Curriculum Structure for B. Tech. Instrumentation Engineering Programme

(In light of NEP 2020)

NCrF Level 6

For students admitted in 2023-24 onwards

Government College of Engineering, Amravati

(An Autonomous Institute of Government of Maharashtra)

Near Kathora Naka, Amravati, Maharashtra
PIN 444604
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Structure for B. Tech. ProgrammeIn light of NEP 2020

For students admitted in 2023-24 onwards

Key Features of Curriculum

1. Multiple entry and exit option after every year.
2. Provision for Open Electives (OE), Vocational and Skill Enhancement Courses (VSE), Ability Enhancement Courses (AE), Indian Knowledge System (IKS), Value Education Courses (VE), Co-Curricular Courses (CC) in addition to program core courses.
3. Mandatory internship of one semester.
4. Credits for Value education courses, Ability Enhancement Courses, Co-Curricular Curricular Activities.
5. Mandatory Non-Credit Courses.
6. Interdisciplinary and multidisciplinary education through single and double minors and open electives.
7. Skill based courses and multiple exit level.
8. Provision for learning in online mode through Swayam/ NPTEL etc courses
9. Provision for B.Tech. Honours with Research degree through research project.
10. Opportunity for learner to choose courses of their interest in all disciplines.
11. Provision of Skill Based Courses and internship/Field project/mini projects for exit options at each level.

12. Flexibility for all types of learners i.e. Good, Normal and Exit

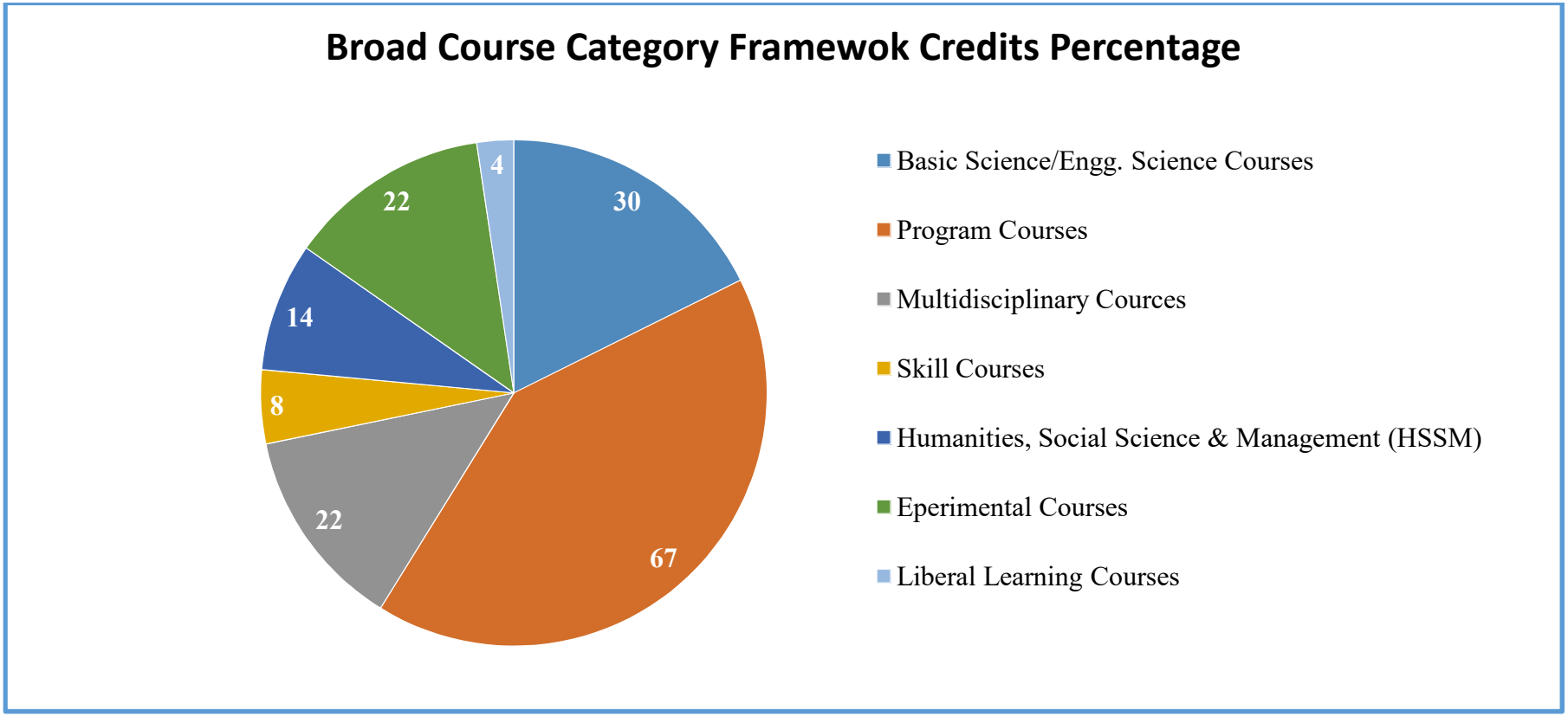
Good Students	Normal Students	Exit
B. Tech. Major with Multidisciplinary Minor	B. Tech. Major with Multidisciplinary Minor	Additional 08 credits in the form of skill-based courses / labs, internship, mini projects shall be offered in 8 weeks.
B. Tech. Honors and Multidisciplinary Minor	--	
B. Tech. Honors with Research and Multidisciplinary Minor	--	
B. Tech. with Double Minor (Multidisciplinary and Specialization Minor)	--	

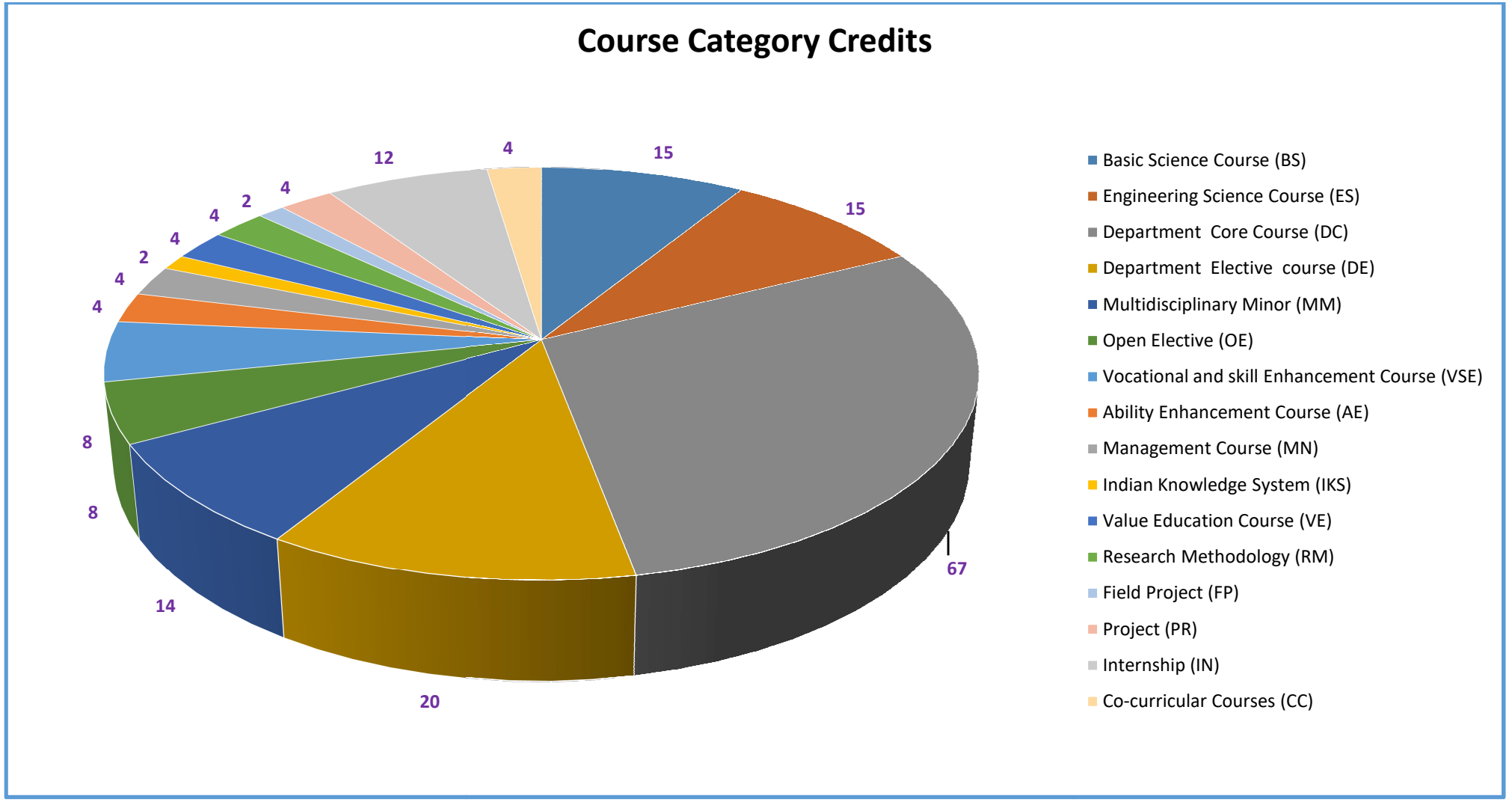
Credit Distribution for each year and Exit Option

NCrFLevel	Year / Semester	Exit Option	Credits	Additional Credits for exit students	Total Credits
4.5	Semester I & II	U. G. Certificate	43	08	51
5.0	Semester III & IV	U. G. Diploma	82	08	90
5.5	Semester V & VI	B. Vocational/B.Sc. Engg.	127	08	135
6.0	Semester VII & VIII	B. Tech.Major with Multidisciplinary Minor	167	--	167
		B. Tech. Honors and Multidisciplinary Minor	167+18=185	--	185
		B. Tech. Honors with Research and Multidisciplinary Minor	167+18=185	--	185
		B. Tech. with Double Minor (Multidisciplinary and Specialization Minor)	167+18=185	--	185

Course Category-wise Credit Distribution

Course Category	As per NEP GR	GCOEA Credits	CC	As per NEP GR	GCOEA Credits
BSC/ESC	30	**30**	BS	14-18	**18**
			ES	16--12	12
Program Courses	64-76	**67**	PC	44-56	**47**
			PE	20	20
Multidisciplinary Courses	22	22	MM	14	14
			OE	8	8
Skill Courses	8	8	VSE	8	8
Humanities, Social Science & Management (HSSM)	14	14	AE	4	4
			EM	4	4
			IKS	2	2
			VE	4	4
Experiential Courses	22	22	RM	4	4
			FP	2	2
			PR	4	4
			IN/OJT	12	12
Liberal Learning Courses	4	4	CC	4	4
Total Credits	**164-176**	167		**164-176**	**167**


Broad Course Category Framewok Credits Percentage
30
67
22
8
14
22
4
Basic Science/Engg. Science Courses
Program Courses
Multidisciplinary Cources
Skill Courses
Humanities, Social Science & Management (HSSM)
Eperimental Courses
Liberal Learning Courses



Semester-wise Credit Distribution

Sr. No.	SEM	I	II	III	IV	V	VI	VII	VIII	Total Credits	NEP Requirement
1	**Basic Science Course (BS)**	8	7	**3**						**18**	14-18
2	Engineering Science Course (ES)	8	4							12	12-16
3	**Program Core Course (PC)**		6	**10**	**11**	**10**	**7**	**3**		**47**	44-56
4	Program Elective Course (PE)					4	8	8		20	20
5	**Multidisciplinary Minor Course (MM)**			3	3	3	3	2		14	14
6	Open Elective Course (OE)				3	3		2		8	8
7	Vocational & Skill Enhancement Course (VSE)			2	1	2	1	2		8	8
8	Ability Enhancement Course (AE)	1	3							4	4
9	Entrepreneurship / Management Courses (EM)			1					3	4	4
10	Indian Knowledge System (IKS)	2								2	2
11	Value Education Course (VE)	2	2							4	4
12	Research Methodology (RM)								4	4	4
13	Field Project (FP)						2			2	2
14	Project (PR)							4		4	4
15	Internship (IN)								12	12	12
16	Co Curricular Course (CC)				2	2				4	4
	Total Credits	**21**	22	**19**	**20**	**24**	**21**	**21**	**19**	167	160-176

General Instructions:

(1) 10% content of syllabus of each theory course shall be completed by the students with self-study. The 10% portion of each course (for self-study) shall be declared by the concerned course-coordinator at the beginning of teaching of the course.

(2) Student can complete **any Course** or programme elective courses PE1 to PE5 in "online" mode, offered through SWAYAM/ NPTELportal or equivalent platform which provides Evaluation mechanism with the permission of Departmental Faculty Board (DFB). In this case –

(i) Students can register and complete these online courses any time after beginning of third semester, however, the student must successfully complete and pass the course, and submit the score card/certificate before declaration of result of respective semester in which the course is being offered.

(ii) In case, if a student registers for a course in online mode but fails in the course, the student will have to register for the course offered by the institute in respective semester as per curriculum. In this case, the student will have to appear for all the examinations (CT1/CT2, TA, ICA, ESE etc) of the course, and successfully complete the course.

(3) In eighth semester, the students have to complete mandatory internship of one semester in the company/ organization approved by the DFB.

(4) In eighth semester during internship, the students have to complete the theory courses in any one of the two modes:

(i) **Online courses** offered through SWAYAM/ NPTELor equivalent platform which provides Evaluation mechanism with the permission of DFB: In this case, students can register and complete these online courses any time after beginning of third semester and complete the course and submit the score card/ certificate before declaration of result of eighth semester.

In case if a student registers for a course in online mode but fails in the course, the student will have to register for the course offered by the institute as per curriculum. In this case, the student will have to appear for all the examinations (CT1/CT2, TA, ICA, ESE etc) of the course personally as per the schedule declared by the institute, and successfully complete the course.

(ii) **Self-study mode:** In this case the student will have to study the course offered by the institute of his/her own. The student shall appear for all the college assessments/ examinations (CT1/CT2, TA and ESE) personally as per the schedule declared by the instituteand successfully complete the course.

(5) In addition to program specific courses, the students have to complete vocational skill courses, internship, field projects connected to **major degree**.

(6) Exit Option:

The exit option at the end of each year will be available to students after even semester. e. 2nd semester, 4th semester &6th semester and will commence from AY 2024-25 for UG Certificate, AY 2025-26 forUG Diploma, AY 2026-27 for B. Voc./B. Sc. Engineering degree.

(7) Students opting for exit at any level (after odd semesters or even semester) will have to earn additional eight credits before exit in skill based vocational courses and internship/apprenticeship/mini project to make them eligible to get UG certificate / UG Diploma or B. Voc./B. Sc. Engineering degree as per eligibility.

(8) Re Entry and Lateral Entry: Students opting for exit at any level after even semester, will have the option to re-enter the programme from where they left off in odd semesters within **four years of exit.** There shall be a gap of at least **one year** between exit and re-entry to UG programme.

(9) Students opting for exit after odd semester, i.e. 1st, 3rd, 5th or 7th semester will have the option to re-enter the programme from where they left off in even semesters only. There shall be a gap of at least **one year** between exit and re-entry to UG programme.

(10) Maximum period for completion of B. Tech. programme:

The student has to complete the degree programme within the stipulated **maximum period of eight years** from the date of admission to first year UG. The maximum duration of the programme includes the period of exit, withdrawal, absence and different kinds of leaves permissible to a student but it shall exclude the period of rustication of the student from the institute. However, genuine cases on confirmation of valid reasons may be referred to Academic Council for extending this limit by **additional one year**.

