GOVERNMENT COLLEGE OF ENGINEERING, AMRAVATI

DEPARTMENT OF ELECTRONICS ENGINEERING

Curriculum for Second Year

B. Tech. (Electronics and Telecommunication)

2020-2021

Specialization: Electronics and Telecommunication

PROGRAM OBJECTIVES

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

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

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

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

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

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

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

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

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

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

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

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

(B) PROGRAM SPECIFIC OUTCOMES (PSOs)

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

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

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

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

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

SEMESTER-III

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

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

*For direct second year admitted students

SST

SEMESTER-IV

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

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

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

SEMESTER-V

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

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

SHU525

SST

SEMESTER-VI

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

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

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

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

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

SEMESTER-VIII

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

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

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

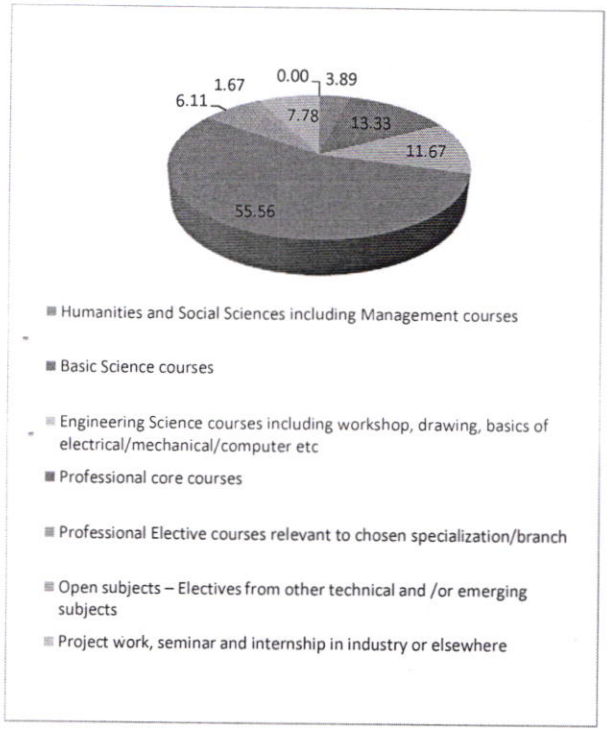
Elective Courses:

ETU624 Open Elective-I	ETU723 Open Elective-II	ETU623 Program Elective-I	ETU625 Program Elective-II	ETU721 Program Elective-III	ETU722 Program Elective-IV	ETU724 Program Elective-V	ETU821 Program Elective-VI
A) Consumer Electronics	A) Mechatronics	A)Information theory & coding	A)Microwave Engineering	A)Antennas & Wave propagation	A)Wireless Communication	A)Satellite Communication	A)Mobile Communication
B) Industrial Electronics	B) Bioengineering	B) Scientific Computing	B) Wavelets and other Engineering Transforms	B) Multirate DSP	B) Adaptive Signal Processing	B) Image and Video processing	B) Speech Processing
		C)Electronic Design Techniques with HDL	C)Micro-Electro-Mechanical Systems	C)CMOS Design	C)Mixed Signal Design	C) Nanotechnology	D)MEMS Technology
		D)Machine learning	D)Fuzzy Logic	D)Artificial Neural Network	D)Soft Computing tool	D) Pattern Recognition	D) Artificial Intelligence

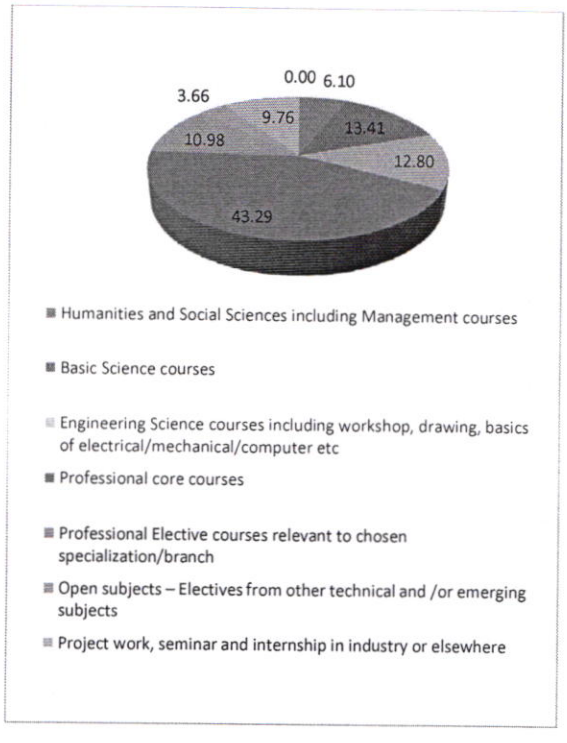
BSC Basic Science Courses
ESC Engineering Science Courses
HSMC Humanities and Social Sciences including Management courses
PCC Professional core courses
PEC Professional Elective courses
OEC Open Elective courses
LC Laboratory course
MC Mandatory courses
SI Summer Industry Internship
PROJ Project

Credit Distribution of Electronics and Telecommunication (Existing and Proposed)

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



Credit Distribution Chart (Existing)



Credit Distribution Chart (Proposed)

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

Sr. No.	Course code with Name of course(old) with total 184 credits		Credit	Course code with Name of course(new)with total 164 credits		Credit
1	SHU 302	Engineering Mathematics - III	3	SHU321C	Transform And Statistical Methods	4
2	ETU303	Electronics Devices and Circuits	4	ETU321	Electronic Devices and Circuits	4
3	ETU 401	Signals and Systems	4	ETU322	Signals and Systems	3
4	ETU 304	Digital Electronics	3	ETU323	Digital Electronics	3
5	ETU301	Network analysis	3	ETU324	Network Theory	4
6	SHU 205	General Proficiency I	2	No Equivalence Provided		--
7	No Equivalence Provided		--	SHU323	Introduction to Constitution of India	--
8	ETU307	Electronics Devices and Circuits Lab	1	ETU325	Electronics Devices and Circuits Lab	1
9	ETU 406	Signals and Systems Lab	1	ETU326	Signal and Systems Lab	1
10	ETU 308	Digital Electronics Lab	1	ETU327	Digital Electronics Lab	1
11	ETU302	Component Devices and instrument Technology	4	No Equivalence Provided		---
12	No Equivalence Provided		-	ETU328	Computer Programming Lab	1

13	ETU306	Component Devices and instrument Technology Lab	1	No Equivalence Provided		-
14	No Equivalence Provided		-	ETU421	Probability Theory and Stochastic Processes	3
15	ETU 404	Control System Engineering	3	No Equivalence Provided		-
16	No Equivalence Provided		-	ETU422	Analog Communication	3
17	ETU 402	Analog Circuits	4	ETU423	Analog Circuits	3
18	ETU 403	Microprocessor and its Interfacing	3	ETU424	Microprocessors and Microcontrollers	4
19	No Equivalence Provided		-	ETU425	Digital System Design	4
20	ETU 405	Object Oriented Programming Lab	2	No Equivalence Provided		-
21	No Equivalence Provided		-	SHU422	Environmental Studies	-
22	ETU 409	Control System Engineering Lab	1	No Equivalence Provided		-
23	No Equivalence Provided		-	ETU426	Analog Communication Lab.	1
24	ETU 407	Analog Circuits Lab	1	ETU427	Analog Circuits Lab.	1
25	ETU 408	Microprocessor and its Interfacing Lab	1	No Equivalence Provided		-
26	No Equivalence Provided		-	ETU428	Microprocessors and Microcontrollers Lab.	1

