

**GOVT. COLLEGE OF ENGINEERING,  
AMRAVATI**

**DEPARTMENT OF ELECTRICAL ENGINEERING**



**PROPOSED CURRICULUM**  
**For**  
**B. TECH. (Electrical Engineering)**

**2020- 20201**

## **PROGRAM OBJECTIVES**

**PEO1:** Graduates will possess fundamental knowledge of science, mathematics and electrical engineering and demonstrate expertise in problem solving, analysis and design related to electrical systems.

**PEO2:** Graduates will be suitable to work in private and public sector, electric utilities, various departments of Central/State/Local Governments, various sectors of Indian industries, multinational corporations and one fifth of them will pursue higher education in chosen field of engineering or management.

**PEO3:** Graduates will be ethical professionals, sensitive to society and engaged in lifelong learning to remain effective members of their communities/teams and will demonstrate leadership and lifelong learning attitude.

## **PROGRAM OUTCOMES (POs):**

**1. Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

**2. Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**3. Design/development of solutions:** 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.

**4. Conduct investigations of complex problems:** 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.

**5. Modern tool usage:** 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.

**6. The engineer and society:** 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.

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

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

**9. Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**10. Communication:** 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.

**11. Project management and finance:** 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.

**12. Life-long learning:** 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.

**B. Tech. (Electrical Engineering)**

<b>SEM III</b>													
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						Credits
			Theory Hrs/week	Tutorial Hrs/week	Practical Hrs/week	Total	Theory			Practical		Total	
							MSE	TA	ESE	ICA	ESE		
BSC	SHU321C *SHU322C	Transform and Statistical methods *Integral Calculus and Probability	3	1	---	4	30	10	60	-	-	100	4
ESC	ETU331C	Analog Electronic Circuits	3	---	---	3	30	10	60	-	-	100	3
PCC	EEU321	Transformers and DC Machines	3	---	---	3	30	10	60	-	-	100	3
PCC	EEU322	Electrical Circuit Analysis	3	1	---	4	30	10	60	-	-	100	4
PCC	EEU323	Energy Resources and Generation	3	---	---	3	30	10	60	-	-	100	3
HSMC	SHU322	Introduction to Constitution of India	1	---	---	1	---	---	60	---	---	60	0
LC	ETU332C	Analog Electronic Lab	---	---	2	2	-	-		50	-	50	1
LC	EEU324	Electrical Machines – Lab I	---	---	2	2	-	-		50	-	50	1
LC	EEU325	Electrical Circuit Analysis Lab	---	---	2	2				50	-	50	1
	Total		<b>16</b>	<b>2</b>	<b>6</b>	<b>24</b>	<b>150</b>	<b>50</b>	<b>360</b>	<b>150</b>		<b>710</b>	<b>20</b>

**\*For Direct second year admitted students**

**B. Tech. (Electrical Engineering)**

SEM IV													
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						Credits
			Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	Theory			Practical		Total	
							MSE	TA	ESE	ICA	ESE		
ESC	ETU431C	Digital Electronics	3	--	---	3	30	10	60	-	-	100	3
PCC	EEU421	AC Machines	3	---	---	3	30	10	60	-	-	100	3
PCC	EEU422	Signals & Systems	3	1	---	4	30	10	60	-	-	100	4
PCC	EEU423	Electromagnetic Fields	4	--	---	4	30	10	60	-	-	100	4
SHMC	SHU423	Cyber law and ethics	2	--	0	2	30	10	60	-	-	100	2
LC	EEU424	Electrical Measurement and Instrumentation Lab	2	---	2	4	-	-	-	50	-	50	3
LC	ETU432C	Digital Electronics Lab	---	---	2	2	-	-	-	50	-	50	1
LC	EEU425	Electrical Machines Lab II	---	---	2	2	-	-	-	50	-	50	1
SHMC	SHU422	Environmental Sciences	1	---	---	1	---	---	60	---	---	60	0
Total			<b>18</b>	<b>1</b>	<b>6</b>	<b>25</b>	<b>150</b>	<b>50</b>	<b>360</b>	<b>150</b>	<b>---</b>	<b>710</b>	<b>21</b>

## SHU321C TRANSFORM AND STATISTICAL METHODS

Teaching Scheme: 03Th+ 01Tut = 04 Total

Total Credits: 04

Evaluation Scheme: 30MSE+60ESE+10TA

Total Marks: 100

---

### 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<sup>th</sup> 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<sup>th</sup> Edition, John Wiley & Sons, 2006.
2. Higher Engineering Mathematics, B. V. Ramana, Tata Mc Graw Hill Publishing company Ltd., New Delhi, 2008, 6<sup>th</sup> 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 successful completion of the course the student will be 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.

