation systems, basics of DPSK, QPSK, MSK. Synchronization, carrier synchronization, symbol synchronization.

Error controlling and coding : Introduction to error control coding, methods of controlling errors, type of errors and code, linear block codes, matrix description of linear block code, error detection and error correction capabilities of linear block code, cyclic code.

Modern techniques of communication: Introduction to mobile communication, cellular mobile telephone architecture, frequency assignments, frequency reuse, cell splitting, call initialization, call termination, handover. Multiple access schemes TDMA, FDMA, CDMA, spread spectrum communication, D.S. spread spectrum, frequency hoping spread spectrum, comparison.

Text Books:

1. Digital and Analog Communication Systems, Shanmugam K.S,John 2nd edition, Wiley and Sons, 1996 .
2. Digital Communication, Simon Haykin, 1st edition, John Wiley and Sons, 1996.

Reference Books:

1. Digital Communication, Proakis J. K, 2nd edition , Mc-Graw Hill Book Co., London, 2008.
2. Mobile Cellular Telecommunications Systems, Wcy Lee, 1st edition, Mc-Graw Hill International Editions, 1990 ,
3. Principles of Communication Systems, Taub, Herbert, Schilling D.L, Mc-Graw Hill International Book Co, 1986.
4. Modern Digital and Communication Systems , Lathi B. P., Holt Rinchart and Winston Inc, 1993.

ET 702 DIGITAL SIGNAL PROCESSING

Teaching Scheme : 04L Total: 04 Credit : 04
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
ESE duration : 2 hrs 30 min.

Introduction to DSP: Frequency domain definition, description, properties of typical signals and systems, discrete time sequences and systems, definition, representation and properties of discrete time signals and linear time invariant systems, convolution and correlation, stability criteria of discrete time systems, linearity unit sample response, solution of linear difference equations.
Z- Transform: Direct Z transform and inverse Z transform, properties, complex Z-plane, ROC determination of filter coefficients, analysis of LTI systems in Z- domain, relationship between Fourier transform and Z-transform.
Fourier analysis: Introduction to Fourier transform of discrete time signal, properties and application of F.T., inverse Fourier transform, sampling and reconstruction of continuous time signal from sequences, Fast Fourier Transform
(FFT), algorithms, decimation in time and frequency, circular convolution and linear convolution from DFT.
Design of Filters: Filter categories, direct form I, direct form II, cascade and parallel structure for IIR and FIR filter, analog filter types, butter worth, elliptic filter, specification and formulae to decide filter order, methods to convert analog filter into IIR digital.
Digital Filters: Steps in filter design, FIR design by frequency sampling method, design by pole zero placements, FIR filter design by windowing method, rectangular, triangular and Blackman window, IIR approximation of derivatives, impulse invariant, bilinear, matched Z transformation.
Multi rate DSP: Introductory concept of multi rate signal processing, decimators and interpolator, filter banks, applications, design of practical sampler, rate converters, multistage implementation for sampling rate conversion, introduction to DSP processors.

Text Books:
1. Digital Signal Processing, Proakis and Monolakis, 3rd edition PHI, 1996 .
2. Digital Signal Processing, Mitra S.K., 3rd edition TMH, 1998.

Reference Books:
1. Discrete Time processing , Oppenhavm and Scheffer, PHI, 2002.
2. DSP and Multi rate Systems , P.P. Vaidyanathan, PHI, 2004.
3. Digital Signal Processing, Ifeachorand Jervis, 2rd edition, PHI, 2002.
4. Digital Signal Processors , B.Venkatramani and M. Bhaskar, TMH.

ET703 ELECTRONIC CIRCUIT DESIGN

Teaching Scheme : 04L Total: 04 Credit : 04
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
ESE duration : 2 hrs 30 min.

Regulated power supply : Design of regulated power supply using transistor as a regulated power supply, op-amp regulator, three-terminal regulator, switching power supplies, heat sinks

Op-amp circuits : Design of DC amplifier, comparator, window detectors, scaling and summing amplifier using IC741 / IC 3245 or equivalent.
Waveform generators and Filters : Design of waveform generator using IC 741, IC 8038, IC 566, design of sweep generator, voltage controlled oscillator, design of IC 555 based circuits, design of first and second order filters, design of notch filter.
Instrumentation amplifier: Design of instrumentation amplifier, temperature controller /indicator using thermocouple, resistance thermal detector and thermister.
Circuit design using MULTI-SIM : Design and simulation of analog /digital circuits, study of import of VHDL/Verilog models, import/export of SPICE models, and export to standard PCB design packages.
Introduction to VHDL : Basic language elements, behavioral modeling, sequential processing, data types, attributes, configurations, synthesis and synthesis issues, RTL simulation, place and route, introduction to VERILOG.
Design using HDLs : Design of combinational blocks such as adders, MUX, DEMUX , encoders, decoders, ALU, design of sequential circuits, asynchronous and synchronous design, issues, state machine modeling (moore and mealy machines).

Text Books :
1. Op-amp and linear integrated circuits, R.A. Gayakwad, 4th editionPrentice-Hall Inc, 2000.
2. VHDL Primer, J.Bhasker, 3rd edition, Pearson Education,2001.

Reference Books:
1. A Monogram of Electronic circuit design , Goyal-Khetan
2. VHDL , Douglas L. Perry, 3 rd edition, Mc- Graw Hill publication.
3. Applications and design with analog integrated circuits, J. Michael Jacob, 2nd edition, , Pearson Education, 2007.

ET704 FIBER OPTIC COMMUNICATION

Teaching Scheme : 04L Total: 04 Credit : 04
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
ESE duration : 2 hrs 30 min.

Introduction to fiber optic: Basic optic principles, snell's law, manufacturing of fiber, different manufacturing techniques, different splicing techniques and connectors.

Optical fiber properties: Theory of circular wave guide, modes in optical fibers, Single mode fiber, multimode fiber, numerical aperture (N.A), power flow. attenuation, absorption losses, bending losses, scattering losses, dispersion, intra modal - intermodal dispersion, and bandwidth parameters. nonlinear effect in single-mode fiber.

Optical sources and detectors: Optical emission from semiconductors, LED, power efficiency, double heterojunction LED, Basic concept of Lasers, semiconductor injection lasers, optical detection principle, absorption, quantum efficiency, responsivity, PIN photo diode, detector noise characteristics, avalanche photo diode(APD) and noise in photodiode, metal semiconductor metal(MSM) photo detectors.

Principles of fiber optic communication: Analog and digital transmission, digital coding , electrical and optical bandwidth, dispersion effects, bandwidth and data rate, dynamic range, noise and bit error rate.

Optical transmitters, receivers, fiber optics test and measurement: Optical transmitter, receiver, digital system planning consideration, power budgeting coherent and non

coherent system, modulation and demodulation scheme, wavelength multiplexing, optical switches, measure fiber output power, perform decibel and dBm power measurement, use of optical time domain
reflectometer (OTDR).

Optical amplifiers and networks: Erbium doped fiber amplifer (EDFA), photonic switching, optical– SONET/SDH, optical interfaces, ring topology, star architecture

Text Books :

1. Optical Fiber Communication and Application, Senior J.M., 3rd edition, PHI, 1998.
2. Optical Fiber Communication, Gerd Keiser, 4th edition, TMH, 2008.

Reference Books:

1. Optical Communication System , Gowar, 3rd edition, Prentice Hall India. , 2000.
2. Fiber optic communication technology, D.F Mynbacv and L. Scheiner, 3rd edition, Pearson Education, 2001.

ET705 ELECTIVE I
(A)MICROPROCESSOR PERIPHERALS AND MICROCONTROLLERS

Teaching Scheme : 04L Total: 04 Credit : 04
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
ESE duration : 2 hrs 30 min.

Interfacing Devices with 8085: Architecture and programming of programmable DMA controller 8237, programmable internal timer/counter 8253, architecture and functioning of floppy disk controller 8272.
Computer peripherals of interfacing: CRT controller 8275, architecture and function of programmable DOT matrix printer controller 8295, USART 8251.
Analog to Digital and Digital to Analog conversion techniques: Case study of ADC 0809, ADC 1210, DAC0808, DAC 1008 and their interfacing with microprocessor, use of ADC in applications like measurement of temperature, flow, speed and pressure.
Microcontroller 8051: Architecture of 8051, signal description, register set, timer structure and their modes, input/output port structure, interrupts and serial port modes, Instruction set of 8051, addressing modes, memory and I/O addressing , programming using 8051.
PIC microcontroller: Introduction to PIC microcontroller, PIC 16C6X/7X, file selection register (FSR), memory organization, instruction set, addressing modes, I/O ports, interrupts, PIC 16C61/71 timers, PIC 16C71 analog to digital converter(ADC), introduction to ARM processor.

Text Books:

1. Microprocessor Interfacing Programming and Hardware, D.B.Hall and V.Douglas, 2nd edition, TMH Book Co. New York, 1991.
2. The 8051 microcontroller, Kenneth Ayala, 3rd edition, Delmar Cengage Learning, 2005.

Reference Books:

1. Advanced microprocessors and Peripherals, A.K.Ray and K.M.Bhurchandi, 2nd edition, Tata McGraw Hill, 2008.
2. Design with PIC microcontrollers, John B. Peatman, 1st edition, PHI, 1998.
3. Fundamentals of microprocessors and microcomputers, B.Ram, 4th edition, Dhanpat Rai publication, 2004.
4. 8051 Microcontroller and Embedded System, Muhammad Ali Mazidi, 2nd edition, Prentice Hall, 2000.

ET705 ELECTIVE I
(B) BIOMEDICAL ENGINEERING.

