Curriculum Structure for B. Tech. Electronics and Telecommunication Engineering Programme

(In light of NEP 2020)

NCrF Level 6

(NEP_Version II)

For students admitted in 2023-24 onwards

Government College of Engineering, Amravati

(An Autonomous Institute of Government of Maharashtra)
Near Kathora Naka, Amravati, Maharashtra
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www.gcoea.ac.in

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Structure for B. Tech. Programme in 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	84	08	92
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

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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	15
			ES	16--12	15
Program Courses	64-76	67	PC	44-56	48
			PE	20	19
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	**160-176**	**167**		**160-176**	**167**

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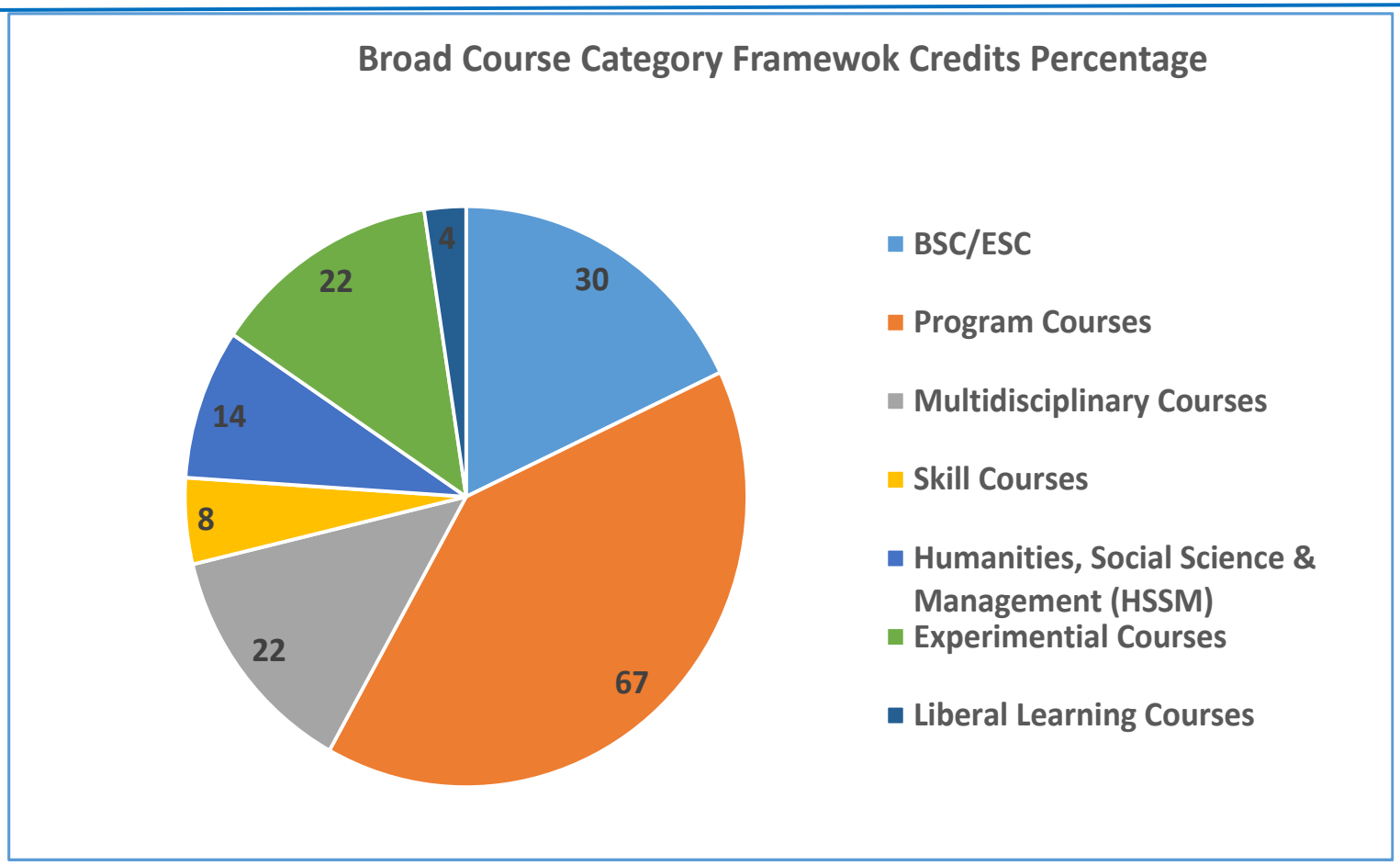

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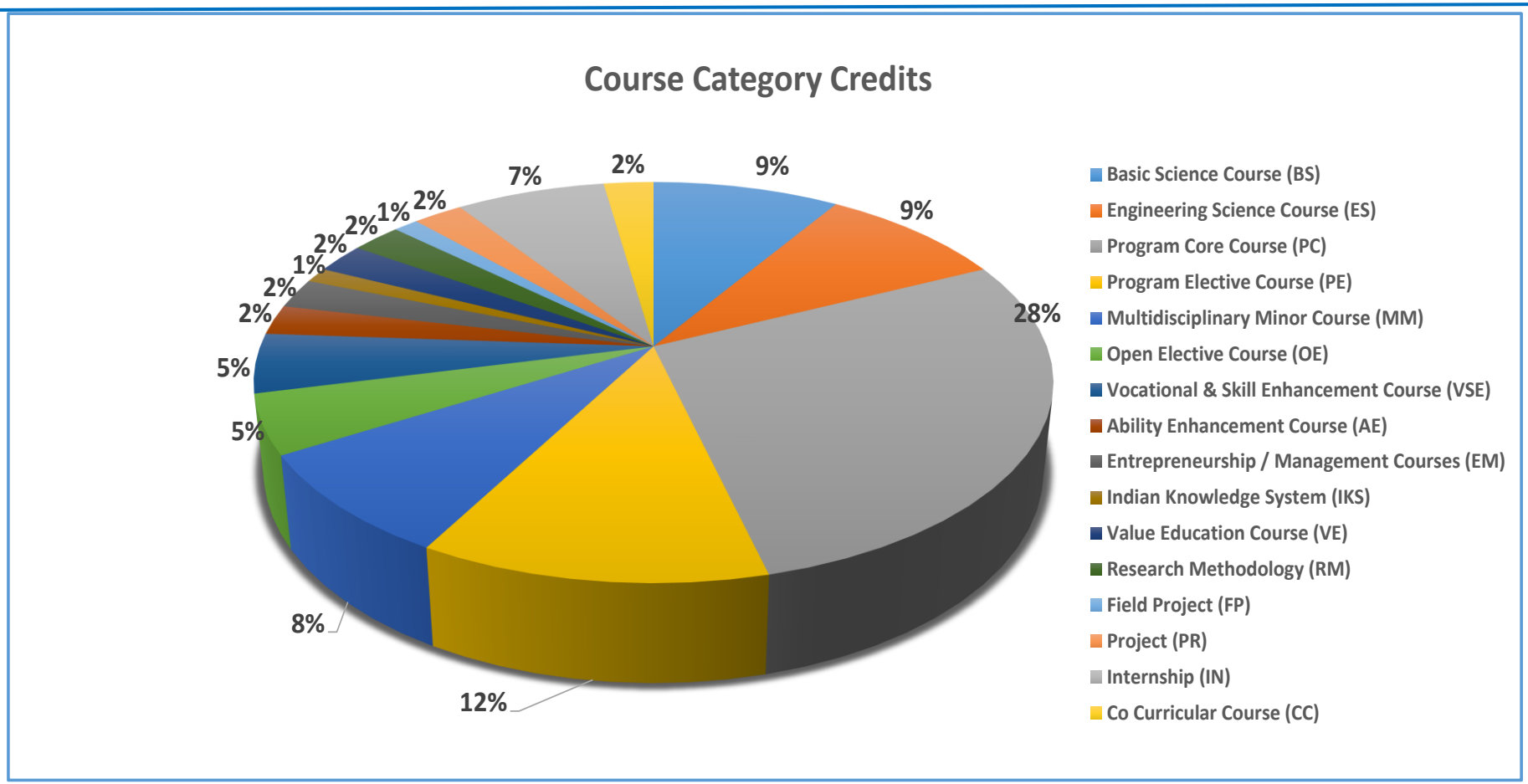

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Semester-wise Credit Distribution

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	16-12
3	Program Core Course (PC)		6	10	14	9	6	3		47	44-56
4	Program Elective Course (PE)					5	8	7		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	2	1	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**	**23**	**23**	**20**	**20**	**19**	**167**	**160-176**

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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/ NPTEL portal 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/ NPTEL or 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 institute and 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 for UG 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 from 1 to 4 Sem total mentioned credits are eligible for admission to the UG Bachelor's Degree with Honours/ Research/ Double Minor. Courses under this category must be completed in online mode through SWAYAM/ NPTEL or equivalent platform which provides evaluation mechanism. Credits/Marks Obtained under this category are directly mapped to mention teaching evaluation scheme. At the time of registration, if mention course is not available on SWAYAM/ NPTEL or equivalent platform , then DFB will provide available alternative/equivalent course.

