Sanjivani Rural Education Society's

Sanjivani College of Engineering, Kopargaon

(An Autonomous Institute Affiliated to Savitribai Phule Pune University, Pune)

DECLARATION

We, the Board of Studies in Electronics and Telecommunication Engineering, hereby declare that, We have designed the Curriculum up to Final Year. B. Tech. Semester-VIII of 2019 Pattern w.e.f A.Y 2022-2023 as per the guidelines. This document also contains the proposed structure Electronics and Telecommunication Engineering. So, we are pleased to submit and publish this FINAL copy of the curriculum for the information of all the concerned stakeholders.

Recommended by

(Dr. B. S. Agarkar)
Chairman
BoS Electronics and Telecommunication Engineering

Approved by

(Dr. A. G. Thakur)
Chairman
Academic Council
SRES Sanjivani College of Engineering, Kopargaon

S. Y. B. TECH. (Electronics and Telecommunication Engineering) SEMESTER-III

Course			Teaching Scheme (Hours/week)				Evaluation Scheme/Max Marks						
							Theory			OR	PR	TW	Total
Cat	Code	Title	L	T	P	Credits	ISE	ESE	CA				
PROJ	ET201	Professional Internship-I	-	-	-	2	-	-	-	50	-	-	50
BSC	BS202	Vector Calculus and Differential Equations	3	1	-	4	30	50	20	-	-	-	100
PCC	ET203	Network Theory	4	-	-	4	30	50	20	-	-	-	100
PCC	ET204	Electronic Devices and Circuits	3	-	-	3	30	50	20	-	-	-	100
PCC	ET205	Digital Electronics	3	-	-	3	30	50	20	-	-	-	100
HSMC	HS206	Universal Human Values & Ethics	3	-	-	3	30	50	20	-	-	-	100
LC	ET207	Network Theory Laboratory	-	-	2	1	-	-	-	50	-	25	75
LC	ET208	Electronic Devices and Circuits Laboratory	-	-	2	1	-	-	-	-	50	25	75
LC	ET209	Digital Electronics Laboratory	-	-	2	1	-	-	-	-	50	25	75
MC	MC210	Mandatory Course-III Constitution of India – Basic features and fundamental principles	2	-	-	No	-	-	-	-	-	-	-
		Total	**18**	**1**	**6**	**22**	**150**	**250**	**100**	**100**	**100**	**75**	**775**

SEMESTER-IV

Course			Teaching Scheme (Hours/week)				Evaluation Scheme/Max Marks						
							Theory			OR	PR	TW	Total
Cat	Code	Title	L	T	P	Credits	ISE	ESE	CA				
PCC	ET211	Transform Theory and Applied Mathematics	3	-	-	3	30	50	20	-	-	-	100
PCC	ET212	Data Structures	4	-	-	4	30	50	20	-	-	-	100
PCC	ET213	Analog Communication	3	-	-	3	30	50	20	-	-	-	100
PCC	ET214	Signals & Systems	4	-	-	4	30	50	20	-	-	-	100
LC	ET215	Transform Theory and Applied Mathematics Tutorial	-	1	-	1	-	-	-	-	-	25	25
LC	ET216	Data Structures Laboratory	-	-	2	1	-	-	-	-	50	25	75
LC	ET217	Analog Communication Laboratory	-	-	2	1	-	-	-	-	50	25	75
LC	ET218	Signals & Systems Tutorial	-	1	-	1	-	-	-	50	-	-	50
PROJ	ET219	Mini Project/Choice Based Subject*	-	-	4	2	-	-	-	-	-	50	50
PROJ	ET220	Technical Seminar	-	-	4	2	-	-	-	-	-	50	50
MC	MC221	Mandatory Course-IV Innovation - Project based – Sc., Tech, Social, Design & Innovation	2	-	-	No	-	-	-	-	-	-	-
		Total	**16**	**2**	**12**	**22**	**120**	**200**	**80**	**50**	**100**	**175**	**725**

Sanjivani Rural Education Society's Sanjivani College of Engineering Kopargaon

Total Credits: 44 **Total Marks: 1500**

(Dr. B. S. Agarkar)
HOD and Chairman BOS
E&TC

(Dr. A. B. Pawar)
Dean Academic

(Dr. A. G. Thakur)
Director and Chairman
Academic Council

T. Y. B. TECH. (Electronics and Telecommunication Engineering) SEMESTER-V

Course			Teaching Scheme (Hours/week)				Evaluation Scheme/Max Marks						
							Theory			OR	PR	TW	Total
Cat	Code	Title	L	T	P	Credits	ISE	ESE	CIA				
PROJ	ET301	Professional Internship-II	-	-	-	2	-	-	-	50	-	-	50
PCC	ET302	Control System	3	-	-	3	30	50	20	-	-	-	100
PCC	ET303	Digital Communication	3	-	-	3	30	50	20	-	-	-	100
PCC	ET304	Linear Integrated Circuits	3	-	-	3	30	50	20	-	-	-	100
PCC	ET305	Object Oriented Programming	3	-	-	3	30	50	20	-	-	-	100
PEC	ET306	Refer List of PEC1	3	-	-	3	30	50	20	-	-	-	100
LC	ET307	Control Systems Tutorial		1		1						25	25
LC	ET308	Digital Communication Laboratory	-	-	2	1	-	-	-	25	-	-	25
LC	ET309	EIC Laboratory	-	-	2	1	-	-	-	-	50		50
LC	ET310	OOP Laboratory	-	-	2	1	-	-	-	-	50		50
PROJ	ET311	Skill Based Credit Course	1	-	-	1	-	-	50	-	-	-	50
MC	MC312	Mandatory Course-V	1	-	-	No	-	-	-	-	-	-	-
		Total	**17**	**1**	**6**	**22**	**150**	**250**	**150**	**75**	**100**	**25**	**750**

MC312	Mandatory Course-V	Sanjivani ECE Talks

SEMESTER-VI

Course			Teaching Scheme (Hours/week)				Evaluation Scheme/Max Marks						
							Theory			OR	PR	TW	Total
Cat	Code	Title	L	T	P	Credits	ISE	ESE	CIA				
PCC	ET313	Microprocessors and Microcontrollers	3	-	-	3	30	50	20	-	-	-	100
PCC	ET314	Electromagnetics	3	-	-	3	30	50	20	-	-	-	100
PEC	ET315	Refer List of PEC2	3	-	-	3	30	50	20	-	-	-	100
OEC	ET316	OEC1: Artificial Intelligence	4	-	-	4	30	50	20	-	-	-	100
HSMC	HS317	Employability Skill Development	1	-	2	2	-	-	-	-	-	50	50
PROJ	ET318	IPR & EDP	2	-	-	2	15	25	10	-	-	-	50
LC	ET319	Microprocessors and Microcontrollers Laboratory	-	-	2	1	-	-	-	-	50	-	50
LC	ET320	Electromagnetics Tutorial	-	1	-	1	-	-	-	50	-	-	50
LC	ET321	IPR & EDP Practical	-	-	2	1	-	-	-	-	-	50	50
MC	MC322	Mandatory Course-VI	1	-	-	No	-	-	-	-	-	-	-
		Total	**17**	**1**	**6**	**20**	**135**	**225**	**90**	**50**	**50**	**100**	**650**

MC322	Mandatory Course-VI	Electronic Waste Management

Professional Elective Course 1 (PEC1):
ET306A Digital Signal Processing
ET306B Database Management system
ET306C Power Electronics

Professional Elective Course 2 (PEC2):
ET315A Digital Image Processing
ET315B Web Technologies
ET315C Renewable Energy Systems

Total Credits: 42

Total Marks: 1400

Sanjivani Rural Education Society's Sanjivani College of Engineering Kopargaon

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Final Year B. TECH. 2019 Pattern (Electronics and Telecommunication Engineering)

SEMESTER-VII

Course			Teaching Scheme (Hours/week)				Evaluation Scheme/Max Marks						
							Theory						
Cat	Code	Title	L	T	P	Credits	CIA	ISE	ESE	OR	PR	TW	Total
PROJ	ET401	Professional Internship-III	-	-	-	2	-	-	-	50	-	-	50
PCC	ET402	Microwave and Optical Communication	3	-	-	3	20	30	50	-			100
PCC	ET403	Embedded Systems and RTOS	3	-	-	3	20	30	50	-	-	-	100
PEC	ET404	Refer List of PEC3	3	-	-	3	20	30	50	-	-	-	100
OEC	ET405	OE-II: The Joy of Computing using Python	3	-	-	3	25	-	75	-	-	-	100
OEC	ET406	OE-III: Online Course Through MOOCs	2	-	-	2	20	-	30	-	-	-	50
LC	ET407	Microwave and Optical Communication Laboratory	-	-	2	1	-	-	-	-	50	-	50
LC	ET408	Embedded Systems and RTOS Laboratory	-	-	2	1	-	-	-	50		-	50
PROJ	ET409	Project Stage I	-	-	4	2				50	-	-	50
MC	MC410	Mandatory Course-VII	-	-	2	No	-	-	-	-	-	-	-
		Total	**14**	**-**	**10**	**20**	**105**	**90**	**255**	**150**	**50**	**-**	**650**

MC410	Mandatory Course-VII	Embedded System Design using MSP430

SEMESTER-VIII

Course			Teaching Scheme (Hours/week)				Evaluation Scheme/Max Marks						
							Theory						
Cat	Code	Title	L	T	P	Credits	CIA	ISE	ESE	OR	PR	TW	Total
PCC	ET411	VLSI Design Technology	3	-	-	3	20	30	50	-	-	-	100
PCC	ET412	Mobile Communication	3	-	-	3	20	30	50	-	-	-	100
PCC	ET413	Computer Networks & Security	3	-	-	3	20	30	50	-	-	-	100
PEC	ET414	Refer List of PEC4	3	-	-	3	20	30	50	-	-	-	100
LC	ET415	VLSI Design Technology Laboratory	-	-	2	1	-	-	-	-	50	-	50
LC	ET416	Mobile Communication Laboratory	-	-	2	1	-	-	-	50	-		50
PROJ	ET417	Project Stage II	-	-	8	4	-	-	-	50	-	100	150
MC	MC418	Mandatory Course-VIII	1	-	-	No	-	-	-	-	-	-	-
		Total	**13**	**-**	**12**	**18**	**80**	**120**	**200**	**100**	**50**	**100**	**650**

MC418	Mandatory Course-VIII	Role of Electronics in Biomedical Engineering

Professional Elective Course 3 (PEC3):
ET404A Video Processing
ET404B Data Mining
ET404C Robotics & Automation

Professional Elective Course 4 (PEC4):-
ET414A Audio and Speech Processing
ET414B Data Analytic
ET414C Automotive Electronics

Total Credits: 38

Total Marks: 1300

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BOS ETE

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Sanjivani Rural Education Society's

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B. Tech. Electronics and Telecommunication Engineering

2019 pattern

Program Structure

(B. Tech. with effect from Academic Year 2019-2020)

At. Sahajanandnagar, Post. Shingnapur Tal. Kopargaon Dist. Ahmednagar,

Maharashtra State, India PIN 423603

Department Vision

Our vision is to produce quality professionals in the field of Electronics & Telecommunication Engineering with knowledge and skillsets to meet diversifying needs of industry and society.

Department Mission

M1- To impart the technology of Electronics & Telecommunication Engineering through effective teaching-learning process.

M2- To establish linkages between industry and academia for overall development of students.

M3- To promote innovative ideas in solving multi-disciplinary engineering problems having social relevance.

M4- To develop technical human resources exhibiting professional and ethical attitudes.

Program Outcomes (POs)

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Educational Objectives (PEOs)

The PEOs of undergraduate programme in Electronics and Telecommunication Engineering are

PEO1: Involve in design, manufacturing, integration and testing of products, software and systems in the field of Electronics & Telecommunication engineering and allied disciplines**.**

PEO2: Solve engineering problems having social relevance by applying knowledge and skillsets related to Electronics & Telecommunication engineering.

PEO3: Pursue higher Education/Research in the field of Engineering/Management or to become a successful entrepreneur in the related areas.

PEO4: Work effectively as an individual and/or a team member of multi-disciplinary assignments involving people across different cultures and national boundaries.

Program Specific Outcomes (*PSOs*)

PSO1: Design, test and implement electronic systems and appliances related to signal processing, embedded systems, industrial automation and IoT using the state of the art components and software.

PSO2: Architect, classify and select appropriate technologies for the implementation of wired and wireless communication systems.

CURRICULUM STRUCTURE - 2019 PATTERN
Second Year B. Tech. (Electronics and Telecommunication Engineering)
WITH EFFECT FROM ACADEMIC YEAR 2020-2021

SEMESTER-I

Course			Teaching Scheme Hours/week				Evaluation Scheme-Marks						
							Theory						
Cat	Code	Title	L	T	P	Credits	ISE	ESE	CA	OR	PR	TW	Total
PROJ	ET201	First Year Internship	-	-	-	2	-	-	-	50	-	-	50
BSC	BS202	Vector Calculus and Differential Equations	3	1	-	4	30	50	20	-	-	-	100
PCC	ET203	Network Theory	4	-	-	4	30	50	20	-	-	-	100
PCC	ET204	Electronic Devices and Circuits	3	-	-	3	30	50	20	-	-	-	100
PCC	ET205	Digital Electronics	3	-	-	3	30	50	20	-	-	-	100
HSMC	HS206	Universal Human Values & Ethics	3	-	-	3	30	50	20	-	-	-	100
LC	ET207	Network Theory Laboratory	-	-	2	1	-	-	-	50	-	25	75
LC	ET208	Electronic Devices and Circuits Laboratory	-	-	2	1	-	-	-	-	50	25	75
LC	ET209	Digital Electronics Laboratory	-	-	2	1	-	-	-	-	50	25	75
MC	MC210	Mandatory Course-III	2	-	-	No	-	-	-	-	-	-	-
		Total	**18**	**1**	**6**	**22**	**150**	**250**	**100**	**100**	**100**	**75**	**775**

MC210	**Mandatory Course-III**	**Constitution of India – Basic features and fundamental principles**

List of Abbreviations

Abbreviation	Full Form	Abbreviation	Full Form
BSC	Basic Science Course	**MC**	Mandatory Course
ESC	Engineering Science Course	**PCC**	Professional Core Course
HSMC	Humanities/Social Sciences/Management Course	**PEC**	Professional Elective Course
IP	Induction Program	**OEC**	Open Elective Course
L	Lecture	**LC**	Laboratory Course
T	Tutorial	**CA**	Continuous Assessment
P	Practical	**OR**	End Semester Oral Examination
ISE	In-Semester Evaluation	**PR**	End Semester Practical Examination
ESE	End-Semester Evaluation	**TW**	Continuous Term Work Evaluation
Cat	Category	**PROJ**	Project

SEMESTER-II

Course			Teaching Scheme Hours/week				Evaluation Scheme-Marks						
							Theory			OR	PR	TW	Total
Cat	Code	Title	L	T	P	Credits	ISE	ESE	CA				
PCC	ET211	Transform Theory and Applied Mathematics	3	-	-	3	30	50	20	-	-	-	100
PCC	ET212	Data Structures	4	-	-	4	30	50	20	-	-	-	100
PCC	ET213	Analog Communication	3	-	-	3	30	50	20	-	-	-	100
PCC	ET214	Signals & Systems	4	-	-	4	30	50	20	-	-	-	100
LC	ET215	Transform Theory and Applied Mathematics Tutorial	-	1	-	1	-	-	-	-	-	25	25
LC	ET216	Data Structures Laboratory	-	-	2	1	-	-	-	-	50	25	75
LC	ET217	Analog Communication Laboratory	-	-	2	1	-	-	-	-	50	25	75
LC	ET218	Signals & Systems Tutorial	-	1	-	1	-	-	-	50	-	-	50
PROJ	ET219	Mini Project/Choice Based Subject*	-	-	4	2	-	-	-	-	-	50	50
PROJ	ET220	Seminar	-	-	4	2	-	-	-	-	-	50	50
MC	MC221	Mandatory Course-IV	2	-	-	No	-	-	-	-	-	-	-
		Total	**16**	**2**	**12**	**22**	**120**	**200**	**80**	**50**	**100**	**175**	**725**

***Note:** Choice Based Subject Teaching Scheme can be decided by department without losing its assigned credits.

MC221	**Mandatory Course-IV**	**Innovation - Project based – Sc., Tech, Social, Design & Innovation**

List of Abbreviations

Abbreviation	Full Form	Abbreviation	Full Form
BSC	Basic Science Course	**MC**	Mandatory Course
ESC	Engineering Science Courses	**PCC**	Professional Core Course
HSMC	Humanities/Social Sciences/Management Courses	**PEC**	Professional Elective Courses
IP	Induction Program	**OEC**	Open Elective Courses
L	Lecture	**LC**	Laboratory Courses
T	Tutorial	**CA**	Continuous Assessment
P	Practical	**OR**	End-Semester Oral Examination
ISE	In-Semester Evaluation	**PR**	End -Semester Practical Examination
ESE	End-Semester Evaluation	**TW**	Continuous Term Work Evaluation
Cat	Category	**PROJ**	Project

Total Credits : 44	**Total Marks : 1500**

Internship 1 (ET201)

Teaching Scheme	Examination Scheme
Lectures: -- Hrs. / Week	OR : 50 Marks
Tutorials: -- Hrs. / Week	
Credits : 02	Total : 50 Marks

Learning from textbooks, lectures and other study material is necessary to create a strong foundation for the students. But in order to give them insights into the real corporate world it is necessary to provide them a taste of practical side of things. Therefore, industrial learning forms a principal part of Engineering studies helping the students gain hands on experience and identify their prospective areas of work in the overall organizational function. Hence Sanjivani College of Engineering offers a month long exposure to the industries in the form of summer internships in reputed organizations/ In house training / Online courses offered by reputed institutes. Students are involved in this internship at the end of their even semester. This opportunity also serves as the ground work for the placement season to come in the next semester.

After successful completion of internship, students have to submit the report of internship.

The assessment scheme consist of oral based on experiences and the report submitted.

Vector Calculus and Differential Equations (BS202)

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Teaching Scheme
Lectures: 03 Hrs. / Week
Tutorial : 01 Hr. / Week
Credits: 04

Examination Scheme
In-Sem Exam: 30 Marks
End-Sem Exam: 50 Marks
CIA : 20 Marks
Total: 100 Marks

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COURSE OBJECTIVES

1. To describe and recall the basics of Vector Calculus and differential equations.
2. To understand the concept for solving problems based on vector and differential calculus in the universe.
3 To apply core concepts for the solution of engineering problems based on Vector calculus and differential equations.
4 To analyze the problems of which kind and their solution methods available in Vector and differential calculus and use a particular method for finding a solutionin the engineering field.

COURSE OUTCOMES

The Students are able to

1 Know and recall the basics of Vector Calculus and differential equations.
2 Understand the concept usedfor solving problems based on vector and differential calculus in the universe.
3 Apply core concepts for the solution of engineering problems based on Vector calculus and differential equations.
4 Analyze the problems of which kind and their solution methods available in Vector and differential calculus and use a particular method for finding a solution in the engineering field.

CO's	Course Outcomes	Bloom's Taxonomy	
		Level	Descriptor
BS202.1	Know and recall the basics of Vector Calculus and differential equations	1	Remember
BS202.2	Understand the concept used for solving problems based on vector and differential calculus in the universe	2	Understand
BS202.3	Apply core concepts for the solution of engineering problems based on Vector calculus and differential equations	3	Apply
BS202.4	Analyze the problems of which kind and their solution methods available in Vector and differential calculus and use a particular method for finding a solution in the engineering field	4	Analyse

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
BS202.1	3	2	-	-	1	-	-	2	2	1	-	1	-	-
BS202.2	3	2	-	-	1	-	-	2	2	1	-	1	-	-

BS202.3	3	2	-	-	1	-	-	2	2	1	-	1	-	-
BS202.4	3	2	-	-	1	-	-	2	2	1	-	1	-	-

COURSE CONTENTS

Unit-I	**VECTOR DIFFERENTIATION**	**No.of Hours**	**COs**
	Scalar and vector point function, Derivative of a vector point function, Gradient of scalar function ∅, Directional derivative, Divergence and Curl of vector point function, Solenoidal and irrotational vector field and scalar potential, vector identities.	08	BS202.1, BS202.3
Unit-II	**VECTOR INTEGRATION**	**No.of Hours**	**COs**
	Line integral, Green's theorem, Work done, Conservative field, surface integral, Stokes theorem, volume integral, Gauss Divergence theorem.	08	BS202.3, BS202.4
Unit-III	**HIGHER ORDER DIFFERENTIAL EQUATION**	**No.of Hours**	**COs**
	Homogeneous and non-homogeneous linear differential equation of n^{th} order and its solution, Method of variation of parameter, operator method for particular integral, solution of certain types of linear differential equation:-Cauchy's and Legendre's differential equation.	08	BS202.1, BS202.2, BS202.3
Unit-IV	**SERIES SOLUTION OF DIFFERENTIAL EQUATION**	**No.of Hours**	**COs**
	Linear differential equations with variable coefficients, solution about ordinary point, about singular point (Frobenius method) series solution of Bessel's equation, series solution of Legendre's equation, Applications Branch wise (Simple Electrical Circuits, Mass spring system and Bending moments).	08	BS202.3, BS202.4
Unit-V	**PARTIAL DIFFERENTIAL EQUATION**	**No.of Hours**	**COs**
	Formation of partial differential equation, Partial differential equation of order one (linear and nonlinear), Charpit method, Partial differential equation of higher order with constant coefficient	08	BS202.2, BS202.3, BS202.4
Unit-VI	**APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATION**	**No.of**	**COs**

		Hours	
	One dimensional heat equation, Wave equation, Two dimensional heat equation (Laplace equation), Telephone equation, Radio equations	08	BS202.1, BS202.3, BS202.4

Books:

Text Book(s)

1. B. S. Grewal, Higher Engineering Mathematics, 42/e, Khanna Publishers, 2012, **ISBN-13: 978-8174091154.**
2. N. P. Bali and Manish Goyal, A TextBook of Engineering, Mathematics, 8/e, Lakshmi Publications, 2012. **ISBN: 9788131808320.**
3. H. K. Das, Engineering Mathematics, S Chand, 2006, **ISBN-8121905209**

References

1. K.A. Stroud & D. S. Booth, Advanced Engineering Mathematics, Industrial Press, 5/e, 2011, **ISBN-9780831134495**
2. P. C. Matthews, Vector Calculus, Springer, 2/e, 2012, **ISBN-9783540761808**
3. Robert C. Wrede, Introduction to vector and tensor analysis, Dover, 2013, **ISBN-048661879X**
4. W. E. Boyce, R. C. Diprima, Elementary differential equation and boundary value problems.
5. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, Narosa Publishing House, 2014. **ISBN-13: 978-1842653418.**
6. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley, 9/e, 2013, **ISBN-13: 978-0471488859.**

Network Theory (ET203)

Teaching Scheme
Lectures: 4 Hrs. / Week

Credits: 4

Examination Scheme
In-Sem Exam: 30 Marks
End Sem Exam: 50 Marks
ContinuousAssessment: 20 Marks
Total: 100 Marks

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Prerequisite Course: Principles of Physics, Basics of Electricity and Magnetism

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Course Objectives:

1. To learn the basics of Network Theory.
2. To know analytical qualities of Network Theory by application of various theorems.
3. To understand the behavior of Networks by analyzing the transient response.
4. To gain knowledge of Network theory for analysis of 2-port networks.
5. To study and understand concept of Resonance.
6. To study filters and understand concept of attenuator.

Course Outcomes (COs): After successful completion of the course, student will be able to

COs	**Statement**	**Bloom's Taxonomy**	
		Level	**Descriptor**
ET203.1	Get the basics of Network, Network Theorem, Two port network parameters and fundamentals of filter.	1	Remember
ET203.2	Comprehend the basics of network theorems, topologies and network transient response and basic of filters.	2	Understand
ET203.3	Develop problem solving technique using networks theorems, Two Port topologies.	3	Apply
ET203.4	Compare the Network theorems, Network topologies for Electrical Circuits.	4	Analyze

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET203.1	3	1	-	-	-	-	-	-	-	-	-	2	3	-
ET203.2	3	2	1	-	-	-	-	-	-	-	-	2	3	-
ET203.3	3	3	2	-	-	-	-	-	-	-	-	3	2	-
ET203.4	3	3	3	-	-	-	-	-	-	-	-	3	3	-

Course Contents

Unit-I	**Basics of Network**	No. of Hours	COs
	Introduction to circuit variables and circuit elements, Review of Kirchhoff's Laws, Mesh and Nodal analysis, Independent and	6 Hrs.	ET203.1 ET203.2 ET203.3

	dependent Sources, Star, Delta connections, Star to Delta and Delta to Star conversion.		
Unit-II	**Network Theorems**	No. of Hours	COs
	Superposition, Thevenin's, Norton's, Maximum Power Transfer Theorem, Reciprocity theorem, Millman's theorems.	6 Hrs.	ET203.1 ET203.2 ET203.3
Unit-III	**Sinusoidal steady state analysis**	No. of Hours	COs
	Representation of sine function as rotating phasor, steady state response using phasor, application to AC circuits, DC transients. Classical solution of first and second order differential equations for Series and parallel R-L, R-C, R-L-C circuits, initial and final conditions in network elements, forced and free response, time constants steady state and transient state response.	6 Hrs.	ET203.2 ET203.3 ET203.4
Unit-IV	**Two Port Network and Network Functions**	No. of Hours	COs
	Terminal pairs, relationship of two port variables, Z, Y, transmission parameters and hybrid parameters, interconnections of two port networks. Network Functions for one port and two port, Series and parallel connections of two port networks, Reciprocal and Symmetrical two port network.	6 Hrs.	ET203.1 ET203.2 ET203.3 ET203.4
Unit-V	**AC Power Analysis and Resonance**	No. of Hours	COs
	AC Power Analysis : Instantaneous and Average power, Maximum average power transfer, RMS value , Apparent power and Power factor. Series and parallel resonance of RLC circuits : bandwidth, Q factor, centre frequency and Selectivity.	6 Hrs.	ET203.1 ET203.2 ET203.3 ET203.4
Unit-VI	**Filter circuits**	No. of Hours	COs
	Filter fundamentals, Constant K -LPF, HPF, BPF and BSF, m derived LPF and HPF, introduction to Neper and Decibel, Relation between Neper and Decibel, Symmetrical T and Π type attenuators, Lattice attenuator, Bridge T-attenuator.	6 Hrs.	ET203.1 ET203.2 ET203.3 ET203.4

Books:

Text Books:

1. M. E. Van Valkenburg,"Network Analysis", Prentice Hall, 3rd edition.
2. D. Roy Choudhury,"Networks And Systems" New Age International Publications, 2nd edition
3. Ravish R Singh, "Network Analysis and synthesis", McGraw Hill education (India) Pvt. Ltd., 3rd edition 2015
4. Dorf & Svoboda, Introduction to Electric Circuits (9th edition), John Wiley, 2013. ISBN 1118477502, ISBN 9781118477502

Reference Books:
1. Alexander and Sadiku,"Electric Circuits", second edition, 2004. 2. K.V.V. Murthy and M.S.Kamath,"Basic Circuit Analysis", first edition (reprinted with corrections), Jaico Publishing. 3. William H. Hayt, Jack E. Kemmerly, "Engineering Circuit Analysis", McGraw Hill International, 5th edition. 4 Franklin F. Kuo, "Network Analysis and Synthesis ", John Wiley. 5 Agarwal, Anant, and Jeffrey H. Lang. "Foundation of Analog and Digital Electronic circuits". San Mateo, CA: Morgan Kaufmann Publishers, Elsevier, July 2005. ISBN: 9781558607354.
Online Resource : https://onlinecourses.nptel.ac.in/noc20_ee46/preview
Guidelines for Continuous Assessment:- MCQ Test, Video Making activity

Electronic Devices and Circuits (ET204)

Teaching Scheme
Lectures: 3Hrs. / Week

Credits: 3

Examination Scheme
In-Sem Exam: 30 Marks
End Sem Exam: 50 Marks
ContinuousAssessment: 20 Marks
Total: 100 Marks

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Prerequisite: Basic knowledge of Semiconductor Physics.

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Course Objectives:

1. To introduce semiconductor devices, FET and MOSFET, their characteristics, operation, circuits and applications.
2. To introduce concepts of positive and negative feedback in electronic circuits.
3. To analyze and interpret FET and MOSFET circuits for small signal at low and high frequencies.
4. To introduce the concept of Power amplifiers, its analysis and efficiency.
5. To simulate electroniccircuits using simulation softwares and verify results.
6. To study the different types of voltage regulators.

Course Outcomes (COs):

After successfully completing the course students will be able to:

COs	Statement	Blooms Taxonomy	
		Level	Descriptor
ET204.1	Recallthe fundamental operation and characteristics of FET and MOSFET	1	Remember
ET204.2	Understand the basic concepts of Feedback amplifiers, Oscillators, Power amplifiers and Voltage regulators.	2	Understand
ET204.3	Apply concept of feedback to improve stability of circuits.	3	Apply
ET204.4	Analyze DC biasing circuit and Small signal model for Transistor.	4	Analyze
ET204.5	Design Power supply using adjustable voltage regulator.	4	Analyze

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET204.1	3	-	2	-	-	-	-	-	-	-	-	2	1	-
ET204.2	3	3	3	-	-	-	-	-	-	-	-	2	3	1
ET204.3	3	3	3	-	-	-	-	-	-	-	-	2	3	3
ET204.4	3	**2**	2	-	-	-	-	-	-	-	-	2	1	3
ET204.5	3	3	3	-	-	-	-	-	-	-	-	2	3	3

Course Contents

Unit-I	FET	No. of Hours	COs
	BJT overview, Introduction to JFET, Types, Construction, Operation, Static Characteristics, Pinch off voltage, FET Volt-Ampere characteristics,	6Hrs.	ET204.1

	FET Configurations (CS/CD/CG) and their Comparison. Biasing of FET (Self).FET as an amplifier and its analysis (CS) and its frequency response. Small signal model, FET as High Impedance circuits.		
Unit-II	MOSFET& its DC Analysis	No. of Hours	COs
	Basics of MOS Transistor operation,Types and Construction of MOSFET, E-MOSFET characteristics & parameters, non-ideal voltage current characteristics viz. Finite output resistance, body effect, sub-threshold conduction, breakdown effects and temperature effects. Common source circuit, Load Line & Modes of operation, common MOSFET configurations: DC Analysis, constant current source biasing.	8Hrs.	ET204.1 ET204.2
Unit-III	MOSFET AC Circuit Analysis:	No. of Hours	COs
	The MOSFET CS small signal amplifier, Small signal parameters, small signal equivalent circuit, Modelling, Body effect, Analysis of CS amplifier. Introduction to BiCMOS technology. The MOSFET internal capacitances and high frequency model. Introduction to MOSFET as basic element in VLSI, V-I characteristic equation in terms of W/L ratio, MOSFET scaling and small geometry effects. MOSFET as switch, diode/active resistor, Current sink and source, current mirror, CMOS Inverter as amplifier: Active load, Current source and Push pull configurations	8Hrs.	ET204.1 ET204.2
Unit-IV	Feedback amplifiers and Oscillators	No. of Hours	COs
	Four types of amplifiers. Feedback topologies. Effect of feedback on terminal characteristics of amplifiers. Examples of voltage series and Current series FET feedback amplifiers and their analysis. Barkhausen criterion, stability with feedback. General form of LC oscillator. FET RC Phase Shift oscillator, Wein bridge oscillator, Hartley and Colpitts oscillators.	7Hrs.	ET204.1 ET204.2
Unit-V	Power Amplifiers	No. of Hours	COs
	Power BJTs, Power MOSFETs, Heat Sinks, Classes of Audio Power Amplifiers (Class A,B,AB,C,D), Analysis of Class A power amplifiers: Direct and transformer coupled power amplifier, Class B & AB Push-Pull and complimentary-symmetry stages, Distortions in amplifiers, Concept of Total Harmonic Distortion (THD).	8Hrs.	ET204.1 ET204.2 ET204.3
Unit-VI	Voltage Regulators	No. of Hours	COs
	Block diagram of an adjustable three terminal positive and negative regulators (317,337).Typical connection diagram, current boosting. Low drop out voltage regulators. Introduction to Switch Mode Power supply (SMPS), Block diagram of SMPS, Types of SMPS. IC3524 based SMPS, Comparison of Linear Power supply and SMPS.	7Hrs.	ET204.4

Text Books:

1. Allen Mottershead, “Electronic Devices and Circuits: An Introduction, Tata McGrawhill.
2. A. K. Maini, “All-in-One Electronic Simplified”, Khanna Publishing House.
3. Donald Neaman, “Electronic Circuit Analysis and Design”, 3rd Edition, Tata McGraw Hill.