**SHU322C INTEGRAL CALCULUS AND PROBABILITY**

Teaching Scheme: 03Th+ 01Tut = 04 Total

Total Credits: 04

Evaluation Scheme: 30MSE+60ESE+10TA

Total Marks: 100

---

**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, 44<sup>th</sup> 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<sup>th</sup> Edition, John Wiley & Sons, 2006.
2. Higher Engineering Mathematics, B.V. Ramana, Tata Mc Graw Hill Publishing company Ltd., New Delhi, 2008, 6<sup>th</sup> edition.
3. A First Course in Probability, S. Ross, 6<sup>th</sup> Ed., Pearson Education India, 2002.
8. An Introduction to Probability and Statistics, V. K. Rohatgi and A.K. Md. Ehsanes Saleh, 2<sup>nd</sup> Edition.
9. Applied Statistics and Probability for Engineers, D. C. Montgomery and G.C. Runger, 5<sup>th</sup> edition, John Wiley & Sons, (2009).
10. Introductory Statistics, P. S. Mann, Wiley Publications, 7<sup>th</sup> edition (2013).
11. I. N. Sneddon, Elements of Partial Differential Equations, Dover Publications, Inc. Mineola New York.

**Course Outcomes:**

After the successful completion of the course the student will be 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.



## ETU331C Analog Electronic Circuits

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:

The subject aims to provide the student with:

- I. To study the various electronic circuits using Diode, Transistor and Mosfet
- II. To understand the working of various Differential, multi-stage amplifiers
- III. Study OpAmp and its application.

#### 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:

1. A. S. Sedra and K. C. Smith, "Microelectronic Circuits", New York, Oxford University Press, 1998.
2. J.V.Wait, L.P.Huelsman and G.A.Korn, "Introduction to Operational Amplifier theory and applications", McGraw Hill U. S., 1992.
3. J. Millman and A. Grabel, "Microelectronics", McGraw Hill Education, 1988.

4. P. Horowitz and W. Hill, "The Art of Electronics", Cambridge University Press, 1989.
5. 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

- ETU 331C.1 Understand the characteristics of transistors.
- ETU 331C.2 Design and analyse various rectifier and amplifier circuits.
- ETU 331C.3 Design sinusoidal and non-sinusoidal oscillators.
- ETU 331C.4 Understand the functioning of OP-AMP and design OP-AMP based circuits

## **EEU321 Transformers and DC Machines**

**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 aware and understand

- I. Basic concept of Magnetic Circuit and Electromagnetic force and torque
- II. Construction, Operation and testing of dc machines
- III. Operation and testing of transformers (single and three phase)

### **Magnetic fields and magnetic circuits (6 Hours)**

Review of magnetic circuits - MMF, flux, reluctance, inductance; review of Ampere Law and Biot Savart Law; Visualization of magnetic fields produced by a bar magnet and a current carrying coil - through air and through a combination of iron and air; influence of highly permeable materials on the magnetic flux lines.

### **Module 2: Electromagnetic force and torque (9 Hours)**

B-H curve of magnetic materials; flux-linkage vs current characteristic of magnetic circuits; linear and nonlinear magnetic circuits; energy stored in the magnetic circuit; force as a partial derivative of stored energy with respect to position of a moving element; torque as a partial derivative of stored energy with respect to angular position of a rotating element. Examples - galvanometer coil, relay contact, lifting magnet, rotating element with eccentricity or saliency

### **Module 3: DC machines (8 Hours)**

Basic construction of a DC machine, magnetic structure - stator yoke, stator poles, pole-faces or shoes, air gap and armature core, visualization of magnetic field produced by the field winding excitation with armature winding open, air gap flux density distribution, flux per pole, induced EMF in an armature coil. Armature winding and commutation – Elementary armature coil and commutator, lap and wave windings, construction of commutator, linear commutation Derivation of back EMF equation, armature MMF wave, derivation of torque equation, armature reaction, air gap flux density distribution with armature reaction.

### **Module 4: DC machine - motoring and generation (7 Hours)**

Armature circuit equation for motoring and generation, Types of field excitations – separately excited, shunt and series. Open circuit characteristic of separately excited DC generator, back EMF with armature reaction, voltage build-up in a shunt generator, critical field resistance and critical speed. V-I characteristics and torque-speed characteristics of separately excited, shunt and series motors. Speed control through armature voltage. Losses, load testing and back-to-back testing of DC machines

### **Module 5: Transformers (12 Hours)**

Principle, construction and operation of single-phase transformers, equivalent circuit, phasor diagram, voltage regulation, losses and efficiency Testing - open circuit and short circuit tests, polarity test, back-to-back test, separation of hysteresis and eddy current losses Three-phase transformer - construction, types of connection and their comparative features, Parallel operation of single-phase and three-phase transformers, Autotransformers - construction, principle, applications and comparison with two winding transformer, Magnetizing current, effect of nonlinear B-H curve of magnetic core material, harmonics in magnetization current, Phase conversion - Scott connection, three-phase to six-phase conversion, Tap-changing transformers - No-load and on-load tap-changing of

transformers, Three-winding transformers. Cooling of transformers.