Multiple exits: Following options are available for multiple exists:

Option	NCrF Level	Qualification Title	Additional credit requirement	Bridge courses
Exit-1	4.5	One year 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 year 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 year Bachelor Degree in Vocation (B.Voc) or B.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

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SEMESTER –III														
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
											Practical		Total	
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE		
BS	SH1301D	Transforms and Linear Algebra	3			3	15	15	10	60			100	3
MM1	ET1315/16	Multidisciplinary Minor 1	3			3	15	15	10	60			100	3
PC	ET1301	Electronic Devices & Circuits	3			3	15	15	10	60			100	3
PC	ET1302	Signals and Systems	3			3	15	15	10	60			100	3
PC	ET1303	Digital Electronics	3			3	15	15	10	60			100	3
PC	ET1304	Electronic Devices & Circuits Lab			2	2					25	25	50	1
VSE	ET1305	Signals and Systems Lab			2	2					25	25	50	1
VSE	ET1306	Digital Electronics Lab			2	2					50		50	1
EM	ET1307	Innovation, Creativity& Entrepreneurship			2	2					50		50	1
Total			**15**		**8**	**23**	**75**	**75**	**50**	**300**	**150**	**50**	**700**	**19**

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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	ET1415 /16	Multidisciplinary Minor 2	3			3	15	15	10	60			100	3
PC	ET1401	Analog Communication	3			3	15	15	10	60			100	3
PC	ET1402	Analog Circuits	3			3	15	15	10	60			100	3
PC	ET1403	Microprocessors and Microcontrollers	3			3	15	15	10	60			100	3
PC	ET1404	Control System	3			3	15	15	10	60			100	3
OE1	SH1401	Open Elective 1	3			3	15	15	10	60			100	3
PC	ET1405	Analog Communication Lab			2	2					25	25	50	1
VSE	ET1406	Analog Circuits Lab			2	2					25	25	50	1
VSE	ET1407	Microprocessors and Microcontrollers Lab			2	2					50		50	1
CC1	SH1402	Co-curricular Course			4	4			20				20	2
Total			**18**		**10**	**28**	**90**	**90**	**80**	**360**	**100**	**50**	**770**	**23**

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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	ET1411	Introduction to Embedded System Design			8	8					50		50		4
EX2	ET1412	Learn the Art and Science of PCB Design with Eagle			8	8					50		50		4
OR															
EX2	ET1413	Internship / Technical Project			16	16					100 @		100		8

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

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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	ET1515/16	Multidisciplinary Minor-3	3			3	15	15	10	60			100	3
PC	ET1501	Electromagnetic Waves	3			3	15	15	10	60			100	3
PC	ET1502	Digital Communication	3			3	15	15	10	60			100	3
PC	ET1503	Digital Signal Processing	3			3	15	15	10	60			100	3
PE1	ET1504	Program Elective 1	3			3	15	15	10	60			100	3
OE2	SH1501	Open Elective 2	3			3	15	15	10	60			100	3
PE	ET1505	Digital Communication Lab			2	2					25	25	50	1
VSE	ET1506	Digital Signal Processing Lab			2	2					25	25	50	1
PE2	ET1507	Laboratory-1			2	2					50		50	1
CC2	SH1502	Co-curricular Course			4	4			20				20	2
MNC2	SH1503	Soft Skills	2			2			20				20	0
Total			**20**	**0**	**10**	**30**	**90**	**90**	**100**	**360**	**100**	**50**	**790**	**23**

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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	ET1521	Program Elective for Honors 1 (Swayam/MOOCS/NPTEL/ Online) from Basket	3				15	15	10	60			100	3
PEH2	ET1522	Program Elective for Honors 2 (Swayam/MOOCS/NPTEL/ Online) from Basket	3				15	15	10	60			100	3
	Total		6				30	30	20	120			200	**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	ET1531	Research Project Stage 1	08	08					100		100	4	08	08

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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	ET1541	Minor Track Course 1 From Basket	3				15	15	10	60			100	3
MN2	ET1542	Minor Track Course 2 From Basket	3				15	15	10	60			100	3
	Total		6				30	30	20	120			200	6

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SEMESTER –VI														
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	ET1615/16	Multidisciplinary Minor 3	3			3	15	15	10	60			100	3
PC	ET1601	Embedded Systems	3			3	15	15	10	60			100	3
PC	ET1602	CMOS Design	3			3	15	15	10	60			100	3
PE3	ET1603	Program Elective 2	3			3	15	15	10	60			100	3
PE4	ET1604	Program Elective 3	3	1		4	15	15	10	60			100	4
VSE	ET1605	Embedded Systems Lab			2	2					25	25	50	1
PE5	ET1606	CMOS Design Lab			2	2					25	25	50	1
FP	ET1607	Laboratory-2/Minor Project			4	4					50		50	2
MNC3	ET1608	MATLAB Fundamentals	2			2	15	15	20				50	0
MNC4	SH1601	NCC/NSS	0			0			20				20	0
Total			**17**	**1**	**8**	**26**	**90**	**90**	**90**	**300**	**100**	**50**	**720**	**20**

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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	ET1611	PC Hardware & Computer Networking			8	8					50		50	4
EX3	ET1612	IoT System			8	8					50		50	4
OR														
EX3	ET1613	Internship / Technical Project			16	16					100@		100	8

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

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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	ET1621	Program Elective for Honors 3 (Swayam/MOOCS/NPTEL/ Online) from Basket					15	15	10	60			100	3
PEH4	ET1622	Program Elective for Honors 4 (Swayam/MOOCS/NPTEL/ Online) from Basket					15	15	10	60			100	3
	Total						30	30	20	120			200	**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	ET1631	Research Project Stage 2			12	12					100	100	200	6

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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	ET1641	Minor Track Course 3 From Basket	3				15	15	10	60			100		3
MN4	ET1642	Minor Track Course 4 From Basket	3				15	15	10	60			100		3
	Total		6				30	30	20	120			200		6

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SEMESTER –VII														
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		
MM5	ET1715/16	Multidisciplinary Minor 5	3			3	15	15	10	60			100	2
PC	ET1701	Digital System Design	3			3	15	15	10	60			100	3
PE6	ET1702	Program Elective 4	3	1		4	15	15	10	60			100	4
PE7	ET1703	Program Elective 5	3			3	15	15	10	60			100	3
OE3	SH1701	Open Elective 3	2			2	15	15	10	60			100	2
VSE	ET1704	Laboratory – 3			2	2					50		50	1
VSE	ET1705	Laboratory – 4			2	2					50		50	1
PR	ET1706	Project			8	8					50	50	100	4
MNC5	ET1707	Raspberry Pi / Arduino interfacing with MATLAB	2			2	15	15	20				50	0
Total			**16**	**1**	**12**	**29**	**90**	**90**	**80**	**300**	**150**	**50**	**750**	**20**

Note: Project Guide Teaching load: 8 hrs/week

Students can register for the elective in seventh semester .Courses will be of completely student's choice but approved by DFB of concerned department and should be **at least of 12 weeks** including tutorials, which will be considered as **4 credit course**.

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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
							Theory				Practical		Total		
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE			
PEH5	ET1721	Program Elective for Honors 1 (Swayam/MOOCS/NPTEL/ Online) from Basket					15	15	10	60			100		3
PEH6	ET1722	Program Elective for Honors 2 (Swayam/MOOCS/NPTEL/ Online) from Basket					15	15	10	60			100		3
	Total						30	30	20	120			200		**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			
PER3	ET1731	Research Project Stage 3			16	16					100	200	300		8

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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	ET1741	Minor Track Course 5 From Basket	3				15	15	10	60			100	3
MN6	ET1741	Minor Track Course 6 From Basket	3				15	15	10	60			100	3
	Total		6				30	30	20	120			200	6

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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	ET1801	Entrepreneurship Management Course	3			3	15	15	10	60			100		3
IN	ET1802	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

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LIST OF PROGRAM ELECTIVES					
Area	**PE1 ET1504**	**PE2 ET1603**	**PE3 ET1604**	**PE4 ET1702**	**PE5 ET1704**
Electronic Design	EDT with HDL	MEMS	VLSI Design	Mixed Signal VLSI	VLSI Verification and Testing
Communication Engineering	Antenna and Wave Propagation	Information Theory and Coding Techniques	Optical Communication	Satellite Communication	Wireless and Mobile Communication
Signal Processing	Engineering Transforms	Multirate DSP	Adaptive Signal Processing	Image and Video Processing	Audio Processing
Computer Vision	Fuzzy Logic and Neural Networks	Soft Computing	Machine Learning	Pattern Recognition	Artificial Intelligence
Competitive Examination	Network Analysis	Control System	Analog and Digital Systems	Communication Engineering	Transmission Lines and Waveguides

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.