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

i) All courses of old curriculum shall be offered during the academic year (2020-2021) for back logger students.
ii) In the academic year 2021-22and onward all students shall register for courses as revised curriculum

Equivalence Scheme for online courses

Sr. No.	Course code with Name of course(old/new)		Credit	Course code with Name of course (online)	Name of Online platform	Credit
1.	ETU321	Electronic Devices and Circuits	4	1. NPTEL course on **Semiconductor Devices and Circuits** 2. NPTEL course on **Fundamental of Semiconductor Devices**	NPTEL	
2.	ETU322	Signals and Systems	3	1. NPTEL course on **Principles of Signals and Systems** 2. NPTEL course on **Signals and Systems**	NPTEL	
3.	ETU323	Digital Electronics	3	1. NPTEL course on **Digital Circuits and Systems** 2. NPTEL course on **Digital Electronic Circuits** 3. NPTEL course on **Digital Circuits**	NPTEL	
4.	ETU324	Network Theory	4	1.1 NPTEL course on **Network Analysis** 1.2 NPTEL course on **Networks and Systems** **(These two courses have covered 100**	NPTEL	

Sr. No.	Course code with Name of course(old/new)		Credit	Course code with Name of course (online)	Name of Online platform	Credit
				percent syllabus)		
5.	ETU501	Linear Integrated Circuits and Applications	3	1. NPTEL course on **OP-AMP Practical Applications: Design, Simulation and Implementation** 2. NPTEL course on **Integrated Circuits, MOSFETs, Op-Amps and their Applications** 3. NPTEL course on **Electronic Modules For Industrial Applications Using Op-Amps**	NPTEL	
6.	ETU502	Analog Communication	3	1. NPTEL course on **Principle of Communication Systems-Part1** 2*. NPTEL course on **Communication Engineering** **3.** NPTEL course on **Analog Communication**	NPTEL	
7.	ETU503	Power Electronics	3	1. NPTEL course on **Power Electronics** 2. NPTEL course on **Advanced Power Electronics and Control** 3. NPTEL course on **Fundamental of Power Electronics**	NPTEL	
8.	ETU504	Microcontroller and Its Applications	3	1. NPTEL course on **Microprocessors and Microcontrollers**	NPTEL	

Sr. No.	Course code with Name of course(old/new)		Credit	Course code with Name of course (online)	Name of Online platform	Credit
9.	ETU505	Humanities and Economics	3	Same course contents are not available in NPTEL/NOC but some topics are approx 30% align	NPTEL	
10.	ETU701	Digital System Design	3	1. NPTEL course on **Digital Electronic Circuits** 2. NPTEL course on **Digital Circuits and Systems**	NPTEL	
11.	ETU702	Digital Communications	3	1. NPTEL course on **Principles of Digital Communications** (IITB) 2. NPTEL course on **Modern Digital Communication Techniques**	NPTEL	
12.	ETU703-I(A)	Fiber Optic Communications	3	1. NPTEL course on **Fiber Optic Communication Technology** 2. NPTEL course on **Fiber Optic Communication Systems and Techniques** 3. NPTEL course on **Optical Communications**	NPTEL	
13.	ETU703-I(B)	Embedded Systems	3	1*. NPTEL course on **Embedded Systems** 2. NPTEL course on **Embedded System Design** 3. NPTEL course on **Embedded**	NPTEL	

Sr. No.	Course code with Name of course(old/new)		Credit	Course code with Name of course (online)	Name of Online platform	Credit
				Systems-Design Verification and Test		
14.	ETU703-I(D)	Artificial Intelligence	3	1. NPTEL course on **Fuzzy Logic Neural Networks**	NPTEL	
15.	ETU704-II(B)	Industrial Electronics	3	1. NPTEL course on **Power Electronics**	NPTEL	

Equivalence B. Tech. Second Year SH Courses A.Y. 2020-21

S.N.	Course in old scheme			Equivalent course in new Scheme		
	Course Code	Course name	No. of Credits	Course Code	Course name	No. of Credits
1	SHU301	Engineering Mathematics- III	03	SHU321A	Differential Equations And Probability	03
2		No Equivalence		SHU322A	Integral Calculus And Probability	03
3	SHU304	Engineering Mathematics- III	03	SHU321B	Transform And Linear Algebra	04
4		No Equivalence		SHU322B	Differential Equation And Transform	04
5	SHU303	Engineering Mathematics- III	03	SHU321C	Transform And Statistical Methods	04
6		No Equivalence		SHU322C	Integral Calculus And Probability	04
7		No Equivalence		SHU323	Introduction To Constitution Of India	00
8		No Equivalence		SHU324	Effective Technical Communication	03
9		No Equivalence		SHU325	Human Values And Ethics	00
10	SHU203	Environmental Studies	03	SHU422	Environmental Studies	00
11		No Equivalence		SHU425	Human Values And Ethics	00
12		No Equivalence		SHU525	Human Values And Ethics	00
13		No Equivalence		SHU725	Human Values And Ethics	00
14	SHU305	General Proficiency- II	2		No Equivalence	
15	SHU401	Engineering Mathematics- IV	3		No Equivalence	
16	SHU402	Engineering Mathematics Lab	2		No Equivalence	
17	SHU403	Engineering Mathematics Lab	2		No Equivalence	

Pulkane

Head, Mathematics

Member secretary
BoS Science & Humanities

Chairman
BoS Science & Humanities

SHU321C TRANSFORM AND STATISTICAL METHODS

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

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

ESE duration:2 Hrs 30 min

Course Objectives:

I. To study method solution of partial differential equations and apply it to solve wave and heat equations.
II. To learn Laplace transform and its properties. Apply it to solve differential equation and to calculate stability of LTI system.
III. To equip students with the foundations of probabilistic and statistical analysis mostly used in varied applications in engineering and science.

Partial differential equations: (10 hours)

Definition, order, degree, classification, formation of partial differential equation, method of separation of variables, first and second order one dimensional wave equation, heat equation and two dimensional Laplace equation.

Laplace Transform: (10 hours)

Laplace Transform, Properties of Laplace Transform, Laplace transform of causal periodic signals, Analysis and Characterization of LTI systems using the Laplace Transform, The transfer function and differential equation, Impulse response and Step response, Causality, Stability, Stability of a causal LTI system

Random variables and Probability Distributions: (10 hours)

Basic concepts of probability and its properties; Conditional probability and independent events; Random variables, discrete and continuous random variables, Mean and variance of Binomial, Poisson and Normal distributions and applications.

Sampling Distributions and Interval of Estimation: (08 hours)

Sampling Distributions: t-distribution, Chi-square distribution, Interval of estimation.