**Text / References:**

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
2. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.
3. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
4. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
5. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

**Course Outcomes:**

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

- |           |  |
|-----------|--|
| EEU 321.1 | Understand the concepts of magnetic circuits.                                |
| EEU 321.2 | Understand the operation of dc machines.                                     |
| EEU 321.3 | Analyse the differences in operation of different dc machine configurations. |
| EEU 321.4 | Analyse single phase and three phase transformers circuits.                  |

## EEU322 Electrical Circuit Analysis

Teaching Scheme	: 03 L + 01 T	Total: 04	Credit: 04
Evaluation Scheme	: 30 MSE +10 TA+ 60 ESE		Total Marks: 100
Duration of ESE	: 2 Hrs.30 min.		

---

### Course Objectives:

To make students aware and understand to

- I. Analyze electrical network problems.
- II. Determine transient and steady state behavior of the electrical networks.
- III. Estimate the parameters of two port networks.

### Module 1: Network Theorems (10 Hours)

Superposition theorem, Thevenin theorem, Norton theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation theorem. Analysis with dependent current and voltage sources. Node and Mesh Analysis. Concept of duality and dual networks.

### Module 2: Solution of First and Second order networks (8 Hours)

Solution of first and second order differential equations for Series and parallel R-L, R-C, R- L-C circuits, initial and final conditions in network elements, forced and free response, time constants, steady state and transient state response.

### Module 3: Sinusoidal steady state analysis (8 Hours)

Representation of sine function as rotating phasor, phasor diagrams, impedances and admittances, AC circuit analysis, effective or RMS values, average power and complex power. Three-phase circuits. Mutual coupled circuits, Dot Convention in coupled circuits, Ideal Transformer.

### Module 4: Electrical Circuit Analysis Using Laplace Transforms (8 Hours)

Review of Laplace Transform, Analysis of electrical circuits using Laplace Transform for standard inputs, convolution integral, inverse Laplace transform, transformed network with initial conditions. Transfer function representation. Poles and Zeros. Frequency response (magnitude and phase plots), series and parallel resonances

### Module 5: Two Port Network and Network Functions (6 Hours)

Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two port networks.

### Text / References:

1. M. E. Van Valkenburg, "Network Analysis", Prentice Hall, 2006.
2. D. Roy Choudhury, "Networks and Systems", New Age International Publications, 1998.
3. W. H. Hayt and J. E. Kemmerly, "Engineering Circuit Analysis", McGraw Hill Education, 2013.
4. C. K. Alexander and M. N. O. Sadiku, "Electric Circuits", McGraw Hill Education, 2004.
5. K. V. V. Murthy and M. S. Kamath, "Basic Circuit Analysis", Jaico Publishers, 1999.
6. Circuit and Network Analysis By Sudhakar Shyamman Tata Mc Graw Hill 2005

**Course Outcomes:**

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

- EEU 322.1      Apply network theorems for the analysis of electrical circuits.
- EEU 322.2      Obtain the transient and steady-state response of electrical circuits.
- EEU 322.3      Analyse circuits in the sinusoidal steady-state (single-phase and three-phase).
- EEU 322.4      Analyse two port circuit behavior.

## EEU323 Energy Resources and Generation

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 aware and understand

- I. Challenges of using sources of energy efficiently and effectively
- II. The energy conversion systems for various power plants
- III. The importance and relevance of renewable energy sources

#### Module 1: Thermal and Hydro Power plant (12Hours)

Selection of site, working of various parts: Economizer, air preheater, condenser, cooling tower, coal handling system, ash handling system, Classification of hydro power plant according to available head, nature of load, functions of different components and their working.

Nuclear and Diesel Power plant: Methods of producing nuclear reactions, functions of different components of nuclear plant, functions of different components of diesel plant.

#### Module 2: Solar Energy and its measurement (6 Hours)

Solar constants, solar radiation at earth's surface, solar radiation geometry, solar radiation measurement, estimation of average solar radiation, solar radiation on tilted surface, principle of solar energy conversion in to heat, flat plate collectors, energy balance equation and collector efficiency.

#### Module 3: Fuel cells (6 Hours)

Chemistry applied to fuel cells, principle and operation, classification and types of fuel cells, performance characteristics of fuel cells, classification of fuel cells system.

#### Module 4: Wind Energy (6 Hours)

Basic principle of wind energy conversion, wind data and energy estimation, selection of site, basic components of wind energy conversion system (WECS), classification of WEC systems, generating system, energy storage, and application of wind energy.

#### Module 5: Other Renewable energy resources (12 Hours)

Ocean energy resources, ocean energy routes, ocean thermal energy conversion, progressive wave, wave data collection, Basic principle of tidal power, components of tidal power plants, operation methods of utilization of tidal energy, estimation of power and energy in simple single basin tidal system. Operating principle of energy from biomass. Energy from biogas, geothermal energy. MHD power generation, energy from urban and rural waste, mini and micro hydroelectric power generation.