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LIST OF MULTIDICIPLINARY 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

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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

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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

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	LIST OF OPEN ELECTIVE COURSES		
	OE-I	**OE-II**	**OE-III**
Course Code	SH1401	SH1501	SH1701
A	**Appreciating Indian Music**	**Environmental law**	**Operational Research**
B	**Introduction to Human Psychology**	**Cyber law**	**Digital Marketing**
C	**Nanotechnology, Science and Application**	**Introduction to Mass Communication**	**Biology for Engineers**
D	**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**

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LIST OF PROGRAM ELECTIVES HONOR'S COURSES (Swayam/NPTEL)			
COURSE CODE/AREA ADVANCED SIGNAL PROCESSING		**COURSE CODE/AREA SOFT COMPUTING**	
ET1521	DSP Architecture	ET1531	Artificial Intelligence
ET 1522	Digital Image and Video Processing	ET 1532	Introduction to Soft Computing and Machine Learning
ET 1621	Wavelet Signal Processing	ET 1631	Computer Vision
ET 1622	Advanced Digital Signal Processing	ET 1632	Natural Language Processing
ET 1721	Pattern Recognition and Computational Intelligence	ET 1731	Optimization Methods in Machine Learning
ET 1722	Adaptive Signal Processing	ET 1732	Hardware for Deep Learning

Honour's Courses:

Advanced Signal Processing

ET1521 DSP Architecture : NPTEL Course on MAPPING SIGNAL PROCESSING ALGORITHMS TO DSP ARCHITECTURES: NOC | Mapping Signal Processing Algorithms to Architectures (nptel.ac.in)

ET1522 Digital Image and Video Processing: a. Digital Image Processing: https://onlinecourses.nptel.ac.in/noc22_ee116/preview

b.Digital Video Processing: https://archive.nptel.ac.in/courses/117/104/117104020/#

ET1621 Wavelet Signal Processing: Introduction to Time-Frequency Analysis and Wavelet Transforms:

https://archive.nptel.ac.in/noc/courses/noc16/SEM2/noc16-ch05/

ET1622 Advanced Digital Signal Processing: Advanced Digital Signal Processing –

Multirate and Wavelets: https://archive.nptel.ac.in/courses/117/101/117101001/

ET1721 Pattern Recognition and Computational Intelligence **:**

Pattern Recognition and Application: https://onlinecourses.nptel.ac.in/noc19_ee56/preview

ET1722 Adaptive Signal Processing: Introduction To Adaptive Signal Processing: https://onlinecourses.nptel.ac.in/noc23_ee138/preview

Soft Computing

ET1531 Foundations of Artificial Intelligence: Fundamentals Of Artificial Intelligence: https://onlinecourses.nptel.ac.in/noc21_ge20/preview

ET1532 Introduction to Soft Computing and Machine Learning:

a. Introduction To Soft Computing: https://onlinecourses.nptel.ac.in/noc22_cs54/preview

b. Introduction to Machine Learning: https://onlinecourses.nptel.ac.in/noc24_cs51/preview

ET1631 Computer Vision: Computer Vision: https://onlinecourses.nptel.ac.in/noc19_cs58/preview

ET1632 Natural Language Processing: Natural Language Processing: https://onlinecourses.nptel.ac.in/noc23_cs45/preview

ET1731 Optimization Methods in Machine Learning: Optimisation for Machine Learning: Theory and Implementation: https://archive.nptel.ac.in/courses/106/106/106106245/#

ET1732 Hardware for Deep Learning: Deep Learning: https://archive.nptel.ac.in/noc/courses/noc18/SEM2/noc18-cs41/

LIST OF MINOR COURSES FOR DOUBLE MINOR (EMBEDDED SYSTEM)							
COURSE CODE	**Civil Engineering**	**Mechanical Engineering**	**Electrical Engineering**	**Electronics Engineering**	**Computer Engineering**	**Information Technology**	**Instrumentation Engineering**
XX1541				ET1541/Embedded System Design with ARM			
XX1542				ET1542/Embedded System Interfacing			
XX1641				ET1641/RTOS			
XX1642				ET1642/Embedded System Design Verification			
XX1741				ET1741/Industrial IoT			
XX1742				ET1742/IoT Edge			

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Double Minor Courses:

ET1541 Embedded System Design with ARM: NOC22 CS93: Embedded System Design with ARM: https://onlinecourses.nptel.ac.in/noc22_cs93/preview

ET1542 Embedded System Interfacing: NOC 24 EE68: Embedded Sensing, Actuation and Interfacing Systems: https://onlinecourses.nptel.ac.in/noc24_ee68/preview

ET1641 RTOS: Real Time Operating System: https://archive.nptel.ac.in/courses/106/105/106105172/

ET1642 Embedded System Design Verification: Embedded System-Design Verification and Test: https://archive.nptel.ac.in/courses/106/103/106103182/

ET1741 Industrial IoT: Introduction to Industry 4.0 and Industrial Internet of Things: https://nptel.ac.in/courses/106105195

ET1742 IoT Edge: NOC23 CS65: Foundation of Cloud IoT Edge ML https://onlinecourses.nptel.ac.in/noc23_cs65/preview

Sample Guidelines for the Honour with Research Project

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 presentation /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

Programme Name:-B. Tech. (Electronics and Telecommunication)

S N.	Course code with Name of course (old) Revised Curriculum 2019-20			Course code with Name of course(NEW) (NEP Version-II)		
	Code	**Name**	**Credit**	**Code**	**Name**	**Credit**
1	ETU324	Network Theory	4		No Equivalence	
2	ETU321	Electronic Devices and Circuits	4	ET1301	Electronic Devices and Circuits	3
3	ETU322	Signals and Systems	3	ET1302	Signals and Systems	3
4	ETU323	Digital Electronics	3	ET1303	Digital Electronics	3
5	ETU325	Electronics Devices and Circuits Lab.	1	ET1304	Electronic Devices and Circuits Lab	1
6	ETU326	Signal and Systems Lab.	1	ET1305	Signals and Systems Lab	1
7	ETU327	Digital Electronics Lab.	1	ET1306	Digital Electronics Lab	1
8		Newly Added		ET1307	Innovation, Creativity& Entrepreneurship	1
9	ETU328	Computer Programming Lab.	1		No Equivalence	
	ETU621	Control Systems	3	ET1404	Control System	3
10	ETU422	Analog Communication	3	ET1401	Analog Communication	3
11	ETU423	Analog Circuits	3	ET1402	Analog Circuits	3
12	ETU424	Microprocessors and Microcontrollers	3	ET1403	Microprocessors and Microcontrollers	3

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13	ETU425	Digital System Design	4	ET1701	Digital System Design	3
14	ETU426	Analog Communication Lab.	1	ET1405	Analog Communication Lab.	1
15	ETU427	Analog Circuits Lab.	1	ET1406	Analog Circuits Lab	1
16	ETU428	Microprocessors and Microcontrollers Lab.	1	ET1407	Microprocessors and Microcontrollers Lab	1
17	ETU421	Probability and stochastic Process	3		No Equivalence	
		Newly Added		ET1411	Introduction to Embedded System Design	4
		Newly Added		ET1412	Learn the Art and Science of PCB Design with Eagle	4
		Newly Added		ET1413	Internship / Technical Project	8

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SEMESTER III

Course Code	SH1301D							Course category			BS
Course Name	TRANSFORMS AND LINEAR ALGEBRA										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
03	-	-	03	15	15	10	60	2 hrs 30 min	-	-	-	03

Course Objectives:

To study solution of partial differential equations and apply it to solve wave and heat equations.

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

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 I: (9 hours)

Vector spaces and Subspaces, Linear dependence and Independence of vectors, Bases and dimensions, Coordinate vectors, Linear transformation, Algebra of linear transformation,

Vector Spaces II: (9 hours)

Representation of linear transformation of matrices relative to basis, Inner product, Inner Product spaces ,Norm and Orthogonality, Orthogonal and orthonormal basis, Gram-Schmidt orthogonalisation process,

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. Higher 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 Mc Graw Hill Publishing company Ltd.,New Delhi,2008, 6th edition.

3.Advanced Engineering mathematics, Reena Garg, Khanna book publishing company, 2021

Course Outcomes:

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

SH1301D.1 Study solution of partial differential equations and apply it to solve wave and heat equations.

SH1301D.2 Study Laplace transform and its properties. Apply it to solve differential equation

SH1301D.3 Equip students with Vector spaces mostly used in varied applications in engineering and science.

SH1301D.4 Study inner product spaces and related processes.

SH1301D.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
SH1301D.1	3	3	3	3	3	0	0	0	0	0	0	0	2	0	0
SH1301D.2	3	3	3	3	3	0	0	0	0	0	0	0	2	0	0
SH1301D.3	3	3	3	3	3	0	0	0	0	0	0	0	2	0	0
SH1301D.4	3	3	3	3	3	0	0	0	0	0	0	0	2	0	0
SH1301D.5	3	3	3	3	3	0	0	0	0	0	0	0	2	0	0

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

Course Code	ET1301							Course category			PC
Course Name	ELECTRONIC DEVICES AND CIRCUITS										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
03	-	-	03	15	15	10	60	2 hrs 30 min	-	-	-	03

Course Objectives:

Students undergoing this course are expected to

1. Introduce semiconductor devices and their properties.
2. Understand the behaviour of semiconductor devices under the application of DC and AC signals.
3. Study MOSFET and BJT model
4. Introduce MOS Technology and related circuits.