Text books:

1. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers,2020, 44th edition.
2. Advanced Engineering Mathematics, H.K.Das, S.Chand & Company Pvt.Ltd,2014.
3. A text book of Engineering Mathematics,N.P. Bali and Manish Goyal, Laxmi Publications, Reprint, 2010.

Reference books:

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

Course Outcomes:

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

SHU321(C).1	To solve partial differential equations and also to solve wave and heat equations.
SHU321(C).2	To use knowledge of Laplace Transform and to solve differential equation and to calculate stability of LTI system.
SHU321(C).3	Tackle problems related to continuous and discrete probability distributions.

ELPO/EXTC//INSTRU **(DSY)**

SHU322C INTEGRAL CALCULUS AND PROBABILITY

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

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

ESE duration:2 Hrs 30 min

Course Objectives:

I. To study method solution of partial differential equations and apply it to solve wave and heat equations.
II. To learn Laplace transform and its properties. Apply it to solve differential equation and to calculate stability of LTI system.

III. To equip students with the foundations of probabilistic and statistical analysis mostly used in varied applications in engineering and science.

Ordinary differential equations of higher orders: (08hours)

Linear differential equation with constant coefficient, complementary function, particular integral, complete solution; method of variation of parameters.

Integral Calculus: (08 hours)

Beta and Gamma functions and their properties; Evaluation of double integrals (Cartesian & polar), change of order of integration.

Partial differential equations: (08 hours)

Definition, order, degree, classification, formation of partial differential equation, method of separation of variables, first and second order one dimensional wave equation, heat equation

Laplace Transform:(08 hours)

Laplace Transform, Properties of Laplace Transform, Laplace transform of causal periodic signals, Analysis and Characterization of LTI systems using the Laplace Transform, The transfer function and differential equation, Impulse response and Step response,

Random variables and Probability Distributions: (08 hours)

Basic concepts of probability and its properties; Conditional probability and independent events; Random variables, discrete and continuous random variables, Mean and variance of Binomial, Poisson and Normal distributions and applications.

Text books:

1. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers, 2020, 44th edition.
2. Advanced Engineering Mathematics, H.K.Das, S.Chand & Company Pvt.Ltd, 2014.
3. A text book of Engineering Mathematics, N.P. Bali and Manish Goyal, Laxmi Publications, Reprint, 2010.

Reference books:

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

Course Outcomes:

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

SHU322(C).1 To solve partial differential equations and also to solve wave and heat equations.
SHU322(C).2 To use knowledge of Laplace Transform and to solve differential equation and to calculate stability of LTI system.
SHU322(C).3 Tackle problems related to continuous and discrete probability distributions.

ETU 321 ELECTRONIC DEVICES AND CIRCUITS

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

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

ESE duration: 2 Hrs 30 min

Course Objectives:

I. To introduce semiconductor devices and their properties.
II. To understand the behavior of semiconductor devices under the application of DC and AC signals.
III. To study MOSFET and BJT amplifier design process
IV. To introduce MOS Technology and related circuits.

Energy bands in intrinsic and extrinsic silicon; Carrier transport: diffusion current, drift current, mobility and resistivity; Generation and recombination of carriers; Poisson and continuity equation

P-N junction characteristics, I-V characteristics and small signal equivalent circuits of diodes, simple diode circuits: clipping, clamping and rectifiers, Zener diode

Bipolar transistors: Bipolar Junction Transistor, I-V characteristics and Ebers-Moll model; LED, photodiode and solar cell

Field Effect Devices: JFET/HFET, JFET characteristics, MIS structures, concept of accumulation, depletion and inversion, MOSFET operation, I-V characteristics, C-V characteristics, MOS capacitor and small signal models

Amplifier models: Voltage amplifier, current amplifier, trans-conductance amplifier and trans-resistance amplifier. Biasing schemes for BJT and FET amplifiers, bias stability, various configurations (such as CE/CS, CB/CG, CC/CD) and their features, small signal analysis, low frequency transistor models, estimation of voltage gain, input resistance, output resistance etc., low frequency analysis of multistage amplifiers

Text Books:

1. J. Millman, C. Halkias and Satyabrata jit, "Electronic Devices and Circuits," 2nd edition, Tata McGraw Hill, 2008.
2. D. R. Cheruku and B. T. Krushna, "Electronic Devices and Circuits," 2nd edition, Pearson Education, 2008.

Reference Books:

1. G. Streetman, and S. K. Banerjee, "Solid State Electronic Devices," 7th edition, Pearson,2014.
2. N.H.E. Weste and D.M. Harris, CMOS VLSI design: A Circuits and Systems Perspective, 4th Edition, Pearson Education India, 2011
3. Y. Tsividis and M. Colin, "Operation and Modeling of the MOS Transistor," Oxford Univ.Press, 2011.

Course Outcomes: At the end of this course students will demonstrate the ability to

ETU 321.1 Understand the principles of semiconductor Physics

ETU 321.2 Be familiar with electronic devices, and their applications to circuits

ETU 321.3 Be able to link knowledge of biasing and other characteristics with circuit operation

ETU 321.4 Realize simple amplifier circuits using BJT and FET.

ETU 322 SIGNALS AND SYSTEMS

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

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

ESE duration: 2 Hrs 30 min

Course Objectives: Students undergoing this course are expected to

I. Know types of signals, their representations for signal processing

II. Know type of systems required for communication and control system.
III. Know Fourier representation and Fourier transform of continuous and discrete time periodic signals
IV. Understand concept of region of convergence(ROC) of Laplace transform and Z-Transform
V. Know the significance of sampling theorem.

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

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

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

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

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

Text Books:

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

Reference books:

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

Course Outcomes:

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

ETU 322.1 Analyze different types of signals

ETU 322.2 Represent continuous and discrete systems in time and frequency domain using different transforms.

ETU 322.3 Investigate whether the system is stable

ETU 322.4 Analyze signals in terms of Z and Laplace transform.

ETU 322.5 Sampling and reconstruction of a signal

ETU323 DIGITAL ELECTRONICS

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

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

ESE duration:2 Hrs 30 min

Course Objectives:

I. To acquire the basic knowledge of digital logic circuit components which is the back bone for digital computers
II. To implement minimization techniques and Boolean algebra for circuit minimization
III. To understand, analyze and design combinational logic circuits using gates and MSIs
IV. To study various components and design sequential circuits and study semiconductor memories

Number system and codes: Positional number system – Binary, octal, decimal, hexadecimal, general conversions, arithmetic operations on unsigned and signed numbers, 1's, 2's, 9's, 10's complement method, negative number representation, BCD codes, gray codes, ASCII codes, error detection and correction codes. Overview and comparison of various logic families

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

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

Sequential circuits – latches, flip flops, edge triggering, asynchronous inputs. Shift registers, Universal shift register, applications. Binary counters – Synchronous and asynchronous up/down counters, mod-N counter, Counters for random sequence.

Semiconductor memories: RAM, ROM, PROM, EPROM, CCD and flash memories. Introduction to PLDs, PLA and FPGA.