Teaching Scheme : 04L Total: 04 Credit : 04
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
ESE duration : 2 hrs 30 min.

Anatomy and Physiology : Elementary ideas of cell structure, heart and circulatory system, control nervous system, musclo-skeletal system, respiratory system, body temperature and reproduction system.
Biomedical Equipment ,Signals and Their recording: Diagnostic, therapeutic and clinical laboratory equipment, bioelectric signals (ECG, EMG, EOG and ERG) and their characteristics, bio-electrodes, electrodes tissue interface, contact impedance, types of electrodes, electrodes for ECG, EEG and EMG.
Transducers for Biomedical Application: Resistive transducers - muscle force and stress (strain gauge), spirometry (potentiont) ,humidity(gamstrers), respiration (thermistor)**,** inductive transducers- flow measurements, muscle movement (LVDT) capacitive transducers - heart sound measurement, pulse pick up photoelectric transducers - pulse transducers, blood pressure, oxygen analyses, piezoelectric transducers - pulse pickup, ultrasonic blood flow meter, chemical transducer- Ag-alfalfas (electrodes, PH electrode).
Signal recording machines and Patient Monitoring system: Physiological pre-amplifier and specialized amplifiers, ECG lead systems details, ECG, EMG, and EEG machines, heart rate measurement pulse rate measurement, respiration, rate measurement, blood pressure measurement, microprocessor applications in patient monitoring.
X- Ray Machine and **Safety Aspect for Medical :** Basic X-ray components and circuits, types of X-ray machines e.g. general purpose, dental image intensifier system, table shooting and maintenance of X- ray machine, gross current, micro current shock, safety standards rays and considerations, safety, testing instruments, biological effects of X-rays and precautions ,operation and function of all the controls of dental X-ray machine, Computerized Axial Tomography (CAT), computerized aided ECG analysis, computerized catheterization.

Text Books :

1. Hand book of Medical instruments R.S. Khandpur , 6th edition, 2004,TMH
2. Biomedical Instrumentation and Measurement, Carr and Brown, 3rd edition, Pearson Education,1996.

Reference Books :

1. Principles of Applied Biomedical Instrumentation ,Goddes and Baker, 4th edition, John Wiley, 1986.
2. Medical Instrumentation, John. G. Webster , 2nd edition, John Wiley, 2006.
3. Medical Electronics and Instrumentation, Sanjay Guha , 5th edition

University Publication, 2006.

ET705 ELECTIVE I
(C) FUZZY LOGIC AND NEURAL NETWORKS

Teaching Scheme : 04L Total: 04 Credit : 04
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
ESE duration : 2 hrs 30 min.

Introduction of Neurons: Biological neurons and their artificial models, introduction to neural computing, components of neuron, input and output weight, threshold, weight factors, transfer functions.
Supervised Learning : Introduction, single layer network, perceptron, linear separability, training algorithm and limitations ;multilayer network: architecture of feed forward network, learning rule, generalized delta rule, learning function;back propagation algorithm.
Unsupervised Learning: Introduction, counter propagation networks, Kohonen's self organizing maps, Hopfield networks.
Fuzzy Sets: Introduction , uncertainty in information, basic concepts of fuzzy sets, operations on fuzzy sets, properties; fuzzy relations, operations, properties, value assignments.
Membership functions : Features, fuzzification, membership value assignments, fuzzy rule based systems, graphical technique of inference, defuzzification :lambda-cuts for fuzzy sets and fuzzy relations, defuzzification methods.
Applications: Fuzzy pattern recognition, feature analysis, partitioning of feature space, single sample identification multi feature pattern recognition, simple fuzzy logic controller: control system design stages, assumptions in a fuzzy control system design, general fuzzy logic controllers, simple examples.

Text Books

1. Introduction to Artificial Neural Systems, J.M. Zurada , 1st edition, Jaico Publishing House, 2004.
2. Fuzzy Logic with Engineering Applications, Timothy Ross, 2nd edition, Wiley, 2004.

Reference Books

1. Neural Networks in Computer Intelligence, Limin Fu, 1st edition, McGraw Hill, 2003.
2. Neuro-Fuzzy and Soft Computing, Jang, Sun, 1st edition, Mizutani, Pearson Education, 2004.
3. Neural Networks and Fuzzy systems, Kosko Bart , 1st edition, PHI, 1992.

ET705 ELECTIVE I
(D) COMPUTER ARCHITECTURE AND ORGANIZATION

Teaching Scheme : 04L Total: 04 Credit : 04
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
ESE duration : 2 hrs 30 min.

Computer performance considerations, performance measures, speed up techniques.
Processor Basics: CPU organization , fundamentals, additional features, data representation , basic formats, fixed-point numbers, floating-point numbers, instruction sets, instruction formats, instruction types, programming considerations.

Datapath Design: Fixed-point arithmetic, addition and subtraction, multiplication and division, arithmetic-logic units, combinational ALUs, sequential ALUs, advanced topics, floating-point arithmetic and pipeline processing.
Control design: Basic concepts, hardwired control, design examples, microprogrammed control, basic concepts, multiplier control unit, CPU control unit, pipeline control, instruction pipelines, pipeline performance, superscalar processing.
Memory Organization: Memory systems, multilevel memories, address translation, memory allocation, cache memories, main features, address mapping
Introduction to Parallel Processing: Processor-level parallelism, multiprocessors, fault tolerance.

Text Book:

1. Computer Architecture and Organization, John P.Hayes , 3rd edition McGraw Hill,1998.
2. Computer system Architecture, Mano Morris, 3rd edition ,Prentice Hall of India ,New Delhi, 1993

Reference Books:

1. Structure Computer Organization, Tanenbaum A.S, 5th edition,Prentice Hall of India, New Delhi, 2006.
2. Computer Organization and Architecture, William Stallings, 6th edition, Prentice Hall of India

ET706 DIGITAL SIGNAL PROCESSING LABORATORY

Teaching Scheme: 02P Total: 02 Credit: 01
Evaluation Scheme: 25 Internal + 25 External Total Marks: 50

It is representative list of practicals. The instructor may choose experiments as per his requirements (so as to cover entire contents of the course) from the list or otherwise. Minimum 08 experiments should be performed
List

1. To perform folding, shifting, time scaling operation on discrete time signal
2. To perform scalar addition and multiplication
3. Perform autocorrelation and cross correlation on signal
4. Write MATLAB code to evaluate impulse response of given difference equation
5. Write MATLAB code to find poles and zeros and express H[Z] in factored form
6. Compute FFT of different signals and sequence
7. Study of design of Butterworth and Chebyshev analog / digital filter
8. FIR filter design using window technique (rectangular window)
9. Write MATLAB code to transform an analog into digital IIR filter using impulse invariance method

ET707 ELECTRONICS CIRCUIT DESIGN LABORATORY

Teaching Scheme: 02P Total: 02 Credit: 01
Evaluation Scheme: 25 Internal + 25 External Total Marks: 50

It is representative list of practicals. The instructor may choose experiments as per his requirements (so as to cover entire contents of the course) from the list or otherwise. Minimum 08 experiments should be performed

List

1. To design and realize a transistorized series pass low voltage regulator
2. To realize a astable multivibrator using IC 555 Timer.
3. To realize a monostable multivibrator using IC 555 Timer.
4. To design a First order high pass filter using op-amp IC 741.
5. To design a second order low pass filter using op-amp IC 741.
6. To design a triangular wave generator using op-amp IC 741.
7. To design Voltage controlled oscillator using IC 566.
8. To design Window detector using op-amp IC 741.
9. To realize and simulate an electronic circuit and to carry out I-V analysis using MultiSIM-9.
10. To realize and simulate an electronic circuit and to carry out frequency analysis using MultiSIM-9.
11. To realize and simulate an electronic circuit with an import/export to various other packages using MultiSIM-9.

ET708 FIBER OPTICS COMMUNICATION LABORATORY

Teaching Scheme: 02P Total: 02 Credit: 01
Evaluation Scheme: 25 Internal + 25 External Total Marks: 50

It is representative list of practicals. The instructor may choose experiments as per his requirements (so as to cover entire contents of the course) from the list or otherwise. Minimum 08 experiments should be performed

List

1. Optical fiber cable as a light guide
2. Fiber optic cable transmission
3. Characteristics of connectors and splices
4. Index-matching procedures
5. Fiber optic transmitter
6. Receiver design
7. Fiber termination techniques
8. Investigate reflection, refraction and critical angle.
9. Measure wavelengths of light using the techniques of Young, Michelson and Lloyd.
10. Test a lens for defects, collimate light and evaluate a person's visual perception skills.
11. Capture light in optical fiber and investigate fiber optics phenomena.
12. View a hologram, observe interference rings and measure diffraction patterns with a ruler.

13. Determine the index of refraction of a liquid or transparent solid by measuring bending in the intense laser beam as it enters or leaves the material.
14. Study characteristics of light: wavelength, interference, diffraction and polarization.

ET709 PROJECT AND SEMINAR

Teaching Scheme: 04P Total: 04 Credit: 04
Evaluation Scheme: 100 Internal Total Marks: 100

100 marks divided in two parts, 50 marks for Seminar and 50 marks for project work

A. Seminar :

1. Student shall select a topic for seminar which is not covered in curriculum. Student shall complete the conceptual study of the selected topic and expected to know functional and technical details of selected topic
2. Before end of semester students shall deliver a seminar and submit seminar report in proper format consisting of
    - Literature survey
    - Concept
    - Functional and Technical detail
    - Present status
    - Future scope
    - Application
    - Comparison with similar technique
    - References
3. Student shall deliver a seminar on report submitted which shall be assessed by two examiner (one should be guide) appointed by HOD

B. Project :

1. Students have to complete project work in VIIth and VIIIth semester. In general a group of 4 -5 student should be allowed to complete one project
2. In VIIth semester student shall complete literature survey and finalized the topic for project. They shall submit synopsis on the selected topic to HOD. On approval of project topic , they shall complete the design work and procure the required components.
3. Before the end of the semester student shall submit one copy of progress report in proper format covering the total work completed by the group
4. There shall be oral exam based on report submitted by student. The oral examination shall be conducted by two examiner (one should be guide) appointed by HOD

ET801 DIGITAL SYSTEM DESIGN

Teaching Scheme : 04L Total: 04 Credit : 04
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
ESE duration : 2 hrs 30 min.