(11) Eligibility for admission to the UG Bachelor's Degree with Honours/ Research/Double Minor:

Students with minimum **CGPA of 7.5** without backlog courses at the end of fourth semester and should have earned 84 **credits** are eligible for admission to the UG Bachelor's Degree with Honours/ Research/ Double Minor.

SEMESTER –I														
Category	**Course Code**	**Name of the Course**	**Teaching Scheme**				**Evaluation Scheme**							**Credits**
							Theory				**Practical**		**Total**	
		Induction Program	TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE		
BS1	SH1121	Engineering Mathematics-I	3	1		4	15	15	10	60			100	4
BS2	SH1122	Engineering Physics	3			3	15	15	10	60			100	3
	SH1123	Engineering Physics Laboratory			2	2					25		25	1
ES1	EE1121	Basic Electrical Engineering	3			3	15	15	10	60			100	3
	EE1122	Basic Electrical Engineering Laboratory			2	2					25		25	1
ES2	CS1121	Programming for Problem Solving	2			2	15	15	10	60			100	2
	CS1122	Programming for Problem Solving Laboratory			2	2					25		25	1
ES3	ME1121	Workshop Practices			2	2					25		25	1
AE1	SH1124	Communication Skill			2	2	0	0	00		50		50	1
VE1	SH1125	Environment Science	2			2	15	15	20				50	2
IKS1	SH1126	Indian Knowledge System	2			2			40				40	2
Total			**15**	**1**	**10**	**26**	**75**	**75**	**100**	**240**	**150**		**640**	**21**

SEMESTER –II														
Category	**Course Code**	**Name of the Course**	**Teaching Scheme**				**Evaluation Scheme**							**Credits**
							Theory				**Practical**		**Total**	
			TH	TU	PR	Total	CT-1	CT-2	TA	ESE	ICA	ESE		
BS3	SH1221	Engineering Mathematics-II	3	1		4	15	15	10	60			100	4
BS4	SH1222	Engineering Chemistry	2			2	15	15	10	60			100	2
	SH1223	Engineering Chemistry Laboratory			2	2					25		25	1
ES4	ME1221	Engineering Graphics	2			2	15	15	10	60			100	2
	ME1222	Engineering Graphics Laboratory			2	2					25		25	1
PC1	**IN1221**	**Elements of Measurement**	**3**			**3**	**15**	**15**	**10**	**60**			**100**	**3**
ES5	**IN1222**	**Elements of Measurement Lab**			**2**	**2**					**25**		**25**	**1**
PC2	**IN1223**	**Introduction to MatLAB**	**2**	**1**		3	**15**	**15**	**10**	**60**			**100**	**3**
AE2	SH1224	Modern Indian Language		2		2	15	15	20				50	2
VE2	SH1225	Universal Human Value	2			2	15	15	20				50	2
MNC1	SH1226	Yoga &Fitness			2	2			20				20	0
AE3	SH1227	Language Laboratory			2	2					25		25	1
			14	**3**	**10**	**28**	**105**	**105**	**110**	**300**	**100**		**720**	**22**

Note : In first semester , the students of Civil, Electrical, Electronics & Telecommunication ,Instrumentation Engineering programmes will be offered the courses mentioned under Semester-I **AND** students of Mechanical , Computer Science Engineering and Information Technology will be offered the courses mentioned under Semester-II and in Second Semester Vice-versa except Engineering Mathematics-I (SH1101) and Engineering Mathematics-II (SH1201).

Equivalence code for NEP V1.0 to be used in NEP V2.0

Sr No	Course Name	Course code Used in NEP Ver 1.0	**New code in NEP V2.0**
1	Physics Laboratory	SH1104	SH1123
2	Basic Electrical & Electronics Laboratory	EE1201	EE1122
3	Workshop Practice	ME1102	ME1121
4	Communication Skill	SH1103	SH1124
5	Chemistry Laboratory	SH1204	SH1223
6	Engineering Graphics	ME1101	ME1221
7	Engineering Graphics Laboratory	ME1103	ME1223
8	Modern Indian Language	SH1203	SH1224

Multiple exits: Following options are available for multiple exists:

Option	NCrF Level	Qualification Title	Additional credit requirement	Bridge courses
Exit-1	4.5	One yr. UG certificate course in Engg/Tech	8	2 Month Internship **OR** Online Two skill courses at ITI Level from NSQF/ESSC/ANY Other agency which provides certification / Evaluation @ **OR** Technical Project
Exit-2	5.0	Two Yr UG Diploma I Engg/Tech	8	2 Month Internship **OR** Online Two skill courses at Diploma Level from NSQF/ESSC/ANY Other agency which provides certification / Evaluation @ **OR** Technical Project
Exit-3	5.5	Three Yr Bachelor Degree in Vocation (B.Voc) orB.Sc. (Engg./Tech)	8	2 Month Internship **OR** Online Two skill courses at Degree Level from NSQF/ESSC/ANY Other agency which provides certification / Evaluation @ **OR** Technical Project

EXIT CRITERIA FOR U. G. Certificate														
Category	Course Code	Name of the Course @	Teaching Scheme				Evaluation Scheme							Credits
							Theory				Practical		Total	
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE		
EX1	IN1211	Industrial Instrumentation	4			4				100				4
EX1	IN1212	Industrial Instrumentation Lab			4	4					25		50	4
		Technical Project/ Programming Language									25			
OR														
EX1	IN1213	Internship / Technical Project									100@		100	8
@ Based on seminar, Internship Report, Internship/ Project evaluation														

SEMESTER –III														
Category	**Course Code**	**Name of the Course**	**Teaching Scheme**				**Evaluation Scheme**							**Credits**
											Practical		**Total**	
			TH	TU	PR	Total	CT-1	**CT-2**	TA	ESE	ICA	ESE		
BS5	**SH1301C**	Transform and Differential Equations	3			3	15	15	10	60			100	3
MM1	**IN 1315/16**	MultiDisciplinaryMinor I	3			3	15	15	10	60			100	3
PC3	IN1301	Sensor & Transducers I	3			3	15	15	10	60			100	3
PC4	IN1302	Electronic Devices & Circuits	3			3	15	15	10	60			100	3
PC5	IN1303	Digital Electronics	3			3	15	15	10	60			100	3
PC6	IN1304	Sensor & Transducers I Lab			2	2					25	25	50	1
VSE1	IN1305	Electronic Devices & Circuits Lab			2	2					25	25	50	1
VSE2	IN1306	Digital Electronics Lab			2	2					50		50	1
EM1	IN1307	Introduction to Lab View			2	2					50		50	1
Total			**15**	**0**	**8**	**23**	**75**	**75**	**50**	**300**	**150**	**50**	**700**	**19**

SEMESTER –IV														
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
							Theory				Practical		Total	
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE		
MM2	**IN1415/16**	MultidisciplinaryMinor-II	3			3	15	15	10	60			100	3
PC7	IN1401	Automatic Control System	3			3	15	15	10	60			100	3
PC8	IN1402	Linear Integrated Circuits	3			3	15	15	10	60			100	3
PC9	IN1403	Sensor & Transducers II	3			3	15	15	10	60			100	3
OE1	SH1401	Open Elective-I	3			3	15	15	10	60			100	3
PC10	IN1404	Automatic Control System Lab			2	2					50		50	1
PC11	IN1405	Linear Integrated Circuits Lab			2	2					50		50	1
VSE3	IN1406	Sensor & Transducers II Lab			2	2					25	25	50	1
CC1	SH1402	Co-curricular Course			4	4			20				20	2
Total			**15**	**0**	**10**	**25**	**75**	**75**	**70**	**300**	**125**	**25**	**670**	**20**

Co-Curricular Course:: Active Participation in Activities such as: Sports, Tech-fest, College Club Activity, University level /college level cultural activities, Drama, painting ,annual day, department student's association/IE/ISTE, paper presentation, foreign language certificate, NCC etc **Co-Curricular Course Activities minimum hours :**:2 hours per week or 24 hours

EXIT CRITERIA FOR U. G. DIPLOMA														
Category	Course Code	Name of the Course @	Teaching Scheme				Evaluation Scheme							Credits
							Theory				Practical		Total	
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE		
EX2	IN1411	IOT based Application									50		50	4
EX2	IN1412	PCB design & Circuit simulator									50		50	4
OR														
EX2	XX1413	Internship / Technical Project									100 @		100	8

@ Based on seminar, Internship Report, Internship/ Project evaluation

SEMESTER –V														
Category	**Course Code**	**Name of the Course**	**Teaching Scheme**				**Evaluation Scheme**							**Credits**
								Theory			**Practical**		**Total**	
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE		
MM3	**IN1515/ 16**	MultiDisciplinaryMinor-III	3			3	15	15	10	60			100	3
PC12	IN1501	Signal & System	3			3	15	15	10	60			100	3
PC13	IN1502	Industrial Automation	3			3	15	15	10	60			100	3
PC14	IN1503	Unit Operations	3			3	15	15	10	60			100	3
PE1	IN1504	Program Elective 1	3	1		4	15	15	10	60			100	4
OE2	SH1501	Open Elective –II	3			3	15	15	10	60			100	3
VSE4	IN1505	Virtual Instrumentation Lab			4	4					50		50	2
PC15	**IN1506**	**Industrial Automation Lab**			**2**	**2**					**25**	**25**	**50**	**1**
CC2	SH1502	Co-curricular Course			4	4			20				20	2
MNC2	SH1503	Soft Skills	2			2			20				20	0
Total			**20**	**1**	**10**	**31**	**90**	**90**	**100**	**360**	**75**	**25**	**740**	**24**

Co-Curricular Course:: Active Participation in Activities such as: Sports, Tech-fest, College Club Activity, University level /college level cultural activities, annual day, department student's association/IE/ISTE, paper presentation, foreign language certificate, NCC etc **Co-Curricular Course Activities minimum hours :**:2 hours per week or 24 hours

ADDITIONAL CRITERIA FOR HONORS															
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme								Credits
							Theory				Practical		Total		
			Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	CT1	CT2	TA	ESE	ICA	ESE			
PEH1	IN1521	Program Elective for Honors 1 (Swayam/MOOCS/NPTEL/ Online) from Basket													3
PEH2	IN1522	Program Elective for Honors 2 (Swayam/MOOCS/NPTEL/ Online) from Basket													3
	Total														**6**

ADDITIONAL CRITERIA FOR HONORS WITH RESEARCH															
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme								Credits
							Theory				Practical		Total		
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE			
PER1	IN1531	Research Project Stage 1			08	08					100		100		4
Total					08	08					100		100		4

ADDITIONAL CRITERIA FOR DOUBLE MINOR (SPECIALIZATION)														
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
							Theory				Practical		Total	
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE		
MN1	IN1541	Minor Track Course 1 From Basket	3				15	15	10	60			100	3
MN2	IN1542	Minor Track Course 2 From Basket	3				15	15	10	60			100	3
	Total		6				30	30	20	120			200	6

SEMESTER –VI															
Category	**Course Code**	**Name of the Course**	**Teaching Scheme**				**Evaluation Scheme**								**Credits**
							Theory				**Practical**		**Total**		
			TH	TU	PR	Total	CT 1	CT 2	TA	ESE	ICA	ESE			
MM4	**IN1615/16**	**Multi Disciplinary Minor-IV**	**3**			**3**	**15**	**15**	**10**	**60**			**100**	**3**	
PC16	IN1601	Process Control	3			3	15	15	10	60			100	3	
PC17	IN1602	Digital Signal processing	3			3	15	15	10	60			100	3	
PE2	IN1603	Program Elective II	3	1		4	15	15	10	60			100	4	
PE3	IN1604	Program Elective III	3	1		4	15	15	10	60			100	4	
VSE5	IN1605	Process Control Lab			2	2					25	25	50	1	
PC18	**IN1606**	**Digital Signal processing Lab**			**2**	**2**					**50**		**50**	**1**	
FP	IN1607	Minor Project			4	4					50		50	2	
MNC3	**IN1608**	**(Program specific course Example: Internet of things based Control)**	2			2	15	15	20					0	
MNC4	SH1601	NCC/NSS							20				20	0	
Total			**17**	**1**	**8**	**27**	**90**	**90**	**90**	**300**	**125**	**25**	**670**	**21**	

EXIT CRITERIA FOR EXIT CRITERIA FOR B. VOC.														
Category	Course Code	Name of the Course @	Teaching Scheme				Evaluation Scheme							Credits
							Theory				Practical		Total	
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE		
EX3	IN1611	Skill Based Courses on Industrial Automation									50		50	4
EX3	IN1612	Industrial Controls Lab									50		50	4
OR														
EX3	IN1613	Internship / Technical Project									100@		100	8

@ Based on seminar, Internship Report, Internship/ Project evaluation

ADDITIONAL CRITERIA FOR HONORS

Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
							Theory				Practical		Total	
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE		
PEH3	IN1621	Program Elective for Honors 3 (Swayam/MOOCS/NPTEL/ Online) from Basket												3
PEH4	IN1622	Program Elective for Honors 4 (Swayam/MOOCS/NPTEL/ Online) from Basket												3
	Total													**6**

ADDITIONAL CRITERIA FOR HONORS WITH RESEARCH

Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
							Theory				Practical		Total	
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE		
PER2	IN1631	Research Project Stage 2			12						100	100	200	6
Total					12						100	100	200	6

ADDITIONAL CRITERIA FOR DOUBLE MINOR (SPECIALIZATION)															
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme								Credits
							Theory				Practical		Total		
			Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	CT1	CT2	TA	ESE	ICA	ESE			
MN3	IN1641	Minor Track Course 3 From Basket	3				15	15	10	60			100		3
MN4	IN1642	Minor Track Course 4 From Basket	3				15	15	10	60			100		3
	Total		6				30	30	20	120			200		6

SEMESTER –VII														
Category	**Course Code**	**Name of the Course**	**Teaching Scheme**				**Evaluation Scheme**							**Credits**
							Theory				**Practical**		**Total**	
			TH	TU	PR	Total	CT 1	CT2	TA	ESE	ICA	ESE		
MM5	**IN1715/16**	**Multi Disciplinary Minor-V**	2		1	3	15	15	10	60			100	2
PC19	IN1701	Instrument System Design	3			3	15	15	10	60			100	3
PE4	IN1702	Program Elective 4	3	1		4	15	15	10	60			100	4
PE5	IN1703	Program Elective 5	4			4	15	15	10	60			100	4
OE3	SH1701	Open Elective 3	2			2	15	15	10	60			100	2
VSE6	IN1704	PE4 Lab			2	2					25	25	50	1
VSE7	IN1705	Instrument System Design Lab			2	2					50		50	1
PR	IN1706	Project			8	8					50	50	100	4
MNC5	IN1707	Advance Sensor Technology in Instrumentation	2			2	15	15	20				50	0
Total			**17**	**1**	**12**	**30**	**90**	**90**	**70**	**300**	**125**	**75**	**750**	**21**

Note: Project Guide Teaching load: 8 hrs/week

Students can register for the elective in seventh semester under Multidisciplinary Minor 4 using **SWAYAM/NPTEL** etc. portal. Courses will be of completely student's choice but approved by DFB of concerned department (other than MM1 to MM3) and should be **at least of 12 weeks** including tutorials, which will be considered as **4 credit course**.

Students can register and complete online courses for Multidisciplinary Minor 4 any time after completion of semester IV, however, the student must successfully complete and pass the course, and submit the score card/certificate before declaration of result of VII th semester.