Text Books:

1. Digital Design by Morris Mano, Pearson education, 2018

2. Digital Principles And Logic Design By A. Saha N. Manna By Infinity Science Press LLC, 2007

Reference Books:

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

Course outcomes

At the end of the course student will be able

ETU323.1 Optimize the digital circuits by applying the applying the Boolean algebra and other minimization techniques
ETU323.2 Examine and design the combinational circuits using gates and MSIs
ETU323.3 Realize the sequential circuits suing flip-flops counters and shift registers.
ETU323.4 Design and realize the digital logic circuits using SSI and MSIs.

ETU324 NETWORK THEORY

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

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

ESE duration: 2.30hrs

Course Objectives:

To make the student able

I. To understand the basics electrical circuits.
II. To apply electrical network theorems and to solve related numerical.
III. To apply Laplace Transform for steady state and transient analysis.
IV. To determine different network functions.

Node and Mesh Analysis: Node and mesh equation, Matrix approach of network containing voltage and current sources, Source transformation and Duality.

Network theorems: Superposition, Reciprocity, Thevenin's, Norton's, Maximum power Transfer, Compensation and Tallegen's theorem as applied to ac circuits.

Steady state response of a network to non-sinusoidal periodic inputs, Introduction to A.C circuits, Power factor, power calculations, Introduction to three phase a.c. circuit and power calculation.

Laplace transforms and properties: Partial fractions, Singularity functions, Waveform synthesis, Analysis of RC, RL, and RLC networks with and without initial conditions with Laplace transforms, evaluation of initial conditions.

Transient behavior, Concept of complex frequency, driving points and transfer functions, Concept of poles and zeros, their properties, Sinusoidal response from pole-zero locations, Convolution theorem. Behaviors of series and parallel resonant circuits.

Text Books:

1. Network analysis: Van Valkenburg, 3rd edition, Prentice Hall of India, 2000
2. Networks and Systems: D Roy Choudhury, 1st edition, New Age International (P) Limited,1998, reprint 2005

Reference Books:

1. Circuits and Networks: Sudhakar, A., Shyammohan S. P., 3rdedition,Tata McGraw-Hill, New Delhi, 2007
2. Engineering Circuit Analysis: William Hayt, 8th edition, McGraw-Hill Education, 2013

Course Outcomes:

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

ETU324.1 Understand basics electrical circuits with nodal and mesh analysis.
ETU324.2 Appreciate electrical network theorems.
ETU324.3 Apply Laplace Transform for steady state and transient analysis.
ETU324.4 Determine different network functions.
ETU324.5 Appreciate the frequency domain techniques.

SHU 323 Introduction to Constitution of India

Teaching Scheme: 1 L **Credit: 00**
Evaluation scheme: 60 ESE **Total Marks: 60**

Course Objectives:

To acquaint students about constitution of India, Fundamental rights, fundamental duties, electoral process and role of central, state and local government and its administration.

Unit I: Introduction to Constitution of India

Salient features of the Constitution of India, Preamble of the Constitution, fundamental rights and fundamental duties, Directive Principles of State Policy and relevance of directive principles. Parliamentary Form of Government in India- President, Vice-President, Prime Minister along with council of Minister, Parliament, Supreme court, Electoral process in India. Amendment Procedure.

Unit II: State executives Governor, chief minister, state legislature, high courts of state,

Unit III: Role and functions of local self government- Municipalities in India, with special reference to 73rd amendment. Panchayat Raj in India with special reference to 74th amendment.

Reference Books:

1. An Introduction to Constitution of India, M.V.Pylee, Vikas Publishing, 2002
2. Constitution of India, Dr. B. R. Ambedkar, Government of India Publication

3. Latest Publications of Indian Institute of Human Rights, New Delhi

Course outcomes:

On the successful completion of this course, Students shall be able to-

SHU323.1 Understand and remember the knowledge of basic information about Indian Constitution.

SHU323.2 Apply the knowledge of fundamental rights and fundamental duties.

ETU325 ELECTRONICS DEVICES AND CIRCUITS LAB

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

Course Objectives:

I. To understand operation of semiconductor devices

II. To understand input, output characteristics and application of semiconductor diodes and transistors

III. To understand the devices in detail to use this devices for various application

IV. To verify the theoretical concepts through circuit simulation package

The instructor may choose experiments as per his/her requirements, so as to cover entire course contents of ETU321. Minimum 8 experiments should be performed.

The list given below is just a guideline.

1. Simple diode circuits: clipping, clamping and rectifiers
2. Zener diode Characteristics and Zener diode as Voltage Regulator
3. Input and output Characteristics of BJT in CE configuration (find h parameters from the characteristics)
4. Single stage BJT CE amplifier (Find performance parameters - Av, Ri and Ro)
5. Comparison of CE, CC, CB configurations for Av, Ri, and Ro
6. Transfer and drain characteristics of JFET. (find gm, rd and μ from characteristics.)
7. Simulate frequency response of single stage BJT CE / FET CS amplifier. (effect of coupling and bypass capacitors)
8. Output and transfer characteristic of n-channel MOSFET
9. Output and transfer characteristic of p-channel MOSFET

Course Outcomes:

ETU325.1 Plot the characteristics of semiconductor diodes and transistors to understand their behavior

ETU325.2 Understanding the input and output characteristics and application of these devices.

ETU325.3 To study and understand the devices in detail to use this devices for various application.

ETU325.4 Simulate a few of the circuit applications using appropriate Circuit Simulation package.

Note :

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

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

ETU326 SIGNALS AND SYSTEMS LAB

Teaching Scheme: 02P	**Credits : 01**	**Evaluation Scheme : 25 ICA+25 ESE**
Total Marks: 50		**ESE Duration: 3.00 Hrs**

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

Course Objectives:

The objectives of this course are to

I. Provide learning practical implementation of the basic principles of signals
II. Acquire knowledge regarding types of system and their properties
III. Verify the concept of DFT, Z- transform and Laplace transform in the laboratory.
IV. Verify the concepts and applications of sampling and aliasing in the laboratory.
V. Provide practical exposure to random variables and processes.

Sample list is given below but any experiment related to signals and systems can be included

List of Experiments

1. To demonstrate generation of various types of signal representation.

2. To explore the effect of transformation of signal parameters (amplitude-scaling, and time shifting).

3. To verify different properties of a given system as linear or non-linear, causal or non-causal, stable or unstable etc.

4. Verification of Parseval's theorem associated with Fourier series analysis for a periodic square wave sampled using appropriate sampling frequency.

5. To study Fourier Transform and inverse Fourier Transform.

6. Verification of Multiplication property associated with Fourier series analysis for a periodic triangular wave sampled using appropriate sampling frequency.

7. Verification of shifting property associated with Fourier series analysis for a periodic square wave sampled using appropriate sampling frequency.

8 .To study Laplace transform and inverse Laplace Transform.

9. To study Z transform and inverse Z transform.

10. To study sampling, aliasing of discrete and continuous signals.

Course Outcomes: Student shall be able to

ETU326.1	Remember basic concepts of signals and systems.
ETU326.2	Analyzing signal and systems in time and frequency domain.
ETU326.3	Apply discrete Fourier transformation of signals.
ETU326.4	Understand need and concept of Z transform
ETU326.5	Evaluate energy and power spectral density of random variables and processes.