Reference Books:
1. Anil K. Maini and Varsha Agarwal, “Electronic Devices and Circuits”, Wiley India 2. David A. Bell, “Electronic Devices and Circuits”, 5th Edition, Oxford Press 3. Phillip E. Allen, Douglas R. Holberg, “CMOS Analog Circuit Design”, Second Edition, Oxford. 4. R. L. Boylstad, L. Nashlesky, “Electronic Devices and circuits Theory”, 9thEdition, Prentice Hall of India, 2006.
Guidelines for Continuous Assessment:- Home Assignments, MCQ test

Digital Electronics (ET205)

Teaching Scheme:
Lectures: 03 Hrs. / Week

Credits: 03

Examination Scheme:
ISE: 30 Marks
ESE: 50 Marks
CIA: 20 Marks
Total: 100 Marks

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Prerequisite Course: Basic Electronics Engineering

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Course Objectives:

1. To introduce the methods for the simplification of logic functions.
2. To acquaint with different types of combinational logic circuits using ICs.
3. To learn the concept of sequential logic circuits.
4. To learn the concept of a finite state machine.
5. To introduce the HDL concept.
6. To acquaint different types of PLDs.

Course Outcomes (COs): After successful completion of course students will be able to:

COs	CO Statement	Bloom's Taxonomy	
		Level	Description
ET205.1	To introduce the methods for the simplification of logic functions.	1	Remember
ET205.2	To acquaint with different types of combinational logic circuits using ICs.	2	Understand
ET205.3	To learn the concept of sequential logic circuits.	3	Apply
ET205.4	To learn the concept of a finite state machine.	2	Understand
ET205.5	To Recognize the Digital Logic Families	1	Remember
ET205.6	To acquaint different types of PLDs.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET205.1	3	0	0	0	0	0	0	0	0	0	0	3	1	0
ET205.2	3	0	0	0	0	0	0	0	0	0	0	1	2	0
ET205.3	3	3	2	0	0	0	0	0	0	0	0	3	2	0
ET205.4	3	2	2	0	0	0	0	0	0	0	0	1	2	0

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET205.5	3	0	0	0	0	0	0	0	0	0	0	3	0	0
ET205.6	3	2	2	0	0	0	0	0	0	0	0	1	2	0

Course Contents:

Unit-I	**Combinational Logic Circuits**	**No. of Hours**	**COs**
	Number system, Representation of truth table, Sum of product (SOP) form, Product of sum (POS) form, Karnaugh map representation of logical functions, Simplification of logical functions using K-Map, Minimization of logical functions specified in SOP and POS form using K-map up to 4 Variables, Design examples: Half adder, Full adder, Half subtractor and Full subtractor. Code converters	06.	ET205.1
Unit-II	**Combinational Logic Design using MSI Chips**	**No. of Hours**	**COs**
	Circuit design using comparator, Binary adder, BCD adder, Look ahead carry generator, Multiplexers and their use in combinational logic designs, Multiplexer trees, Priority encoder Demultiplexers and their use in combinational logic designs, Demultiplexer trees , Decoders.	06	ET205.2
Unit-III	**Sequential Logic Design**	**No. of Hours**	**COs**
	One bit memory cell, Clocked SR, JK, MS J-K flip flop, D and T flip-flops. Use of preset and clear terminals, Excitation table for flip flops. Conversion of flip flops. Application of flip flops: registers, shift registers, Counters: asynchronous counter, synchronous counter, Johnson ring counter, MOD counter.	08	ET205.3
Unit-IV	**Finite State Machines**	**No. of Hours**	**COs**
	Mealy and Moore machines representation. State diagram, State table, State reduction and state assignment, Design procedure: sequence generator using shift register and sequence detector.	06	ET205.4
Unit-V	**Digital Logic Families**	**No. of Hours**	**COs**
	Classification of logic families, Characteristics of logic families, Operation of TTL NAND gate, Passive pull-up, Active pull-up, TTL with open collector output, Schottky TTL, TTL characteristics, TTL 5400/7400 series. CMOS logic: CMOS inverter, CMOS Characteristics, CMOS configuration: Wired logic, open drain output. TTL to CMOS and CMOS to TTL interfacing.	06	ET205.5
Unit-VI	**Programmable Logic Devices and Semiconductor Memories**	**No. of Hours**	**COs**
	Programmable logic devices and their types: PROM, PLA, PAL, CPLD,	06.	ET205.6

	FPGA. Designing combinational circuits using PLDs. Classification and characteristics of memories: RAM, ROM, EPROM, EEPROM, NVRAM, SRAM, and DRAM.		

Books:

Text Books:

1. R.P. Jain, “Modern digital electronics” , 3rd edition , 12th reprint Tata McGraw Hill Publication,2007.
2. Thomas Floyd, “Digital Electronics”, 11th Edition.
3. M. Morris Mano, “Digital Logic and Computer Design” 4the edition,Prentice Hall of India, 2013.
4. Taub and Schilling, “Digital Principles and Applications,” TMH.

Reference Books:

1. Anand Kumar, “Fundamentals of Digital Circuits” 1 st edition, Prentice Hall of India, 2001
2. J. F. Wakerly, “Digital Design- Principles and Practices,” 3rd Edition, Pearson
3. M. M. Mano, “Digital Design,” Prentice Hall India.

e-Resources:

1. https://nptel.ac.in/courses/108/105/ 108105113/

2. https://nptel.ac.in/courses/117/106/117106086/

3. https://nptel.ac.in/courses/108/105/108105132/

Guidelines for Continuous Internal Assessment:

Home Assignments/Class Tests

UNIVERSAL HUMAN VALUES AND PROFESSIONAL ETHICS (HS 206)

Teaching Scheme
Lectures: 03 Hrs./ Week
Credits: 03

Examination Scheme
In-Sem Exam: 30 Marks
End Sem Exam: 50 Marks
ContinuousAssessment: 20 Marks
Total: 100 Marks

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Course Objectives:

1. To make the students aware about the concept and need of value education.
2. To help the students appreciate the essential complementarity between values and skills to ensure sustained happiness and prosperity.
3. To facilitate the development of a holistic perspective among the students towards life and profession.
4. To facilitate the understanding of harmony at various levels staring from self and going towards family, society and nature.
5. To make the students aware about the correlation between engineering ethics and social experimentation in various situations.
6. To highlight the importance of professional ethics in the wake of global realities.

Course Outcomes (COs):

After successful completion of this course, the students should be able to:

COs	Course Outcomes	Blooms Taxonomy	
		Level	Descriptor
HS 206.1	Recognize the concept of self-exploration as the process of value education.	1	Remember
HS 206.2	Interpret the human being as the coexistence of self and body.	2	Understand
HS 206.3	Apply the holistic approach for fulfilling human aspirations for the humans to live in harmony at various levels.	3	Apply
HS 206.4	Organize the universal human order in correlation with professional ethics.	4	Analyze
HS 206.5	Implement ethical practices in engineering profession.	3	Apply
HS 206.6	Outline the importance of various ethical practices in the wake of global realities.	4	Analyze

Mapping of Course Outcomes to Program Outcomes (POs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
HS 206.1	-	-	-	-	-	2	-	3	-	1	-	2
HS 206.2	-	-	-	-	-	2	-	3	-	1	-	2
HS 206.3	-	-	-	-	-	3	2	3	-	1	-	2
HS 206.4	-	-	-	-	-	3	-	3	-	1	-	2
HS 206.5	-	-	-	-	-	3	-	3	-	1	-	2
HS 206.6	-	-	-	-	-	3	2	3	-	1	-	2

COURSE CONTENTS

Unit No.		No. of Hours	COs
Unit-I	**Introduction to Value Education**	06	HS 206.1
	Values, Morals and Ethics; Concept and need of value education; Self-exploration as the process for value education; Guidelines for value education; Basic human aspirations and their fulfillment		
Unit-II	**Harmony in Human Being**	06	HS 206.2
	Human being as the coexistence of self and the body; Discrimination between the needs of the self and the body; The body as an instrument; Harmony in the self; Harmony of the self with the body		
Unit-III	**Harmony in the family, Society and Nature**	06	HS 206.3
	Harmony in the family- The basic unit of human interaction; Values in the human to human relationship; Harmony in the society; Vision for the universal human order; Harmony in the nature; Realizing existence as coexistence at all levels		
Unit-IV	**Professional Ethics**	06	HS 206..4
	Natural acceptance of human values; Definitiveness of ethical human conduct; Humanistic education and universal human order; Competence in professional ethics; Transition towards value-based life and profession		
Unit-V	**Engineering Ethics and Social Experimentation**	06	HS 206.5
	Need of engineering ethics; Senses of engineering ethics; Variety of moral issues; Moral autonomy; Utilitarianism; Engineering as experimentation; Engineers as responsible experimenters; Codes of ethics		
Unit-VI	**Global Issues**	06	HS 206.6
	Globalization and multi-national corporations; Cross-cultural issues; Business ethics; Environmental ethics; Computer ethics; Bio-ethics; Ethics in research; Intellectual property rights and plagiarism		

Text Books:

1. R. R. Gaur, R. Sangal, G. P. Bagaria, "A Foundation Course in Human Values and Professional Ethics", Excel Books Pvt. Ltd.
2. R. S. Naagarazan, "A Textbook on Professional Ethics and Human Values", New Age International (P) Ltd. Publishers

Reference Books:

1. B. P. Banerjee, "Foundations of Ethics and Management", Excel Books Pvt. Ltd.
2. P. L. Dhar, R. R. Gaur, "Science and Humanism", Commonwealth Publishers
3. M. K. Gandhi, "The Story of my Experiments with Truth", Discovery Publisher
4. http://uhv.org.in/

Considering the specific nature of this course, the methodology is explorational and thus universally adaptable. In order to connect the content of this course with practice, minimum 6 group activities should be conducted with active involvement of the students. The continuousassessment should be strictly based on the participation of the students in these activities.

Network Theory Laboratory (ET207)

Teaching Scheme
Practical: 2 Hrs. / Week
Credits: 1

Examination Scheme
OR: 50 Marks
TW: 25 Marks,
Total: 75 Marks

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Prerequisite Course: Principles of Physics, Basics of Electricity and Magnetism

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Course Objectives:

1 Gain an understanding of the basics of Network Theory.
2 Investigate the analytical qualities of Network Theory by application of various theorems.
3 Demostrate the behavior of Networks by analyzing the transient response.
4 To verify Two-port networks parameters
5 To study and understand concept of Resonance.
6 To study fundamentals of filters and its operation .

Course Outcomes (COs): After successful completion of the course, student will be able to

COs	Statement	Bloom's Taxonomy	
		Level	Descriptor
ET207.1	Interpret basics of network theorems, topologies and its transient response.	2	Understand
ET207.2	Implement electric networks using networks theorems, two Port topologies.	3	Apply
ET207.3	Deduce the response of various circuits using Network theorems, Network topologies .	4	Analyze

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO 3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET207.1	-	-	-	-	2	-	-	1	2	-	1	2	3	2
ET207.2	-	-	-	-	2	-	-	1	2	-	1	3	2	2
ET207.3	-	-	-	-	2	-	-	1	2	-	1	3	3	2

Course Contents

List of Practical (Minimum 8 Practicals)

1. Verification of Maximum Power Transfer theorem.
2. Verification of Millman's theorem.
3. Verification of Reciprocity theorem.
4. *Simulation of time response of R-C circuit to a step D.C. voltage input. (Charging and discharging of a capacitor through a resistor)
5. *Simulation of time response of R-L circuit to a step D.C. voltage input. (Rise and decay of current in an inductive circuit)
6. To determine equivalent parameters of parallel connection of two-port network.
7. To Measure and Verify Z, Y, Parameters of a Two-port Network

8. To study the effect of resonance in series RLC circuit.
9. To study the operation of low pass and high pass prototype filters.
10. To study the operation of band pass and band stop prototype filters

*Based on simulation software such as Proteus, spice

Electronic Devices and Circuits Laboratory (ET208)

Teaching Scheme
Practical: 2 Hrs. / Week

Credits: 1

Examination Scheme
PR: 50 Marks
TW: 25 Marks
Total: 75Marks

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Prerequisite Course: Basic knowledge of Semiconductor Physics.

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Course Objectives:

1To introduce semiconductor devices FET and MOSFET, their characteristics, operations, circuits and applications.
2To introduce concepts of both positive and negative feedback in electronic circuits.
3To analyze and interpret FET and MOSFET circuits for small signal at low and high frequencies.
4To introduce the concept of Power amplifiers, analysis and efficiency.
5To simulate electronics circuits using computer simulation software and verify desired results.
6To study the different types of voltage regulators.

Course Outcomes (COs):

After successfully completing the course students will be able to:

COs	Statement	Blooms Taxonomy	
		Level	Descriptor
ET208.1	Explain basics ,operation and characteristics of FET and MOSFET	2	Understand
ET208.2	Analyze DC biasing circuit and Small signal model for Transistor.	4	Analyze
ET208.3	Apply concept of feedback to improve stability of circuits.	3	Apply
ET208.4	Understand the basic concepts of Power amplifiers.	2	Understand
ET208.5	Design Power supply using adjustable voltage regulator.	4	Analyze

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET208.1	-	-	-	-	-	-	-	2	2	-	-	3	1	-
ET208.2	-	-	-	-	3	-	-	2	2	-	-	3	2	2
ET208.3	-	-	-	-	3	-	-	2	2	-	-	3	2	3
ET208.4	-	-	-	-	3	-	-	2	2	-	-	3	2	3
ET208.5	-	-	-	-	3	-	-	2	2	-	-	3	2	3

Course Contents

Sr. No	List of Practical (Minimum 8)
1	Design a single stage FET Amplifier in CS configuration and verify DC operating point.
2	Build and test single stage CS amplifier using FET. Calculate R_i, R_o and Av.
3	Simulate frequency response of single stage CS amplifier using Proteus software (use same circuit) and find the bandwidth.
4	Simulate Voltage-Series feedback amplifier using Proteus software and calculate R_{if}, R_{of}, A_{vf} and Bandwidth.
	or
5	Simulate current series feedback amplifier using Proteus software and find R_{if}, R_{of}, G_{mf} and Bandwidth.
6	Simulate LC oscillator using FET.
7	Simulate MOSFET/ CMOS Inverter using Proteus software.
8	To find the efficiency of Class B and Class AB power amplifier.
9	Design and implement an adjustable voltage regulator using IC 317.

Digital Electronics Laboratory (ET209)

Teaching Scheme
Practical: 2 Hrs. / Week

Credits: 1

Examination Scheme
PR = 50 Marks,
TW=25 Marks
Total: 75 Marks

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Prerequisite Course: Basic Knowledge of Logic Gates

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Course Objectives:

1. Acquaint different combination logic circuits.
2. Acquaint different Sequential logic circuits.
3. Make students familiar with logic families.

Course Outcomes (COs): After successful completion of course students will be able to:

COs	Statements	Bloom's Taxonomy	
		Level	Description
ET209.1	Document laboratory report on results.	2	Understand
ET209.2	Design and Implement digital circuits.	3	Apply
ET209.3	Focus on different logic family parameters.	4	Analyze

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET209.1	1	-	-	-	-	-	-	-	-	2	-	-	-	2
ET209.2	2	2	2	-	-	-	-	-	-	-	-	3	-	2
ET209.3	2	-	-	1	-	-	-	-	-	-	-	2	-	2

Course Contents

List of Practical (Minimum 8 Practical to be perform)

1.Design and Implement 8:1 MUX using IC-74LS153 & Verify its Truth Table.
2.Design & Implement the given 4 variable function using IC74LS153. Verify its Truth-Table.
3.Design and Implement full adder and subtractor function using IC- 74LS138.
4.Design & Implement 3-bit code converter using IC-74LS138.(Binary to Gray)
5.Design and Implement 4-bit Comparator and Design and Implement 8-bit Comparator
6.Design and Implement MOD-N using IC-74LS90 and draw Timing diagram.
7.Design and Implement MOD-N using IC-74LS93 and draw Timing diagram.
8.Design & Implement 4-bit Up/down Counter and MOD-N Up/down Counter using IC74HC191/ IC74HC193. Draw Timing Diagram
9. To find various TTL and CMOS parameters
10. Design and Implement 4-bit Ring Counter/ Twisted ring Counter using shift registers IC 74HC194/IC74LS95.

Note: For each experiment refer datasheets .

Constitution of India – Basic features and fundamental principles (MC210)

Teaching Scheme — Examination Scheme
Practical: 2 Hrs. / Week — Credits: Non Credit

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Course Objectives

1. To study the historical background, salient features and preamble of Indian constitution
2. To study the provision of fundamental right in the Indian constitution.
3. To study the directive principle of state policy and fundamental duties.
4. To study the system of government through parliamentary and federal system,
5. To understand the formation, structure and legislative framework of central government.
6. To understand the formation, structure and legislative framework of state government.

Course Outcomes

CO	Course Outcome	Bloom's Taxonomy Level	Level
MC210.1	The students can describe background, salient features of constitution of India	Remember	1
MC210.2	The students can explain the system of government, it's structure and legislative framework also can interpret the fundamental rights and duties	Understand	2
MC210.3	The student can use the fundamental rights and duties in their life	Apply	3

Unit-1: Introduction to Constitution of India

a. Historical background
b. Salient features
c. Preamble of constitution

Unit-2: Fundamental rights

a. Features of fundamental rights
b. Basic rights 1. Right to equality; 2. Right to freedom; 3. Right against exploitation; 4. Right to freedom of religion; 5. Cultural and educational rights; 6.Right to property; 7. Right to constitutional remedies

Unit-3: (A) Directive principle of state policy:

a. Features of directive principle
b. Classification of directive principle
c. Criticism of directive principle
d. Utility of directive principle

e. Conflict between Fundamental rights and directive principle

(B) Fundamental duties:

a. List of fundamental duties
b. Features of fundamental duties
c. Criticism of fundamental duties
d. Significance of fundamental duties
e. Swaran Singh Committee Recommendations

Unit-4: System of Government

a. Parliamentary system: Features of parliamentary government, Features of presidential government, merits and demerit of Parliamentary system
b. Federal system: Federal features of constitution, unitary features of constitution
c. Centre and state relation: Legislative relation, administrative relations and financial relation.
d. Emergency provision: National emergency, Financial emergency and criticism of emergency provision

Unit-5: Central government

a. President: Election of president, powers and functions of president, and Veto power of president
b. Vice-president: Election of vice-president, powers and functions of vice-president
c. Prime minister: Appointment of PM, powers and functions of PM, relationship with president
d. Central council of ministers: Appointment of ministers, responsibility of ministers, features of cabinet committees, functions of cabinet committees
e. Parliament: Organization of parliament, composition of the two houses , duration two houses, membership of parliament, session of parliament, joint sitting of two houses, budget in parliament.
f. Supreme court (SC): Organization of supreme court, independence of supreme court, jurisdiction and powers of supreme court

Unit-6: State government

a. Governor: Appointment of governor, powers and functions of governor, constitutional position
b. Chief minister: Appointment of CM, powers and functions of CM, relationship with governor
c. State council of ministers: Appointment of ministers, responsibility of ministers, cabinet.
d. High court (HC): Organization of HC, independence of HC, jurisdiction and powers of HC
e. Sub-ordinate court: Structure and jurisdiction, Lok Adalats, Family court, Gram Nyayalayas

Reference Book:

1. Indian Polity for Civil Service Examination, M Laxmikanth, Mc GrawHill Education, Fifth Edition.
2. Introduction to the Constitution of India, Durga Das Basu, LexisNexis, 22 nd Edition

Transform Theory and Applied Mathematics (ET211)

Teaching Scheme
Lectures: 03 Hrs. / Week

Credits: 03

Examination Scheme
In-Sem Exam : 30 Marks
End Sem Exam : 50 Marks
Continuous Assessment : 20 Marks
Total : 100 Marks

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Prerequisite Course: NIL

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Course Objectives:

1. To introduce a concept of Laplace and Fourier transforms
2. To study Z transform and its properties
3. To understand the Calculus and its applications
4. To apply co-ordinate geometry concepts for field and space.
5. To explain statistical parameters and random processes.
6. To understand complex variable for integrals and residue applications.

Course Outcomes (COs):

CO	Course Outcome Statement	Bloom's Taxonomy	
		Level	Descriptor
ET211.1	List the formulas and conversion techniques of various transforms and applied mathematics.	1	Remember
ET211.2	Interpret the significance of various transforms and applied mathematics along with its applications in the field of Engineering.	2	Understand
ET211.3	Construct the concepts of various transforms and applied mathematics to solve real life problems in the field of Communication systems and Signal processing.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET211.1	3	2	1	-	-	1	-	-	-	-	-	2	1	--
ET211.2	3	2	1	-	-	1	-	-	-	-	-	2	2	--
ET211.3	3	3	2	-	-	1	-	-	-	-	-	2	3	--

Course Contents

Unit-I	Laplace Transform & Fourier Transform	No. of Hours	COs
	Laplace Transform(LT) :Definition of LT, Properties and Inverse Laplace Transform, Solutions of differential equations Fourier Transform (FT): Fourier transform, Properties and Inverse Fourier Transform.	06 Hrs.	ET211.1 ET211.2 ET211.3

	Applications of LT and FT		
Unit-II	Z-Transform	No. of Hours	COs
	Introduction, Definition, Standard properties, ZT of standard sequences and their inverses, Solution of difference equations, Applications of ZT.	06 Hrs.	ET211.1 ET211.2 ET211.3
Unit-III	Calculus	No. of Hours	COs
	Theorems of integral calculus, evaluation of definite and improper integrals, partial derivatives and its applications, maxima and minima.	06 Hrs.	ET211.1 ET211.2 ET211.3
Unit-IV	Co-ordinate geometry and applications	No. of Hours	COs
	Introduction to 3-D orthogonal Co-ordinate systems - Cartesian, cylindrical, spherical and its representation, conversion of one co-ordinate system into another co-ordinate system, Applications in electromagnetic field.	08 Hrs.	ET211.1 ET211.2 ET211.3
Unit-V	Statistics and Random Processes	No. of Hours	COs
	Mean, median, mode and standard deviation, Correlation & Covariance function, Random Processes, Ergodic processes, Correlation and regression analysis	06 Hrs.	ET211.1 ET211.2 ET211.3
Unit-VI	Complex Analysis	No. of Hours	COs
	Analytic functions, Cauchy-Riemann equations, Cauchy's integral theorem, Cauchy's integral formula; Taylor's and Laurent's series, residue theorem.	06 Hrs.	ET211.1 ET211.2 ET211.3

Books:

Text Books:

1. M. D. Greenberg, "Advanced Engineering Mathematics", 2e, Pearson Education, ISBN-13: 978-8177585469
2. B.S. Grewal, "Higher Engineering Mathematics", 2e,Khana Book Publication, Delhi., ISBN-13: 978-8193328491
3. B.V. Ramana, "Higher Engineering Mathematics",1e, Tata McGraw Hill. ISBN-13: 978-0070634190

Reference Books:

1. Francis B. Hildebrand , "Advanced Calculus for Applications" ,Pearson; 2 edition, ISBN978-0130111890
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 10ed, Wiley; 10th edition, ISBN-13: 978-8126554232
3. Nicholas J. Higham, "Applied Mathematics", Princeton University Press, ISBN 978-0-691-15039-0
4. Logan, J. David (John David), "Applied mathematics", 3ed, ISBN: 0-471-74662-2

Guidelines for Teachers Assessment:- MCQ Test, Home Assignments, Extempore Quiz.

Data Structures (ET212)

Teaching Scheme
Lectures: 04 Hrs / Week

Examination Scheme
In-Sem Exam: 30 Marks
End Sem Exam: 50 Marks
Continuous Assessment: 20 Marks

Credits: 04
Total: 100 Marks

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Prerequisite: Basic Knowledge of C Programming

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Course Objectives:

1. To impart the basics of algorithm development and analysis of algorithm.
2. To emphasize practical concerns, rather than mathematical analysis.
3. To introduce students to common programming techniques/algorithms (recursion, searching and Sorting, etc.)
4. To understand the memory requirement for various data structures.
5. To introduce students to several fundamental abstract data types (ADTs) and data structures.
6. To introduce various techniques for representation of the data in the real world.

Course Outcomes (COs):

After successful completion of course students will be able to:

COs	Statement	Bloom's Taxonomy	
		Level	Descriptor
ET212.1	Learn the Fundamentals of data structures and it's applications	1	Remember
ET212.2	Understand the algorithms to solve programming problems	2	Understand
ET212.3	Apply appropriate data structures and efficient algorithm to solve the problems of various domain	3	Apply
ET212.4	Analyze time and space efficiency of algorithms	4	Analyze

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET212.1	2	3	2	3	-----	-----	-----	-----	-----	-----	-----	-----	-----	3
ET212.2	2	3	3	2	-----	-----	-----	-----	-----	-----	-----	-----	2	2
ET212.3	2	3	3	----	2	-----	-----	-----	-----	-----	-----	-----	-----	2
ET212.4	3	-----	-----	-----	1	-----	-----	-----	-----	-----	-----	-----	-----	1

Course Contents

Unit-I	Overview of C Programming	No. of Hours	COs

	Functions: Definition, Types of functions with appropriate examples, recursive functions. Macros, Comparison Macros with function. Structures: Definition, Self-Referential Structure, Array of structures. Arrays: Concept of Sequential Organization, Polynomial representation using arrays, Pointers: Basic concepts. Pointer declaration & initialization. Pointer to a pointer. Pointers and arrays, pointers and structures.	(08 Hrs.)	ET212.1, ET212.2 ET212.3, ET212.4
Unit-II	Introduction to Data Structures	No. of Hours	COs
	Introduction: Concepts and definition of data, data type, data object, data structures. Types of Data Structures-Linear and Non Linear. Searching Methods: Sequential Search and Binary Search. Sorting Methods: Selection sort, Bubble sort, Insertion sort. Introduction to Time complexity and Space complexity, brief overview of the Big Oh and other notations. Concept of Abstract Data Type (ADT).	(08 Hrs.)	ET212.1, ET212.2 ET212.3, ET212.4
Unit-III	Dynamic memory allocation and Linked List	No. of Hours	COs
	Introduction: Dynamic memory management. Linked List: Concept of Singly Linked List: Different operations such as Creation, Insertion, deletion, display, search of node in linked list. Concept of Doubly Linked List and Circular Linked List, Comparison of Linked List with Array. Applications of Linked list.	(08 Hrs.)	ET212.1, ET212.2 ET212.3, ET212.4
Unit-IV	Stack and Queues	No. of Hours	COs
	Stacks: Definition & example, representation using arrays & linked list. Applications of Stacks: Concept of infix, postfix and prefix expressions, conversion of infix to postfix expression, evaluation of postfix expression. Queues: Definition & example, representation of queue using array and linked list. Concept of Circular queue, Priority Queue. Applications of Queue.	(08 Hrs.)	ET212.1, ET212.2 ET212.3, ET212.4
Unit-V	Trees	No. of Hours	COs
	Introduction: tree terminologies, Binary trees and its representation, Types of Binary Trees. Binary Search Tree (BST): Implementation of Binary Search Tree, BST traversals – preorder, in order & post order, Primitive operations on BST: Create, insert, delete and Search.	(08 Hrs.)	ET212.1, ET212.2 ET212.3, ET212.4
Unit-VI	Graphs	No. of Hours	COs
	Graphs: Concepts and terminology, Types of graphs, representation of graph using adjacency matrix, adjacency list, Traversals: DFS & BFS. Minimal spanning tree: Concept, Kruskal, Prim's algorithm.	(08 Hrs.)	ET212.1, ET212.2 ET212.3, ET212.4
Books:			
Text Books:			
1. E. Balgurusamy, "Programming in ANSI C", Tata McGraw-Hill,(3rdEdition)			

2. Yashavant Kanetkar, “Data Structures Through C”, BPB Publication, 2nd Edition
Reference Books:
1. Seymour Lipschutz, “Data Structure with C”, Schaum’s Outlines, McGraw Hill Education.ISBN-13: 978-1259029967 2. Y. Langsam, M J Augenstein, Aaron Tenenbaum – “DS using C and C++” – Pearson Education, ISBN 81-317-0328-2 3. Ellis Horowitz, Sartaj Sahni, “Fundamentals of Data Structures”, university press, ISBN 10:0716782928 4. R. Gilberg & B.Forouzan, “Data Structures A Pseudo code Approach with C”, Cengage Learning. ISBN 9788131503140.
Guidelines for Continuous Assessment: - Group Discussion, Quiz, Presentation on Specific Topic, Online Assignments etc.

Analog Communication (ET213)

Teaching Scheme
Lectures: 03 Hrs. / Week

Examination Scheme
In-Sem Exam: 30 Marks
End Sem Exam: 50 Marks
Continuous Assessment: 20 Marks

Credits: 03
Total: 100 Marks

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Prerequisite Course: NIL

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Course Objectives:

1. To understand the concept of communication system.
2. To understand the concept of amplitude modulation and different methods of generating AM signals.
3. To study frequency modulation and its different generation methods.
4. To understand operation of TRF and super heterodyne receiver.
5. To study different types and sources of noise.
6. To analyze different types of pulse modulation.

Course Outcomes (COs):

After completion of course students will be able to

COs	Statement	Blooms Taxonomy	
		Level	Descriptor
ET213.1	Remember the concepts and various components of Modulator and Demodulator circuits of analog communication systems.	2	Remember
ET213.2	Apply conceptual knowledge to get modulation and demodulation of AM signals.	3	Apply
ET213.3	Apply conceptual knowledge to get modulation and demodulation of FM signals.	3	Apply
ET213.4	Analyze radio receivers with their different performance parameters.	4	Analyze
ET213.5	Understand the different types of noise and its effect on communication system.	4	Understand
ET213.6	Apply the knowledge of pulse modulation & multiplexers to study the real life applications	2	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO 2	PO3	PO4	PO5	PO 6	PO7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2
ET213.1	2	---	---	---	---	---	---	---	---	1	---	1	1	2
ET213.2	1	1	---	---	1	---	---	---	---	---	---	---	1	---
ET213.3	1	1	---	---	1	---	---	---	---	---	---	---	1	---
ET213.4	1	2	2	1	1	---	---	---	---	---	---	---	1	1
ET213.5	1	1	1	---	1	---	---	---	---	---	---	---	1	1

ET213.6	2	---	---	---	1	2	---	---	---	1	---	1	1	2

Course Contents

Unit-I	Introduction to Communication Systems	No. of Hours	COs
	Communication, Basic Elements of Communication System, Analog and Digital Communication System Overview, Electromagnetic Spectrum and its Usage, Classification of communication system, Modulation, Need of Modulation, Types of Modulation, Communication Channels, Baseband and Carrier Communication.	06 Hrs.	ET213.1
Unit-II	Amplitude Modulation	No. of Hours	COs
	Amplitude Modulation(AM), Mathematical Expression, Modulation Index, Bandwidth of AM, Generation methods of AM Signal, Side Band, DSBFC and its Spectrum, Power Relations Applied to Sinusoidal Signals, DSBSC-Multiplier Modulator, Switching Modulator, Ring Modulator and its Spectrum, SSBSC, ISB and VSB, Their Generation Methods, Comparison and its Applications.	06 Hrs.	ET213.2
Unit-III	Angle Modulation	No. of Hours	COs
	Frequency Modulation (FM), Mathematical Expression, Modulation Index, Spectrum Analysis, Narrowband FM, Wideband FM, Single Tone Frequency Modulation, Transmission Bandwidth of FM Waves, Phase modulation(PM), Relation between FM and PM, Generation methods of FM, Direct and Indirect Methods, Armstrong's Indirect Method, Comparison between AM, FM and PM..	06 Hrs.	ET213.3
Unit-IV	Radio Receivers	No .of Hours	COs
	Main functions of receiver, Tuned Radio Frequency (TRF) Receiver, Super heterodyne receiver for AM and FM, Automatic Gain Control (AGC), Performance Parameters: Sensitivity, selectivity, fidelity, image frequency rejection etc. AM detection types: Envelope Detection, Rectifier Detection, FM Detection: Using Phase Lock Loop (PLL).	06 Hrs.	ET213.4
Unit-V	Noise	No. of Hours	COs
	Definition Of Noise, Effect Of Noise, Sources Of Noise, Internal & External Sources of Noise, Types Of Noise, Signal To Noise Ratio(SNR), SNR Of Tandem Connection, Figure Of Merit Calculations, Noise Figure, Noise Temperature, Friss Formula For Noise Figure, Noise Bandwidth, Noise Reduction Techniques.	06 Hrs.	ET213.5

Unit-VI	Pulse Modulation & Multiplexing	No. of Hours	COs
	Sampling, Sampling Rate, Sampling Theorem, Nyquist Criteria, Types Of Sampling: Ideal, Natural & Flat Top, Analog Pulse Modulation: PAM, PWM & PPM, Multiplexing, Types of Multiplexers, Analog Multiplexing, FDM, WDM.	06 Hrs.	ET213.6
Books:			
Text Books:			
1. B. P. Lathi, "Communication Systems", BS publications. 2. George Kennedy, "Electronic Communications", McGraw Hill Kennedy.			
Reference Books:			
1. Simon Haykin, "An introduction to analog & digital communications", John Wiley & Sons 2. Roddy and Coolen, "Electronic Communication Systems", Pearson Education. 3. Frank R. Dungan, "Electronic Communication Systems", Delmar Publishers. 4. R. G. Gupta, "Audio & Video Systems" Tata McGraw-Hill			
Guidelines for Teacher's Assessment:- Unit Test, Home Assignments etc.			