ADDITIONAL CRITERIA FOR HONORS															
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme								Credits
							Thoery				Practical		Total		
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE			
PEH5	IN1721	Program Elective for Honors 1 (Swayam/MOOCS/NPTEL/ Online) from Basket													3
PEH6	IN1722	Program Elective for Honors 2 (Swayam/MOOCS/NPTEL/ Online) from Basket													3
	Total														**6**

ADDITIONAL CRITERIA FOR HONORS WITH RESEARCH															
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme								Credits
							Theory				Practical		Total		
			TH	TU	PR	Total	CT 1	CT2	TA	ESE	ICA	ESE			
PER3	IN1731	Research Project Stage 3			16	16					100	200	300		8
Total											100	200	300		8

ADDITIONAL CRITERIA FOR DOUBLE MINOR (SPECIALIZATION)														
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
							Theory				Practical		Total	
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE		
MN5	IN1741	Minor Track Course 5 From Basket	3				15	15	10	60			100	3
MN6	IN1741	Minor Track Course 6 From Basket	3				15	15	10	60			100	3
	Total		6				30	30	20	120			200	6

SEMESTER –VIII														
Category	**Course Code**	**Name of the Course**	**Teaching Scheme**				**Evaluation Scheme**							**Credits**
								Theory			**Practical**		**Total**	
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE	Total	
RM	SH1801	Research Methodology (Online through SWAYAM/NPTEL)	4			4	15	15	10	60			100	4
EM2	IN1801	Project Engg Management	3			3	15	15	10	60			100	3
IN	IN1802	Internship (Online reviews - one in each month)									100	200	300	12
		Total	7			7	30	30	20	120	100	200	500	19

Note: Internship Guide Teaching load: 4 hrs/week

LIST OF PROGRAM ELECTIVES					
	PE1 IN1504	**PE2 IN1604**	**PE3 IN1605**	**PE4 IN1703**	**PE5 IN1705**
A	Biomedical Engg	Biomedical Signal processing	Biomedical Image Processing	Biomedical Equipment Techniques	Rehabilitation Engg
B	Mechatronics	Analytical Instrumentation	Building Automation	Modern Control Theory	Embedded Sensing, Actuation and Interfacing Systems ~~[PPI]~~
C	Digital Control	Process Modelling Optimization	Neural Fuzzy Control	Environmental Pollution Control	Adaptive & Optimum Control System
	SWAYAM/NPTEL etc related to vertical approved by DFB	**SWAYAM/NPTEL**etc related to vertical approved by DFB	**SWAYAM/NPTEL**etc related to vertical approved by DFB	**SWAYAM/NPTEL**/etc related to vertical approved by DFB	**SWAYAM/NPTEL**etc related to vertical approved by DFB

SWAYAM/NPTEL etc. portal. Courses for PE1 to PE5 should be related to concerned vertical approved by DFB and should be **at least of 12 weeks** including tutorials.

LIST OF MULTIDISCIPLINARY MINOR COURSES

Sr No.	Offering Department	Name of Programme /Minor Course	Students from Department who can register
1	CSE	Data Science	CE,ME,EE,ENTC,INST
		Artificial Intelligence	CE,ME,EE,ENTC,INSTR
2	IT	Machine Learning	CE,ME,EE,ENTC,INST
		Software Engineering	CE,ME,EE,ENTC,INST
3	ENTC	IOT	CE,ME,EE,CSE,IT,INST
		Electronics and Telecommunication Engg.	CE,ME,EE,CSE,IT,INST
4	ME	Mechanical Engineering	CE,EE,ENTC,CSE,IT,INS
		Automation & Robotics	CE,EE,ENTC,CSE,IT,INS
		Industrial Management	ME,CE,ENTC,CSE,IT,EE,INST
5	CE	Building Construction and Management	ME,EE,ENTC,CSE,IT,INST
		Business Economics	ME,EE,ENTC,CSE,IT,INST,CE
6	EE	Energy Engineering	ME,CE,ENTC,CSE,IT,INST
		Electrical Motors & Drives	ME,CE,ENTC,CSE,IT,INST
7	INST	Instrumentation and Control	ME,CE,ENTC,CSE,IT,EE
		Banking and Finance	ME,CE,ENTC,CSE,IT,EE,INST

Name of Programme /Minor Course	Course Code	Civil Engineering		Mechanical Engineering			Electrical Engineering	
		Building Construction and Management (TRACK-I)	**Business Economics (TRACK-II)**	**Mechanical Engineering (TRACK-I)**	**Automation & Robotics (TRACK-II)**	**Industrial Management (TRACK-III)**	**Energy Engineering(TRACK-I)**	**Electrical Motors & Drives (TRACK-II)**
MinorCourse-1	XX1315/16/17	CE1315 Basics of Civil Engineering	CE1316 Principles of Macroeconomics	ME1315 Production Technology	ME1316 Hydraulics and Pneumatics	ME1317 Organizational Behaviour	EE1315 Introduction to Renewable Energy	EE 1316 Electrical Motors
MinorCourse-2	XX1415/16/17	CE1415 Building Construction	CE1416 Principles of Microeconomics	ME1415 New and Renewable Energy Sources	ME1416 Automation in Manufacturing	ME1417 Human Resource Management	EE1415 Energy Resources, Environment and Economics	EE 1416 Special Electrical Machines
MinorCourse-3	XX1515/16/17	CE1515 Building Planning & Drawing	CE1516 Business Statistics	ME1515 Automobile Engineering	ME1516 Mechatronic Systems	ME1517 Material Management	EE1515 Energy Efficiency in Electrical Utilities	EE 1516 Power Electronics
MinorCourse-4	XX1615/16/17	CE1615 Building Estimates & Tendering	CE1616 Financial Accounting	ME1615 Basic of Product Design	ME1616 Industrial Robotics	ME1617 Marketing Management	EE1615 Energy Management	EE 1616 Electrical Drives and Control
MinorCourse-5	XX1715/16/17	CE1715 Construction Management	CE1716 Minor Project	ME1715 Industrial Management and Quality Control	ME1716 Computer Integrated Manufacturing	ME1717 Corporate Financial Reporting and Analysis	EE1715 Project	EE 1716 Project

Name of Programme /Minor Course	Course Code	Electronics Engineering		Computer Engineering		Information Technology		Instrumentation Engineering	
		Internet of Things(TRACK-I)	Electronics and Telecommunication Engg. (TRACK-II)	Data Science (TRACK-I)	AI (TRACK-II)	Machine Learning (TRACK-I)	Software Engineering (TRACK-II)	Instrumentation and Control (TRACK-I)	Banking and Finance(TRACK-II)
MinorCourse-1	XX1315/16	ET1315 Introduction to internet of things	ET1316 Digital Circuits	CS1315 Fundamentals of data science	CS1316 Introduction to Artificial Intelligence	IT1315 Essential math for machine learning	IT1316 Data Structure & Algorithms	IN1315 Industrial Measurement I	IN1316 Bank operations Management
MinorCourse-2	XX1415/16	ET1415 IoT Architecture & Protocols	ET1416 Communication Engineering	CS1415 Computational Data Analytics	CS1416 Data Mining	IT1415 Artificial Intelligence	IT1416 Software Engineering	IN1415 Industrial Measurement II	IN1416 Strategic management and innovation in banking
MinorCourse-3	XX1515/16	ET1515 Programming with Arduino and Raspberry-Pi	ET1516 Microprocessor &Embedded System	CS1515 Natural Language Processing	CS1516 Introduction to Machine Learning	IT1515 Machine learning	IT1516 Object Oriented Design & Programming	IN1515 Control system Engineering	IN1516 Security analysis and portfolio management
MinorCourse-4	XX1615/16	ET1615 Industrial Internet of Things	ET1616 Wireless Communication	CS1615 Application of data science	CS1616 Optimization Methods in Machine Learning	IT1615 Deep Learning	IT1616 Software Testing	IN1615 Industrial Automation	IN1616 Spreadsheet based data analysis
MinorCourse-5	XX1715/16/17	ET1715 Project	ET1716 Project	CS1715 Marketing Analytics for Big Data	CS1716 Human Applications of AI	IT1715 Minor Project	IT1716 Minor Project	IN1715 Programming for PLAC,DCS & SCADA	IN1716 IT operations &Management

LIST OF OPEN ELECTIVE COURSES		
OE-I	**OE-II**	**OE-III**
Appreciating Indian Music	**Environmental law**	**Operational Research**
Introduction to Human Psychology	**Cyber law**	**Digital Marketing**
Nanotechnology, Science and Application	**Introduction to Mass Communication**	**Biology for Engineers**
Introduction to Exercise Physiology & Sports Performance	**Foreign Language Japanese (N5) /German(A1)**	**Foreign Language Japanese(N4) /German(A2)**
SWAYAM/NPTEL https://onlinecourses.nptel.ac.in/noc22_hs57/preview https://onlinecourses.nptel.ac.in/noc24_hs39/preview https://onlinecourses.nptel.ac.in/noc19_mm21/preview https://onlinecourses.nptel.ac.in/noc24_hs86/preview	**SWAYAM/NPTEL**	**SWAYAM/NPTEL**

LIST OF PROGRAM ELECTIVES HONOR'S COURSES (Swayam /NPTEL)	
COURSE CODE	**Instrumentation and Control**
IN1521	Neural Based Control
IN1522	Digital Image Processing
IN1621	Speech and Audio Signal Processing
IN1622	Wavelet transform and Its Application
IN1721	Process Equipment Design
IN1722	Applied Instrumentation system Design

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LIST OF MINOR COURSES FOR DOUBLE MINOR (SPECIALIZATION)							
COURSE CODE	**Civil Engineering**	**Mechanical Engineering**	**Electrical Engineering**	**Electronics Engineering**	**Computer Engineering**	**Information Technology**	**Instrumentation Engineering**
IN1541							Sensor Design
IN1542							Robotics and Control
IN1641							Industrial Drives
IN1642							Advance Programming for various PLC/SCADA /DCS system
IN1741							Process Equipment Design
IN1742							AI based Control applications

Sample Guidelines for the Honour with Research Project

(Sample/Illustration purpose, BOS May change or may add courses related to topic of research)

The purpose of this course is to introduce students to the process of conducting research projects/work. The students will be helped to conceptualise, design and execute a research project by a teacher guide.

Stage-1:

- Student have to complete online course related to topic/perquisite course prescribed by the assigned guide/BOS
  OR
- The focus will be on discussions and analysis of assignments. Learners will be encouraged to read books and research journals related to his/her research topic (literature review, theory and hypotheses etc) and share them in the seminars and evaluated by two member Team of department and same to be enter in ICA format.

Stage-2:

Sample steps:

- Research design/Methodology
- Sampling tool of data collection
- data processing and analysis
- Plan of research report
- Publish review paper in peer view journal/Scopus indexed journal and seminar on it
- The faculty supervisor will assess the method and procedures used by the learner
- At end evaluated by two member Team of department

Stage-3:

- If applicable initiate Actual implementation
- Data Analysis and Interpretation: The outcome of the research is presented in tabular form with the help of statistical procedures. The data are analysed and interpreted and presented in the form of a research report and presenatation/seminar.

- Report writing
- Publish paper on findings in peer view journal/Scopus indexed journal.
- Two member Team of department will assess the Findings method and procedures
- The faculty supervisor will assess the presentation of major findings depending on the methodology used, presentation of results, interpretation of the results with discussion, summary of the proposed research problem and conclusion.
- Two member Team of department (may evaluated by Guide and external expert) will assess the Findings method and procedures etc

Note : Guide Teaching load : 4 Hrs per student in Research stage -1 /2/3

Equivalence Scheme

[Equivalence Old second year to NEP-Phase II new version]

Programme Name:-B. Tech. Instrumentation Engineering

Sr.	Course code & course Name Old[2019-2020]			Course code & course Name New NEP VII		
	Course Code	Course Name	Credits	Course Code	Course Name	Credits
ODD Semester						
1.	SHU321C SHU322C	Transform and Statistical Methods / Integral Calculus And Probability	4	SH1301(C)	Transform and Differential Equations	3
2.	INU321	Sensors and Transducers-I	3	IN1301	Sensor & Transducers I	3
3.	INU322	Electrical Measurement and Instrumentation	3	No equivalence		
4.	INU323	Electronics Devices and Circuits	3	IN1302	Electronics Devices and Circuits	3
5.	SHU325	Human values and ethics	0	No equivalence		
6.	INU324	Sensors and transducers-I Lab	1	IN1304	Sensors and transducers-I Lab	1
7.	INU325	Electrical Measurement and Instrumentation Lab	1	No equivalence		
8.	INU326	Electronics Devices and Circuits Lab	1	IN1305	Electronics Devices and Circuits Lab	1
9.	INU327	Computational Methods Lab	1	No equivalence		
10.	SHU232	Introduction to Constitution of India	0	No equivalence		
EVEN Semester						
1.	INU421	Sensors and Transducers-II	3	IN1403	Sensors and Transducers-II	3
2.	INU422	Linear Integrated Circuits	4	IN1402	Linear Integrated Circuits	3
3.	INU423	Control System Engineering	4	IN1401	Automatic Control System	3
4.	INU424	Signals and Systems	3	IN1501	Signals and Systems	3

5.	INU425	Digital Electronics	3	IN1303	Digital Electronics	3
6.	SHU422	Environmental Studies	0	No equivalence		
7.	INU426	Sensors and Transducers-II Lab	1	IN1304	Sensors and Transducers-II Lab	1
8.	INU427	Linear Integrated Circuits Lab	1	IN1405	Linear Integrated Circuits Lab	1
9.	INU428	Control System Engineering Lab	1	IN1404	Automatic Control System Lab	1
10.	INU429	Signals and Systems Lab	1	No equivalence		
11.	INU430	Digital Electronics Lab	1	1306	Digital Electronics Lab	1

SEMESTER –III

Course Code	SH1301(C)							Course category			BS06
Course Name	TRANSFORM AND DIFFERENTIAL EQUATIONS										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				CT1 CT2	TA	ESE	ESE Duration	ICA	ESE		
03	00	00	03	15 15	10	60	2 hrs 30 min	00	00	100	03

Course Objectives:

1. To study solution of partial differential equations and apply it to solve wave and heat equations.
2. To learn Laplace transform and its properties. Apply it to solve differential equation
3. To equip students with Vector spaces mostly used in varied applications in engineering and science.
4. To learn inner product spaces and related processes.
5. To learn vector calculus and their applications

Course Contents

Partial differential equations and its applications: (9 hours)

Definition, formation of partial differential equation, Lagrange's linear equation, nonlinear equations of the first order. method of separation of variables for solving second order Partial differential equations, Solutions of wave equation, one dimensional heat flow equation and two dimensional heat flow equation in steady state (Laplace equation)

Laplace Transform :(9 hours)

Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic Functions, Inverse Laplace Transform, Convolution theorem. Unit step function, unit impulse function. Applications of Laplace transforms to linear differential equations and simultaneous linear differential equations

Vector Spaces :(9 hours)

Vector spaces and Subspaces, Linear dependence and Independence of vectors, Bases and dimensions, Coordinate vectors, Linear transformation, Algebra of linear transformation, Representation of linear transformation of matrices relative to basis.

