AISSMS
INSTITUTE OF INFORMATION TECHNOLOGY
(IOIT)

ADDING VALUE TO ENGINEERING

An Autonomous Institute Affiliated to Savitribai Phule Pune University
Approved by AICTE, New Delhi and Recognised by Govt. of Maharashtra
Accredited by NAAC with "A+" Grade | NBA - 5 UG Programmes

ACADEMIC COURSE STRUCTURE
[as per NEP]

ELECTRONICS AND TELECOMMUNICATION ENGINEERING

B.TECH 4 YEAR UG COURSE
(Applicable for the batches admitted from 2023-2024)

AISSMS INSTITUTE OF INFORMATION TECHNOLOGY
Kennedy Road, Near RTO,
Pune – 411 001, Maharashtra State, India
Email: principal@aissmsioit.org, Website:
https://www.aissmsioit.org

Institute Vision & Mission

Vision

To be recognized amongst top 10 private engineering colleges in Maharashtra by the year 2026 by rendering value added education through academic excellence, research, entrepreneurial attitude, and global exposure.

Mission

- To enable placement of 150 plus students in the 7 lacs plus category &ensure 100% placement of all final year students
- To connect with 10 plus international universities, professional bodies and organizations to provide global exposure to students
- To create conducive environment for career growth, prosperity, and happiness of 100% staff.
- To be amongst top 5 private colleges in Pune in terms of admission cut off.

Quality Policy

We commit ourselves to provide quality education & enhance our students quality through continuous improvement in our teaching and learning processes.

Department Vision & Mission

Vision

To be one of the renowned Electronics & Telecommunication Engineering programmes imparting quality education by promoting professionalism, values, and ethics leading to a progressive career in industry & academia globally.

Mission

- To boost employability/entrepreneurship/higher studies through value-added activities.
- To inculcate research attitude and professional ethics for addressing the needs of industry.

Program Educational Objectives (PEOs)

Graduates will

1. Engage in solving problems in the E&TC domain by developing products/offering services to cater to the needs of the society.
2. Work in diverse career fields of information and communication technology.
3. Develop new methodologies and technologies for solving real-life problems

Program Outcomes (POs)

1. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. [Engineering knowledge]
2. Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. [Problem analysis]
3. Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. [Design/development of solutions]
4. Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. [Conduct investigations of complex problems]
5. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations. [Modern tool usage]
6. Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. [The engineer and society]
7. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. [Environment and sustainability]
8. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. [Ethics]
9. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. [Individual and team work]
10. Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. [Communication]
11. Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. [Project management and finance]
12. Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. [Life-long learning]

Program Specific Outcomes (PSOs)

Graduates will be able to

1. Apply domain-specific knowledge to analyze, design and develop electronics and telecommunication systems/applications in the field of Embedded Systems, Very Large Scale Integration (VLSI), Internet of Things (IoT), and Communication Technology.
2. Select and apply software and hardware tools such as Electronic Design Automation (EDA) and Test/Measurement equipment to solve engineering problems.

Program- E&TC Engineering
(Autonomous Curriculum Structure)

A. Definition of Credit:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week 2 Hours Practical (Lab)/week	**0.5** credits 1 credit

B. Range of credits –

A range of credits from 160 to 176 for a student to be eligible to get Undergraduate degree in Engineering. A student will be eligible to get Undergraduate degree with Honors 20 credits and/or Minors14 credits, if he/she completes additional credits.

C. Credit for Undergraduate Degree in E&TC Engineering

Sr. No.	Year	Semester	Credits
1	First Year	I	21
2		II	19
3	Second Year	III	22
4		IV	24
5	Third Year	V	23
6		VI	25
7	Final Year	VII	12
8		VIII	14
Total Credits			**160**

D. Structure of Undergraduate Engineering program

Sr. no.	Domains	Code	Credits	NEP Suggested
1	Basic Science courses	BSC	16	14-18
2	Engineering Science courses	ESC	16	12-16
3	Programme Core Courses	PCC	59	44-56
4	Programme Elective courses	PEC	15	20
5	Open Elective other than particular Programme	OEC	06	08
6	Vocational and Skill Enhancement Course	VSE	08	08
7	Humanities Social Science and Management	HSM	12	14
8	Experiential Learning Courses	ELC	24	22
9	Liberal Learning Courses	LLC	04	04
Total			**160**	**160-176**

E. Domain wise credits Distribution

Sr. no.	Code	Credits									
		Semesters								Total	NEP
		I	II	III	IV	V	VI	VII	VIII		
1	BSC	8	8	-	-	-	-	-	-	**16**	14-18
2	ESC	9	7	-	-	-	-	-	-	**16**	12-16
3	PCC	-	-	16	16	13	11	3	-	**59**	44-56
4	PEC	-	-	-	-	4	4	7	-	**15**	20
5	OEC	-	-	3	-	3		-	-	**6**	08
6	VSE	1	1	-	3	-	3	-	-	**8**	08
7	HSM	-	-	3	3	3	3	-	-	**12**	14
8	ELC	3	3	-	-	-	2	2	14	**24**	22
9	LLC	-	-	-	2		2	-	-	**4**	04
Total Credits		**21**	**19**	**22**	**24**	**23**	**25**	**12**	**14**	**160**	**160-174**
Exam Total		**650**	**650**	**725**	**725**	**725**	**725**	**600**	**600**	**5400**	
Total Working Hours per Week		**30**	**28**	**24**	**26**	**26**	**29**	**16**	**26**		

F. Honors Structure: BUSINESS ANALYTICS AND ENTREPRENEURSHIP

Sr. No.	Course Code	Courses Name	Sem	Hours per week			Credit	Examination Scheme					Total
				L	T	P		ISE	ESE	TW	PR	OR	
1	ETHDT511	Basic Digital Marketing	V	3	-	2	4	40#	60*	25	-	25	150
2	ETHDT613	Advance Digital Marketing	VI	3	-	2	4	40#	60*	25	-	25	150
3	ETHDT707	Entrepreneurship I	VII	3	-	4	5	40#	60*	25	-	25	150
4	ETHDT803	Entrepreneurship II	VIII	3	-	4	5	40#	60*	25	-	25	150
			Total	12	-	12	18	160	240	100	-	100	600

G. Honors Degree- with Research

Sr. No.	Course Code	Courses Name	Sem	Hours per week			Credit	Examination Scheme					Total
				L	T	P		ISE	ESE	TW	PR	OR	
1	ETHDR708	Research Methodology	VII	3	-	-	3	40#	60*	-	-	-	100
2	ETHDR709	Mathematical Modeling	VII	3	-	-	3	40#	60*	-	-	-	100
3	ETHDR710	Dissertation Phase I	VII	-	-	4	2	-	-	25		25	50
4	ETHDR804	Research Publicationand Ethics	VIII	2	-	-	2	20#	30#	-	-	-	50
5	ETHDR805	Paper Publication	VIII	-	-	4	2	-	-	50	-	-	50
6	ETHDR806	Dissertation Phase II	VIII	-	-	12	6	-	-	100	-	50	150
			Total	**8**	**-**	**20**	**18**	**100**	**150**	**175**	**100**	**75**	**500**

H. Major Courses

Sr. No.	Course code	Courses Name	Sem	Hours per week			Credit	Examination Scheme					Total
				L	T	P		ISE	ESE	TW	PR	OR	
1.	ETPCC302	Applied Mathematics	III	3	--	--	3	40#	60*	--	--	--	100
2.	ETPCC303	Analog Electronic Circuits	III	4	--	--	4	40#	60*	--	--	--	100
3.	ETPCC304	Digital Systems	III	3	--	--	3	40#	60*	--	50	--	100
4.	ETPCC305	Electronic instrumentation & Measuring Systems	III	3	--	--	3	40#	60**	--	--	-	100
5.	ETPCC307	Analog Electronic Circuits Lab	III	--	--	2	1	--	--	--	50	--	50
6.	ETPCC308	Digital Systems Lab	III	--	--	2	1	--	--	--	50	--	50
7.	ETPCC308	Electronic instrumentation & MeasuringSystems Lab	III	--	--	2	1	--	--	--	50	--	50
8.	ETPCC402	Integrated circuits	IV	3	--	--	3	40#	60*	--	--	--	100
9.	ETPCC403	Data structures	IV	3	--	--	3	40#	60**	--	--	--	100
10.	ETPCC404	Signals & systems	IV	3	--	--	3	40#	60*	--	--	--	100
11.	ETPCC405	Analog Communication	IV	3	-	--	3	40#	60*	--	--	--	100
12.	ETPCC407	Integrated circuits Lab	IV	--	--	2	1	--	--	--	50	--	50
13.	ETPCC408	Data structures Lab	IV	--	--	2	1	--	--	25	--	--	25
14.	ETPCC409	Signals & systems Lab	IV	--	1	--	1	--	--	25	--	--	25
15.	ETPCC410	Analog Communication Lab	IV	--	--	2	1	--	--	--	50	--	50

16.	ETPCC502	Electromagnetic Field Theory and Antenna design	V	3	1	--	4	40#	60*	--	--	--	100
17.	ETPCC503	Microcontroller & Embedded Systems	V	3	--	--	3	40#	60**	--	--	--	100
18.	ETPCC504	Digital Communication and Coding Theory	V	4	--	--	4	40#	60*	--	--	--	100
19.	ETPEC505	Elective I: Digital signal processing/ Mechatronics	V	3	--	--	3	40#	60*	--	--	--	100
20.	ETPCC507	Microcontroller & Embedded Systems	V	--	--	2	1	--	--	--	50	--	50
21.	ETPCC508	Digital Communication and Coding Theory	V	--	--	2	1	--	--	--	50	--	50
22.	ETPEC509	Elective I Lab : Digital signal processing/ Mechatronics	V	--	--	2	1	--	--	--	--	50	50
23.	ETPCC602	Computer Networks	VI	3	--	--	3	40#	60**	--	--	--	100
24.	ETPCC603	Power Electronics	VI	3	--	--	3	40#	60*	--	--	--	100
25.	ETPCC604	Cellular Network	VI	3	--	2	4	40#	60*	--	--	--	100
26.	ETPEC605	Elective II: Antenna and wave theory/VLSI	VI	3	--	--	3	40#	60*	--	--	--	100
27.	ETPCC607	Computer Networks and Power Electronics Lab	VI	--	--	2	1	--	--	--	50	--	50
28.	ETPEC608	Elective II Lab : Antenna and wave theory/ VLSI	VI	--	--	2	1	--	--	--	50	--	50
29.	ETELC609	Mini Project	VI	--	--	4	2	--	--	--	--	50	50
30.	ETPCC701	5G Technology	VII	2	--	--	2	40#	60*	--	--	--	100
31.	ETPEC702	Elective III- Digital image and video processing/Audio Video Engineering/ Fiber optics and communication	VII	3	--	--	3	40#	60*	--	--	--	100
32.	ETPEC703	Elective IV- Electronics in agriculture/Wireless sensor network/Electronic Product design	VII	3	--	--	3	40#	60*	--	--	--	100
33.	ETPCC704	5G Technology Lab	VII	--	--	2	1	--	--	--	50	--	50
34.	ETPEC705	Elective III Lab- Digital image and video processing/Audio Video Engineering/ Fiber optics and communication	VII	--	--	2	1	--	--	50	50	--	100
35.	ETELC706	Project stage I	VII	--	--	4	2	--	--	100	--	50	150
36.	ETELC801	Internship/2 MOOCs/ Entrepreneurship/ Research Project/ Foreign University Certification Course	VIII	2	--	20	12	--	--	200 @	--	100	300
37.	ETELC802	Project stage II	VIII	--	--	4	2	--	--	200 @	--	100	300
Total				**60**	**2**	**60**	**92**	**760**	**1140**	**750**	**525**	**500**	**3525**

I. Minor Courses:

Sr. No.	Course code	Courses Name	Sem	Hours per week			Credit	Examination Scheme					Total
				L	T	P		ISE	ESE	TW	PR	OR	
1.	ETMNR301	Analog Electronic Circuits	III	3	--	--	3	--	75*	--	--	--	75
2.	ETMNR302	Analog Electronic Circuits Lab	III	--	--	2	1	--	--	25	--	--	25
3.	ETMNR401	Integrated circuits	IV	3	--	--	3	--	75*	--	--	--	75
4.	ETMNR402	Integrated circuits Lab	IV	--	--	2	1	--	--	25	--	--	25
5.	ETMNR501	Microcontroller and Embedded Systems	V	3	--	--	3	--	75*	--	--	--	75
6.	ETMNR502	Microcontroller and Embedded Systems Lab	V	--	--	2	1	--	--	25	--	--	25
7.	ETMNR601	VLSI	VI	3	--	--	3	--	75*	--	--	--	75
8.	ETMNR602	VLSI Lab	VI	--	--	2	1	--	--	25	--	--	25
Total				**12**		**8**	**16**	**--**	**300**	**100**	**--**	**--**	**400**

J. Open Elective Courses

Sr. No.	Course code	Courses Name	Sem	Hours per week			Credit	Examination Scheme					Total
				L	T	P		ISE	ESE	TW	PR	OR	
1.	ETOEC306	Open source software: ESim-MOOCS (H/W oriented programming language)	III	3	--	--	3	$40^{\$}$	$60^{\$\$}$	-	--	--	100
2.	ETOEC506	IoT-MOOCS	V	3	--	--	3	$40^{\$}$	$60^{\$\$}$	--	--	--	100
Total				**6**	**--**	**--**	**6**	**80**	**120**	**--**	**--**	**--**	**200**

K. Vocational and Skill Enhancement Courses

Sr. No.	Course code	Courses Name	Sem	Hours per week			Credit	Examination Scheme					Total
				L	T	P		ISE	ESE	TW	PR	OR	
1	ETVSE406	Open-source software –Scilab	IV	1	--	4	3	--	--	50	50	--	100
2	ETVSE606	Embedded systems & RTOS	VI	1	--	4	3	--	--	50	50	--	100
Total				**2**	**--**	**8**	**6**	**--**	**--**	**100**	**100**	**--**	**200**