Note :

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

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

ETU327 DIGITAL ELECTRONICS LAB

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

Course Objectives:

I. To acquire the hands-on experience of digital component, circuit realization using bread board
II. To realize combinational logic circuits using gates and MSIs
III. To realize sequential circuits using gates and MSIs

The instructor may choose experiments as per his/her choice, so as to cover entire course contents of ETU323. Minimum 8 experiments should be performed.

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

1. Combinational Logic design using basic gates (Code Converters, Comparators, etc).
2. Combinational Logic design using decoders and MUXs.
3. Arithmetic circuits - Half and full address and subtractors.
4. Arithmetic circuits – design using adder ICs, BCD adder.
5. Flip flop circuit (RS latch, JK & master slave) using basic gates.
6. Asynchronous Counters
7. Synchronous counters, Johnson & Ring counters.
8. Sequential Circuit designs (sequence detector circuit).

Course Outcomes:

ETU327.1 To apply concepts and methods of digital system design techniques introduced in ETU323 through experimentation.
ETU327.2 To design, analyze, synthesize and realize combinational circuits using components and ICs
ETU327.3 To design and realize sequential circuits.
ETU327.4 To write clear and concise lab journal and reports.

Note :

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

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

ETU328 COMPUTER PROGRAMMING LAB

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

Course Objectives:

Students will be able to

I. Comprehend the difference between MATLAB and PYTHON
II. Study MATLAB as a scientific computing language with powerful computational built in functions and dynamic variable arrays with unbounded dimensions
III. Study Python as a Open source and huge community developed high level language with available various packages, useful for current era of big-data, cloud computing, web designing, natural language processing and data analytics
IV. Choose the suitable programming language for solving specific problems.

Lab contents: Minimum eight experiments shall be performed to cover entire curriculum of course out of following representative list.

1. Compare MATLAB and Python Programming Languages on the basis of their key features.
2. Write a MATLAB program for matrix manipulations like addition, substation, multiplication of two matrices, a matrix and a scalar variable.
3. Write a MATLAB program to read images, perform basic operations like changing brightness, adding, subtracting them and writing them. Use the imtool image viewer to perform the same operations on image.
4. Write a MATLAB program to perform logical operations; Create user defined functions to do the same logical operations.
5. Use Signal Generator block of MATLAB Simulink to produce Sine, square, triangle and random signals.
6. Write a Python program for calculating sum, average, mean, mode, median, standard deviation of elements in an array.
7. Write a Python program that will find minimum and maximum numbers in a List, compute average of these two and find the sum of differences of all the elements in the list from this average.
8. Write a Python program used to find all the words (substrings separated by a space) which are greater than given length k in a given String.
9. Write a Python program to find grades of the students. The test grade is an average of the respective marks scored in assignments, tests and lab-works using Dictionaries.
10. Write a Python program to sort the list of tuples by the second item of each tuple.
11. Write a python program to read contents of a file and copy only the content of odd lines into new file.

Course Outcomes:

ETU328.1	Understand the concept of MATLAB and PYTHON programming
ETU328.2	Acquire programming skills for MATLAB and PYTHON
ETU328.3	Applying MATLAB for interactive computations
ETU328.4	Develop ability to use PYTHON as a scripting language and write database applications

Note :

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

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

ETU421 PROBABILITY THEORY AND STOCHASTIC PROCESSES

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

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

ESE duration:2 Hrs 30 min

Course Objectives:

To make the student able

I. To understand the fundamentals of probability.
II. To understand the concepts of random variables.
III. To understand the concept of sequence and series of random variables.
IV. To understand theorems in random process, stochastic processes and its applications, its spectral representation and its spectrum estimation.
V. To understand Markov chains, Markov processes, Power spectral density and random variable in linear systems.

Set, sample sets, operation with sets, various relation, indicator; Probability theory, experiments, sample spaces and events; Axiom of probability; Assigning probability; Joints and Conditional probability; Bayes theorem; Independence.

Discrete random variables, cumulative distributed function; probability density function; Gaussian random variable and introduction to other important random variables; Conditional distribution and density ; reliability and failure rates;

Expected value of a random variable; expected value of function of a random variable; moments; central moments; conditional expected value; transformations of random variables; characteristic functions; ,probability generating functions; moment generating functions; evaluating tail probabilities, Markov's inequality, Chebyshev's inequality, Chernoff bound.

Random sequences and series; independent and identically distributed random variables; convergence modes of random sequences; law of large numbers; central limit theorem; confidence interval; random sum of random variables.

Random process its definition and classification of processes; mathematical tools for studying random processes; stationary and Ergodic random processes; properties of the autocorrelation function; Gaussian random processes; Poisson processes.

Definition and examples of Markov processes; calculating transition and state probabilities in Markov chain; characterization of Markov chain; continuous time Markov processes; Definition of power spectral density; Wiener-Khintchine-Einstein theorem; bandwidth of random process; spectral estimation; thermal noise ; introduction to random process in linear system.

Text Books:

1. Henry Stark and John W. Woods, "Probability and Random Processes with Applications to Signal Processing", 3rd edition, 2001, Pearson Education.
2. Athanasios Papoulis and S. Unnikrishna Pillai, "Probability, Random Variables and Stochastic Processes", 4th edition, 2002, McGraw Hill.

Reference Books:

1. Kai Lai Chung and Farid AitSahlia, "Elementary Probability Theory", 4th edition, 2007, Springer.
2. Simon Haykin, "Communication Systems", 4th edition, 2000, John Wiley & Sons.
3. Uwe Hassler, " Stochastic Processes and calculus", 1st edition, 2016, Springer.
4. Achim Klenke, " Probability Theory", 2nd edition, 2014, Springer.

Course Outcomes:

After completing this course, Students shall be able to learn:

ETU421.1 Representation of probability and random variables.

ETU421.2 Investigate characteristics of probability, random variables.

ETU421.3 Investigate the random sequence and series.

ETU421.4 Make use of theorems related to random variables, stochastic processes, its applications, its spectral representation and its spectrum estimation.

ETU421.5 Markov chains, Markov processes, Power spectral density and random variables in linear system.

ETU422 ANALOG COMMUNICATION

Teaching Scheme: 03L + 0T **Total: 03** **Credits: 03**
Evaluation Scheme: 30MSE + 10 TA + 60 ESE **Total Marks: 100**
ESE duration: 2.30hrs

Course Objective:

The course aims to provide the students with

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

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

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

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

Angle (Exponential) Modulation and Demodulation: Generalized concept and features of angle modulation; Frequency modulation (FM): modulation index, power requirement, frequency spectrum, bandwidth, phasor comparison of narrowband FM and AM waves, generation of FM, demodulation, interference in FM system, pre-emphasis and de-emphasis techniques, FM receiver, noise in FM receiver. Signal-to-noise ratio (SNR) calculations for frequency modulation (FM) for low noise conditions

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

Signal-to-noise ratio (SNR) calculations for amplitude modulation (AM) and frequency modulation (FM) for low noise conditions

Antenna and Wave propagation:

Antenna: Introduction, Basic Antenna system, Antenna parameters, Yagi Uda antenna, Dish antenna

Wave propagation: Fundamentals of electromagnetic waves, Ground wave propagation, sky wave, space wave, tropospheric scatter, Extraterrestrial propagation.