Random Variables and Probability Distributions:(9 hours)

Random variables, Discrete and Continuous random variables, Distribution functions, Probability distribution of continuous random variable. Joint distribution of discrete and continuous random variables, Conditional distribution, Mathematical expectation, Mean, moments and variance. Variance for joint distribution and Covariance

Vector Calculus: (9 hours)

Scalar and vector fields, line and surface integrals, gradient, divergence and curl, directional derivative, line integral independent of path, Green's, Gauss divergence and Stoke's theorems (Without proofs) and their simple 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, Volume-I and Volume-II Laxmi Publications, Reprint,2023

Reference books:

1. Advanced Engineering Mathematics, Erwin Kreyszig, 9th Edition, John Wiley & Sons, 2006.
2. Higher Engineering Mathematics, B.V. Ramana, Tata McGraw Hill Publishing company Ltd. New Delhi,2008, 6th edition.
3. Advanced Engineering mathematics, Reena Garg, Khanna book publishing company, 2021
4. Introduction to Probability Theory, P. G. Hoel, S. C. Port and C. J. Stone, Universal Book Stall, 2003(Reprint).
5. A First Course in Probability, S. Ross, 6th Ed., Pearson Education India,2002.
6. An Introduction to Probability Theory and its Applications, W. Feller, Vol. 1, 3rd Ed., Wiley,1968

Course Outcomes:

After the successfully completion of the course the student will able to

1301C.1. Study solution of partial differential equations and apply it to solve wave and heat equations.

1301C.2. Study Laplace transform and its properties. Apply it to solve differential equation

1301C.3. Equip students with Vector spaces mostly used in varied applications in engineering and science.

1301C.4. Study inner product spaces and related processes.

1301C.5. Solve vector calculus problems and their applications

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
SH1301C	3	3	3	3	3	-	-	-	-	-	-	-	2	-	-
SH1301C	3	3	3	3	3	-	-	-	-	-	-	-	2	-	-
SH1301C	3	3	3	3	3	-	-	-	-	-	-	-	2	-	-
SH1301C	3	3	3	3	3	-		-	-	-	-	-	2	-	-
SH1301C	3	3	3	3	3	-	-	-	-	-	-	-	2	-	-

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

Course Code	IN1315							Course category			MM1
Course Name	Industrial Measurement-I										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
03	00	00	03	15	15	10	60	2 hrs 30 min	00	00	100	03

Course Objectives:

To make the students aware and understand:

1. To provide the knowledge of fundamentals and types of all the sensors and Transducers
2. To understand the sensors and transducers concept and its applications in the process measurement
3. To describe, draw, classify and produced sketches, drawings to explain working principles of various sensors and transducers.
4. To select transducers/sensors for specific applications

Course Contents:

Temperature Measurement :- Temperature scales, classification of temperature sensors, standards, working principle, types, materials, Non electrical sensors (thermometer, thermostat), electrical sensors (RTD, thermocouple, thermistor), radiation sensors (pyrometers), photo electric radiation thermometers, IC temperature transducers

Pressure measurement: Definition, pressure scale, standards, working principle, types, materials, elastic pressure sensors, secondary pressure sensors, differential pressure sensors, capacitive (delta cell), high-pressure sensors, low-pressure sensors, Pressure Transmitter definition, two wire and four wire transmitters, I/P and P/I converters.

Flow Measurement: Essential principles of fluid mechanics and properties of fluid, types of fluid flow, continuity equation, Bernoulli's equation, Newtonian and non-newtonian fluids, Reynolds‟s number, laminar and turbulent flows, hydrostatic law and pascal's law, Selection criteria of flow sensors. Head Type Flow Meter: Orifice, venturi, nozzle, pitot tube, Variable

Area Type Flow Meter: Rota-meter, Open Channel: Turbine, Target, Electro Magnetic, Ultrasonic, Vortex Shedding, Mass Flow Meter: Coriolis, Thermal & solid flow meters

Level measurement: Basic level measurement principals, Need for level measurement, types and classification, construction and working, selection criteria for level sensors. float, Bubblers, displacer (torque tube unit), capacitive, conductivity, Differential level sensor, float level sensor, Laser level sensor, microwave level switch, radar Laser (contact, non-contact – TDR / PDS), optical level devices, radiation level sensor, , Ultrasonic level Detector

Humidity, pH and Viscosity Measurement: Humidityterms - dry & wet bulb psychrometers - hot wire electrode type hygrometer, electrolytic hygrometer, Dewpoint hygrometer, Capacitive hygrometer, pH measurement : Nearnst equation, construction & working of pH sensor, temperature compensation, pH measurement electrodes, maintenance and applications, Viscosity terms, saybolt viscometer, rotometer type viscometer, Optical Hygrometer

Text Books:

1. Arun Ghosh, Introduction to Measurements and Instrumentation, PHI Learning Pvt. Ltd.
2. B. C. Nakra and K. K. Choudhari, “Instrumentation Measurements and Analysis” by, Tata McGraw Hill Education, Second ed., 2004.

Reference Books:

1. A. K. Sawhney, “Electrical and Electronic Measurements and Instrumentation”, Dhanpat Rai and Sons, Eleventh ed., 2000.
2. D.V.S. Murthi, “Instrumentation and Measurement Principles”, PHI, New Delhi, Second ed. 2003.
3. B. C. Nakra and K. K. Choudhari, “Instrumentation Measurements and Analysis” by, Tata McGraw Hill Education, Second ed., 2004.
4. E.O. Doebelin, “Measurement Systems”, McGraw Hill.
5. Bentley J. P., Principles of measurement systems, Third Edition, Pearson education Asia pvt.ltd, 2000
6. D. Patranabis, “Principle of Industrial Instrumentation”, Tata McGraw Hill, Second ed., 1999.
7. S. P. Venkateshan,” Mechanical Measurements”, Willy publication second edition. 2015

Useful Link:

1. **Course name: Industrial Measurement-I course**
   https://onlinecourses.nptel.ac.in/noc23_ee105/preview Name of Course offered by NPTEL: Transducers for Instrumentation By Prof. Ankur Gupta, IIT Delhi.

Course Outcomes:

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

INU1315.1 : Identification of sensors and transducer (Primary and secondary).

INU1315.2 : Demonstrate the working principles of various sensors and transducers

INU1315.3 : Evaluate and classify various sensors and transducers

INU1315.4 : Interpret the characteristics of the transducers/sensors

INU1315.5 : Demonstrate working principle of chemical sensors used in process industry

CO – PO – PSO Mapping:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IN1315.1	1	1	--	--	--	--	--	--	--	1	--	--	2	--	--
IN1315.2	1	1	1	2	--	--	--	--	--	--	--	--	1	--	--
IN1315.3	1	--	1	2	--	--	--	1	--	--	--	--	2	--	1
IN1315.4	1	--	1	--	--	--	1	--	--	--	1	--	2	1	--
IN1315.5	1	1	1	--	2	--	--	--	--	--	--	--	2	--	1
Average	1	1	1	2	2	0	1	1	0	1	1	0	1.8	1	1

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

Course Code	IN 1316	**Course category**	**MM1**
Course Name	**BANKING OPERATION AND MANAGEMENT**		

Teaching Scheme				**Examination Scheme**								**Credits**
				Theory					Practical		Total	
Th	Tu	Pr	Total	CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
03	00	00	03	15	15	10	60	2hr30 min	00	00	100	03

Course Objective :

This course aims at enabling the students to understand and to contribute to the strategic operational policies and practices of commercial banks management in a competitive environment

Introduction –Scheduled and non scheduled banks, origin and developments, evolution and growth of banking system in India, present structure of banking

Concept of Bank marketing, formulating and implementing marketing strategies for commercial bank ,relationship banking concept and strategy

Liquidity, purpose, sources, measurement, liquidity, profitability problems , theories of liquidity management, priorities in the employment of bank funds ,capital adequacy in banks

Credit Management : cardinal principal of sound bank lending, formulating loan policy, factors influencing loan policy, contents of loan policy ,evaluating credit applicant, loan supervision

Investment Management: Nature and significance of investment management in commercial banks, fundamental principles of security investment by commercial bank ,management of security investment ,reviewing investment portfolio, organization of investment function

Asset Liability Management and Non performing asset : concept of Asset Liability Management ,objectives ,functions,processes,measurement and management risks, concept of NPAs, NPAs in Indian commercial banks, causes, suggestions and steps for containing NPAs, Prudential norms

Books /Reference Books

1 Srivastava, Divya Nigam, Manageent of Indian financial Institutions, Himalaya Publishing house

2 M.Y.Khan,Indian Financial System,Tata Mc Graw Hill

3 Bharati Pathak,Indian Financial System

4 Gerald Halter,Bank Investments and Funds Management ,McMillan

5 Stigum,Managing Bank Assets and Liabilities,Dow-Jones Irwin

6 Dudley Luckett,Money and Banking ,Mc Graw Hill

7 Vasant Joshi ,Vinay Joshi ,Managing Indian Banks, -Challenges Ahead Response Books

8 Journals: Professional Banker

Coure Outcome

IN1316.1 Gain thorough understanding with fundamentals of Banking operation & Management

IN1316.2 Express the liquidity system in banking

IN1316.3 Explore the credit management system and loan system in banking

IN1316.4 Explore the investment portfolio with good strategy

IN1316.5 Identify the ALM and NPA in banking

CO PO PSO Mapping

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IN1316.1	3	--	--	--	--	--	--	--	--	--	--	--	3	--	--
IN1316.2	3	2	--	--	--	--	--	--	--	--	--	--	3	--	--
IN1316.3	3	--	--	--	--	--	--	--	--	2	--	--	3	--	--
IN1316.4	3	--	--	--	--	--	--	--	--	2	--	--	3	--	--
IN1316.5	3	--	--	--	--	--	--	--	--	2	--	--	3	--	--
Average	3	2	0	0	0	0	0	0	0	2	0	0	3	0	0

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

Course Code	IN1301							Course category			PC2
Course Name	SENSOR AND TRANSDUCER-I										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
03	00	00	03	15	15	10	60	2 hrs 30 min	00	00	100	03

Course Objectives:

To make the students aware and understand:

5. To provide the knowledge of fundamentals and types of all the sensors and Transducers
6. To understand the sensors and transducers concept and its applications in the process measurement
7. To describe, draw, classify and produced sketches, drawings to explain working principles of various sensors and transducers.
8. To select transducers/sensors for specific applications

Course Contents:

Temperature Measurement :- Temperature scales, classification of temperature sensors, standards, working principle, types, materials, Non electrical sensors (thermometer, thermostat), electrical sensors (RTD, thermocouple, thermistor), radiation sensors (pyrometers), photo electric radiation thermometers, IC temperature transducers, thermowell and its types

Pressure measurement: Definition, pressure scale, standards, working principle, types, materials, elastic pressure sensors, secondary pressure sensors, differential pressure sensors, capacitive (delta cell), high-pressure sensors, low-pressure sensors, Pressure Transmitter definition, classification, pneumatic transmitter-force balance type, torque balance type, two wire and four wire transmitters, I/P and P/I converters.

Flow Measurement: Essential principles of fluid mechanics and properties of fluid, types of fluid flow, continuity equation, Bernoulli's equation, Newtonian and non-newtonian fluids, Reynolds‟s number, laminar and turbulent flows, hydrostatic law and pascal's law, Selection

criteria of flow sensors. Head Type Flow Meter: Orifice, venturi, nozzle, pitot tube, Variable Area Type Flow Meter: Rota-meter, Open Channel: Turbine, Target, Electro Magnetic, Ultrasonic, Vortex Shedding, anemometers, Mass Flow Meter: Coriolis, Thermal & solid flow meters

Level measurement: Basic level measurement principals, Need for level measurement, types and classification, construction and working, selection criteria for level sensors. float, Bubblers, displacer (torque tube unit), capacitive, conductivity, Differential level sensor, float level sensor, Laser level sensor, microwave level switch, radar Laser (contact, non-contact – TDR / PDS), optical level devices, radiation level sensor, , Ultrasonic level Detector , vibrating level switch , solid level detectors and application.

Humidity, pH and Viscosity Measurement: Humidityterms - dry & wet bulb psychrometers - hot wire electrode type hygrometer, electrolytic hygrometer, Dewpoint hygrometer, Capacitive hygrometer, pH measurement : Nearnst equation, construction & working of pH sensor, temperature compensation, pH measurement electrodes, maintenance and applications, Viscosity terms, saybolt viscometer, rotometer type viscometer, Industrial consistencymeters Optical Hygrometer,oscillating Hygrometer

Text Books:

1. Arun Ghosh, Introduction to Measurements and Instrumentation, PHI Learning Pvt. Ltd.
2. B. C. Nakra and K. K. Choudhari, “Instrumentation Measurements and Analysis” by, Tata McGraw Hill Education, Second ed., 2004.

Reference Books:

1. A. K. Sawhney, “Electrical and Electronic Measurements and Instrumentation”, Dhanpat Rai and Sons, Eleventh ed., 2000.
2. D.V.S. Murthi, “Instrumentation and Measurement Principles”, PHI, New Delhi, Second ed. 2003.
3. B. C. Nakra and K. K. Choudhari, “Instrumentation Measurements and Analysis” by, Tata McGraw Hill Education, Second ed., 2004.
4. E.O. Doebelin, “Measurement Systems”, McGraw Hill.
5. Bentley J. P., Principles of measurement systems, Third Edition, Pearson education Asia pvt.ltd, 2000
6. D. Patranabis, “Principle of Industrial Instrumentation”, Tata McGraw Hill, Second ed., 1999.

7. S. P. Venkateshan," Mechanical Measurements", Willy publication second edition. 2015

Useful Link:

Course name: Sensor & Transducer-I course
https://onlinecourses.nptel.ac.in/noc23_ee105/preview Name of Course offered by NPTEL: Transducers for Instrumentation By Prof. Ankur Gupta, IIT Delhi.

Course Outcomes:

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

IN1301.1 : Identify, list, define verity of sensors, transducer (Primary and secondary).

IN1301.2 : Describe, draw, classify and produced sketches, drawings to explain working principles of various sensors and transducers

IN1301.3 : Evaluate and monitor asses and compare of various sensors and transducers

IN1301.4 : Interpret the characteristics of the transducers/sensors

IN1301.5 : Demonstrate working principle of chemical sensors used in process industry

CO – PO – PSO Mapping:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IN1301.1	1	1	--	--	--	--	--	--	--	1	--	--	2	--	--
IN1301.2	1	1	1	2	--	--	--	--	--	--	--	--	1	--	--
IN1301.3	1	--	1	2	--	--	--	1	--	--	--	--	2	--	1
IN1301.4	1	--	1	--	--	--	1	--	--	--	1	--	2	1	--
IN1301.5	1	1	1	--	2	--	--	--	--	--	--	--	2	--	1
Average	1	1	1	2	2	0	1	1	0	1	1	0	1.8	1	1

0 - Not correlated 1 - Weakly Correlated2- Moderately Correlated 3- Strongly Correlated

Course Code	IN1302							Course category		PC3
Course Name	Electronic Devices and circuits									
Teaching Scheme				Examination Scheme						Credits
Th	Tu	Pr	Total	Theory				Practical		Total
				CT1	CT2	TA	ESE	ICA	ESE	
03	00	00	03	15	15	10	60	00	00	04

Course Objectives:
To make the students aware and understand:

I. Understand the structure of basic electronic devices.
II. Familiarize the operation and applications of transistor like BJT and FET.
III. Understand the operation of large signal amplifiers.
IV. Explore the characteristics of amplifier gain and frequency response.
V. Learn the required functionality of positive and negative feedback systems.

Course Contents:

Bipolar Junction Transistor: Transistor characteristics, Transistor amplifier characteristics, transistor biasing, different modes of operation and configurations,Transistor current components, thermal stability, thermal runway.DC analysis of BJT.

Transistors at high frequencies: Hybrid-pi CE transistor model, Hybrid-pi conductance and capacitance, validity at Hybrid-pi model, variation of Hybrid-pi parameters.