### Text/ References:

1. Conventional Energy Technology, S.B.Pandya, Tata Mc-GrawHill 2005.
2. Non Conventional Energy Resources, G.D.Rai, Khanna Publishers 2001.
3. Energy and Atmosphere, I.M.Campbell, Wiley, New York, 2006.
4. Solar Energy, S.P.Sukhatme, Tata Mc-Graw Hill, 2006.
5. Non Conventional Energy Resources, B.H.Khan, Tata Mc-Graw Hill, 2003.
6. <http://www.nptel.iitm.ac.in/> 5. [www.ocw.mit.edu](http://www.ocw.mit.edu)

**Course Outcomes:**

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

- EEU323.1. List and generally explain the main sources of energy and their primary applications nationally and internationally
- EEU323.2. Understand the energy scenario and the consequent growth of the power generation from renewable energy sources.
- EEU323.3. Describe the challenges and problems associated with the use of various energy sources, including fossil fuels, with regard to future supply and the impact on the environment
- EEU323.4. Understand the basic physics of wind and solar power generation.
- EEU323.5. Understand the issues related to the grid-integration of solar and wind energy systems.



## 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.

### Course Content

#### 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 73<sup>rd</sup> amendment. Panchayat Raj in India with special reference to 74<sup>th</sup> 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.

## ETU332C Analog Electronic Lab

Teaching Scheme : 02 P  
Evaluation Scheme : 50 ICA

Total: 02

Credit: 01  
Total Marks: 50

---

**Course Objectives:**

To make students aware and understand to

- I. Design, build, test and analyze performance of various electronic circuits using Diode, Transistor and FET
- II. Have experience of design and implementation of various amplifiers
- III. Analyze and design various applications of OP-AMP

**Minimum eight** hands-on experiments related to the course contents of ETU 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.
- 15 To 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 –

- ETU 332C.1 Set up a bias point in a transistor.
- ETU 332C.2 Verify the working of diodes, transistors and their applications.
- ETU 332C.3 Build a common emitter/base/collector amplifier and measure its voltage gain.
- ETU 332C.4 Explore the operation and advantages of feedback amplifiers.
- ETU 332C.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.

## **EEU324 Electrical Machines – Lab I**

<b>Teaching Scheme</b>	<b>: 02 P</b>	<b>Total: 02</b>	<b>Credit: 01</b>
<b>Evaluation Scheme</b>	<b>: 50 ICA</b>		<b>Total Marks: 50</b>

---

---

### **Course Objectives:**

To make the students aware and understand:

- I. Various parts of d.c. machine and transformer
- II. Operation and performance of dc motors
- III. Testing of dc machines and transformers

Minimum Eight hands-on experiments related to the course contents of EEU321 Electrical Machines –I to be performed. Representative list is as follows,

1. To identify and understand the functions of various parts of d.c. machines
2. To plot the OCC of d.c. generator
3. To find the critical speed of the d.c. generator
4. To perform and verify the speed control method of d.c. shunt motor
5. To perform the Swinburn test on d.c. machine
6. To perform the load test on d.c. series generator
7. To perform the load test on d.c. series motor
8. To perform the load test on d.c. shunt generator
9. To perform the load test on d.c. shunt motor
10. To perform the load test on d.c. compound generator
11. To perform the load test on d.c. compound motor
12. To perform the test/tests on d.c. machine to separate the losses at constant speed
13. To perform the Hopkinson's Test on d.c. machines
14. To perform the Field test on the d.c. machines
15. To perform the Sumpner's Test on single phase transformer
16. To identify and understand the functions of various parts of the three phase transformer
17. To perform the OC and SC test on three phase transformer
18. To perform the direct loading test on three phase transformer
19. To perform the various connections of three phase transformer
20. To study the scott connection of transformer
21. To perform OC and SC test on single phase transformer

### **Course Outcomes :**

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

- |           |   |
|-----------|---|
| EEU 324.1 | Identify and understand the functions of various parts of d.c. machines |
| EEU 324.2 | Plot various characteristics of dc generators                           |
| EEU 324.3 | Start and operate dc motor according to requirement                     |
| EEU 324.4 | Test dc machines and transformers                                       |

**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.

## **EEU325 Electrical Circuit Analysis Lab**

**Teaching Scheme : 02 P Total 02**  
**Evaluation Scheme : 50 ICA**

**Credit: 01**  
**Total Marks: 50**

---

### **Course Objectives:**

To make the students aware and understand:

- I. Various electrical circuit theorems.
- II. Two port network parameters.
- III. Steady state response of electrical circuits.

Minimum Eight Hands-on experiments related to the course contents of EEU322 Electrical Circuit Analysis to be performed.. Representative list is as follows.