L. Humanities Social Science and Management Courses

Sr. No.	Course Code	Courses Name	Sem	Hours per week			Credit	Examination Scheme					Total
				L	T	P		ISE	ESE	TW	PR	OR	
1.	ETHSM301	Democracy, election and Governance	III	2	--	--	2	--	--	25	--	25	50
2.	ETHSM310	Audit Course 3: Vedic Mathematics	III	1	--	--	1	--	--	25	--	--	25
3.	ETHSM401	Business Accounting for Engineering	IV	2	--	--	2	--	--	25	--	25	50
4.	ETHSM411	Audit Course 4 : Sustainable development goal	IV	1	--	--	1	--	--	25	--	--	25
5.	ETHSM501	Intellectual Property Rights	V	2	--	--	2	--	--	25	--	25	50
6.	ETHSM510	Audit Course 5: Foreign Language Japanese /German Level 1	V	1	--	--	1	--	--	25	--	--	25
7.	ETHSM601	Seminar and technical paper writing	VI	1	--	2	2	--	--	50	--	--	50
8.	ETHSM610	Audit Course 6: Foreign Language Japanese /German Level 2	VI	1	--	--	1	--	--	25	--	--	25
Total				**11**	**--**	**2**	**12**	**--**	**--**	**225**	**--**	**75**	**300**

M. Experiential Learning Courses

Sr. No.	Course Code	Courses Name	Sem	Hours per week			Credit	Examination Scheme					Total
				L	T	P		ISE	ESE	TW	PR	OR	
1	ETELC609	Mini project	VI	--	--	4	2	--	--	--	--	50	50
2	ETELC706	Project Stage 1	VII	--	--	4	2	--	--	100	--	50	150
3	ETELC801	Internship	VIII	2	--	20	12	--	--	200@	--	100	300
4	ETELC802	Project Stage 2	VIII	--	--	4	2	--	--	200	--	100	300
Total				**2**	**--**	**30**	**18**	**--**	**--**	**500**	**--**	**300**	**800**

N. Liberal Learning Courses

Sr. No.	Course Code	Courses Name	Sem	Hours per week			Credit	Examination Scheme					Total
				L	T	P		ISE	ESE	TW	PR	OR	
1	ETLLC412	Lifelong learning skills 1	IV	1	--	--	1	--	--	--	--	--	--
2	ETLLC413	Lifelong learning skills 2	IV	1	--	--	1	--	--	--	--	--	--
3	ETLLC611	Lifelong learning skills 3	VI	1	--	--	1	--	--	--	--	--	--
4	ETLLC612	Lifelong learning skills 4	VI	1	--	--	1	--	--	--	--	--	--
Total				**4**	--	--	**4**	--	--	--	--	--	--

All the students are required to acquire 2 credits, one each from A. and B. which will have grades as below:

A. Extracurricular Activities:

Sr. No.	Activity	Level	Achievement	Grade	Achievement	Grade
1.	Sports	Inter collegiate	Participation	P	Prizewinner	C
		University	Participation	C	Prizewinner	B
		Zonal	Participation	B	Prizewinner	B+
		State	Participation	B+	Prizewinner	A
		National	Participation	A	Prizewinner	A+
		International	Participation	A+	Prizewinner	O
2.	NSS/NCC	Camp	Attended	B		
		Camp+5Activities	Attended	B+		
		Camp+10Activities	Attended	A		
		Camp+15Activities	Attended	A+		
		Camp+20Activities	Attended	O		
3.	Cultural	Inter collegiate	Participation	B	Prizewinner	B+
		State	Participation	B+	Prizewinner	A
		National	Participation	A	Prizewinner	A+
		International	Participation	A+	Prizewinner	O
4.	Community Engagement	Certified by NGO/Authorities with report and geo- tagged photograph	1 Activity	B		
			2Activities	B+		
			3Activities	A		
			4Activities	A+		
			5Activities	O		

B. Co-curricular Activities:

Sr. No	Activity	Level	Achievement	Grade	Achievement	Grade
1.	Conference	National	Participation	B	Prizewinner	A
		International	Participation	B+	Prizewinner	A+
		International(Scopus indexing)	Participation	A+	Prizewinner	O
2.	Journal Publication	Non-refereed but recognized and reputed journal/periodical having ISSN number.		B		
		Refereed Journal - As listed by UGC		A		
		Refereed Journals- As listed by Scopus		A+		
		Refereed Journals - As listed by SCI/SCIE		O		
3.	Hackathon		Participation	A+	Prizewinner	O
4.	Professional Body	National	Membership	P	3rd Prize	A
			Activities/ participation	B	2nd Prize	A+
			5participations	B+	1st Prize	O
5.	Internship	1 week	Completed	C		
		2 week	Completed	B		
		3 week	Completed	B+	Sponsored Project	A+
		4 week	Completed	A	Job through internship	O
6.	Entrepreneurship	Awareness camp	Attended	A	Product Developed	A+
					Own Startup	O
7.	Project/Technical events	Inter collegiate	Participation	P	Prizewinner	C
		University	Participation	C	Prizewinner	B
		Zonal	Participation	B	Prizewinner	B+
		State	Participation	B+	Prizewinner	A
		National	Participation	A	Prizewinner	A+
		International	Participation	A+	Prizewinner	O

O. Exit Courses

Sr. No.	Exit Point	Course code	Course Name	Hours per week			Credit	Examination Scheme					Total
				L	T	P		ISE	ESE	TW	PR	OR	
Certificate course in Electronic Circuit Design													
1	Exit course after F.Y	ETEX101	Analog Electronic circuits	--	--	4	2	--	--	50	--	--	50
		ETEX102	Digital Systems	--	--	4	2	--	--	50	--	--	50
		ETEX103	Internship	--	--	8	4	--	--	100	--	--	100
Total				--	--	16	8	--	--	200	--	--	**200**
Diploma in Electronics Hardware design													
2	Exit course After S.Y.	ETEX201	Microcontroller and Embedded Systems	--	--	4	2	--	--	50	--	--	50
		ETEX202	Digital Communication and coding theory	--	--	4	2	--	--	50	--	--	50
		ETEX203	Internship	--	--	8	4	--	--	50	--	--	50
Total				**-**	**--**	**16**	**8**	--	--	**200**	--	--	**200**
B. Voc in Signal Processing													
3	Exit Course After T.Y.	ETEX301	Digital imageand video processing	--	--	4	2	--	--	50	--	--	50
		ETEX302	Audio Video Engineering	--	--	4	2	--	--	50	--	--	50
		ETEX303	Internship	--	--	8	4	--	--	50	--	--	150
Total				**-**	**--**	**16**	**8**	--	--	**200**	--	--	**200**

SEMESTER WISE STRUCTURES

Electronics &Telecommunication Engineering - Second Year (Semester –III)

Sr. No.	Code	Course Title	Hours per week			Credits	Examination scheme					
			L	T	P		ISE	ESE	TW	PR	OR	Total
1	ETHSM301	Democracy, election and governance	2	--	--	2	-	-	25	-	25	50
2	ETPCC302	Applied mathematics	3	--	--	3	40#	60*	-	-	-	100
3	ETPCC303	Analog Electronic Circuits	4	--	--	4	40#	60*	-	-	-	100
4	ETPCC304	Digital Systems	3	--	--	3	40#	60*	-	-	-	100
5	ETPCC305	Electronic instrumentation& Measuring Systems	3	-	--	3	40#	60**	-	-	-	100
6	ETOEC306	Open source software: ESim-MOOCS (H/W oriented programming language)	3	--	--	3	40$	60$$	-	-	-	100
7	ETPCC307	Analog Electronic Circuits Lab	--		2	1	-	-		50	-	50
8	ETPCC308	Digital Systems Lab	--		2	1	-	-		50		50
9	ETPCC309	Electronic instrumentation & Measuring Systems Lab	--	--	2	1	-	-	50	-	--	50
10	ETHSM310	Audit Course 3: Vedic Mathematics	1	--	--	1	-	-	25	-	--	25
Total			**19**	**--**	**06**	**22**	**200**	**300**	**100**	**100**	**25**	**725**

* **End Semester Examination (ESE)** based on subjective questions.

** **Practical or Activity based Evaluation.**

In Semester Evaluation based on Presentation/Group Discussion/Laboratory Work/Course Project/Home Assignment/Comprehensive Viva Voce/Blog Writing/Case Study/Survey/Multiple-Choice Question (MCQ) examination/Subjective Examination

$ **For MOOCs:** Assignments marks will be converted on the scale of 40 marks.

$$ **For MOOCs:** Score of examination conducted by the respective authority of MOOCor Score of ESE Conducted by Institute will be converted on the scale of 60 marks.

MOOC:

ESim- EDA tool for circuit design, simulation, analysis and PCB design:(8weeks)

https://onlinecourses.swayam2.ac.in/aic20_sp59/preview

Electronics &Telecommunication Engineering- Second Year (Semester –IV)

Sr. No.	Code	Course Title	Hours per week			Credits	Examination scheme					
			L	T	P		ISE	ESE	TW	PR	OR	Total
1	ETHSM401	Business Accounting for Engineering	2	-	-	2	-	-	25	-	25	50
2	ETPCC402	Integrated Circuits	3	-	-	3	40#	60*	-	-	-	100
3	ETPCC403	Data structures	3	-	-	3	40#	60**	-	-	-	100
4	ETPCC404	Signals & systems	3	--	-	3	40#	60*	-	-	-	100
5	ETPCC405	Analog Communication	3	-	-	3	40#	60*	-	-	-	100
6	ETVSE406	Open- source software – Scilab	1	-	4	3	-	-	50	50		100
7	ETPCC407	Integrated Circuits Lab	-	-	2	1	-	-	--	50	-	50
8	ETPCC408	Data structuresLab	-	-	2	1	-	-	25	- -		25
9	ETPCC409	Signals & systems lab	-	1	-	1	-	-	25	-	-	25
10	ETPCC410	Analog Communication Lab	-	-	2	1	-	-	-	50	-	50
11	ETHSM411	Audit Course 4 : Sustainable development goal	1	-	-	1	-	-	25	-	-	25
12	ETLLC412	Lifelong learning skills 1	-	-	-	1	-	-	-	-	-	-
13	ETLLC413	Lifelong learning skills 2	-	-	-	1	-	-	-	-	-	-
Total			**16**	**01**	**10**	**24**	**160**	**240**	**150**	**150**	**25**	**725**

* **End Semester Examination (ESE)** based on subjective questions.

** **Practical or Activity based Evaluation.**

\# **In Semester Evaluation** based on Presentation/Group Discussion/Laboratory Work/Course Project/Home Assignment/Comprehensive Viva Voce/Blog Writing/Case Study/Survey/Multiple-Choice Question (MCQ) examination/ Subjective Examination.

$ **For MOOCs :** Assignments marks will be converted on the scale of 40 marks.

$$ **For MOOCs:** Score of examination conducted by the respective authority of MOOCor Score of ESE Conducted by Institute will be converted on the scale of 60 marks.

Electronics &Telecommunication Engineering- Third Year (Semester –V)

Sr. No.	Code	Course Title	Hours per week			Credits	Examination scheme					
			L	T	P		ISE	ESE	TW	PR	OR	Total
1	ETHSM501	Intellectual Property Rights	2	--	--	2	-	-	25	-	25	50
2	ETPCC502	Electromagnetic Field Theory and Antenna design	3	1	--	4	40#	60*	-	-	-	100
3	ETPCC503	Microcontroller & Embedded Systems	3	--	--	3	40#	60**	-	-	-	100
4	ETPCC504	Digital Communication and Coding Theory	4	--	--	4	40#	60*	-	-	-	100
5	ETPEC505	Elective I: Digital signal processing/ Mechatronics	3	--	--	3	40#	60*	-	-	-	100
6	ETOEC 506	IoT-MOOCS	3	--	--	3	40$	60$$	-	-		100
7	ETPCC507	Microcontroller & Embedded Systems Lab	--	--	2	1	-	-		50	-	**50**
8	ETPCC508	Digital Communication and Coding Lab	--	--	2	1	-	-		50	-	50
9	ETPEC509	Elective I Lab	--	--	2	1	-	-		-	50	50
10	ETHSM510	Audit Course 5: Foreign Language Japanese /German Level 1	1	--	--	1			25			25
Total			**19**	**01**	**06**	**23**	**200**	**300**	**50**	**100**	**75**	**725**

* **End Semester Examination (ESE)**based on subjective questions.

** **Practical or Activity based Evaluation.**

\# **In Semester Evaluation** based on Presentation/Group Discussion/Laboratory Work/Course Project/Home Assignment/Comprehensive Viva Voce/Blog Writing/Case Study/Survey/Multiple-Choice Question (MCQ) examination/ Subjective Examination.

$ **For MOOCs:** Assignments marks will be converted on the scale of 40 marks.

$$ **For MOOCs:** Score of examination conducted by the respective authority of MOOCor Score of ESE Conducted by Institute will be converted on the scale of 60 marks.

Elective-I	1. Digital Signal Processing 2. Mechatronics

MOOC:

Introduction To Internet of Things (12weeks)

https://onlinecourses.nptel.ac.in/noc22_cs53/preview

Electronics &Telecommunication Engineering- Third Year (Semester –VI)

Sr. No.	Code	Course Title	Hours per week			Credits	Examination scheme					
			L	T	P		ISE	ESE	TW	PR	OR	Total
1	ETHSM601	Seminar and Technical paper writing	1	--	2	2	-	-	50	-	-	50
2	ETPCC 602	Computer Networks	3	--	-	3	40#	60**	-	-	-	100
3	ETPCC603	Power Electronics	3	--	-	3	40#	60*	-	-	-	100
4	ETPCC 604	Cellular Network	3	--	2	4	40#	60*	-	-	-	100
5	ETPEC605	Elective II: Antenna and wave theory/ VLSI	3	--	--	3	40#	60*	-	-	-	100
6	ETVSE 606	Embedded systems & RTOS	1	--	4	3	40$	60$$	-	-	-	100
7	ETPCC 607	Computer Networks and Power Electronics Lab	--	--	2	1	-	-		50	-	50
8	ETPEC608	Elective II Lab	--	--	2	1	-	-		50		50
9	ETELC609	Mini project	--	--	4	2	-	-		-	50	50
10	ETHSM610	Audit Course 6: Foreign Language Japanese /German Level 2	1	--	--	1			25			25
11	ETLLC611	Lifelong learning skills 3	--	--	--	1						
12	ETLLC612	Lifelong learning skills 4	--	--	--	1						
Total			**15**	**-**	**16**	**25**	**200**	**300**	**75**	**100**	**50**	**725**

* **End Semester Examination (ESE)** based on subjective questions.