Ionosphere: Structure, layers of Ionosphere, critical frequency, MUF, skip distance and virtual height.

Text Books:

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

Reference Books:

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

Course Outcome:

ETU422.1 Interpret the basic concept of communication systems and gain the knowledge of components of analogue communication system.

ETU422.2 Understand the analog modulation transmission and reception and achieve Knowledge in various methods of analog and digital communication, including amplitude Modulation (AM), Frequency Modulation (FM) and Phase Modulation (PM)

ETU422.3 Illustrate how the mathematical concepts bend the analog communication process.

ETU422.4 Analyze the effect of noise on various transmission systems and learn wave propagation.

ETU422.5 Illustrate techniques for antenna parameter measurements.

ETU423 ANALOG CIRCUITS

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

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

ESE duration: 2 Hrs.30Min

Course Objectives:

To make the student able to

I. Study negative feedback and power amplifier circuits
II. Study various Oscillators circuits
III. Develop the skill to build, test, diagnose and rectify the OP-AMP based electronic circuits.
IV. Study various active filters

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

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

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

OPAMP, inverting, non-inverting, differential amplifier configurations, Input offset voltage, input bias and offset current, Thermal drift, CMRR, PSRR.

OP-AMP applications: review of inverting and non-inverting amplifiers, integrator and differentiator, summing amplifier, precision rectifier, Schmitt trigger and its applications. Active filters: Low pass, high pass, band pass and band stop, design guidelines.

Text Books:

1.Millman's Electronic Devices and Circuits, J. Millman, C. C. Halkias, S. Jit, 3rd edition, McGraw-Hill Education (India) Private Limited, 2010 .

2. Tobey, Graeme ,Huelsman , Operational amplifiers, Design and applications, McGraw Hills, Edition

Reference Books:

1. Adel S. Sedra and K. C. Smith, "Microelectronic Circuits," 6th Ed. Oxford University Press India, 2010

2. Electronics Devices and Circuits, S. Salivahanan, N. Sureshkumar, 3rd edition, McGrew Hill Education (India) Private Limited, 2012

3. Ramakant A Gayakwad, "Op-Amps and Linear Integrated Circuits", PHI, 4th edition

4. D.Roy Choudhary, Shail Jain, "Linear Integrated Circuits", New Age Int.

Course Outcomes:

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

ETU423.1	Analyze negative feedback amplifier and power amplifiers
ETU423.2	Understand various oscillator circuits
ETU423.3	Understand the functioning of OP-AMP and design OP-AMP based circuits
ETU423.4	Troubleshoot various linear applications of OP-AMP
ETU423.5	Helps students to know about active filter design

ETU424 MICROPROCESSORS AND MICROCONTROLLERS

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

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

ESE duration: 2Hrs.30Min.

Course Objectives:

To make the student able

I. To learn the fundamentals of microprocessors and microcontrollers
II. To understand the concepts of Assembly Language Programming
III. To understand the basic hardware interfacing
IV. To develop application based systems using microprocessors and microcontrollers with efficient programming

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

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

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

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

Introduction to Advanced Microcontrollers: ARM and PIC

Text Books:

1. Microprocessor, Architecture, Programming and Applications with 8085, Ramesh S. Gaonkar, 5th edition, Penram International Publication, 2004.
2. The 8051 microcontroller, Kenneth Ayala, 3rd edition, Delmar Cengage Learning, 2005.
3. 8051 Microcontroller and Embedded System, Muhammad Ali Mazidi, 2nd edition, Prentice Hall, 2000

Reference books:

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

Course Outcomes:

After completing this course, Students shall be able to:

ETU424.1 Understand Microprocessor and Microcontrollers basics

ETU424.2 Develop and implement Assembly language programs

ETU424.3 Understand the hardware interfaces required to develop a simple microcomputer system

ETU424.4 Develop simple application based projects.

ETU425 DIGITAL SYSTEM DESIGN

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

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

ESE duration: 2 hrs 30 min.

Course Objectives:
Student shall be

I. Able to perform the analysis and design of various digital electronic circuits.

II. Able to design and analyze a given combinational and sequential circuit.

II. Able to understand the logic design of programmable devices, including SPLDs, CPLDs and FPGAs.

III. Able to synthesize and simulate with hardware description language (VHDL)

Recapitulation of digital logic and minimization techniques.

Introduction to VHDL, design units, data objects, data types, concurrent and sequential statements.

Subprograms: Function, Procedures, attributes, generic, generate, package, IEEE std logic library, file I/O, test bench, component declaration, instantiation, configuration

Combinational logic circuit design and its VHDL implementation: Multiplexers, De-multiplexer, Encoders, Decoders, Comparators, Code converters, Priority encoders, Parity generator/checker.
Read only memory (ROM), Programmable Logic Array (PLA), Programmable array logic (PAL), Complex Programmable Logic Devices (CPLD) and field programmable gate array (FPGA).

Synchronous Sequential Circuit Design and its VHDL implementation: Design of shift registers and counters, analysis of clocked sequential networks, Finite state machines, Mealy and Moore, derivation of state graph and tables, state assignments.

Asynchronous sequential circuit design – primitive flow table, concept of race, critical race and hazards, design issues like metastability, synchronizers, clock skew and timing considerations. Introduction to place & route process.

Text Books:

1. Roth C.H., "Fundamentals of Logic Design", Jaico Publishers. V Ed., 2009.
2. Digital Circuit and Logic Design, S.C. Lee, 3rd edition, Prentice Hall of India Pvt. Ltd, 2002
3. M. M. Mano, "Digital Design", 6th ed., Pearson Education, Delhi, 2018.

4. VHDL: Analysis and Modeling of Digital Systems, Z. Navabi, McGraw Hill International Ed. 1998
5. A VHDL Primer, J. Bhasker, 1st Edition, PTR Prentice Hall, Englewood Cliffs, New Jersey, 1991

Reference Books :

1. Modern Digital Electronics, R. P. Jain , 4th edition, TMH Publication, 2009
2. T. L. Floyd "Digital Fundamentals", 11th ed., Pearson Education, 2018.
3. Wakerly J F, "Digital Design: Principles and Practices, Prentice-Hall", 5th Ed., 2018.
4. D. D. Givone, "Digital Principles and Design", Tata Mc-Graw Hill, New Delhi, 2003.
5. S.Brown and Z.Vranesic, "Fundamentals of Digital Logic with VHDL Design", Tata Mc-Graw Hill, 2013.
6. VHDL – 3rd Edition – Douglas Perry – TMH

Course Outcomes:

At the end of the course student shall be able to

ETU425.1 Design and Analysis of Combinational Logic circuits.

ETU425.2 Design and Analysis of Modular Combinational Logic circuits using MUX/DEMUX, Encoder/Decoder, PLDS.