Course Contents:

Low frequency and high frequency models of BJT and MOSFET, Small signal Analysis of CE, CS, CD and Cascade amplifier

Field Effect Devices: MIS (metal-insulator-semiconductor) structures, concept of accumulation, depletion and inversion, MOSFET operation, I-V characteristics, C-V characteristics, MOS capacitor, MOSFET as a switch, CMOS logic gate circuits, Bi-CMOS circuits

MOSFET amplifiers: Current mirrors: Basic current mirror, Cascade current mirror, Single-ended amplifiers: CS amplifier – with resistive load, diode connected load, current source load, triode load, source degeneration. CG and CD amplifiers, Cascade amplifier

Frequency response of amplifiers, Differential Amplifiers, CMRR, Differential amplifiers with active load, two stage amplifiers

Integrated circuit fabrication process: oxidation, diffusion, ion implantation, photolithography, etching, chemical vapour deposition, sputtering, twin-tub CMOS process

Text Books:

1. Electronic devices & Circuits by Millman, Halkias & Jit, TMH 2/e 2008
2. CMOS VLSI Design by N.H.E.Weste, D. Harris, Pearson(3/e) 2005
3. Design of Analog CMOS Integrated Circuits by Behzad Razavi, McGraw Hill 2/e 2017

Reference Books:

1. Microelectronic Circuits by A.S.Sedra & K.C.Smith, Oxford 5/e 2004
2. CMOS Analog Circuit Design by Allen, Holberg, Oxford 2/e 2004

Useful Links:

1. Web course on Basic Electronics, IIT Roorkee by Dr. Pramod Agarwal https://nptel.ac.in/courses/117107095
2. Video course on Analog Electronic Circuits, IIT Kharagpur by Prof. Pradip Mandal https://nptel.ac.in/courses/108105158

Course Outcomes:

After Completion of Course, the student will able to

ET1301.1 Be familiar with electronic devices, and their applications to circuits

ET1301.2 Analyze the characteristics of electronic device like MOSFET

ET1301.3 Analyze MOSFET and BJT amplifier circuits parameters

ET1301.4 Discuss about the frequency response of MOSFET amplifiers

ET1301.5 Understand the basic processes required for fabrication of electronic devices

CO-PO-PSO Mapping

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ET1301.1	1	1	1	1	0	0	1	0	0	0	1	1	1	1	0
ET1301.2	1	1	1	1	0	0	1	0	0	0	1	1	1	1	0
ET1301.3	1	1	1	1	0	0	1	0	0	0	1	1	1	1	0
ET1301.4	1	1	1	1	0	0	1	0	0	0	1	1	2	2	0
ET1301.5	1	1	2	2	1	0	1	0	0	0	1	1	2	2	0

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

Course Code	ET1302							Course category			PC
Course Name	SIGNALS AND SYSTEMS										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
03	-	-	03	15	15	10	60	2 hrs 30 min	-	-	-	03

Course Objectives: Students undergoing this course are expected to

1. Know types of signals, their representations with sampling for signal processing
2. Know type of systems required for electronic Applications.
3. Know Fourier representation and Fourier transform of continuous and discrete time periodic signals
4. Understand concept of region of convergence(ROC) of Laplace transform and Z0 Transform

Introduction to signals and system: Continuous and discrete time signals, transformation of signals, unit impulse and unit step functions. System - continuous & discrete time system, continuous and discrete LTI system, properties of LTI system. Causal LTI system described by differential and difference equation.

Fourier series representation: Fourier Series Representation of Periodic Signal, properties of Continuous and Discrete -Time Fourier Series. Parseval's Relation of Periodic Signal.

Fourier Transform: continuous-time and discrete time Fourier Transform for Periodic Signals, Properties of the Fourier Transform. Discrete time Fourier transform (DTFT), Magnitude and Phase response, properties of DTFT such as convolution, multiplication and duality.

Review of Laplace and Z- transform: Introduction to Laplace and Z-transforms, properties of Laplace and Z-Transform. The Inverse Laplace and Z-Transform, Pole- zero plot, , Analysis and Characterization of LTI Systems, System function algebra and block diagram representation.

Sampling: The sampling theorem, sampling of continuous time signals, digitization and reconstruction of a signal, ideal interpolator, effect of under sampling: aliasing, discrete time processing of continuous time signals.

Text Books:

1. Oppenheim, A.V.,Willsky, A.S. and Nawab, S.H., "Signals & Systems", 2nd1997Ed., Prentice-Hall of India.
2. Haykin, S. and Van Been, B., "Signals and Systems" 2nd 2003Ed., John Wiley & Sons.

Reference books:

1. Roberts, M.J., "Fundamentals of Signals & Systems", Tata McGraw-Hill.2007
2. Ziemer, R.E., Tranter, W.H. and Fannin, D.R., "Signals and Systems: Continuous and Discrete", 4th2001Ed., Pearson Educat4.Lath
3. Lathi, B. P., "Linear Systems and Signals", 2nd2006 Ed., Oxford University press.

Useful Links:

1. https://www.youtube.com/playlist?list=PLC6210462711083C4
2. https://onlinecourses.nptel.ac.in/noc21_ee28/preview

Course Outcomes:

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

ET1302.1 Understand mathematical description and representation different types of signals and systems

ET1302.2 Develop IO relationship for LTI system and understand the convolution operator for continuous and discrete time system

ET1302.3 Represent continuous and discrete systems in time and frequencydomain using different transforms like Fourier series and Fourier Transform

ET1302.4 Understand the limitations of Fourier transform and need for Laplace transform and develop the ability to analyze the system in s- domain.

ET1302.5 Understand sampling and various issues related to it

CO-PO-PSO Mapping

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ET1302.1	1	0	0	0	1	0	0	0	0	0	0	0	1	1	0
ET1302.2	2	1	0	0	1	0	0	0	0	0	0	0	2	2	0
ET1302.3	2	2	1	1	2	2	0	0	0	0	0	0	2	2	0
ET1302.4	3	3	3	2	3	3	0	0	0	0	0	0	3	3	0
ET1302.5	1	1	2	1	1	1	0	0	0	0	0	0	1	1	0

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

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Course Code	ET1303						Course category			PC
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	-	-	03	15	15	10	60	2 hrs 30 min	-	-	-	03

Course Objectives:

1. To acquire the basic knowledge of digital logic circuit components
2. To implement minimization techniques and Boolean algebra for circuit minimization
3. To understand, analyse and design combinational logic circuits using gates and MSIs
4. To study various components and design sequential circuits and study semiconductor Memories

Number system and codes: Positional number system, conversions and arithmetic. Arithmetic using rth complements, Signed number representation and arithmetic, Codes: BCD, Gray, ASCII, etc and error detection and correction codes.

Boolean algebra and functions Minimization: Boolean algebra, Logic gates – basic, derived and universal, theorems and properties of Boolean algebra, DeMorgan's theorem, canonical and standard SOP and POS forms, simplification and synthesis of Boolean functions using gates, Boolean theorems, K-Map ,don't care condition (up to four variables) and Quine McCluskey method (up to 6 variables), Implementation of Boolean expressions.

Combinational logic Circuit- adders, subtractors, BCD adder, ripple carry look ahead adders, comparator, parity generator, encoders, decoders, multiplexers, de-multiplexers, Realization of Boolean expressions-using decoders-and multiplexers.

Sequential circuits – latches, flip flops, its triggering, inter-conversion, Shift registers: SISO, SIPO, PISO, PIPO, and Universal; Counters – Synchronous and asynchronous up/down counters, mod-N counter, Counters for random sequence.

Semiconductor logic families and memories: Semiconductor logic families: Introduction, Characteristics of digital ICs, RTL, DTL and TTL, comparisons of logic families; Semiconductor memories: RAM, ROM, PLA and PAL.

Text Books:

1. Digital Principles & Logic Design by A. Saha N. Manna by Infinity Science Press LLC, 2007
2. Digital Design by Morris Mano, Pearson education, 2018

Reference Books:

1. T. L. Floyd "Digital Fundamentals", 11th ed., Pearson Education, 2018.
2. Wakerly J F, "Digital Design: Principles and Practices, Prentice-Hall", 5th Ed., 2018.
3. Roth C.H., "Fundamentals of Logic Design", Jaico Publishers. V Ed., 2009.

Useful Links:

1. https://onlinecourses.nptel.ac.in/noc22_ee55/preview or
2. https://archive.nptel.ac.in/courses/108/105/108105132/

Course outcomes

At the end of the course student will be able

ET1303.1 Optimize the digital circuits by applying the applying the Boolean algebra and other minimization techniques
ET1303.2 Examine and design the combinational circuits using gates and MSIs
ET1303.3 Realize the sequential circuits suing flip-flops counters and shift registers.
ET1303.4 Comparisons of logic families and implementation of gates using RTL, DTL and TTL
ET1303.5 Device logic circuits using SSIs and MSIs.