** **Practical or Activity based Evaluation.**

\# **In Semester Evaluation** based on Presentation/Group Discussion/Laboratory Work/Course Project/Home Assignment/Comprehensive Viva Voce/Blog Writing/Case Study/Survey/Multiple-Choice Question (MCQ) examination/ Subjective Examination

$ **For MOOCs:** Assignments marks will be converted on the scale of 40 marks.

$$ **For MOOCs:** Score of examination conducted by the respective authority of MOOCor Score of ESE Conducted by Institute will be converted on the scale of 60 marks.

Elective-II	1. Antenna and wave theory
	2. VLSI

Electronics &Telecommunication Engineering- Final Year (Semester –VII)

Sr. No.	Code	Course Title	Hours per week			Credits	Examination scheme					
			L	T	P		ISE	ES E	TW	PR	OR	Total
1	ETPCC701	5G Technology	2	-	-	2	40#	60*	-	-	-	100
2	ETPEC702	Elective III- Digitalimage and video processing/Audio Video Engineering/Fiber optics and communication	3	-	-	3	40#	60*	-	-	-	100
3	ETPEC703	Elective IV- Electronics in agriculture/Wireless sensor network/Electronic Product design	3	-	-	3	40#	60*	-	-	-	100
4	ELPCC704	5G Lab	-	-	2	1	-	-	-	50	-	50
5	ETPEC705	Elective III Lab	-	-	2	1	-	-	50	50	-	100
6	ETELC 706	Project Stage1	-	-	4	2	-	-	100	-	50	150
Total			**8**	**-**	**8**	**12**	**120**	**180**	**150**	**100**	**50**	**600**

* **End Semester Examination (ESE)** based on subjective questions.

** **Practical or Activity based Evaluation.**

\# **In Semester Evaluation** based on Presentation/Group Discussion/Laboratory Work/Course Project/Home Assignment/Comprehensive Viva Voce/Blog Writing/Case Study/Survey/Multiple-Choice Question (MCQ) examination/ Subjective Examination

$ **For MOOCs:** Assignments marks will be converted on the scale of 40 marks.

$$ **For MOOCs:** Score of examination conducted by the respective authority of MOOC or Score of ESE Conducted by Institute will be converted on the scale of 60 marks.

Elective - III	Elective - IV
1. Digital image and video processing 2. Audio Video Engineering 3. Fiber optics and communication	1.Electronics in agriculture 2.Wireless sensor network 3.Electronic Product design

Electronics &Telecommunication Engineering- Final Year (Semester –VIII)

Sr. No.	Code	Course Title	Hours per week			Credits	Examination scheme					
			L	T	P		ISE	ESE	TW	PR	OR	Total
1	ETELC801	Internship/ 2 MOOCs/ Entrepreneurship/ Research Project/ Foreign University Certification Course	2	--	20	12	--	--	200[@]	--	100	400
2	ETELC802	Project stage II	-	-	04	2	-	-	200 @	-	100	300
		Total	**02**	**--**	**24**	**14**	**-**	**-**	**400**	**-**	**200**	**600**

$ **For MOOCs:** Assignments marks will be converted on the scale of 40 marks.
$$ Score of examination conducted by the respective authority of MOOC or Score of ESE Conducted by Institute will be converted on the scale of 60 marks.
@ Marks obtained in two MOOCs will be converted on the scale of 200 marks.

Under ETELC801 select any two Massive Open Online Courses (not less than 8 week) the table listed below

CMOS Digital VLSI Design	https://onlinecourses.nptel.ac.in/noc21_ee09/preview
Real-time Digital Signal Processing	https://onlinecourses.nptel.ac.in/noc22_ee99/preview

Second Year Electronics and Telecommunications (2022 Course)
Democracy, Election and Governance ETHSM 301

Course Code:	**ETHSM301**	**Credit**	**2**
Contact Hours:	2 Hrs/week (L)	**Type of Course:**	Lecture
Examination Scheme	**TW Evaluation** 25 Marks	**Oral** 25 Marks	

Pre-requisites:

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term work Evaluation	Internal	25
2.	Oral	Internal	25

Course Objectives

1	To introduce the students meaning of democracy and the role of the governance
2	To help them understand the various approaches to the study of democracy and governance.

Course Outcomes: Students will be able to

301.1	Know the meaning of democracy and the role of the governance in life.
301.2	Understand the various approaches to the democracy and governance..

Topics covered:

UNIT I: Democracy- Foundation and Dimensions (5 hrs.)

a. Constitution of India
b. Evolution of Democracy- Different Models
c. Dimensions of Democracy- Social, Economic, and Political

UNIT II: Decentralization (5 hrs.)

a. Indian tradition of decentralization
b. History of panchayat Raj institution in the lost independence period
c. 73rd and 74th amendments
d. Challenges of caste, gender, class, democracy and ethnicity

UNIT III: Governance (5 hrs.)

a. Meaning and concepts
b. Government and governance
c. Inclusion and exclusion

Syllabus contents required for competitive exams (GATE, UPSC, MPSC etc.)(*if completeunit is applicable then write only "unit 1/2/.." or write the contents from that unit):*1. NA.

Text Books:

1. Banerjee-Dube, I. (2014). *A history of modern India*. Cambridge UniversityPress.
2. Basu, D. D. (1982). *Introduction to the Constitution of India*. Prentice Hall ofIndia.
3. Bhargava, R. (2008). *Political theory: An introduction*. Pearson EducationIndia.
4. Bhargava, R., Vanaik, A. (2010) *Understanding Contemporary India: Critical Perspective.* New Delhi: Orient Blackswan.
5. Chandhoke. N., Proyadardhi.P, (ed) (2009), '*Contemporary India: Economy, Society, Politics*', Pearson India Education Services Pvt. Ltd, ISBN 978-81- 317-1929-9.
6. Chandra, B. (1999). *Essays on contemporary India*. Har-Anand Publications.
7. Chaterjee, P. (1997). State and Politics in India.
8. Dasgupta. S., (ed) (2011), *'Political Sociology'*, Dorling Kindersley (India)Pvt. Ltd., Licensees of Pearson Education in south Asia. ISBN: 978-317-6027- 7.
9. Deshpande, S. (2003). Contemporary India: A Sociological View, New Delhi:Viking Publication.
10. Guha, R. (2007). India After Gandhi: The History of the World's Largest. *Democracy, HarperCollins Publishers, New York.*
11. Guha, R. (2013). *Gandhi before India*. Penguin UK.
12. Jayal. N.G. (2001). *Democracy in India.*New Delhi: Oxford University Press
13. Kohli, A. (1990). *Democracy and discontent: India's growing crisis of governability*. Cambridge University Press.
14. Kohli, A., Breman, J., & Hawthorn, G. P. (Eds.). (2001). *The success of India'sdemocracy* (Vol. 6). Cambridge University Press.
15. Kothari, R. (1989). *State against democracy: In search of humane governance*.Apex Pr.
16. Kothari, R. (1970). *Politics in India*. New Delhi: Orient Blackswan
17. Kothari, R. (1995). *Caste in Indian politics*. Orient Blackswan.
18. Sarkar, S. (2001). *Indian democracy: the historical inheritance. the Success of India's Democracy*, 23-46.

मराठी संदर्भ ग्रंथ:

१. राही श्रुती गणेश., आवटे श्रीरंजन, (२०१९), *'आपलं आयकार्ड'*, सुहास पळशीकर द युनिक अॅकॅडमी पब्लिकेशनप्रा.लि.,.

२. व्होरा राजेंद्र., पळशीकर, सुहास.(२०१४). *भारतीय लोकशाही अर्थ आणि व्यवहार.* पुणे : डायमंड प्रकाशन.

३. सुमंत, यशवंत.(२०१८). *प्रा. यशवंत सुमंत यांची तीन भाषणे.* पुणे : युनिक अॅकॅडमी पब्लिकेशन्स प्रा.लि

४. भोळे. भा.ल. (२०१५). *भारतीय गणराज्याचे शासन आणि राजकारण.* नागपूर: पिंपळापुरे बुक प्रकाशन

५. कसबे. रावसाहेब. (२०१०)डॉ. आंबेडकर आणि भारतीय राज्यघटना. पुणे: सुगावा प्रकाशन

Note: The assessment for the subject shall be based on presentation and report submission.

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Second Year Electronics and Telecommunications (2022 Course)
Applied Mathematics ETPCC 302

Course Code:	**ETPCC 302**	**Credit**	**3**
Contact Hours:	3 Hrs/week (L)	**Type of Course:**	Lecture
Examination Scheme	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Pre-requisites: Differential equations of first order and first degree, Integral calculus and vector calculus.

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-Sem. Evaluation	Internal	40
2.	End Semester Examination	External	60

Course Objectives

1	To make the students familiarize with concepts and techniques in higher order differential equations.
2	To impart the knowledge of Laplace transform and inverse Laplace transform.
3	To provide the knowledge about the statistical methods probability theory, probability distribution to model the random processes in engineering.
4	To introduce the basic concept of vector differentiation and integration.

Course Outcomes: Students will be able to

302.1	Solve higher order linear differential equation using appropriate techniques for modelinguse it for analysis control systems, signal conditioning/processing
302.2	Explain the concept of Laplace transform and use it solve problems related to signal processing and control systems.
302.3	Explain least square method to fit a curve, correlation coefficient & regression lines for the data and use it for histogram calculations & image processing.
302.4	Explain the concept the probability distribution for data analysis and use it for histogram calculations & image processing.
302.5	Find the differentiation of vector function and apply to electro- magnetic fields & wave theory.
302.6	Explain the work done & surface integral and apply it for electromagnetic fields.

Topics covered:

UNIT I: Linear Differential Equations (LDE) and Applications (6 hrs.)
LDE of nth order with constant coefficients, Complementary Function, Particular Integral, ar General method, Short methods, Method of variation of parameters, Cauchy's and Legendre's DE Simultaneous and Symmetric simultaneous DE. Applications to Circuit analysis & Signal processing.

UNIT II: Laplace Transform (6 hrs.)
Laplace Transform Definition, Laplace transform of elementary functions, properties of Laplace transforms multiplication by nt, division by t and derivatives. Inverse Laplace transform Applications of Laplace transforms to solve differential equation.

UNIT III: Statistics (6 hrs.)

Measures of central tendency, Measures of dispersion, Coefficient of variation, Moments, Skewness and Kurtosis, Curve fitting: fitting of straight line, parabola and related curves, Correlation and Regression, Applications to Characteristics of equipment and signals.

UNIT IV: Probability and Probability Distributions (6 hrs.)

Probability, Theorems on Probability, Probability density function, Probability distributions, Binomial distribution, Poisson distribution, Normal distribution, Test of Hypothesis: Chi-Square test, t-test, Applications to image processing, Histogram calculation, signal transmission and reception.

UNIT V- Vector Differential Calculus (6 hrs.)

Physical interpretation of Vector differentiation, Vector differential operator, Gradient Divergence and Curl, Directional derivative, Solenoidal, Irrotational and Conservative fields, Scalar potential, Vector identities.

UNIT VI- Vector Integral Calculus & Applications (6 hrs.)

Line, Surface and Volume integrals, Work-done, Green‟s Lemma, Gauss's Divergence theorem, Stoke's theorem. Applications to problems in Electro-magnetic fields.

Text Books:

1. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill.
   B.S. Grewal, 'Higher engineering Mathematics', Khanna publishers, Delhi (40th edition),(2008).

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th edition, Wiley Publications, 2015.
2. C. Ray Wylie and Louis C. Barrett Advanced Engineering Mathematics, 6th edition, Tata-McGraw Hill 2005.
3. Introduction to Probability and Statistics for Engineers and Scientists, 5e, by Sheldon M. Ros (Elsevier Academic Press).

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Second Year Electronics and Telecommunications (2022 Course)
Analog Electronic Circuits ETPCC303

Course Code:	**ETPCC303**	**Credit**	**4**
Contact Hours:	4 Hrs/week (L)	**Type of Course:**	Lecture
	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Pre-requisites:
Basic knowledge of Semiconductor Physics and Basic Electronics Engineering.

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-Sem. Evaluation	Internal	40
2.	End Semester Examination	External	60

Course Objectives

1	To brief about Semiconductor devices JFET & MOSFET, its characteristics, parameters and applications.
2	To discuss MOSFET DC and AC Configurations and it's analysis.
3	To explain various MOSFET Circuits
4	To introduce concepts of feedbacks in amplifiers & oscillators.
5	To impart skills to evaluate the performance of voltage regulator and SMPS Circuits

Course Outcomes: Students will be able to

303.1	Compare the characteristics and parameters of JFET towards its applications.
303.2	Compare the characteristics and parameters of MOSFET towards its DC circuits.
303.3	Interpret, apply & evaluate MOSFET AC circuits.
303.4	Explain various MOSFET circuits and their applications.
303.5	Explain MOSFET amplifiers with and without feedback & MOSFET oscillators, for given specifications.
303.6	Analyze the performance of linear and switching voltage regulators towards applications in regulated power supplies.

Topics covered:

UNIT I: Junction Field Effect Transistor (JFET) (6 hrs.)
Introduction to JFET, Types, Construction, Operation, Static Characteristics, Pinch off voltage JFET Volt-Ampere characteristics, JFET Configurations (Common Source/Commo Drain/Common Gate) and their Comparison. Self-Biasing circuit of JFET, Small signal mode of JFET, JFET as an amplifier & its analysis (Common Source). Frequency response of Commo Source JFET amplifier.

UNIT II: Metal Oxide Semiconductor FET(MOSFET) & it's DC Analysis (6 hrs.)
MOSFET operation, Construction of n-channel E-MOSFET, E-MOSFET characteristics & parameters, non-ideal voltage current characteristics i.e. Finite output resistance, body effect, sub threshold conduction, breakdown effects and temperature effects, MOSFET DC Analysis.

UNIT III: MOSFET AC circuit Analysis (6 hrs.)