Introduction to digital logic : Review of switching algebra, boolean algebraic theorems, function of binary variables, standard form of logical functions, minimization methods of

boolean functions, K-map up to five variables, Quine Mcclusky method, don't care conditions and it's effects.
Combinational logic :Analysis and synthesis of AND – OR, universal gates, combinational logic design using 74/54 series MSI chips concerning to binary parallel adders, Look-ahead carry adder construction , multiplexers, demultiplexer, decoders, encoders, comparators, code converters, priority encoders, parity generator/ checker and BCD-to-seven segment decoder.
Programmable logic devices : Combinational logic design using PLDs like ROM array, PLA, PAL, preliminary design concepts using CPLDs and FPGAs.
Synchronous Sequential circuits : Design of counter and sequential networks, analysis of clocked sequential networks, general models of sequential machines, mealy and moore machine, equivalence and minimization networks, derivation of state graph and tables, reduction of state assignments.
Asynchronous Sequential circuits: Analysis of asynchronous sequential networks, derivation and reduction of primitive flow tables, state assignments and realization of flow tables, hazards, asynchronous sequential network design.
Fault detection and location : Fault detection and location in combinational circuits, path sensitizing method, Equivalent - Normal-Form (ENF) method,
Two-level fault detection, fault detection and location in sequential circuits using circuit test approach.

Text Books :

1. Fundamental of Logic Design, Charles H. Roth Jr., 4th edition, Jaico , 2003. Publication.
2. Digital Circuit and Logic Design S.C. Lee, 3rd edition, Prentice Hall of India Pvt. Ltd.

Reference Books:

1. Modern Digital Electronics R.P.Jain, 3rd edition, TMH Publication, 2003.
2. Digital Electronic Circuits and Systems, N.M. Morris, 2nd edition , Mac millan Press.
3. Fault Tolerant and Fault Testable Hardware Design , Parag K. Lala, B.S.

ET802 MICROWAVE ENGINEERING

Teaching Scheme : 04L Total: 04 Credit : 04
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
ESE duration : 2 hrs 30 min.

Microwave communication: Introduction, Microwave Spectrum and Bands, Applications of Microwaves.
Rectangular waveguides: TE/TM mode analysis, expressions for fields, characteristic equation and cut-off frequencies, filter characteristics, dominant and degenerate modes, sketches of TE and TM mode fields in the cross-section, mode characteristics – phase and group velocities, wavelengths and impedance relations power transmission and power losses in rectangular guide, related problems, introduction to circular wave guide.
Microstrip lines: Introduction, Zo relations, effective dielectric constant, losses, Q factor.
Microwave tubes: Limitations and losses of conventional tubes at microwave frequencies, microwave tubes – O type and M type classifications. O-type tubes, two cavity klystrons structure, velocity modulation process and applegate diagram, bunching process and small signal theory, expressions for o/p power and efficiency. reflex klystrons structure, applegate diagram and principle of working, mathematical theory of bunching, power output,

efficiency, electronic admittance, oscillating modes and o/p characteristics, electronic and mechanical tuning, related problems, significance, types and characteristics of slow wave structures; structure of TWT and amplification process (qualitative treatment), suppression of oscillations, nature of the four propagation constants, gain considerations.
M-type tubes: Introduction, cross-field effects, magnetrons – different types, eight cavity cylindrical travelling wave magnetron, Hull Cut-off and Hartree Conditions, modes of resonance and PI mode operation, separation of PI mode, o/p characteristics.
Microwave solid state devices: Introduction, classification, applications. varactor diode, step recovery diode, parametric amplifiers, tunnel diode, gunn diode, negative resistance amplifier, PIN diode, IMPATT and TRAPATT diodes, MASAER'S.
Wave guiding system (passive components): Microwave passive components, terminator, attenuator, phase changer, directional coupler, hybrid junction, microwave propagation in ferrites, devices employing, Faraday rotation scattering matrix formulation for N port junction
Microwave resonators and filters: Basic resonant circuits RLC, transmission line resonators, Fabry Perot resonator, rectangular and circular cavities and their Q, transmission line filter, quarter wave and direct coupled cavity filter.
VHF, UHF And microwave antennas: Arrays with parasitic elements, Yagi - Uda arrays, folded dipoles and their characteristics, reflector antennas, flat sheet and corner reflectors, paraboloidal reflectors, geometry, characteristics, types of feeds, F/D ratio, spill over, back lobes, aperture blocking, off-set feeds, cassegrainian Feeds. horn Antennas, types, optimum Horns, design, characteristics of pyramidal horns, lens antennas, geometry, features, dielectric Lenses and Zoning, applications.

Text Books:

1. Microwave Devices and Circuits, , Samuel Y. Liao, 3rd edition, PHI, 1994.
2. Antennas for All Applications, , John D. Kraus and Ronald J. Marhefka, 3rd edition, Tata McGraw- Hill, 2003.

Reference Books

1. Microwave Engineering Passive Circuits, Peter A. Rizzi, 1st edition, PHI,1999.
2. Electronic and Radio Engineering, F.E. Terman,4th edition, McGraw-Hill,1955.
3. Foundations for Microwave Engineering, R.E. Collin, 2nd edition, IEEE Press, John Wiley, 2002.
4. Electromagnetic Waves and Radiating Systems, E.C. Jordan and K.G. Balmain, 2nd edition, PHI, 2000.

ET803 ELECTIVE II
(A) WIRELESS COMMUNICATION

Teaching Scheme : 04L Total: 04 Credit : 04
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
ESE duration : 2 hrs 30 min.

Introduction to wireless communication system: Evolution of cellular mobile systems(1st, 2nd, 3rd generation), A basic cellular system, cell shape, concept of frequency reuse, hand off strategies, power control operation of cellular systems, example of cellular calls.

Cellular concept - system design fundamentals: Frequency assignments, channel assignment strategies, co-channel and non-co-channel interference, cellular system capacity, performance criteria, trunking and grade of service, improving coverage and capacity in cellular system.

Multiple access technique for wireless communication: FDMA, TDMA, FHMA, SDMA, Packet radio. Mobile Radio propagation and Antennas, radio propagation mechanism, path loss modeling and signal coverage, multipath propagation, fading, doppler shift, fast and slow fading, control of fading in mobile systems, Antennas at cell site, mobile antenna, diversity.

Wireless systems and standards: GSM system architecture, radio subsystem, channel types, frame structure, signal processing in GSM, CDMA (IS-95), frequency and channel specifications, forwardand reverse CDMA channel.

Cordless systems and WLL: Introduction to cordless systems, CT2 and DECT standards, DECT architecture, DECT frame format and radio link, DECT operation, IEEE802.16 ,role of WLL, propagation considerations for WLL, LMDS and MMDS.

Wireless LAN: Overview of wireless LAN, wireless LAN technologies, infrared, spread-spectrum, narrow band microwave LAN, mobile data networks, CDPD, GPRS, WAP.

Bluetooth: Overview, radio specification, base band specification, link manager specifications.

Text Books:

1. Mobile Cellular Telecommunications, William CY Lee., 2nd edition, 1995, MGH
2. Wireless Communications Principles and Practice , Theodore S. Rappaport, 2nd edition, Pearson Education, 2002.

Reference Books :

1. Wireless Communications and Networks, William Stallings, 3rd edition, Pearson Education, 2003.
2. Principles of Wireless Networks , K. Pahlavan and P. Krishnamurthy, 2nd edition, Pearson Education , 2002.
3. Mobile Communications, Jochen Schiller, 2nd edition, Pearson Education, 2002.
4. The Essential Guide to Wireless Communication Applications , Andy Dornam, 3rd edition, Pearson Education, 2003.

ET803 ELECTIVE II
(B) SATELLITE COMMUNICATION

Teaching Scheme : 04L Total: 04 Credit : 04
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
ESE duration : 2 hrs 30 min.

Overview of satellite systems: Introduction to satellite frequency bands, satellite types – LEO,MEO, GEO and HEO, communication satellite system, orbit, modulation, transmission and multiplexing, India's advancement in satellite program a brief history.

Orbits and launching methods: Kepler's law, orbital aspects of satellite communication, orbital period and velocity, effects of orbital inclination, azimuth and elevation, converge angle and slant range, orbit determination, orbit perturbations orbital effects in communication, system performance, launch vehicles and propulsion.

Satellite channel: Radio wave propagation, polarization, antennas, atmospheric losses, receiver noise, carrier to noise ratio, satellite link analysis, frequency reuse and depolarization.

Satellite Transponder: The transponder model, satellite front end, RF filtering of digital carriers, satellite signal processing, transponder limiting, nonlinear satellite amplifier, RF link.

Multiple access: Principles of frequency multiple access system, FDMA channelization, principles of TDMA system, satellite effects on TDMA performance, code division multiple access, synchronized, non-synchronized CDMA,DAMA, antijam advantages of spectral spreading, comparison of Multiple access techniques.