Signals and Systems (ET214)

Teaching Scheme
Lectures: 4Hrs. / Week

Credits: 04

Examination Scheme
In-Sem Exam: 30 Marks
End Sem Exam: 50 Marks
CIA: 20 Marks
Total: 100 Marks

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Course Objectives:

1. To understand the mathematical description of continuous and discrete time signals and systems.
2. To analyze Linear Time Invariant (LTI) systems in time domain.
3. To study the signal and system using the tool Laplace Transform.
4. Analyze the spectral characteristics of continuous-time periodic and a periodic signals using Fourier analysis.
5. Analyze the continuous time signal using Fourier transform.
6. To study correlation and its properties.

Course Outcomes (COs):

After completion of this subject student should be able to:

Course Code	Course outcome	Blooms Taxonomy	
		Level	Descriptor
ET214.1	List the formulas and standard signals representation for system analysis	1	Remember
ET214.2	Interpret the difference between continuous and discrete time signals and systems & different transform techniques	2	Understand
ET214.3	Classify the knowledge to determine system behavior for variable inputs, Conversion of signal from one domain and to determine parameters of random signals	3	Apply

ET214.4	Analyze the system, Transform techniques for knowledge of signals and system.	4	Analyze

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET214.1	3	2	1	-	-	-	-	-	-	-	-	-	3	-
ET214.2	3	2	2	-	-	-	-	-	-	-	-	-	2	-
ET214.3	1	3	3	-	-	-	-	-	-	-	-	-	3	-
ET214.4	2	2	3	-	-	-	-	-	-	-	-	-	3	-

Course Contents

Unit-I	Introduction to Signals and Systems	No. of Hours	CO 1
	Introduction and Classification of signals: Definition of signal and system, communication and control systems as examples, Continuous time and discrete time signal, Classification of signals, Elementary signals, different signal Operations Systems: Definition, Classification: linear and non-linear, time variant and invariant, causal and non-causal, static and dynamic, stable and unstable, invertible.	8 Hrs.	ET214.1, ET214.2
Unit-II	Time domain representation of LTI System	No. of Hours	CO 2
	System modeling: Input-output relation, definition of impulse response, convolution sum, convolution integral, computation of convolution integral, Computation of convolution sum. Properties of convolution. System interconnection, system properties in terms of impulse response, step response.	8 Hrs.	ET214.1, ET214.2
Unit-III	System analysis using Laplace Transform	No. of Hours	CO 3
	Definition of Laplace Transform (LT), Limitations of Fourier transform and need of Laplace transform, ROC, Laplace transform of standard periodic and aperiodic functions, Inverse Laplace transform based on partial fraction expansion, Transfer function, concept of Poles and Zeros, stability considerations in S domain, Electrical Network using Laplace Transform approach.	8 Hrs.	ET214.3, ET214.4
Unit-IV	Fourier Series	No. of Hours	CO 4
	Fourier series (FS) representation of periodic Continuous Time (CT) signals, Dirichlet condition for existence of Fourier series, orthogonality, basis	8 Hrs.	ET214.3, ET214.4

	functions, Amplitude and phase response, FS representation of CT signals using trigonometric and exponential Fourier series. Applications of Fourier series, properties of Fourier series and their physical significance, Gibbs phenomenon.		
Unit-V	Fourier Transform	No. of Hours	CO 5
	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, FT of standard periodic CT signals, Properties and their significance, Interplay between time and frequency domain ,Fourier Transform for periodic signals, introduction to Discrete Time Fourier Transform.	8 Hrs.	ET214.3, ET214.4
Unit-VI	Correlation and Distribution function	No. of Hours	CO 6
	Correlogram, Introduction to Correlation: Autocorrelation, Cross correlation for Continuous and discrete signals and their properties. Distribution Function : Normal, Gaussian, Rayleigh.	6 Hrs.	ET214.4

Books:

Text Books:

1. Simon Haykins and Barry Van Veen, "Signals and Systems", John Wiley and sons.
2. B. P. Lathi, "Linear Systems and Signals", OXFORD University Press.

Reference Books:

1. Alan V. Oppenheim, Alan S. Willsky with IAN T. Young, "Signals and Systems", Prentice-Hall.
2. S. S. Soliman & M.D. Srinath, "Continuous and Discrete Signals and Systems", Prentice- Hall, 1990.
3. Shaila Dinkar Apte "Signals and Systems: Principles and Applications", Cambridge University Press.
4.Charles Phillips, "Signals, Systems and Transforms", 3rd Edition, Pearson Education.
5. M.J. Roberts "Signal and Systems", Tata McGraw Hill 2007.

Guidelines for Continuous Assessment:-
For examples:-Multiple Select/Choice questions, Unit Test, Home Assignments, Oral.

Transform Theory and Applied Mathematics Tutorial (ET215)

Teaching Scheme
Tutorial: 01 Hr/ Week
Credits: 01

Examination Scheme
Term Work : 25 Marks
Total : 25 Marks

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Prerequisite Course: NIL

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Course Objectives:

1. To introduce a concept of Laplace and Fourier transforms
2. To study Z transform and its properties
3. To understand the Calculus and its applications
4. To apply co-ordinate geometry concepts for field and space.
5. To explain statistical parameters and random processes.
6. To understand complex variable for integrals and residue applications.

Course Outcomes (COs):

CO	Course Outcome (s)	Bloom's Taxonomy	
		Level	Descriptor
ET215.1	List the formulas and conversion techniques of various transforms and applied mathematics.	1	Remember
ET215.2	Interpret the significance of various transforms and applied mathematics along with its applications in the field of Engineering.	2	Understand
ET215.3	Construct the concepts of various transforms and applied mathematics to solve real life problems in the field of Communication systems and Signal processing.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET215.1	3	2	1	-	-	-	-	-	2	1	-	2	1	--
ET215.2	3	2	1	-	-	-	-	-	3	1	-	2	2	--
ET215.3	3	3	2	-	-	-	-	-	2	2	-	2	3	--

Tutorial Course Contents

Sr. No.	List of Tutorial (Minimum 8 per subject)	COs
1	To study properties of Laplace Transform and solve numerical.	ET215.1, ET215.2 , ET215.3
2	To study properties of Fourier Transform and solve numerical.	ET215.1, ET215.2 , ET215.3

3	To study properties of Z-Transform properties and solve numerical.	ET215.1, ET215.2 , ET215.3
4	To solve Numerical on definite and improper integrals.	ET215.2 , ET215.3
5	To solve Numerical on partial derivatives, maxima and minima.	ET215.2 , ET215.3
6	To understand orthogonal Co-ordinate systems, its conversion and solve numerical.	ET215.1, ET215.2 , ET215.3
7	To Evaluate various parameters of Statistical random processes and solve numerical.	ET215.1, ET215.2 , ET215.3
8	To solve numerical on Cauchy-Riemann theorem, Taylor's and Laurent's series, residue theorem in complex numbers.	ET215.2 , ET215.3
9	To study the application of maxima and minima in Engineering	ET215.2 , ET215.3
10	To study the application of Random processes in Engineering	ET215.2 , ET215.3

Books:
Text Books:
1. M. D. Greenberg, "Advanced Engineering Mathematics", 2e, Pearson Education, ISBN-13: 978-8177585469 2. B.S. Grewal, "Higher Engineering Mathematics", 2e,Khana Book Publication, Delhi., ISBN-13: 978-8193328491 3. B.V. Ramana, "Higher Engineering Mathematics",1e, Tata McGraw Hill. ISBN-13: 978-0070634190
Reference Books:
1. Francis B. Hildebrand , "Advanced Calculus for Applications" ,Pearson; 2 edition, ISBN978-0130111890 2. Erwin Kreyszig, "Advanced Engineering Mathematics", 10ed, Wiley; 10th edition, ISBN-13: 978-8126554232 3. Nicholas J. Higham, "Applied Mathematics", Princeton University Press, ISBN 978-0-691-15039-0 4. Logan, J. David (John David), "Applied mathematics", 3ed, ISBN: 0-471-74662-2

Data Structures Laboratory (ET216)

Teaching Scheme
Practical: 02 Hrs / Week

Credits: 01

Examination Scheme
Practical Exam: 50 Marks
TW: 25 Marks
Total: 75 Marks

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Prerequisite: Basic Knowledge of C Programming

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Course Outcomes (COs): (Practical)

After successful completion of course students will be able to:

CO	Course Outcome (s) statement	Bloom's Taxonomy	
		Level	Descriptor
ET216.1	Apply suitable algorithm to implement applications of various data structures	3	Apply
ET216.2	Handle operations like insertion, deletion, searching, sorting and traversing on various data structures	3	Apply
ET216.3	Design & implement various linear and nonlinear data structures	4	Analyze

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET216.1	----	3	3	2	---	----	----	----	2	----	----	----	----	2
ET216.2	----	3	3	2	2	----	----	----	2	----	----	----	----	2
ET216.3	----	3	2	3	3	----	----	----	3	----	----	----	----	3

Students are required to complete at least 8 experiments. Star (*) marked experiments are compulsory.

Practical Course Contents

Sr. No.	List of Practical's	COs
1	Find out key number from the sequence of numbers given with the help of suitable searching algorithm.	ET216.1, ET216.2, ET216.3
2	* Implementation of Sorting for the given numbers with suitable sorting algorithm.	ET216.1, ET216.2, ET216.3
3	*Implementation of Singly Linked List	ET216.1, ET216.2, ET216.3
4	Array Implementation of Stack.	ET216.1, ET216.2, ET216.3
5	Linked Implementation of Stack	ET216.2, ET216.1
6	Conversion of Infix to Postfix.	ET216.1, ET216.2, ET216.3
7	Array Implementation of Queue.	ET216.1, ET216.2, ET216.3
8	Apply the logic for performing: a. to obtain substring, b. to decide palindrome, c. to compare with other name, d. to copy, e. to reverse, on student's name.	ET216.1, ET216.2, ET216.3
9	Implementation of Doubly Linked List.	ET216.1, ET216.2, ET216.3
10	*Implement Binary Search Tree.	ET216.1, ET216.2, ET216.3
11	* Implementation of Depth First Search and Breadth First Search.	ET216.1, ET216.2, ET216.3

12	Array Implementation of Circular Queue.	ET216.1, ET216.2, ET216.3
13	Representation of polynomial using array of structure	ET216.1, ET216.2, ET216.3
14	Check continuity of different types of parenthesis using stack.	ET216.1, ET216.2, ET216.3

Books:

Text Books:

1. E Balgurusamy, "Programming in ANSI C", Tata McGraw-Hill,(3rd Edition)
2. Yashavant Kanetkar, "Data Structures Through C", BPB Publication, 2nd Edition

Reference Books:

1. Seymour Lipschutz, "Data Structure with C", Schaum's Outlines, McGraw Hill Education.ISBN-13: 978-1259029967
2. Y. Langsam, M J Augenstein, Aaron Tenenbaum – "DS using C and C++" – Pearson Education, ISBN 81-317-0328-2
3. Ellis Horowitz, Sartaj Sahni, "Fundamentals of Data Structures", university press, ISBN 10:0716782928
4. R. Gilberg & B.Forouzan, "Data Structures A Pseudo code Approach with C", Cengage Learning. ISBN 9788131503140.

Analog Communication Laboratory (ET217)

Teaching Scheme
Practical: 02Hrs. / Week

Credits: 01

Examination Scheme
Practical: 50 Marks
Term work: 25 Marks
Total: 75 Marks

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Course Objectives:

1. To introduce the concept of communication system.
2. To understand the concept of modulation with AM & FM modulation.
3. To introduce the students with the concept of sampling theorem.
4. Apply modern tools in the study of modulation.
5. To study the performance parameters of the receivers.
6. To introduce the students with the concept of pulse modulation techniques.

Course Outcomes (COs): (Practical)

After successful completion of course students will be able to:

COs	Statement	Bloom's Taxonomy	
		Level	Descriptor
ET217.1	Understand the fundamental concepts and various components of analog communication systems.	2	Understand
ET217.2	Apply conceptual knowledge to get modulation and demodulation of AM and FM signals.	3	Apply
ET217.3	Analyze sampling theorem for various frequencies.	4	Analyze
ET217.4	Design & implement AM and FM using MATLAB code	3	Create
ET217.5	Discuss the performance parameters of radio receivers.	4	Understand
ET217.6	Apply the knowledge of pulse modulation & to study the real life applications	2	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET217.1	2	---	---	---	---	---	---	---	---	1	---	1	1	---
ET217.2	1	1	---	---	1	---	---	---	---	---	---	---	1	1
ET217.3	1	1	---	---	1	---	---	---	---	---	---	---	1	1
ET217.4	1	2	2	1	1	---	---	---	---	---	---	---	1	1
ET217.5	1	1	1	1	1	---	---	---	---	---	---	---	1	1
ET217.6	1	---	---	---	1	2	---	---	---	1	---	---	1	---

Students shall perform at least 8 experiments.

Practical Course Contents

Sr. No.	Title of Practical	COs
1	Study Of Communication System & The Role Of Different Components In The Communication System.	ET217.1
2	AM Generation (DSB-FC): Calculation Of Modulation Index By Graphical Method, Power Of AM Wave For Different Modulating Signal And Observe Spectrum.	ET217.2
3	Envelope Detector: Practical Diode Detector & Observe Effect Of Change In RC Time Constant Which Leads To Diagonal & Negative Clipping.	ET217.2
4	Frequency Modulator & Demodulator, Calculation Of Modulation Index & BW Of FM.	ET217.2
5	Measurement of Performance Characteristics of Radio Receiver: Sensitivity, Selectivity, Fidelity.	ET217.5
6	Verification Of Sampling Theorem, PAM Techniques, (Flat Top & Natural Sampling), Reconstruction Of Original Signal, Observe Aliasing Effect In Frequency Domain.	ET217.3
7	Generation And Detection Of PWM Using IC 555.	ET217.6
8	Write A MATLAB Code & Simulate To Generate Amplitude Modulation [AM] Waveform For Given Modulation Index, Signal Frequency & Carrier Frequency.	ET217.2, ET217.4
9	Write A MATLAB Code & Simulate To Generate Frequency Modulation [FM] Waveform For Given Modulation Index, Signal Frequency & Carrier Frequency.	ET217.2, ET217.4
10	To Test & Observe The Different Stages Of Public Address (PA) System.	ET217.1

Books:
Text Books:
1. B. P. Lathi, “Communication Systems”, BS publications. 2. George Kennedy, “Electronic Communications”, McGraw Hill Kennedy.
Reference Books:
1. Simon Haykin, “An introduction to analog & digital communications”, John Wiley & Sons 2. Roddy and Coolen, “Electronic Communication Systems”, Pearson Education. 3. Frank R. Dungan, “Electronic Communication Systems”, Delmar Publishers. 4. R. G. Gupta, "Audio & Video Systems" Tata McGraw-Hill
Guidelines for Continuous Assessment:-Test, Home Assignments etc.

Signals and Systems Tutorial (ET218)

Teaching Scheme
Tutorials: 01 Hr. /Week
Credits: 01

Examination Scheme
Oral: - 50Marks
Total: 50 Marks

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Course Objectives:

1. To understand the mathematical description of continuous and discrete time signals and systems.
2. To analyze Linear Time Invariant (LTI) systems in time domain.
3. To study the signal and system using the tool Laplace Transform.
4. Analyze the spectral characteristics of continuous-time periodic and a periodic signals using Fourier analysis.
5. Analyze the continuous time signal using Fourier transform.
6. To study correlation and its properties.

Course Outcomes (COs):

After completion of this subject student should be able to:

Course Code	Course outcome	Blooms Taxonomy	
		Level	Descriptor
ET218.1	List the formulas and standard signals representation for system analysis	1	Remember
ET218.2	Interpret the difference between continuous and discrete time signals and systems & different transform techniques	2	Understand
ET218.3	Classify the knowledge to determine system behavior for variable inputs, Conversion of signal from one domain and to determine parameters of random signals	3	Apply
ET218.4	Analyze the system, Transform techniques for knowledge of signals and system.	4	Analyze

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2

ET218.1	3	2	1	-	-	-	-	-	2	1	-	2	3	-
ET218.2	3	2	2	-	-	-	-	-	3	1	-	2	2	-
ET218.3	1	3	3	-	-	-	-	-	2	2	-	2	3	-
ET218.4	2	2	3	-	-	-	-	-	2	1	-	2	3	-

Tutorial Course Contents

Sr. No.	List of Tutorial (Minimum 8 per subject)	COs
1	A) Sketch and write mathematical expression for the following signals in CT and Discrete Time (DT) a) Sine b) Rectangular c) Exponential d) Unit Impulse e) Unit Step f) Ramp g) Signum h) Sinc B) Classify and find the respective value for the above signals a) Periodic / Non Periodic b) Energy / Power /Neither . c) Even and Odd	ET218.1, ET218.2
2	Perform the following signal operations: Amplitude scaling, addition, multiplication, differentiation, integration (accumulator for DT), time scaling, and time shifting and folding.	ET218.1, ET218.2
3	To study various types of systems .Determine whether each one of them is Memory less, Causal, Linear, Stable, Time invariant, Invertible.	ET218.1, ET218.2
4	To study impulse response of LTI System.	ET218.1, ET218.2
5	Perform Convolution Integral and convolution sum of CT and DT Signals.	ET218.1, ET218.2
6	To study the Fourier series of Continuous signal.	ET218.1, ET218.3
7	To study the Fourier Transform of Continuous signal.	ET218.3, ET218.4
8	To study the application of Laplace Transform in system stability and in electrical networks.	ET218.3
9	Perform auto correlation and cross correlation of DT and CT signals.	ET218.1, ET218.2

Books:

Text Books:

1. Simon Haykins and Barry Van Veen, “Signals and Systems”, John Wiley and sons.
2. B. P. Lathi, “Linear Systems and Signals”, OXFORD University Press.

Reference Books:

1. Alan V. Oppenheim, Alan S. Willsky with IAN T. Young, “Signals and Systems”, Prentice-Hall.
2. S. S. Soliman & M.D. Srinath, “Continuous and Discrete Signals and Systems”, Prentice- Hall, 1990.
3. Shaila Dinkar Apte “Signals and Systems: Principles and Applications”, Cambridge University Press.
4.Charles Phillips, “Signals, Systems and Transforms”, 3rd Edition, Pearson Education.

5. M.J. Roberts “Signal and Systems”, Tata McGraw Hill 2007.

Mini Project (ET219)

Teaching Scheme
Practical : 04 Hrs. / Week
Credits: 02

Examination Scheme
TW: 50 Marks
Total: 50 Marks

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Prerequisite Course: Proteus ARES for PCB artwork design OR Express PCB OR PSpice etc.

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Course Objectives:

1. To undertake & execute a Mini Project through a group of students.
2. To plan for various activities of the project and distribute the work amongst team members.
3. To learn budget planning for the project.
4. To inculcate electronic hardware implementation skills by -
   a. Learning PCB artwork design using an appropriate EDA tool.
   b. Imbibing good soldering and effective trouble-shooting practices.
   c. Following correct grounding and shielding practices.
   d. Knowing the significance of aesthetics & ergonomics while designing electronic product.
5. To understand the ‘Product Development Cycle’ through Mini Project.
6. To develop student’s abilities to transmit technical information clearly and test the same by delivery of Seminar based on the Mini Project.

Course Outcomes (COs): After successfully completing the course students will be able to

COs	Statement	Bloom’s Taxonomy	
		Level	Descriptor
ET219.1	Understand, plan and execute a Mini Project with team.	2	Understand
ET219.2	Implement electronic hardware by learning PCB artwork design, soldering techniques, troubleshooting, etc.	3	Apply
ET219.3	Prepare a technical report based on the Mini project.	2	Understand
ET219.4	Deliver technical seminar based on the Mini Project work carried out.	5	Evaluate
ET219.5	Design and Develop a product as per the application	6	Create
ET219.6	Test the Project in different environmental conditions	4	Analyze

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET219.1	-	3	-	-	-	-	-	1	3	-	-	2	2	-
ET219.2	2	-	3	2	3	-	-	1	3	-	-	2	-	3
ET219.3	-	-	-	-	-	-	-	1	3	3	-	-	-	3

ET219.4	-	-	-	-	-	-	-	1	3	-	-	-	2	-
ET219.5	-	3	3	-	-	-	-	1	3	-	3	3	-	3
ET219.6	-	-	2	3	-	-	-	1	3	-	-	3	-	3

Guidelines:

1. Project group shall consist of not more than 3 students per group.
2. Suggested Plan for various activities to be monitored by the teacher.
   a. Week 1 & 2 : Formation of groups, Finalization of Mini project & Distribution of work.
   b. Week 3 & 4 : PCB artwork design using an appropriate EDA tool, Simulation.
   c. Week 5 & 6 : Project Review as per the defined Rubrics in the evaluation sheet, Hardware assembly and Testing
   d. Week 7 & 8 : Enclosure Design, Fabrication, etc.
   e. Week 9 & 10 : Preparation, Checking & Correcting of the Draft Copy of Report
   f. Week 11 & 12: Project Review as per the defined Rubrics in the evaluation sheet, Demo and Group presentations
3. Mini Project Work should be carried out in the Projects Laboratory.
4. Project designs ideas can be necessarily adapted from recent issues of electronic design magazines Application notes from well-known component manufacturers may also be referred.
5. Hardware component is mandatory.
6. Layout versus schematic verification is mandatory.
7. Domains for projects may be from the following , but not limited to:
   a. Instrumentation and Control Systems
   b. Electronic Communication Systems
   c. Power Electronics
   d. Audio , Video Systems
   e. Embedded Systems
   f. Solar Energy Based
8. Project based on latest technology is appreciable.
9. A project report with following contents shall be prepared:
   a. Title
   b. Specifications
   c. Block diagram
   d. Circuit diagram
   e. Selection of components
   f. Simulation results
   g. PCB artwork
   h. Layout versus schematic verification report
   i. Testing procedures
   j. Enclosure design
   k. Test results
   l. Conclusion
   m. References

Continuous Assessment : Based on project review(15 Marks +15 Marks), Project report(20 Marks) and Execution of the project (50 Marks) .

References:

1. https://www.electronicsforu.com/category/electronics-projects/hardware-diy
2. https://www.elprocus.com/electronics-for-you-mini-projects-ideas/

3. https://core-electronics.com.au/projects
4. https://www.skyfilabs.com/electronics-ece-mini-projects-for-engineering-students
5. https://www.cst.cam.ac.uk/teaching/part-ib/group-projects

Seminar (ET220)

Teaching Scheme
Practical: 4 Hrs. /Week
Credits: 2

Examination Scheme
Term work: 50 marks
Total: 50 Marks

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Course Objectives:

1. Understand the diverse social and economic, racial context, the themes of the seminar.
2. Identify, understand and discuss current, real-world issues.
3. Distinguish and integrate academic knowledge to apply multidisciplinary strategy to address current issues.
4. Improve oral and written communication skills.
5. Explore an appreciation of the self in relation to its larger diverse social and academic contexts.
6. Apply principles of ethics and respect in interaction with others.

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

Course Outcomes	Statement	Bloom's Descriptor	
		Level	Descriptor
ET220.1	Learn and integrate through independent learning and collaborative study.	2	Understand
ET220.2	To Recognize real-world issues.	1	Remember
ET220.3	Develop knowledge in the engineering, humanities, sciences, and social sciences with disciplinary specialization.	3	Apply
ET220.4	To develop and convey intended meaning using verbal and non-verbal method of communication that demonstrates respect and understanding in a complex society.	3	Apply
ET220.5	To understand self, relationships and diverse global perspectives.	2	Understand

Mapping of course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET220.1	2	--	--	--	--	--	--	--	--	--	--	2	2	--
ET220.2	2	2	--	-2	--	--	--	--	--	--	--	2	--	2
ET220.3	2	--	--	--	2	2	--	--	--	--	2	2	--	2
ET220.4	2	--	--	--	--	--	--	--	3	3	--	3	--	2
ET220.5	2	--	--	--	2	--	--	--	--	--	--	2	--	2

A. Guidelines for Students:

1. Seminar group shall consist of not more than 3 students per group
2. Individual student have to present seminar topic.
2. Seminar topic should be innovative, emerging and current issues addressed.
3. Student should collect all information related with topic with authentic and validate proofs.

B. Domains for Seminar may be from the following, but not limited to:

- Communication Engineering,
- Computer/Communication Networking
- WSN and IOT
- Microcontroller based/Embedded systems
- VLSI Technology,
- Power electronics and drives
- Instrumentation,

- Agriculture Engineering
- Biomedical Engineering
- Robotics/Mechatronics/Process Automation
- Automotive Electronics

C. Monitoring: Suggested Plan for various activities to be monitored by the teacher.

Week 1 & 2: Finalization of seminar topic with broad literature survey
Week 3 & 4: Preparation of brief Introduction and abstract
Week 5 to 6: Finalization of topics and subtopics for chapters
Week 6 to 7: Intermediate review of the seminar topic
Week 8 & 9: Preparation of conclusions and summery
Week 10 & 11: Preparation of report and presentation
Week 12 &13 : Present seminar

Note: - Log book for all these activities shall be maintained. It is mandatory to submit the seminar report.

D. Report writing: A report with following contents shall be prepared:

Contents

1) Cover Page & Title Page
2) Certificate
3) Abstract
4) Acknowledgments
5) List of figures
6) List of tables
7) Abbreviations
8) Contents
9) Chapters
10) Appendix
11) References

Journals to Refer like but not limited to :
Bell Labs Technical Journal
IEEE Communications Magazine
IEEE Consumer Electronics Magazine
IEEE Instrumentation & Measurement Magazine
IEEE Signal Processing Magazine
IEEE Transactions on Circuits and Systems II: Express Briefs
Elsevier science direct E-journals, Sensors and Actuators A: Physical ISSN no. 0924-4247,
Elsevier science direct E-journals, Computer Vision and Image Understanding, ISSN no.1077-3142
Elsevier science direct E-journals, Digital Signal Processing, ISSN no. 1051-2004

Elsevier science direct E-journals, Microelectronic Engineering, ISSN no. 0167-9317

Mandatory Course IV(MC221)

Innovation - Project based – Science and Technology, Social, Design & Innovation

Teaching Scheme
Lectures: 2 Hrs. / Week
Credits: 0

Examination Scheme

Total: 0 Marks

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Many students, when they enter engineering, are full of enthusiasm to understand new areas, to build systems and to experiment and play with them. This enthusiasm is to be tapped and to direct it to exploration and sustained pursuit by the student, which may result in development of a working system, a prototype, or a device or material, etc. They are expected to come up with novel and useful ideas on social problems. Students may be encouraged to take up projects which are aimed at providing solutions to societal problems, reduce drudgery and improving efficiency in rural work, green technologies, utilization of rural and urban waste, sanitation and public health, utilizing non-conventional energy sources, technologies for the benefit of the differently abled people and technologies ready to be implemented in the Institute.

Two types of activities may be undertaken under this

(a) Exposure to social problems (which are amenable to technological solutions)

(b) Design & Innovation (to address above problems)

After this student be encouraged to undertake technology projects of social relevance

Course Objectives

1. To develop strategic thinking to solve social problems in innovative manner.
2. Understand the role of innovation and technical change in enterprise and national level economic performance
3. Understand the technological, human, economic, organizational, social and other dimensions of innovation
4. Understand the effective management of technological innovation requires the integration of people, processes and technology
5. Recognize opportunities for the commercialization of innovation
6. Understand the attributes of innovations

Course Outcomes (CO): After successfully completing the course students will be able to

CO	Course Outcome Statements	Bloom's Taxonomy	
		Level	Descriptor
MC221.1	Understand need of innovation and social problems	2	Understand

MC221. 2	Understand opportunity recognition and ideation management to solve the social problems	2	Understand
MC221.3	Understand the technological, human, economic, organizational, social and other dimensions of innovation	2	Understand
MC221.4	Understand the effective management of technological innovation requires the integration of people, processes and technology	2	Understand
MC221.5	Recognize opportunities for the commercialization of innovation	1	Remember
MC221.6	Understand the attributes of innovations	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
MC221.1	-	-	2	2	-	1	-	-	-	-	-	-	2	-
MC221.2	-	-	3	2	-	3	-	-	-	-	1	-	3	-
MC221.3	-	-	3	2	-	3	-	-	-	-	1	-	-	-
MC221.4	-	-	-	-	-	2	2	-	-	-	1	-	-	-
MC221.5	-	-	-	-	-	1	2	1	-	-	-	1	-	-
MC221.6	-	-	-	-	-	2	-	-	-	-	-	2	-	-

Course Contents

Unit-I	**Introduction to innovation**	No. of Hours	COs
	Understand the concept of innovation, Know the difference between innovation and invention, Understand the reasons for innovation, The Innovation Matrix or 4 types of innovation	4Hrs.	MC221.1
Unit-II	**Process of Innovation**		
	Know what the process of innovation entails, Know the steps involved in creative problem solving, know how to build organizations for executing innovation, Evaluation of innovation	4Hrs.	MC221.2
Unit-III	**Idea generation**		
	Understand the discovery process for opportunities, Identify the people to be involved in the idea generation process, Know the methods for discovering opportunities	4Hrs.	MC221.3

Unit-IV	**Developing innovative culture**		
	Know the organizational features that facilitate innovation, how organizations can learn from new information, know how to manage available resources for innovation, A case study on product development in an open innovation environment.	4Hrs.	MC221.4
Unit-V	**Leveraging on user innovation**		
	Know how to identify lead users, Strategies of leveraging on user innovation, how to create new products based on user innovations	4Hrs.	MC221.5
Unit-VI	**Innovation attributes and their adoption rate**		
	Know the attributes of innovations, Know the rate of innovation diffusion, Know the variables determining the rate of adoption of an innovation, know how to protect their innovations	4Hrs.	MC221.6

Books

1. Saini**,** H. S**.,** Singh**,** R. K., Reddy**,** K. Satish ," Innovations in Electronics and Communication Engineering" Publisher *Springer*.
2. Shrenik Suresh Sarade, "Electronics Engineering Innovation-I: Electronics Project Designing for Engineering" LAP LAMBERT Academic Publishing
3. Dr R V Mahendra Gowda, "Innovation in Engineering Education"
4. NPTEL- Innovation, Business Models and Entrepreneurship

References

1. Graduate Certificate in Innovation-**Singapore Management University**
   I-Design Thinking-Opportunity Recognition and Ideation Management
   II-Design Thinking -Innovation Management Tool
   III-Implementing Effective Innovation Processes
2. Democratizing innovation by Eric Von Hippel
3. Masachussetts Institute of Technology, managing innovation process (Links to an external site.)
4. The Open University, The concept of Innovation (Links to an external site.)
5. OER Commons, On Innovation

Guidelines for Continuous Assessment: -

1. Presentation based on Case study

2. Unit Test,
3. Home Assignments.

Sanjivani Rural Education Society's

Sanjivani College of Engineering, Kopargaon

(An Autonomous Institute Affiliated to Savitribai Phule Pune University, Pune)

B. Tech. Electronics and Telecommunication Engineering

2019 pattern

Program Structure

(B. Tech. with effect from Academic Year 2019-2020)

At. Sahajanandnagar, Post. Shingnapur Tal. Kopargaon Dist. Ahmednagar,

Maharashtra State, India PIN 423603

Department Vision

Our vision is to produce quality professionals in the field of Electronics & Telecommunication Engineering with knowledge and skillsets to meet diversifying needs of industry and society.

Department Mission

M1- To impart the technology of Electronics & Telecommunication Engineering through effective teaching-learning process.

M2- To establish linkages between industry and academia for overall development of students.