MOSFET Common Source amplifier circuit, Load Line & Modes of operation, Small signal model of MOSFET and its parameters, Analysis of Common Source amplifier circuit. Introduction to Bi-CMOS technology, MOSFET internal capacitances and high frequency model.

UNIT IV: MOSFET Circuits (6 hrs.)

MOSFET as switch, diode/active resistor, Current sink and Current source circuits, current mirro circuits, Voltage references, Basic principle of band gap reference, CMOS Inverter as amplifier Active load, Current source and Push pull configurations.

UNIT V- Feedback amplifiers & Oscillators (6 hrs.)

Feedback Amplifiers: Four types of amplifiers. Feedback topologies. Effect of feedback or terminal characteristics of amplifiers. Examples of voltage series and Current series FET feedbacl amplifiers and their analysis.

Oscillators: Barkhausen criterion, stability with feedback. General form of LC oscillator. FET RC Phase Shift oscillator, Wein bridge oscillator, Hartley and Colpitts oscillators.

UNIT VI- Voltage Regulator & Switched Mode Power Supply (SMPS) (6 hrs.)

Voltage Regulator: Block diagram of an adjustable three terminal positive and negative regulators (317,337), Typical connection diagram, current boosting. Low drop out voltage regulators.

Switched Mode Power Supply (SMPS): Introduction to Switch Mode Power supply (SMPS), Block diagram of SMPS, Types of SMPS. Comparison of Linear Power supply and SMPS..

Syllabus contents required for competitive exams (GATE, UPSC, MPSC etc.)(*if complete unit is applicable then write only "unit 1/2/.." or write the contents from that unit):*1. NA.

Text Books:

1. Millman Halkias, "Integrated Electronics-Analog and Digital Circuits and Systems", Tata McGraw Hill, 2000.
2. Donald Neaman, "Electronic Circuit Analysis and Design",3rd Edition, Tata McGraw Hill
3. David A.Bell,"ElectronicDevicesandCircuits",5thEdition, Oxford press

Reference Books:

1. R. L. Boylstad, L. Nashlesky, "Electronic Devices and circuitsTheory", 9thEdition, PrenticeHall of India, 2006.
2. Phillip E. Allen, Douglas R. Holberg, "CMOS Analog Circuit Design", Second Edition, Oxford.
3. K. R. Botkar, "Integrated Circuits", 5th Edition, Khanna Publication.

E- Books / E- Learning References:

1. NPTEL Course **"Analog Electronic Circuits"**
   https://nptel.ac.in/courses/108/105/108105158/
2. NPTEL Course on **"Analog Circuits"**
   https://nptel.ac.in/courses/108/101/108101094/

Second Year Electronics and Telecommunications (2022 Course)

Digital Systems ETPCC304

Course Code:	**ETPCC304**	**Credit**	**3**
Contact Hours:	3 Hrs/week (L)	**Type of Course:**	Lecture
Examination Scheme	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Pre-requisites:

- Number Systems, Logic Functions and Boolean algebra.

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-Sem. Evaluation	Internal	40
2.	End Semester Examination (Activity based)	External	60

Course Objectives

1	To introduce the fundamental concepts associated with logic families.
2	To analyze logic processes and implement logical operations using combinational logic circuits.
3	To study the sequential logic circuits design both in synchronous and Asynchronous modes.
4	To study fundamentals of VLSI.

Course Outcomes: Students will be able to

304.1	Illustrate the digital logic families.
304.2	Apply the concept of combinational logic design for implementing combinational circuits.
304.3	Construct design steps for simple combinational circuits.
304.4	Compare and convert different flip flops.
304.5	Design synchronous and asynchronous sequential logic circuits.
304.6	Simulate combinational and sequential circuits using HDL.

Topics covered:

UNIT I: Introduction To Digital Electronics (7 hrs.)

Digital Logic families: Introduction, Specification terminology: Fan out, Unit load, Current and voltage parameters; TTL, ECL, MOS, CMOS logic families and their comparison, Tristate Logic CMOS logic: CMOS inverter, NAND, NOR gates, unconnected inputs, wired logic, open drain output.

Signed Binary number representation and Arithmetic: Sign Magnitude, 1's complement & 2's complement representation, unsigned Binary arithmetic (addition, subtraction, multiplication, and division), subtraction using 2's complement;

UNIT II: Combinational Logic Design (7 hrs.)

Definition of combinational logic, canonical forms, Standard representations for logic functions,k-map representation of logic functions (SOP and POS forms), minimization of logical functionsfor min-terms and max-terms (upto 4 variables), don't care conditions, Design Examples: Arithmetic Circuits, BCD to 7 segment decoder, Code converters.

UNIT III: Combinational Circuits (5 hrs.)

Design using SSI chips: Code converters, Half- Adder, Full Adder, Half Subtractor, Full Subtractor, n bit Binary adder.

Introduction to MSI chips: Multiplexer (IC 74153), Demultiplexer (IC 74138), Decoder (74238), Binary adder (IC 7483)

Design using MSI chips: BCD adder & subtractor using IC 7483, Implementation of logic Functions using IC 74153 & 74138.

UNIT IV: Sequential Logic Design (7 hrs.)

Introduction to sequential circuits: Difference between combinational circuits and sequential circuits; Memory element-latch & Flip-Flop.

Flip- Flops: Logic diagram, truth table & excitation table of SR, JK, D, T flip flops; Conversion from one FF to another , Study of flip flops with regard to asynchronous and synchronous, Preset & Clear, Master Slave configuration ; Study of 7474, 7476 flip flop ICs.

UNIT V- Sequential Circuits (6 hrs.)

Application of flip-flops: Counters- asynchronous, synchronous and modulo n counters, study of 7490 modulus n counter ICs & their applications to implement mod counters; Registers- shi register types (SISO, SIPO, PISO &PIPO) & applications.

UNIT VI- Introduction to HDL (6 hrs.)

Library, Entity, Architecture, Modeling styles, Data objects, Concurrent and sequential statements, Design examples using HDL for basic combinational and sequential circuits.

Syllabus contents required for competitive exams (GATE, UPSC, MPSC etc.)(*if complete unit is applicable then write only "unit 1/2/.." or write the contents from that unit):*1. NA.

Text Books:

1. R.P. Jain, "Modern Digital Electronics", Tata McGraw Hill Publication, 3 rd Edition.
2. Thomas Floyd, "Digital Electronics", 11th Edition.
3. M. Morris Mano, "Digital Logic and Computer Design", Prentice Hall of India, 4 th Edition.
4. Taub and Schilling, "Digital Principles and Applications," TMH
5. J. Bhaskar, "A VHDL primer "Prentice-Hall of India, 3rd Edition.

Reference Books:

1. Anand Kumar, "Fundamentals of Digital Circuits", Prentice Hall of India, 1 st Edition.
2. J. F. Wakerly, "Digital Design- Principles and Practices," Pearson, 3 rd Edition.
3. M. M. Mano, "Digital Design," Prentice Hall India.

E- Books / E- Learning References:

1. NPTEL Course on "Digital Circuits" Link of the Course: https://nptel.ac.in/courses/108/105/
2. NPTEL Course on ""Digital Circuits & Systems"" Link of the Course: https://nptel.ac.in/courses/117/106/117106086/

Second Year Electronics and Telecommunications (2022 Course)
Electronics Instrumentation and Measuring Systems ETPCC305

Course Code:	**ETPCC305**	**Credit**	**3**
Contact Hours:	3 Hrs/week (L)	**Type of Course:**	Lecture
Examination Scheme	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks (Activity based)	

Pre-requisites:

- Basic knowledge Basic Electronics Engineering and Analog Electronics.

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-Sem. Evaluation	Internal	40
2.	End Semester Examination	External	60

Course Objectives

1	To get fundamental knowledge of sensors and transducers and their operating principles, for measurement of mechanical parameters.
2	To impart interdisciplinary knowledge regarding transducers.
3	To provide a basic understanding of instrumentation and general Instrumentation systems.
4	To make the students understand working principle and use of different types of measuring Instruments.
5	To make the students understand use of other display devices, recorders and timer/counter.
6	To make the students understand advanced measurement systems

Course Outcomes: Students will be able to

305.1	Apply and select sensors/transducers for particular application.
305.2	Describe the various types of sensors including thermal, mechanical, electrical, electromechanical and optical sensors.
305.3	Select and use the instruments for measurement & analysis of basic electronic parameters.
305.4	Understand the principles of different Oscilloscopes for specific applications.
305.5	Identify the use of other display devices, recorders and timer/counter in measurement systems.
305.6	Use the advanced measurement systems for electronics parameter measurement.

Topics covered:

UNIT I: Basics of Instrumentation and Measuring Systems (6 hrs.)

General Configuration and functional description of measuring instruments, static and dynami characteristics of instruments, errors in instrumentation systems, active and passive transducer and their classification. Units Systems, Statistical metrics in measurement systems, probability of errors, Calibration of measurement system.

UNIT II: Position, Motion, Pressure, Temperature and Flow Sensors (8 hrs.)

Position and motion sensing: Potentiometers, LVDT, proximity sensors (inductive, capacitive and optical), absolute and incremental optical encoders. Pressure Sensors: Diaphragms, capsules, bellows and bourdon tube. Stress, Strain and Force: Strain

Gauges and load cell. Temperature: Resistance temperature detectors, thermistors, thermocouples and pyrometers. Level: Ultrasonic, Capacitance probe type. Flow Rate: Pitotstatic tube, ultrasonic flow meters.
UNIT III: Electronics Measuring Instruments (8 hrs.)
Voltage & current measurement, Digital Voltmeter (DVM), types of DVM, Digital Multi meter, true r.m.s. voltmeter, Vector voltmeter, Impedance meter, Q-meter, Harmonic Distortion analyzers, Wave analyzer, Spectrum Analyzer, Logic Analyzer.
UNIT IV: Special purpose Oscilloscopes (8 hrs.) Dual trace CRO, DSO, Sampling CRO, curve Tracer, Power Oscilloscopes, Delayed sweep CRO, Component Test, Z-modulation and X-Y mode operations, Measurements on oscilloscope, Oscilloscope accessories.
UNIT V- Display devices, Recorders and universal counter / Timer (6 hrs.) LCD Display, LED/OLED Display, Plasma Display, X-Y Plotters, Strip Chart Recorders, Universal counter/ Timers (for time period, time interval, frequency, frequency ratio and pulse measurement), Frequency synthesis techniques, Synthesizers . Communication buses PC / instruments (EIA/TIA 232, 423, 422, 488), Internal & external acquisition cards.
UNIT VI- Advanced measurement systems. (8 hrs.) Automatic Test Equipments, Microwave measurements using Network Analyzer, EMI/EMC test instruments, OTDR, Field Strength Meter, Industrial revolutions & their impact on Industrial Automation, Case study of Electronics Measurement Systems (e.g. DSO, Multi trace CRO, Spectrum Analyzer, Logic Analyzer).
Syllabus contents required for competitive exams (GATE, UPSC, MPSC etc.) *"units 1/2/3/4/5/6".*

Text Books:

2. Oliver-Cage, "Electronic Measurements and Instrumentation", TMH.
3. Cooper & Helfrick, "Modern Electronics Instrumentation & Measurement Techniques", PHI, 3rd Edition.

Reference Books:

4. M.M.S. Anand, "Electronics Instruments and Instrumentation Technology", PHI, Eastern Economy Edition.
5. H. S. Kalsi, "Electronics Instrumentation" TMH, 2 nd Edition
6. Allen Moris, Reza Langari, "Measurement and Instrumentation Theory & Applications", Elsevier, Academic Press, 2 nd Edition

MOOC / NPTEL Courses:

1. NPTEL Course on "Electrical Measurements & Electronics Instruments " Link of the Course: https://nptel.ac.in/courses/108/105/108105153/

2. NPTEL Course on "Introduction to Industry 4.0 and Industrial Internet of Things" Link of the Course: https://onlinecourses.nptel.ac.in/noc21_cs66/preview

3. NPTEL Course on "Design Principles of RF and Microwave Filters and Amplifiers" Link of the Course: https://nptel.ac.in/courses/117/105/117105138/

Second Year Electronics and Telecommunications (2022 Course)
Open source software: eSim ETOEC306

Course Code:	**ETOEC306**	**Credit**	**3**
Contact Hours:	3 Hrs./week (L)	**Type of Course:**	Lecture
Examination Scheme	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Pre-requisites:

- Knowledge of Basic Electronics Engineering.

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-Sem. Evaluation	Internal	40
2.	End Semester Examination	External	60

Course Objectives

1	To discuss open-source software eSim.
2	To design electronic schematic diagrams using eSim
3	To design PCB layout of Electronic circuits.

Course Outcomes: Students will be able to

306.1	Demonstrate features of eSim open source EDA tool.
306.2	Design and Simulate schematic circuits in eSim.
306.3	Apply footprints and set required parameters for PCB design.
306.4	Design PCB layout and generate the Gerber file of any schematic circuit.

Topics covered:

UNIT I : Introduction to eSim-(6 hrs.)

Introduction and features of eSim, Launch eSim through terminal, Add components to circuit schematic, Connect the components using wires, Annotate the components, Generate spice netlist, Add source details and analysis, parameters, Convert Spice netlist to Ngspice format, Simulate the circuit, Understand the multi-meter functionality.

UNIT II: Simulation of Electronic circuits- (6 hrs.)

Creating a schematic, Assigning Values to components, Annotating the schematic, Performing Electrical Rules Check, Generating a netlist, Setting transient parameters, Converting KiCad netlist to ngspice netlist, Assigning Device models to the semiconductor components, Simulating the electronic circuit, Understanding the Python Plotting feature and ngspice terminal.

UNIT III: PCB Design-(6 hrs.)

Mapping Components with footprints

Simulating a circuit, Removing sources, labels and plots from the schematic, Adding Connecto to schematic, Performing annotation, ERC, Launching Cvpcb, Segregating footprints accordi to their libraries, Viewing selected footprint, Assigning footprints to corresponding componen Saving the footprint association.

Setting Parameters for PCB designing

Generating .net netlist file, Launching Pcbnew, Reading .net netlist, Moving footprints, Orienting footprints, Selecting working layer, Creating board outline, Setting design rules for DRC, Changing global track width, Verifying drill hole size, Verifying drill hole shape.