Application of satellite communication: Earth station technology and satellite services, earth station design, tracking, equipment for earth station, domestic satellite systems using small earth stations, VSAT, Global positioning system, satellite navigation, direct broadcast satellite television and radio, satellite services and the internet.

Text Books :

1. Satellite Communication, Robert M.Gagliardi, 1st edition, CBS publications and Distributors, 1987.
2. Satellite Communication, Pratt Timothy, Bostian W.Charles and Jeremy Allnutt, 2nd edition, Willey International Publication, 2003.

References:

1. Satellite Communication, Dennis Roddy, 3rd edition, 2001,Mc-Graw Hill
2. Satellite Communication systems engineering, Wilbur L, Henri, Robert, 2nd edition, Pearson Education, 2003.
3. www.isro.org

ET803 ELECTIVE II
(C) COMPUTER NETWORK AND COMMUNICATION

Teaching Scheme : 04L Total: 04 Credit : 04
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
ESE duration : 2 hrs 30 min.

Introduction: Communication network, data communication, components of data communication, data representation, and data flow.

Types of communication networks: LAN, MAN, WAN, LAN topologies, bus, ring, star, network models, OSI model, layered architecture, various layers in OSI model in detail, introduction to circuit switching, packet switching, message switching.

Data Link control Protocols: ARQ retransmission strategy, stop and wait ARQ, go-back-N ARQ, selective repeat ARQ, piggybacking, sliding window protocol, framing, HDLC, SDLC, LAPD, queuing models.

Multiple Access Protocol: Channel allocation, random access methods - ALOHA, slotted ALOHA, CSMA, CSMA/CD, control access methods - polling, token passing by token ring, token bus.

TCP/IP Protocols : Overview of TCP/IP, UDP, IP address type, IP addressing and related issues, IP address resolution techniques, IP datagram and datagram forwarding.

Networking devices and routing techniques: Hubs, repeaters, bridges, routers, gateways, switches, routing switches, routing algorithms; fixed routing, random routing, flooding

routing, and adaptive routing.
Introduction to Ethernet: Frame relay, FDDI, introduction to SONET/SDH, ISDN and Broadband ISDN, introduction to BLUETOOTH technology architecture, layers and frame format in BLUETOOTH, introduction to electronic mail architecture, user agent, message transfer agent-SMTP, introduction to ATM technology, its architecture and layers.

Text Books :

1. Computer Networks , Andrew S. Tanenbaum, 4th edition, Prentice Hall Publications, 2002.
2. Data Communications and Networking, Behrouz Forouzan, 4th edition, Tata McGraw Hill Publications, 2006.

Reference Books

1. Computer Networks and Internets, Douglas E. Comer, 4th edition Prentice Hall Publications, 2003 .
2. Data and Computer Communications, William Stallings, 8th edition, Prentice Hall Publications, 2007.
3. Local Area Networks , Gerd Keiser, 2nd edition, Tata McGraw Hill Publications, 1989 .

ET803 ELECTIVE II
(D) SPEECH PROCESSING

Teaching Scheme : 04L Total: 04 Credit : 04
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
ESE duration : 2 hrs 30 min.

Nature of speech signal : Speech production mechanism, classification of speech, sounds, nature of speech signal, models of speech production ; speech signal processing: purpose of speech processing, digital models for speech signal ; digital processing of speech signals, significance, short time analysis.
Time domain methods for speech processing : Time domain parameters of speech, methods for extracting the parameters, zero crossings, auto correlation function, pitch estimation.
Frequency domain methods for speech processing : Short time fourier analysis, filter bank analysis, spectrographic analysis, format extraction, pitch extraction ; analysis synthesis systems.
Linear predictive coding of speech : Formulation of linear prediction problem in time domain, solution of normal equations, interpretation of linear prediction in auto correlation and spectral domains.
Homomorphic speech analysis : Central analysis of speech, format and pitch estimation.
Applications of sppech processing: Introduction of application based on speech recognition and speech synthesis.

Textbooks

1. Digital processing of speech signals, L.R. Rabiner and R.E Schafer, 1st edition, Prentice Hall, 1978.
2. Fundamentals of speech recognition, Signal Processing, Rabiner L. Juang B.H, 1st edition, Prentice Hall,1993.

Reference Books

1. Speech Analysis Synthesis and Perception, J.L Flanagan , 2nd edition, Sprenger Vertag,1972.
2. Principles of Computer Speech, I.H.Witten , 1st edition, Academic press ,1983.

ET804 ELECTIVE III
(A) DIGITAL IMAGE PROCESSING

Teaching Scheme : 04L Total: 04 Credit : 04
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
ESE duration : 2 hrs 30 min.

Introduction to digital image processing : Digital image fundamental, component of image processing system, elements of visual perception, simple image model, sampling and quantization, basic relationships between pixel, imaging geometry, Gray scale image representation.
Image Transforms: Introduction to the Fourier Transform, DFT, properties of two dimensional Fourier Transform, FFT, Hadamard, Harr DCT, slant transform.
Image enhancement, basic techniques, enhancement by point processing, spatial filtering, enhancement in frequency domain, histogram based processing, homomorphic filtering.
Image Restoration: Degradation model, diagonalisation concept, algebraic approach to restoration. inverse filtering, Weiner (CNS) filtering restoration in spatial domain, Basic morphological concept, morphological principles, binary morphology, Basic concepts of erosion and dilation.
Image Compression: Fundamentals, image compression models, elements of information theory, lossy and predictive methods, vector quantization, run length coding, Hauff coding, and lossless compression, compression standards.
Image Segmentation: Detection of discontinuities, edge linking and boundary detection, thresholding, region oriented Segmentation.

Text Books:

1. Digital Image Processing, Gonzalez and Woods, 2nd edition, Prentice Hall, 2005.
2. Digital Image Processing, A.K.Jain, 2nd edition, PHI, 2004.

Reference Books:

1. Digital Image Processing, William K. Pratt, 3rd edition, John Wiley, 2005.
2. Digital Image Processing and Computer Vision, Schalkoff R. J. , John Wiley and Son, 1988.

ET804 ELECTIVE III
(B)VERY LARGE SCALE INTEGRATION DESIGN

Teaching Scheme : 04L Total: 04 Credit : 04
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
ESE duration : 2 hrs 30 min.

Introduction to VLSI Circuits: MOS transistor switch, CMOS circuits and Logic design, realization of universal gates, compound gates, tristates, multiplexers, latches using MOS transistors, CMOS fabrication and layout **,**CMOS inverter, fabrication process, layout design rules, design flow, design entry, function simulation, planning, placement and routing.
MOS Transistor theory and modeling : Ideal I-V characteristics, C-V characteristics, MOS capacitance models, non-ideal I-V effects, analysis using CAD tools.

CMOS Processing technology : Wafer formation, well and channel formation, contacts and metallization, design rules, interconnects, circuit elements, Design Rule checking(DRC), manufacturing issues.
Circuit characterization and performance estimation : Resistance, capacitance and inductance estimation, delay estimation, delay models, transistor sizing, static and dynamic power dissipation, low power design, reliability issues.
CMOS logic design : Basic physical design of simple logic gates, design of CMOS NAND gate, adder cell, comparator circuit, RS latch, clock divider, shift registers, analog cells using CMOS layout design tool.
Analog integrated circuit design using CMOS : Single stage amplifier, differential amplifier, voltage regulator, Analog IC design, operational amplifier, Digital to Analog and Analog to Digital converters.

Text Books :

1. CMOS VLSI Design A circuits and systems perspective, Neil Weste, David Harris, Ayan Banerjee, 3rd edition, Pearson Education, 2006.
2. Basics of CMOS cell design, Etienne Sicard, Sonia Bendhia, 1st edition TMH Publications, 2005.

Reference Books:

1. CMOS Analog Circuit Design, Phillip E. Allen and Douglas R., 2nd edition, Holberg Oxford University Press Publication,2004.
2. "VLSI Digital signal processing systems Design and Implementation " K. K. Parhi; John Wiley and Sons

ET 804 ELECTIVE III
(C) SYSTEM SOFTWARE

Teaching Scheme : 04L Total: 04 Credit : 04
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
ESE duration : 2 hrs 30 min.

Introduction to system software: Assemblers, linkers, microprocessors, compilers, interpreters, loaders, compiler drivers, static linking, object files, reloadable object files, symbols and symbol tables, symbol resolution, relocation, executable object files, loading executable object files, dynamic linking with shared libraries, loading and linking shared libraries from applications, position independent code, tools for manipulating object files
Computer system overview : CPU registers, interrupts, memory hierarchy, cache memory, I/O communication techniques
Operating system overview : objectives and functions, evolution of operating systems, characteristics of modern operating systems like windows, Unix, Linux
Processes : process states, description, control, Unix SVR4 process management, processes and threads, symmetric multiprocessing, microkernels, windows thread, SMP management, Solaris thread, Linux process and thread management
Language processors: Introduction, language processing activities, fundamentals of language processing and language specification, language processor development tools.
Data structures for language processing: Search Data structures, allocation data structures.
Assemblers: Elements of assembly language programming, a simple assembly scheme, pass structure of assemblers, design of a two pass assembler, a single pass assembler for IBM PC.