CO-PO-PSO Mapping

CO	PO / PSO														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
ET1303.1	2	0	0	0	0	0	0	0	0	0	0	0	2	1	0
ET1303.2	2	1	0	0	0	0	0	0	0	0	0	0	3	2	0
ET1303.3	2	2	1	1	1	1	0	0	0	0	0	0	3	2	0
ET1303.4	1	2	1	2	2	2	0	0	0	0	0	0	3	1	0
ET1303.5	3	3	1	2	3	1	0	0	1	1	0	0	3	3	0

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

Course Code	ET1304						Course category		PC
Course Name	ELECTRONIC DEVICES AND CIRCUITS LABORATORY								
Teaching Scheme				Examination Scheme					Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
-	-	02	02	-	-	-	-	-	25	25	50	01

Course Objectives:

Students undergoing this course are expected to

1. Plot the characteristics of transistors to understand their behavior
2. Understand the input and output characteristics of these devices
3. Study and understand the devices in detail to use this devices for various application
4. Understand a few of the circuit applications using appropriate Circuit Simulation package

Hardware Experiments

1. MOSFET modes of operation
2. Output and transfer characteristic of n-channel MOSFET
3. Output and transfer characteristic of p-channel MOSFET
4. MOSFET amplifier
5. Current mirror circuits

Simulation Experiments

6. Simulate frequency response of single stage BJT CE / FET CS amplifier.
7. MOS CS amplifier with resistive load, diode connected load, current source load
8. Differential amplifier

Course Outcomes:

After Completion of Course, the student will able to

ET1304.1 Be familiar with electronic devices and their applications to circuits

ET1304.2 Demonstrate simple amplifier circuits using BJT and FET

ET1304.3 Analyze simple current mirror circuits

ET1304.4 Demonstrate theoretical device/circuit operation in properly constructed analog circuits

ET1304.5 Simulate a few of the circuit applications using appropriate Circuit Simulation package

CO-PO-PSO Mapping

CO	PO / PSO														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
ET1304.1	1	0	0	0	0	1	1	0	0	0	1	3	2	0	1
ET1304.2	1	1	0	0	0	1	1	0	0	0	1	1	2	0	1
ET1304.3	1	1	0	0	0	1	1	0	0	0	1	1	2	0	1
ET1304.4	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0
ET1304.5	1	0	0	0	0	0	1	0	0	0	0	0	1	0	1

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

Course Code	ET1305						Course category		VSE1
Course Name	SIGNALS AND SYSTEMS LABORATORY								
Teaching Scheme				Examination Scheme					Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
-	-	02	02	-	-	-	-	-	25	25	50	01

The term work shall include minimum 10 experiments based on theory syllabus signal and systems as per sample list given below, using MATLAB or equivalent MATHCAD, LAB VIEW etc application software packages.

Course Objectives:

The objectives of this course are to

1. Provide learning practical implementation of the basic principles of signals
2. Acquire knowledge regarding types of system and their properties
3. Verify the concept of DFT, Z- transform and Laplace transform in the laboratory.
4. Verify the concepts and applications of sampling and aliasing in the laboratory.
5. Provide practical exposure to random variables and processes.

List of Experiments

Sample list is given below but other experiments can be included as per the instructor

1. To demonstrate generation of various types of signal representation.
2. To explore the effect of transformation of signal parameters (amplitude-scaling, and time shifting).
3. To verify different properties of a given system as linear or non-linear, causal or non-causal, stable or unstable etc.
4. Verification of Parseval's theorem associated with Fourier series analysis for a periodic square wave sampled using appropriate sampling frequency.
5. To verify Fourier Transform and inverse Fourier Transform.
6. Verification of Multiplication property associated with Fourier series analysis for a periodic triangular wave sampled using appropriate sampling frequency.
7. Verification of shifting property associated with Fourier series analysis for a periodic square wave sampled using appropriate sampling frequency.

8. To demonstrate the use of Laplace transform and inverse Laplace Transform.
9. To Implement Z transform and inverse Z transform.
10. To study sampling, aliasing of discrete and continuous signals.

Course Outcomes:

Student shall be able to

ET1305.1 Verify basic concepts of signals and systems.
ET1305.2 Analyzing signal and systems in time and frequency domain
ET1305.3 Substantiate the use of discrete Fourier transformation
ET1305.4 Understand and verify need and concept of Z and Laplace transform
ET1305.5 Substantiate the process of sampling and various issues related to it.

Note:

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

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

CO-PO-PSO Mapping

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ET1305.1	1	0	0	0	1	0	0	0	0	0	0	0	1	1	0
ET1305.2	1	1	0	0	2	0	0	0	0	0	0	0	2	2	0
ET1305.3	2	2	2	2	3	2	0	0	0	0	0	0	3	3	0
ET1305.4	2	2	2	2	3	3	0	0	0	0	0	0	3	3	0
ET1305.5	1	2	1	3	1	3	0	0	0	0	0	0	1	1	0

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

Sign Sign Sign Sign
Member Secretary BoS Chairperson Dean, Academics Principal

Course Code	ET1306						Course category		VSE2
Course Name	DIGITAL ELECTRONICS LABORATORY								
Teaching Scheme				Examination Scheme					Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
-	-	02	02	-	-	-	-	-	50	-	50	01

Course Objectives:

To make student able

1. To acquire the hands-on experience of digital component, circuit realization using breadboard
2. To realize combinational logic circuits using gates and MSIs
3. To realize sequential circuits using gates and MSIs
4. To design Combinational Logic Circuits

The instructor may choose experiments as per his/her choice, so as to cover entire course contents of ET1303. Minimum 8 experiments should be performed.

Following list of laboratory experiments is indicative but not limited to following topics

1. To verify working of different logic gates and Boolean algebra.
2. To realize all gates using NOR/and NAND gates
3. Combinational Logic design using basic gates (Code Converters, Comparators, etc).
4. Combinational Logic design using decoders and MUXs.
5. Realize Arithmetic circuits - Half and full address and subtractors.
6. Design Arithmetic circuits – design using adder ICs, BCD adder.
7. Flip flop circuit (RS latch, JK & master slave) using basic gates.
8. Inter conversation of Flip Flops
9. Asynchronous Counters
10. Synchronous counters, Johnson & Ring counters.
11. Sequential Circuit designs (sequence detector circuit).

Course Outcomes:

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

ET1306.1 Realize the importance of Boolean algebra

ET1306.2 Apply concepts and methods of Combinational circuit design techniques introduced in ET1303 through experimentation.

ET1306.3 To design, analyze, synthesize and realize combinational circuits using componentsand ICs

ET1306.4 Apply concepts and methods of Sequential circuit design techniques introduced inET1303 through experimentation.

ET1306.5 Able to design and realize simple digital systems

Note:-

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

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

CO-PO-PSO Mapping

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ET1306.1	1	0	0	0	1	0	0	0	0	0	0	0	1	1	0
ET1306.2	1	1	1	0	1	1	0	0	0	0	0	0	2	1	0
ET1306.3	2	2	1	1	2	1	0	0	0	0	0	0	2	2	0
ET1306.4	3	3	2	1	2	2	0	0	1	0	0	0	3	3	0
ET1306.5	3	3	3	3	3	3	0	0	0	0	0	0	3	3	-

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

Course Code	ET1307						Course category		EM1
Course Name	INNOVATION, CREATIVITY& ENTREPRENEURSHIP								
Teaching Scheme				Examination Scheme					Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
-	-	02	02	-	-	-	-	-	50	-	50	01

Course Objectives:

1. To provide all facilities under one roof for the conversion of an idea into a prototype.
2. Making students more curious, imaginative, creative and provide students for knowledge of Electronics Components and soldering techniques and its package information for electronics circuit design
3. Knowledge for the assembling of electronics circuit with components on PCB (Printed Circuit Board) of circuit design.
4. Design and development of Small electronic project based on hardware and software for electronics systems

Students are expected to complete work in group of max.three in pertaining to following aspects:

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

Course Outcomes:

ET1307.1 Students will be able to practice acquired knowledge within the chosen area of technology for project development.

ET1307.2 Identify, discuss and justify the technical aspects of the chosen project with a comprehensive and systematic approach.

ET1307.3 Work as an individual with implementation of overall knowledge acquired in a program in development of technical projects.

ET1307.4 Communicate and report effectively project related activities.

Note:-

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

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

CO-PO-PSO Mapping

CO	PO / PSO														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
ET1307.1	1	0	0	0	0	1	1	0	0	0	1	3	2	0	1
ET1307.2	1	1	0	0	0	1	1	0	0	0	1	1	2	0	1
ET1307.3	1	1	0	0	0	1	1	0	0	0	1	1	2	0	1
ET1307.4	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0

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

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Member Secretary BoS Chairperson Dean, Academics Principal

Semester IV

Course Code	ET1401								Course category			PC
Course Name	ANALOG COMMUNICATION											
Teaching Scheme				Examination Scheme								Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
03	-	-	03	15	15	10	60	2.30 Hrs.	-	-	100	03

Course Objectives:

The course aims to provide the students with

1. The concepts and issues related to analogue communication such as modulation, demodulation, transmitters and receivers and noise performance.
2. The techniques for generating and demodulating narrow-band and wide-band frequency and phase modulated signals
3. Various radio receivers with their parameters.
4. Basic introduction to antennas, their principal of operation also introduce to wave propagation.

Course Contents:

Introduction to communication systems: The communication process, Sources of information, Communication networks, communication channels, Electromagnetic frequency spectrum, communication systems, need of modulation and its types, bandwidth requirement.

Noise: Sources of noise and its types signal to noise ratio, noise factor, noise figure, definition of noise figure, calculation of noise figure, noise figure from equivalent noise resistance, noise temperature and noise equivalent temperature.