UNIT IV: PCB layout procedure -(6 hrs.)

Launching Pcbnew, Selecting working layer, Placing a track between two nodes, Adding a ground plane outline for the board, Adding a ground plane for the board, Placing Dimensions forthe board Placing text on the board, Performing DRC, Generating Gerber files, Viewing createdGerber files.

E- Books / E- Learning References:

1. https://onlinecourses.swayam2.ac.in/aic20_sp59/preview
2. https://spoken-tutorial.org

List of Tutorials:

1. Installation of eSim in Linux and Windows
2. Schematic Creation and Simulation of electronic circuits.
3. Mapping Components with Footprints of electronic circuits.
4. Setting Parameters for PCB designing.
5. PCB layout of schematic circuit.

Second Year Electronics and Telecommunications (2022 Course)
Analog Electronic Circuits Lab ETPCC307

Course Code:	**ETPCC307**	**Credit**	**1**
Contact Hours:	2 Hrs/week	**Type of Course:**	**Practical**
Examination Scheme	**Practical** 50 Marks		

Pre-requisites:

- Basic knowledge of Semiconductor Physics and Basic Electronics Engineering.

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Practical Examination	External	50

Course Objectives

1	To brief about Semiconductor devices JFET & MOSFET, its characteristics, parameters & applications.
2	To discuss MOSFET DC and AC Configurations and its analysis.
3	To explain various MOSFET Circuits
4	To introduce Concepts of feedback in amplifiers & oscillators.
5	To impart skills to evaluate the performance of voltage regulator

Course Outcomes: Students will be able to

307.1	Design and analyze analog electronic circuits.
307.2	Make use of the appropriate instrument for measurement
307.3	Implement and test the performance of the circuit.
307.4	Explain the working principle of different electronic circuits.

List of Experiments: (Any 8)

1. Design, build and test JFET/MOSFET voltage divider DC biasing circuit.
2. Build and test single-stage CS amplifier using MOSFET. Calculate Ri, Ro and Av.
3. Simulate frequency response of single stage CS amplifier (use same circuit) and find the bandwidth.
4. Simulate Voltage-Series feedback amplifier and calculate Rif, Rof, Avf and Bandwidth.
5. Implement current series feedback amplifier and find Rif, Rof, Gmf and Bandwidth.
6. Simulate LC oscillator using FET.
7. Implement Wein bridge /RC phase shift oscillator using FET/MOSFET.
8. Simulate MOSFET as a CMOS Inverter.
9. Build and test MOSFET as a switch.
10. Design and implement an adjustable voltage regulator using three terminals voltage regulator IC.

Second Year Electronics and Telecommunications (2022 Course)

Digital Systems Lab ETPCC 308

Course Code:	**ETPCC 308**	**Credit**	**1**
Contact Hours:	2 Hrs/week (PR)	**Type of Course:**	Practical
Examination Scheme	**Practical** 50 Marks		

Pre-requisites:

- Basic knowledge of IC.

Course assessment methods/tools:

Sr.	Course assessment methods/tools	External/ Internal	Mark
1.	Practical	External	50

Course Objectives	
1	To analyze logic processes and implement logical operations using combinational logic circuits.
2	To study the sequential logic circuits design both in synchronous and Asynchronous modes.
3	To simulate HDL code.

Course Outcomes: Students will be able to

308.1	Design and implement the digital circuit using combinational logic.
308.2	Design and implement the digital circuit using sequential logic.
308.3	Write and simulate combinational and sequential circuit using HDL.

List of Experiments:

Group A (Solve any 6)

1. **Verify four voltage and current parameters for TTL and CMOS (IC 74LSXX, 74HCXX), (Refer Data-Sheet).**

2. **Study of IC-74LS153 as a Multiplexer:** (Refer Data-Sheet).
   a. Design and Implement 8:1 MUX using IC-74LS153 & Verify its Truth Table.
   b. Design & Implement the given 4 variable function using IC74LS153. Verify its Truth-Table.
3. **Study of IC-74LS138 as a Demultiplexer / Decoder:** (Refer Data-Sheet)
   a. Design and Implement full adder and subtractor function using IC-74LS138.
   b. Design & Implement 3-bit code converter using IC-74LS138. (Gray to Binary/Binary to Gray).
4. **Study of IC-74LS83 as a BCD adder:** (Refer Data-Sheet).
   a. Design and Implement 1-digit BCD adder usingIC-74LS83.
   b. Design and Implement 4-bit Binary sub tractor using IC-74LS83.

   OR

4. **Study of IC-74LS85 as a magnitude comparator:** (Refer Data-Sheet)
   a. Design and Implement 4-bit Comparator.
   b. Design and Implement 8-bit Comparator.
5. **Study of code converter**
   a. Design and Implement code converter (Binary to Grey or Grey to Binary)
6. **Study of Counter ICs (74LS90/74LS93):** (Refer Data-Sheet)
   a. Design and Implement MOD-N and MOD-NN using IC-74LS90 and draw Timing diagram.

b. Design and implement Mo4OD-N and MOD NN using IC 74LS95 and draw timing diagram

OR

6. Study of synchronous counter:

a. Design & Implement 4-bit Up/down Counter and MOD-N Up/down Counter using IC74HC191 / IC74HC193. Draw Timing Diagram.

7. Study of Shift Register:

Design and Implement 4-bit right shift and left shift register using D-flip flop.

OR

7. Study of Shift Register (74HC194 / 74LS95):

a. Design and Implement Pulse train generator using IC-74HC194 / IC74LS95 (Use right shift/ left shift).

b. Design and Implement 4-bit Ring Counter/ Twisted ring Counter using shift registers IC 74HC194 / IC74LS95.

Group B (Solve any 2)

8. Write a HDL code for half adder and simulate it.

OR

8. Write a HDL code for full adder and simulate it.

9. Design a D-FF using HDL and obtain simulation waveform.

OR

9. Design a T-FF using HDL and obtain simulation waveform.

10. Design a SR-FF using HDL and obtain simulation waveform.

OR

10**. Design a JK-FF using HDL and obtain simulation waveform.**

Second Year Electronics and Telecommunications (2022 Course)

Electronics Instrumentation and Measuring Systems Lab ETPCC309

Course Code:	**ETPCC309**	**Credit**	**1**
Contact Hours:	2 Hrs/week (P)	**Type of Course:**	Practical
Examination Scheme	Term Work. Evaluation 50 Marks		

Pre-requisites:

- Basic knowledge Basic Electronics Engineering and Analog Electronics.

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term Work	Internal	50

Course Objectives

1	To get fundamental knowledge of transducers used for measurement of weight and temperature.
2	To provide treatment for random error by statistical analysis using 6 and ½ digit DMM.
3	To make the students understand RMS, true RMS value and Q factor measurements.
4	To make the students aware about different analyzers.
5	To make the students understand different oscilloscopes.
6	To make the students understand advanced measurement systems

Course Outcomes: Students will be able to

309.1	Apply and select sensors/transducers for particular application.
309.2	Select and use the instruments for measurement & analysis of random error.
309.3	Understand the principles of different meters for specific applications.
309.4	Understand the principles of different analyzers for specific applications.
309.5	Understand the principles of different Oscilloscopes for specific applications.
309.6	Use the advanced measurement systems for electronics parameter measurement.

List of Laboratory Experiments

1. Weight measurement using load cell and strain gauges.
2. Temperature measurement. (RTD signal conditioning with bridge circuit, instrumentation amplifier, ADC and microcontroller)
3. Statistical analysis of measurements, probable error, calibration of meters
4. Measurement of RMS of common and true RMS of complex waveforms.
5. Measurement of L, C, R, Q and Dissipation Factor using Q –Meter.

6. Measurement of Total Harmonic Distortion contained by output of amplifier/ inverter.
7. Measurements of Time period, Time Interval, Frequency and frequency ratio using universal counter/ Timer.
8. Measurements using Digital Storage Oscilloscope, different modes of DSO, capturing transients and analysis of waveforms.
9. Measurement using spectrum analyzer by observing spectrum of AM and FM waveforms for different modulation indices.
10. Case study of measurement system using Vector Network Analyzer/software package like LABVIEW or other software or virtual lab.

Virtual Lab Courses:

1 https://iitg.vlabs.ac.in/Understanding_The_%20Basic_Functions_Of_An%20Oscilloscope.htm l

2 https://www.iitk.ac.in/mimt_lab/vlab/index.php?pg=smith

3. https://www.iitk.ac.in/mimt_lab/vlab/index.php?pg=reflection_coefficients

Second Year Electronics and Telecommunications (2022 Course)
Vedic Mathematics ETHSM 310

Course Code:	**ETHSM310**	**Credit**	**1**
Contact Hours:	1 Hrs/week (L)	**Type of Course:**	Lecture
Examination Scheme	**TW Evaluation** 25 Marks		

Pre-requisites: Vedic Sutras,Vedic Sub Sutras

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term work Evaluation	Internal	25

Course Objectives

1	To develop the understanding of techniques/ sutras to solve mathematical arithmetic's in easy and faster way and use these techniques in various competitive examinations.
2	To improve speed and efficiency to solve even the most complex mathematical problems.
3	To remove the phobia about mathematics in the minds of students.
4	To help students to have better command over mathematical concepts and boost up their self-confidence level towards the subject.

Course Outcomes: Students will be able to

310.1	Apply Vedic Mathematics techniques to Perform quickly and accurately mathematical calculations like multiplication, division, squares, cubes,LCM,HCF.
310.2	Apply Vedic Mathematics techniques to solve Linear Equations, Quadratic Equations, Factorization of a Cubic Polynomial.
310.3	Apply Vedic Mathematics techniques to Perform calculations in Coordinate Geometry, Differentiation, Integration and Trigonometry without relying heavily on calculators or written methods.

Topics covered:

UNIT I: Basic level (4 hrs.)

Introduction of Vedic Mathematics, Multiplication, Square, Cube, Divisibility Test , Highest Common Factor of Polynomials, Multiplication of Polynomials, Division of Polynomials.

UNIT II: Intermediate Level (4hrs.)

Linear Equations, Quadratic Equations, Factorization of a Cubic Polynomial, Magic squares, Dates and Calendar.

UNIT III: Advance Level (3 hrs.)

Determinant, Coordinate Geometry, Differentiation, Integration, Trigonometry.

Syllabus contents required for competitive exams (GATE, UPSC, MPSC etc.)(*if complete unit is applicable then write only "unit 1/2/.." or write the contents from that unit):*1. NA.

Textbooks

1. Advanced Vedic Mathematics, Rajesh Kumar Thakur.
2. Vedic Mathematics Made Easy , Dhaval Bathia
3. VEDIC MATHEMATICS For Students: LEVEL – 1 OF 5 SERIES, by Nava Vision

Reference books

1. Sri Bharatikrishna Tirthaji,"Vedic Mathematics", Published by Motilal Banarsidass, 1965.ISBN 81-208-0163-6.
2. Williams K.R. "Discover Vedic Mathematics" Vedic Mathematics Research Group, 1984.ISBN 1-869932-01-3.
3. Wiliams K.R. and M.Gaskell "The Cosmic Calculator". Motilal Banarsidass, 2002. ISBN 81-208-1871-7.
4. Nicholas A.P., Williams,J. Pickles. "Vertically and Crosswise". Inspiration books, 1984.ISBN 1-902517-03-2.

Second Year Electronics and Telecommunications (2022 Course)
Business Accounting for Engineering (ETHSM 401)

Course Code:	**ETHSM401**	**Credit**	**2**
Contact Hours:	2 Hrs./week (L)	**Type of Course:**	Lecture
Examination Scheme	**25 Marks TW 25 Marks OR**		

Pre-requisites: Knowledge of Basic Mathematics

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term work Evaluation	Internal	25
2.	Oral Examination	External	25

Course Objectives

1.	To explain the concept of accounting, importance and types of accounting
2	To Interpret methods of journal and Ledger.
3	To explain the Trading Account .
4	To discuss the need of management accounting.
5	To Explain the need of Cost Accounting
6	To explain the method of Costing

Course Outcomes: Students will be able to

401.1	Identify the key elements of the concept of Accounting in financial statements .
401.2	Identify the types of Cash Books .
401.3	Analyze the principles of preparing Accounts.
401.4	Summarize the concepts of Management Accounting .
401.5	Identify the importance of Cost Accounting.
401.6	Make use of analytical classification of cost

Topics covered:

UNIT I: Introduction to Accounting: (4 hrs.)
Introduction of Accounting, Importance of Accounting, Functions of Accounting, Types & Principles of Accounting

UNIT II: Accounting Transactions (4hrs.)
Introduction to Journal & Ledger, Distinction Between Journal and Ledger, Cash Book , Subsidiary Books, Kinds of Subsidiary Books, Type of Discounts

UNIT III: Trail Balance and Accounts: (4 hrs.)
Introduction to Trail Balance , Methods of Preparing Trail Balance, Trading Account., Preparation of Trading Account, Profit and Loss Account, Preparation of Profit and Loss Account, Balance Sheet

UNIT IV- Management Accounting (4 hrs.)
Nature, Functions and Scope of Management Accounting, Financial Analysis and Planning.

UNIT V- Cost Accounting (4 hrs.)
Introduction of Cost Accounting, Need for Cost Accounting, Growth and Development of Cost Accounting, Importance of Cost Accounting, Financial Accounting v/s Cost Accounting.

UNIT VI- Elements of Costs (4 hrs.)
Introduction to Elements of Cost, Classification of Cost, Functions, Capital and Revenue.