Macros and macro processors: Macro definition and call, macro expansion, nested macro calls, advanced macro facilities, design of a macro pre-processor, linkers, relocation and linking concepts, design of a linker, self relocating programs, a linker for MS-DOS, linking for overlays, loaders.
Software tools: Software tools for program development, editors, debug monitors, programming environments, and user interfaces.
Statement of problem: Recognizing basic elements, recognizing syntactic units and interpreting meaning, intermediate form, arithmetic statements, non arithmetic statements, non executable statements, storage allocation, code generation, optimisation (machine independent), optimisation (machine dependent), assembly phase, general model of the compiler.
Phases of the compiler: Lexical phase, syntax phase, interpretation phase, optimisation, storage assignment, code generation, assembly phase, passes of the compiler.
Data structures: Introduction, implementation, recursion, call and return statements, storage classes, static, automatic, external control and based storage implementation, block structure, non-local go to's, interrupts, pointers.
Interpreters: Use and overview, pure and impure interpreters

Text books
1. Systems Programming and OS, Harshawardhan P.Bal, 2nd edition, TMH, 2004
2. Systems Programming , John Donovan, TMH,2000.

Reference books
1. Compilers principles, technique and tools, Alfred V Aho, Ravi Sethi, Jeffrey D Ulman, Addison Wesley Publication, 1986.
2. Modern compiler implementation in C 2nd edition, Andrew Appel, Cambridge, 1998.

ET 804 ELECTIVE III
(D) BIOINFORMATICS

Teaching Scheme : 04L   Total: 04   Credit : 04
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE   Total Marks: 100
ESE duration : 2 hrs 30 min.

Introduction to bioinformatics: Introduction to LINUX, changing password, ending the session, lock facility, window basics, controlling windows and scroll bars, GUI in Red Hat LinuxVersion9.0,accessories, internet, programming, system tools, preferences and miscellaneous.
PERL and JAVA: Overview of PERL, installation of PERL and tools for its programming, Examples in bioperl reverse compliment program. Overview of JAVA, tools for its programming, examples, brief analysis of swing program.
Sequence database and sequence analysis : Entrez, pubmed, medline and pubmed central, analysis of gene bank flat file with example, tools within NCBI, KEGG, fly base, miRNA registry, eukaryotic promoter database, database searches, algorithms, substitution matrices, gap penalty.
BLAST and FLASTA: Karlin altshul statistics, analysis of blat results an overview of different blat like programs, gapped-blast, PSI-blat and PHI-blast, blast andinformation theory, UCSC browser and BLAT, fasta, analysis of fasta results.

Genome sequencing and Maps: Sanger method, shot gun approach, human genome, genome annotation, gene ontology, physical maps, genetic maps, cytogenetic maps, Marshfield map, radiation hybrid maps, Stanford map, SNP and HAP map.
Analysis Tools: Bioinformatics programming tool kit, proteome analysis through LC-MS, NMR, x-ray crystallographic analysis, microscopic image analysis and automated gel analysis, network pathway analysis and metabolomics software, facilities in bioconductor.

Text books

1. Bioinformatics-A modern approach, Vittal R. Srinivas, 1st edition, PHI publisher, 2005.
2. Bioinformatics concepts Skills and application C.Rastogi, Namita Mendirata and Parag Rastogi , 3rd editionCBS publisher, 2003.

Reference books

1. Bioinformatics a practical guide to analysis the genes and proteins 2nd edition, Andreas D. Baxevanisand B.F. Francis Quellette, John Wiley, 2002.
2. Bioinformatics-Principles and Application 3rd edition, Harshawardhan P.Bal, TMH ,2005.
3. Introduction to Bioinformatics 2nd edition, Arthur M. Lesk, Oxford University, 2002.

ET805 DIGITAL SYSTEM DESIGN LABORATORY

Teaching Scheme: 02P Total: 02 Credit: 01
Evaluation Scheme: 25 Internal + 25 External Total Marks: 50

It is representative list of practicals. The instructor may choose experiments as per his requirements (so as to cover entire contents of the course) from the list or otherwise. Minimum 08 experiments should be performed
List

1. To design and realize a 4-bit binary subtractor using IC 7483.
2. To design and realize a one-digit BCD Adder using IC 7483.
3. To design a combinational logic circuit which detects a 4-bit binary number divisible by 03.
4. To realize a full adder using 4:1 multiplexers.
5. To implement a 4-bit Binary to Gray code converter using logic gates.
6. To design and realize a 5-bit comparator using IC 7485.
7. To design and realize a 4-bit even parity checker using EX-OR gates.
8. To design and realize a new flip-flop: E-T flip-flop.
9. To convert a J-K flip-flop to D-flip-flop and T-flipflop.
10. To realize a BCD to seven segments decoder based one-digit display.
11. To realize a 3-bit asynchronous counter.
12. To realize a 3-bit asynchronous counter with seven segment display.

ET806 MICROWAVE ENGINEERING LABORATORY

Teaching Scheme: 02P Total: 02 Credit: 01
Evaluation Scheme: 25 Internal + 25 External Total Marks: 50

It is representative list of practicals. The instructor may choose experiments as per his requirements (so as to cover entire contents of the course) from the list or otherwise. Minimum 08 experiments should be performed

List

1. Study of the characteristics of the Klystron Tube.
2. Frequency and wavelength measurement.
3. Determination of standing wave ratio and reflection coefficient coefficient.
4. Impedance measurement.
5. Study of Magic Tee, Directional Coupler, Isolator, circulator and Attenuator.
6. Study of I – V characteristics oh Gunn Diode.
7. Measurement of the gain and polar pattern of various microwave antennas.
8. Study of various feature of Doppler RADAR

ET807 LABORATORY II
(A) DIGITAL IMAGE PROCESSING

Teaching Scheme: 02P Total: 02 Credit: 01
Evaluation Scheme: 25 Internal + 25 External Total Marks: 50

It is representative list of practicals. The instructor may choose experiments as per his requirements (so as to cover entire contents of the course) from the list or otherwise. Minimum 08 experiments should be performed

List

1) To study Image processing toolbox.
2) Image Arithmetic.
3) Determining the value of Individual pixels
4) Adjusting contrast and brightness of image.
5) Linear filtering using convolution and correlation
6) Study of Dilation and Erosion
7) Image Analysis: a)Edge detection b)Boundary tracing c)Line detection
8) Region based processing: Specifying a region of interest and filtering region
   Study of Image compression

ET807 LABORATORY II
(C)VERY LARGE SCALE INTEGRATION DESIGN

Teaching Scheme: 02P Total: 02 Credit: 01
Evaluation Scheme: 25 Internal + 25 External Total Marks: 50

It is representative list of practicals. The instructor may choose experiments as per his requirements (so as to cover entire contents of the course) from the list or otherwise. Minimum 08 experiments should be performed

List

1. To write VHDL program for 1 : 4 decoder and implement on FPGA
2. To write VHDL program for a combinational logic circuit and its implementation on FPGA
3. To write VHDL program for a flip-flop (S-R, J-K, D, T Flip-flop) and implement on FPGA

4. To write VHDL program for a Finite State Machine (FSM), and implement on FPGA
5. To write VHDL program for a (asynchronous/ synchronous) counter and implement on FPGA
6. To design a basic CMOS inverter using a CMOS layout design tool.
7. To design a basic logic gate using a CMOS layout design tool.
8. To design an universal logic gate using a CMOS layout design tool.
9. To design a combinational logic using a CMOS layout design tool.

ET807 LABORATORY II
(C) SYSTEM SOFTWARE

Teaching Scheme: 02P Total: 02 Credit: 01
Evaluation Scheme: 25 Internal + 25 External Total Marks: 50

It is representative list of practicals. The instructor may choose experiments as per his requirements (so as to cover entire contents of the course) from the list or otherwise. Minimum 08 experiments should be performed

List

1. Implementing a queue using linked list
2. Creating an expression tree and tree traversals.
3. Creating a mnemonic table using Hashing.
4. Implementing pass I of an assembler.
5. Implementing pass II of an assembler. (Synthesizing target code for the assembler using the output of Pass I).
6. Implementing of a macro-processor.
7. Implementing a lexical analyzer

ET807 LABORATORY II
(D)BIOINFORMATICS

Teaching Scheme: 02P Total: 02 Credit: 01
Evaluation Scheme: 25 Internal + 25 External Total Marks: 50

It is representative list of practicals. The instructor may choose experiments as per his requirements (so as to cover entire contents of the course) from the list or otherwise. Minimum 08 experiments should be performed

.

List

1. Installing Linux on computer
2. Implementing different Linux keyword and commands
3. Creating accounts and assigning different rights.
4. Creating and changing attributes of the files.
5. Understanding of various Unix command
6. Understanding concept of JAVA language
7. Creating applets in JAVA
8. Study of various Bioinformatics tools

ET808 PROJECT

Teaching Scheme: 06P Total: 06 Credit: 08
Evaluation Scheme: 100 Internal + 100 External Total Marks: 50

1. In continuation with the work completed in VII th semester, student shall complete the implementation of ideas given in synopsis, so that working model of project shall be complete before the end of semester.
2. Students shall submit final project report in proper format which shall include the work completed in VII th semester also.
3. HOD shall design an evaluation system to evaluate the progress of project work.
4. Final examination of project shall include demonstration of working model, presentation by student and oral examination based on total project work. Project work shall be accessed by guide and one external examiner.

ET301 ENGINEERING MATHEMATICS-III

Teaching Scheme: 04 L TOTAL 04 Credits : 04
Marking scheme: 15CT1 + 15CT2 + 10TA + 60 ESE Total Marks: 100
Duration of ESE : 2 Hrs.30 min.