Amplitude (Linear)Modulation and Demodulation: Amplitude modulation (AM), double side band (DSB), double side band suppressed carrier (DSB-SC), single side band (SSB), vestigial side band modulation (VSB): generation, demodulation; independent side band(ISB) transmission, modulation index, frequency spectrum, power requirement of these systems, super heterodyne radio receiver. Noise in AM receivers using coherent detection and envelop detection. Signal-to-noise ratio (SNR) calculations for amplitude modulation (AM) for low noise conditions

Angle (Exponential) Modulation and Demodulation: Generalized concept and features of angle modulation; Frequency modulation (FM): modulation index, power requirement, frequency spectrum, bandwidth, phasor comparison of narrowband FM and AM waves, generation of FM, demodulation, interference in FM system, pre-emphasis and de-emphasis

techniques, FM receiver, noise in FM receiver. Signal-to-noise ratio (SNR) calculations for frequency modulation (FM) for low noise condition.

Phase modulation (PM): modulation index, power requirement, frequency spectrum, bandwidth analysis of narrow band FM, wide band FM and PM, interference in angle modulated system.

Antenna and Wave propagation:

Antenna: Introduction, Basic Antenna system, Antenna parameters, Yagi Uda antenna, Dishantenna
Wave propagation: Fundamentals of electromagnetic waves, Ground wave propagation, skywave, space wave, tropospheric scatter, Extraterrestrial propagation.
Ionosphere: Structure, layers of Ionosphere, critical frequency, MUF, skip distance andvirtual height.

Text Books:

1. Modern Digital and Analog Communication Systems, B. P. Lathi, 4rd edition,Oxford University press, 2009
2. Electronic communication systems, G. Kennedy and B. Davis, 5th edition, TataMcGraw Hill, 2012.

Reference Books:

1. Communication System, S. Haykin, 5th edition, John Wiley and sons, 2009.
2. Electronic communications, R. Dennis and J. Coolen, 4th edition, Prentice Hall
3. Communication Electronics Principles and Application, "Frenzel", Tata McGraw Hill, 3rd Edition

Useful Links:

1. https://onlinecourses.nptel.ac.in/noc23_ee117/preview
2. https://www.udemy.com/share/101Ina/

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

ET1401.1 Interpret the basic concept of communication systems and gain the knowledge of components of analogue communication system.

ET1401.2 Understand the concepts of analog modulation transmission and reception, various methods of analog communication.

ET1401.3 Illustrate and evaluate the parameters of analog communication system.

ET1401.4 Analyze the effect of noise on various transmission systems and summarize the concepts of wave propagation.

ET1401.5 Understand and evaluate antenna parameters and design antenna.

CO – PO – PSO Mapping:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ET1401.1	1	0	0	0	1	0	0	0	1	0	0	1	1	1	0
ET1401.2	1	0	0	0	1	0	0	2	1	1	2	2	1	1	1
ET1401.3	3	1	0	0	1	1	1	0	1	0	0	0	2	1	1
ET1401.4	3	2	1	1	1	2	2	2	1	2	2	2	2	2	3
ET1401.5	3	3	2	1	1	1	2	2	1	2	3	3	2	3	3

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

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Member Secretary BoS Chairperson Dean, Academics Principal

Course Code	ET1402						Course category		PC
Course Name	ANALOG CIRCUITS								
Teaching Scheme				Examination Scheme					Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
03	-	-	03	15	15	10	60	2 hrs 30 min	-	-	-	03

Course Objectives:

Students undergoing this course are expected to

1. Study negative feedback and power amplifier circuits
2. Study various Oscillators circuits
3. Develop the skill to build, test, diagnose and rectify the OP-AMP based electronic circuits.
4. Study various active filters using OP-AMP

Course Contents:

Feedback Amplifier : Classification of amplifier, concept of feedback, types of feedback (positive and negative feedback), general characteristics of negative feedback amplifier - transfer gain, input resistance and output resistance, negative feedback amplifier - analysis of voltage series, current series, voltage shunt and current shunt negative feedback amplifier

Large Signal Amplifier: High frequency transistor models, frequency response of single stage and multistage amplifiers, cascode amplifier, current mirrors and differential amplifiers. Various classes of operation (Class A, B, AB, C etc.), their power efficiency and linearity issues.

Oscillators: Review of the basic concept, Barkhausen criterion, RC oscillators (phase shift, Wien bridge etc.), LC oscillators (Hartley, Colpitt, Clapp etc.), non-sinusoidal oscillators. Multivibrator: astable, bistable and monostable multivibrator.

OP-AMP, inverting, non-inverting, differential amplifier configurations, Input offset voltage, input bias and offset current, Thermal drift, CMRR, PSRR.
OP-AMP applications: review of inverting and non-inverting amplifiers, integrator and differentiator, summing amplifier, precision rectifier, Schmitt trigger and its applications. Active filters: Low pass, high pass, band pass and band stop, design guidelines.

Text Books:

1. Elecronic devices & Circuits by Millman, Halkias & Jit, TMH 2/e 2008
2. Linear Integrated Circuits by D.Roy Choudhary, Shail Jain, New Age International

Reference Books:

1. Electronic Circuits Analysis and Design by Donald A Neamen, TMH 2/e 2002

2. Op-Amps and Linear Integrated Circuits by Ramakant A Gayakwad, PHI 4/e
3. Operational amplifiers, Design and applications by Tobey, Graeme, Huelsman , McGraw Hills Edition

Useful links:

1. Web course on Analog Circuits, IIT Roorkee by Dr. Pramod Agarwal https://nptel.ac.in/courses/117107094
2. Video course on Analog Circuits and Systems, IISC Bangalore by Prof. K. Radhakrishna Rao https://nptel.ac.in/courses/117108107

Course Outcomes:

After Completion of Course, the student will able to

ET1402.1 Analyze negative feedback amplifier and power amplifiers circuits

ET1402.2 Understand various oscillator circuits

ET1402.3 Understand the functioning of OP-AMP and design OP-AMP based circuits

ET1402.4 Troubleshoot various linear applications of OP-AMP

ET1402.5 Helps students to know about active filter design using OP-AMP

CO-PO-PSO Mapping

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ET1402.1	1	1	1	1	0	0	1	0	0	0	1	1	2	1	0
ET1402.2	1	1	1	1	0	0	1	0	0	0	1	1	2	1	0
ET1402.3	1	1	2	2	1	0	1	0	0	0	1	1	3	2	0
ET1402.4	1	1	1	1	1	0	1	0	0	0	1	1	1	1	0
ET1402.5	1	0	1	1	0	0	1	0	0	0	1	1	2	1	0

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

Course Code	ET1403						Course category		PC
Course Name	MICROPROCESSOR AND MICROCONTROLLER								
Teaching Scheme				Examination Scheme					Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
03	-	-	03	15	15	10	60	2 hrs 30 min	-	-	-	03

Course Objectives:

To make the student able

1. To learn the fundamentals of microprocessors and microcontrollers
2. To understand the concepts of Assembly Language Programming
3. To understand the basic hardware interfacing
4. To develop application systems based on microprocessors and microcontrollers with efficient programming

Course Contents:

8-bit Microprocessors: Block diagram and operation of microcomputer system, Introduction to Intel's 8085 Architecture and its description along with functional pin diagram, organization of Memory in microcomputer system. Flag structure, Addressing Modes & Instruction set of 8085.

Assembly Language Programming: Assembly language Programming and timing diagram of instructions; Concept of Interrupts and its structure and programming in 8085 & Interrupt service routines, timer/counter; Serial communication basics in 8085.

Microcontrollers: Introduction to MCS51 family, microprocessor and microcontroller comparison, architecture of 8051, pin configuration and description, register organization, input/output port structure, timer structure and their modes, interrupts and serial port modes, Addressing modes, instruction set, bit and byte level logical operations, programming of serial and parallel ports, timer/counters, and interrupts..

Interfacing with 8051: Interfacing of LED, Seven segment, LCD, ADC, DAC, memory, DC and Stepper motor.

Introduction to Advanced Microcontrollers: ARM and PIC

Text Books:

1. Microprocessor, Architecture, Programming and Applications with 8085, Ramesh S. Gaonkar, 5th edition, Penram International Publication, 2004.
2. The 8051 microcontroller, Kenneth Ayala, 3rd edition, Delmar Cengage Learning,

2005.
3. 8051 Microcontroller and Embedded System, Muhammad Ali Mazidi, 2nd edition, Prentice Hall, 2000

Reference books:

1. 0000 to 8085 – Introduction to Microprocessor for Engineers and Scientists, P. R. Sridhar and P. K. Ghosh, 2nd edition, Prentice Hall India Ltd, 2005.
2. Introduction to Microprocessor, Aditya P. Mathur, 3rd edition, Tata McGraw-Hill,2004.
3. Advanced microprocessors and Peripherals, A.K.Ray and K.M.Bhurchandi, 2nd edition, Tata McGraw Hill, 2008
4. Design with PIC microcontrollers, John B. Peatman, 1st edition, PHI, 1998

Useful Link:

1. https://archive.nptel.ac.in/courses/108/105/108105102/

Course Outcomes:

After completing this course, Students shall be able to:
ET1403.1 Understand Microprocessor and Microcontrollers basics

ET1403.2 Develop and implement Assembly language programs

ET1403.3 Understand the hardware interfaces required to develop a simple microcomputer system

ET1403.4 Learn Assembly language programming for 8085

ET1403.5 Develop simple application based projects.