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 verify Tellegen's theorem.
5. To find Z parameters of two, two port networks connected in series.
6. To find Y parameters of two, two port networks connected in parallel.
7. To determine ABCD parameters of given two port network
8. To find transmission parameters of two, two port networks connected in cascade.
9. To study the response of RL series circuit to sinusoidal input and dc input (using MATLAB).
10. To study the response of RC series circuit to sinusoidal input and dc input (using MATLAB).

### **Course Outcomes :**

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

- EEU 325.1      Construct simple electrical circuits using suitable elements  
EEU 325.2      Perform experimnts for verification of various facts and principles  
EEU 325.3      Derive conclusions on the basis of the readings/ observations

**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: 30 MSE +10 TA+ 60 ESE**

**Total Marks: 100**

**Duration of ESE : 2 Hrs.30 min.**

### **Course Objectives:**

- I. To acquire the basic knowledge of digital logic circuit components
- II. To understand and analyze and design combinational logic circuits using gates and MSIs
- III. To design and realize combinational and sequential digital electronic circuits

### **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-state logic.

### **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, serial adder, 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- and D-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 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.

**CourseOutcomes:**

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

- ETU 431C.1 Understand working of logic families and logic gates.
- ETU 431C.2 Design and implement Combinational and Sequential logic circuits.
- ETU 431C.3 Understand the process of Analog to Digital conversion and Digital to Analog conversion.
- ETU 431C.4 Be able to use PLDs to implement the given logical problem.

## **EEU421 AC Machines**

**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 aware and understand

- I. Basic concept of AC machine winding and revolving magnetic field
- II. Operation and testing of Induction machine (single and three phase)
- III. Construction , Operation and testing of synchronous machines

### **Module 1: Fundamentals of AC machine windings (8 Hours)**

Physical arrangement of windings in stator and cylindrical rotor; slots for windings; single- turn coil - active portion and overhang; full-pitch coils, concentrated winding, distributed winding, winding axis, 3D visualization of the above winding types, Air-gap MMF distribution with fixed current through winding - concentrated and distributed, Sinusoidally distributed winding, winding distribution factor

### **Module 2: Pulsating and revolving magnetic fields (4 Hours)**

Constant magnetic field, pulsating magnetic field - alternating current in windings with spatial displacement, Magnetic field produced by a single winding - fixed current and alternating current Pulsating fields produced by spatially displaced windings, Windings spatially shifted by 90 degrees, Addition of pulsating magnetic fields, Three windings spatially shifted by 120 degrees (carrying three-phase balanced currents), revolving magnetic field.

### **Module 3: Induction Machines (12 Hours)**

Construction, Types (squirrel cage and slip-ring), Torque Slip Characteristics, Starting and Maximum Torque. Equivalent circuit. Phasor Diagram, Losses and Efficiency. Effect of parameter variation on torque speed characteristics (variation of rotor and stator resistances, stator voltage, frequency). Methods of starting, braking and speed control for induction motors. Generator operation. Self-excitation. Doubly-Fed Induction Machines.

### **Module 4: Single-phase induction motors (6 Hours)**

Constructional features, double revolving field theory, equivalent circuit, determination of parameters. Split-phase starting methods and applications

### **Module 5: Synchronous machines (10 Hours)**

Constructional features, cylindrical rotor synchronous machine - generated EMF, equivalent circuit and phasor diagram, armature reaction, synchronous impedance, voltage regulation. Operating characteristics of synchronous machines, V-curves. Salient pole machine - two reaction theory, analysis of phasor diagram, power angle characteristics. Parallel operation of alternators - synchronization and load division.

### **Text/References:**

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", McGraw Hill Education, 2013.
2. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
3. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
4. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.
5. A. S. Langsdorf, "Alternating current machines", McGraw Hill Education, 1984.

6. P. C. Sen “Principles of Electric Machines and Power Electronics”, John Wiley & Sons, 2007.

**Course Outcomes:**

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

- EEU 421.1 Understand the concepts of rotating magnetic fields.
- EEU 421.2 Understand the operation of ac machines.
- EEU 421.3 Analyse performance characteristics of ac machines.



## EEU422 Signals and Systems

Teaching Scheme : 03 L + 01 T	Total: 04	Credit: 04
Evaluation Scheme : 30 MSE +10 TA+ 60 ESE		Total Marks: 100
Duration of ESE : 2 Hrs.30 min.		

---

---

### Course Objectives:

- I. Understand the concepts of continuous time and discrete time systems.
- II. Able to find output of LTI system by convolution.
- III. Analyse LTI systems in frequency domain

### Module 1: Introduction to Signals and Systems (3 hours):

Signals and systems as seen in everyday life, and in various branches of engineering and science. Signal properties: periodicity, absolute integrability, determinism and stochastic character. Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability. Examples.