Amplifier configurations and comparison, multistage amplifier, amplifier noise and distortion, two stage RC Coupled amplifier, high input resistance transistor circuit.

Large signal amplifiers: Class A, B, AB, and C operations and their performance characteristics, push pull, complimentary symmetry amplifier.

Feedback amplifiers: Classification, feedback concept, transfer gain with feedback, general characteristics ofnegative feedback amplifier, Input and output resistance, method of analysis of feedbackamplifier, voltage-series, current-series, voltage–shunt, current-shunt feedback. Positivefeedback in amplifiersFeedback concept, transfer gain, general characteristics of negative feedback amplifier, methods of feedback and their effects.

Oscillators: Barkhausen's criterion and stability of oscillatorsSinusoidal oscillator, resonant circuit, phase shift oscillator, wein bridge oscillator, crystal oscillator and frequency stability, collpitts oscillator, Hartley oscillator.

Introduction to Unipolar Devices: Ideal M/S diode, Si-SiO2 MOS diode, MOSFET, MOSFET structure, physical operation, current – voltage characteristics, DC circuit analysis, MOSFET as an amplifier and as a switch, FET, Basic device characteristics, Comparison of BJT and FET amplifier.Multistage Amplifiers and Differential Amplifier

Multistage amplifiers: BIMOS cascade amplifier, Differential amplifier– Common mode and Difference mode analysis – FET input stages – Single tuned amplifiers – Gain and frequency response – Neutralization methods.

Text Books: -

1. Integrated Electronics, Analog and Digital Circuits and Systems, Millman J.and Halkias C. C, 27th Edition, McGraw Hill, 1972
2. Electronics Principles, Malvino A.P, 6th Edition, Tata McGraw Hill New Delhi, 2001.

Reference Books: -

1. Electronic Devices and Circuit Theory, Boylestad and Nishelsky, 9th Edition, Prentice Hall of India, 2005
2. Electronics Devices, T. Floyd, 6th edition, Pearson.

Useful Link:

1. EDC course https://swayam.gov.in/nd1_noc20_ee77/preview
   Name of the course: Semiconductor Devices and Circuits, **Prof. Sanjiv Sambandan, IISc Banglore.**

2. https://swayam.gov.in/nd1_noc20_ee85/preview
   Name of the course: Microelectronics: Devices To CircuitsBy Prof. Sudeb Dasgupta | IIT Roorkee

Course Outcomes:
On completion of the course, students will be able to:

INU1302.1: Illustrate the structure and working operation of basic semiconductor devices.
INU1302.2: Understand how complex devices such as transistors, FET, MOSFET are modeled.
INU1302.3: Understand how the models are used in the design and analysis of useful circuits.
INU1302.4: Choose and adapt the required components to construct an amplifier circuit.
INU1302.5: Design and analysis of oscillators.

CO – PO – PSO Mapping:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IN1302.1	2	2	--	--	--	--	--	--	--	1	--	--	2	--	--
IN1302.2	2	2	1	2	--	--	--	--	--	--	--	--	1	--	--
IN1302.3	3	2	1	2	0	--	--	1	--	--	--	--	2	--	1
IN1302.4	3	2	1	--	--	--	1	--	--	--	1	--	2	1	--
IN1302.5	2	1	1	--	1	--	--	--	--	--	--	--	2	--	1
Average	2.4	1.8	0.8	0.8	0.2	0	0.2	0.2	0	0.2	0.2	0	1.8	0.2	0.4

-- - Not correlated 1 - Weakly Correlated2- Moderately Correlated 3- Strongly Correlated

Course Code	IN1303							Course category			PC4
Course Name	DIGITAL ELECTRONICS										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
03	00	00	03	15	15	10	60	2 hrs 30 min	00	00	100	03

Course Objectives:

To make the students aware and understand:

1. To analyze logic processes and implement logical operations using combinational logic circuits.
2. To understand characteristics of memory and their classification .
3. To understand concepts of sequential circuits and to analyze sequential systems in terms of state machines.
4. To understand concept of Programmable Devices, PLA, PAL, CPLD and FPGA .
5. To study the structure, function and characteristics of digital logic families .

Course Contents:

Digital Logic Families: Logic Gates, Fundamental concept of Boolean Algebra, Code Conversion, Digital IC specification terminology, different types of logic families, complementary metal oxide semiconductor logic, logic families interfacing - TTL driving CMOS, CMOS driving TTL, measurement of specification parameters of IC's, 5400 / 7400 series ICs, Tristate Logic, Comparison of Different logic families.

Combinational logic design: Switching algebra, combinational circuit analysis, combinational circuit synthesis, and combinational circuit minimization, K-Map of three, four, five variable functions, minimizing SOP and POS expressions. Arithmetic logic unit , design of encoders, decoders, tri-state devices, multiplexers, demultiplexers, comparators, arithmetic circuits– half and full adders, ripple adders, subtractors, carry look ahead adders, combinational multipliers, examples- barrel shifter, floating point encoder etc.

Sequential logic design: Latches and flip flops, edge triggered and master slave flip flops (SR, JK, D, T etc), feedback sequential circuit design, sequential PLDs, Counters and shift registers, synchronous design methodology, clock skew, gating the clock, asynchronous inputs.

A/D and D/A Converters: Single slope, dual slope tracking and successive approximation type, Introduction to flash A/D converter, comparison of commercial IC's and Criteria for judging the performance. Binary weighted resister type D/A converter, R-2-R ladder type D/A converter.

Programmable Logic Devices I: Introduction to memories, Types of memories, Memory specification, Introduction to PAL, PLA, Configurable Programmable Logic Devices, Various types of CPLD's.

Programmable Logic Devices II: Introduction to FPGA and its various architectures. PLD Programming concepts, Introduction to PLD Programming languages

Text Books: -

1. Ronald J. Toccii, "Digital Systems: Principles and Applications", Pearson LPE, Fourth ed. 2009.
2. R. P. Jain, "Modern Digital Electronics", McGraw Hill Higher Education, Fourth ed., 2010.

Reference Books and Websites: -

1. Mano M.M, "Digital Logic and Computer Design", Pearson LPE, Fourth, ed., 2009.
2. Boyce J. C., "Digital Logic: Operation and Analysis", Prentice Hall, Second ed., 1982. .

Useful Link:

1. https://onlinecourses.nptel.ac.in/noc22_ee55/preview

Course Outcomes:

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

IN1303.1 : Explain logic processes and implement logical operations using combinational logic circuits
IN1303.2 : Explain characteristics of memory and their classification
IN1303.3 :Designconcepts of sequential circuits and to analyze sequential systems in terms of state machines.
IN1303.4 : Understand how to analyze and organize theProgrammable Devices, PLA, PAL, CPLD and FPGA.
IN1303.5 : Study the structure, function and characteristics of digital logic families.

CO – PO – PSO Mapping:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IN1303.1	2	2	0	0	0	0	0	0	0	1	0	0	2	0	0
IN1303.2	2	2	1	2	0	0	0	0	0	0	0	0	1	0	0
IN1303.3	3	2	1	2	0	0	0	1	0	0	0	0	2	0	1
IN1303.4	3	2	1	0	0	0	1	0	0	0	1	0	2	1	0
IN1303.5	2	1	1	0	1	0	0	0	0	0	0	0	2	0	1
Average	2.4	1.8	0.8	0.8	0.2	0	0.2	0.2	0	0.2	0.2	0	1.8	0.2	0.4

0 - Not correlated 1 - Weakly Correlated2- Moderately Correlated 3- Strongly Correlated

Course Code	IN1304						Course category		PC5
Course Name	SENSOR AND TRANSDUCER-I LABORATORY								
Teaching Scheme				Examination Scheme					Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
00	00	02	02	00	00	00	00	-	25	25	50	01

Course Objectives:

To make the students aware and understand:

1. To measure different physical parameters
2. To calibrate different type of transducers
3. To apply different methods of measurements

Minimum Eight Experiments to be performed covering the entire Syllabus of **IN1305 SENSORS AND TRANSDUCERS-I**. Representative list is as follows.

1. To determine RTD, thermister and thermocouple characteristics.
2. Measurement of Pressure using Bellows, Bourdon gauge, Diaphragm.
3. To determine performance of C-type bourdon gauge
4. Calibration of pressure gauge using dead weight pressure tester
5. Measurement of temperature using hot wire anemometer
6. Capacitive level measurement system.
7. To determine the LVDT characteristics
8. To humidity of given solutions
9. To determine flow using orifice or venturimeter or rotameter and compare the accuracy
10. Measurement of pH and conductivity of given solutions

Course Outcomes:

Upon Completion of this course, students will able to

IN1304.1 : To plot characteristics of various transducers and sensors

IN1304.2 : Analyze and interpret data of various measurement
IN1304.3 : Calibrate various type of transducers

Note:

ICA- The Internal Continuous Assessment shall be based on the practical record and Knowledge/skill acquired. The performance shall be assessed 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 the experiments and may be followed by sample questions.

CO-PO-PSO Mapping

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IN1304.1	1	--	--	--	--	1	1	--	--	--	1	3	2	--	1
IN1304.2	1	1	--	--	--	1	1	--	--	--	1	1	2	--	1
IN1304.3	1	1	--	--	--	1	1	--	--	--	1	1	2	--	1
Averaeg	1	1	0	0	0	1	1	0	0	0	1	1.66	2	0	1

0 - Not correlated 1 - Weakly Correlated2- Moderately Correlated 3- Strongly Correlated

Course Code	IN1305							Course category			VSE1
Course Name	ELECTRONIC DEVICES AND CIRCUITS LABORATORY										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
00	00	02	02	00	00	00	-	25	25	50	01

Course Objectives:
To make the students aware and understand

1. To identify and test various electronic components
2. To plot the characteristics of transistor and other devices.
3. To design and implement amplifier and oscillator circuits.
4. To understand the devices in detail to use these devices for various application

Minimum Eight Experiments to be performed covering the Entire Syllabus of **IN1306 ELECTRONIC DEVICES AND CIRCUITS LABORATORY**Representative list is as follows.

1. To obtain characteristic of transistor as a switch circuit.
2. To obtain input and output characteristics and calculate gain of CE amplifier circuit.
3. To obtain input and output characteristics and calculate gain of CB amplifier circuit.
4. To obtain frequency response of single stage transistor amplifier.
5. To design and implement class AB push-pull power amplifier.
6. To obtain the transfer characteristics of JFET.
7. To study IV characteristics of JFET and MOSFET.
8. To study the effect of
    a. voltage series feedback on two stage amplifier
    b. current series feedback on single stage CE amplifier.
9. Determine the efficiency of push pull power amplifier
10. To implement RC phase shift, wein bridge oscillator.

Course Outcomes :

Upon Completion of this course, students will able to

IN1305.1: Analyse the transistor characteristics.
IN1305.2: Design and implement various amplifiers and analyse frequency responses
IN1305.3: Interpret the construction, operation and characteristics of JFET, MOSFET and oscillators.

Note:

ICA- The Internal Continuous Assessment shall be based on the practical record and

Knowledge/skill acquired. The performance shall be assessed 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 the experiments and may be followed by sample questions.

CO – PO – PSO Mapping:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IN1305.1	2	--	--	--	--	1	1	--	--	--	1	2	2	--	1
IN1305.2	1	2		--	1	1	1	--	--	--	1	1	2	--	1
IN1305.3	1	1	--	--	--	1	1	--	--	--	1	1	1	--	1
Average	1.33	1.5	0	0	1	1	1	0	0	0	1	1.33	1.67	0	1

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

Course Code	IN1306							Course category			VSE2
Course Name	DIGITAL ELECTRONICS LABORATORY										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
00	00	02	02	00	00	00	-	50	00	50	01

Course objective:

1. To know the concepts of Combinational circuits.
2. To understand the concepts of flip-flops, registers and counters
3. To understand concepts of sequential circuits and to analyze sequential systems in terms of state machines.

Minimum Eight Experiments to be performed covering the entire Syllabus of **IN1307 DIGITAL ELECTRONICS**. Representative list is as follows.

1. Measurement of IC's parameters like rise time, fall time, propagation delays, and current and voltage parameters.
2. Design and implementation of arithmetic circuits
3. Design and implementation of various code converters and its applications
4. Design and implementation of multiplexer and demultiplexer and its applications
5. Design and implementation of encoders and decoders and its applications
6. Design and implementation of synchronous and asynchronous counters and its applications
7. Design and implementation of non sequential counters
8. Design and implementation of shift registers and its applications
9. Implementation and verifications of Combinational circuits on programmable logic devices
10. Implementation and verifications of sequential circuits on programmable logic devices

Course outcome: Upon Completion of this course, students will able to

IN1306.1: Design experimental setup for measurement of digital IC parameters & its verification.
IN1306.2: Design, realize and analyze various combinational and sequential circuits
IN1306.3: Select and use latest hardware and software tools for digital system realization

Note:
ICA- The Internal Continuous Assessment shall be based on the practical record and Knowledge/skill acquired. The performance shall be assessed experiment wise by using continuous assessment formats A and B.

CO – PO – PSO Mapping:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IN1306.1	2	--	--	--	--	1	1	--	--	--	1	2	2	--	1
IN1306.2	1	2	--	--	1	1	1	--	--	--	1	1	2	--	1
IN1306.3	1	1	--	--	--	1	1	--	--	--	1	1	1	--	1
Averaeg	1.33	1.5	0	0	1	1	1	0	0	0	1	1.33	1.67	0	1

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

Course Code	IN1307							Course category			EM1
Course Name	INTRODUCTION TO LabView										
Teaching Scheme				Examination Scheme							Credits
				Theory					Practical		Total	
Th	Tu	Pr	Total	CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
00	00	02	02	--	--	--	--	2hr30 min	50	00	50	01

Course Objective :

1. To Impart the knowledge about LabView Environment
2. To introduce the programming structure and datatypes that exist in LabView
3. To Introduce the editing and debugging technique in LabView

Minimum Eight Experiments to be performed covering the Entire Syllabus of **IN1308 INTRODUCTION TO LabView**

Start using LabView – The LabView Environment ,Front Panel, Block Diagram,Control pallete ,Function palate ,Tool pallete ,wiring, toolbar, execution, dataflow programming Grphical programming ,Simple exercises

Introduction to Loop and Structures :For Loop, While Loop ,Structures- case structure,Sequence structure,event structure ,simple exercises based on loops and structure

Introduction to SubVI :Create new subVI,input and output subVI connectors,create subVI from existing code.

Working with Data :Arrays,Auto indexing ,Array functions ,plotting the Data Simple projects to be done by using the LabView software

Representative List Of Experiments

1. To perform basic arithmetic operations using Labview.

2. To perform Boolean operations using Labview

3. : To find the sum of 'n' numbers using FOR loop.

4. To perform the factorial of a given number using FOR loop.

5. To find the sum of n natural numbers using while loop

6. To perform the factorial of a given number using WHILE loop

7. To sort even numbers using WHILE loop in an array

8. To find the maximum and minimum variable from an array

9. To bundle and unbundle a cluster

10. To perform functions using flat and stacked sequence.

11. : To create a sine wave using formula node.

12. To apply filtering technique for a given input signal

13. To perform discrete cosine transform on the given signal

14. To perform convolution of two signals

15. To perform Windowing Technique using LabView

Course Outcomes:

Upon Completion of this course, students will able to

IN1307.1 Understand Front panel, block diagram, icons, connector panes

IN1307.2 Use the programming structure and datatypes that exist in LabView

IN1307.3 Write and execute the simple programs in LabView

Note:

ICA- The Internal Continuous Assessment shall be based on the practical record and Knowledge/skill acquired. The performance shall be assessed experiment wise by using continuous assessment formats A and B.