CO-PO-PSO Mapping

CO	PO / PSO														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
ET1403.1	2	0	0	0	1	0	0	0	0	0	0	0	1	1	0
ET1403.2	2	1	0	0	1	0	0	0	0	0	0	0	2	2	0
ET1403.3	2	2	1	1	3	1	0	0	0	0	0	0	2	2	0
ET1403.4	1	2	2	2	2	2	0	0	0	0	0	0	3	3	0
ET1403.5	3	3	2	2	3	1	0	0	1	1	0	0	3	3	0

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

Course Code	ET1404							Course category			PC
Course Name	CONTROL SYSTEMS										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
03	--	--	03	15	15	10	60	2.30 Hrs.	--	--	100	03

Course Objectives:

To make the students aware and understand:

1. To learn modelling of a physical system
2. To understand the concept of stability of system
3. To understand the systems in time and frequency domain
4. To understand the state space modelling and its analysis

Course Contents:

Introduction: Basic Components of a Control System, Examples of Control System Applications, Open Loop Control Systems, Closed Loop Control Systems, Effect of Feedback on System Parameters, Block Diagrams, and Signal Flow Graphs Analysis.

Time Domain Analysis: Standard Test signal, Time response of systems to ,First order and second order system, steady state error and error constant, effect of adding zeros to a system, Design specification of second order system.

Stability Analysis: concept of stability, necessary condition for stability, Hurwitz, Routh stability criteria, special cases for determining relative stability, Root locus concept.

Frequency Domain Analysis: Nyquist stability criterion, Assessment of relative stability, Bode Plot, stability margins on Bode plot.

State variable Analysis: Concept of state, state Variable and state model, state model for linear continuous time system, State variable and linear discrete time system, solution of state equation, concept of controllability and Observability.

Text Book:

1. I.J. Ngarath and M. Gopal, "Control system Engineering" New Age International Publisher

Reference Books:

1. Kuo, B.C., "Automatic Control System", Prentice Hall

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

3. Ogata, K., "Modern Control Engineering", Prentice Hall,

Useful Link:

1. https://archive.nptel.ac.in/courses/107/106/107106081

Course Outcomes:

ET1404.1 Model a physical system by means of block diagrams, mathematical model and Transfer functions

ET1404.2 Analyze the systems in time.

ET1404.3 Investigate stability of a system using different tests

ET1404.4 Analyze the system in frequency domain Model

ET1404.5 Analyze the control systems using state space analysis

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ET1404.1	3	2	3	2	1	1	0	1	2	2	2	3	0	1	1
ET1404.2	3	2	2	3	1	1	1	0	2	1	2	2	0	1	1
ET1404.3	2	2	2	3	2	1	1	1	2	2	2	2	0	1	1
ET1404.4	2	2	3	3	2	1	0	1	2	2	2	3	0	1	1
ET1404.5	2	2	3	0	3	1	0	1	2	2	0	0	0	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, wadi swar, sanvadi swar,varjit swar, 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 Bhatkhande lipi), Different THAATs and their brief information, Definition of Raga, Sargam geet, the concept of Khyal , aalap and tana, Raga and Time Association, Basic ragas (Bhupali, Yaman, Bhimpalasi and Kedar) along with Aaroha, avaroha, pakad and sargam geet 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 Bhajni Theaka)
Practical exercises in clapping and counting rhythms to internalize talas.

Introduction to Musical Instruments:
Classification of Indian Musical Instruments (String, wind, percussion and Solid Instruments), components parts of Indian classical instruments along with neat sketch
Biography- Ustad Zakir Husen (Tabla), Pandit Appa Jalgaokar (Harmonium)
Pandit Ravi Shankar (Sitar), Pandit Hari Prasad Chaurasiya (Flute), Dr. N Rajam (Violin)

Textbooks:

1. Indian Classical Music By Ravi S. Prasanna
2. Appreciating Indian Music By 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 Correlated 2- Moderately Correlated 3- Strongly Correlated

Course Code	SH1401B							Course Category			OE1
Course Name	Introduction to Human Psychology										
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. Understand the human 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	0	0	0	0	0	1	2	0	0	0	3	1	2
SH1401B.2	2	0	0	0	0	0	0	1	2	0	0	0	2	1	1
SH1401B.3	2	2	0	0	0	0	0	1	2	0	0	0	2	1	1
SH1401B.4	2	0	0	0	0	0	0	1	2	0	0	0	2	1	1
SH1401B.5	2	2	0	0	0	0	0	1	2	0	0	0	2	1	1

0 - 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	-	-	100	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. Oweus, 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 Nanodevices Vol 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	0	2	0	0	0	0	0	1	2	2	3	2	2	1
SH1401C.2	3	2	3	0	2	0	2	0	0	3	2	3	2	2	1
SH1401C.3	3	2	3	2	0	0	3	3	1	3	3	3	2	2	1
SH1401C.4	3	2	3	2	2	0	2	0	0	3	3	3	2	2	1
SH1401C.5	3	2	3	2	2	0	3	1	0	3	3	3	2	2	1

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

Course Code	ET1405							Course category			PC
Course Name	ANALOG COMMUNICATION 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 will be able to:

1. Familiarize the students with basic analog communication systems.
2. Integrate theory with experiments so that the students appreciate the knowledgegained from the theory course, e.g., amplitude and frequency modulation, pulse modulation.
3. Understand Modulation and demodulation techniques of AM, FM.
4. Know Characteristics of AM and FM receivers.

Course Contents:

Minimum Ten experiments related to the course contents of Analog Communication are to be performed.

Representative list of experiments related to the course contents of (ANALOG COMMUNICATION):

1. To Study Noise Spectral density.
2. AM modulation: Calculation of Modulation Index.
3. FM modulation: Calculation of Modulation Index.
4. Pre-emphasis and De-emphasis.
5. FM Modulation using PLL.
6. Demodulation of AM and FM.
7. Effect of noise on AM and FM
8. Pulse Amplitude Modulation and Demodulation.
9. Generation of double side band suppressed carrier.
10. To study SSB modulation and de-modulation.
11. Observe and plot radiation pattern of Omni-directional and directional antenna.

Note:

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

ESE: The end semester Exam for practical may/shall be based on performance in one of the experiments and may be followed by sample questions.

Course Outcomes:

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

ET1405.1 To develop practical knowledge about theories of analog communication.

ET1405.2 Evaluate analog modulated waveform in time /frequency domain and also find modulation index.

ET1405.3 Develop understanding about performance of analog communication systems.

ET1405.4 Analyze performance of noise on AM and FM.

ET1405.5 Illustrate techniques for antenna parameter measurements and analyze the performance of radiation pattern

CO – PO – PSO Mapping:

	Program Outcomes														
Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ET1405.1	2	1	0	0	0	0	0	1	0	0	0	1	0	0	0
ET1405.2	3	2	0	0	0	0	0	1	0	0	0	0	0	2	0
ET1405.3	0	0	3	0	0	1	2	1	1	0	2	0	0	0	1
ET1405.4	3	2	0	0	2	1	2	1	1	2	1	2	2	2	1
ET1405.5	2	2	2	2	3	1	3	1	2	2	3	3	1	1	1

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

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

Course Code	ET1406						Course category		PC
Course Name	ANALOG CIRCUITS LABORATORY								
Teaching Scheme				Examination Scheme					Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
-	-	02	02	-	-	-	-	-	25	25	50	01

Course Objectives:

Students undergoing this course are expected to

1. Design, test and analyze various clipping and clipper circuits.
2. Understand various oscillator circuits
3. Analyze and design various applications of OP-AMP circuits
4. Simulate a few of the circuit applications using appropriate Circuit Simulation package.

Course Contents:

Design Experiments

1. Single stage BJT CE amplifier.

   (Find performance parameters - Av, Ri, Ro & Bandwidth for BJT CE amplifier.)
2. Voltage series feedback amplifier
3. Voltage shunt feedback amplifier
4. Class A power amplifier with resistive load
5. Multivibrator - astable, monostable, bistable
6. OP-AMP applications- Integrator, Differentiators, etc.
7. OP-AMP applications- Schmitt trigger, etc.
8. Filter Design.

Simulation Based Experiments

1. Simulate frequency response of single stage BJT CE / FET CS amplifier.

   (Effect of coupling and bypass capacitors.)

2. Design and simulate LC and RC oscillators.

(Compare practical and theoretical oscillation frequency.)

3. Design and simulate active filters

Course Outcomes:

After Completion of Course, the student will able to

ET1406.1 Analyze negative feedback amplifier and power amplifiers

ET1406.2 Understand various oscillator circuits

ET1406.3 Understand the functioning of OP-AMP and design OP-AMP based circuits

ET1406.4 Troubleshoot various linear applications of OP-AMP

ET1406.5 Helps students to know about active filter design

CO-PO-PSO Mapping

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ET1406.1	1	0	0	0	0	1	1	0	0	0	1	1	1	0	1
ET1406.2	1	1	0	0	0	1	1	0	0	0	1	1	1	0	1
ET1406.3	1	1	0	0	0	1	1	0	0	0	1	1	1	0	1
ET1406.4	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0
ET1406.5	1	0	0	0	0	0	1	0	0	0	0	0	1	0	1

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

Course Code	ET1407						Course category		VSE3
Course Name	MICROPROCESSOR AND MICROCONTROLLER LABORATORY								
Teaching Scheme				Examination Scheme					Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
-	-	02	02	-	-	-	-	-	50	-	50	01

Course Objectives:

To make student able

1. To learn the instruction set of microprocessor and microcontroller
2. To understand the concept of Assembly Language Programming
3. To understand the interfacing of peripheral devices and their programming
4. To develop application based programs

Course Contents:

Minimum eight experiments shall be performed to cover entire curriculum of courseET1404. The list given below is just a guideline.