Text Books:

[T1] Fundamentals of Accounting & Financial Analysis: By Anil Chowdhary (Pearson Education).
[T2] Financial Accounting For Management: By Dr. S. N. Maheshwari (Vikas Publishing House)
[T3] Accounting Made Easy By Rajesh Agarwal & R Srinivasan (Tata McGraw –Hill).
[T4] Principles of Accountancy – N.Vinayakam,P.L.Mani,K.L. Nagarajan - S.Chand & Company Ltd., New Delhi
[T5] Accounting for Management, N.P.Srinivasan and M.Sakthivel Murugan, S.Chnad & Company
Ltd., New Delhi
[T6] Cost Accounting, R.S.N Pillai and V.Bagavathi, "S.Chand and Company Ltd., New Delhi.Edn.2004 S.P.Iyyangar
[T7] Cost Accounting Principles and Practice, Sultan Chnad, New Delhi. 2005

Reference Books:

[R1] Financial accounting: By Jane Reimers (Pearson Education)
[R2] Financial Accounting For Management: By Amrish Gupta (Pearson Education).
[R3] Double entry book Keeping, T.S.Grewal, Sultan Chnad & Sons, New Delhi
[R4] Management Accounting, Sharma and Gupta, Kalyani Publishers, New Delhi

E- Books / E- Learning References:

1. NPTEL Course on Decision making using financial accounting
Link of the Course: https://nptel.ac.in/courses/110106135
2. NPTEL Course on Financial Accounting
Link of the Course: https://archive.nptel.ac.in/courses/110/101/110101131

Second Year Electronics and Telecommunications (2022 Course)
Integrated Circuits (ETPCCC402)

Course Code:	**ETPCC402**	**Credit**	**3**
Contact Hours:	3 Hrs/week (L)	**Type of Course:**	Lecture
Examination Scheme	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Pre-requisites:

Basic knowledge of Analog Electronic Circuits.

Course assessment methods/tools:

Sr. No.		External/ Internal	Marks
1.	In-Sem. Evaluation	Internal	40
2.	End Semester Examination	External	60

Course Objectives	
1	To understand Op amp Fundamentals.
2	To know linear and nonlinear applications of operational amplifier ICs.
3	To understand various converters using op amp
4	To understand Filters using op amp
5	To study and use different special purpose ICs

Course Outcomes: Students will be able to	
402.1	Identify internal structure and characteristics of op-amp
402.2	Explain and analyze Linear applications of op-amp
402.3	Explain and analyze Non-linear applications of op-amp
402.4	Design,build and test op-amp based ADC and DAC circuits
402.5	Design active filters
402.6	Apply functionalities of PLL and Timer IC with their applications

Topics covered:

UNIT I: Op Amp Fundamentals (6 hrs.)

Block diagram of OP-AMP, Explanations of each block, Differential Amplifier configurations, Differential amplifier analysis, Need and types of level shifter, ideal parameters and practical parameters of OP-AMP and their comparison, current mirror circuits.

UNIT II: Linear Applications of Op Amp (6 hrs.)

Inverting and Non-inverting amplifier, voltage follower, voltage scaling, difference amplifier, Ideal integrator, errors in ideal integrator, practical integrator, frequency response of practical integrator, applications of integrator, Ideal differentiator, errors in ideal differentiator, practical differentiator, frequency response of practical differentiator, applications of differentiator Requirements of Instrumentation amplifier, 3 OP-AMP Instrumentation amplifier Instrumentation amplifier applications.

UNIT III: Non Linear Applications of OP amp (6 hrs.)

Comparator, characteristics of comparator, applications of comparator, Schmitt trigger (symmetrical/asymmetrical), Square wave generator, triangular wave generator, Problems in basic rectifier, Need of precision rectifier, Half wave , Full wave precision rectifiers, peak

detectors, sample and hold circuits.

UNIT IV: Converters (6 hrs.)

and F-V converter, I-V and V-I converter, Current amplifier, DAC, types of DAC, characteristics, specifications, advantages and disadvantages of each type of DAC, ADC, types of ADC, characteristics, specifications, advantages and disadvantages of each type of ADC.

UNIT V: Filters s (6 hrs.)

Design and frequency scaling of First order and second order Active LP, HP, BP and wide and narrow band BR Butterworth filters and notch filter. All pass filters

UNIT VI: Special Purpose ICs (6 hrs.)

The 555 Timer IC, Internal schematic, Astable and monostable modes of operation Phase Locked Loop IC 565, Block Diagram, Characteristics, phase detectors, Details of PLL IC 565 Applications, Typical circuits., Voltage Controlled Oscillator Basic Operation

Text Books:

1. Ramakant A Gayakwad, "Op-Amps and Linear Integrated Circuits", PHI, 4th edition
2. D.Roy Choudhary, Shail Jain, "Linear Integrated Circuits", New Age Int. press

Reference Books:

1. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", Tata McGraw Hill., Third Edition
2. G.B.Clayton, "Operational Amplifiers", International Edition.
3. K. R. Botkar, "Integrated Circuits", 5th Edition, Khanna Publication.

E- Books / E- Learning References:

1. NPTEL Course "Integrated Circuits" https://nptel.ac.in/courses/108108111

Second Year Electronics and Telecommunications (2022 Course)
Data Structures (ETPCC 403)

Course Code:	**ETPCC 403**	**Credit**	**3**
Contact Hours:	3 Hrs/week (L)	**Type of Course:**	Lecture
Examination Scheme	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks (Activity Based)	

Pre-requisites:

- Basic knowledge of Python.

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-Sem. Evaluation	Internal	40
2.	End Semester Examination	External	60

Course Objectives	
1	To learn different sorting and searching algorithms and their analysis.
2	To learn linear data structures: Stack and Queue, Linked List and their applications.
3	To learn nonlinear data structures: Tree, Graph and their applications.
4	To study the systematic ways of solving problem, various methods of organizing large amount of data.
5	To solve problems using data structures such as binary tree, binary search tree, and graph and writing programs.

Course Outcomes: Students will be able to	
403.1	Demonstrate various operations on data structures in python
403.2	Implement sorting and searching algorithms and calculate their complexity.
403.3	Develop applications of stack and queue using array.
403.4	Demonstrate applicability of Linked List.
403.5	Demonstrate applicability of Binary Tree with respect to its time complexity.
403.6	Apply the knowledge of graph for solving the problems of spanning tree and shortest path algorithm.

Topics covered:

UNIT I: ARRAYS (6 hrs.)

Basics of array, Array as abstract Data Type, Implementing Arrays, and
Two Dimensional Array: implementation Of 2 Dimensional arrays,
Matrix: Implementation of matrix, Matrix operation like addition, subtraction, scaling. Multiplication. Transpose.

UNIT II: SEARCHING AND SORTING ALGORITHMS (6 hrs.)

Algorithms: Analysis of Iterative and Recursive algorithms, Space & Time complexity, Asymptotic notation- Big-O, Theta and Omega notations.
Searching methods: Linear, Binary and Fibonacci Search.
Sorting methods: Bubble, Insertion, Selection, Merge, and Quick Sort.

UNIT III: STACK AND QUEUES (6 hrs.)

Stack: Concept, Basic Stack operations, Array representation of stack, Stack as ADT, Stack Applications: Reversing data, Arithmetic expressions conversion and evaluation.
Queue: Concept, Queue operations, Array representation of queue, Queue as ADT, Circular queue, Priority Queue, Applications of queue.

UNIT IV: LINKED LIST (6 hrs.)

Concept of linked organization, Singly Linked List, Stack using linked list, Queue using linked list, Doubly Linked List, Circular Linked List, Linked list as ADT.

UNIT V- TREES (6 hrs.)

Introduction to trees: Basic Tree Concepts. **Binary Trees:** Concept & Terminologies, Representation of Binary Tree in memory, Traversing a binary tree. **Binary Search Trees (BST):** Basic Concepts, BST operations, Concept of Threaded Binary Search Tree, AVL Tree: Basic concepts and rotations of a Tree.

UNIT VI- GRAPHS (6 hrs.)

Graph: Basic Concepts & terminology. **Representation of graphs:** Adjacency matrix, Adjacency list. **Operations on graph:** Traversing a graph. **Spanning trees:** Minimum Spanning tree- Kruskal's Algorithm, Prim's Algorithm and Dijkstra's Shortest Path Algorithm.

Syllabus contents required for competitive exams (GATE, UPSC, MPSC etc.)(*if complete unit is applicable then write only "unit 1/2/.." or write the contents from that unit):*1. NA.

Text Books:

1. Rance D. Necaise, Data Structures and Algorithms Using Python by, John Wiley and Sons. ISSN: 9788126562169
2. Reema Thareja, "Python Programming Using Problem Solving Approach", Oxford University Press, ISBN 13: 978-0-19-948017-6.
3. R. Nageswara Rao, "Core Python Programming", Dreamtech Press; Second edition ISBN-10: 938605230X, ISBN-13: 978-9386052308 ASIN: B07BFSR3LL

Reference Books:

4. Narasimha Karumanchi, Data Structures And Algorithms Made Easy, Career Monk Publications
5. Y Daniel Liang, "Introduction to Programming using Python", Pearson
6. Benjamin Baka, David Julian, "Python Data Structures and Algorithms", Packt Publishers,2017

Second Year Electronics and Telecommunications (2022 Course)
Signals and systems (ETPCC404)

Course Code:	**ETPCC404**	**Credit**	**3**
Contact Hours:	3 Hrs/week (L)	**Type of Course:**	Lecture
Examination Scheme	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Pre-requisites:

- Integration, differentiation, matrix operations .

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-Sem. Evaluation	Internal	40
2.	End Semester Examination	External	60

Course Objectives

1	To understand the mathematical representation of continuous and discrete time signals and systems..
2	To classify signals and systems into different categories.
3	To analyze Linear Time Invariant (LTI) systems in time and transform domains.
4	To understand concepts of correlation, spectral density

Course Outcomes: Students will be able to

404.1	Identify, classify basic signals and perform operations on signals.
404.2	Identify, Classify the systems based on their properties in terms of input output relation , impulse response and to determine the convolution between to signals.
404.3	Analyze and resolve the signals in frequency domain using Fourier Transform.
404.4	Resolve the signals in complex frequency domain using Laplace and Z Transform
404.5	Apply and analyze the LTI systems using Laplace and Z Transforms.
404.6	Determine correlation and spectral density between signals.

Topics covered:

UNIT I: Introduction to Signals & Systems (6 hrs.)

Introduction, Graphical, Functional, Tabular and Sequence representation of Continuous and Discrete time signals. Basics of Elementary signals: Unit step, Unit ramp, Unit parabolic, Impulse, Sinusoidal, Real exponential, Complex exponential, Rectangular pulse, Triangular, Signum, Sinc and Gaussian function.

Operations on signals: time shifting, time reversal, time scaling, amplitude scaling, signal addition, subtraction, signal multiplication. Communication, control system and Signal processing examples.

Classification of signals: Deterministic, Random, periodic , Non periodic, Energy , Power, Causal , Non Causal, Even and odd signal.

Systems:

Introduction, Classification of Systems: Lumped Parameter and Distributed Parameter System, static and

dynamic systems, causal and non-causal systems, Linear and Non- linear systems, time variant and time invariant systems, stable and unstable systems, invertible and non- invertible systems

UNIT II: Time domain representation of LTI System (6 hrs.)

Input-output relation, definition of impulse response, convolution sum, convolution integral, computation of convolution integral using graphical method for unit step to unit step, unit step to exponential ,exponential to exponential, unit step to rectangular and rectangular to rectangular only

Computation of convolution sum. Properties of convolution. System interconnection, system properties in terms of impulse response, step response in terms of impulse response

UNIT III: Fourier Transform (6 hrs.)

Fourier Transform (FT) representation of aperiodic CT signals, Dirichlet condition for existence of Fourier transform, evaluation of magnitude and phase response, FT of standard CT signals, Properties and their significance, Interplay between time and frequency domain using sinc and rectangular signals, Fourier Transform for periodic signals.

UNIT IV: Laplace transform (6 hrs.)

Definition of Laplace Transform (LT), Limitations of Fourier transform and need of Laplace transform, ROC, Properties of ROC, Laplace transform of standard periodic and aperiodic functions, properties of Laplace transform and their significance, Laplace transform evaluation using properties, Inverse Laplace transform based on partial fraction expansion, stability considerations in S domain, Application of Laplace transforms to the LTI system analysis.

UNIT V- z-transform (6 hrs.)

Need for z-transform, relation between Laplace transform and z transform, relation between Fourier transform and z transform, Concept of ROC and Properties of ROC and z transform, Relation between pole locations and time domain behavior, causality and stability considerations for LTI systems, Solution of difference equations using z transform.

UNIT VI- Correlation and Spectral Density (6 hrs.)

Definition of Correlation and Spectral Density, correlogrm, analogy between correlation, covariance and convolution, conceptual basis, auto-correlation, cross correlation, energy/power spectral density, properties of correlation and spectral density, inter relation between correlation and spectral density.

Text Books:

1. Simon Haykins and Barry Van Veen, “Signals and Systems”, Wiley India, 2nd Edition.
2. M.J. Roberts “Signal and Systems”, Tata McGraw Hill 2007.
3. Dr. Shaila Apte , “Signal and System”, Wiley India Publication, 2nd Edition

Reference Books:

1. Charles Phillips, “Signals, Systems and Transforms”, Pearson Education, 3rd Edition.
2. A. Nagoor Kanni “Signals and Systems”, Mc Graw Hill, 2nd Edition.
3. Schaum's Outline of “Theory and Problems of “Signal and system”, 2nd Edition.

E- Books / E- Learning References:

1. NPTEL Course on “Principles of Signals & System ”
Link of the Course: https://nptel.ac.in/courses/108/104/108104100/
2. NPTEL Course on “Signals and systems”
Link of the Course: http://www.nptelvideos.in/2012/12/signals-and-system.html

Second Year Electronics and Telecommunications (2022 Course)

Analog Communication (ETPCC405)

Course Code:	**ETPCC405**	**Credit**	**3**
Contact Hours:	3 Hrs/week (L)	**Type of Course:**	Lecture
Examination Scheme	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Pre-requisites:

Basics of communication system and Signals and System.

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-Sem. Evaluation	Internal	40
2.	End Semester Examination	External	60

Course Objectives

1	To describe and analyze the mathematical techniques of generation, transmission and reception of amplitude modulation (AM), frequency modulation (FM) and phase modulation (PM) signals..
2	To discuss the performance levels (Signal-to-Noise Ratio) of AM systems in the presence of additive white noise.
3	To introduce the students with the concept of Sampling theorem and pulse modulation techniques PAM, PWM, PPM.

Course Outcomes: Students will be able to

405.1	Analyze the techniques of generation, transmission and reception of Amplitude Modulation Systems.
405.2	Compare and contrast between various types of AM radio receivers.
405.3	Explain generation and detection of FM systems.
405.4	Compare and contrast between types of FM radio receivers.
405.5	Classify different types of noise and analyze the performance of analog communication systems in presence of noise.
405.6	Identify various pulse analog modulation techniques.