ETU425.3 Design and Analysis of Sequential Logic circuits.

ETU425.4 Write a VHDL code to implement a particular design/block.

SHU422 Environmental Studies

Teaching Scheme: Th-01 **Credit: 00**
Evaluation scheme: 20TA + 30 ESE **Total Marks: 50**
ESE duration: 1Hr.30Min

Course objectives: The objectives of offering this course are to-

I. Be aware of various environmental factors and there preservation.
II. Teach them how to protect Environment and natural resources.

III. How to make equitable use of energy resources.

Course Content

The Multidisciplinary Nature of Environmental Studies: Definition, scope and importance, Need for public awareness.

Social issues and Environment: From Unsustainable to sustainable development, urban problems related to energy, Water conservation, rainwater harvesting, and watershed management Resettlement and rehabilitation of people, problems.
Environmental ethics: Issues and possible solution, Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, Wasteland reclamation. Consumerism and Waste products, Environment protection act, Air (prevention & control) act, Water (prevention and control) act, Wildlife protection act, Forest conservation act, Issues involved in enforcement of environmental legislation.
Human population and environment: Environment and human health, Human rights, Role of Information Technology in Environment and human health, Public awareness.

Natural Recourses: Conventional energy resources: definition, classification, composition, energy content types: coal, petroleum, natural gases, hydrogeothermal, nuclear, environmental implication of energy uses. Non conventional energy resources: solar energy, wind energy, tidal energy, geothermal energy, hydropowers and biogas.

Ecosystem and Biodiversity: Concept of ecosystem, Structure and function of ecosystem, Producer, consumer, decomposers. Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of following ecosystem: Forest ecosystem, Grass land ecosystem, Desert ecosystem Aquatic ecosystem (Rivers and ocean).
Introduction- definition: genetics, species and ecosystem, diversity.
Biogeographically classification of India. Conservation of biodiversity- In-situ and Ex-situ conservation of Biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts. Endangered and endemic species of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, national and local level. India as mega diversity nation. Hot spot of biodiversity.

Environmental Pollution: Definition, Causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Noise pollution, Thermal pollution, Nuclear hazards, Solid waste, Management, Causes effects and control measures, Role of individual in prevention of pollution, Hazardous waste management, Biomedical waste management, Disaster management: floods, earthquake, cyclone and landslides.

Course outcomes: After studying the course, the students will be able to:-

SHU422.1 Convey the Environmental awareness among peoples.

SHU422.2 Apply Conservation of various natural resources and environmental factors.

SHU422.3 Aware about social and environmental issues.

Recommended Books:

1) The Biodiversity of India, Bharucha Erach ,Marin Publishing Pvt. Ltd., Ahmedabad
2) Brunner R.C., 1989,Hazardous Waste Incineration, McGraw Hill Inc.
3) Marine pollution, Clark R.S., Clanderson Press Oxford (TB)
4) Environmental Chemistry, De A.K. Wiley Estern Lmt.
5) Environmental Chemistry, Sharma B.K., 2001 Goel Publ., House, Meerat.
6) Environmental Management, Wagner K.D., 1998, W.B. Saunders Co., Philadel phia, USA
7) Environmental Studies, Benny Joseph, 1st edition,2005,Tata Mcgraw-Hill Publ

ETU426 ANALOG COMMUNICATION LAB

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

Course Objective:

I. Familiarize the students with basic analog communication systems.
II. Integrate theory with experiments so that the students appreciate the knowledge gained from the theory course, e.g., amplitude and frequency modulation, pulse modulation.
III. Understand Modulation and demodulation techniques of AM, FM.
IV. Know Characteristics of AM and FM receivers.

Minimum eight experiments shall be performed to cover entire curriculum of course ETU422. The list is just a guide line.

List

1. To Study Noise Spectral density.

2. AM modulation: Calculation of Modulation Index.

3. FM modulation: Calculation of Modulation Index.

4. Pre-emphasis and De-emphasis.

5. FM Modulation using PLL.

6. Demodulation of AM and FM.

7. Effect of noise on AM and FM

8. Pulse Amplitude Modulation and Demodulation.

9. Generation of double side band suppressed carrier.

10. To study SSB modulation and de-modulation.

11. Observe and plot radiation pattern of Omni-directional and directional antenna.

Course Outcomes:

ETU426.1	To develop practical knowledge about theories of analog communication.
ETU426.2	Evaluate analog modulated waveform in time /frequency domain and also find modulation index.
ETU426.3	Develop understanding about performance of analog communication systems.
ETU426.4	Analyze performance of noise on AM and FM.
ETU426.5	Illustrate techniques for antenna parameter measurements and analyze the performance of radiation pattern.

Note :

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

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

ETU427ANALOG CIRCUITS LAB

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

The instructor may choose experiments as per his/her requirements, so as to cover entire course contents of ETU423.Minimum 10 experiments should be performed.

At the end of the laboratory work, students will demonstrate the ability to:

I. Design, build, test and analyze performance of various amplifier circuits.
II. Analyze and design various applications of OP-AMP
III. Simulate a few of the circuit applications using appropriate Circuit Simulation package.

Design Experiments

1. Single stage BJT CE amplifier.

(Find performance parameters - Av, Ri, Ro & Bandwidth for BJT CE amplifier.)

2. Voltage series feedback amplifier

3. Voltage shunt feedback amplifier

4.Class A power amplifier with resistive load

5. Multivibrator - astable, monostable bistable

6.OP-AMPapplications- Integrator, Differentiators.

7. OP-AMP applications- Schmitt trigger.

8. filter Design.

Simulation Based Experiments

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

(Effect of coupling and bypass capacitors.)

2.Design and simulate LC and RC oscillators.

(Compare practical and theoretical oscillation frequency.)

3. Design and simulate active filters

Note :

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

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

ETU428 MICROPROCESSORS AND MICROCONTROLLERS LAB

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

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

ESE duration: 3.00hrs

Course Objectives:

To make student able

I. To learn the instruction set of microprocessor and microcontroller
II. To understand the concept of Assembly Language Programming
III. To understand the interfacing of peripheral devices and their programming
IV. To develop application based programs

Minimum eight experiments shall be performed to cover entire curriculum of course ETU424. The list given below is just a guideline.

List:

To write Assembly Language Program (ALP) using 8085 and 8051

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

Course Outcomes:

After completing this course, Students shall be able to:

ETU424.1 Understand Microprocessor and Microcontrollers basics
ETU424.2 Develop Assembly language programs
ETU424.3 Learn the hardware interfaces required to develop a simple microcomputer system
ETU424.4 Develop simple application based projects

Note :

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

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

ETU331C Analog Electronic Circuits

Teaching Scheme	**: 03 L Total: 03**	**Credit: 03**
Evaluation Scheme	**: 15 CT1 + 15 CT2 +10 TA+ 60 ESE**	**Total Marks: 100**
Duration of ESE	**: 2 Hrs.30 min.**	

Module 1: Diode circuits (4 Hours)

P-N junction diode, I-V characteristics of a diode; review of half-wave and full-wave rectifiers, Zener diodes, clamping and clipping circuits.