Linear Differential Equations with constant coefficients:
General solution to L.D.E. of n_{th} order with constant coefficients, rules for finding C.F., General method for finding P.I., P.I. of some standard functions, Method of Variation of Parameters, Cauchy's and Legendre's L.D.E., simultaneous linear differential equations . Applications of L.D.E.: Electrical Circuits, Kirchoff's Law, LCR Circuits, Coupled Electrical Circuits.
Partial Diff. Equations: Definition, formation of P.D.E., complete solution of PDE, Linear and non-linear PDE of types (i) f(p, q)= 0, (ii)f(p, q, z)= 0, (iii)f(p, q, x, y)= 0,(iv)f(p, q, x, y, z)= 0 ie Lagrange's form Pp+Qq=R and Clairaut's form z = px + qy + f(p, q), (v)Equations reducible to above forms. Complete solution of PDE of first and second order by method of separation of variables.
Laplace Transform: Definition, standard formulae and properties of LT., Laplace transform of unit step and periodic functions. Laplace Transform of unit impulse function., Inverse Laplace Transform, Convolution Property, Application of LT to solve LDE with constant coefficients.
Vector Calculus: Scalar and vector point functions, Differentiation of a vector function, Tangent and normal components of velocity and acceleration, orthogonal curves, Operator delta, Gradient of scalar point function& their physical meaning . Divergence and Curl of vector point function & their physical meaning. vector identities, solenoidal and conservative fields. Line integral, work done by force.
Functions of complex variables: Analytic function, C-R equations(Cartesian & polar), Harmonic function, Milne Thompson method for finding analytic function, Conformal mappings, Bilinear transformation.
Text Books :
1) Text book of applied Mathematics by P.N.Wartikar and J.N.Wartikar, Pune vidyarthi griha,Pune 2001.
2) Higher Engineering Mathematics by B.S.Grewal, Khanna publication,6th edition, New Delhi,1976.
Reference Books:
1) Advanced Engineering Mathematics by Kreyzig, John Wiley & sons 9th edition 1995.
2) Advanced Engineering Mathematics by John bird 5th edition Elsevier publication 2007.
3) Higher Engineering mathematics by C.R.Wiley, 8th edition John Wiley and sons 1999.

ET302 COMPONENT DEVICES AND TECHNOLOGY

Teaching Scheme: 04L Total: 04 Credit: 04
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
Duration of ESE : 2 Hrs.30 min.

Devices and components: Resistors, capacitors, inductors, transformers, Switches and relays: types, construction, specifications, applications and testing. Fuses, cables and connectors: types, construction, and specifications, applications and testing. Heat sinks, inductor and transformer types, design.
Crystal growth technique: Structure and properties of Silicon (Si) Germanium (Ge) and Gallium Arsenide (GaAs), preparation, purification by zone refining and single crystal growth by Czocharlski method for Si, Ge and GaAs ,cutting of crystal , cementing of slices and ingots , lapping and polishing.
Measurements and etching: Resistivity measurement by two probes, four probe method, determination of conduction type by Hall effect.
Etching types: Electrolytic etching and etchants for Si and Ge, photoengraving

Formation of p-n junction: Alloying, diffusion, epitaxy and ion implantation, significance and formation of ohmic contact by welding (electric and ultrasonic welding) and thermo compression bonding, protection of p-n junction by oxidation and desiccants.
Planar technology for p-n junction diode and transistor: Hermetic encapsulation of devices, fabrication of optical fiber and splicing, properties of monolithic integrated components, monolithic integrated diodes, resistors, capacitors, transistors and Field Effect Transistors(FETs), introduction to various technologies Small Scale Integration(SSI),Medium Scale Integration(MSI), Large Scale Integration(LSI),Very Large Scale Integration(VLSI),Ultra Large Scale Integration(ULSI).

Text Book

1. Modern Electronic Equipment, (1st edition, 1999), by R.S. Khandpur, Tata Mc- Graw Hill

Reference Books

1. Electrical Safety Handbook (3rd edition, 2005) by J. Cadick, M. Capelli-Schellpfeffer, D. Neitzel, Mc-Graw Hill Professional
2. Electronics Testing and Fault Diagnosis (2nd edition, 1989) by G. C. Loveday, Longman Scientific and Technical
3. VLSI Technology (2nd edition, 2003) by S. M. Sze, Tata Mc-Graw Hill
4. Optoelectronic, an Introduction to Materials and Devices (1st edition, 1996) by J. Singh, Prentice Hall India
5. Solid-state Electronic Devices (6th edition, 2003), by S. Banerjee, B. G. Streetman, Pearson Education

ET303 ELECTRICAL TECHNOLOGY

Teaching Scheme: 04 L Total : 04 Credit: 04
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
Duration of ESE : 2 Hrs.30 min.

Measurement of resistance: Wheatstone bridge, Kelvin's double bridge, Megger.
Measurement of inductance and capacitance: Maxwell's bridge, Hay's bridge, Anderson's bridge, Schering's bridge, Loss of charge method, Carey Foster's bridge, measurement of Q factor and tan _, measurement of active and reactive power in three phases balanced and unbalanced load, electrodynamometer type power factor meter, construction and working principle of wattmeter, frequency meter.
D.C. motors: Electrical and mechanical characteristics, speed control methods for series, shunt and compound motor, applications. Braking: Resistance, plugging and regenerative.
Induction motors: Construction, working principle, torque equation, characteristics, speed control methods: armature voltage or frequency control, rotor control, slip power recovery scheme, applications, braking: resistance, plugging and regenerative.
Transformer: Three phase transformer connections, Scott and open delta connection, three-phase to six-phase conversion. Construction, working principle and application of pulse and ferrite core transformer. Construction, working principle and applications of tachogenerator (AC and DC), stepper motor, servomotor (AC and DC), singlephase induction motors, universal and hysterisis motor.

Text Books

1. Electrical Machines (2nd edition), by S. K. Bhattacharya, Tata Mc-Graw Hill.
2. Modern Electronic Instrumentation and Measurement Techniques (1st edition, 1990), by A. D. Helfrick, W. D. Cooper, Prentice Hall India.

Reference Books

1. Electrical Machines, Drives and Power Systems (5th edition), by T. Wildi, Pearson Education.
2. Electrical Machines (1st edition), by S. Ghosh, Pearson Education.
3. Electrical Machines (1st edition), by C. I. Hubert, Pearson Education.
4. First Course in Electrical Drives (1st edition), by S. K. Pillai, New Age International.
5. Electrical Measurements and Measuring Instruments (1st edition), by E.W. Golding, ELBS.

ET304 ELECTRONIC DEVICES AND CIRCUITS

Teaching Scheme: 04L + 1T Total: 05 Credit: 05
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
Duration of ESE : 2 Hrs.30 min.

Introduction to semiconductor theory: p-n junction diode, theory and applications as rectifiers and filters with analysis.
Theory and analysis of Bi-junction transistor (BJT): Construction, working, methods of biasing, stability and stability factor, BJT as amplifier, switch, h–parameter, r-parameter, high frequency model.
Transistor amplifier and oscillators circuits with analysis: Emitter follower, Darlington emitter follower, bootstrap emitter follower, RC coupled amplifier, transformer coupled amplifier, direct coupled amplifier, Oscillators – RC oscillators(Wein Bridge and Phase shift), LC oscillators(Hartley, Colpitt's , Clapp) and crystal oscillators.
Large signal amplifiers: Class A, B, AB and C amplifiers, calculations of power gain, efficiency, power dissipation and distortion.
Theory, construction and applications of diodes: Zener, Schottkey, tunnel, varactor, light emitting diode (LED), photodiode, positive intrinsic negative (PIN) diode, phototransistor.
Theory of field effect transistor (FET): Types, characteristics, working, parameters and biasing.
Text Books

1. Electronic Devices and Circuits (2nd edition) by J. Millman and C. Halkias, Mc-Graw Hill.
2. Electronic Devices and Circuits, (1st edition) by D. R. Cheruku and B. T. Krushna, Pearson.

Reference Books

1. Electronics Devices and Circuits Theory, (9th edition, 2007) by R. Boylestad and L. Nashelsky, Prentice Hall India.
2. Electronics Devices, (6th edition) by T. Floyd, Pearson.

ET305 INSTRUMENTATION

Teaching Scheme :04L Total :04 Credit :04
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
Duration of ESE : 2 Hrs.30 min.

Transducer classification: Active/Passive, primary, secondary, analog / digital.
Basic signal conditioning circuits: Resistive capacitive, inductance reactance bridge, current/voltage sensitive Wheatstone bridges and generalised instrumentation system with particular examples.
Static characteristics: Accuracy, precision, sensitivity, threshold, resolution, repeatability and hysterisis.
Errors: Gross, systematic, random, limiting.
Statistical parameter: Arithmetic mean average deviation, standard deviation, probable error, Histogram, normal and Gaussian curve of errors.
Electronic instrumentation: -Analog and digital data acquisition system, analog electronic multimeter, introduction to digital voltmeter and universal counter. Stripchart and X-Y recorders, optical encoders.
Temperature sensors: LM 335, resistor temperature detector (RTD), thermistors, thermocouples, thermocouples laws and its compensation methods.
Pyrometers: Total/Partial radiation and optical pyrometers.
Strain gauges: Wire factor strain measurement and temperature compensation methods.

Displacement measurement: Using resistive, capacitive, linear variable differential transformer (LVDT) and rotary variable differential transformer (RVDT) and eddy current methods.
Pressure measurement: Elastic, inductive, piezoelectric and capacitive transducers, low pressure measurement using ionization gauge, Pirani gauge, thermocouple, vacuum gauge.
Level measurement: Using ultrasonic, capacitive, inductive, and resistive with float, gamma rays and eddy current techniques.
Flow measurement: Using ultra sonic, electro-aquatic and hot wire anemometer.
Humidity measurement: Using resistive, capacitive and crystal transducer.
Velocity measurement: Using electro-aquatic and photo detectors (both linear and angular velocity).
Cathode Ray Oscilloscope : Block diagram, operation, front panel description and application.