### Module 2: Behavior of continuous and discrete-time LTI systems (8 hours)

Impulse response and step response, convolution, input-output behavior with aperiodic convergent inputs, cascade interconnections. Characterization of causality and stability of LTI systems. System representation through differential equations and difference equations. State-space Representation of systems. State-Space Analysis, Multi-input, multi-output representation. State Transition Matrix and its Role. Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse response.

### Module 3: Fourier, Laplace and z- Transforms (10 hours)

Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients. Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete- Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem. Review of the Laplace Transform for continuous time signals and systems, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behavior. The z- Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis.

### Module 4: Sampling and Reconstruction (4 hours)

The Sampling Theorem and its implications. Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects. Relation between continuous and discrete time systems. Introduction to the applications of signal and system theory: modulation for communication, filtering, feedback control systems.

### Text/References:

1. A. V. Oppenheim, A. S. Willsky and S. H. Nawab, "Signals and systems", Prentice Hall India, 1997.
2. J. G. Proakis and D. G. Manolakis, " Digital Signal Processing: Principles, Algorithms and Applications", Pearson, 2006.

3. H. P. Hsu, "Signals and systems", Schaum's series, McGraw Hill Education, 2010.
4. S. Haykin and B. V. Veen, "Signals and Systems", John Wiley and Sons, 2007.
5. A. V. Oppenheim and R. W. Schaffer, "Discrete-Time Signal Processing", Prentice Hall, 2009.
6. M. J. Robert "Fundamentals of Signals and Systems", McGraw Hill Education, 2007.
7. B. P. Lathi, "Linear Systems and Signals", Oxford University Press, 2009.

**Course Outcomes:**

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

- |           |   |
|-----------|---|
| EEU 422.1 | Understand the concepts of continuous time and discrete time systems. |
| EEU 422.2 | Analyse systems in complex frequency domain.                          |
| EEU 422.3 | Understand sampling theorem and its implications.                     |

# EEU423 Electromagnetic Fields

Teaching Scheme : 04 L Total: 04

Credit: 04

Evaluation Scheme: 30 MSE +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE : 2 Hrs.30 min.

---

---

## Course Objectives:

To make the students aware and understand:

- I. Electrostatic boundary-value problems.
- II. The types and properties of magnetic materials.
- III. The concept of static and time varying fields.

Note:-This course shall have Lectures and Tutorials. Most of the students find difficult to visualize electric and magnetic fields. Instructors may demonstrate various simulation tools to visualize electric and magnetic fields in practical devices like transformers, transmission lines and machines.

### Module 1: Review of Vector Calculus (6 hours)

Vector algebra-addition, subtraction, components of vectors, scalar and vector multiplications, triple products, three orthogonal coordinate systems (rectangular, cylindrical and spherical). Vector calculus-differentiation, partial differentiation, integration, vector operator del, gradient, divergence and curl; integral theorems of vectors. Conversion of a vector from one coordinate system to another.

### Module 2: Static Electric Field (6 Hours)

Coulomb's law, Electric field intensity, Electrical field due to point charges. Line, Surface and Volume charge distributions. Gauss law and its applications. Absolute Electric potential, Potential difference, Calculation of potential differences for different configurations. Electric dipole, Electrostatic Energy and Energy density

### Module 3: Conductors, Dielectrics and Capacitance (6 Hours)

Current and current density, Ohms Law in Point form, Continuity of current, Boundary conditions of perfect dielectric materials. Permittivity of dielectric materials, Capacitance, Capacitance of a two wire line, Poisson's equation, Laplace's equation, Solution of Laplace and Poisson's equation, Application of Laplace's and Poisson's equations.

### Module 4: Static Magnetic Fields (6 Hours)

Biot-Savart Law, Ampere Law, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic potentials. Steady magnetic fields produced by current carrying conductors.

### Module 5: Magnetic Forces, Materials and Inductance (6 Hours)

Force on a moving charge, Force on a differential current element, Force between differential current elements, Nature of magnetic materials, Magnetization and permeability, Magnetic boundary conditions, Magnetic circuits, inductances and mutual inductances.

### Module 6: Time Varying Fields and Maxwell's Equations (6 Hours)

Faraday's law for Electromagnetic induction, Displacement current, Point form of Maxwell's equation, Integral form of Maxwell's equations, Motional Electromotive forces. Boundary Conditions.

**Text / References:**

1. M. N. O. Sadiku, "Elements of Electromagnetics", Oxford University Publication, 2014.
2. A. Pramanik, "Electromagnetism - Theory and applications", PHI Learning Pvt. Ltd, New Delhi, 2009.
3. A. Pramanik, "Electromagnetism-Problems with solution", Prentice Hall India, 2012.
4. G. W. Carter, "The electromagnetic field in its engineering aspects", Longmans, 1954.
5. W. J. Duffin, "Electricity and Magnetism", McGraw Hill Publication, 1980.
6. W. J. Duffin, "Advanced Electricity and Magnetism", McGraw Hill, 1968.
7. E. G. Cullwick, "The Fundamentals of Electromagnetism", Cambridge University Press, 1966.
8. B. D. Popovic, "Introductory Engineering Electromagnetics", Addison-Wesley Educational Publishers, International Edition, 1971.
9. W. Hayt, "Engineering Electromagnetics", McGraw Hill Education, 2012.