CO – PO – PSO Mapping:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IN1307.1	2	--	--	--	--	--	--	--	--	3	--	--	2	--	--
IN1307.2	2	--	--	--	--	--	--	--	--	3	--	--	2	--	--
IN1307.3	2	--	--	--	--	--	--	--	--	3	--	--	1	--	--
	2	0	0	0	0	0	0	0	0	3	0	0	1.67	0	0

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

SEMESTER –IV

Course Code	IN1415							Course category				MM2
Course Name	INDUSTRIAL MEASUREMENT-II											
Teaching Scheme				Examination Scheme								Credits
				Theory					Practical		Total	
Th	Tu	Pr	Total	CT 1	CT 2	TA	ESE	ESE Duration	ICA	ESE		
03	00	00	03	15	15	10	60	2hr30 min	00	00	100	03

Course Objectives :

To make the students aware and understand:

1. To understand how physical quantities are measured and how they are converted to electrical or other forms
2. To have an adequate knowledge of change in resistance in various transducers
3. To develop the knowledge of inductance and capacitance transducers.
4. To teach the design of signal conditioning circuits

Course Contents:

Displacement Measurement: Resistive (Potentiometer and Linear), Inductive(LVDT and Eddy current type) and capacitive(Capacitance principles Concept & variable capacitance due to change in dielectric media, area of the plate, distance between the plates) Displacement Sensors, Piezoelectric Transducers and Sensors, Time-of-Flight Ultrasonic Displacement Sensors, Optical Encoder Displacement Sensors, Hall effect transducers. Strain Gauge measurement : Loading Effect types of strain gauges, derivation of gauge factor, bridge configurations, compensation, applications of strain gauges

Velocity and speed measurement: Doppler Velocimeter, Doppler effect, Ultrasonic Doppler velocity meter, time of flight velocimeter Mechanical tachometer: centrifugal force tachometer, vibrating tachometer , Electrical Tachometer: Drag Cup Tachometer, AC-DC Tachogenerators, Photoelectric tachometer, Photoelectric tachometer, Toothed rotor variable reluctance tachometer. Magnetic pickups, stroboscope

Vibration and acceleration measurement: Eddy current type, piezoelectric type, Seismic Transducer, Accelerometer: Absolute Accelerometer, Relative AccelerometerPiezoelectric accelerometers , Piezoresistive Accelerometers, Strain gauge accelerometer

Force and torque measurement: Basic methods of force measurement, elastic force traducers, strain gauge, load cells, shear web, piezoelectric force transducers, vibrating wire force transducers, Strain gauge torque meter, Inductive torque meter, Magneto-strictive transducers, torsion bar dynamometer, etc. Applications of Force and Torque sensors.

Design of signal conditioning circuit : Input Characteristics, Amplifiers, operational amplifiers Voltage Follower, various Converters, Sensor Connections, use of bridges, voltage generator, oscillators, Signal Conditioning for Resistive Sensors, Reactance Variation and Electromagnetic Sensors, Signal Conditioning for Reactance Variation Sensors, Self-Generating Sensors

Advances in sensors technology: Introduction to Smart sensors, MEMS, Nano sensors, Semiconductor sensors, Optical fiber sensors. Applications of these technologies in various industry sectors.

Text Books:

1. S. P. Venkateshan," Mechanical Measurements", Willy publication second edition. 2015
2. Ramon Pallaį S-areny, John g. Webster, "sensors and signalconditioning" second edition, john wiley & sons, inc

Reference Books:

1. A. K. Sawhney, "Electrical and Electronic Measurements and Instrumentation", Dhanpat Rai and Sons, Eleventh ed., 2000.
2. D.V.S. Murthi, "Instrumentation and Measurement Principles", PHI, New Delhi, Second ed. 2003.
3. B. C. Nakra and K. K. Choudhari, "Instrumentation Measurements and Analysis" by, Tata McGraw Hill Education, Second ed., 2004.
4. E.O. Doebelin, "Measurement Systems", McGraw Hill.

Useful Link:

1. **Course name: Industrial Measurement -II course**
   https://onlinecourses.nptel.ac.in/noc23_ee105/preview Name of Course offered by NPTEL: Transducers for Instrumentation By Prof. Ankur Gupta, IIT Delhi.

Course Outcomes:

Upon Completion of this course, students will able to

INU1415.1 Interpret the concepts of signal conditioning circuits for resistive sensors
INU1415.2 To demonstrate working of various resistive, inductive and capacitive transducers
INU1415.3 Illustrate the working principle of velocity and acceleration transducers
INU1415.4 Apply the adequate knowledge of force transducers

INU1415.5 Provide exposure new trends in smart sensors.

CO – PO – PSO Mapping:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IN1415.1	1	1	--	--	--	--	--	--	--	1	--	--	2	--	--
IN1415.2	1	1	1	2	--	--	--	--	--	--	--	--	1	--	--
IN1415.3	1	--	1	2	--	--	--	1	--	--	--	--	2	--	1
IN1415.4	1	--	1	--	--	--	1	--	--	--	1	--	2	1	--
IN1415.5	1	1	1	--	2	--	--	--	--	--	--	--	2	--	1
Average	1	1	1	2	2	0	1	1	0	1	1	0	1.8	1	1

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

Course Code	IN 1416							Course category			MM2
Course Name	**Strategic Management and Innovation in Banking**										
Teaching Scheme				**Examination Scheme**							**Credits**
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
03	00	00	03	15	15	10	60	2hr30 min	00	00	100	03

Course Objective:

The course aims to provide the cutting edge knowledge on the subject to the functionaries working at various positions. Strategic management provides the objective oriented approach to identify the steps an organization can initiate to grow and improve its financial health.

Course Contents :

Strategy and strategic leadership in dynamic times –Introducing strategic management ,leading strategically through effective vision and mission

Strategic Thinking Meaning ,foundation of strategy ,strategic intelligence including strategy analytics, appreciation of conflicts including resources ,strategic finance management ,strategic asset management

Innovation and Technology factor Innovation, Strategic management of innovation and challenges, strategy design process, Management of technological innovation and challenges

Digital Factor Digitalization, payment system, strategic digital banking and capabilities applied and required along the stages of the customer journey, big data, social media.

Sustainability, effects and measures Trough an index score (including social, environment, economic and developing the index)corporate social responsibility in banks

Text/Reference Books:

1 Strategic management and Innovation in banking -Indian Institute of Banking and finance

2 Ethics in Banking - Indian Institute of Banking and finance

3 John A Peace II ,Richard B ,Amita Mital ,Strategic Management planning for domestic and global competition ,Tata McGraw Hill

Course Outcomes:

IN1416.1 Address the banking and strategy in the context of fast changing environment

IN1416.2 Analysis of the strategy asset management system

IN1416.3 Explore the management of technological innovation in banking

IN1416.4 Demonstrate the digital technology system in banking

IN1416.5 Explore the Corporate social responsibility in banking system

CO PO PSO Mapping

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IN1416.1	3	--	--	--	--	--	--	--	--	--	--	--	3	--	--
IN1416.2	3	2	--	--	--	--	--	--	--	--	--	--	3	--	--
IN1416.3	3	--	--	--	--	--	--	--	--	2	--	--	3	--	--
IN1416.4	3	--	--	--	--	--	--	--	--	2	--	--	3	--	--
IN1416.5	3	--	--	--	--	--	--	--	--	2	--	--	3	--	--
Average	3	2	0	0	0	0	0	0	0	2	0	0	3	0	0

0 - Not correlated 1 - Weakly Correlated2- Moderately Correlated 3- Strongly Correlated

Course Code	IN1401								Course category			PC7
Course Name	**AUTOMATIC CONTROL SYSTEM**											
Teaching Scheme				**Examination Scheme**								**Credits**
				Theory					Practical		Total	
Th	Tu	Pr	Total	CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
03	00	00	03	15	15	10	60	2hr30 min	00	00	100	03

Course Objectives:

To make the students aware and understand:

1. To impart the basic knowledge of fundamentals of control systems
2. To impart the knowledge of the mathematical model for different physical systems
3. To impart the knowledge of transfer function analysis for control system by BDR,SFG techniques
4. To impart the knowledge of identifying performance characteristics of first and second-order systems for different standard inputs
5. To impart the knowledge of testing the stability of control system by RH Crietiron, time domain and frequency domain techniques, state space representation of control system

Course Contents:

Fundamentals of control systems: Introduction to need for automation and automatic control, Basic Components of a Control System, Concept of open loop and closed loop Systems, Examples of control system, Effects of Feedback, Types of Feedback Control Systems. Review of Laplace and inverse Laplace transform, Transfer functions.

Mathematical modeling: Mathematical modeling of: electrical systems, mechanical systems, electro-mechanical systems, Electrical analogues of dynamical systems, Block diagrams, Block diagram reductions, Signal flow graph, Mason's gain formula, Application of gain formula to block diagrams.

Time response analysis: Time response of system, Standard test signals, Analysis of first order and second order systems, Time response specifications, Steady state errors and error constants.

Stability analysis: Stability of open loop and closed loop systems, Routh-Hurwitz criterion, Stability and Performance analysis, Root locus techniques, Root locus construction rules, Sketching of Root Locus.

Frequency response analysis: Frequency domain specifications, Correlation between time and frequency responses, Bode plots, Relative stability, Phase margin and Gain margin, Minimum and non-minimum phase systems, Introduction to polar plots, Nyquist plot, and Nyquist stability criterion.

Introduction to State Space : State Space Representation of the control system , State Variables representation ,conversion of transfer function to state variable model ,Representation of state equation .

Text Books:

1. Norman Nise, Control System Engineering, Wiley International, sixth edition, 2011.
2. Nagrath and Gopal, Control System Engineering-, New Age International Publication, fifth edition, 2003.

Reference Books:

1. C.H. Houpis, S.N. Sheldon, Linear Control System Analysis and Design with MATLAB, CRC Press; 6 edition.
2. G. Goodwin, S.Graebe, Mario Salgado, Control System Design, Pearson Education, edition.
3. G. Franklin, J.Powell, A. Naeini, Feedback Control of Dynamic Systems, Pearson, 6th edition.
4. K. Ogata, Modern Control Engineering, Prentice Hall Publications, fifth edition.
5. Dorf and Bishop, Modern Control Systems:, Addison Wesley, LPE, 9th Edition.
6. B. C. Kuo, Automatic control system, Prentice Hall of India, 7th Edition, 1995

Course Outcomes:

After completion of the course students will be able to

IN 1401.1 Classify open and closed control systems with their characteristics

IN1401.2 Develop the mathematical model of electrical, mechanical system and Derive the transfer function of given system by using BDR,SFG techniques

IN 1401.3 Analyse the response of first and second-order systems for different standard inputs

IN1401.4 Comment on the stability of control system by using RH Criterion, time domain and frequency domain techniques

IN 1401.5 Represent the control system in State space representation

CO – PO – PSO Mapping:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IN1401.1	3	--	--	--	--	--	--	--	--	--	--	--	3	--	--
IN1401.2	3	2	--	--	--	--	--	--	--	--	--	--	3	--	--
IN1401.3	3	--	--	--	--	--	--	--	--	2	--	--	3	--	--
IN1401.4	3	--	--	--	--	--	--	--	--	2	--	--	3	--	--
IN1401.5	3	--	--	--	--	--	--	--	--	2	--	--	3	--	--
Average	3	2	0	0	0	0	0	0	0	2	0	0	3	0	0

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

Course Code	IN1402							Course category				PC8
Course Name	LINEAR INTEGRATED CIRCUITS											
Teaching Scheme				Examination Scheme								Credits
				Theory					Practical		Total	
Th	Tu	Pr	Total	CT 1	CT 2	TA	ESE	ESE Duration	ICA	ESE		
03	00	00	03	15	15	10	60	2hr30 min	00	00	100	03

Course Objectives:

To Make the students aware and understand:

1. To understand the concepts of linear integrated circuits.
2. To understand the basic operation of operational amplifier.
3. To Design circuit using operational amplifier for various applications.
4. Implement different linear and non- linear applications of operational amplifier for signal conditioning circuits.
5. Understand and demonstrate the functions of timer, voltage regulator, filters and oscillators.

Course Contents:

Operational Amplifiers Fundamentals: Characteristics of Op Amp, Noise figure, Types of Noise, Causes of Slew Rate, Concept of dB, Frequency response, Frequency/Phase Compensation Techniques. SR, CMRR, PSRR/SVRR. Offset adjustment techniques, Comparative study of different amplifier ICs such as LM 741, LM 324, OP 07.

Feedback amplifiers. Concept of feedback, positive and negative feedback amplifiers, voltage series feedback amplifier, Voltage shunt feedback amplifier and differential amplifier configuration and their special cases.

Linear Applications of op amp: Voltage Summing with averaging amplifier, Voltage subtractor, voltage follower, peak amplifier, analog adder, Current booster, Integrator and practical integrator, Differentiator and practical differentiator, Instrumentation Amplifier with three op-amp, Current to voltage and voltage to current converter, voltage to frequency converter, analog multipliers and dividers.

Non-linear Applications of Op-amp: Log/antilog amplifiers, Comparator characteristics, peak detectors, wave shaping circuits Schmitt's trigger, clippers and clampers, pulse generators, ZCD and it's application, Schmitt trigger with external bias, window detector. Precision half wave and full wave rectifiers with IC 741.

Timers and Voltage regulators: Timers: Triggerable and retriggerable, IC 555, pin configuration and operation, design and application of monostable multivibrators and astable multivibrators. Voltage regulators : Linear and Switching DC Voltage regulators: Basic 78XX and 79XX voltage regulators, voltage regulator IC723.

Active filters and oscillators: First order and Second order active low pass, high pass filter, band pass filter, band stop/band reject, Notch filter, all pass filters, Introduction of butterworth, chebyshev , elliptic and Bessel filters. Sinusoidal oscillators using Op amp: Barkhausen criteria, Wein Bridge oscillator, RC phase shift oscillator. Hartley oscillator.

Text Books: -

1. Op-amp and Integrated circuits, Ramakant A. Gaikwad, 3rd Edition, PHI Publication, 2002
2. Integrated Circuits, K.R. Botkar, 9th Edition , Khanna Publisher, 2003

Reference Books : -

1. Operational Amplifiers and Linear ICs, D. A. Bell, Oxford University Press, 3rd edition, 2011
2. Design with Op-amp and Analog Integrated circuits, Sergio Franco, Tata McGraw Hill Edition, New Delhi, 1998.
3. Analog Electronics, L. K. Maheshwari and M.M.S. Anand, Prentice Hall of India, New Delhi.
4. Physics of Semiconductor Devices, S. M. Sze, 5th edition, John Wiley Publications.
5. Op-amp and Linear Integrated Circuits Theory and Applications, J. Fiore, Delmar Thompson Learning, 1st edition, 2001.
6. Operational Amplifiers and Linear Integrated Circuits, R. Coughlin, F. Driscoll, PHI, 6th edition, 2001

Useful Link:

Linear Integrated Circuits course https://swayam.gov.in/nd1_noc19_ee39/preview
Name Of Course:Op-Amp Practical Applications: Design, Simulation and Implementation**, IISc Banglore , Prof. Hardik Pandya**

Course Outcomes:
Upon Completion of this course, students will able to

IN1402.1 : Understand the concepts of linear integrated circuits.
IN1402.2 : Understand the basic operation of operational amplifier.
IN1402.3 : Design circuit using operational amplifier for various applications.
IN1402.4 : Implement different linear and non- linear applications of operationalamplifier for signal conditioning circuits.
IN1402.5 : Understand and demonstrate the functions of timer, voltage regulator, filters and oscillators.