M3- To promote innovative ideas in solving multi-disciplinary engineering problems having social relevance.

M4- To develop technical human resources exhibiting professional and ethical attitudes.

Program Outcomes (POs)

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Educational Objectives (PEOs)

The PEOs of undergraduate programme in Electronics and Telecommunication Engineering are

PEO1: Involve in design, manufacturing, integration and testing of products, software and systems in the field of Electronics & Telecommunication engineering and allied disciplines**.**

PEO2: Solve engineering problems having social relevance by applying knowledge and skillsets related to Electronics & Telecommunication engineering.

PEO3: Pursue higher Education/Research in the field of Engineering/Management or to become a successful entrepreneur in the related areas.

PEO4: Work effectively as an individual and/or a team member of multi-disciplinary assignments involving people across different cultures and national boundaries.

Program Specific Outcomes (*PSOs*)

PSO1: Design, test and implement electronic systems and appliances related to signal processing, embedded systems, industrial automation and IoT using the state of the art components and software.

PSO2: Architect, classify and select appropriate technologies for the implementation of wired and wireless communication systems.

CURRICULUM STRUCTURE - 2019 PATTERN
Second Year B. Tech. (Electronics and Telecommunication Engineering)
WITH EFFECT FROM ACADEMIC YEAR 2020-2021

SEMESTER-I

Course			Teaching Scheme Hours/week				Evaluation Scheme-Marks						
							Theory						
Cat	Code	Title	L	T	P	Credits	ISE	ESE	CA	OR	PR	TW	Total
PROJ	ET201	First Year Internship	-	-	-	2	-	-	-	50	-	-	50
BSC	BS202	Vector Calculus and Differential Equations	3	1	-	4	30	50	20	-	-	-	100
PCC	ET203	Network Theory	4	-	-	4	30	50	20	-	-	-	100
PCC	ET204	Electronic Devices and Circuits	3	-	-	3	30	50	20	-	-	-	100
PCC	ET205	Digital Electronics	3	-	-	3	30	50	20	-	-	-	100
HSMC	HS206	Universal Human Values & Ethics	3	-	-	3	30	50	20	-	-	-	100
LC	ET207	Network Theory Laboratory	-	-	2	1	-	-	-	50	-	25	75
LC	ET208	Electronic Devices and Circuits Laboratory	-	-	2	1	-	-	-	-	50	25	75
LC	ET209	Digital Electronics Laboratory	-	-	2	1	-	-	-	-	50	25	75
MC	MC210	Mandatory Course-III	2	-	-	No	-	-	-	-	-	-	-
		Total	**18**	**1**	**6**	**22**	**150**	**250**	**100**	**100**	**100**	**75**	**775**

MC210	**Mandatory Course-III**	**Constitution of India – Basic features and fundamental principles**

List of Abbreviations

Abbreviation	Full Form	Abbreviation	Full Form
BSC	Basic Science Course	**MC**	Mandatory Course
ESC	Engineering Science Course	**PCC**	Professional Core Course
HSMC	Humanities/Social Sciences/Management Course	**PEC**	Professional Elective Course
IP	Induction Program	**OEC**	Open Elective Course
L	Lecture	**LC**	Laboratory Course
T	Tutorial	**CA**	Continuous Assessment
P	Practical	**OR**	End Semester Oral Examination
ISE	In-Semester Evaluation	**PR**	End Semester Practical Examination
ESE	End-Semester Evaluation	**TW**	Continuous Term Work Evaluation
Cat	Category	**PROJ**	Project

SEMESTER-II

Course			Teaching Scheme Hours/week				Evaluation Scheme-Marks						
							Theory			OR	PR	TW	Total
Cat	Code	Title	L	T	P	Credits	ISE	ESE	CA				
PCC	ET211	Transform Theory and Applied Mathematics	3	-	-	3	30	50	20	-	-	-	100
PCC	ET212	Data Structures	4	-	-	4	30	50	20	-	-	-	100
PCC	ET213	Analog Communication	3	-	-	3	30	50	20	-	-	-	100
PCC	ET214	Signals & Systems	4	-	-	4	30	50	20	-	-	-	100
LC	ET215	Transform Theory and Applied Mathematics Tutorial	-	1	-	1	-	-	-	-	-	25	25
LC	ET216	Data Structures Laboratory	-	-	2	1	-	-	-	-	50	25	75
LC	ET217	Analog Communication Laboratory	-	-	2	1	-	-	-	-	50	25	75
LC	ET218	Signals & Systems Tutorial	-	1	-	1	-	-	-	50	-	-	50
PROJ	ET219	Mini Project/Choice Based Subject*	-	-	4	2	-	-	-	-	-	50	50
PROJ	ET220	Seminar	-	-	4	2	-	-	-	-	-	50	50
MC	MC221	Mandatory Course-IV	2	-	-	No	-	-	-	-	-	-	-
		Total	**16**	**2**	**12**	**22**	**120**	**200**	**80**	**50**	**100**	**175**	**725**

***Note:** Choice Based Subject Teaching Scheme can be decided by department without losing its assigned credits.

MC221	**Mandatory Course-IV**	**Innovation - Project based – Sc., Tech, Social, Design & Innovation**

List of Abbreviations

Abbreviation	Full Form	Abbreviation	Full Form
BSC	Basic Science Course	**MC**	Mandatory Course
ESC	Engineering Science Courses	**PCC**	Professional Core Course
HSMC	Humanities/Social Sciences/Management Courses	**PEC**	Professional Elective Courses
IP	Induction Program	**OEC**	Open Elective Courses
L	Lecture	**LC**	Laboratory Courses
T	Tutorial	**CA**	Continuous Assessment
P	Practical	**OR**	End-Semester Oral Examination
ISE	In-Semester Evaluation	**PR**	End -Semester Practical Examination
ESE	End-Semester Evaluation	**TW**	Continuous Term Work Evaluation
Cat	Category	**PROJ**	Project

Total Credits : 44	**Total Marks : 1500**

Transform Theory and Applied Mathematics (ET211)

Teaching Scheme
Lectures: 03 Hrs. / Week

Examination Scheme
In-Sem Exam : 30 Marks
End Sem Exam : 50 Marks
Continuous Assessment : 20 Marks
Total : 100 Marks

Credits: 03

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Prerequisite Course: Basics of Calculus

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Course Objectives:

1. To introduce a concept of Laplace and Fourier transforms
2. To study Z transform and its properties
3. To understand the Calculus and its applications
4. To apply co-ordinate geometry concepts for field and space.
5. To explain statistical parameters and random processes.
6. To understand complex variables for integrals and residue applications.

Course Outcomes (COs):

CO	Course Outcome Statement	Bloom's Taxonomy	
		Level	Descriptor
ET211.1	List the formulas and conversion techniques of various transforms and applied mathematics.	1	Remember
ET211.2	Interpret the significance of various transforms and applied mathematics along with its applications in the field of Engineering.	2	Understand
ET211.3	Construct the concepts of various transforms and applied mathematics to solve real life problems in the field of Communication systems and Signal processing.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET211.1	3	2	1	-	-	1	-	-	-	1	-	2	1	--
ET211.2	3	2	1	-	-	1	-	-	-	1	-	2	2	--
ET211.3	3	3	2	-	-	1	-	-	-	1	-	2	3	--

Course Contents

Unit-I	Laplace Transform & Fourier Transform	No. of Hours	COs
	Laplace Transform(LT) :Definition of LT, Properties and Inverse Laplace Transform, Solutions of differential equations Fourier Transform (FT): Fourier transform, Properties and Inverse Fourier Transform. Applications of LT and FT	06 Hrs.	ET211.1 ET211.2 ET211.3
Unit-II	Z-Transform	No. of	COs

		Hours	
	Introduction, Definition, Standard properties, ZT of standard sequences and their inverses, Solution of difference equations, Applications of ZT.	06 Hrs.	ET211.1 ET211.2 ET211.3
Unit-III	Calculus	No. of Hours	COs
	Theorems of integral calculus, evaluation of definite and improper integrals, partial derivatives and its applications, maxima and minima.	06 Hrs.	ET211.1 ET211.2 ET211.3
Unit-IV	Co-ordinate geometry and applications	No. of Hours	COs
	Introduction to 3-D orthogonal Co-ordinate systems - Cartesian, cylindrical, spherical and its representation, conversion of one co-ordinate system into another co-ordinate system, Applications in electromagnetic field.	08 Hrs.	ET211.1 ET211.2 ET211.3
Unit-V	Statistics and Random Processes	No. of Hours	COs
	Mean, median, mode and standard deviation, Correlation & Covariance function, Random Processes, Ergodic processes, Correlation and regression analysis	06 Hrs.	ET211.1 ET211.2 ET211.3
Unit-VI	Complex Analysis	No. of Hours	COs
	Analytic functions, Cauchy-Riemann equations, Cauchy's integral theorem, Cauchy's integral formula; Taylor's and Laurent's series, residue theorem.	06 Hrs.	ET211.1 ET211.2 ET211.3

Books:

Text Books:

1. M. D. Greenberg, “Advanced Engineering Mathematics”, 2e, Pearson Education, ISBN-13: 978-8177585469
2. B.S. Grewal, “Higher Engineering Mathematics”, 2e,Khana Book Publication, Delhi., ISBN-13: 978-8193328491
3. B.V. Ramana, “Higher Engineering Mathematics”,1e, Tata McGraw Hill. ISBN-13: 978-0070634190

Reference Books:

1. Francis B. Hildebrand , “Advanced Calculus for Applications” ,Pearson; 2 edition, ISBN978-0130111890
2. Erwin Kreyszig, “Advanced Engineering Mathematics”, 10ed, Wiley; 10th edition, ISBN-13: 978-8126554232
3. Nicholas J. Higham, “Applied Mathematics”, Princeton University Press, ISBN 978-0-691-15039-0
4. Logan, J. David (John David), “Applied mathematics”, 3ed, ISBN: 0-471-74662-2

Online resource : Engineering Mathematics - I - Course (nptel.ac.in)

Guidelines for Teachers Assessment:- MCQ Test, Presentations

Data Structures (ET212)

Teaching Scheme
Lectures: 04 Hrs. / Week

Credits: 04

Examination Scheme
ISE : 30 Marks
ESE : 50 Marks
CIA : 20 Marks
Total: 100 Marks

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Prerequisite: Basic Knowledge of C Programming

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Course Objectives:

1. To impart the basics of algorithm development and analysis of algorithms.
2. To emphasize practical concerns, rather than mathematical analysis.
3. To introduce students to common programming techniques/algorithms (recursion, searching and Sorting, etc.)
4. To understand the memory requirement for various data structures.
5. To introduce students to several fundamental abstract data types (ADTs) and data structures.
6. To introduce various techniques for representation of the data in the real world.

Course Outcomes (COs):

After successful completion of course students will be able to

COs	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
ET212.1	Learn the Fundamentals of data structures and it's applications	1	Remember
ET212.2	Understand the algorithms to solve programming problems	2	Understand
ET212.3	Apply appropriate data structures and efficient algorithm to solve the problems of various domain	3	Apply
ET212.4	Analyze time and space efficiency of algorithms	4	Analyze

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET212.1	2	3	2	3	-----	-----	-----	-----	-----	-----	-----	-----	-----	3
ET212.2	2	3	3	2	-----	-----	-----	-----	-----	-----	-----	-----	2	2
ET212.3	2	3	3	----	2	-----	-----	-----	-----	-----	-----	-----	-----	2
ET212.4	3	-----	-----	-----	1	-----	-----	-----	-----	-----	-----	-----	-----	1

Course Contents

Unit-I	**Overview of C Programming**	No. of Hours	COs
	Functions: Definition, Types of functions with appropriate examples, recursive functions. Macros, Comparison Macros with function. Structures: Definition, Self-Referential Structure, Array of structures. Arrays: Concept of Sequential Organization, Polynomial representation using arrays, Pointers: Basic concepts. Pointer declaration & initialization. Pointer to a pointer. Pointers and arrays, pointers and structures.	08	ET212.1, ET212.2 ET212.3, ET212.4
Unit-II	**Introduction to Data Structures**	No. of Hours	COs
	Introduction: Concepts and definition of data, data type, data object, data structures. Types of Data Structures-Linear and Non Linear. Searching Methods: Sequential Search and Binary Search. Sorting Methods: Selection sort, Bubble sort, Insertion sort. Introduction to Time complexity and Space complexity, brief overview of the Big Oh and other notations. Concept of Abstract Data Type (ADT).	08	ET212.1, ET212.2 ET212.3, ET212.4
Unit-III	**Dynamic memory allocation and Linked List**	No. of Hours	COs
	Introduction: Dynamic memory management. Linked List: Concept of Singly Linked List: Different operations such as Creation, Insertion, deletion, display, search of node in linked list. Concept of Doubly Linked List and Circular Linked List, Comparison of Linked List with Array. Applications of Linked list.	08	ET212.1, ET212.2 ET212.3, ET212.4
Unit-IV	**Stack and Queues**	No. of Hours	COs
	Stacks: Definition & example, representation using arrays & linked list. Applications of Stacks: Concept of infix, postfix and prefix expressions, conversion of infix to postfix expression, evaluation of postfix expression. Queues: Definition & example, representation of queue using array and linked list. Concept of Circular queue, Priority Queue. Applications of Queue.	08	ET212.1, ET212.2 ET212.3, ET212.4
Unit-V	**Trees**	No. of Hours	COs
	Introduction: tree terminologies, Binary trees and its representation, Types of Binary Trees. Binary Search Tree (BST): Implementation of Binary Search Tree, BST traversals – preorder, in order & post order, Primitive operations on BST: Create, insert, delete and Search.	08	ET212.1, ET212.2 ET212.3, ET212.4

Unit-VI	**Graphs**	No. of Hours	COs
	Graphs: Concepts and terminology, Types of graphs, representation of graph using adjacency matrix, adjacency list, Traversals: DFS & BFS. Minimal spanning tree: Concept, Kruskal, Prim's algorithm.	08	ET212.1, ET212.2 ET212.3, ET212.4

Text Books:

1. E. Balgurusamy, "Programming in ANSI C", Tata McGraw-Hill,(3rd Edition)
2. Yashavant Kanetkar, "Data Structures Through C", BPB Publication, 2nd Edition

Reference Books:

1. Seymour Lipschutz, "Data Structure with C", Schaum's Outlines, McGraw Hill Education.
2. Y. Langsam, M J Augenstein, Aaron Tenenbaum – "DS using C and C++" – Pearson Education.
3. Ellis Horowitz, Sartaj Sahni, "Fundamentals of Data Structures", university press.
4. R. Gilberg & B.Forouzan, "Data Structures A Pseudo code Approach with C", Cengage Learning.

Guidelines for Continuous Internal Assessment:-

10 Marks based on Students' performance in programming Assignments and remaining 10 marks on class assignments /Quiz. These evaluation components should be carried out on completion of each unit and average should be taken.

If required necessary changes in the CIA components can be made by respective course teacher

Analog Communication (ET213)

Teaching Scheme:
Lectures: 03 Hrs. / Week

Examination Scheme:
In-Sem Exam: 30 Marks
End Sem Exam: 50 Marks
Continuous Assessment: 20 Marks
Total: 100 Marks

Credits: 03

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Prerequisite Course: Basic Electronics Engineering

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Course Objectives:

1. To understand the concept of a communication system.
2. To understand the concept of amplitude modulation and different methods of generating AM signals.
3. To study frequency modulation and its different generation methods.
4. To understand the operation of TRF and super heterodyne receivers.
5. To study different types and sources of noise.
6. To analyze different types of pulse modulation.

Course Outcomes (COs):

After completion of course students will be able to

COs	Statement	Bloom's Taxonomy	
		Level	Descriptor
ET213.1	Remember the concepts and various components of Modulator and Demodulator circuits of analog communication systems.	2	Remember
ET213.2	Apply conceptual knowledge to get modulation and demodulation of AM signals.	3	Apply
ET213.3	Apply conceptual knowledge to get modulation and demodulation of FM signals.	3	Apply
ET213.4	Analyze radio receivers with their different performance parameters.	4	Analyze
ET213.5	Understand the different types of noise and its effect on the communication system.	4	Understand
ET213.6	Apply the knowledge of pulse modulation & multiplexers to study the real life applications	2	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET213.1	2	---	---	---	---	---	---	---	---	1	---	1	1	2
ET213.2	1	1	---	---	1	---	---	---	---	---	---	---	1	---
ET213.3	1	1	---	---	1	---	---	---	---	---	---	---	1	---
ET213.4	1	2	2	1	1	---	---	---	---	---	---	---	1	1

ET213.5	1	1	1	---	1	---	---	---	---	---	---	---	1	1
ET213.6	2	---	---	---	1	2	---	---	---	1	---	1	1	2

Course Contents:

Unit-I	**Introduction to Communication Systems**	**No. of Hours**	**COs**
	Communication, Basic Elements of Communication System, Analog and Digital Communication System Overview, Electromagnetic Spectrum and its Usage, Classification of communication system, Modulation, Need of Modulation, Types of Modulation, Communication Channels, Baseband and Carrier Communication.	06 Hrs.	ET213.1
Unit-II	**Amplitude Modulation**	**No. of Hours**	**COs**
	Amplitude Modulation(AM), Mathematical Expression, Modulation Index, Bandwidth of AM, Generation methods of AM Signal, Side Band, DSBFC and its Spectrum, Power Relations Applied to Sinusoidal Signals, DSBSC-Multiplier Modulator, Switching Modulator, Ring Modulator and its Spectrum, SSBSC, ISB and VSB, Their Generation Methods, Comparison and its Applications.	06 Hrs.	ET213.2
Unit-III	**Angle Modulation**	**No. of Hours**	**COs**
	Frequency Modulation (FM), Mathematical Expression, Modulation Index, Spectrum Analysis, Narrowband FM, Wideband FM, Single Tone Frequency Modulation, Transmission Bandwidth of FM Waves, Phase modulation(PM), Relation between FM and PM, Generation methods of FM, Direct and Indirect Methods, Armstrong's Indirect Method, Comparison between AM, FM and PM..	06 Hrs.	ET213.3
Unit-IV	**Radio Receivers**	**No. of Hours**	**COs**
	Main functions of receiver, Tuned Radio Frequency (TRF) Receiver, Super heterodyne receiver for AM and FM, Automatic Gain Control (AGC), Performance Parameters: Sensitivity, selectivity, fidelity, image frequency rejection etc. AM detection types: Envelope Detection, Rectifier Detection, FM Detection: Using Phase Lock Loop (PLL).	06 Hrs.	ET213.4
Unit-V	**Noise**	**No. of Hours**	**COs**
	Definition Of Noise, Effect Of Noise, Sources Of Noise, Internal & External Sources of Noise, Types Of Noise, Signal To Noise Ratio(SNR), SNR Of Tandem Connection, Figure Of Merit Calculations, Noise Figure, Noise Temperature, Friss Formula For Noise Figure, Noise Bandwidth, Noise Reduction Techniques.	06 Hrs.	ET213.5

Unit-VI	Pulse Modulation & Multiplexing	No. of Hours	COs
	Sampling, Sampling Rate, Sampling Theorem, Nyquist Criteria, Types Of Sampling: Ideal, Natural & Flat Top, Analog Pulse Modulation: PAM, PWM & PPM, Multiplexing, Types of Multiplexers, Analog Multiplexing, FDM, WDM.	06 Hrs.	ET213.6

Books:

Text Books:

1. B. P. Lathi, “Communication Systems”, BS publications.
2. George Kennedy, “Electronic Communications”, McGraw Hill Kennedy.

Reference Books:

1. Simon Haykin, “An introduction to analog & digital communications”, John Wiley & Sons
2. Roddy and Coolen, “Electronic Communication Systems”, Pearson Education.
3. Frank R. Dungan, “Electronic Communication Systems”, Delmar Publishers.
4. R. G. Gupta, "Audio & Video Systems" Tata McGraw-Hill

Guidelines for Teacher’s Assessment:- Unit Test, Home Assignments etc.

Signals and Systems (ET214)

Teaching Scheme
Lectures: 4Hrs. / Week

Credits: 04

Examination Scheme
In-Sem Exam: 30 Marks
End Sem Exam: 50 Marks
CIA: 20 Marks
Total: 100 Marks

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Prerequisite Course: NIL

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Course Objectives:

1. To understand the mathematical description of continuous and discrete time signals and systems.
2. To analyze Linear Time Invariant (LTI) systems in time domain.
3. To study the signal and system using the tool Laplace Transform.
4. Analyze the spectral characteristics of continuous-time periodic and a periodic signals using Fourier analysis.
5. Analyze the continuous time signal using Fourier transform.
6. To study correlation and its properties.

Course Outcomes (COs):

After completion of this subject student should be able to:

Course Code	Course outcome	Blooms Taxonomy	
		Level	Descriptor
ET214.1	List the formulas and standard signals representation for system analysis	1	Remember
ET214.2	Interpret the difference between continuous and discrete time signals and systems & different transform techniques	2	Understand
ET214.3	Classify the knowledge to determine system behavior for variable inputs, Conversion of signal from one domain and to determine parameters of random signals	3	Apply
ET214.4	Analyze the system, Transform techniques for knowledge of signals and system.	4	Analyze

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET214.1	3	2	1	-	-	-	-	-	-	-	-	-	3	-
ET214.2	3	2	2	-	-	-	-	-	-	-	-	-	2	-
ET214.3	1	3	3	-	-	-	-	-	-	-	-	-	3	-
ET214.4	2	2	3	-	-	-	-	-	-	-	-	-	3	-

Course Contents

Unit-I	Introduction to Signals and Systems	No. of Hours	CO 1

	Introduction and Classification of signals: Definition of signal and system, communication and control systems as examples, Continuous time and discrete time signal, Classification of signals, Elementary signals, different signal Operations Systems: Definition, Classification: linear and non-linear, time variant and invariant, causal and non-causal, static and dynamic, stable and unstable, invertible.	8 Hrs.	ET214.1, ET214.2
Unit-II	Time domain representation of LTI System	No. of Hours	CO 2
	System modeling: Input-output relation, definition of impulse response, convolution sum, convolution integral, computation of convolution integral, Computation of convolution sum. Properties of convolution. System interconnection, system properties in terms of impulse response, step response.	8 Hrs.	ET214.1, ET214.2
Unit-III	System analysis using Laplace Transform	No. of Hours	CO 3
	Definition of Laplace Transform (LT), Limitations of Fourier transform and need of Laplace transform, ROC, Laplace transform of standard periodic and aperiodic functions, Inverse Laplace transform based on partial fraction expansion, Transfer function, concept of Poles and Zeros, stability considerations in S domain, Electrical Network using Laplace Transform approach.	8 Hrs.	ET214.3, ET214.4
Unit-IV	Fourier Series	No. of Hours	CO 4
	Fourier series (FS) representation of periodic Continuous Time (CT) signals, Dirichlet condition for existence of Fourier series, orthogonality, basis functions, Amplitude and phase response, FS representation of CT signals using trigonometric and exponential Fourier series. Applications of Fourier series, properties of Fourier series and their physical significance, Gibbs phenomenon.	8 Hrs.	ET214.3, ET214.4
Unit-V	Fourier Transform	No. of Hours	CO 5
	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, FT of standard periodic CT signals, Properties and their significance, Interplay between time and frequency domain ,Fourier Transform for periodic signals, introduction to Discrete Time Fourier Transform.	8 Hrs.	ET214.3, ET214.4
Unit-VI	Correlation and Distribution function	No. of Hours	CO 6
	Correlogram, Introduction to Correlation: Autocorrelation, Cross correlation for Continuous and discrete signals and their properties. Distribution Function : Normal, Gaussian, Rayleigh.	6 Hrs.	ET214.4
Books:			
Text Books:			

1. Simon Haykins and Barry Van Veen, “Signals and Systems”, John Wiley and sons. 2. B. P. Lathi, “Linear Systems and Signals”, OXFORD University Press.
Reference Books:
1. Alan V. Oppenheim, Alan S. Willsky with IAN T. Young, “Signals and Systems”, Prentice-Hall. 2. S. S. Soliman & M.D. Srinath, “Continuous and Discrete Signals and Systems”, Prentice- Hall, 1990. 3. Shaila Dinkar Apte “Signals and Systems: Principles and Applications”, Cambridge University Press. 4.Charles Phillips, “Signals, Systems and Transforms”, 3rd Edition, Pearson Education. 5. M.J. Roberts “Signal and Systems”, Tata McGraw Hill 2007.
Online resource :
Guidelines for Continuous Assessment:- For examples:-Multiple Select/Choice questions, Video making activity

Transform Theory and Applied Mathematics Tutorial (ET215)

Teaching Scheme
Tutorial: 01 Hr/ Week
Credits: 01

Examination Scheme
Term Work : 25 Marks
Total : 25 Marks

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Prerequisite Course: NIL

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Course Objectives:

1. To introduce a concept of Laplace and Fourier transforms
2. To study Z transform and its properties
3. To understand the Calculus and its applications
4. To apply co-ordinate geometry concepts for field and space.
5. To explain statistical parameters and random processes.
6. To understand complex variable for integrals and residue applications.

Course Outcomes (COs):

CO	Course Outcome (s)	Bloom's Taxonomy	
		Level	Descriptor
ET215.1	List the formulas and conversion techniques of various transforms and applied mathematics.	1	Remember
ET215.2	Interpret the significance of various transforms and applied mathematics along with its applications in the field of Engineering.	2	Understand
ET215.3	Construct the concepts of various transforms and applied mathematics to solve real life problems in the field of Communication systems and Signal processing.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET215.1	3	2	1	-	-	-	1	-	2	1	-	2	1	--
ET215.2	3	2	1	-	-	-	1	-	3	1	-	2	2	--
ET215.3	3	3	2	-	-	-	1	-	2	2	-	2	3	--

Tutorial Course Contents

Sr. No.	List of Tutorial (Minimum 8 per subject)	COs
1	To study properties of Laplace Transform and solve numerical.	ET215.1, ET215.2 , ET215.3
2	To study properties of Fourier Transform and solve numerical.	ET215.1, ET215.2 , ET215.3
3	To study properties of Z-Transform properties and solve numerical.	ET215.1, ET215.2 , ET215.3
4	To solve Numerical on definite and improper integrals.	ET215.2 , ET215.3

5	To solve Numerical on partial derivatives, maxima and minima.	ET215.2 , ET215.3
6	To understand orthogonal Co-ordinate systems, its conversion and solve numerical.	ET215.1, ET215.2 , ET215.3
7	To Evaluate various parameters of Statistical random processes and solve numerical.	ET215.1, ET215.2 , ET215.3
8	To solve numerical on Cauchy-Riemann theorem, Taylor's and Laurent's series, residue theorem in complex numbers.	ET215.2 , ET215.3
9	To study the application of maxima and minima in Engineering	ET215.2 , ET215.3
10	To study the application of Random processes in Engineering	ET215.2 , ET215.3

Books:

Text Books:

1. M. D. Greenberg, "Advanced Engineering Mathematics", 2e, Pearson Education, ISBN-13: 978-8177585469
2. B.S. Grewal, "Higher Engineering Mathematics", 2e,Khana Book Publication, Delhi., ISBN-13: 978-8193328491
3. B.V. Ramana, "Higher Engineering Mathematics",1e, Tata McGraw Hill. ISBN-13: 978-0070634190

Reference Books:

1. Francis B. Hildebrand , "Advanced Calculus for Applications" ,Pearson; 2 edition, ISBN978-0130111890
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 10ed, Wiley; 10th edition, ISBN-13: 978-8126554232
3. Nicholas J. Higham, "Applied Mathematics", Princeton University Press, ISBN 978-0-691-15039-0
4. Logan, J. David (John David), "Applied mathematics", 3ed, ISBN: 0-471-74662-2

Data Structures Laboratory (ET216)

Teaching Scheme
Practical: 02 Hrs / Week

Credits: 01

Examination Scheme
Practical Exam: 50 Marks
TW: 25 Marks
Total: 75 Marks

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Prerequisite: Basic Knowledge of C Programming

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Course Objectives:

1. To impart the basics of algorithm development and analysis of algorithms.
2. To introduce students to common programming techniques/algorithms (recursion, searching and Sorting, etc.)
3. To understand the memory requirement for various data structures.

Course Outcomes (COs): After successful completion of course students will be able to

CO	CO statement	Bloom's Taxonomy	
		Level	Descriptor
ET216.1	Apply suitable algorithm to implement applications of various data structures	3	Apply
ET216.2	Handle operations like insertion, deletion, searching, sorting and traversing on various data structures	3	Apply
ET216.3	Design & implement various linear and nonlinear data structures	4	Analyze

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET216.1	----	3	3	2	---	----	----	----	2	----	----	----	----	2
ET216.2	----	3	3	2	2	----	----	----	2	----	----	----	----	2
ET216.3	----	3	2	3	3	----	----	----	3	----	----	----	----	3

Students are required to complete at least 8 experiments. Star (*) marked experiments are compulsory.

Practical Course Contents

Sr. No.	Title of Experiment	COs
1	Find out key number from the sequence of numbers given with the help of a suitable searching algorithm.	ET216.1, ET216.2, ET216.3
2	* Implementation of Sorting for the given numbers with suitable sorting algorithm.	ET216.1, ET216.2, ET216.3
3	*Implementation of Singly Linked List	ET216.1, ET216.2, ET216.3

4	Array Implementation of Stack.	ET216.1, ET216.2, ET216.3
5	Linked Implementation of Stack	ET216.2, ET216.1
6	Conversion of Infix to Postfix.	ET216.1, ET216.2, ET216.3
7	Array Implementation of Queue.	ET216.1, ET216.2, ET216.3
8	Apply the logic for performing: a. to obtain substring b. to decide palindrome c. to compare with other name d. to copy e. to reverse the student's name.	ET216.1, ET216.2, ET216.3
9	Implementation of Doubly Linked List.	ET216.1, ET216.2, ET216.3
10	*Implement Binary Search Tree.	ET216.1, ET216.2, ET216.3
11	* Implementation of Depth First Search and Breadth First Search.	ET216.1, ET216.2, ET216.3
12	Array Implementation of Circular Queue.	ET216.1, ET216.2, ET216.3
13	Representation of polynomial using array of structure	ET216.1, ET216.2, ET216.3
14	Check continuity of different types of parenthesis using stack.	ET216.1, ET216.2, ET216.3

Text Books:

1. E Balgurusamy, “Programming in ANSI C”, Tata McGraw-Hill,(3rd Edition)
2. Yashavant Kanetkar, “Data Structures Through C”, BPB Publication, 2nd Edition

Reference Books:

1. Seymour Lipschutz, “Data Structure with C”, Schaum’s Outlines, McGraw Hill Education.
2. Y. Langsam, M J Augenstein, Aaron Tenenbaum – “DS using C and C++” – Pearson Education
3. Ellis Horowitz, Sartaj Sahni, “Fundamentals of Data Structures”, university press
4. R. Gilberg & B.Forouzan, “Data Structures A Pseudo code Approach with C”, Cengage Learning.

Analog Communication Laboratory (ET217)

Teaching Scheme:
Practical: 02Hrs. / Week

Credits: 01

Examination Scheme:
Practical: 50 Marks
Term work: 25 Marks
Total: 75 Marks

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Course Objectives:

1. To introduce the concept of a communication system.
2. To understand the concept of modulation with AM & FM modulation.
3. To introduce the students with the concept of sampling theorem.
4. Apply modern tools in the study of modulation.
5. To study the performance parameters of the receivers.
6. To introduce the students with the concept of pulse modulation techniques.

Course Outcomes (COs): After successful completion of course students will be able to:

COs	Statement	Bloom's Taxonomy	
		Level	Descriptor
ET217.1	Understand the fundamental concepts and various components of analog communication systems.	2	Understand
ET217.2	Apply conceptual knowledge to get modulation and demodulation of AM and FM signals.	3	Apply
ET217.3	Analyze sampling theorem for various frequencies.	4	Analyze
ET217.4	Design & implement AM and FM using MATLAB code	3	Create
ET217.5	Discuss the performance parameters of radio receivers.	4	Understand
ET217.6	Apply the knowledge of pulse modulation & to study the real life applications	2	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET217.1	2	---	---	---	---	---	---	---	---	1	---	1	1	---
ET217.2	1	1	---	---	1	---	---	---	---	---	---	---	1	1
ET217.3	1	1	---	---	1	---	---	---	---	---	---	---	1	1
ET217.4	1	2	2	1	1	---	---	---	---	---	---	---	1	1
ET217.5	1	1	1	1	1	---	---	---	---	---	---	---	1	1
ET217.6	1	---	---	---	1	2	---	---	---	1	---	---	1	---

Students shall perform at least 8 experiments.