Module 2: BJT circuits (8 Hours)

Structure and I-V characteristics of a BJT; BJT as a switch. BJT as an amplifier: small-signal model, biasing circuits, current mirror; common-emitter, common-base and common-collector amplifiers; Small signal equivalent circuits, high-frequency equivalent circuits

Module 3: MOSFET circuits (8 Hours)

MOSFET structure and I-V characteristics. MOSFET as a switch. MOSFET as an amplifier: small-signal model and biasing circuits, common-source, common-gate and common-drain amplifiers; small signal equivalent circuits - gain, input and output impedances, trans-conductance, high frequency equivalent circuit.

Module 4: Differential, multi-stage and operational amplifiers (8 Hours)

Differential amplifier; power amplifier; direct coupled multi-stage amplifier; internal structure of an operational amplifier, ideal op-amp, non-idealities in an op-amp (Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product)

Module 5: Linear applications of op-amp (8 Hours)

Idealized analysis of op-amp circuits. Inverting and non-inverting amplifier, differential amplifier, instrumentation amplifier, integrator, active filter, P, PI and PID controllers and lead/lag compensator using an op-amp, voltage regulator, oscillators (Wein bridge and phase shift). Analog to Digital Conversion.

Module 6: Nonlinear applications of op-amp (6 Hours)

Hysteretic Comparator, Zero Crossing Detector, Square-wave and triangular-wave generators. Precision rectifier, peak detector. Monoshot.

Text/References:

A. S. Sedra and K. C. Smith, "Microelectronic Circuits", New York, Oxford University Press, 1998.

1. J.V.Wait, L.P. Huelsman and G.A.Korn, "Introduction to Operational Amplifier theory and applications", McGraw Hill U. S., 1992.
2. J. Millman and A. Grabel, "Microelectronics", McGraw Hill Education, 1988.
3. P. Horowitz and W. Hill, "The Art of Electronics", Cambridge University Press, 1989.
4. P. R. Gray, R. G. Meyer and S. Lewis, "Analysis and Design of Analog Integrated Circuits" John Wiley & Sons, 2001.

Course Outcomes:

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

ETU331(C).1	Understand the characteristics of transistors.
ETU331(C).2	Design and analyze various rectifier and amplifier circuits.
ETU331(C).3	Design sinusoidal and non-sinusoidal oscillators.
ETU331(C).4	Understand the functioning of OP-AMP and design OP-AMP based circuits

ETU332C Analog Electronic Circuits Lab

Teaching Scheme	**: 02 P**	**Total: 02**	**Credit: 01**
Evaluation Scheme	**: 50 ICA**		**Total Marks: 50**

Minimum eight hands-on experiments related to the course contents of ETU331C Analog Electronic Circuits **shall be performed.**

The representative list of experiment is as follows.

1. To study and compare V-I characteristics of PN- junction diode and Zener diode.
2. To Study of diode as clipper and clamper.
3. To study half wave & full wave rectifier without filter and to calculate its ripple factor
4. To study bridge full wave rectifier without filter and to calculate its ripple factor.
5. To study half wave & full wave rectifier with filter and to calculate its ripple factor
6. To study bridge full wave rectifier with filter and to calculate its ripple factor.
7. To study the input and output characteristics of a given transistor in CE configuration.
8. To Study of CE amplifier- current & power gains and input, output impedances.
9. To study biasing of transistor by following method:

a. Fixed bias. b. Voltage divider bias.

10. To study the frequency response of RC coupled amplifier.
11. Measurement and study of output characteristics of JFET.
12. Measurement and study of output characteristics of MOSFET.
13. To study Hartley oscillator.
14. To study the different types of negative feedback in two stage amplifier and to observe its effects upon the amplifier parameters.

15To study biasing of transistor by following method:

a. Fixed bias. b. Voltage divider bias.

Course Outcomes:

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

ETU332(C).1	Set up a bias point in a transistor.
ETU332(C).2	Verify the working of diodes, transistors and their applications.
ETU332(C).3	Build a common emitter/base/collector amplifier and measure its voltage gain.
ETU332(C).4	Explore the operation and advantages of feedback amplifiers.
ETU332(C).5	Learn to design different types of filters and apply the same to oscillators and amplifiers.

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

ETU431C Digital Electronics

Teaching Scheme : 03 L Total: 03 **Credit: 03**
Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE : 2 Hrs.30 min.

Module 1:Fundamentals of Digital Systems and logic families (7Hours)
Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, number systems-binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes, characteristics of digital lCs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-statelogic.

Module 2: Combinational Digital Circuits (7Hours)
Standard representation for logic functions, K-map representation, simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, seria ladder, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices, Q-M method of function realization.

Module 3: Sequential circuits and systems (7Hours)
A 1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop, J- K-TandD-types flipflops, applications of flipflops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple(Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of counters.

Module 4: A/D and D/A Converters (7Hours)
Digital to analog converters: weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, examples of D/A converter lCs, sample and hold circuit, analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters, example of A/D converter ICs

Module 5: Semiconductor memories and Programmable logic devices. (7Hours)

Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, read only memory (ROM), read and write memory(RAM), content addressable memory (CAM), charge de coupled device memory (CCD), commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic, complex Programmable logic devices (CPLDS), Field Programmable Gate Array (FPGA).

Text/References:

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.
3. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.

Course Outcomes:

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

ETU431(C).1	Understand working of logic families and logic gates.
ETU431(C).2	Design and implement Combinational and Sequential logic circuits.
ETU431(C).3	Understand the process of Analog to Digital conversion and Digital to Analog conversion.
ETU431(C).4	Be able to use PLDs to implement the given logical problem.

ETU432C Digital Electronics Lab

Teaching Scheme : 02 P **Total: 02** **Credit: 01**
Evaluation Scheme : 25 ICA + 25 ESE **Total Marks: 50**

Minimum Eight hands-on experiments related to the course contents of ETU 431C Digital Electronics to be performed. Representative list is as follows:

1. To verify truth table of different logic gates.
2. NOR gate as universal gate: Realization of AND/ OR/ NAND/ NOT/ EX-OR gates using NOR gates only
3. NAND gate as universal gate: Realization of AND/ OR/ NOR / NOT/ EX-OR gates using NAND gates only
4. Realization of half adder using gates
5. Realization of half subtractor using gates
6. Implementation of full Adder circuit using gates
7. To study Flip-Flops (Realization of RS/ T/ D/ JKMS flip-flops using logic gates)
8. To study counters: Up counter/ down counter/ up-down counter/ decade counter
9. To study shift registers: Left shift/ right shift register
10. To study analog to digital converter
11. To study digital to analog converter

Course Outcomes:

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

ETU432(C).1 Analyze and design simple logic circuits using gates

ETU432(C).2 Construct the circuits for experiments and take readings/ observations

ETU432(C).3 Derive conclusions on the basis of the readings/ observations in context of digital electronics

ETU432(C).4 Explain the working principle of various combinational and sequential logic circuits

ETU432(C).5 Explain the working principle of ADC and DAC

Note:

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

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