**Course outcomes:**

At the end of the course, students will demonstrate the ability

- |           |   |
|-----------|---|
| EEU 423.1 | To understand the basic laws of electromagnetism.   |
| EEU 423.2 | To obtain the electric and magnetic fields for simple configurations under static conditions. |
| EEU 423.3 | To analyse time varying electric and magnetic fields.   |
| EEU 423.4 | To understand Maxwell's equation in different forms and different media.                      |
| EEU 423.5 | To understand the propagation of EM waves.  |

	<b>Cyber Law and Ethics</b>		<b>2 credits</b>
--	-----------------------------	--	------------------

## EEU424 Electrical Measurement and Instrumentation Lab

Teaching Scheme : 02 L + 02 P

Total 04

Credit: 03

Evaluation Scheme : 50 ICA

Total Marks: 50

---

### Course Objectives:

To make the students aware and understand:

- I. Different bridges and their applications.
- II. Different transducers and their working principles.
- III. Measurement of non-electrical parameters like pressure, force, velocity etc.

### Lectures/Demonstrations:

1. Concepts relating to Measurements: True value, Accuracy, Precision, Resolution, Drift, Hysteresis, Dead-band, Sensitivity.
2. Errors in Measurements. Basic statistical analysis applied to measurements: Mean, Standard Deviation, Six-sigma estimation,  $C_p$ ,  $C_{pk}$ .
3. Sensors and Transducers for physical parameters: temperature, pressure, torque, flow. Speed and Position Sensors.
4. Current and Voltage Measurements. Shunts, Potential Dividers, Instrument Transformers, Hall Sensors.
5. Measurements of R, L and C.
6. Digital Multi-meter, True RMS meters, Clamp-on meters, Meggers.
7. Digital Storage Oscilloscope.

### Experiments

1. Measurement of a batch of resistors and estimating statistical parameters.
2. Measurement of L using a bridge technique as well as LCR meter.
3. Measurement of C using a bridge technique as well as LCR meter.
4. Measurement of Low Resistance using Kelvin's double bridge.
5. Measurement of High resistance and Insulation resistance using Megger.
6. Usage of DSO for steady state periodic waveforms produced by a function generator.  
Selection of trigger source and trigger level, selection of time-scale and voltage scale. Bandwidth of measurement and sampling rate.
7. Download of one-cycle data of a periodic waveform from a DSO and use values to compute the RMS values using a C program.
8. Usage of DSO to capture transients like a step change in R-L-C circuit.
9. Current Measurement using Shunt, CT, and Hall Sensor.

### Course Outcomes:

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

- |           |  |
|-----------|--|
| EEU 424.1 | Design and validate DC and AC bridges.   |
| EEU 424.2 | Analyze the dynamic response and the calibration of few instruments.                                   |
| EEU 424.3 | Learn about various measurement devices, their characteristics, their operation and their limitations. |
| EEU 424.4 | Understand statistical data analysis.  |
| EEU 424.5 | Understand computerized data acquisition.  |

**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.**

## ETU432C Digital Electronics Lab

Teaching Scheme : 02 P  
Evaluation Scheme : 50 ICA

Total: 02

Credit: 01  
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 Logic gates and MSIs
- III. To realize sequential circuits using gates, FF and MSIs

Minimum Eight hands-on experiments related to the course contents of ETU 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 –

- ETU 432C.1 Analyze and design simple logic circuits using gates
- ETU 432C.2 Construct the circuits for experiments and take readings/ observations
- ETU 432C.3 Derive conclusions on the basis of the readings/ observations in context of digital electronics
- ETU 432C.4 Explain the working principle of various combinational and sequential logic circuits
- ETU 432C.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.



## **EEU425 Electrical Machines Lab II**

<b>Teaching Scheme</b>	<b>: 02 P</b>	<b>Total: 02</b>	<b>Credit: 01</b>
<b>Evaluation Scheme</b>	<b>: 50 ICA</b>		<b>Total Marks: 50</b>

---

### **Course Objectives:**

Minimum Eight Hands-on experiments related to the course contents of EEU 421 Electrical Machines - II to be performed. Representative list is as follows

- 1) To Determine the regulation of three phase Alternator by direct loading method
- 2) To determine the regulation of three phase Alternator by Synchronous Impedance Method
- 3) To find  $X_d$  and  $X_q$  of salient pole synchronous machine by slip test
- 4) To study starting and reversal of direction of rotation of three phase synchronous motor
- 5) To plot the 'V' and 'Inverted V' curves of synchronous motor
- 6) Application of synchronous motor as power factor correction device
- 7) To perform the load test on three phase induction motor and plot its characteristics
- 8) Perform the No load and short circuit test on three phase Induction motor to find its Equivalent circuit
- 9) Construction of Circle diagram from the No load and short circuit test Data
- 10) Speed control of three phase induction motor
- 11) Study of three phase induction motor starters
- 12) Running light and locked rotor test on single phase induction motor to find its equivalent circuit.
- 13) Parallel operation of Alternators (Synchronizing Methods)