Practical Course Contents

Sr. No.	Title of Practical	COs
1	Study Of Communication System & The Role Of Different Components In The Communication System.	ET217.1
2	AM Generation (DSB-FC): Calculation Of Modulation Index By Graphical Method, Power Of AM Wave For Different Modulating Signal And Observe Spectrum.	ET217.2
3	Envelope Detector: Practical Diode Detector & Observe Effect Of Change In RC Time Constant Which Leads To Diagonal & Negative Clipping.	ET217.2
4	Frequency Modulator & Demodulator, Calculation Of Modulation Index & BW Of FM.	ET217.2
5	Measurement of Performance Characteristics of Radio Receiver: Sensitivity, Selectivity, Fidelity.	ET217.5
6	Verification Of Sampling Theorem, PAM Techniques, (Flat Top & Natural Sampling), Reconstruction Of Original Signal, Observe Aliasing Effect In Frequency Domain.	ET217.3
7	Generation And Detection Of PWM Using IC 555.	ET217.6
8	Write A MATLAB Code & Simulate To Generate Amplitude Modulation [AM] Waveform For Given Modulation Index, Signal Frequency & Carrier Frequency.	ET217.2, ET217.4
9	Write A MATLAB Code & Simulate To Generate Frequency Modulation [FM] Waveform For Given Modulation Index, Signal Frequency & Carrier Frequency.	ET217.2, ET217.4
10	To Test & Observe The Different Stages Of Public Address (PA) System.	ET217.1

Books:
Text Books:
1. B. P. Lathi, “Communication Systems”, BS publications. 2. George Kennedy, “Electronic Communications”, McGraw Hill Kennedy.
Reference Books:
1. Simon Haykin, “An introduction to analog & digital communications”, John Wiley & Sons 2. Roddy and Coolen, “Electronic Communication Systems”, Pearson Education. 3. Frank R. Dungan, “Electronic Communication Systems”, Delmar Publishers. 4. R. G. Gupta, "Audio & Video Systems" Tata McGraw-Hill
Guidelines for Continuous Assessment:-Test, Home Assignments etc.

Signals and Systems Tutorial (ET218)

Teaching Scheme
Tutorials: 01 Hr. /Week
Credits: 01

Examination Scheme
Oral: - 50Marks
Total: 50 Marks

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Course Objectives:

1. To understand the mathematical description of continuous and discrete time signals and systems.
2. To analyze Linear Time Invariant (LTI) systems in time domain.
3. To study the signal and system using the tool Laplace Transform.
4. Analyze the spectral characteristics of continuous-time periodic and a periodic signals using Fourier analysis.
5. Analyze the continuous time signal using Fourier transform.
6. To study correlation and its properties.

Course Outcomes (COs):

After completion of this subject student should be able to:

Course Code	Course outcome	Blooms Taxonomy	
		Level	Descriptor
ET218.1	List the formulas and standard signals representation for system analysis	1	Remember
ET218.2	Interpret the difference between continuous and discrete time signals and systems & different transform techniques	2	Understand
ET218.3	Classify the knowledge to determine system behavior for variable inputs, Conversion of signal from one domain and to determine parameters of random signals	3	Apply
ET218.4	Analyze the system, Transform techniques for knowledge of signals and system.	4	Analyze

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET218.1	3	2	1	-	-	-	1	-	2	1	-	2	3	-
ET218.2	3	2	2	-	-	-	1	-	3	1	-	2	2	-
ET218.3	1	3	3	-	-	-	1	-	2	2	-	2	3	-
ET218.4	2	2	3	-	-	-	1	-	2	1	-	2	3	-

Tutorial Course Contents

Sr. No.	List of Tutorial (Minimum 8 per subject)	COs
1	A) Sketch and write mathematical expression for the following signals in CT and Discrete Time (DT) a) Sine b) Rectangular c) Exponential d) Unit Impulse e) Unit Step f) Ramp g) Signum h) Sinc B) Classify and find the respective value for the above signals a) Periodic / Non Periodic b) Energy / Power /Neither	ET218.1, ET218.2

	. c) Even and Odd	
2	Perform the following signal operations: Amplitude scaling, addition, multiplication, differentiation, integration (accumulator for DT), time scaling, and time shifting and folding.	ET218.1, ET218.2
3	To study various types of systems .Determine whether each one of them is Memory less, Causal, Linear, Stable, Time invariant, Invertible.	ET218.1, ET218.2
4	To study impulse response of LTI System.	ET218.1, ET218.2
5	Perform Convolution Integral and convolution sum of CT and DT Signals.	ET218.1, ET218.2
6	To study the Fourier series of Continuous signal.	ET218.1, ET218.3
7	To study the Fourier Transform of Continuous signal.	ET218.3, ET218.4
8	To study the application of Laplace Transform in system stability and in electrical networks.	ET218.3
9	Perform auto correlation and cross correlation of DT and CT signals.	ET218.1, ET218.2

Books:
Text Books:
1. Simon Haykins and Barry Van Veen, "Signals and Systems", John Wiley and sons. 2. B. P. Lathi, "Linear Systems and Signals", OXFORD University Press.
Reference Books:
1. Alan V. Oppenheim, Alan S. Willsky with IAN T. Young, "Signals and Systems", Prentice-Hall. 2. S. S. Soliman & M.D. Srinath, "Continuous and Discrete Signals and Systems", Prentice- Hall, 1990. 3. Shaila Dinkar Apte "Signals and Systems: Principles and Applications", Cambridge University Press. 4.Charles Phillips, "Signals, Systems and Transforms", 3rd Edition, Pearson Education. 5. M.J. Roberts "Signal and Systems", Tata McGraw Hill 2007.

Mini Project (ET219)

Teaching Scheme
Practical : 04 Hrs. / Week
Credits: 02

Examination Scheme
TW: 50 Marks
Total: 50 Marks

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Prerequisite Course: Proteus ARES for PCB artwork design OR Express PCB OR PSpice etc.

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Course Objectives:

1. To undertake & execute a Mini Project through a group of students.
2. To plan for various activities of the project and distribute the work amongst team members.
3. To learn budget planning for the project.
4. To inculcate electronic hardware implementation skills by -
   a. Learning PCB artwork design using an appropriate EDA tool.
   b. Imbibing good soldering and effective trouble-shooting practices.
   c. Following correct grounding and shielding practices.
   d. Knowing the significance of aesthetics & ergonomics while designing electronic product.
5. To understand the 'Product Development Cycle' through Mini Project.
6. To develop student's abilities to transmit technical information clearly and test the same by delivery of Seminar based on the Mini Project.

Course Outcomes (COs): After successfully completing the course students will be able to

COs	Statement	Bloom's Taxonomy	
		Level	Descriptor
ET219.1	Understand, plan and execute a Mini Project with team.	2	Understand
ET219.2	Implement electronic hardware by learning PCB artwork design, soldering techniques, troubleshooting, etc.	3	Apply
ET219.3	Prepare a technical report based on the Mini project.	2	Understand
ET219.4	Deliver technical seminar based on the Mini Project work carried out.	5	Evaluate
ET219.5	Design and Develop a product as per the application	6	Create
ET219.6	Test the Project in different environmental conditions	4	Analyze

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET219.1	-	3	-	-	-	-	-	1	3	-	-	2	2	-
ET219.2	2	-	3	2	3	-	-	1	3	-	-	2	-	3
ET219.3	-	-	-	-	-	-	-	1	3	3	-	-	-	3
ET219.4	-	-	-	-	-	-	-	1	3	-	-	-	2	-
ET219.5	-	3	3	-	-	-	-	1	3	-	3	3	-	3
ET219.6	-	-	2	3	-	-	-	1	3	-	-	3	-	3

Guidelines:

1. Project group shall consist of not more than 3 students per group.

2. Suggested Plan for various activities to be monitored by the teacher.
    a. Week 1 & 2 : Formation of groups, Finalization of Mini project & Distribution of work.
    b. Week 3 & 4 : PCB artwork design using an appropriate EDA tool, Simulation.
    c. Week 5 & 6 : Project Review as per the defined Rubrics in the evaluation sheet, Hardware assembly and Testing
    d. Week 7 & 8 : Enclosure Design, Fabrication, etc.
    e. Week 9 & 10 : Preparation, Checking & Correcting of the Draft Copy of Report
    f. Week 11 & 12: Project Review as per the defined Rubrics in the evaluation sheet, Demo and Group presentations
3. Mini Project Work should be carried out in the Projects Laboratory.
4. Project designs ideas can be necessarily adapted from recent issues of electronic design magazines Application notes from well-known component manufacturers may also be referred.
5. Hardware component is mandatory.
6. Layout versus schematic verification is mandatory.
7. Domains for projects may be from the following , but not limited to:
    a. Instrumentation and Control Systems
    b. Electronic Communication Systems
    c. Power Electronics
    d. Audio , Video Systems
    e. Embedded Systems
    f. Solar Energy Based
8. Project based on latest technology is appreciable.
9. A project report with following contents shall be prepared:
    a. Title
    b. Specifications
    c. Block diagram
    d. Circuit diagram
    e. Selection of components
    f. Simulation results
    g. PCB artwork
    h. Layout versus schematic verification report
    i. Testing procedures
    j. Enclosure design
    k. Test results
    l. Conclusion
    m. References

Continuous Assessment : Based on project review(15 Marks +15 Marks), Project report(20 Marks) and Execution of the project (50 Marks) .

References:

1. https://www.electronicsforu.com/category/electronics-projects/hardware-diy
2. https://www.elprocus.com/electronics-for-you-mini-projects-ideas/
3. https://core-electronics.com.au/projects
4. https://www.skyfilabs.com/electronics-ece-mini-projects-for-engineering-students
5. https://www.cst.cam.ac.uk/teaching/part-ib/group-projects

Seminar (ET220)

Teaching Scheme	Examination Scheme
Practical: 4 Hrs. /Week	Term work: 50 marks
Credits: 2	Total: 50 Marks

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Course Objectives:

1. Understand the diverse social and economic, racial context, the themes of the seminar.
2. Identify, understand and discuss current, real-world issues.
3. Distinguish and integrate academic knowledge to apply multidisciplinary strategy to address current issues.
4. Improve oral and written communication skills.
5. Explore an appreciation of the self in relation to its larger diverse social and academic contexts.
6. Apply principles of ethics and respect in interaction with others.

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

Course Outcomes	Statement	Bloom's Descriptor	
		Level	Descriptor
ET220.1	Learn and integrate through independent learning and collaborative study.	2	Understand
ET220.2	To Recognize real-world issues.	1	Remember
ET220.3	Develop knowledge in the engineering, humanities, sciences, and social sciences with disciplinary specialization.	3	Apply
ET220.4	To develop and convey intended meaning using verbal and non-verbal method of communication that demonstrates respect and understanding in a complex society.	3	Apply
ET220.5	To understand self, relationships and diverse global perspectives.	2	Understand

Mapping of course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET220.1	2	--	--	--	--	--	--	--	--	--	--	2	2	--
ET220.2	2	2	--	-2	--	--	--	--	--	--	--	2	--	2
ET220.3	2	--	--	--	2	2	--	--	--	--	2	2	--	2
ET220.4	2	--	--	--	--	--	--	--	3	3	--	3	--	2
ET220.5	2	--	--	--	2	--	--	--	--	--	--	2	--	2

A. Guidelines for Students:

1. Seminar group shall consist of not more than 3 students per group
2. Individual student have to present seminar topic.
2. Seminar topic should be innovative, emerging and current issues addressed.
3. Student should collect all information related with topic with authentic and validate proofs.

B. Domains for Seminar may be from the following, but not limited to:

- Communication Engineering,
- Computer/Communication Networking
- WSN and IOT
- Microcontroller based/Embedded systems
- VLSI Technology,
- Power electronics and drives
- Instrumentation,
- Agriculture Engineering
- Biomedical Engineering

- Robotics/Mechatronics/Process Automation
- Automotive Electronics

C. Monitoring: Suggested Plan for various activities to be monitored by the teacher.

Week 1 & 2: Finalization of seminar topic with broad literature survey
Week 3 & 4: Preparation of brief Introduction and abstract
Week 5 to 6: Finalization of topics and subtopics for chapters
Week 6 to 7: Intermediate review of the seminar topic
Week 8 & 9: Preparation of conclusions and summery
Week 10 & 11: Preparation of report and presentation
Week 12 &13 : Present seminar

Note: - Log book for all these activities shall be maintained. It is mandatory to submit the seminar report.

D. Report writing: A report with following contents shall be prepared:

Contents

1) Cover Page & Title Page
2) Certificate
3) Abstract
4) Acknowledgments
5) List of figures
6) List of tables
7) Abbreviations
8) Contents
9) Chapters
10) Appendix
11) References

Journals to Refer like but not limited to :
Bell Labs Technical Journal
IEEE Communications Magazine
IEEE Consumer Electronics Magazine
IEEE Instrumentation & Measurement Magazine
IEEE Signal Processing Magazine
IEEE Transactions on Circuits and Systems II: Express Briefs
Elsevier science direct E-journals, Sensors and Actuators A: Physical ISSN no. 0924-4247,
Elsevier science direct E-journals, Computer Vision and Image Understanding, ISSN no.1077-3142
Elsevier science direct E-journals, Digital Signal Processing, ISSN no. 1051-2004
Elsevier science direct E-journals, Microelectronic Engineering, ISSN no. 0167-9317

Mandatory Course IV(MC221)

Innovation - Project based – Science and Technology, Social, Design & Innovation

Teaching Scheme
Lectures: 2 Hrs. / Week
Credits: 0

Examination Scheme
Total: 0 Marks

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Many students, when they enter engineering, are full of enthusiasm to understand new areas, to build systems and to experiment and play with them. This enthusiasm is to be tapped and to direct it to exploration and sustained pursuit by the student, which may result in development of a working system, a prototype, or a device or material, etc. They are expected to come up with novel and useful ideas on social problems. Students may be encouraged to take up projects which are aimed at providing solutions to societal problems, reduce drudgery and improving efficiency in rural work, green technologies, utilization of rural and urban waste, sanitation and public health, utilizing non-conventional energy sources, technologies for the benefit of the differently abled people and technologies ready to be implemented in the Institute.

Two types of activities may be undertaken under this

(a) Exposure to social problems (which are amenable to technological solutions)

(b) Design & Innovation (to address above problems)

After this student be encouraged to undertake technology projects of social relevance

Course Objectives

1. To develop strategic thinking to solve social problems in innovative manner.
2. Understand the role of innovation and technical change in enterprise and national level economic performance
3. Understand the technological, human, economic, organizational, social and other dimensions of innovation
4. Understand the effective management of technological innovation requires the integration of people, processes and technology
5. Recognize opportunities for the commercialization of innovation
6. Understand the attributes of innovations

Course Outcomes (CO): After successfully completing the course students will be able to

CO	Course Outcome Statements	Bloom's Taxonomy	
		Level	Descriptor
MC221.1	Understand need of innovation and social problems	2	Understand
MC221. 2	Understand opportunity recognition and ideation management to solve the social problems	2	Understand

MC221.3	Understand the technological, human, economic, organizational, social and other dimensions of innovation	2	Understand
MC221.4	Understand the effective management of technological innovation requires the integration of people, processes and technology	2	Understand
MC221.5	Recognize opportunities for the commercialization of innovation	1	Remember
MC221.6	Understand the attributes of innovations	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
MC221.1	-	-	2	2	-	1	-	-	-	-	-	-	2	-
MC221.2	-	-	3	2	-	3	-	-	-	-	1	-	3	-
MC221.3	-	-	3	2	-	3	-	-	-	-	1	-	-	-
MC221.4	-	-	-	-	-	2	2	-	-	-	1	-	-	-
MC221.5	-	-	-	-	-	1	2	1	-	-	-	1	-	-
MC221.6	-	-	-	-	-	2	-	-	-	-	-	2	-	-

Course Contents

Unit-I	**Introduction to innovation**	No. of Hours	COs
	Understand the concept of innovation, Know the difference between innovation and invention, Understand the reasons for innovation, The Innovation Matrix or 4 types of innovation	4Hrs.	MC221.1
Unit-II	**Process of Innovation**		
	Know what the process of innovation entails, Know the steps involved in creative problem solving, know how to build organizations for executing innovation, Evaluation of innovation	4Hrs.	MC221.2
Unit-III	**Idea generation**		
	Understand the discovery process for opportunities, Identify the people to be involved in the idea generation process, Know the methods for discovering opportunities	4Hrs.	MC221.3
Unit-IV	**Developing innovative culture**		

	Know the organizational features that facilitate innovation, how organizations can learn from new information, know how to manage available resources for innovation, A case study on product development in an open innovation environment.	4Hrs.	MC221.4
Unit-V	**Leveraging on user innovation**		
	Know how to identify lead users, Strategies of leveraging on user innovation, how to create new products based on user innovations	4Hrs.	MC221.5
Unit-VI	**Innovation attributes and their adoption rate**		
	Know the attributes of innovations, Know the rate of innovation diffusion, Know the variables determining the rate of adoption of an innovation, know how to protect their innovations	4Hrs.	MC221.6

Books

1. Saini**,** H. S**.,** Singh**,** R. K., Reddy**,** K. Satish ," Innovations in Electronics and Communication Engineering" Publisher *Springer*.
2. Shrenik Suresh Sarade, "Electronics Engineering Innovation-I: Electronics Project Designing for Engineering" LAP LAMBERT Academic Publishing
3. Dr R V Mahendra Gowda, "Innovation in Engineering Education"
4. NPTEL- Innovation, Business Models and Entrepreneurship

References

1. Graduate Certificate in Innovation-**Singapore Management University**
   I-Design Thinking-Opportunity Recognition and Ideation Management
   II-Design Thinking -Innovation Management Tool
   III-Implementing Effective Innovation Processes
2. Democratizing innovation by Eric Von Hippel
3. Masachussetts Institute of Technology, managing innovation process (Links to an external site.)
4. The Open University, The concept of Innovation (Links to an external site.)
5. OER Commons, On Innovation

Guidelines for Continuous Assessment: -

1. Presentation based on Case study
2. Unit Test,
3. Home Assignments.

Sanjivani Rural Education Society's

Sanjivani College of Engineering, Kopargaon

(An Autonomous Institute Affiliated to Savitribai Phule Pune University, Pune)

B. Tech. Electronics and Telecommunication Engineering

2019 pattern

Program Structure

(B. Tech. with effect from Academic Year 2019-2020)

At. Sahajanandnagar, Post. Shingnapur Tal. Kopargaon Dist. Ahmednagar,

Maharashtra State, India PIN 423603

Department Vision

Our vision is to produce quality professionals in the field of Electronics & Telecommunication Engineering with knowledge and skillsets to meet diversifying needs of industry and society.

Department Mission

M1- To impart the technology of Electronics & Telecommunication Engineering through effective teaching-learning process.

M2- To establish linkages between industry and academia for overall development of students.

M3- To promote innovative ideas in solving multi-disciplinary engineering problems having social relevance.

M4- To develop technical human resources exhibiting professional and ethical attitudes.

Program Outcomes (POs)

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Educational Objectives (PEOs)

The PEOs of undergraduate programme in Electronics and Telecommunication Engineering are

PEO1: Involve in design, manufacturing, integration and testing of products, software and systems in the field of Electronics & Telecommunication engineering and allied disciplines**.**

PEO2: Solve engineering problems having social relevance by applying knowledge and skillsets related to Electronics & Telecommunication engineering.

PEO3: Pursue higher Education/Research in the field of Engineering/Management or to become a successful entrepreneur in the related areas.

PEO4: Work effectively as an individual and/or a team member of multi-disciplinary assignments involving people across different cultures and national boundaries.

Program Specific Outcomes (*PSOs*)

PSO1: Design, test and implement electronic systems and appliances related to signal processing, embedded systems, industrial automation and IoT using the state of the art components and software.

PSO2: Architect, classify and select appropriate technologies for the implementation of wired and wireless communication systems.

CURRICULUM STRUCTURE - 2019 PATTERN
Third Year B. Tech. (Electronics and Telecommunication Engineering)
WITH EFFECT FROM ACADEMIC YEAR 2021-2022

SEMESTER-V

Course			Teaching Scheme Hours/week				Evaluation Scheme-Marks						
							Theory						
Cat	Code	Title	L	T	P	Credits	ISE	ESE	CA	OR	PR	TW	Total
PROJ	ET301	Professional Internship-II	-	-	-	2	-	-	-	50	-	-	50
PCC	ET302	Control System	3	-	-	3	30	50	20	-	-	-	100
PCC	ET303	Digital Communication	3	-	-	3	30	50	20	-	-	-	100
PCC	ET304	Linear Integrated Circuits	3	-	-	3	30	50	20	-	-	-	100
PCC	ET305	Object Oriented Programming	3	-	-	3	30	50	20	-	-	-	100
PEC	ET306	Refer List of PEC1	3	-	-	3	30	50	20	-	-	-	100
LC	ET307	Control Systems Tutorial	-	1	-	1	-	-	-	-	-	25	25
LC	ET308	Digital Communication Laboratory	-	-	2	1	-	-	-	25	-	-	25
LC	ET309	LIC Laboratory	-	-	2	1	-	-	-	-	50		50
LC	ET310	OOP Laboratory	-	-	2	1	-	-	-	-	50		50
PROJ	ET311	Skill Based Credit Course	1	-	-	1	-	-	50	-	-	-	50
MC	MC312	Mandatory Course-V	1	-	-	Non Credit	-	-	-	-	-	-	-
		Total	**17**	**1**	**6**	**22**	**150**	**250**	**150**	**75**	**100**	**25**	**750**

MC312	Mandatory Course-V	Sanjivani ECE Talks

SEMESTER-VI

Course			Teaching Scheme Hours/week				Evaluation Scheme-Marks						
							Theory						
Cat	Code	Title	L	T	P	Credits	ISE	ESE	CA	OR	PR	TW	Total
PCC	ET313	Microprocessors and Microcontrollers	3	-	-	3	30	50	20	-	-	-	100
PCC	ET314	Electromagnetics	3	-	-	3	30	50	20	-	-	-	100
PEC	ET315	Refer List of PEC2	3	-	-	3	30	50	20	-	-	-	100
OEC	ET316	OEC1: Artificial Intelligence	4	-	-	4	30	50	20	-	-	-	100
HSMC	HS317	Employability Skill Development	1	-	2	2	-	-	-	-	-	50	50
PROJ	ET318	IPR & EDP	2	-	-	2	15	25	10	-	-	-	50
LC	ET319	Microprocessors and Microcontrollers Laboratory	-	-	2	1	-	-	-	-	50	-	50
LC	ET320	Electromagnetics Tutorial	-	1	-	1	-	-	-	50	-	-	50
LC	ET321	IPR & EDP Practical	-	-	2	1	-	-	-	-	-	50	50
MC	MC322	Mandatory Course-VI	1	-	-	Non Credit	-	-	-	-	-	-	-
		Total	**17**	**1**	**06**	**20**	**135**	**225**	**90**	**50**	**50**	**100**	**650**

MC322	Mandatory Course-VI	Electronic Waste Management

Professional Elective Course 1 (PEC1):
ET306A Digital Signal Processing
ET306B Database Management system
ET306C Power Electronics

Professional Elective Course 2 (PEC2):
ET314A Digital Image Processing
ET314B Web Technologies
ET314C Renewable Energy Systems

Total Credits: 42 **Total Marks: 1400**

List of Abbreviations

Abbreviation	Full Form	Abbreviation	Full Form
BSC	Basic Science Course	**MC**	Mandatory Course
ESC	Engineering Science Course	**PCC**	Professional Core Course
HSMC	Humanities/Social Sciences/Management Course	**PEC**	Professional Elective Course
IP	Induction Program	**OEC**	Open Elective Course
L	Lecture	**LC**	Laboratory Course
T	Tutorial	**CA**	Continuous Assessment
P	Practical	**OR**	End Semester Oral Examination
ISE	In-Semester Evaluation	**PR**	End Semester Practical Examination
ESE	End-Semester Evaluation	**TW**	Continuous Term Work Evaluation
Cat	Category	**PROJ**	Project

Professional Internship II (ET301)

Teaching Scheme
Lectures: -- Hrs. / Week
Tutorials: -- Hrs. / Week
Credits: 02

Examination Scheme
OR: 50 Marks

Total: 50 Marks

Prerequisite : Engineering Knowledge

Course Objectives:

1. To encourage and provide opportunities for students to get professional/personal experience through internships.
2. To learn and understand real life/industrial situations.
3. To get familiar with various tools and technologies used in industries and their applications.
4. To nurture professional and societal ethics.
5. To create awareness of social, economic and administrative considerations in the working environment of industry organizations.
6. To learn integration of conceptual aspects & practical word.

Course Outcomes (COs):

After completion of course students will be able to

COs	CO Statement	Blooms Taxonomy	
		Level	Descriptor
EC401.1	Explain professional competence through industry internship.	2	Understand
EC401.2	Apply knowledge gained through internships to complete academic activities in a professional manner.	3	Apply
EC401.3	Classifying the appropriate technology and tools to solve given problem.	2	Understand
EC401.4	To demonstrate abilities of a responsible professional and use ethical practices in day-to-day life.	2	Understand
EC401.5	Creating network and social circle, and developing relationships with industry people.	3	Apply
EC401.6	To analyze various career opportunities and decide carrier goals.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC401.1	2	2	2	2	3	1	1	1	1	2	1	1	---	1
EC401.2	1	2	2	2	3	2	1	1	1	2	2	1	---	1
EC401.3	-	-	-	-	-	1	-	-	2	2	1	1	---	2
EC401.4	2	-	-	-	-	2	2	3	-	1	-	2	---	1
EC401.5	-	-	-	-	-	1	2	1	1	1	2	1	---	2
EC401.6	-	-	-	-	-	1	-	-	2	1	-	2	---	1

Internship provides an excellent opportunity to learner to see how the conceptual aspects learned in classes are integrated into the practical world. Industry/on project experience provides much more professional experience as value addition to classroom teaching.

Guidelines:

Internships are educational and career development opportunities, providing practical experience in a field or discipline. Internships are far more important as the employers are looking for employees who are properly skilled and having awareness about industry environment, practices and culture. Internship is structured, short-term, supervised training often focused around particular tasks or projects with defined time scales.

Core objective is to expose technical students to the industrial environment, which cannot be simulated/experienced in the classroom and hence creating competent professionals in the industry and to understand the social, economic and administrative considerations that influence the working environment of industrial organizations.

Engineering internships are intended to provide students with an opportunity to apply conceptual knowledge from academics to the realities of the field work/training. The following guidelines are proposed to give academic credit for the internship undergone as a part of the Third Year Engineering curriculum.

Duration:

Internship is to be completed after semester 4 and before commencement of semester 5 of at least 4 to 6 weeks; and it is to be assessed and evaluated in semester 5.

Internship work Identification:

Student may choose to undergo Internship at Industry/Govt. Organizations/NGO/MSME/Rural Internship/ Innovation/IPR/Entrepreneurship. Student may choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry/NGO's/Government organizations/Micro/Small/ Medium enterprises to make themselves ready for the industry [1].

Students must register at Intern Shala [2]. Students must get Internship proposals sanctioned from college authority well in advance. Internship work identification process should be initiated in the Vth semester in coordination with training and placement cell/ industry institute cell/ internship cell. This will help students to start their internship work on time. Also, it will allow students to work in vacation period after their VIth semester examination and before academic schedule of semester VII.

Student can take internship work in the form of the following but not limited to:

- Working for consultancy/ research project,
- Contribution in Incubation/ Innovation/ Entrepreneurship Cell/ Institutional Innovation Council/ startups cells of institute /
- Learning at Departmental Lab/Tinkering Lab/ Institutional workshop,
- Development of new product/ Business Plan/ registration of start-up,
- Industry / Government Organization Internship,
- Internship through Internshala,
- In-house product development, intercollegiate, inter department research internship under research lab/group, micro/small/medium enterprise/online internship,
- Research internship under professors, IISC, IIT's, Research organizations,

•NGOs or Social Internships, rural internship,
•Participate in open-source development.

Internship Diary/ Internship Workbook:

Students must maintain Internship Diary/ Internship Workbook. The main purpose of maintaining diary/workbook is to cultivate the habit of documenting. The students should record in the daily training diary the day-to-day account of the observations, impressions, information gathered and suggestions given, if any. The training diary/workbook should be signed every day by the supervisor.

Internship Diary/workbook and Internship Report should be submitted by the students along with attendance record and an evaluation sheet duly signed and stamped by the industry to the Institute immediately after the completion of the training.

Internship Work Evaluation:

Every student is required to prepare a maintain documentary proofs of the activities done by him as internship diary or as workbook. The evaluation of these activities will be done by Programme Head/Cell In-charge/ Project Head/ faculty mentor or Industry Supervisor based on- Overall compilation of internship activities, sub-activities, the level of achievement expected, evidence needed to assign the points and the duration for certain activities.

Assessment and Evaluation is to be done in consultation with internship supervisor (Internal and External – a supervisor from place of internship.

Recommended evaluation parameters:

Internship Diary/Workbook and Internship Report - 50 Marks

Evaluation through Seminar Presentation/Viva-Voce at the Institute-

The student will give a seminar based on his training report, before an expert committee constituted by the concerned department as per norms of the institute. The evaluation will be based on the following criteria:

•Depth of knowledge and skills
•Communication & Presentation Skills
•Team Work
•Creativity
•Planning & Organizational skills
•Adaptability
•Analytical Skills
•Attitude & Behavior at work
•Societal Understanding
•Ethics
•Regularity and punctuality
•Attendance record
•Diary/Work book
•Student's Feedback from External Internship Supervisor

After completion of Internship, the student should prepare a comprehensive report to indicate what he has observed and learnt in the training period.

Internship Diary/workbook may be evaluated on the basis of the following criteria:

- ●Proper and timely documented entries
- ●Adequacy & quality of information recorded
- ●Data recorded
- ●Thought process and recording techniques used
- ●Organization of the information

The report shall be presented covering following recommended fields but limited to,

- •Title/Cover Page
- •Internship completion certificate
- •Internship Place Details- Company background-organization and activities/Scope and object of the study / Supervisor details
- •Index/Table of Contents
- •Introduction
- •Title/Problem statement/objectives
- •Motivation/Scope and rationale of the study
- •Methodological details
- •Results / Analysis /inferences and conclusion
- •Suggestions / Recommendations for improvement to industry, if any
- •Attendance Record
- •Acknowledgement
- •List of reference (Library books, magazines and other sources)

Feedback from internship supervisor (External and Internal)

Post internship, faculty coordinator should collect feedback about student with recommended parameters include as- Technical knowledge, Discipline, Punctuality, Commitment, Willingness to do the work, Communication skill, individual work, Team work, Leadership….

Reference:

https://www.aicte-india.org/sites/default/files/AICTE%20Internship%20Policy.pdf

https://internship.aicte-india.org/

Control Systems (ET302)

Teaching Scheme
Lectures: 03 Hrs. / Week

Credits: 03

Examination Scheme
ISE:30 Marks
ESE:50 Marks
CIA:20 Marks
Total:100 Marks

Prerequisite:
Mathematical background of differential equations, Laplace transforms and Matrix theory

Course Objectives:

1. To learn mathematical modeling of different kinds of physical systems.
2. To study response of first order and second order systems in the time domain.
3. To introduce the concept of system stability and different criteria for determining the same.
4. To learn various frequency response plots and correlate between time domain and frequency domain specifications.
5. To introduce the principles of state space analysis in modeling physical systems.
6. To study various modes of control actions and their applications.