Topics covered:

UNIT I: AMPLITUDE MODULATION (8 hrs.)

Base band & Carrier communication, Need of modulation ,Generation of AM (DSBFC) and its spectrum, Power relations applied to sinusoidal signals, DSBSC – multiplier modulator, Nonlinear generation, switching modulator, Ring modulator & its spectrum, Modulation Index. SSBSC , ISB & VSB, their generation methods & Comparison, Block Diagram of AM Transmitter .DRM radio introduction.

UNIT II: AM RECEPTION (8 hrs.)

Block diagram of TRF AM Receivers, Super Heterodyne Receiver, Dual Conversion Super heterodyne Receiver, Concept of Series & Parallel resonant circuits for Bandwidth & Selectivity. Performance Characteristics: Sensitivity, Selectivity, Fidelity, Image Frequency Rejection and IFRR. Tracking, Mixers. AM Detection: Rectifier detection, Envelope detection; Demodulation of DSBSC: Synchronous detection; Demodulation of SSBSC: Envelope detection

UNIT III: ANGLE MODULATION (6 hrs.)

Instantaneous frequency, Concept of Angle modulation, frequency spectrum& Eigen Values, Narrow band & wide band FM, Modulation index, Bandwidth, Bessel's Function and its

mathematical analysis, Phase Modulation, Generation of FM (Direct & Indirect Method), Direct Digital Synthesis in FM Modulator, Comparison of AM,FM and PM.

UNIT IV: FM RECEPTION (8 hrs.)
Block diagram of FM Receiver, FM ,Two way FM Radio Receiver, FM detection using Phase lock loop(PLL) ,Slope detector, Balanced Slope detector , Foster-Seeley discriminator, Ratio detector. Frequency Division Multiplexing.

UNIT V- NOISE (6 hrs.)
Sources of Noise, Types of Noise, White Noise, Thermal noise, shot noise, partition noise, Low frequency or flicker noise, burst noise, avalanche noise, Signal to Noise Ratio, SNR of tandem connection, Noise Figure, Noise Temperature, Friss formula for Noise Figure, Noise Bandwidth .Behavior of Baseband systems and Amplitude modulated systems i.e.DSBSC and SSBSC in presence of noise.

UNIT VI- PULSE MODULATION (6 hrs.)
Band limited & time limited signals ,Sampling theorem in time domain, Nyquist criteria, Types of sampling- ideal, natural, flat top, Aliasing & Aperture effect. PAM ,PWM & PPM. Introduction to Pulse Code Modulation, Delta modulation, Adaptive delta modulation ,Time Division Multiplexing.

Syllabus contents required for competitive exams (GATE, UPSC, MPSC etc.)(*if complete unit is applicable then write only "unit 1/2/.." or write the contents from that unit):*1. NA.

Text Books:

1. George Kennedy, "Electronic Communication Systems" 6th Edition, McGraw-Hill.
2. Dennis Roddy &Coolen, "Electronic Communication",4th Edition, Prentice Hall.

Reference Books:

1. B. P. Lathi, "Modern Digital and Analog. Communication Systems", 3rd Edition, Oxford University Press.
2. Simon Haykin, "Communication Systems", 5th Edition, John Wiley & Sons.
3. Taub& Schilling, "Principles of Communication Systems", Tata McGraw-Hill.
4. Frenzel, "Principles of Electronic Communication Systems"4th Edition, Tata McGraw-Hill.

E- Books / E- Learning References:

1.NPTEL Course on "Principles of Communication Systems - I "
Link of the Course: https://nptel.ac.in/courses/108104091

Second Year Electronics and Telecommunications (2022 Course)
Open Source Software: Scilab (ETVSE406)

Course Code:	**ETVSE 406**	**Credit**	**3**
Contact Hours:	01Hrs/week (L) 04Hrs/week(PR)	**Type of Course:**	Lecture
Examination Scheme	**TW Evaluation:** 50 Marks	**Practical Evaluation:** 50 Marks	

Pre-requisites:

Basics of programming, Mathematics

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term work	Internal	50
2.	Practical	External	50

Course Objectives

1	To interpret methods and basic concepts of scientific programming using Scilab.
2	To develop programs in Scilab
3	To Evaluate, analyze the problems and plot the results
4	To Perform mathematical Modelling in Scilab

Course Outcomes: Students will be able to

406.1	To apply the main features of the SCILAB program development environment to enable their usage in higher learning.
406.2	To interpret types of programming languages and concept of free, opensource, proprietary software
406.3	To implement simple mathematical functions/equations in numerical computing environment such as SCILAB.
406.4	To Interpret and visualize simple mathematical functions and operations there on using plots/display
406.5	Analyze the program for correctness and determine/estimate/predict the output and verify it under a simulation environment using SCILAB tools and to interpret the results of the problem statement in the form of plots.
406.6	To apply the knowledge of matrix, physics and mathematics and Signal processing concepts for writing a program

Topics covered:

Unit I- Types of programming languages and selection criterion, concept of free, opensource proprietary software (5 hrs)

Introduction to SCILAB (Features, capabilities and applications) and development environment, Program execution process and format. Concept and examples of built-in functions and the concept of toolboxes, Variables and constants Definition, naming (identifiers or labels for different entities), initialization and accessing of variables. Constants and their representation, Data types-classification, memory requirement, range of values, usage and type specifiers.

UNIT II: Control structure (5 hrs.)

Branching: Conditional (if, if-else, nested and ladder if-else, switch constructs) and unconditional (break, continue and go to statements), Looping: Entry controlled (for and while)

UNIT III:BasicPloting (6 hrs.)
Built in functions, generating waveforms, Sound replay, load and save, Statement strokes and expressions, Standard input and output statements, and plot functions, Escape characters.

UNIT IV: Arrays/Matrices and strings Functions (4 hrs)
Definition, declaration, initialization (static and run-time or dynamic) and arrays, matrices and strings, Accessing of strings, array and matrices elements and relevant operations, Comparison of built-in, library and user-defined functions.

UNIT V: Application of Scilab for coding equation (2 hrs.)
D Students should be able to code Mathematical equations by referring to the Scilab NPTEL course.

UNIT VI: Application of Scilab for subject specific problem solving(2 hrs.)
Students should be able to code equations for simple electronic systems such as RLC response /Signal and systems /control system by referring to the Scilab NPTEL course.

Text Books:

1. SCILAB by Example ,M.Affouf, Create Space Independent Publishing Platform,2012
2.Introduction to Scilab: For Engineers and Scientists, by SandeepNagar,Apress; 1st ed. edition (13 December 2017)

Reference Books:

1. Introduction to Scilab: For Engineers and Scientists, by SandeepNagar,Apress; 1st ed. edition (13 December 2017)
2. Scilab: A Practical Introduction to Programming and Problem Solving Book by Tejas Sheth,20
3.

E- Books / E- Learning References:

1. NPTEL Course on Scilab Link of the Course: **https://nptel.ac.in/courses/110106135**
Online Tutorials:**1 . https://www.scilab.org/tutorials**

2. ANU Teaching Modules Scilab Tutorials Graeme Chandler and Stephen Roberts
http://sites.poli.usp.br/d/pqi2501/tutorial-Scilab-08.pdf

List of Tutorials

Session 1 : Basic commands ,Expressions, Indexing
Session 2 : Matrices manipulation-I
Session 3 : Matrices manipulation-II and control statements,loops
Session 4 Data Analysis
Session 5 : Graphics and plotting
Session 6 :Polynomials and Symbolic functions
Session 7 : Numerical Methods/ Calculus
Session 8: Program execution for DSP /control systems/ Plot discharging voltage across resistor/capacitor.
Session 9:Assignment for comprehension and summary of commands / functions and advantage of scilab over other types of software.

Second Year Electronics and Telecommunications (2022 Course)
Integrated Circuits Lab (ETPCC 407)

Course Code:	**ETPCC 407**	**Credit**	**1**
Contact Hours:	2 Hrs/week	**Type of Course:**	**Practical**
Examination Scheme	**Practical** 50 Marks		

Pre-requisites:

- Basic knowledge of Analog Electronic Circuits.

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Practical Examination	External	50

Course Objectives

1	To understand Op amp Fundamentals.
2	To know linear and nonlinear applications of operational amplifier ICs.
3	To understand various converters using op amp
4	To understand Filters using op amp
5	To study and use different special purpose ICs

Course Outcomes: Students will be able to

407.1	Design and analyzeanalog electronic circuits.
407.2	Make use of the appropriate instrument for measurement
407.3	Implement and test the performance of the circuit.
407.4	Explain the working principle of different electronic circuits.

List of Experiments:

1. Measurement of Op amp DC Parameters
2. Measurement of Op amp AC Parameters
3. Design,build and test op-amp based Integrator
4. Design,build and test Symmetrical Schmitt Trigger circuit.
5. Design build and test Precision rectifiers.
6. Design, Build and Test a Square wave and Triangular Wave generator
7. Design, build and test R-2R ladder DAC
8. Simulate Active filter circuits
9. Design, build and test Astable/Monostable Oscillator using IC 555.

Activity based Project:

10. Design,simulate,build and test any op amp/IC555 based application

Second Year Electronics and Telecommunications (2022 Course)
Data Structures Lab (ETPCC 408)

Course Code:	**ETPCC 408**	**Credit**	**1**
Contact Hours:	2 Hrs/week (PR)	**Type of Course:**	Practical
Examination Scheme	**TW** 25 Marks		

Pre-requisites:

- Basic knowledge of Python.

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	TW	Internal	50

Course Objectives

1	To learn different sorting and searching algorithms and their analysis.
2	To learn linear data structures: Stack and Queue, Linked List and their applications.
3	To learn nonlinear data structures: Tree, Graph and their applications.
4	To study the systematic ways of solving problem, various methods of organizing large amount of data.
5	To solve problems using data structures such as binary tree, binary search tree, and graph and writing programs.

Course Outcomes: Students will be able to

408.1	Demonstrate various operations on Array using python
408.2	Implement sorting and searching algorithms using python
408.3	Implement stack and queue using python.
408.4	Demonstrate various operations Linked List using python.
408.5	Implement Binary search Tree using python.
408.6	Implement and traverse Graph using python.

List of Experiments:

1. Write a python program to perform basic operation such as. Traverse, Insertion, Deletion, Search, Update on an array
2. Write a python program to Implement a Binary Search in Python
3. Write a python program to arrange the elements in ascending order using bubble sort
4. Write a Python program to create a linked list and display its elements
5. Write a Python code to implement Stack.
6. Write a Python code to implement Queue.
7. Write a Python code to create and traverse binary search tree
8. Write a Python code to traverse the graph using DFS algorithm

Virtual LAB Links:

Link of the Virtual Lab: https://ds1-iiith.vlabs.ac.in/data-structures-1/

Second Year Electronics and Telecommunications (2022 Course)
Signals and systems Lab (ETPCC 409)

Course Code:	**ETPCC 409**	**Credit:**	**1**
Contact Hours:	1 Hr/week	**Type of Course:**	Tutorial
Examination Scheme	Term Work Evaluation 25 Marks		

Pre-requisites:

- Integration, differentiation, matrix operations .

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term work Evaluation	Internal	25

Course Objectives	
1	To understand the mathematical representation of continuous and discrete time signals and systems..
2	To classify signals and systems into different categories.
3	To analyze Linear Time Invariant (LTI) systems in time and transform domains.
4	To understand concepts of correlation, spectral density

Course Outcomes: Students will be able to	
409.1	Classify basic signals and perform operations on signals.
409.2	Classify the systems based on their properties in terms of input output relation , impulse response.
409.3	Compute the convolution between two signals
409.3	Analyze and resolve the signals in frequency domain using Fourier Transform.
409.4	Resolve the signals in complex frequency domain using Laplace and z Transform.
409.5	Analyze the LTI systems using Laplace and z Transforms.
409.6	Determine correlation and spectral density between signals.

Topics covered:

1 A) Sketch and write mathematical expression for the following signals in CT and Discrete Time (DT)
a) Sine b) Rectangular c) Triangular d) Exponential e) Unit Impulse f) Unit Step
g) Ramp h) Signum i) Sinc

B) Classify and find the respective value for the above signals
a) Periodic / Non Periodic b) Energy / Power /Neither

2) Take any two CT and DT signals and perform the following operations: Amplitude scaling, addition, multiplication, differentiation, integration (accumulator for DT), time scaling, and time shifting and folding.

3) Express any two system mathematical expressions in input output relation form and determine whether each one of them is, Memory less, Causal, Linear, Stable, Time invariant, Invertible.

4)Compute Convolution Integral and convoltion sum of two Signals. (Various Combinations can be

taken for this.)

5) State and prove the various properties of CT Fourier Transform. Take rectangular and sinc Signal as examples and demonstrate the applications of CTFT properties. And also demonstrate the interplay between the time and frequency domain.

6) State and prove the properties of CT Laplace Transform. Take any example of a system in time domain and demonstrate the application of LT in system analysis.

7) State and prove the various properties of z transform. Determine causality and stability of LTI system.

8) To perform auto and cross correlation for DT and CT signals. Also explain the relation between Convolution and Correlation.

Text Books:

1. Simon Haykins and Barry Van Veen, "Signals and Systems", Wiley India, 2nd Edition.
2. M.J. Roberts "Signal and Systems", Tata McGraw Hill 2007.
3. Dr. ShailaApte , "Signal and System", Wiley India Publication, 2nd Edition
4. Rameshbabu, "Signal and systems", Scientech publication

Reference Books:

1. Charles Phillips, "Signals, Systems and Transforms", Pearson Education, 3rd Edition.
2. A. NagoorKanni "Signals and Systems", McGraw Hill, 2nd Edition.
3. Schaum's Outline of "Theory and Problems of "Signal and system", 2nd Edition.