List:

1. To write Assembly Language Program (ALP) using 8085 and 8051
2. To develop programs on data transfer operations such as block move, exchange, sorting
3. To implement arithmetic operations (8-bit and 16-bit) like addition, subtraction, multiplication, division, square, cube using look-up tables, multi byte arithmetic operations
4. To implement logical operations such as Boolean & logical instructions bit manipulations.
5. To find largest/smallest element in an array,
6. To arrange the array elements in ascending/descending order using bubble sorting.
7. To understand the concept of Stack and Subroutine.
8. To understand the concept of serial communication.
9. To write delay subroutines using timer/counter.
10. Interfacing of
    a. Relays for controlling operations,
    b. Generation of various types of waveforms using ADC/DAC,
    c. Interfacing basic output devices like LED, LCD, keyboard, 7-segment display, DIP switches, Push button switches
    d. Implementation of stepper and DC motor control.
11. To implement a simple microcontroller based application system like temperature

control etc.

Course Outcomes:

After completing this course, Students shall be able to:

ET1407.1 Appreciate architecture of Microprocessor and Microcontrollers basics
ET1407.2 Realize the importance of Instruction set
ET1407.3 Develop Assembly language programs for 8085/8051
ET1407.4 Learn the hardware interfaces required to develop a simple microcomputer system
ET1407.5 Develop simple application based projects

Note :

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

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

CO-PO-PSO Mapping

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ET1407.1	1	0	0	0	1	0	0	0	0	0	0	0	1	1	0
ET1407.2	1	1	0	0	1	0	0	0	0	0	0	0	1	1	0
ET1407.3	2	2	1	1	3	1	0	0	0	0	0	0	2	2	0
ET1407.4	2	2	2	2	2	2	0	0	1	0	0	0	2	2	0
ET1407.5	3	3	3	3	3	2	0	0	2	1	0	0	3	3	-

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

Course Code	ET1411	Course category	EX2
Course Name	INTRODUCTION TO EMBEDDED SYSTEM DESIGN		

Teaching Scheme				Examination Scheme								Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
--	--	08	08	--	--	--	--	--	50	--	50	04

Course objectives:

To make student able
1. To design and manufacture embedded system products
2. To design embedded systems using a building block approach
3. To know embedded systems using a microcontroller MSP430
4. To learn effective embedded programming techniques in C

Contents:

Introduction to Embedded Systems and Computer Systems Terminology. Modular approach to Embedded System Design using Six-Box model: Input devices, output devices, embedded computer, communication block, host and storage elements and power supply.

Microcontroller Based Embedded System Design. Salient Features of Modern Microcontrollers. Elements of Microcontroller Ecosystem and their significance.

Introduction to MSP430 Microcontroller.

Fundamentals of Physical Interfacing. Connecting Input Devices: Switches, Keyboard and Output devices: LEDs, Seven Segment Displays (SSD).
Introduction to Embedded C. Interfacing LEDs and Switches with MSP430 using Digital Input and Output.

Useful Link:
1. Introduction to Embedded System Design - Course (nptel.ac.in)

Text Books :

1. Designing Embedded Hardware, John Catsoulis. 2nd edition. Shroff Publishers and Distributors. ISBN-10: 9788184042597

References Books:

1. Embedded System Design: A Unified Hardware / Software Introduction. Tony Givargis and Frank Vahid. Wiley. ISBN-10: 812650837X
2. MSP430 Microcontroller Basics. John H. Davies. Elsevier. ISBN-10: 9789380501857.
3. Programming Embedded Systems in C and C++. Micheal Barr. Shroff Publishers and Distributors. ISBN-10: 817366076X

Course Outcomes:

After completing this course, Students shall be able to:

ET1411.1 Acquire knowledge about devices and buses used in embedded networking

ET1411.2 Develop programming skills in embedded systems for various applications.

ET1411.3 Acquire knowledge about MSP430 Microcontroller

ET1411.4 Acquire knowledge about MSP430 Timer Module and its Modes of Operation

ET1411.5 Acquire knowledge about communication protocols

CO-PO-PSO Mapping

CO	PO / PSO														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
ET1411.1	1	0	0	0	1	0	0	0	0	0	0	0	1	1	1
ET1411.2	1	1	1	0	2	0	3	0	0	0	1	2	1	1	1
ET1411.3	2	0	1	1	3	1	2	0	0	0	0	0	2	1	1
ET1411.4	2	0	0	1	2	2	2	0	1	0	0	0	2	1	1
ET1411.5	3	0	0	1	3	2	2	0	1	1	0	0	3	1	1

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

Course Code	ET1412	Course category	EX2
Course Name	PCB DESIGN WITH EAGLE		

Teaching Scheme				Examination Scheme								Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
--	--	08	08	--	--	--	--	--	50	--	50	04

Course Objectives:

To make student able

1. To Learn Circuit design and PCB Design with the most powerful and most widely used tool Eagle
2. To be able to create single and double sided PCB Designs
3. To understand use of Eagle for PCB Design
4. To understand Gerber file and export gerber file for production
5. To Start designing the boards

Course contents

Basics of Printed Circuit Board, Downloading Eagle, Software installation and creating the project

An Overview of Circuit Boards and EAGLE Design, Overview of Circuit Design with EAGLE

Designing a Simple Circuit: An Inverting Amplifier, The Inverting Amplifier Schematic, Board Layout, Routing, CAM Processor Layout and Design Rules

Single Sided PCB Design, Single Sided PCB Design Hands on

Creating PCB Project, Copper Pour

Double Sided PCB Design

SMT Components, Create Custom Library Component in Eagle

Use Link:

1. Learn the Art and Science of PCB Design with Eagle | Udemy

Book and References:

1. Make Your Own PCBs with EAGLE: From Schematic Designs to Finished Boards 2nd Edition by Simon Monk (Author), Duncan Amos (Author)

2. **Designing Circuit Boards with EAGLE: Make High-Quality PCBs at Low Cost** by Matthew Scarpino ,Released March 2014, Publisher(s): Pearson, ISBN: 9780133820027

Course Outcomes:

After completing this course, Students shall be able to:

ET1412.1 To design PCB with the most powerful and most widely used tool Eagle
ET1412.2 To design single and double sided PCB Designs
ET1412.3 To understand use of Eagle for PCB Design
ET1412.4 To understand Gerber file and export gerber file for production
ET1412.5 To Start designing the boards

CO-PO-PSO Mapping

CO	PO / PSO														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
ET1412.1	1	0	0	0	1	0	0	0	0	0	0	0	1	1	1
ET1412.2	1	1	1	0	2	0	3	0	0	0	1	2	1	1	1
ET1413.3	2	0	1	1	3	1	2	0	0	0	0	0	2	1	1
ET1414.4	2	0	0	1	2	2	2	0	1	0	0	0	2	1	1
ET1415.5	3	0	0	1	3	2	2	0	1	1	0	0	3	1	1

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

Course Code	ET1413						Course category		EX2
Course Name	ET1413 INTERNSHIP / TECHNICAL PROJECT								
Teaching Scheme				Examination Scheme					Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
-	-	16	16	-	-	-	-	-	100	-	100	08

Course Objectives:

To make the students competent to:

1. Carry out industry internship / Technical Projects
2. Prepare report of industry internship / Technical Projects

Course Contents:

Industry internship

Students must complete Internship for a duration of minimum eight weeks, after completion of second semester of first year. The company/organization for Internship must be approved by the DFB. All the official formalities to be completed by the student.

The students should undergo related trainings and perform tasks assigned to him in the Industry, under the guidance of Industry personnel. The students shall submit the report based on the Industry Internship along with the Completion Certificate given by Industry.

Industry internship may be carried out in any one of the following construction industry:

i) Central Government Department related to Electronics and Telecommunication Engineering e.g. BSNL, BHARAT ELECTRONICS etc.
ii) State Government Department related to Electronics and Telecommunication Engineering e.g. MSETC, Pune Maharashtra Power Grid Corporation of India Ltd (PGCIL) etc.
iii) Private Limited Company related to Electronics and Telecommunication Engineering AIRTEL MOBILES, SAMSUNG, VIDEOCON etc.

At the end of internship, student should submit the report based on training received during internship and also give presentation for the same to the panel of examiners / Evaluation Committee comprising of Experts appointed by the Program Head.

Course Outcome:

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

ET1413.1: Prepare report based on Industry internship

ET1413.2: Give presentation based on Industry internship

CO – PO – PSO Mapping:

Course Outcomes	Program Outcomes														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
ET1413.1	1	3	1	3	1	1	3	1	1	1	2	1	2	0	0
ET1413.2	1	3	1	3	1	1	3	1	1	1	2	1	2	0	0

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

Sign Sign Sign Sign
Member Secretary BoS Chairperson Dean, Academics Principal