Course Outcomes (COs):

After successful completion of this course, students will be able to:

Course Outcomes	Statements	Bloom's Taxonomy	
		Level	Descriptor
ET302.1	Model different electrical, mechanical and electro-mechanical systems using block diagrams and SFG techniques.	2	Understand
ET302.2	Compute different time domain specifications of first and second order systems.	3	Apply
ET302.3	Determine the stability of closed loop control systems using RH criterion and root locus.	3	Apply
ET302.4	Draw the frequency response plots of control systems.	3	Apply
ET302.5	Outline the concepts of state space analysis in system modelling.	4	Analyze
ET302.6	Summarize the operation of different modes of controllers and their applications to understand.	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET302.1	3	2	-	-	2	-	-	-	-	-	-	-	1	-
ET302.2	3	2	-	-	-	-	-	-	-	-	-	-	1	-
ET302.3	3	2	-	-	-	-	-	-	-	-	-	-	1	-
ET302.4	3	2	-	-	-	-	-	-	-	-	-	-	1	-
ET302.5	3	2	-	-	2	-	-	-	-	-	-	-	1	-
ET302.6	1	1	-	-	2	-	-	-	-	-	-	-	1	-

Course Contents

.		No. of Hours	COs
Unit-I	**Introduction to Control Systems**	06	ET302.1
	Basic elements of a control system; Open loop and Closed loop systems; Transfer function; Modelling of electrical systems and translational & rotational mechanical systems; Block diagram reduction; Signal flow graph		
Unit-II	**Time Domain Analysis**	06	ET302.2
	Standard input signals; Transient analysis of First order and Second order systems; Steady state error and error constants; Time domain specifications for second order system		
Unit-III	**Stability Analysis**	06	ET302.3
	Concept of stability; Routh-Hurwitz criterion; Relative stability; Root locus technique; Construction of root locus; Application of root locus; Concept of dominant poles; Stability of higher order systems		
Unit-IV	**Frequency Domain Analysis**	06	ET302.4
	Correlation between time domain and frequency domain analysis; Polar Plots; Bode Plots; Determination of frequency domain specifications and stability analysis; Nyquist stability criterion		
Unit-V	**State Space Analysis**	06	ET302.5
	Concept of state and state space; Advantages of state space analysis over classical techniques; Transfer function from state model; State model of physical systems; Phase variable forms; Solution of homogeneous state equations; State transition matrix and its properties; Computation of state transition matrix; Concepts of controllability and observability.		
Unit-VI	**Controller Principles**	06	ET302.6
	Introduction to P, PI,PD and PID controller and their characteristics; Tuning of controllers; Zeigler-Nichols method; Introduction to programmable logic controllers and ladder logic		

Books:

Text Books:

1. I. J. Nagrath, M. Gopal, “Control System Engineering”, New Age International Publishers, 5th Edition, 2009.
2. Farid Golnaraghi, Benjamin C Kuo, “Automatic Control Systems”, 9th Edition, John Wiley and Sons

Reference Books:

1. Curtis D. Johnson, “Process Control Instrumentation Technology”, Eighth Edition, PHI Pvt. Ltd., New Delhi, 2011
2. Richard C. Drof , Robert N. Bishop, “Modern Control Systems”, Addison Wesley Publishing Company, 2001
3. B. C. Kuo, “Digital Control Systems”, Oxford University Press, 2012
4. Schaum’s Outline Series, “Feedback Control Systems” Tata McGraw-Hill, 2007.
5. John J. D’Azzo, Constantine H. Houpis, “Linear Control System Analysis and Design”, Tata McGraw-Hill, Inc., 1995.

e-Resources

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

Guidelines for Continuous Assessment:

10 Marks based on Students' performance in class tests and remaining 10 marks on class assignments /Quiz. These evaluation components should be carried out on completion of each unit and average should be taken.

Digital Communication (ET303)

Teaching Scheme:
Lectures: 03 Hrs/Week

Credits: 03

Examination Scheme:
In-Sem Exam: 30 Marks
End-Sem Exam: 50 Marks
CIA: 20 Marks
Total: 100 Marks

Prerequisite Course: Knowledge of Analog Communication

Course Objectives:

1. To study the functional blocks of different waveform coding techniques.
2. To learn the various data formats with their spectra.
3. To study binary and M-ary digital modulation techniques.
4. To learn the response of a matched filter receiver in presence of noise.
5. To introduce the principle of Spread Spectrum techniques
6. To learn the different coding techniques for data compression.

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

Course Outcomes	Statement	Bloom's Descriptor	
		Level	Descriptor
ET303.1	Compare the waveform coding techniques in terms of bit rate, bandwidth and SNR.	2	Understand
ET303.2	Organize the data formats for reliable baseband transmission.	4	Analyze
ET303.3	Differentiate bandpass modulation techniques along with their performance measure.	4	Analyze
ET303.4	Compute the error probability of digital modulation techniques with matched filters.	3	Apply
ET303.5	Illustrate the concept of Direct Sequence and Frequency Hopped Spread Spectrum.	2	Understand
ET303.6	Implement a data compression scheme of source and channel coding.	3	Apply

Mapping of course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET303.1	2	2	-	2	-	-	-	-	-	-	-	-	-	2
ET303.2	2	3	-	-	-	-	-	-	-	-	-	-	-	1
ET303.3	2	1	2	-	1	-	-	-	-	-	-	-	-	2
ET303.4	3	-	2	-	-	-	-	-	-	-	-	-	-	2
ET303.5	3	-	-	-	1	-	-	-	-	-	-	-	-	2
ET303.6	-	2	3	-	-	-	-	-	-	-	-	-	-	1

Course Contents

Unit-I	**Waveform Coding Techniques**	**No. of Hours**	**COs**
	Comparison between analog and digital communication, Block diagram of digital communication system, Sampling theorem, aliasing effect, PCM Generation and Reconstruction, Bandwidth and SNR analysis of PCM, Quantization Noise, Uniform and Non-uniform Quantization, Companded PCM : A-law and μ law, DPCM, DM, ADM Performance comparison of above systems with PCM.	07	ET303.1
Unit-II	**Baseband Digital Data Transmission**	**No. of Hours**	**COs**
	Digital Multiplexing: Multiplexers and hierarchies, Data Multiplexers. Data formats (NRZ, RZ, AMI and Phase Manchester formats) and their spectra, synchronization: Bit Synchronization, Scramblers, Frame Synchronization, Inter-Symbol Interference, Channel Equalization, Eye pattern.	06	ET303.2
Unit-III	**Digital Modulation Techniques**	**No. of Hours**	**COs**
	Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Binary Phase Shift Keying (BPSK), Quadrature Phase Shift Keying (QPSK), M-ary PSK, Quadrature Amplitude Modulation (QAM), Binary Frequency Shift Keying(BFSK), M-ary FSK, Minimum Shift Keying (MSK), and GMSK. Band pass demodulation in the presence of Gaussian noise.	07	ET303.3
Unit-IV	**Optimal Reception of Digital Signal**	**No. of Hours**	**COs**
	Matched Filter, Probability of Error of Matched Filter, and Correlation receiver. Calculation of error probability for BASK, BPSK and BFSK, QAM and MSK.	06	ET303.4
Unit-V	**Spread Spectrum Techniques**	**No. of Hours**	**COs**
	Pseudo Noise sequences (PN), Spread Spectrum principle (SS), Direct Sequence Spread Spectrum (DSSS) with coherent BPSK, Frequency Hop Spread Spectrum (FHSS) and types, processing gain, jamming, orthogonality between PN codes, CDMA. Commercial applications of Spread Spectrum-cellular systems and GPS. 10Introduction of OFDM.	06	ET303.5
Unit-VI	**Coding Techniques**	**No. of Hours**	**COs**
	Entropy and its properties, Huffman coding, Shannon-Fano coding, The Lempel Ziv algorithm, Mutual information, Channel capacity, Channel Coding theorem, Differential entropy and mutual Information for continuous ensembles, Information Capacity theorem, LBC: Syndrome, Error detection and correction capability, Standard array and syndrome decoding, Single parity check codes.	06	ET303.6

Books

Text Books:

1. Simon Haykin, Michael Moher, “Communication Systems”, *Wiley*, (5th Edition), (2009).
2. Bernard Sklar, “Digital Communications fundamentals and Applications”, *Prentice Hall P T R*, (2nd Edition), (2009).

Reference Books:

1. Donald L. Schilling, Goutam Saha, Herbert Taub, “Principles of Communication system”, Tata McGraw-Hill Education Pvt. Ltd, (4th Edition), (2015).
2. A. B. Carlson and P. B. Crilly, “Communication Systems”, McGraw-Hill, (5th Edition), (2002).
3. T. L. Singal, “Analog and Digital Communication”, Tata McGraw-Hill, (1st Edition), (2012).
4. K. Sam Shanmugam, “Digital and analog communication systems”, Wiley Publication, (1st Edition), (1996).
5. B. P. Lathi, Gupta, “Analog and Digital Communication” Oxford University Press (AICTE)
6. Debajani Mitra, “Analog and Digital Communication”, TMH Publication (AICTE)

e-Resources:

1. http://nptel.ac.in/courses/Webcoursecontents/IIT%20Kharagpur/Dig%20Comm/New_index1.html
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-02-introduction-to-eecs-ii-digital-communication-systems-fall-2012/

Guidelines for Continuous Internal Assessment:

10 Marks based on student performance in open book test and remaining 10 marks on Quiz. These evaluation components should be carried out on completion of each unit and average should be taken.
If required, necessary changes in the CIA components can be made by respective course teacher

Linear Integrated Circuits (ET304)

Teaching Scheme
Lectures: 03 Hrs. / Week

Credits: 03

Examination Scheme
In-Sem Exam: 30 Marks
End-Sem Exam: 50 Marks
CIA: 20 Marks
Total: 100 Marks

Prerequisite Course: Basics of Op-amp

Course Objectives:

1. To have idea of internal structure of Op-Amp.
2. To introduce linear applications of Op-Amp.
3. To introduce non-linear applications of Op-Amp.
4. Knowledge of Converters using Op-amp
5. To understand functionalities of PLL and its use in various applications in communication and control systems.
6. Usefulness of Filter in various fields.

Course Outcomes (COs): After successful completion of this course students will be able to

Course Outcomes	Statements	Bloom's Taxonomy	
		Level	Descriptor
ET304.1	Describe the Analysis of Op-amp and the characteristics of Op-amp.	2	Understand
ET304.2	Determine linear Applications of Op-amp and its usefulness.	3	Apply
ET304.3	Determine non- linear Applications of Op-amp and its usefulness.	3	Apply
ET304.4	Explain V to I, I to V, V to F, F to V, ADC and DAC.	2	Understand
ET304.5	Explain the functionalities of PLL to Frequency synthesizer, FM and AM demodulators	2	Understand
ET304.6	Modify knowledge of Op-amp in Analog Filter design.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET304.1	3	1	-	2	-	-	-	-	-	-	-	2	2	
ET304.2	2	2	1	-	-	-	-	-	-	-	-	2	2	
ET304.3	3	2	3	-	1	-	-	-	-	-	-	2	3	
ET304.4	3	2	2	-	-	-	-	-	-	-	-	2	2	
ET304.5	2	2	-	-	1	-	-	-	-	-	-	2	1	
ET304.6	2	2	-	-	-	-	-	-	-	-	-	2	1	

Course Contents

Unit-I	**OP-AMP Fundamentals**	No. of Hours	COs
	Block diagram of OP-AMP, Differential Amplifier configurations, Differential amplifier analysis for dual-input balanced-output configurations using 'r'	06 Hrs.	ET304.1

	parameters, Need and types of level shifter, current mirror circuits, Op-amp Parameters, Voltage series and voltage shunt feedback amplifier, feedback effect on Ri, Ro, bandwidth and voltage gain.		
Unit-II	**Linear Applications of OP-AMP**	No. of Hours	COs
	Summing amplifier, difference amplifier, Ideal integrator, practical integrator with frequency response, Advantages of practical integrator over Ideal integrator, Ideal differentiator, practical differentiator with frequency response, Advantages of practical differentiator over Ideal differentiator, Instrumentation amplifiers. Applications of Integrator, Differentiator and Instrumentation Amplifier.	06 Hrs.	ET304.2
Unit-III	**Non-linear Applications of OP-AMP**	No. of Hours	COs
	Comparator, characteristics of comparator, applications of comparator, Inverting Schmitt trigger(symmetrical/asymmetrical), Non- inverting Schmitt trigger, clippers and clampers, Square wave generator, triangular wave generator, Need of precision rectifier, Half wave, Full wave precision rectifiers, peak detectors.	06 Hrs.	ET304.3
Unit-IV	**Converters using OP-AMP**	No. of Hours	COs
	I-V and V-I converter, current amplifier, DAC: Binary Weighted and R/2R Ladder type 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, Flash type ADC, Applications of Converter	07 Hrs.	ET304.4
Unit-V	**Phase Locked Loop & Oscillators**	No. of Hours	COs
	Block diagram of PLL, characteristics/parameters of PLL and different applications of PLL, Oscillators principle, design of R-C phase shift, Wein bridge and voltage controlled oscillators.	06 Hrs.	ET304.5
Unit-VI	**Active filters**	No. of Hours	COs
	Need of Active filter over passive filter, Design and frequency scaling of First order and second order Active LP, HP, BP, wide and narrow band BR Butterworth filters and notch filter, All pass filters, Applications of filter.	07 Hrs.	ET304.6

Text Books:

1. Ramakant A. Gaikwad, “Op Amps and Linear Integrated Circuits”, Pearson Education 2000.
2. Salivahanan and Kanchana Bhaskaran, “Linear Integrated Circuits”, Tata McGraw Hill, India 2008.

Reference Books:

1. George Clayton and Steve Winder, “Operational Amplifiers”, 5th Edition Newnes..

2. Gray, Hurst, Lewise, Meyer, “Analysis & Design of Analog Integrated Circuits”, Wiley Publications on Education.
3. Sergio Franco, “Design with Operational Amplifiers and Analog Integrated Circuits”, McGraw Hill Education.
4. A.S. Sedra and K.C.Smith,”Microelectronic Circuits”, Saunder's College Publishing, 1991

e-Resources

1. https://nptel.ac.in/courses/108/108/108108111/

Guidelines for Continuous Assessment:-

1. Circuit simulation based on topics from Unit I, II and III.
2. Circuit simulation based on topics from Unit IV, V and VI.

Object Oriented Programming (ET305)

Teaching Scheme
Lectures: 03 Hrs. / Week

Credits: 03

Examination Scheme
ISE : 30 Marks
ESE : 60 Marks
CIA : 20 Marks
Total: 100 Marks

Prerequisite: Knowledge of C programming

Course Objectives:

1. To learn object oriented programming concepts.
2. To introduce standard techniques for software development, using object oriented approach
3. To Learn Fundamental concepts of C++.
4. To Study Fundamental concepts of Java.
5. To make the students familiar with programs in C++ and Java for problem solving.
6. To make the students familiar with components of GUI based programming.

Course Outcomes (COs):
After successful completion of course students will be able to

COs	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
ET305.1	Recognize features of OOP, it's benefits & applications	1	Remember
ET305.2	Implement the concepts of abstraction, data encapsulation, inheritance and polymorphism in C++	3	Apply
ET305.3	Illustrate basic program constructs in Java	2	Understand
ET305.4	Implement the concepts of classes, Objects and Methods in Java.	3	Apply
ET305.5	Implement the concepts of Inheritance, Package and Interface in Java	3	Apply
ET305.6	Design Java Applications using Exception handling, AWT & Applets.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET305.1	2	--	1	--	--	--	--	--	--	--	--	2	3	--
ET305.2	1	2	2	--	3	--	--	--	--	--	--	1	1	--
ET305.3	1	--	2	--	1	--	--	--	--	--	--	1	2	--
ET305.4	1	2	2	--	2	--	--	--	--	--	--	2	2	--
ET305.5	2	2	2	--	3	--	--	--	--	--	--	2	2	--
ET305.6	1	2	3	--	2	--	--	--	--	--	--	1	2	--

Course Contents

Unit-I	**Object Oriented Programming Paradigms**	No. of Hours	COs
	Need of Object-Oriented Programming (OOP), Object Oriented Programming Paradigm, Basic Concepts of Object-Oriented Programming, Benefits of OOP, C++ as object-oriented programming language. Software Development Life Cycle, Functions in C++, Function prototyping, Reference variable, call by reference, return by reference, inline function, A Simple C++ Program.	06 .	ET305.1
Unit-II	**Object Oriented Programming with C++**	No. of Hours	COs
	A C++ program with class, Classes and Objects, Member allocation for objects, Arrays of objects, Objects as function arguments, Constructors and types, Destructors. Operator overloading, containment, Inheritance and their types, polymorphism, exception handling	06	ET305.2
Unit-III	**Fundamentals of Java Programming**	No. of Hours	COs
	Java History, Overview of Java Language with other programming languages, Java features, Java and Word Wide Web, Java Virtual Machine, Constants, Variables, and Data Types, Operators and Expressions, Decision making. Simple Java Program, Java Tokens, Java Statements, Typecasting, Type conversion in expressions, Operator precedence and associativity, Control statements- Decision making & branching, Decision making & looping, For Each version of for loop.	06	ET305.3
Unit-IV	**Classes, Objects and Methods in Java**	No. of Hours	COs
	Class fundamentals, creating Objects, assigning object reference variables, Methods, this keyword, garbage collection, finalize method, overloading methods, overriding methods, **Arrays:** one dimensional array, multi-dimensional array, alternative array declaration statements. **String Handling:** String class methods.	06	ET305.4
Unit-V	**Inheritance, Packages, Interfaces**	No. of Hours	COs
	Inheritance basics, constructors in derived class. Object class, Packages, access protection, importing packages, instance of operator. Interfaces: Defining interfaces, extending interfaces, Implementation of interfaces, Accessing interface variables. Default interface methods, Use static method in interface.	06	ET305.5

Unit-VI	**Exception handling & GUI Programming in Java**	No. of Hours	COs
	Concept of Exception handling, types of errors, multiple catch statements. Applets: Concept, creating an Applet, difference between applets and applications. Life cycle of an applet, types of applets. Introduction to AWT: Working with windows, Using AWT controls-push Buttons, Label, Text Fields, Text Area, Check Box, and Radio Buttons.	06	ET305.6

Text Books:

1. E.Balagurusamy, “Object Oriented Programming using C++ and Java”, Tata McGraw Hill.
2. Herbert Schildt, “Java: The Complete Reference”, McGraw Hill, (7th Edition).

Reference Books:

1. Robert Lafore, “Object Oriented Programming using C++”, SAMS publishing, (4th Edition).
2. E.Balagurusamy, “Programming with C++”, Tata McGraw Hill, (3rd Edition)
3. T. Budd, “Understanding OOP with Java”, Pearson Education.
4. E. Balagurusamy, “Programming with Java A Primer”, Tata McGraw Hill, (3rd Edition)
5. Deitel, H.M. & Deitel, “Java: How to Program”, Prentice Hall (8th Ed.).

e-Resources:

1. https://nptel.ac.in/courses/106/105/106105191/
2. https://nptel.ac.in/courses/106/105/106105151/

Guidelines for Continuous Assessment:

10 Marks based on Students’ performance in programming Assignments and remaining 10 marks on class assignments /Quiz. These evaluation components should be carried out on completion of each unit and average should be taken.

If required necessary changes in the CIA components can be made by respective course teacher

Digital Signal Processing (ET306A)

Teaching Scheme
Lectures: 03 Hrs. / Week

Credits: 03

Examination Scheme
In-Sem Exam: 30 Marks
End-Sem Exam: 50 Marks
CIA: 20 Marks
Total: 100 Marks

Prerequisite Course : Knowledge of Z-Transform, Laplace transform.

Course Objectives:

1. To introduce the concepts of sampling and aliasing of discrete time signal.
2. To study different transforms for discrete time signals and systems.
3. To study implementation techniques of digital filters.
4. To learn the concept of multi rate sampling.
5. To learn the philosophy of FIR and IIR filter design.
6. To brief the applications of DSP in different signal processing domains.

Course Outcomes (COs):

After completion of course students will be able to

Course Outcomes	Course outcome	Blooms Taxonomy	
		Level	Descriptor
ET306A.1	Describe various elements of DSP and their requirements.	2	Understand
ET306A.2	Determine the transform techniques like DTFT and DFT on discrete time signal.	3	Apply
ET306A.3	Compute discrete time signal with FFT algorithms.	3	Apply
ET306A.4	Select appropriate method for IIR filter for various applications.	4	Analyze
ET306A.5	Select appropriate window function for FIR filter for various applications.	4	Analyze
ET306A.6	Summarise applications of DSP in different signal processing domains.	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET306A.1	3	1	---	---	---	---	---	---	---	---	---	---	1	---
ET306A.2	3	1	2	---	2	---	---	---	---	---	---	---	2	---
ET306A.3	3	1	2	---	2	---	---	---	---	---	---	1	2	---
ET306A.4	3	2	2	2	2	---	---	---	---	---	---	1	2	---
ET306A.5	3	2	2	2	2	---	---	---	---	---	---	1	2	---
ET306A.6	3	2	2	1	---	---	---	---	---	---	---	2	2	---

Course Contents

Unit-I	**Introduction to DSP**	No. of Hours	CO .1
	Basic elements of DSP and its requirements, advantages over Analog signal processing. DT signals, need of sampling theorem in signal processing, recovery of analog signals, mapping between analog frequencies to digital frequency. Concept of Basis function and orthogonality.	06 Hrs.	ET306A.1
Unit-II	**Discrete Fourier Transform**	No. of Hours	CO 2
	DTFT, Properties of DTFT, Introduction of DFT, Properties of DFT, Twiddle factor and its properties, circular convolution using-concentric circle, expression, DFT-IDFT. Computation of linear convolution using circular convolution, circular convolution for avoidance of aliasing.	07 Hrs.	ET306A.2
Unit-III	**Fast Fourier Transform**	No. of Hours	CO 3
	FFT, decimation in time and decimation in frequency using Radix-2 FFT algorithm, comparison of computational complexity with direct computation, Butterfly diagram, Linear filtering using overlap add and overlap save method, IDFT by FFT algorithm.	07 Hrs.	ET306A.3
Unit-IV	**IIR Filter Design**	No. of Hours	CO 4
	Concept of analog filter design, Design of IIR filters from analog filters, IIR filter design by impulse invariance method, Bilinear transformation method. Frequency warping effect, Butterworth filters, design of Butterworth filter, IIR filter realization using direct form, cascade form and parallel form.	07 Hrs.	ET306A.4
Unit-V	**FIR Filter Design**	No. of Hours	CO 5
	Ideal filter requirements, Gibb's phenomenon, windowing techniques, characteristics and comparison of different window functions, Design of linear phase FIR filter using windows and frequency sampling method. FIR filters realization using direct form.	06 Hrs.	ET306A.5
Unit-VI	**Multi rate DSP and Applications of DSP**	No. of Hours	CO 6
	Concept of Multirate DSP, Sampling rate conversion by a non-integer factor, concept of decimation and interpolation, Design of two stage sampling rate converter, General Architecture of DSP, DSP processor TMS320C67XX (Features and Architecture). Application of DSP in different domain (speech Processing, Image processing, biomedical and Radar signal processing).	06 Hrs.	ET306A.6
Books:			

Text Books:

1. John G. Proakis, Dimitris G. Manolakis, — Digital Signal Processing: Principles, algorithms and applications Fourth edition, Pearson Prentice Hall.
2. S. Salivahanan, C. Gananpriya — Digital Signal processing, McGraw Hill Publication
3. Sen M. Kuo Woon- Seng S. Gan - Digital Signal processing, Pearson Publication

Reference Books:

1. Ifaeachor E.C,Jervis B. W., — Digital Signal processing : Practical approach, Pearson publication
2. Li Tan, Jean Jiang, — Digital Signal Processing: Fundamentals and applications— Academic press
3. Lathi, B. P., Linear Systems and Signals, 2nd edition, Oxford University Press.
4. S. K.Mitra - Digital Signal Processing, McGraw Hill Publication.

e-Resources : https://nptel.ac.in/courses/117/102/117102060/

Guidelines for Continuous Assessment: -
Programming assignments in MATLAB

Database Management System (ET306B)

Teaching Scheme
Lectures: 3 Hrs. / Week

Credits: 3

Examination Scheme
In-Sem Exam: 30 Marks
End-Sem Exam: 50 Marks
CIA: 20 Marks
Total: 100 Marks

Prerequisite course : DSA

Course Objectives:

1. To study the fundamental concepts of database management.
2. To introduce a different database design approach covering conceptual and logical design.
3. To learn the basic issues of transaction processing and concurrency control.
4. To study various Database Architectures and Applications.
5. To learn a powerful, flexible and scalable general-purpose distributed database.

Course Outcomes (COs):

On completion of the course, student will be able to–

Course Outcomes	Course Outcome(s) statement	**Bloom's Taxonomy**	
		Level	**Descriptor**
ET306B.1	Construct ER model for given requirements and convert the same into database tables.	2	Understand
ET306B.2	Illustrate basic program constructs in SQL and PL/SQL.	2	Understand
ET306B.3	Implement database design using normalization.	3	Apply
ET306B.4	Implement the isolation property, including locking, time stamping based on concurrency control.	3	Apply
ET306B.5	Explain different database architecture and use of appropriate architecture in real time environment.	2	Understand
ET306B.6	Select appropriate NoSQL databases for real time applications.	4	Analyze

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes PSOs):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET306B.1	3	---	2	---	1	---	---	---	---	---	---	1	2	---
ET306B.2	2	1	3	1	1	---	---	---	---	---	---	2	2	---
ET306B.3	1	1	2	1	1	---	---	---	---	---	---	1	1	---
ET306B.4	2	---	2	1	1	---	---	---	---	---	---	1	1	---
ET306B.5	2	---	2	0	3	---	---	---	---	---	---	3	2	---
ET306B.6	2	---	1	1	3	---	---	---	---	---	---	3	2	---

Course Contents

Unit-I	**Introduction to DBMS**	No. of Hours	COs
	Introduction to Database Management Systems, Purpose of Database Systems, Database-System Applications, View of Data, Database Languages, Database System Structure, Data Models, Database users, Database Design and ER Model: Entity, Attributes, Relationships, Constraints, Keys, Design Process.	07	ET306B.1
Unit-II	**SQL AND PL/SQL**	No. of Hours	COs
	SQL: Characteristics and advantages, SQL Data Types and Literals, SQL Operators, Tables: Creating, Modifying, Deleting, Views: Creating, Dropping, Updating using Views, Indexes, SQL DML Queries: SELECT Query and clauses, Set Operations, Predicates and Joins, Database Modification using SQL Insert, Update and Delete Queries. PL/SQL: concept of Stored Procedures & Functions.	07	ET306B.2
Unit-III	**Relational Database Design**	No. of Hours	COs
	Relational Model: Basic concepts, Attributes and Domains, Relational Integrity: Domain, Referential Integrities, Enterprise Constraints, Database Design: Features of Good Relational Designs, Normalization, Atomic Domains and Normal Form.	06	ET306B.3
Unit-IV	**Database Transactions and Query Processing**	No. of Hours	COs
	Basic concept of a Transaction, Transaction Management, Properties of Transactions, Concept of Schedule, Serial Schedule, Concurrency Control: Need, Locking Methods, Deadlocks, Time-stamping Methods, Recovery methods: Shadow-Paging and Log-Based Recovery, Checkpoints.	07	ET306B.4
Unit-V	**Database System Architectures**	No. of Hours	COs
	Introduction to Database Architectures: Multi-user DBMS Architectures, Case study- Oracle Architecture. Parallel Databases: Speedup and Scale up, Distributed Databases: Architecture of Distributed Databases Design.	06	ET306B.5
Unit-VI	**NoSQL Database**	No. of Hours	COs
	Introduction to NoSQL Database, Types and examples of NoSQL Database, Structured verses unstructured data, Distributed Database Model, Comparative study of SQL and NoSQL, Mongodb- Introduction.	06	ET306B.6
Text Books:			
1. Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", McGraw Hill Publishers 2. Connally T, Begg C., "Database Systems", Pearson Education 3. R. P. Mahapatra and Govind Verma, “Database Management Systems”, Khanna Publishing House			
Reference Books:			

1. Raghurama Krishan, “Database Management Systems”, McGrawHill
2. S.K.Singh, “Database Systems : Concepts, Design and Application”, Pearson, Education
3. Pramod J. Sadalage and Martin Fowler, “NoSQL Distilled”, Addison Wesley
4. Kristina Chodorow, Michael Dirolf, “MangoDB: The Definitive Guide”, O’Reilly Publications

e-Resources:

1. https://nptel.ac.in/courses/106/105/106105175/

Guidelines for Continuous Internal Assessment: -

Assignment will be evaluated on each unit for 10 marks.
MCQ Test will be evaluated on each unit for 10 marks.

PEC1: Power Electronics (ET306C)

Teaching Scheme
Lectures: 3 Hrs. / Week
Credit: 3

Examination Scheme
In-Sem Exam: 30 Marks
End-Sem Exam: 50 Mark
CIA: 20 Marks

Prerequisite Course: Network basics, Semiconductor basics

Course Objectives:

1. To introduce different power semiconductor devices, their construction, characteristics and turning on circuits.
2. To give an exposure to students, working & analysis of controlled rectifiers for different loads.
3. To study DC choppers and AC voltage controllers.
4. To study Inverters and its performance parameters.
5. To study SMPS and resonant converters.
6. To study the different motor drives, various power electronics applications like UPS.

Course Outcomes (COs):

After successful completion of the course, student will be able to:

Course Outcomes	Course Outcome(s)Statement	**Bloom's Taxonomy**	
		Level	**Descriptor**
ET306C.1	Describe basic operation and performance characteristics of power semiconductor devices, SCR, MOSFET and IGBT.	2	Understand
ET306C.2	Explain the characteristic of half and full controlled converter.	3	Apply
ET306C.3	Select suitable power converter to control electric motors	4	Analyze
ET306C.4	Focus on IGBT based single phase and three phase inverters.	4	Analyze
ET306C.5	Draw switch mode power supply circuit using different DC-DC converters.	3	Apply
ET306C.6	Determine the use of power converter in commercial and industrial applications.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
ET306C.1	2	----	1	--	--	--	--	--	--	--	--	----	2	--
ET306C.2	3	----	2	1	1	--	--	--	--	--	--	1	2	--
ET306C.3	3	----	2	1	1	--	--	--	--	--	--	1	2	--
ET306C.4	3	----	2	1	1	--	--	--	--	--	--	--	2	--
ET306C.5	2	----	2	2	--	--	--	--	--	--	--	1	2	--

ET306C.6	2	----	3	3	2	----	----	--	--	--	--	1	2	--

Course Contents

Unit-I	**Power Semiconductor Devices**	7 Hrs.	COs
	SCR: Construction, steady state characteristics and switching characteristics of SCR, SCR ratings:I_L,I_H,V_{BO},V_{BR},dv/dt,di/dt,surge current and rated current, Gate characteristic, Gate drive requirements, Synchronized UJT triggering circuit. **Power MOSFET & IGBT:** Construction, Steady state characteristics, switching characteristics Gate drive circuits. Protections and thermal consideration of power devices.		ET306C.1
Unit-II	**AC-DC Power Converter**	7 Hrs.	COs
	Concept of line and natural commutation, single phase Semi and full bridge converters for R, R-L, R-L-E loads, performance parameters, Effect of free-wheeling diode, Three phase semi and full converters for R load. 12 pulse HVDC converter.		ET306C.2
Unit-III	**DC –DC converters and AC voltage Controller**	6 Hrs.	COs
	Working principle of step-down chopper for R-L load (highly inductive), control strategies, performance parameters, Step-up chopper, Quadrant operations of Type A, Type B Type C Type D and Type E choppers, Single-Phase full wave AC voltage controller with R load.		ET306C.3
Unit-IV	**DC- AC Power Converters**	6 Hrs.	COs
	Single phase full bridge square wave, quasi-square wave, PWM Inverters and comparison of their performance, Three phase voltage source inverter for balanced star R load.	.	ET306C.4
Unit-V	**Switching Power Supplies**	7 Hrs.	COs
	Limitation of linear power supplies, overview of switching power supplies, Concept of Buck and Boost converter, flyback converter for SMPs, Resonant converters-need, concept of Zero- voltage and Zero-current switching. Comparison of linear, switch mode and resonant power supplies. Electromagnetic Interference, sources, minimizing techniques, shielding techniques for EMI.		ET306C.5
Unit-VI	**Power Electronics Applications**	7 Hrs.	COs
	Block diagram and configuration of UPS, salient features of UPS, and selection of battery charger ratings for Online UPS, Design of battery charging circuit for electric vehicles. Separately excited DC motor drive, BLDC motor drive. Variable voltage & variable frequency three phase induction motor drive.	.	ET306C.6
Books:			
Text Books:			
1. M. H. Rashid, Power Electronics circuits devices and applications‖, PHI New Delhi, 3rd edition, 2004. 2. P.C. Sen., Modern Power Electronics, 2nd edition, S.Chand & Co.			

Reference Books:

1. Ned Mohan, Robbins, Power electronics, 3rd edition, John Wiley and sons.
2. M. S. Jamil Asghar, Power Electronics, PHI New Delhi, 2004
3. V.R.Moorthi, Power Electronics, Oxford University Press.
4. P. S. Bimbhra, Power Electronics, Khanna Publishers, New Delhi.

Guidelines for Continuous Internal Assessment:

10 Marks based on Students' performance in presentation, video making activity and remaining 10 marks on Quiz. These evaluation components should be carried out on completion of each unit and average should be taken.

If required, necessary changes in the CIA components can be made by respective course teacher.