CO – PO – PSO Mapping:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IN1402.1	2	2	--	--	--	--	--	--	--	1	--	--	2	--	--
IN1402.2	2	2	1	2	--	--	--	--	--	--	--	--	1	--	--
IN1402.3	3	2	1	2	--	--	--	1	--	--	--	--	2	--	1
IN1402.4	3	2	1	--	--	--	1	--	--	--	1	--	2	1	--
IN1402.5	2	1	1	--	1	--	--	--	--	--	--	--	2	--	1
Average	2.4	1.8	1	2	1	0	1	1	0	1	1	0	1.8	1	1

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

Course Code	IN1403							Course category				PC9
Course Name	SENSOR AND TRANSDUCER-II											
Teaching Scheme				Examination Scheme								Credits
				Theory					Practical		Total	
Th	Tu	Pr	Total	CT 1	CT 2	TA	ESE	ESE Duration	ICA	ESE		
03	00	00	03	15	15	10	60	2hr30 min	00	00	100	03

Course Objectives :

To make the students aware and understand:

5. To understand how physical quantities are measured and how they are converted to electrical or other forms
6. To have an adequate knowledge of change in resistance in various transducers
7. To develop the knowledge of inductance and capacitance transducers.
8. To teach the design of signal conditioning circuits

Course Contents:

Displacement Measurement: Resistive (Potentiometer and Linear), Inductive(LVDT and Eddy current type) and capacitive(Capacitance principles Concept & variable capacitance due to change in dielectric media, area of the plate, distance between the plates) Displacement Sensors, Piezoelectric Transducers and Sensors, Time-of-Flight Ultrasonic Displacement Sensors, Optical Encoder Displacement Sensors, Hall effect transducers. Strain Gauge measurement : Loading Effect types of strain gauges, derivation of gauge factor, bridge configurations, compensation, applications of strain gauges

Velocity and speed measurement: Doppler Velocimeter, Doppler effect, Ultrasonic Doppler velocity meter, time of flight velocimeter Mechanical tachometer: centrifugal force tachometer, vibrating tachometer , Electrical Tachometer: Drag Cup Tachometer, AC-DC Tachogenerators, Photoelectric tachometer, Photoelectric tachometer, Toothed rotor variable reluctance tachometer. Magnetic pickups, stroboscope

Vibration and acceleration measurement: Eddy current type, piezoelectric type, Seismic Transducer, Accelerometer: Absolute Accelerometer, Relative AccelerometerPiezoelectric accelerometers , Piezoresistive Accelerometers, Strain gauge accelerometer

Force and torque measurement: Basic methods of force measurement, elastic force traducers, strain gauge, load cells, shear web, piezoelectric force transducers, vibrating wire force transducers, Strain gauge torque meter, Inductive torque meter, Magneto-strictive transducers, torsion bar dynamometer, etc. Dynamometer (servo control and absorption) instantaneous power measurement and alternator power measurement. Applications of Force and Torque sensors.

Design of signal conditioning circuit : Input Characteristics, Amplifiers, operational amplifiers Voltage Follower, various Converters, Sensor Connections, use of bridges, voltage generator, oscillators, Signal Conditioning for Resistive Sensors, Reactance Variation and Electromagnetic Sensors, Signal Conditioning for Reactance Variation Sensors, Self-Generating Sensors, Signal Conditioning for Self-Generating Sensors

Advances in sensors technology: Smart sensors, MEMS, Nano sensors, Semiconductor sensors, Optical fiber sensors. Applications of these technologies in various industry sectors.

Text Books:

1. S. P. Venkateshan," Mechanical Measurements", Willy publication second edition. 2015
2. Ramon Palla¡ S-areny, John g. Webster, "sensors and signalconditioning" second edition, john wiley & sons, inc

Reference Books:

1. A. K. Sawhney, "Electrical and Electronic Measurements and Instrumentation", Dhanpat Rai and Sons, Eleventh ed., 2000.
2. D.V.S. Murthi, "Instrumentation and Measurement Principles", PHI, New Delhi, Second ed. 2003.
3. B. C. Nakra and K. K. Choudhari, "Instrumentation Measurements and Analysis" by, Tata McGraw Hill Education, Second ed., 2004.
4. E.O. Doebelin, "Measurement Systems", McGraw Hill.

Useful Link:

1. **Course name: Sensor & Transducer-I course**
   https://onlinecourses.nptel.ac.in/noc23_ee105/preview Name of Course offered by NPTEL: Transducers for Instrumentation By Prof. Ankur Gupta, IIT Delhi.

Course Outcomes:

Upon Completion of this course, students will able to

IN1403.1	Interpret the concepts of signal conditioning circuits for resistive sensors
IN1403.2	To demonstrate working of various resistive, inductive and capacitive transducers
IN1403.3	Illustrate the working principle of velocity and acceleration transducers
IN1403.4	Apply the adequate knowledge of force transducers
IN1403.5	Provide exposure new trends in smart sensors.

CO – PO – PSO Mapping:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IN1403.1	1	1	--	--	--	--	--	--	--	1	--	--	2	--	--
IN1403.2	1	1	1	2	--	--	--	--	--	--	--	--	1	--	--
IN1403.3	1	--	1	2	--	--	--	1	--	--	--	--	2	--	1
IN1403.4	1	--	1	--	--	--	1	--	--	--	1	--	2	1	--
IN1403.5	1	1	1	--	2	--	--	--	--	--	--	--	2	--	1
Average	1	1	1	2	2	0	1	1	0	1	1	0	1.8	1	1

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

Course Code	SH1401A							Course Category			OE1
Course Name	Appreciating Indian Music										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT-1	Ct-2	TA	ESE	ESE Duration	ICA	ESE		
03	-	-	03	15	15	10	30	2 hrs 30 min	-	-	100	03

Course Objectives:

1.To familiarize students with the historical and cultural context of Indian Classical Music.

2.To introduce students to the fundamental concepts of raga, tala, and improvisation.

3.To develop students' listening skills through analysis and appreciation of classical music recordings.

4.To provide students with practical training in basic vocal or instrumental techniques.

5.To encourage critical thinking and reflection on the aesthetic and philosophical aspects of Indian Classical Music.

Course Contents:

Introduction to Indian Music:

Historical overview: origins, evolution, and major developments, definitions (sangeet, swar and its types, saptak and its types, aroha, aavaroha, pakad, alankar, wadiswar, sanvadiswar,varjitswar, sthayi and antara) Regional variations and prominent classical music traditions (Hindustani and Carnatic). Influence of spirituality, mythology, and philosophy on Indian Classical Music.

Fundamentals of Raga:

Understanding the concept of raga (melodic framework) and its elements, Notation systems and the role of improvisation within the framework of raga (Paluskar and Bhatkhandelipi), Different THAATs and their brief information, Definition of Raga, Sargamgeet, the concept of Khyal ,aalap and tana, Raga and Time Association, Basic ragas (Bhupali, Yaman, Bhimpalasi and Kedar) along with Aaroha, avaroha, pakad and sargamgeet and khyal.

Introduction to Taala:

Understanding the components of a tala cycle (Defining- Taal, Lay and its types, matras, theaka, sum,tali, kaal, avartan).Study of common talas (Teental, Rupak, Kehrarva, Dadra and BhajniTheaka) Practical exercises in clapping and counting rhythms to internalize talas.

Introduction to Musical Instruments:

Classification of Indian Musical Instruments (String, wind, percussion and SolidInstruments), components parts of Indian classical instruments along with neat sketchBiography- UstadZakirHusen (Tabla), PanditAppaJalgaokar (Harmonium) Pandit Ravi Shankar (Sitar), PanditHari Prasad Chaurasiya (Flute), Dr. N Rajam (Violin)

Textbooks:

1. Indian Classical Music By Ravi S. Prasanna

2.Appreciating Indian MusicBy Emmons E. White

3. Fundamental of Indian Music By. S. Sharma.

References:

1. Indian Music By Dr. Thakur J. Sing

2. Finding the Raga By Amit Choudhari.

3.History of Indian Music By B. A. Pingle

4. Raga Harmony By L. Subramaniam

Course Outcomes:

After successful completion of this course student will be able to

SH1401A.1: Students will demonstrate an understanding of the historical development and cultural significance of various genres and styles of Indian music.

SH1401A.2: Students will understanding classical, folk, and contemporary forms, by discussing key historical milestones and movements.

SH1401A.3: Students will be able to applying knowledge of musical elements such as raga, tala, swara, and laya to identify stylistic features, structural patterns, and aesthetic qualities.

SH1401A.4: Students will develop skills and competencies relevant to careers in music education.SH1401A.5:Students will develop skills and competencies relevant to research, arts administration, cultural advocacy, or related fields, preparing them for further academic pursuits or professional endeavors in the music industry.

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
SH1401A.1	1	0	0	0	0	1	2	2	3	0	0	0	1	0	2
SH1401A.2	1	0	0	0	0	1	2	2	3	0	0	0	1	0	2

SH1401A.3	1	0	0	0	0	1	2	2	3	0	0	0	1	0	2
SH1401A.4	1	0	0	0	0	1	2	2	3	0	0	0	1	0	2
SH1401A.5	1	0	0	0	0	1	2	2	3	0	0	0	1	0	2

0 - Not correlated 1 - Weakly Correlated2- Moderately Correlated 3- Strongly Correlated

Course Code	SH1401B							Course Category			OE1
Course Name	Introduction to HumanPsychology										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT-1	CT-2	TA	ESE	ESE Duration	ICA	ESE		
03	-	-	03	15	15	10	60	2 hrs 30 min	-	-	100	03

Course Objectives:

To make the students will be able to:

1. Understandthehuman behaviour.

2. Helps humans in exerting more control over situations

3. Basic cognitive processes that guide human behaviours.

4. Tackling everyday problems and attaining optimal solutions

5. Knowledge about human cognitive systems in designing sophisticated Artificial Intelligence (AI) systems.

Course Contain:

Introduction to Cognitive Psychology:

- History,
- Theory
- Research in Human Cognition

Basic Cognitive Processes:

- Object Perception and Recognition
- Attentional Processes and cognition
- Memory Introduction
- Long Term Memory

Organizational Knowledge:

- Memory of general knowledge.
- Concept Formation
- Visual and Spatial Memory

The Use of Knowledge:

- Human language skills.
- Thought process and Problem Solving
- Reasoning
- Decision Making

Textbooks:

1. Kathleen Galotti, Cognitive Psychology, Cengage Learning.
2. Robert Stenberg, Applied Cognitive Psychology, Cengage Learning.

References:

1. Bridger Riegler, Cognitive Psychology, Pearson Press
2. Stephen Kosslyn, Cognitive Psychology, PHI Press

Course Outcomes:

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

SH1401B.1: To learn history of Human Psychology.

SH1401B.2: To understand, theory and research in Human Psychology.

SH1401B.3: To learn the Basic Cognitive Processes.

SH1401B.4: To understand about Organizational Knowledge.

SH1401B.5: Apply the knowledge of human Psychology to developed process of problem solving, reasoning, decision making.

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
SH1401B.1	2	3	--	--	--	--	--	1	2	--	--	--	3	1	2
SH1401B.2	2	--	--	--	--	--	--	1	2	--	--	--	2	1	1
SH1401B.3	2	2	--	--	--	--	--	1	2	--	--	--	2	1	1
SH1401B.4	2	--	--	--	0	0	0	1	2	0	0	0	2	1	1
SH1401B.5	2	2	--	--	--	--	--	1	2	--	--	--	2	1	1

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

Course Code	SH1401C							Course Category			OE1
Course Name	Nanotechnology, Science and Application										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT-1	Ct-2	TA	ESE	ESE Duration	ICA	ESE		
03	-	-	03	15	15	10	60	2 hrs. 30 min	-	-	20	00

Course Objectives:

Students will be able to:

1. To understand the history, background and nature of Nano science and nanotechnology as well as the quantum and Nano sized scale effect on materials.

2. To acquire theoretical understanding of different types of nanostructure

3. To understand the synthesis technique and its types.

4.To learn the different methods of characterization.

5.Aim to approach towards advance research and application of nanoparticals.

Course Contents:

Basics of Nanoscience:

Introduction, Effect of reduction of dimensions on physical properties, History of Nanotechnology, Quantum size effect,

Different classes of Nanomaterial's:

Classification based on dimensionality-Quantum Dots, Wells and Wires, preparation of quantum nanostructures, conduction electrons and dimensionality, Fermi gas and density of states, potential wells, partial confinement, properties dependent on density of states, exitons, single electron tunnelling.

Material Synthesis Method:

Nanostructures of one dimension: Crystalline growth, Template based synthesis. Nanostructures of two dimensions: Fundamentals of thin film growth, physical vapour deposition, chemical vapour deposition, atomic layer deposition, self-assembly, Sol-Gel films, and electrochemical deposition.

Material Characterization Methods:

UV visible microscopy, Scanning electron microscopy (SEM), Transmission electron microscope (TEM), x-ray diffraction (XRD). Atomic Force Microscope (AFM)

Application of Nanomaterial's:

Agriculture field, Medical field, Space Technology, Food Technology, Water Treatment, Energy Sector, Automobile, Electronics Field, Textile Field, Cosmetic.

Textbooks:

1. Introduction to Nanotechnology by C.P. Poole Jr. and F.J. Owens, Wiley Interscience

2. Nano-Technology by Gregory Timp (Editior), AIP Press, Springer.

3. Pradeep T., "A Textbook of Nanoscience and Nanotechnology", Tata McGraw Hill Education Pvt. Ltd.

Reference Books and website links:

1. Hari Singh Nalwa, "Nanostructured Materials and Nanotechnology", Academic Press

2. Graphene: Synthesis and applications, edited by Wonbong Choi and Jo-won Lee.

3. Semiconductor Nanostructures and NanodevicesVol 1-5-A. A. Balandin, K. L.Wang.

4. Springer Handbook of Nanotechnology: Bharat Bhushan

5. Nanofabrication towards biomedical application: Techniques, tools, Application and impact: Ed. Challa S., S. R. Kumar, J. H. Carola

6. A. S. Edelstein and R. C. Cammarata, "Nanomaterials: Synthesis, Properties and Applications", Institute of Physics Pub., 1998.

7. G. Cao, Nanostructures &Nanomaterials: Synthesis, Properties &Applications , Imperial College Press, 2004.

8. G.A. Ozin and A.C. Arsenault, "Nano chemistry : A chemical approach to nanomaterials", Royal Society of Chemistry, 2005.

9. Joel I. Gersten, "The Physics and Chemistry of Materials", Wiley, 2001.

10. K.W. Kolasinski, "Surface Science: Foundations of Catalysis and Nanoscience", Wiley, 2002.

11. Physical Chemistry – Atkins Peter, Paula Julio.

12.Nanotechnology in Biology and Medicine: Methods, Devices, and Applications.

Course Outcomes:

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

SH1401C.1: To learn basic of Nano science with special, emphasize on nanomaterial's.

SH1401C.2: Correlate physical behavior of materials at the Nano scale.

SH1401C.3: Understand the physical, chemical and other important methods for synthesis of nanoparticles.

SH1401C.4: Understand the various characterization techniques of Nano materials.

SH1401C.5 Apply the knowledge gained to suggest different applications of Nano science and technology.