E- Books / E- Learning References:

1. NPTEL Course on "Principles of Signals &System "
   Link of the Course: https://nptel.ac.in/courses/108/104/108104100/
2. NPTEL Course on "Signals and systems"
   Link of the Course: http://www.nptelvideos.in/2012/12/signals-and-system.html

Second Year Electronics and Telecommunications (2022 Course)
Analog Communication Lab (ETPCC410)

Course Code:	**ETPCC410**	**Credit**	**1**
Contact Hours:	2 Hrs/week	**Type of Course:**	**Practical**
Examination Scheme	**Practical** 50 Marks		

Pre-requisites:

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Practical Examination	External	50

Course Objectives

1	To demonstrate generation and detection of AM ,DSB-SC,SSB signals.
2	To demonstrate generation and detection of FM .
3	To prove the sampling Theorem.
4	To demonstrate the pulse modulation techniques.

Course Outcomes: Students will be able to

410.1	Measure and calculate modulation index, spectrum of AM signal.
410.2	Measure and calculate modulation index, spectrum of FM signal.
410.3	Verify sampling theorem.
410.4	Acquire knowledge about pulse modulation systems.

List of Experiments: (Any 8)

1. To generate AM (DSB-FC): Calculation of modulation index by graphical method, Power of AM Wave for different modulating signal.
2. To detect AM signal using Envelope Detector - Practical diode detector, Observe effect of change in RC time constant which leads to diagonal and negative clipping
3. To generate DSB-SC with the help of Balanced Modulator IC1496/1596 & its detection
4. To generate SSB signal using Filter method/ phase shift method & its detection
5. To generate Frequency signal & demodulate using IC 565 (PLL based), calculation of modulation index & BW of FM.
6. Frequency modulator & demodulator using Varicap/Varactor Diode and NE 566 VCO.
7. Verification of Sampling Theorem, PAM Techniques, (Flat top & Natural sampling), reconstruction of original signal, Observe Aliasing Effect in frequency domain.
8. To Generate AM and FM waveform for given modulation index, signal frequency and carrier Frequency using suitable software.
9. Prove sampling Theorem. Reconstruct the analog signal from its samples. Observe aliasing effect by varying sampling frequency using suitable software.
10. Generation and Detection of PWM using IC 555 onFalstad.

Second Year Electronics and Telecommunications (2022 Course)
Sustainable Development Goals ETHSM 411

Course Code:	**ETHSM 411**	**Credit**	**1**
Contact Hours:	1 Hrs/week (L)	**Type of Course:**	Lecture
Examination Scheme	**TW Evaluation** 25 Marks		

Pre-requisites: Basic Concepts of Environmental Studies

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term work Evaluation	Internal	25

Course Objectives

1	To discuss the sustainable development goals.
2	To explain framework of Seventeen Sustainable Development Goals.
3	To discuss structure and order of Sustainable Development Goals.
4	To study cases of Sustainable Development Goals.

Course Outcomes: Students will be able to

411.1	Explain sustainable development goals.
411.2	Describe framework of Seventeen Sustainable Development Goals.
411.3	Discuss structure and order of Sustainable Development Goals.
411.4	Report case studies of Sustainable Development Goals.

Topics covered:

UNIT I: Introduction to SDGs (3 hrs.)

Sustainability, Sustainable development, Role of UN and the Need for SDGs, Scope and Inclusion and Agenda 2030, Our Common Future and Philosophy behind SDGs, Distinction between Development and Sustainable Development

UNIT II: Sustainable Development Goals(5 hrs.)

Framework and Structuring of Seventeen SDGs
SDG 1: No Poverty
SDG 2: Zero Hunger
SDG 3: Good Health and Well-being
SDG 4: Quality Education
SDG 5: Gender Equality
SDG 6: Clean Water and Sanitation
SDG 7: Affordable and Clean Energy
SDG 8: Decent Work and Economic Growth
SDG 9: Industry, Innovation and Infrastructure
SDG 10: Reduced Inequality
SDG 11: Sustainable Cities and Communities
SDG 12: Responsible Consumption and Production
SDG 13: Climate Action
SDG 14: Life Below Water
SDG 15: Life on Land

SDG 16: Peace and Justice Strong Institutions
SDG 17: Partnerships to achieve the Goal

UNIT III: SDG Structure and Order (3 hrs.)

Interrelationships and Connections between Seventeen SDGs, SDG Structure and Order at Levelsof People, Ecological and Spiritual , SDGs and Socio Ecological Systems: Economy; Society; Biosphere

UNIT IV: Sustainable Development Goals- Case Studies (2 hrs.)

Case Studies from around the World, Case studies from India

Syllabus contents required for competitive exams (GATE, UPSC, MPSC etc.)(*ifcompleteunit is applicable then write only "unit 1/2/.." or write the contents from that unit):*1. NA.

Text Books:

1. Hazra, Somnath., Bhukta, Anindya (2020) Sustainable Development Goals An Indian Perspective, Springer International Publishing, Switzerland
2. Ziai, Aram (2016) Development Discourse and Global History from colonialism to the sustainable development goals. Routledge, London & New York
3. OECD (2019), Sustainable Results in Development: Using the SDGs for Shared Results and Impact, OECD Publishing, Paris, https://doi.org/10.1787/368cf8b4-en.
4. Sachs, J., Schmidt-Traub, G., Kroll, C., Lafortune, G., Fuller, G., Woelm, F. 2020. The Sustainable Development Goals and COVID-19. Sustainable Development Report 2020. Cambridge: Cambridge University Press.

Relevantwebsites,movies, and documentaries

https://www.un.org/sustainabledevelopment/

Second Year Electronics and Telecommunications (2022 Course) Analog Electronic Circuits ETMNR301			
Course Code:	**ETMNR301**	**Credit**	**3**
Contact Hours:	3 Hrs/week (L)	**Type of Course:**	Lecture
Examination Scheme	End-sem. Examination: 75 Marks		

Pre-requisites:

Basic knowledge of Semiconductor Physics and Basic Electronics Engineering.

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term work	Internal	25
2.	End Semester Examination	External	75

Course Objectives	
1	To brief about Semiconductor devices JFET & MOSFET, its characteristics, parameters & applications.
2	To discuss MOSFET DC and AC Configurations and its analysis.
3	To introduce Concepts of feedbacks in amplifiers
4	To impart skills to evaluate the performance of voltage regulator

Course Outcomes: Students will be able to	
301.1	Compare the characteristics and parameters of JFET towards its applications.
301.2	Compare the characteristics and parameters of MOSFET towards its DC circuits.
301.3	Interpret, apply & evaluate MOSFET AC circuits.
301.4	Explain MOSFET amplifiers with and without feedback
301.5	Analyze the performance of voltage regulators towards its applications.

Topics covered:

UNIT I: Junction Field Effect Transistor (JFET) (6 hrs.)

Introduction to JFET, Types, Construction, Operation, Static Characteristics, Pinch off voltage, JFET Volt-Ampere characteristics, JFET Configurations (Common Source/Common Drain/Common Gate) and their Comparison. Self-Biasing circuit of JFET

UNIT II: Metal Oxide Semiconductor FET(MOSFET) & it's DC Analysis (6 hrs.)

MOSFET operation, Construction of n-channel E-MOSFET, E-MOSFET characteristics & parameters, non-ideal voltage current characteristics i.e. Finite output resistance, body effect, sub-threshold conduction, breakdown effects and temperature effects, MOSFET DC Analysis.

UNIT III: MOSFET AC circuit Analysis (6 hrs.)

MOSFET Common Source amplifier circuit, Load Line & Modes of operation, Small signal model of MOSFET and its parameters,Analysis of Common Source amplifier circuit. Frequency Response of CS Amplifier.

UNIT IV- Feedback amplifiers (6 hrs.)

Feedback Amplifiers: Four types of amplifiers. Feedback topologies. Effect of feedback on terminal characteristics of amplifiers. Examples of voltage series and Current series FET feedback amplifiers.

UNIT V- Voltage Regulator (6 hrs.)
Voltage Regulator: Block diagram of an adjustable three terminal positive and negative regulators (317,337), Typical connection diagram, Specifications of 317 and 337
Syllabus contents required for competitive exams (GATE, UPSC, MPSC etc.)(*if completeunit is applicable then write only "unit 1/2/.." or write the contents from that unit):*1. NA.

Text Books:

1.Millman Halkias, "Integrated Electronics-Analog and Digital Circuits and Systems", Tata McGraw Hill, 2000.

2.Donald Neaman, "Electronic Circuit Analysis and Design",3rd Edition, Tata McGraw Hill

3. David A.Bell,"ElectronicDevicesandCircuits",5thEdition, Oxford press

Reference Books:

1. R. L. Boylstad, L. Nashlesky, "Electronic Devices and circuitsTheory", 9thEdition, PrenticeHall of India, 2006.
2. Phillip E. Allen, Douglas R. Holberg, "CMOS Analog Circuit Design", Second Edition, Oxford.
3. K. R. Botkar, "Integrated Circuits", 5th Edition, Khanna Publication.

E- Books / E- Learning References:

1.NPTEL Course **"Analog Electronic Circuits"**
https://nptel.ac.in/courses/108/105/108105158/

2. NPTEL Course on **"Analog Circuits"**
https://nptel.ac.in/courses/108/101/108101094/

Second Year Electronics and Telecommunications (2022 Course)
Analog Electronic Circuits ETMNR302

Course Code:	**ETMNR302**	**Credit**	**1**
Contact Hours:	2 Hrs/week	**Type of Course:**	**Practical**
Examination Scheme	Term work 25 Marks		

Pre-requisites:

- Basic knowledge of Semiconductor Physics and Basic Electronics Engineering.

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Practical Examination	External	50

Course Objectives

1	To brief about Semiconductor devices JFET & MOSFET, its characteristics, parameters & applications.
2	To discuss MOSFET DC and AC Configurations and its analysis.
3	To introduce Concepts of feedback in amplifiers
4	To impart skills to evaluate the performance of voltage regulator

Course Outcomes: Students will be able to

302.1	Design and analyze analog electronic circuits.
302.2	Make use of the appropriate instrument for measurement
302.3	Implement and test the performance of the circuit.
302.4	Explain the working principle of different electronic circuits.

List of Experiments:

1.Design, build and test JFET/MOSFET voltage divider DC biasing circuit.

2.Build and test single-stage CS amplifier using MOSFET.

3.Simulate frequency response of single stage CS amplifier (use same circuit) and find the bandwidth.

4. Simulate current series feedback amplifier.

5. Design and implement an adjustable voltage regulator using three terminals voltage regulator

Second Year Electronics and Telecommunications (2022 Course)
Integrated Circuits ETMNR401

Course Code:	**ETMNR401**	**Credit**	**3**
Contact Hours:	3 Hrs/week (L)	**Type of Course:**	Lecture
Examination scheme	End-sem. Examination 75 Marks		

Pre-requisites:

Basic knowledge of Analog Electronic Circuits.

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term work	Internal	25
2.	End Semester Examination	External	75

Course Objectives

1	To understand Op amp Fundamentals.
2	To know linear and nonlinear applications of operational amplifier ICs.
3	To understand Filters using op amp
4	To study and use different special purpose ICs

Course Outcomes: Students will be able to

401.1	Identify internal structure and characteristics of op-amp
401.2	Explain and analyze Linear applications of op-amp
401.3	Explain and analyze Non-linear applications of op-amp
401.4	Design active filters
401.5	Apply functionalities of Timer IC with their applications

Topics covered:

UNIT I: Op Amp Fundamentals (6 hrs.)

Block diagram of OP-AMP, Explanations of each block, Differential Amplifier configurations, Differential amplifier analysis, Need and types of level shifter, ideal parameters and practical parameters of OP-AMP and their comparison

UNIT II: Linear Applications of Op Amp(6 hrs.)

Inverting and Non-inverting amplifier, voltage follower, voltage scaling, difference amplifier, Ideal integrator, errors in ideal integrator, practical integrator, frequency response of practical integrator,Ideal differentiator, errors in ideal differentiator, practical differentiator, frequency response of practical differentiator

UNIT III: Non Linear Applications of OP amp(6 hrs.)

Comparator,Schmitt trigger (symmetrical), Square wave generator, triangular wave generator, Problems in basic rectifier, Need of precision rectifier, Half wave, Full wave precision rectifiers,

UNIT IV: Filterss (6 hrs.)

Design and frequency scaling of First order and second order Active LP, HP, BP and wide and narrow band BR Butterworth filters and notch filter. All pass filters

UNIT V: Special Purpose IC(6 hrs.)

The 555 Timer IC, Internal schematic, Astable and monostable modes of operation, Applications of IC 555

Text Books:

1.Ramakant A Gayakwad, “Op-Amps and Linear Integrated Circuits”, PHI, 4th edition
2.D.Roy Choudhary, Shail Jain, “Linear Integrated Circuits”, New Age Int.
press

Reference Books:

4. Sergio Franco, “Design with Operational Amplifiers and Analog Integrated Circuits”, Tata McGraw Hill., Third Edition
5. G.B.Clayton, “Operational Amplifiers”, International Edition.
6. K. R. Botkar, “Integrated Circuits”, 5th Edition, Khanna Publication.

E- Books / E- Learning References:

1.NPTEL Course **“Integrated Circuits”**
https://nptel.ac.in/courses/108108111

Second Year Electronics and Telecommunications (2022 Course) Integrated Circuits Lab ETMNR402			
Course Code:	**ETMNR402**	**Credit**	**1**
Contact Hours:	2 Hrs/week	**Type of Course:**	**Practical**
Examination Scheme	**Term work 25 Marks**		

Pre-requisites:

- Basic knowledge of Analog Electronic Circuits.

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Practical Examination	External	50

Course Objectives	
1	To understand Op amp Fundamentals.
2	To know linear and nonlinear applications of operational amplifier ICs.
3	To understand Filters using op amp
4	To study and use special purpose IC

Course Outcomes: Students will be able to	
402.1	Design and analyze analog electronic circuits.
402.2	Make use of the appropriate instrument for measurement
402.3	Implement and test the performance of the circuit.
402.4	Explain the working principle of different electronic circuits.

List of Experiments: (any 5)

1. Measurement of Op amp DC Parameters
2. Measurement of Op amp AC Parameters
3. Simulate op-amp based Integrator
4. Design, build and test Symmetrical Schmitt Trigger circuit
5. Simulate Precision rectifiers.
6. Simulate Square wave and Triangular Wave generator
7. Simulate Active filter circuits
8. Design, build and test Astable /Monostable multivibrator using IC 555