Control Systems Tutorials (ET307)

Teaching Scheme
Tutorial: 01 Hr / Week
Credits: 01

Examination Scheme
Term work: 25 Marks

Prerequisite:
Mathematical background of differential equations, Laplace transforms and Matrix theory

Course Objectives:

1. To learn mathematical modeling of different kinds of physical systems.
2. To study response of first order and second order systems in the time domain.
3. To introduce the concept of system stability and different criteria for determining the same.
4. To learn various frequency response plots and correlate between time domain and frequency domain specifications.
5. To introduce the principles of state space analysis in modeling physical systems.
6. To study various modes of control actions and their applications.

Course Outcomes (COs):

After successful completion of this course, students will be able to:

Course Outcomes	Statements	Bloom's Taxonomy	
		Level	Descriptor
ET307.1	Model different electrical, mechanical and electro-mechanical systems using block diagrams and SFG techniques.	2	Understand
ET307.2	Compute different time domain specifications of first and second order systems.	3	Apply
ET307.3	Determine the stability of closed loop control systems using RH criterion and root locus.	3	Apply
ET307.4	Draw the frequency response plots of control systems.	3	Apply
ET307.5	Outline the concepts of state space analysis in system modelling.	4	Analyze
ET307.6	Summarize the operation of different modes of controllers and their applications to understand.	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET307.1	3	2	-	-	2	-	-	-	-	-	-	-	1	-
ET307.2	3	2	-	-	-	-	-	-	-	-	-	-	1	-
ET307.3	3	2	-	-	-	-	-	-	-	-	-	-	1	-
ET307.4	3	2	-	-	-	-	-	-	-	-	-	-	1	-
ET307.5	3	2	-	-	2	-	-	-	-	-	-	-	1	-
ET307.6	1	1	-	-	2	-	-	-	-	-	-	-	1	-

Course Contents

General Guidelines

- Minimum 8 tutorials should be completed from the given list.
- Any 6 tutorials from the first 8 in the list should be taken in the class. But it is advisable if all 8 tutorials are carried out. On each tutorial, minimum 2 - 3 examples should be taken.
- Knowledge of Simulink is essential for Tutorial No. 9 and 10. Both these tutorials are mandatory.
- Tutorials should be evaluated on a weekly basis.

List of Tutorials

Sr. No.	Tutorial Title	COs
1.	Modelling of electrical and translational & rotational mechanical systems	ET307.1
2.	Determination of transfer function using block diagram reduction	ET307.1
3.	Determination of transfer function using signal flow graph	ET307.1
4.	Calculation of time domain specifications of a second order system.	ET307.2
5.	Stability analysis using Routh – Hurwitz criterion.	ET307.3
6.	Construction of root locus.	ET307.3
7.	Construction of Bode plot.	ET307.4
8.	Development of state space model of physical system	ET307.5
9.	Mathematical modelling of a physical system in Simulink.	ET307.1
10.	Simulation of a PID controller action in Simulink.	ET307.6

Books:
Text Books:
1 I. J. Nagrath, M. Gopal, "Control System Engineering", New Age International Publishers, 5th Edition, 2009. 2 Farid Golnaraghi, Benjamin C Kuo, "Automatic Control Systems", 9th Edition, John Wiley and Sons
Reference Books:
1 Richard C. Drof, Robert N. Bishop, "Modern Control Systems", Addison Wesley Publishing Company, 2001 2 Schaum's Outline Series, "Feedback Control Systems" Tata McGraw-Hill, 2007. 3 John J. D'Azzo, Constantine H. Houpis, "Linear Control System Analysis and Design", Tata McGraw-Hill, Inc., 1995.

Digital Communication Laboratory (ET308)

Teaching Scheme
Practical: 2Hrs/Week
Credits: 01

Examination Scheme
OR: 25 Marks

Prerequisite Course: - Knowledge of Analog Communication.

Course Objectives:

1. To study the functional blocks of different waveform coding techniques.
2. To learn the various data formats with their spectra.
3. To study binary and M-ary digital modulation techniques.
4. To learn the response of matched filter receiver in presence of noise.
5. To introduce the principle of Spread Spectrum techniques
6. To learn the different coding techniques for data compression.

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

Course Outcomes	Statement	Bloom's Descriptor	
		Level	Descriptor
ET308.1	Compare the waveform coding techniques in terms of bit rate, bandwidth and SNR.	2	Understand
ET308.2	Organize the data formats for reliable baseband transmission.	4	Analyze
ET308.3	Differentiate band pass modulation techniques along with their performance measure.	4	Analyze
ET308.4	Compute the error probability of digital modulation techniques with matched filter.	3	Apply

ET308.5	Illustrate the concept of Direct Sequence and Frequency Hopped Spread Spectrum.	2	Understand
ET308.6	Implement a data compression scheme of source and channel coding.	3	Apply

Mapping of course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET308.1	2	2	-	2	-	-	-	-	-	-	-	-	-	2
ET308.2	2	3	-	-	-	-	-	-	-	-	-	-	-	1
ET308.3	2	1	2	-	-	-	-	-	-	-	-	-	-	2
ET308.4	3	-	2	-	1	-	-	-	-	-	-	-	-	2
ET308.5	3	-	-	-	1	-	-	-	-	-	-	-	-	2
ET308.6	-	2	3	-	1	-	-	-	-	-	-	-	-	1

Practical Course Contents

General Guidelines :

- Minimum 8 experiments should be completed from the given list.
- Experiments should be evaluated on a weekly basis.

Sr. No.	Title of Practical	COs
1	To measure and verify the sampling theorem and aliasing effect with different sampling frequency.	ET308.1
2	To measure Bit-rate, Signal to Noise Ratio and Quantization error for PCM.	ET308.1
3	To measure and plot slope overload and Granular noise in Delta modulation.	ET308.1
4	To measure and plot slope overload and Granular noise in Adaptive Delta modulation.	ET308.1
5	To observe line codes (NRZ, RZ, Polar RZ, Bipolar (AMI), Manchester) and interpret spectral analysis for a given bit pattern.	ET308.2
6	To measure bandwidth of BFSK in presence of noise and observe the waveform.	ET308.3
7	To compare and measure bit rate, bandwidth of BPSK, QPSK in presence of noise and observe the waveform.	ET308.3
8	Write a program to calculate the error probability of BPSK and QPSK. Compare theoretical and practical BERs.	ET308.4
9	Write a program to calculate the error probability of QAM. Compare theoretical and practical BERs.	ET308.4
10	To observe and verify properties of PN sequence.	ET308.5
11	Write a program for coding and decoding of (N,k) Linear Block Code.	ET308.6

Linear Integrated Circuits Laboratory (ET309)

Teaching Scheme
Lectures: 02 Hrs. / Week
Credits: 01

Examination Scheme
Practical Exam: 50 Marks
Total: 50 Marks

Prerequisite Course: Basic Knowledge of Circuits

Course Objectives:

1. To have idea of different parameters of Op-Amp.
2. To analyze and identify linear applications of Op-Amp.

3. To analyze and identify non-linear applications of Op-Amp.
4. Knowledge of Converters using Op-amp.
5. To learn functionalities of PLL.
Course Outcomes (COs): After successful completion of this course students will be able to

Course Outcomes	Statements	Bloom's Taxonomy	
		Level	Descriptor
ET309.1	To gain knowledge to select particular Op-amp	2	Understand
ET309.2	Implement various Applications of Op-amp	3	Apply
ET309.3	Implement hardwired circuit to test performance and application for what it is being designed.	4	Analyze

Mapping of course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET309.1	2	-	-	-	2	-	-	1	2	-	-	2	1	-
ET309.2	2	2	2	-	2	-	-	1	2	-	-	2	1	-
ET309.3	2	2	2	-	2	-	-	1	2	-	-	2	1	-

Practical Course Contents

General Guidelines

- Minimum 8 experiments should be completed from the given list.
- Knowledge of circuit maker/ LTspice is essential for experiment No. 11. This experiment is mandatory.
- Experiments should be evaluated on a weekly basis.

Sr. No.	List of Practical's	CO's
1	Measure Op-Amp parameters : Input bias current, input offset current and input offset voltage. Slew rate, CMRR. Compare the result with datasheet of corresponding Op-Amp.	ET309.1 , ET309.3
2	Design, build and test integrator and differentiator for given frequency.	ET309.2 , ET309.3
3	Design, build and test instrumentation amplifiers to amplify input signal.	ET309.2 , ET309.3
4	Design, build and test precision half wave rectifier.	ET309.2 , ET309.3
5	Design, build and test Schmitt trigger and plot transfer characteristics.	ET309.2 , ET309.3
6	Design, build and test PLL.	ET309.2
7	Design and implement 2 bit R-2R ladder DAC & Flash type ADC.	ET309.2 , ET309.3
8	Design, build and test square wave generator.	ET309.2 , ET309.3
9	Design and implement V-I converter.	ET309.2 , ET309.3
10	Design and implement active filters	ET309.2 , ET309.3
11	Simulation on any one application of Op-amp	ET309.1 , ET309.2

Object Oriented Programming Lab (ET310)

Teaching Scheme
Practical: 02 Hrs / Week
Credits: 01

Examination Scheme
Practical Exam: 50 Marks
Total: 50 Marks

Prerequisite: Basic Knowledge of C Programming

Course Objective:

1. To learn the object oriented programming concepts.
2. To make the students familiar with programs in C++ and Java for problem solving
3. To introduce components of GUI based programming.
4. To lay a foundation for advanced programming.

Course Outcomes:

After successful completion of course students will be able to:

COs	CO statement	Bloom's Taxonomy	
		Level	Descriptor
ET310.1	Differentiate various programming paradigms	2	Understand
ET310.2	Illustrate fundamental programming constructs in C++ and Java	2	Understand
ET310.3	Implement concepts of classes, objects, methods, and handle object creation, initialization, and destruction to model real-world problems.	3	Apply
ET310.4	Select from applet and AWT to Develop GUI based application	4	Analyze

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET310.1	2	--	1	--	--	--	--	--	--	--	--	2	3	--
ET310.2	1	2	2	--	3	--	--	--	--	--	--	1	1	--
ET310.3	1	2	2	--	2	--	--	--	--	--	--	2	2	--
ET310.4	1	2	3	--	2	--	--	--	--	--	--	1	2	--

General Guidelines

- Minimum 8 experiments should be completed from the given list.
- Experiment No. 2 and 11 are compulsory.
- Experiment should be evaluated on a weekly basis.

Practical Course Contents

Sr. No.	Title of Experiment	COs
1	Write a program in C++ to find maximum of two numbers using inline functions	ET310.1, ET310.2

2	Write a Program to create class with members and functions, accept and display details for single object	ET310.3
3	Write a program in C++ using Constructors and destructors	ET310.2
4	Write a program in C++ for multiple inheritance	ET310.3
5	Write a program in Java to implement a Calculator with operations add, subtract, multiply, divide	ET310.1, ET310.2
6	Write a Program on method overloading using Java	ET310.2
7	Write a program in Java to sort i) List of integers ii) List of names	ET310.2
8	Write a Program in java on interface demonstrating concept of multiple inheritance	ET310.1, ET310.3
9	Write a java program which use try and catch for exception handling	ET310.3
10	Write a Program in java on single and multilevel inheritance (Use super keyword)	ET310.1, ET310.3
11	Write a Program on Applet to demonstrate Graphics, Font and Color class	ET310.4
12	Write Program in java on AWT controls	ET310.4
13	Write a Java program which imports user defined package and uses members of the classes contained in the package	ET310.3

Skill Based Credit Course (EC311)

Teaching Scheme:	**Examination Scheme:**
Lectures: 01 Hrs. / Week	CIA: 50 Marks
Credits: 01	Total: 50 Marks

Course Objectives:

The major objectives of skill based credit course inclusion are –

1. To make students aware about the current skill set requirements in the industry.
2. To give them exposure to the latest technology trends.
3. To bring opportunities to the learners to think, design and implement solutions to the real time problems as per the Industry standards.
4. To make students proficient in the selected skill set.

General Guidelines:

This course is intended to make students competent for the particular skill set requirement of the Industry. The department will identify such course and prepare the detailed syllabus for the student's reference. Students will have to complete particular skill based credit course as per guidelines provided in syllabus. The department will decide this course keeping in view of industry demand and placement requirements. The respective staff-incharge involved in the conduction of this course, will ensure that he/she will also get trained in the respective skill set and will assist students in the successful completion of the course.

Some Skill based Credit Courses, which can be offered for the Department of Electronics and Computer Engineering are:

1. PCB Design and fabrication

2. Python Programming

3. Embedded system Design

4. EXCEL fundamentals for Data Analysis

5. PLC and SCADA:

Mandatory Course V (MC312)

Sanjivani ECE Talks

Teaching Scheme
Lectures: 1 Hrs. / Week
Credits: 0

Examination Scheme
Total: 0 Marks

About the Course:

The objective is for students to get exposure to a diversity of areas other than their own field of study, but in a less formal and more engaging setup. These areas could be from science, engineering, social sciences, arts or even politics. Although practice is important and lectures are already part of every academic curriculum, engineering students usually get exposure to only a small set of areas which are part of their curriculum.

To be good citizens and human beings, as well as to be better engineers or scientists, they should be exposed to other diverse areas. For this purpose, renowned experts and practitioners from other areas of science, engineering, social sciences or arts should be invited to colleges to give lectures specially targeted at engineering students to help open up their minds. These lectures should not be of the kind one gets in classrooms, but more like invited talks or tutorials at research conferences, or lectures based on personal experiences of these renowned experts and practitioners.

One of the models for these could be the lectures of, say, the famous physicist Richard Feynman. Some of the TED Talks can also serve as models for this. These lectures should serve as kinds of bridges between theory and practice of activities in areas other than their own. They should be motivational, in the sense that they should help students willingly and happily take up activities in at least one or two of the diverse areas. They should help in producing more rounded human beings who can interact fruitfully with other kinds of people, not just with other engineers of their own branches. In addition, the students should feel the thrill of meeting people who have not only excelled in their fields, but have motivated others to do so. Even the more articulate politicians could be invited to present their view of the world to students, according to their different ideologies. But if this last part is done, it must be ensured that all major distinct ideologies are represented, so that students get to know very different viewpoints directly from their committed supporters. Since students are going to be citizens and voters, they should know more about political viewpoints that they can get from popular news channels or from social media.

Sr.No	Expert Lecture Title	Details of Expert	*Objectives	*Outcomes
1.				
2.				
3.				
4.				
5.				
6.				
7.				

8.				
9.				
10.				

Session: For arranging sessions, topics could be selected from following domains, but **not restricted to**

- SCIENCE
- ENVRIONMENT AND SUSTAINABILTY
- BEHAVIORAL AND INTERPERSONAL SKILLS
- BANKING
- FINANCE
- ART FORM
- SOCIAL SCIENCE
- TECHNICAL TOPICS
- DISASTER MANAGEMENT
- ROAD SAFETY
- WOMEN'S EMPOWERMENT
- ENTREPRENEURSHIP
- HEALTH
- MOTIVATIONAL THOUGHTS
- ENGINEER AND SOCIETY
- ETHICS
- TEAM WORK
- POLITICS

Execution guidelines:

- Depending on expert lecture title, course objectives and course outcomes will be framed.
- Depending on feedback and short quiz given by the students at the end of session, the attainment of corresponding outcomes will be done.
- The faculty been assigned with the load of this subject will consolidate individual attainment for calculation of final course attainment.
- The same faculty will also be responsible for smooth conduction and coordination of session which includes
    1. Collecting topic choices from the faculties.
    2. Identifying expert and mode of conduction.
    3. Maintaining attendance, feedback, attainments and other official records.

Sanjivani College of Engineering, Kopargaon
(An Autonomous Institute affiliated to SPPU, Pune)
Department of Electronics and Telecommunication Engineering

B Tech Honors in Embedded Systems & IoT
w. e. f. Academic Year 2021-22

T. Y. B. TECH SEMESTER-V

Course			Teaching Scheme Hours/week				Evaluation Scheme-Marks						
							Theory			OR	PR	TW	Total
Cat	Code	Title	L	T	P	Credits	ISE	ESE	CA				
PCC	ET8101	Microcontroller and Embedded C Fundamentals	4	-	-	4	30	50	20	-	-	-	100
		Total	**4**	**-**	**-**	**4**	**30**	**50**	**20**				**100**

T. Y. B. TECH SEMESTER-VI

Course			Teaching Scheme Hours/week				Evaluation Scheme-Marks						
							Theory			OR	PR	TW	Total
Cat	Code	Title	L	T	P	Credits	ISE	ESE	CA				
PCC	ET8102	Embedded system hardware and software design	4	-	-	4	30	50	20	-	-	-	100
LC	ET8103	Embedded system hardware and software design Lab	-	-	2	1	-	-	-	-	50	-	50
		Total	**4**	**-**	**2**	**5**	**30**	**50**	**20**	**-**	**50**	**-**	**150**

Final Year B. TECH. SEMESTER-VII

Course			Teaching Scheme Hours/week				Evaluation Scheme-Marks						
							Theory			OR	PR	TW	Total
Cat	Code	Title	L	T	P	Credits	ISE	ESE	CA				
PCC	ET8104	Computer Networks and IoT Protocols	4	-	-	4	30	50	20	-	-	-	100
LC	ET8105	Computer Networks and IoT Protocols Lab	-	-	2	1	-	-	-	-	50	-	50
		Total	**4**	**-**	**2**	**5**	**30**	**50**	**20**	**-**	**50**	**-**	**150**

Final Year B. TECH. SEMESTER-VIII

Course			Teaching Scheme Hours/week				Evaluation Scheme-Marks						
							Theory			OR	PR	TW	Total
Cat	Code	Title	L	T	P	Credits	ISE	ESE	CA				

PCC	ET8106	Advanced Embedded System Design and IoT	4	-	-	4	30	50	20	-	-	-	100
		Total	**4**	**-**	**-**	**4**	**30**	**50**	**20**	**-**	**-**	**-**	**100**

Microcontroller and Embedded C Programming (ET8101)

Teaching Scheme
Lectures: 4 Hrs. / Week

Credits: 4

Examination Scheme
In-Sem Exam: 30 Marks
End-Sem Exam: 50 Marks
CIA: 20 Marks
Total: 100 Marks

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Prerequisite:- Digital Electronics

Course Objectives:

1. To introduce students with the wide scope and applications of embedded systems
2. To make them capable to design and develop solutions to real world problems

Course Outcomes (COs): After successful completion of the course, student will be able to

COs	Course Outcome Statement	Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand different architectural features of Microcontroller and Microcontroller families.	2	Understand
CO2	Elaborate capabilities of Microcontroller and different Open source embedded hardware platforms.	4	Analyze
CO3	Select a Microcontroller or platform for specific applications. Write, simulate and execute programs in embedded C for specified application.	4	Analyze
CO4	Interface and operate various real world devices and component through prototyping boards, Design solutions to different real world problems using embedded systems.	4	Analyze

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO 8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	-	-	-	-	-	-	-	-	2	3	-
CO2	3	2	1	-	2	-	-	-	-	-	-	2	3	-
CO3	3	3	2	-	2	-	-	-	-	-	-	3	2	-
CO4	3	3	3	-	2	-	-	-	-	-	-	3	3	-

Course content

Unit-I	**Microcontroller architecture**	No. of Hours	COs
	Introduction to the concepts of microprocessors, microcontrollers, RISC, CISC, Harvard and Von Neumann architectures. Role of embedded systems. Selection of microcontrollers, variants of different Microcontroller family and their features. Applications of microcontrollers. Architecture of generalized Microcontroller. Working of Microcontroller, Concept and future trends in Microcontroller, Concept of IP core.	6 Hrs.	CO1
Unit-II	**Open source embedded platforms and applications**	No. of Hours	COs
	Survey of different open source hardware platforms and its variants with special focus on Arduino family, Atmega 328P-features, architecture, port structure, Concept of sensors and actuators, data acquisition systems,	6 Hrs.	CO2
Unit-III	**Embedded C**	No. of Hours	COs
	Introduction to simulation, debugging, and testing, programming concepts: variables, functions, conditional statements, memory map, MACROs, accessing different register, Concept of Scalability and portability. Process of Embedded C to Assembly conversion with case study. Introduction to Arduino IDE-features, IDE overview,	6 Hrs.	CO3
Unit-IV	**GPIO and communication**	No. of Hours	COs
	Concept of GPIO in Atmega 328P based Arduino board, digital input and output, concept of UART & serial communication, Concept of timers, interfacing LED, LCD and keypad	6 Hrs.	CO3
Unit-V	**Analog Input & output**	No. of Hours	COs
	Concept of ADC, interfacing with different sensors like LDR, temperature sensor(LM35), Ultrasonic Sensor, IR sensor,	6 Hrs.	CO4

	concept of PWM, DC motor interface using PWM, Servo motor interfacing		
Unit-VI	**Case study of different Microcontroller based application**	No. of Hours	COs
	Home automation, farm automation, room temperature controller etc.	6 Hrs.	CO4

CIA Activity

1. Collection of features and pin diagrams of any one of following controllers. (5 marks)

PIC microcontrollers,
AVR microcontrollers,
ARM microcontrollers,
Intel microcontrollers any other microcontroller family

2. Prepare the block diagram of any one of the following real-world control application based on microcontroller. (5 marks)

Temperature control, Weighing machine, Humidity control, Public telephone (Landline), Street-light control, Lift controller, Washing machine control,
Any other application of similar nature and magnitude

3. Collection of features and pin diagrams of any one open source hardware platforms like Arduino, Raspberry pi etc. (5 marks)

4. Writing a program and simulation for any application in 2nd activity for specified microcontroller family. (5 marks)

Books:

Text Books:

1. David E. Simon, "An Embedded Software Primer", Addison Wesley; 2nd edition, ISBN: 978-02-016-1569-2
2. Raj Kamal, "Embedded Systems: Architecture, Programming and Design", Tata McGraw-Hill Education (India), 2011.

Reference Books:

1. Frank Vahid, Tony Givargis, "Embedded System Design: A Unified Hardware/Software Introduction", Wiley- India,(2009) ISBN:- 978-81-265-0837-2.
2. Massimo Banzi, Michael Shiloh, "Getting Started With Arduino - The Open Source Electronics Prototyping Platform", Shroff/Maker Media; 3rd edition 2014, ISBN: 978-93-511-0907-5
3. https://www.arduino.cc/
4. https://www.raspberrypi.org/
5. https://www.digit.in/technology-guides/

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Department of Electronics and Telecommunication Engineering

B Tech Honors in Industrial Automation and Robotics
w. e. f. Academic Year 2021-22

T. Y. B. TECH SEMESTER-V

Course			Teaching Scheme Hours/week				Evaluation Scheme-Marks						
							Theory			OR	PR	TW	Total
Cat	Code	Title	L	T	P	Credits	ISE	ESE	CA				
PCC	ET8201	Sensors and Signal Processing	4	-	-	4	30	50	20	-	-	-	100
LC	ET8202	Sensors and Signal Processing Lab	-	-	2	1	-	-	-	-	50	-	50
		Total	**4**	**-**	**2**	**5**	**30**	**50**	**20**	**-**	**50**	**-**	**150**

T. Y. B. TECH SEMESTER-VI

Course			Teaching Scheme Hours/week				Evaluation Scheme-Marks						
							Theory			OR	PR	TW	Total
Cat	Code	Title	L	T	P	Credits	ISE	ESE	CA				
PCC	ET8203	Robotics	4	-	-	4	30	50	20	-	-	-	100
		Total	**4**	**-**	**-**	**4**	**30**	**50**	**20**				**100**

Final Year B. TECH. SEMESTER-VII

Course			Teaching Scheme Hours/week				Evaluation Scheme-Marks						
							Theory			OR	PR	TW	Total
Cat	Code	Title	L	T	P	Credits	ISE	ESE	CA				
PCC	ET8204	PLCs and Industrial Automation	4	-	-	4	30	50	20	-	-	-	100
LC	ET8205	PLCs and Industrial Automation Lab	-	-	2	1	-	-	-	-	50	-	50
		Total	**4**	**-**	**2**	**5**	**30**	**50**	**20**	**-**	**50**	**-**	**150**

Final Year B. TECH. SEMESTER-VIII

Course			Teaching Scheme Hours/week				Evaluation Scheme-Marks						
							Theory			OR	PR	TW	Total
Cat	Code	Title	L	T	P	Credits	ISE	ESE	CA				
PCC	ET8206	IoT and Cloud Computing for Industrial Automation	4	-	-	4	30	50	20	-	-	-	100
		Total	**4**	**-**	**-**	**4**	**30**	**50**	**20**	**-**	**-**	**-**	**100**

Sensors and Signal Processing (ET8201)

Teaching Scheme
Lectures: 04 Hrs./ Week

Credits: 04

Examination Scheme
In Sem Exam : 30 Marks
End-Sem Exam: 50 Marks
CIA: 20 Marks
Total: 100 Marks

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Prerequisite:

Basic knowledge of physical phenomena in sensor materials

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Course Objectives:

1. To make the students aware about the concept and the role of instrumentation systems in process automation
2. To learn the principle of operations of different types of sensors employed in process automation and control
3. To get an understanding of the design principles of different signal conditioning circuits employed in conjunction with various sensors
4. To highlight the importance of smart sensors in the emerging areas of industrial automation

Course Outcomes (COs):

After successful completion of this course, the students should be able to:

COs	Course Outcomes	Blooms Taxonomy	
		Level	Descriptor
CO.1	Recall various components of a measurement system and its input-output characteristics	1	Remember
CO.2	Classify various sensors employed in process automation and explain their working principles	2	Understand
CO.3	Implement different signal conditioning circuits working in conjunction with various sensors	3	Apply

CO.4	Differentiate among various sensors and signal conditioning blocks employed in process automation	4	Analyze

Mapping of Course Outcomes to Program Outcomes (POs):

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

Course Contents

Unit No.		No. of Hours	COs
Unit-I	**Introduction to measurement systems**	06	CO.1
	Definition, Application and types of measurements, Instrument classification, Functional elements of an instrument, Input-output configuration of measuring instruments, Methods of correction for interfering and modifying inputs, Standards, Calibration, Introduction to Static characteristics and Dynamic characteristics, Selection of instruments, Loading effects.		
Unit-II	**Sensors for displacement, velocity and vibration measurement**	08	CO.2 & CO.4
	Sensors and transducers-definition and classification, resistance potentiometers, strain gauges, inductive and capacitance sensors, piezo electric sensors, Hall effect sensors, ultrasonic sensors, optical sensors and photo electric pickups, magnetic pickups, proximity sensors, accelerometers, seismic transducers		
Unit-III	**Sensors for force, torque and pressure measurement**	04	CO.2 & CO.4
	Elastic sensors, Bonded strain gauge, piezo electric sensors, capacitance sensors, variable reluctance pick up, dynamometers		
Unit-IV	**Sensors for Temperature, flow and level measurement**	06	CO.2 & CO.4
	Temperature sensors- thermocouples, RTD, thermistors, semiconductor sensors Flow sensors-Electro- magnetic flow meter, ultrasonic flow meter, turbine flow meter		

	Level sensors- capacitance sensor, ultrasonic sensor		
Unit-V	**Transducer Signal conditioning**	06	CO.3 & CO.4
	Need of signal conditioning, signal conditioning blocks, linearization, signal conversion, filtering, impedance matching bridge circuits, operational amplifiers and instrumentation amplifiers in signal conditioning, Digital signal conditioning, Data acquisition systems, selection criteria for sensors and signal conditioning, overall error determination		
Unit-VI	**Smart sensors**	06	CO.2 & CO.4
	Smart sensors- Definition and characteristics, principle of operation, interface, commercially available smart sensors, Introduction to MEMS sensors and Wireless sensors		

Text Books:
1. Curtis D. Johnson, "Process Control Instrumentation Technology", 10th Edition, Prentice Hall of India Pvt. Ltd New Delhi
2. E. O. Dobelin, "Measurement Systems", 4th Edition, Mc Graw Hill
Reference Books:
1. D. V. S. Murthy, "Transducers and Instrumentation", Prentice Hall of India Pvt. Ltd, New Delhi 2. Bela G. Liptak, "Instrument Engineers Handbook, Process Measurement and Analysis, 4th Edition, CRC Press 3. D. Patranabis, "Sensors and Transducers", 2nd Edition, PHI Learning Pvt. Ltd. 4. John G. Webster, "Sensors and Signal Conditioning', 2nd Edition, Wiley Inter Science
Guidelines for Continuous Assessment:- MCQ Quiz, Home Assignments, PBL

Sensors and Signal Processing Laboratory (ET8202)

Teaching Scheme
Practical: 2 Hrs. / Week
Credits: 01

Examination Scheme
PR: 50 Marks

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Prerequisite:

Basic knowledge of physical phenomena in sensor materials

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Course Objectives:

1. To make the students aware about the concept and the role of instrumentation systems in process automation
2. To learn the principle of operations of different types of sensors employed in process automation and control
3. To get an understanding of the design principles of different signal conditioning circuits employed in conjunction with various sensors
4. To highlight the importance of smart sensors in the emerging areas of industrial automation

Course Outcomes (COs):

After successful completion of this course, the students should be able to:

COs	Course Outcomes	Blooms Taxonomy

		Level	Descriptor
CO.1	Recall various components of a measurement system and its input-output characteristics	1	Remember
CO.2	Classify various sensors employed in process automation and explain their working principles	2	Understand
CO.3	Implement different signal conditioning circuits working in conjunction with various sensors	3	Apply
CO.4	Differentiate among various sensors and signal conditioning blocks employed in process automation	4	Analyze

Mapping of Course Outcomes to Program Outcomes (POs):

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

Course Content

Sr. No.	Name of Experiment	COs
1.	Measurement of displacement using LVDT	CO1, CO2
2.	Calibration of linear and rotary encoders	CO1, CO2
3.	Characteristics of optical position sensor	CO1, CO2
4.	Measurement of speed using photo electric and magnetic pick ups	CO1, CO2
5.	Measurement of liquid level using capacitance sensor	CO1, CO2
6.	Measurement of liquid flow measurement using turbine flow meter	CO1, CO2
7.	Measurement of weight using strain gauge load cell	CO1, CO2
8.	Calibration of differential pressure transmitter	CO1, CO2
9.	Design of a temperature indicator using RTD/Thermocouple/Thermistor	CO1, CO3
10.	Measurement of liquid level/ flow using Smart transmitter	CO1, CO3, CO4

Minimum 6 experiments should be performed out of Experiment No. 1-8. Experiment No. 9 &10 are mandatory

Text Books:
1. Curtis D. Johnson, "Process Control Instrumentation Technology", 10th Edition, Prentice Hall of India Pvt. Ltd New Delhi

2. E. O. Dobelin, “Measurement Systems”, 4th Edition, Mc Graw Hill
Reference Books:
1. D. V. S. Murthy, “Transducers and Instrumentation”, Prentice Hall of India Pvt. Ltd, New Delhi 2. John G. Webster, “Sensors and Signal Conditioning’, 2nd Edition, Wiley Inter Science

Sanjivani Rural Education Society's

Sanjivani College of Engineering, Kopargaon

(An Autonomous Institute Affiliated to Savitribai Phule Pune University, Pune)

B. Tech. Electronics and Telecommunication Engineering

2019 Pattern

Program Structure and Syllabus

(B. Tech. with effect from Academic Year 2019-2020)

At. Sahajanandnagar, Post. Shingnapur Tal. Kopargaon Dist. Ahmednagar,

Maharashtra State, India PIN 423603

CURRICULUM STRUCTURE - 2019 PATTERN
Third Year B. Tech. (Electronics and Telecommunication Engineering)
WITH EFFECT FROM ACADEMIC YEAR 2021-2022

SEMESTER-V

Course			Teaching Scheme Hours/week				Evaluation Scheme-Marks						
							Theory			OR	PR	TW	Total
Cat	Code	Title	L	T	P	Credits	ISE	ESE	CIA				
PROJ	ET301	Professional Internship-II	-	-	-	2	-	-	-	50	-	-	50
PCC	ET302	Control System	3	-	-	3	30	50	20	-	-	-	100
PCC	ET303	Digital Communication	3	-	-	3	30	50	20	-	-	-	100
PCC	ET304	Linear Integrated Circuits	3	-	-	3	30	50	20	-	-	-	100
PCC	ET305	Object Oriented Programming	3	-	-	3	30	50	20	-	-	-	100
PEC	ET306	Refer List of PEC1	3	-	-	3	30	50	20	-	-	-	100
LC	ET307	Control Systems Tutorial	-	1	-	1	-	-	-	-	-	25	25
LC	ET308	Digital Communication Laboratory	-	-	2	1	-	-	-	25	-	-	25
LC	ET309	LIC Laboratory	-	-	2	1	-	-	-	-	50		50
LC	ET310	OOP Laboratory	-	-	2	1	-	-	-	-	50		50
PROJ	ET311	Skill Based Credit Course	1	-	-	1	-	-	50	-	-	-	50
MC	MC312	Mandatory Course-V	1	-	-	Non Credit	-	-	-	-	-	-	-
		Total	**17**	**1**	**6**	**22**	**150**	**250**	**150**	**75**	**100**	**25**	**750**