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
SH1401C.1	2	--	2	--	--	--	--	--	1	2	2	3	2	2	1
SH1401C.2	3	2	3	--	2	--	2	--	--	3	2	3	2	2	1
SH1401C.3	3	2	3	2	--	--	3	3	1	3	3	3	2	2	1
SH1401C.4	3	2	3	2	2	--	2	--	--	3	3	3	2	2	1
SH1401C.5	3	2	3	2	2	--	3	1	--	3	3	3	2	2	1

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

Course Code	IN1404						Course category		PC10	
Course Name	AUTOMATIC CONTROL SYSTEM LABORATORY									
Teaching Scheme				Examination Scheme						Credits
				Theory					Practical	Total	
Th	Tu	Pr	Total	CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
00	00	02	02	--	--	--	--	2hr30 min	50	00	50	01

Course Objectives:

1. To introduce the MATLAB software from control systems point of view.
2. To provide adequate knowledge in the time response of systems using Software.
3. To Show the Effect of addition of poles and zeros to forward path of an open loop and closed loop system using software.

Minimum Eight Experiments to be performed covering the Entire Syllabus of **INU1405 AUTOMATIC CONTROL SYSTEMLABORATORY** Representative list is as follows.

1. Plot the Transfer function and find the poles and zeros of the given TF

2. Use R-C/ R-L-C circuit to analyze the response of a second order system for standard test inputs.

3. Develop a Simulink model to find steady state error for a type 0, type 1 and type 2 systems.

4. Modeling of Physical Systems using Simulink.

5. Introduction to MATLAB, MATLAB's Simulink and control systems toolbox (with some examples) or any other control system related software package.

6. Study of time response characteristics of first/second order control system using Software.

7. Study and plot the unit step responses of addition of a pole and a zero to the closed loop transfer function

8. Use software to plot the Root Locus plot of given transfer functions and analyze the stability.

9. Use software to plot the Bode diagram of given transfer functions and analyze the stability.

10. Use Software to represent state space representation of given control system

Course Outcomes: Upon Completion of this course, students will able to

INU1404.1: Plot the transfer function and calculate the Poles and Zeros of Transfer Function.

INU1404.2: Analyze the given systems using Time Domain and frequency domain analysiswith the help of software. [MatLab/SciLab]

INU1404.3: Develop mathematical model for electrical systems.

Note:

ICA- The Internal Continuous Assessment shall be based on the practical record and Knowledge/skill acquired. The performance shall be assessed experiment wise by using continuous assessment formats A and B.

CO-PO-PSO Mapping

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IN1404.1	1	--	--	--	--	--	--	--	--	3	--	--	--	2	--
IN1404.2	1	--	--	--	--	--	--	--	--	3	--	--	--	2	--
IN1404.3	1	--	--	--	--	--	--	--	--	3	--	--	--	2	--
Average	1	0	0	0	0	0	0	0	0	3	0	0	0	2	0

- Not correlated 1 - Weakly Correlated2- Moderately Correlated 3- Strongly Correlated

Course Code	IN1405							Course category			PC11
Course Name	LINEAR INTEGRATED CIRCUITSLABORATORY										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
00	00	02	02	00	00	00	00	00	50	00	50	01

Course Objectives:
To make the students aware and understand

1. Acquire fundamental concepts of linear integrated circuits.
2. Design and implement inverting-non inverting and differential circuits with op-amp.
3. Become familiar with the applications of timers, Voltage regulators, filters and oscillators

Minimum Eight Experiments to be performed covering the Entire Syllabus of **IN1406 LINEAR INTEGRATED CIRCUITS LABORATORY** Representative list is as follows.

1. Measurement of op-amp parameters and comparison with op-amp data sheets.
2. Assembling of op-amp Inverting, Non inverting and differential circuits to measure an input in the range of mill volts to few volts.
3. Design of attenuator circuit using amplifier and testing for gain.
4. Design of voltage adder, voltage averaging, voltage subtractor circuits using op-amp.
5. Design of signal conditioning circuit to operate a relay or to generate timing delays (e.g.1 sec, 10 sec.) using IC 555.
6. Design of instrumentation amplifier using 3 op-amps and testing for gain, frequency response.
7. Design of a circuit to work as voltage regulator of 10 or 20 volts using IC 723.
8. Design Monostable, bistable, and astable multivibrators using timer IC 555.
9. Design of low and high pass filters with a cut off frequency of 1 kHz or 2 kHz and testing for frequency response.
10. Design of cascade amplifier system using op-amp and testing for gain and frequency response.
11. Design of different types of oscillators using op-amp.

12. Design of band pass filter using op-amp and testing for frequency response.
13. Design of Clippers and Clampers.
14. Use of 565 PLL as a frequency multiplier

Course Outcomes:

Upon Completion of this course, students will able to

IN1405.1: Design and analyze concepts of linear integrated circuits.

IN1405.2: Develop linear and nonlinear applications of operational amplifier.

IN1405.3: Perform the basic operations of timer, voltage regulator, filter and oscillators.

Note :

ICA – The Internal Continuous Assessment shall be based on the practical record and knowledge/skill acquired. The performance shall be assessed experiment wise by using continuous assessment formats, A and B.

CO-PO-PSO Mapping

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IN1405.1	1	--	--	--	--	1	1	--	--	--	1	3	2	--	1
IN1405.2	1	1	--	--	--	1	1	--	--	--	1	1	2	--	1
IN1405.3	1	1	--	--	--	1	1	--	--	--	1	1	2	--	1
Average	1	1	0	0	0	1	1	0	0	0	1	1.66667	2	0	1

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

Course Code	IN1406							Course category			VSE3
Course Name	SENSOR AND TRANSDUCER-II LABORATORY										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
00	00	02	02	00	00	00	00	-	25	25	50	01

Course Objectives:
To make the students aware and understand:

1. Acquire the knowledge of the constructions and working principle of differenttypes of sensors and transducers
2. Understand different techniques of measurement for physical parameters.
3. Design signal conditioning circuits for different sensors

The instructor may choose experiments as per his/her choice, so as to cover entire course contents of **IN1407SENSOR AND TRANSDUCER-II LABORATORY**. Minimum 8 experiments should be performed.Representative list is as follows.

1. Measurement of strain using strain gauge.
2. Loading effect of Potentiometer
3. Characteristics of Piezo-electric Transducer
4. Study of distance measurement using ultrasonic transducer.
5. Measurement of Displacement by (a) Piezoelectric pickup and (b) Light dependent resistor
6. Measurement of speed and torque using Opto Electronic Sensor
7. Characteristics of Hall effect sensor
8. Measurement of level using capacitive transducer.
9. Study of Differential Pressure Transducer & signal conditioning of output signal

Course Outcomes:
Upon Completion of this course, students will able to

IN1406.1 Examine the characteristics of different transducer
IN1406.2 Identify suitable instruments to meet the requirements of industrial applications
IN1406.3 Apply concepts and methods various measurements in IN1406 through experiments

Note:
ICA- The Internal Continuous Assessment shall be based on the practical record and Knowledge/skill acquired. The performance shall be assessed 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 the experiments and may be followed by sample questions.

CO-PO-PSO Mapping

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IN1406.1	1	-	-	-	-	1	1	-	-	-	1	3	2	-	1
IN1406.2	1	1	-	-	-	1	1	-	-	-	1	1	2	-	1
IN1406.3	1	1	-	-	-	2	1	-	1	-	1	1	1	-	1
Average	1	1	0	0	0	1.33	1	0	1	0	1	1.67	1.67	0	1

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

Course Code	IN1411							Course category			EX2
Course Name	IOT BASED APPLICATIONS										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
00	00	00	00	00	00	00	-	50	00	50	04

Course Objectives:

To make the students aware and understand:
1. To study the structure, function and characteristics of Internet of Things
2. To identify the communication protocols.
3. To develop fundamentals of Arduino Uno
4. To recognize various devices, sensors and applications
5. To explain the design of the various IoT Applications.

Course Contents:

Introduction to IoT: Evolution of Internet of Things, Enabling Technologies, M2M Communication, IoT World Forum (IoTWF) standardized architecture, Simplified IoT Architecture, Core IoT Functional Stack, Fog, Edge and Cloud in IoT, Functional blocks of an IoT ecosystem, Sensors, Actuators, Smart Objects and Connecting Smart Objects.

IoT Protocol : IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.11ah and Lora WAN, Network Layer: IP versions, Constrained Nodes and Constrained Networks,IoT protocols: MQTT/MQTTS, CoAP, 6LoWPAN, like TCP, UDP, HTTP/S., Comparison of the different IoT protocols.

Data Analytics and Design : Data Analytics: Introduction, Structured Versus Unstructured Data, Data in Motion versus Data at Rest, IoT Data Analytics Challenges, Data Acquiring, Organizing in IoT/M2M,Design Methodology, Embedded computing logic, System on Chips, IoT system building blocks, Overview of IoT supported Hardware platforms such as: Raspberry pi, Arduino Board

Arduino Environment : Setup the IDE, Writing Arduino Software, Arduino Libraries, Basics of Embedded C programming for Arduino, Interfacing LED,LCD, push button , buzzer ,Temperature, Humidity, Motion, Light and Gas Sensor,Actuators,Relay Switch and Servo Motor with Arduino

Case Studies/Industrial Applications: IoT applications in home, infrastructures, buildings, security, Industries, Homeappliances, other IoT electronic equipments, Industry 4.0 concepts.

Text Books: -
1. Internet of Things: A Hands-on Approach , Arshdeep Bahga, Vijay Madisetti, Universities Press, 2015.

2. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017

Reference Books and Websites: -

1. Internet of Things: Architecture, Design Principles And Applications, Rajkamal, McGraw Hill HigherEducation
2. ArduinoUno:A Hands-On Guide for Beginner, Agus Kurniawan , 1st edition
3. Getting Started with the Internet of Things, Cuno Pfister, O"Reilly Media, 2011, ISBN: 978-1-4493- 9357-1
4. Internet of Things (A Hands-onApproach)Vijay Madisetti and Arshdeep Bahga, 1st Edition, VPT, 2014
5. The Internet of Things – Key applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi and Wiley, 2012
6. "From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence",Jan Ho¨ ller, VlasiosTsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle and Elsevier, 2014.

Useful Link:

1. IOT course https://nptel.ac.in/courses/106105166 Name Of Course: Introduction to Internet of things, IIT Kharagpur , Prof.Sudip Misra.

Course Outcomes:

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

IN1411.1 : Explain the structure, function and characteristics of Internet of Thing.
IN1411.2 : Identify the communication protocols.
IN1411.3 :Understand design methodology and hardware platforms involved in IoT.
IN1411.4 :Understand how to analyze and organize the data in IoT.
IN1411.5 : Compare IOT Applications in Industrial & realworld.

CO – PO – PSO Mapping:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IN1411.1	2	2	--	--	--	--	--	--	--	1	--	--	2	--	--
IN1411.2	2	2	1	2	--	--	--	--	--	--	--	--	1	--	--
IN1411.3	3	2	1	2	--	--	--	1	--	--	--	--	2	--	1
IN1411.4	3	2	1	--	--	--	1	--	--	--	1	--	2	1	--
IN1411.5	2	1	1	--	1	--	--	--	--	--	--	--	2	--	1
Average	2.4	1.8	1	2	1	0	1	1	0	1	1	0	1.8	1	1

0 - Not correlated 1 - Weakly Correlated2- Moderately Correlated 3- Strongly Correlated

Course Code	IN1412							Course category			EX2
Course Name	PCB Design and Circuit Simulator										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
00	00	00	00	00	00	100	-	50	00	50	04

Course Objectives:

To make the students aware and understand:

1. To Acquire the basic level knowledge required to understand PCBs
2. To study the importance of manufacturing documents.
3. To Understand the basic concept of how to design PCB for Manufacturing and assembly point of view.
4. To study the basic concept of fault finding /repair and rework methods in PCB.
5. To Understand the basic level knowledge required to understand assembly techniques for leaded and SMDs.

Course Contents:

Printed circuit Board Design: History of Printed Circuit Boards. Various types of Printed Circuit Boards-Single Sided Boards, Double Sided Plated through Hole Boards, multilayer Boards. Process of PCB design and product development flow.

PCB Layout Design: Study of technical terms in layout design. :- Board outline Design, components placement, Details of layers, Routing methods, Copper Pour, Adding reference texts, Build library parts (footprints, schematic symbols) Generation of various Manufacturing Documents/Output files generation (Gerber file generation) IPC standards for printed circuit board design.

PCB Manufacturing Techniques: Fabrication methods Film Master generation method :various material used in Manufacturing of Printed Circuit Boards and properties of material. Cleaning Method of base materials before pattern transfer. Manual and Mechanical Cleaning Methods Printed Circuit Board Manufacturing Methods : Method of Screen Printing for pattern transfer, Method of Wet film and Dry film for single and Double Sided Board Manufacturing. Method of Solder-mask and Legend Printings. Plating and Etching Techniques, Mechanical methods required in manufacturing of PCBs like punching, drilling, milling and routing.Study of-Fault Finding methods of PCBs, Repairing Techniques.Materials used in Soldering Process. Types of soldering techniques.De-soldering techniques.

PCB Assembly Techniques : Components Preparation Method, Lead identification of components , Component mounting techniques , Lead Forming methods, Leaded through hole assembly and Surface Mount Assembly. Mixed Assembly Techniques of through hole

and SMDs. Manual Assembly method, Semiautomatic and automatic Assembly method. Tools used in assembly process. Introduction of SPICE simulation software like multisim.

Text Books:

1. "Make Your Own PCBs with EAGLE: From Schematic Designs to Finished Boards (Electronics)" by Simon Mon
2. "PCB Design for Real-World EMI Control (The Springer International Series in Engineering and Computer Science)" by James Drewniak and Bruce R Archambeault.

Reference Books:

1. "PCB Design: Printed Circuit Board" by Michael Dsouza and Dsouza Michael
2. "PCB Design Using AutoCAD (EDN Series for Design Engineers)" by Chris Schroeder
3. "OSCAD: An Open Source EDA Tool for Circuit Design, Simulation, Analysis and PCB Design" by Save Yogesh
4. "Complete PCB Design Using OrCAD Capture and PCB Editor" by Kraig Mitzner
5. "PCB Design in EAGLE – Part 1: Learn about EAGLE's user interface, adding parts, schematics, and more!" by Andy Artes
6. "Designing Circuit Boards with EAGLE: Make High-Quality PCBs at Low Cost" by Matthew Scarpino

Useful link:

PCB design
https://hillmancurtis.com/nptel-pcb-design/#:~:text=The%20NPTEL%20PCB%20Design%20course%20is%20a%2012%2Dweek%20course,lectures%2C%20quizzes%2C%20and%20assignments.

Course Outcomes:

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

IN1412.1 Explain the basic level knowledge required to understand PCBs
IN1412.2 Identify importance of manufacturing documents.
IN1412.3 Understand the basic concept of how to design PCB for Manufacturing and assembly point of view.
IN1412.4 Interpret the basic concept of fault finding /repair and rework methods in PCB.
IN1412.5 Understand assembly techniques for leaded and SMDs.

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IN1412.1	2	2	--	--	--	--	--	--	--	1	--	--	2	--	1
IN1412.2	2	2	1	--	--	--	--	--	--	--	--	--	1	--	--
IN1412.3	3	2	1	--	--	--	--	1	--	--	--	--	2	1	1
IN1412.4	3	2	1	--	--	--	1	--	--	--	1	--	2	1	--
IN1412.5	2	1	--	--	--	--	--	--	--	2	--	--	2	1	1
Average	2.4	1.8	1	0	0	0	1	1	0	1.5	1	0	1.8	1	1

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