Text Books

1. Instrumentation Devices, by D. P. Ekman, Tata McGraw-Hill.
2. Electronic Instrumentation and Measurement Techniques (1st edition), by A. D. Helfrick and W. D. Cooper

Reference Books

1. Instrumentation: Devices and Systems (2nd edition), by C. S. Rangan, G. R. Sharma and V. S. Mani, Tata McGraw-Hill.
2. Principles of Industrial Instrumentation (2nd edition), by Patranabis, Tata McGraw-Hill.
3. Industrial Instrumentation and Control (2nd edition), by J. Singh, Tata McGraw-Hill

ET306 GENERAL PROFICIENCY I

Teaching Scheme: 02P Total : 02 Credit : 02
Evaluation Scheme: 50 Internal Total Marks: 50

After completing this course the student should able to get proficiency in
1. Reading, Writing and Speaking Skills
Style and Structure: art of writing, Elements of prose, aspects of effective style, patterning the test, editing
the own writing, the mechanism of writing
The building blocks of good English: uses of words, improving the vocabulary, mastering grammar, the
secret of punctuation, dictionaries and how to use them,
Writing at work, home: Writing letters at work, how to write reports, writing for meeting, job application,
writing letters from home, invitation and announcement, modes of address, coping with exams, studied
techniques, essay writing and research,
The skill of good speaking: improving your voice and speech, the art of conversation, public speaking,
using visual aids, being interviewed by media, job interview, dealing with the boss, dealing with the subordinates, how to run a meeting, negotiating and selling
2. Thinking skill: How to think, critical thinking and lateral thinking.
3. Memorising and memorising skills

References

1. Orient communication in English for technical students, by Longman, TTTI Calcutta.
2. How to write and speak better, Reader’s digest, Touchan Books Limited. Editor John Ellison Kahn

3. Six Hat thinking, by E. D. Bono, Pengwin Books
4. English Grammar by Wren and Martin.
5. Word Power Made Easy by Norman Lewis, Goyal Saab, Goyal Publishers.

Minimum 10 experiments based on above syllabus,

1. Vocabulary building (words/week)
2. Demonstration of audio, video CDs.(LRs)
3. Reading, orating and writing paragraphs from English daily.
1. Precise writing and comprehension.
2. Enriching communication with use of idioms and phrases.
3. Learning read/write/speak by listening to learning recourses
4. Supervised one to one, one to many and many to many communication (letter, extempore, board writing, telephonic conversation, debate, elocution etc.)
5. Demonstration of Audio, Video CDs of interviews, speeches etc.
6. Audio recording of the conversations and analysing it offline.
7. Pronunciation of foreign language words commonly practiced. (French, Greek, Latin etc)
8. Six thinking hats/lateral thinking.
9. Practice of memorizing

ET307 COMPONENT DEVICES AND TECHNOLOGY LABORATORY

Teaching Scheme: 02P Total : 02 Credit : 01
Evaluation Scheme: 25 Internal + 25 External Total Marks: 50

Minimum eight experiments shall be performed from the list given below. The experiments to carry shall cover
entire curriculum and the list is just a guideline.

List

1. Passive components (resistors, capacitors, inductors).
2. Active component (diodes and transistors).
3. Electric safety (leakage current measurement).
4. switches (mechanical and electronic).
5. Relays (low voltage).
6. Fuses, cable and connector.
7. Heat sink for electronic devices.
8. Mini project (electronic circuit fabrication).
9. Surface mount devices.

ET308 ELECTRICAL ENGINEERING LABORATORY

Teaching Scheme: 02P Total : 02 Credit : 01
Evaluation Scheme: 25 Internal + 25 External Total Marks: 50

Minimum eight experiments shall be performed from the list given below. The experiments to carry shall cover
entire curriculum and the list is just a guideline.

List

1. Measurement of low resistance by Kelvin’s double bridge.
2. Measurement of high resistance by loss of charge method.
3. Measurement of unknown capacitance by De-saulty’s bridge.
4. Measurement of unknown inductance by Maxwell’s inductance and capacitance bridge.
5. Speed control of D.C. shunts motor by voltage control and flux control method.

6. Rheostatic braking of D. C. shunt motor.
7. Measurement of three-phase power in balanced load by two-wattmeter method.
8. Study of Megger for measurement of (high resistance).
9. Study of single-phase induction motor.
10. Study of three-phase transformer connection (Scott and open delta).

ET309 ELECTRONIC DEVICES AND CIRCUITS LABORATORY

Teaching Scheme: 02P Total : 02 Credit : 01
Evaluation Scheme: 25 Internal + 25 External Total Marks: 50

Minimum eight experiments shall be performed from the list given below. The experiments to be carried shall
cover entire curriculum and the list is just a guideline.

List

1. Characteristics of diode.
2. 2. Diode as rectifier.
3. Diode rectifier with filter.
4. Characteristics of transistor
5. Transistor as amplifier and switch.
6. Transistor analysis.
7. Transistor coupled amplifier.
8. Frequency response of transistor.
9. Transistor as power amplifier.
10. Characteristics of field effect transistor.

ET310 INSTRUMENTATION LABORATORY

Teaching Scheme: 02P Total : 02 Credit : 01
Evaluation Scheme: 25 Internal + 25 External Total Marks: 50

Minimum eight experiments shall be performed from the list given below. The experiments to be carried shall
cover entire curriculum and the list is just a guideline.

List

1. Measurement of unknown resistance, capacitance and inductance using bridges.
2. Measurement of physical quantity (like temperature, pressure, air velocity, etc) using transducer.
3. Displacement measurement.
4. Water level measurement.
5. Water flow measurement.
6. X-Y recorder.
7. Strain measurement.
8. Ultra sonic transducer.
9. Photo detector.

ET401 ENGINEERING MATHEMATICS-IV

Teaching Scheme: 04 L TOTAL 04 Credits : 04
Marking scheme: 15CT1 + 15CT2 + 10TA + 60 ESE Total Marks: 100
Duration of ESE : 2 Hrs.30 min.

Z-Transform:
Definition, standard forms and properties of Z-transform (i.e. linearity, shifting, multiplication by k and change of scale property), Z-transform of impulse and unit step function, Z-transform of derivatives and integrals, inverse Z-transform. Application of Z-transform to find the solution to difference equations of the first and second order.
Fourier transform:
Complex exponential form of Fourier series, Fourier integral, Fourier sine and cosine integrals, Fourier transform, Fourier sine and cosine transform, inverse Fourier transform.
Vector spaces:
vector spaces and subspaces, null spaces, column spaces and linear transformations, linearly independent sets, bases, coordinate systems, dimensions of vector space, change of bases ,application to difference equations. Orthogonality and least squares: Inner product, length and orthogonality, orthogonal sets, orthogonal projections, Gram-Schmidt process, least square problems, inner product spaces.
Complex integration:
Line and contour integration, singular points, expansion of functions in Taylor's and Laurent's series, Cauchy's integral theorem and integral formula, residue theorem, evaluation of real integrals using residue theorem.
Probability:
Introduction to random processes, probability distributions i.e. discrete and continuous distributions, probability density function, Binomial, Poisson, Normal distributions.
Text Books:

1) Text book of applied Mathematics by P.N.Wartikar and J.N.Wartikar Pune vidyarthi griha,Pune 2001.
2) Higher Engineering Mathematics by B.S.Grewal, khanna publication, new Delhi, 6th edition,1976.
3) Linear algebra and its applications by D.C.Lay 3th edition Addison Wesley, 2004.

Reference Books:

1) Advanced Engineering Mathematics by John bird 5th edition Elsevier publication 2007.
2) Advanced Engineering Mathematics by Kreyzig, 9th edition, John Wiley Publication 1995.
3) Linear Algebra with applications by Nicolson, Mc Graw Hill 2004.

ET402 FUNDAMENTALS OF COMMUNICATION

Teaching Scheme: 04L + 1T Total : 05 Credit : 05
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
Duration of ESE : 2 Hrs.30 min.

Basics: Signals and its type, electromagnetic frequency spectrum, basics of communication, various base bands, bandwidth of different base band.
Modulation and wave propagation :Its need and types Amplitude modulation , mathematical analysis, modulation index, frequency spectrum, power requirement of this systems, generation of AM signal, Frequency modulation (FM), mathematical analysis, modulation index, frequency spectrum, power requirement of FM**,** wave propagation and its different types, maximum usable frequency (MUF), critical frequency, fading, virtual height, skip distance, single and multi hop transmission, duct propagation.

Noise: Sources of noise and its types, signal to noise ratio, noise factor, noise figure, noise temperature, noise equivalent temperature.
Transmission line: Various parameters of transmission line, their relations, derivation of standing wave ratio, quarter wave transformer, stub matching, Smith chart.
Antenna: Radiation pattern, types of antenna, antenna arrays, turnstile, loop, log -periodic, UHF and microwave (only structure and principle)
Telephony: Basics of land line telephony, working of exchanges local and trunk, basics of integrated service digital network (ISDN), basics of wireless phones such as mobile, cellular, paging system, facsimile.

Text Book

1. Electronic communication systems,(4th edition,2006), by Kennedy and Davis, Tata Mc-Graw Hill.

Reference Books

1. Electronic communication,(6th edition,1990), by R. L. Shrader, Tata Mc-Graw Hill
2. Electronic communication, by L. Temes, M. Schultz , Tata Mc-Graw Hill
3. Electronic communications systems, (4th edition), by T. Wayne, Pearson
4. Electronic communications, (4th edition) by R. Dennis and J. Coolen, Prentice Hall

ET403 DIGITAL ELECTRONICS

Teaching Scheme: 04L Total : 04 Credit : 04
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
Duration of ESE : 2 Hrs.30 min.