### **Course Outcomes**

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

- 1) Identify and understand the functions of various parts of alternators
- 2) Plot various characteristics of alternators
- 3) Start and operate induction motor according to requirement
- 4) Test induction motors

### **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.

## SHU-424 ENVIRONMENTAL STUDIES

Teaching Scheme: 02 L

Total: 02

Credit: 00

Evaluation scheme: 60 ESE

ESE Duration: 2:30 hrs

Total Marks: 60

---

### Course objectives:-

The objectives of offering this course are to-

- I. Be aware of various environmental factors and their preservation.
- II. Teach them how to protect Environment and natural resources.
- III. How to make equitable use of energy resources.

**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.

## Equivalence-I

S. N.	Course in old Scheme (184)			Equivalent course in new scheme (155)		
	Course Code	Course name	No. of Credits	Course Code	Course name	No. of Credits
1	SHU303	Engineering Mathematics - III	3	SHU321C	Transform and Statistical methods	4
2	ETU311	Electronic Devices and Circuits	3	ETU331C	Analog Electronic Circuits	3
3	EEU301	Signals & Systems	4	EEU422	Signals & Systems	4
4	EEU302	Network Analysis	4	EEU322	Electrical Circuit Analysis	4
5	EEU303	Electrical Measurement and Instrumentation	3		-----	
6	ETU312	Electronic Devices and Circuits Lab	2	ETU332C	Analog Electronic Lab	1
7	EEU304	Signals & Systems Lab	1		----	
8	EEU305	Network Analysis Lab	1	EEU325	Electrical Circuit Analysis Lab	1
9	EEU306	Electrical Measurement and Instrumentation Lab	1	EEU424	Electrical Measurement and Instrumentation Lab	3
10	SHU305	General Proficiency - II	1		----	
11	SHU401	Engineering Mathematics - IV	3		----	
12	EEU401	Pulse & Digital Circuits	4	ETU431C	Digital Electronics	3
13	EEU402	Electrical Machines - I	3	EEU321	Transformers and DC Machines	3
14	EEU403	Energy Resources & Generation	3	EEU323	Energy Resources & Generation	3
15	EEU404	Electromagnetic Engineering	4	EEU423	Electromagnetic Fields	4
16	SHU402	Engineering Mathematics Lab	2		----	
17	EEU405	Pulse & Digital Circuits Lab	1	ETU 432C	Digital Electronics Lab	1
18	EEU406	Electrical Machines - I Lab	1	EEU324	Electrical Machines Lab I	1
19	EEU407	Numerical Methods Lab	1		-----	
20	EEU408	Computational Lab - I	1		-----	

## Equivalence-II

S. N.	Course in new scheme (155)			Equivalent course in old Scheme (184)		
	Course Code	Course name	No. of Credits	Course Code	Course name	No. of Credits
1	SHU321 C	Engineering Mathematics - III	4	---	---	---
2	ETU331 C	Analog Electronic Circuits	3	ETU311	Electronic Devices and Circuits	3
3	EEU321	Transformers & DC Machines	3	EEU402	Electrical Machines - I	3
4	EEU322	Electrical Circuit Analysis	4	EEU302	Network Analysis	4
5	EEU323	Energy Resources & Generation	3	EEU 403	Energy Resources & Generation	3
6	ETU322 C	Analog Electronic Lab	1	ETU312	Electronic Devices and Circuits Lab	1
7	EEU324	Electrical Machines Lab I	1	EEU406	Electrical Machines - I Lab	1
8	EEU325	Electrical Circuit Analysis Lab	1	EEU305	Network Analysis Lab	1
9	SHUMC	Environmental Sciences	0		Environmental Sciences	0
10	ETU 431C	Digital Electronics	3	EEU401	Pulse & Digital Circuits	4
11	EEU421	AC Machines	3	EEU502	Electrical Machines - II	3
12	EEU422	Signals & Systems	4	EEU301	Signals & Systems	4
13	EEU423	Electromagnetic Fields	4	EEU404	Electromagnetic Engineering	4
14	SHU423 C	Biology – I	2	---		
15	EEU424	Electrical Measurement and Instrumentation Lab	3	EEU306	Electrical Measurement and Instrumentation Lab	1
16	ETU432 C	Digital Electronics Lab	1	EEU405	Pulse & Digital Circuits Lab	1
17	EEU425	Electrical Machines Lab II	1	EEU506	Electrical Machines - II Lab	1
18	SHUMC	NCC/NSS	0		NCC/NSS	0