Switching characteristics: Diode, transistor, FET, MOSFET.
Boolean algebra: Logic circuits, arithmetic circuits, and simplification of Boolean function using Boolean theorem, K-map, realization of AND- OR logics.
Error detecting and correcting codes: Weighted/non- weighted codes, alphanumeric codes, Binary Coded Decimal , Hamming codes, parity codes,biquinary codes, Cyclic Redundancy Code method.
Digital logic families: RTL, DTL, HTL, TTL, ECL, IIL, CMOS, their characteristics, fan-in, fan-out, noise immunity,Tri-stage logic, details of TTL analysis.
Sequential circuit: Flip-flop,S-R ,J-K,Master slave J-K,D type, T type excitation table of flip-flop, shift registers.
Counter: Counter I C, asynchronous and synchronous, preset able up/down counter
Semiconductor memories: RAM cell, ROM, PROM, EPROM, EEPROM, CCD Memories, introduction to CPLD and FPGA.
Arithmetical circuits : Half adder, full adder, half subtractor, full subtractor, 4-bit binary adder/subtractor, BCD adder/subtractor.

Text Book

1. Digital principles and application(6th editon, 2006), by A. P. Malvino, D. P. Leach, Tata Mc-Graw Hill

Reference Books

1. Digital electronics, (2nd edition), by W. H. Gothman, Prentice Hall India
2. Digital logic and computer design, by M. Morris, Prentice Hall India
3. Digital Principles and Design,(1st edition, 2002) by D. Givone, Tata Mc-Graw Hill
4. Modern Digital electronics,(3rd edition, 2005) by R. P. Jain., Tata Mc-Graw Hill

ET404 NETWORK ANALYSIS

Teaching Scheme : 04L Total :04 Credit : 04
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
Duration of ESE : 2 Hrs.30 min.

Terminal Element Relationships: V-I relationship for Inductance and Capacitance- Constant Flux Linkage Theorem and Constant Charge Theorem- v-i relationship for Independent Voltage and Current Sources - v-i relationship for dependent voltage and current sources- Source Functions: unit impulse, unit step, unit ramp and inter relationship, sinusoidal input ,generalized exponential input.
Basic Nodal and mesh Analysis: Introduction, Nodal analysis, the super node, mesh analysis, the super mesh, nodal vs mesh analysis, computer aided circuit analysis using Pspice
Useful circuit analysis techniques: Linearity and superposition, source transformations, Thevinin's theorem , Norton's theorem, Maximum power transfer theorem, Delta-wye transformations
Time Domain Analysis of Circuits: Linear Differential Equations for Series RC, Parallel RC, Series RL, Parallel RL, Series RLC, Parallel RLC and Coupled Circuits-Complete Solution for step/impulse/sinusoid voltage/current inputs-Natural Response-Transient Response-Time Constant-Rise and Fall times-Concept of d.c steady state and sinusoidal steady state-Frequency Response of simple circuits from steady state solution-Solution of two mesh circuits by differential equation method-Determination of initial conditions. Time domain analysis using Pspice
Transformation of a Circuit into s-domain: Transformed equivalent of inductance, capacitance and mutual inductance -Impedance and admittance in the transform domain - Node Analysis and Mesh Analysis of the transformed circuit - Nodal Admittance Matrix and Mesh Impedance Matrix in the s-domain - Solution of transformed circuits including mutually coupled circuits-Input and transfer immittance functions - Transfer functions - Impulse response and Transfer function - Poles and Zeros - Pole Zero plots, using Pspice for transform domain analysis
Sinusoidal Steady State analysis: Introduction, characteristics of sinusoids, forced response to sinusoidal functions, the complex forcing function, The phasor, phasor relationships for R L C, impedance and admittance , sinusoidal steady state analysis with phasors, pspice for sinusoidal steady state analysis.
Two Port Networks: two port networks-characterizations in terms of impedance, admittance, hybrid and transmission parameters-inter relationships among parameter sets-Reciprocity Theorem-Interconnection of Two port networks: Series, Parallel and Cascade - Network Functions-Pole Zero plots and steady state response from pole-zero plots. Use of Pspice for two port networks.
Passive Filters: Constant k and m derived LC filters – low pass, high pass, band pass, band stop filter.

Text Book

1. Network analysis, (3rd edition, 1995), by M. E. Van Valkenburg, Prentice Hall of India.

Reference Books

1. Circuits and networks, (3 edition, 2007), by Sudhakar and M. Shyam, Tata McGraw-Hill.
2. Linear circuit analysis (11th edition), by De Carlo and Lin, Oxford University Press
3. Circuit analysis (1st edition, 1993) by T. S. K. V. Iyer, Tata McGraw-Hill
4. Engineering circuit analysis (6th edition), by W. Hayt, I. f. Jr. and J. E. Kemmerly, McGraw Hil1

ET405 HUMANITIES AND ECONOMICS

Teaching Scheme :04L Total :04 Credit : 04
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
Duration of ESE : 2 Hrs.30 min.

Human needs : Motivation, MASLAW's need hierarchy theory, importance of humanities to engineer, Constitution of India rights and duties
Organisation : Organization change and development, manpower planning, man power development, career management.
Sustainable development: Introduction and meaning, implication of human population growth, pollution control.
Psychology : Definition, nature, scope, hurdles, application in industries .
Behavioral science: Importance of science and technology on culture of civilization, function of family, type of family, social responsibility of business
Economics : Importance, factor of production, elasticity of demand, laws of return.
Production : Cost of production, break even analysis, cost benefit analysis,
Banking and taxations : Function of various banks, roles of bank in development, type of taxation.
Business : Prevention and control of monopoly, restrictive trade practices **Globalisation** : Economics and globalisation, foreign collaboration, joint ventures, impact of competition on small-scale industries, value added tax(VAT)

Text Book

1. Principle of Management (2nd edition), by P.C. Tripathy, P. N. Reddy, Tata McGraw-Hill.

Reference Books

1. Introduction to Microeconomics, by P.C. Ray, Macmillan.
2. Business Economics, by V. G. Mankar, Macmillan.

ET406 GENERAL PROFICIENCY II

Teaching Scheme: 02P Total :02 Credit: 02
Evaluation Scheme: 50 Internal Total Marks: 50

After completing this course the student should able to effectively communicate
Accessing conversation control: Recognise clues and cues, problem centered and solution centered behavior, conversation through statement and request, using dynamics in conversation, importance of territory and permissions, how to win or loose in conversation using facts and opinion to diverge and converge, using visuals to improve your verbal, summerising conversation, scheduling and managing it, challenging assumption and effectiveness, giving feedback, when to be positive and negative, speeding up and slow down conversation ,key rules of conversation control ,using conversation control skills, improving the conversation control
Body Language: A frame work for understanding, territories and zone, palm gesture, hand and arm gesture, hand-to face gesture, arm barriers, leg barriers, other popular gesture and action, eye signals, courtship gesture and signal, etc, territorial and ownership gesture, carbon copies and mirror images, body lowering and status, pointers, desks tables and seating arrangement, power plays, putting it all together.
Memorising and memorising technique
Proposal and Report writing practices (R and D, project, patent, etc)

References

1. Long man, Orient communication in English for technical students, TTTI Calcutta (for first topic)
2. How to write and speak better, Reader's digest, Touchan Books Limited. Editor John Ellison Kahn
3. Allan Pease, Body language, Sheldon press

Minimum 10 experiments based on above syllabus

1. Live observation of the conversation/communication, body language.
2. Learning conversation by listening to guidelines.(with learning recourses)
3. Supervised one to one, one to many and many to many conversation can be practiced.
4. Demonstration of Audio, Video CDs of well known personalities.
5. Audio recording of the conversations and analysing it offline.
6. Video recording of the conversations and analysing it offline.
7. Talking in front of mirror in the laboratory in presence of observers like other batch mates, group leaders and/or teachers
8. Report writing.
9. Johnharry Window
10. I am okay-you are okay model.

ET407 ENGINEERING MATHEMATICS IV LABORATORY

Teaching Scheme: 02P Total: 02 Credit : 01
Evaluation Scheme: 25 Internal + 25 External Total Marks: 50

Minimum eight experiments shall be performed from the list given below. The experiments to be carried shall
cover entire curriculum and the list is just a guideline.

List

To be conducted with the help of MATLAB/MAPPLE (engineering application).
1. Getting started with (inbuilt demonstrations and help) MatLab, Mapple and MathCAD
2. Solution of linear equations, matrix operations, differential equations, derivatives, integration using MATLAB and MAPPLE.
3. Nonlinear equation (example: Gauss Elimination, Newton Raphson, Modified Newton Raphson Secant, etc).
4. Plotting of graphs, like bar, pie, line etc with given set of data or of given equations.
5. Infinite series (example: Sine, Cosine, etc).
6. Laplace transform.
7. Fourier series and transforms.
8. Z transform.
9. Probability.
10.Statistics.

ET408 FUNDAMENTALS OF COMMUNICATION LABORATORY

Teaching Scheme: 02P Total: 02 Credit: 01
Evaluation Scheme: 25 Internal + 25 External Total Marks: 50

Minimum eight experiments shall be performed from the list given below. The experiments to be carried shall
cover entire curriculum and the list is just a guideline.

List

1. Random noise, power spectral density, signal to noise ratio, noise figure.
2. Calculating modulation index of amplitude modulated wave.
3. Frequency modulated wave.
4. Generation Double side band suppressed carrier wave.
5. Single side band wave generation.
6. Demodulator (Amplitude and frequency modulation).
7. Transmission and reception (A.M. and F.M.).

8. Transmission line (stub matching, Standing Wave ratio, etc).
9. High frequency antenna (radiation pattern, square law, etc).