MC312	**Mandatory Course-V**	**Sanjivani ECE Talks**

SEMESTER-VI

Course			Teaching Scheme Hours/week				Evaluation Scheme-Marks						
							Theory			OR	PR	TW	Total
Cat	Code	Title	L	T	P	Credits	ISE	ESE	CIA				
PCC	ET313	Microprocessors and Microcontrollers	3	-	-	3	30	50	20	-	-	-	100
PCC	ET314	Electromagnetics	3	-	-	3	30	50	20	-	-	-	100
OEC	ET315	OEC1: Artificial Intelligence	4	-	-	4	30	50	20	-	-	-	100
PROJ	PR316	IPR & EDP	2	-	-	2	15	25	10	-	-	-	50
LC	PR317	IPR & EDP Lab	-	-	2	1	-	-	-	-	-	50	50
HSMC	HS318	Corporate Readiness	1	-	2	2	-	-	-	-	-	50	50
PEC	ET319	Refer List of PEC2	3	-	-	3	30	50	20	-	-	-	100
LC	ET320	Microprocessors and Microcontrollers Laboratory	-	-	2	1	-	-	-	-	50	-	50
LC	ET321	Electromagnetics Tutorial	-	1	-	1	-	-	-	50	-	-	50
MC	MC322	Mandatory Course-VI	1	-	-	Non Credit	-	-	-	-	-	-	-
		Total	**17**	**1**	**06**	**20**	**135**	**225**	**90**	**50**	**50**	**100**	**650**

MC322	**Mandatory Course-VI**	**Electronic Waste Management**

Professional Elective Course 1 (PEC1):
ET306A Digital Signal Processing
ET306B Database Management system
ET306C Power Electronics

Professional Elective Course 2 (PEC2):
ET319A Digital Image Processing
ET319B Web Technologies
ET319C Renewable Energy Systems

Total Credits: 42 **Total Marks: 1400**

List of Abbreviations

Abbreviation	Full Form	Abbreviation	Full Form
BSC	Basic Science Course	**MC**	Mandatory Course
ESC	Engineering Science Course	**PCC**	Professional Core Course
HSMC	Humanities/Social Sciences/Management Course	**PEC**	Professional Elective Course
IP	Induction Program	**OEC**	Open Elective Course
L	Lecture	**LC**	Laboratory Course
T	Tutorial	**CA**	Continuous Assessment
P	Practical	**OR**	End Semester Oral Examination
ISE	In-Semester Evaluation	**PR**	End Semester Practical Examination
ESE	End-Semester Evaluation	**TW**	Continuous Term Work Evaluation
Cat	Category	**PROJ**	Project

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B Tech Honors in Embedded Systems & IoT
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T. Y. B. TECH SEMESTER-V

Course			Teaching Scheme Hours/week				Evaluation Scheme-Marks						
							Theory						
Cat	Code	Title	L	T	P	Credits	ISE	ESE	CA	OR	PR	TW	Total
PCC	ET8101	Microcontroller and Embedded C Programming	4	-	-	4	30	50	20	-	-	-	100
		Total	**4**	**-**	**-**	**4**	**30**	**50**	**20**				**100**

T. Y. B. TECH SEMESTER-VI

Course			Teaching Scheme Hours/week				Evaluation Scheme-Marks						
							Theory						
Cat	Code	Title	L	T	P	Credits	ISE	ESE	CA	OR	PR	TW	Total
PCC	ET8102	Embedded system hardware and software design	4	-	-	4	30	50	20	-	-	-	100
LC	ET8103	Embedded system hardware and software design Lab	-	-	2	1	-	-	-	-	50	-	50
		Total	**4**	**-**	**2**	**5**	**30**	**50**	**20**	**-**	**50**	**-**	**150**

B Tech Honors in Industrial Automation and Robotics
w. e. f. Academic Year 2021-22
T. Y. B. TECH SEMESTER-V

Course			Teaching Scheme Hours/week				Evaluation Scheme-Marks						
							Theory						
Cat	Code	Title	L	T	P	Credits	ISE	ESE	CA	OR	PR	TW	Total
PCC	ET8201	Sensors and Signal Processing	4	-	-	4	30	50	20	-	-	-	100
LC	ET8202	Sensors and Signal Processing Lab	-	-	2	1	-	-	-	-	50	-	50
		Total	**4**	**-**	**2**	**5**	**30**	**50**	**20**	**-**	**50**	**-**	**150**

T. Y. B. TECH SEMESTER-VI

Course			Teaching Scheme Hours/week				Evaluation Scheme-Marks						
							Theory						
Cat	Code	Title	L	T	P	Credits	ISE	ESE	CA	OR	PR	TW	Total
PCC	ET8203	Robotics	4	-	-	4	30	50	20	-	-	-	100
		Total	**4**	**-**	**-**	**4**	**30**	**50**	**20**				**100**

Microprocessors and Microcontrollers (ET313)

Teaching Scheme
Lectures: 3 Hrs/Week

Credits 3

Examination Scheme
In-Sem Exam: 30 Marks
End Sem Exam: 50 Marks
CIA: 20 Marks
Total: 100 marks

Prerequisite: - Knowledge of computer architecture and Embedded C programming

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Course Objectives:

1. To introduce the fundamentals of microprocessor and microcontroller
2. To study the applications of microprocessors and microcontrollers
3. To introduce the architecture and features of typical microprocessor and microcontrollers
4. To interface real world input and output devices
5. To Study hardware and software development tools for developing embedded applications
6. To understand need of microprocessors and microcontrollers in embedded system

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

Course Outcomes	Course Outcome Statements	Bloom's Descriptor	
		Level	Descriptor
ET313.1	Describe the functional blocks, interrupt structure and memory mapping of 8085 microprocessor	2	Understand
ET313.2	Implement the concepts of assembly language programming in microprocessors	3	Apply
ET313.3	Compare architectures and features of microprocessors and microcontrollers	4	Analyse
ET313.4	Develop programs in assembly language for interfacing peripherals using 8051 microcontroller	3	Apply
ET313.5	Describe architectures of 8051 and PIC 18F microcontroller	2	Understand
ET313.6	Demonstrate the use of embedded C language for interfacing peripherals using PIC microcontroller	3	Apply

Mapping of course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET313.1	2	2	-	2	-	-	-	-	-	-	-	-	-	2
ET313.2	2	3	-	-	-	-	-	-	-	-	-	-	-	1
ET313.3	2	3	2	-	3	-	-	-	-	-	-	-	-	2
ET313.4	3	-	2	-	-	-	-	-	-	-	-	-	-	2
ET313.5	3	-	-	-	3	-	-	-	-	-	-	-	-	2
ET313.6	-	2	3	-	-	-	-	-	-	-	-	-	-	1

Course Contents

Unit-I	**Introduction to 8085 Microprocessor**	No. of Hours	COs
	Basic 8085 microprocessor architecture and its functional blocks, 8085 microprocessor IC pin outs and signals, address, data and control buses. 8085 features. Interrupt system of 8085, Stack and subroutine. Types of memory and memory interfacing. Decoding techniques-absolute and partial. Mapping techniques -I/O mapped I/O and memory mapped-I/O. Serial I/O lines of 8085 and the implementation asynchronous serial data communication using SOD and SID	07	ET313.1
Unit-II	**Programming with 8085 Microprocessor**	No. of Hours	COs
	Basic instruction set, timing states, machine cycles and instruction cycles. Instruction timing diagram and, interrupt process and timing diagram of interrupt instruction execution. Writing assembly language programs. Looping, counting and indexing operations related programs. Stacks and subroutines operations related programs. Conditional call and return instructions operations related programs. Debugging programs.	06	ET313.2
Unit-III	**8051 Architecture, Addressing modes and Instructions**	No. of Hours	COs
	Microprocessors and Microcontrollers, CISC and RISC Processors, Harvard and Von Neumann Architectures, MCS-51 architecture, Pin description, PSW, Internal and external memories, Counters and Timers, Serial communication, Stack and Stack Pointer, Port Structure, Interrupts. 8051 Addressing modes, MCS-51 Instruction set and simple assembly language programs.	07	ET313.3
Unit-IV	**Real World Interfacing with 8051**	No. of Hours	COs
	Interfacing 8051 to LED, switches, relay and buzzer, Interfacing 8051 to LCD, Interfacing 8051 to keypad, Interfacing 8051 to Stepper motor, Interfacing 8051 to ADC and DAC, Interfacing serial port of 8051 to PC	06	ET313.4
Unit-V	**PIC Microcontroller Architecture**	No. of Hours	COs
	Architecture of PIC 18X series, registers, memory organization, Instruction set, Interrupts, Timers, I/O port expansion, I2C bus for peripheral chip access, A/D converter, UART, Power down modes, Configuration bit settings.	06	ET313.5
Unit-VI	**Real world Interfacing with PIC**	No. of Hours	COs
	Interfacing PIC 18F with LED, Push Buttons, Relay, Buzzer, Keypad, LCD, DC Motor (PWM), ADC and DAC, Interfacing serial	06	ET313.6

	port of PIC18F to PC		

Books

Text Books:

1. Microprocessor and interfacing 8085, Douglas V Hall, Tata McGraw Hill.
2. Microprocessor-Architecture, programming and application with 8085, Gaonkar, Penram international.
3. Mohammad Mazidi, Janice Mazidi and Rolin McKinlay, "The 8051 Microcontroller and Embedded Systems using Assembly and C", Pearson Education, (2nd Edition), (2014), ISBN : 978-81-317-1026-5
4. Mazidi, Mckinley, Causey, "PIC Microcontrollers and Embedded Systems", Pearson Education, (1st Edition), (2013), ISBN: 978-81-317-1675-5

Reference Books:

1. D.V. Kodavade, S. Narvadkar, 8085-86 microprocessors Architecture programming and interfaces, Wiley.
2. Myke Predko, "Programming and customizing the 8051 microcontroller", Tata McGraw Hill. (2nd Edition), (2014), ISBN: 978-00-704-2140-0
3. Kenneth Ayala "The 8051- Architecture, Programming and Applications", West Publishing Company, (3nd Edition), (2014), ISBN: 978-03-147-7278-7 (AICTE)
4. 18F xxx reference manual

Online Resources:

1. www.microchip.com
2. https://www.microchip.com/en-us/products/microcontrollers-and-microprocessors/8-bit mcus/8051
3. https://nptel.ac.in/courses/117/104/117104072/

Continuous Internal Assessment:-

MCQ Test on Each Unit

Prepare mini project using 8051 or PIC

Electromagnetics (ET314)

Teaching Scheme
Lectures: 03 Hrs. / Week
Credits: 03

Examination Scheme
In-Sem Exam: 30 Marks
End Sem Exam: 50 Marks
CIA: 20 Marks
Total: 100 Marks

Prerequisite Course: Co-ordinate Geometry (Cartesian, Cylindrical and Spherical), Vector Calculus

Course Objectives:

1. To demonstrate Basic concepts of Electrostatic Laws and Theorems.
2. To construct concepts of Magnetostatic Laws and Theorems.
3. To distinguish time varying electric and magnetic fields.
4. To organize transmission line fundamentals and apply them to the basic problem.
5. To describe the Uniform plane wave propagation in various media
6. To compare the fundamentals of Antenna and its parameters

Course Outcomes (COs): After successfully completing the course students will be able to

CO	Course Outcome Statements	Bloom's Taxonomy	
		Level	Descriptor
ET314.1	Illustrate the principles of electrostatics to the problems related to electric field, magnetic field.	3	Apply
ET314.2	Organize the electromagnetic problem and solve using Maxwell's equations	4	Analyze
ET314.3	Formulate the wave equation and solve it for uniform plane wave.	2	Understand
ET314.4	Contrast the transmission line equations and Reflected waves	4	Analyze
ET314.5	Develop the use of Smith chart for impedance calculations	3	Apply
ET314.6	Compare the given antenna and its various parameters	4	Analyze

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET314.1	3	2	1	-	-	-	-	-	-	-	-	-	3	-
ET314.2	3	2	1	-	-	-	-	-	-	-	-	-	3	-
ET314.3	3	2	1	-	-	-	-	-	-	-	-	-	3	-
ET314.4	3	3	3	-	-	-	-	-	-	-	-	-	3	-
ET314.5	3	3	3	-	-	-	-	-	-	-	-	-	2	-
ET314.6	3	3	3	-	-	-	-	-	-	-	-	-	1	2

Course Contents

Unit-I	**Electrostatics and Magnetostatics**	No. of Hours	COs
	Electric field intensity, Electric flux Density , Magnetic field intensity, Magnetic flux density, Maxwell 's Equation for Static Electric field and Magnetic field : Gauss's law , conservative nature of Electric field , Non-existence of magnetic monopoles , Ampere's law .	06Hrs.	ET314.1
Unit-II	**Time Varying Fields and Maxwell's equations**	No. of Hours	COs
	Faraday's law, Conduction current and Displacement current, Maxwell's equations in point form and integral form for dynamic field, Boundary conditions, Power and Poynting theorem.	06Hrs.	ET314.2
Unit-III	**Uniform Plane Waves**	No. of Hours	COs
	Maxwell's equation using phasor notations, Electromagnetic wave equations (Helmholtz equation), phase velocity depth of penetration, skin effect, Reflection of plane waves : Normal incidence, oblique incidence, Polarization: Linear, circular & Elliptical polarization.	06 Hrs.	ET314.3
Unit-IV	**Transmission Lines 1**	No. of Hours	Cos
	Transmission Line parameters, Transmission line equations: general solution, physical significance of the equations, Characteristics impedance, Propagation constant, wavelength, velocity of propagation, the distortion less line, Input impedance of open and short-circuited lines, Reflection on a line not terminated in Z0, reflection coefficient, reflection factor and reflection loss, standing waves, standing wave ratio.	07 Hrs.	ET314.4
Unit-V	**Transmission Lines 2**	No. of Hours	Cos
	Impedance matching using Quarter wave transformer, stub matching, Smith Chart: Constant R circles, Constant X circles, Problems solving using Smith chart, S-parameters, Application of Transmission lines.	06 Hrs.	ET314.5
Unit-VI	**Antenna Fundamentals**	No. of Hours	Cos
	Friis Transmission equation, Types of Antennas, Radiation Mechanism. Antenna Parameters: Radiation pattern, radiation power density, radiation intensity, directivity, gain, antenna efficiency, half power beam width, bandwidth, antenna polarization, input impedance, antenna radiation efficiency, effective length, effective area, reciprocity.	06 Hrs.	ET314.6

Books:

Text Books:

1. Mathew N. O. Sadiku, _Principles of Electromagnetics‘, 4th Edition ,Oxford University Press Inc, 2009.
2. William H. Hayt and John A. Buck, _Engineering Electromagnetics‘, Tata McGraw Hill, 8th Revised edition, 2011.
3. C. A. Balanis, “Antenna Theory - Analysis and Design", John Wiley.

Reference Books:

1. Kraus and Fleish, _Electromagnetics with Applications‘, McGraw Hill International Editions, 5th edition, 2010.
2. Jordan and Balmain, —Electromagnetic Waves and Radiating Systems‖, PHI, 1964
3. K. D. Prasad, “Antenna & Wave Propagation”, Satya Prakashan, New Delhi
4. John D Kraus, “ Antenna& Wave Propagation”, 4th Edition, McGraw Hill, 2010

Online Resources :

https://easyengineering.net/electromagnetic-theory-handwritten/

https://electricalstudyhub.blogspot.com/2017/05/electromagnetic-field-theory-notes-pdf.html

https://www.newtondesk.com/electromagnetic-theory-handwritten-study-notes/

https://nptel.ac.in/courses/115/101/115101005/

Guidelines for Continuous Assessment:-

Unit Tests , Extempore

OEC-1: Artificial Intelligence (ET315)

Teaching Scheme
Lectures: 4 Hrs. / Week
Credits: 4

Examination Scheme
In-Sem Exam: 30 Marks
End Sem Exam: 50 Marks
CIA: 20 Marks
Total: 100 Marks

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Prerequisite : Basics of Statistic, Fundamentals of programming

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Course Objectives :

1. To learn key components of Artificial Intelligence system.
2. To convey the ideas in AI research and programming language related to emerging technology.
3. To know the concepts of machine learning, pattern recognition, and natural language processing.
4. To elaborate the numerous applications and huge possibilities in the field of AI that go beyond the normal human imagination.

Course Outcomes (COs): After successful completion of the course, student will be able to

Course Outcomes	Course Outcome Statements	Bloom's Taxonomy	
		Level	Descriptor
ET315.1	Demonstrate the key components of intelligent agents	2	Understand
ET315.2	Analyze various uninformed search and informed search strategies.	4	Analyse
ET315.3	Apply knowledge representation techniques and problem solving strategies to common AI applications.	3	Apply
ET315.4	Categorize different Learning Techniques	4	Analyse
ET315.5	Explain various pattern recognition techniques	4	Analyse
ET315.6	Review the components of Natural Language Understanding .	5	Evaluate

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
ET315.1	3	-	-	-	-	-	-	-	-	-	-	-
ET315.2	1	2	-	1	-	-	-	-	-	-	-	-
ET315.3	3	2	-	-	-	-	-	-	-	-	-	-
ET315.4	1	-	-	2	-	-	-	-	-	-	-	-
ET315.5	1	-	3	-	-	-	-	-	-	-	-	-
ET315.6	2	-	-	2	-	-	-	-	-	-	-	-

Course Contents

Unit-I	**Foundation**	No. of Hours	COs
	Intelligent Agents, Agents and environments, Good behavior, The nature of environments, structure of agents, Problem Solving, problem solving agents, example problems, Searching for solutions, uniformed search strategies, avoiding repeated states, searching with partial information.	8 Hrs.	ET315.1
Unit-II	**Searching Techniques**	No. of Hours	COs
	Search and exploration, Informed search strategies, heuristic function, local search algorithms and optimistic problems, local search in continuous spaces, online search agents and unknown environments, Constraint satisfaction problems (CSP), Backtracking search and Local search for CSP, Games: Optimal decisions in games, Alpha-Beta Pruning,	8 Hrs.	ET315.2
Unit-III	**Knowledge Representation**	No. of Hours	COs
	First order logic, representation revisited, Syntax and semantics for first order logic, Knowledge engineering in first order logic, Inference in First order logic, prepositional versus first order logic, unification and lifting, forward chaining, backward chaining, Resolution, Knowledge representation.	8 Hrs.	ET315.3
Unit-IV	**Learning**	No. of Hours	COs
	Learning from observations: forms of learning, Inductive learning, Learning decision trees, Ensemble learning, Knowledge in learning, Logical formulation of learning, Explanation based learning, Inductive logic programming, Statistical learning methods, Learning with complete data, Learning with hidden variable, EM algorithm, Neural networks - Reinforcement learning, Passive reinforcement learning, Active reinforcement learning.	8 Hrs.	ET315.4
Unit-V	**Pattern Recognition**	No. of Hours	COs
	Basic steps of pattern recognition system, Principal Component Analysis,Linear Discriminant Analysis, Classification, Object Recognition- Template Matching theory,Prototype Matching Theory,Pattern Mining- Apriori Algorithm,Speech Recognition,	8 Hrs.	ET315.5
Unit-VI	**Natural Language Understanding**	No. of Hours	COs

	Why NL, Formal grammar for a fragment of English, Syntactic analysis, Augmented grammars, Semantic interpretation, Ambiguity and disambiguation, Discourse understanding, Grammar induction, Probabilistic language processing, Probabilistic language models.	8 Hrs.	ET315.6

Books:

Text Books:

1.Stuart Russell, Peter Norvig, "Artificial Intelligence", A Modern Approach, Pearson Education/Prentice Hall of India.
2. Parag Kulkarni, Prachi Joshi, "Artificial Intelligence- Building Intelligent Systems" PHI Learning Pvt Ltd
3.Munesh Chandra Trivedi " A classical approach to Artificial Intelligence" , Khanna Publishing House

Reference Books:

1. Nils J. Nilsson, "Artificial Intelligence: A new Synthesis", Harcourt Asia Pvt. Ltd.
2. George F. Luger, "Artificial Intelligence-Structures and Strategies for Complex Problem Solving", Pearson Education/ PHI.
3. Deepak Khemani, "A First Course in Artificial Intelligence", Mc Graw Hill Education(India), 2013, ISBN : 978-1-25-902998-1
4. Chandra S. S.& H.S.Anand " Artificial Intelligence and Machine Learning" PHI Publishing
5. R.B. Mishra "Artificial Intelligence" PHI Publishing.

Guidelines for Continuous Assessment:- Unit Test will be conducted for 10 marks and Related Online Courses on NPTEL/Coursera/Udemy/Simply learn platform will be completed for 10 marks

Intellectual Property Rights and Entrepreneurship Development (PR316)

Teaching Scheme
Lectures: 2 Hrs. / Week

Examination Scheme
InSem Exam: 15 Marks
CIA: 10 Marks
End Sem Exam: 25 Marks

Credits: 02
Total: 50 Marks

Intellectual Property Rights and EDP (PR317)

Practical: 02 Hrs./ Week
Term Work: 50 marks

Prerequisite Course: NIL

Course Objectives:

1.To introduce student with IPR
2. To explain IPR procedure in India such as Patents, Designs and Trademarks
3. To make aware economic importance of IPRs.
4. To develop ability to search and analyse the IPRs.
5. To Instill a spirit of entrepreneurship among the student participants.
6. To give insights into the Management of Small Family Business.

Course Outcomes (COs): After learning the course the leaners will be able to,

Course Outcome(s)	Blooms Technology	
	Level	Descriptor
CO1. Understand patenting system	2	Create
CO2. Understand the procedure to file patent in India	2	Apply
CO3.Understading of financial importance of IPR	2	Understand
CO4. Search and analyse the patents, designs and Trademarks	4	Analyse
CO5. Identify the Skill sets required to be an Entrepreneur.	4	Analyse
CO6. Understand the Role of supporting agencies and Governmental initiatives to promote Entrepreneurship.	4	Analyse

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						2			2			3		
CO2						2			2			3		
CO3						2			2			3		
CO4						2			2			3		
CO5						2	2	2			3			
CO6						2	2	2			3			

Course Contents

	Introduction to IPR	No.of Hours	COs
Unit-I	▰ Concepts of IPR ▰ The history behind development of IPR ▰ Necessity of IPR and steps to create awareness of IPR ▰ Concept of IP Management ▰ Intellectual Property and Marketing ▰ IP asset valuation ● Introduction to the leading International Instruments concerning Intellectual Property Rights: the Berne Convention, Universal Copyright Convention, The Paris Convention, Patent Co-operation Treaty, TRIPS, The World Intellectual Property Organization (WIPO) and the UNESCO	4	1
	Patents	No.of Hours	COs
Unit-II	▰ Introduction to Patents ▰ Procedure for obtaining a Patent ▰ Licensing and Assignment of Patents i. Software Licensing ii. General public Licensing iii. Compulsory Licensing ▰ Infringement of Patents ▰ Software patent and Indian scenario	4 Hrs.	2

	Designs	No. of Hours	COs
Unit-III	● Registrable and non-Registrable Designs ● Novelty & Originality ● Procedure for Registration of Design ● Copyright under Design ● Assignment, Transmission, License ● Procedure for Cancellation of Design ● Infringement ● Remedies	4 Hrs.	3
	Trademarks and Copy Rights	No.of Hours	COs
Unit-IV	A) **Trademarks** ▰ Concept of trademarks ▰ Importance of brands and the generation of "goodwill" ▰ Trademark registration procedure ▰ Infringement of trademarks and Remedies available ▰ Assignment and Licensing of Trademarks **B) Copyright Right** ● Concept of Copyright Right ▰ Assignment of Copyrights ▰ Registration procedure of Copyrights ▰ Infringement (piracy) of Copyrights and Remedies ▰ Copyrights over software and hardware	4 Hrs.	4

	Entrepreneurship: Introduction	No.of Hours	COs
Unit-V	5.1 **Concept and Definitions**: Entrepreneur & Entrepreneurship, Entrepreneurship and Economic Development, A Typology of Entrepreneurs. **5.2 Entrepreneurial Competencies:** The Entrepreneur's Role, Entrepreneurial Skills: creativity, problem solving, decision making, communication, leadership quality; Self-Analysis, Culture & values, Risk-taking ability, Technology knowhow. 5.3 **Factor Affecting Entrepreneurial Growth:** Economic & Non-Economic Factors, EDP Programmes. **5.4 Steps in Entrepreneurial Process:** Deciding Developing Moving Managing Recognizing.	4	5
	Resources for Entrepreneurship	No.of Hours	COs
Unit-VI	**6.1 Project Report Preparation:** Specimen Format of Project Report; Project Planning and Scheduling using PERT / CPM; Methods of Project Appraisal – Feasibility Study both Economic and Market Preparation projected financial statement. **6.2 Role of Support Institutions and Management of Small Business:** Director of Industries, DIC, SIDO, SIDBI, Small Industries Development Corporation (SIDC), SISI, NSIC, NISBUED, State Financial Corporation (SFC) EPC, ECGC. **6.3 Various Governmental Initiatives:** Make in India Start Up India Stand Up India Digital India Skill India **6.4 Case Studies of Successful Entrepreneurs**	4	

Text Books:

1. Neeraj Pandey and Khushdeep Dharni, Intellectual Property Rights, PHI, New Delhi
2. The Indian Patent act 1970.
3. The copy right act 1957
4. Manual of patent office practice and procedure of Govt. of India.
5. Manual of Designs Practice and Procedure of Govt. India
6. Manual of Trademarks Practice and Procedure of Govt. India
7. Semiconductor Integrated Circuits Layout Design (SICLD) Act 2000 of Govt. India
8. Intellectual Property Rights- A Primer, R. Anita Rao & Bhanoji, Rao, Eastern BookCo.
9. The Dynamics of Entrepreneurial Development & Management by Desai, Vasant, Himalaya Publishing House, Delhi.
10. Managing Small Business by Longenecker, Moore, Petty and Palich, Cengage Learning, India Edition.
11. Cases in Entrepreneurship by Morse and Mitchell, Sage South Asia Edition.
12. Entrepreneurship – Indian Cases on Change Agents by K Ramchandran, TMGH.

Reference Books:

1. Handbook of Indian Patent Law and Practice,
2. Entrepreneurship: New Venture Creation by David H. Holt
3. Entrepreneurship Development New Venture Creation by Satish Taneja, S.L.Gupta
4. Project management by K. Nagarajan.

List of experiments: The term work shall consist following experiments/reports to completed within the semester.

1. Searching of patent, design, trademarks, and copy rights at various databases and its report preparation.
2. Patent draft preparation for a sample invention
3. Design draft preparation for a sample design
4. Trademark draft preparation for a sample Trademark/Device
5. Copy right draft preparation for a sample documents/audio/video
6. Report preparation of patent Infringement
7. Preparation of Detailed project report for new business/industry/startup
8. Visit to industry to understand entrepreneurship and its report preparation

Corporate Readiness (HS318)

Teaching Scheme
Lectures: 1 Hrs. / Week
Practical: 2 Hrs. / Week
Credits: 2

Examination Scheme
TW: 50 Marks

Total: 50 Marks

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Prerequisite Course: (Quantitative aptitude, Verbal and non verbal communication)

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Course Objectives:

1. To develop clarity in the exploration process of student career and to match his skills and interests with a chosen career path.
2. To develop required aptitude skills.
3. To design the functional and chronological resume.
4. To demonstrate the importance of critical thinking ability and expression in group discussions
5. To prepare students for the various professional interviews.
6. To develop different soft skills necessary to get success in their profession.

Course Outcomes (COs): After successful completion of this course students should be able to
CO1. Remember placement processes of various organizations and modern job search approach.
CO2. Understand Industry Specific skill set with a view to design an Ideal Resume.
CO3. Apply the knowledge of GD & Presentation Skill during Industry Assessments for Placement/Internship/Industry Training/Higher Studies/Competitive Exams etc.
CO4. Analyse and apply the critical thinking ability as required during Aptitude/Technical Tests.
CO5. Evaluate Technical/General Dataset to interpret insights in it.
CO6. Create an ideal personality that fits Industry requirement.

Course Contents

Unit-I	Placement Awareness	No. of Hours	COs
	Discussion over Different Companies for recruitment, their eligibility criteria and placement procedures. Revision and Assessment of Quantitative Aptitude.	02 Hrs.	CO 1
Unit-II	Resume Writing	No. of Hours	COs
	Keywords, resume examples for industry, professional font, active language, important achievements, Proofread and edit. Innovative resume building- video resume.	02 Hrs.	CO2
Unit-III	Group Discussion and Presentation skills	No. of Hours	COs
	Why GDs are implemented commonly, Aspects which make up a Group Discussion, Tips on group discussion, do's and don'ts of GD and Presentation skills.	02 Hrs.	CO3
Unit-IV	Logical Reasoning I	No. of	COs

		Hours	
	Coding and Decoding (Visual Reasoning and series), Statement & Conclusions (Syllogisms), Relationships (Analogy), Attention to Details, Flowcharts ,Crypt arithmetic	06 Hrs.	CO4
Unit-V	Logical Reasoning II	No. of Hours	COs
	Data Interpretation, Data Sufficiency	04 Hrs.	CO5
Unit-VI	Logical Reasoning III	No. of Hours	COs
	Blood relation and dices, Clocks and Calendar, Direction sense and cubes, Logical connectives, Puzzle	06 Hrs.	CO6

Learning Resources :

Text Books: (Max. 2-3 Books with details as per given example)

1. A Modern Approach to Verbal & Non-Verbal Reasoning by R.S. Agarwal

2. Reasoning verbal and non verbal by B. S. Sijwali.

Reference Books:(Min. 04 Books with details as per given example)

1 Shortcuts in Reasoning (Verbal, Non-Verbal, Analytical)
2 Analytical Reasoning by MK Panday
3 Logical and analytical reasoning by k. Gupta
4 Multi dimensional reasoning by Mishra & Kumar dr. Lal

E- Books : (Min.02 Books details to be specified here)
https://themech.in/quantitative-aptitude-and-logical-reasoning-books/
https://www.thelocalhub.in/2021/01/reasoning-competitive-exams-pdf.html

E-learning Resources/MOOCs/ NPTEL Course Links: (Min. 03 course links to be specified here)

1. https://www.practiceaptitudetests.com/non-verbal-reasoning-tests/
2. https://www.educationquizzes.com/11-plus/non-verbal-reasoning/
3. https://www.livecareer.com/resume/examples/web-development/e-learning-developer

PEC2 – Digital Image Processing (ET319A)

Teaching Scheme
Lectures: 3 Hrs. / Week

Examination Scheme
In-Sem Exam: 30 Marks
End-Sem Exam: 50 Marks
CIA: 20 Marks
Total: 100 Marks

Credits: 3

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Prerequisite: Digital Signal Processing

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Course Objectives:

1. To learn the fundamental concepts of digital image processing.
2. To study basic image processing operations.
3. To introduce image analysis algorithms.
4. To introduce scope and current applications of digital image processing.
5. To explore students with object recognition techniques.

Course Outcomes (COs): After successful completion of the course, student will be able to

COs	Statement	Bloom's Taxonomy	
		Level	Descriptor
ET319A.1	Explain Fundamentals of Image Processing	2	Understand
ET319A.2	Use enhancement operations for image processing applications	3	Apply
ET319A.3	Utilize segmentation operations for image processing applications.	3	Apply
ET319A.4	Demonstrate compression techniques for image processing.	3	Apply
ET319A.5	Demonstrate basics of morphological image processing	2	Understand
ET319A.6	Construct object recognition system.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET319A.1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
ET319A.2	2	1	1	-	2	-	-	-	-	-	-	-	2	-
ET319A.3	2	1	1	-	2	-	-	-	-	-	-	-	2	-
ET319A.4	2	1	1	-	2	-	-	-	-	-	-	-	2	-
ET319A.5	2	-	-	-	-	-	-	-	-	-	-	-	2	-
ET319A.6	2	1	1	-	2	-	-	-	-	-	-	-	-	-

Course Contents

Unit-I	**Fundamentals of Image Processing**	No. of Hours	COs
	Steps in image processing, Human Visual System, Sampling & quantization, Representing digital images, Spatial & gray-level resolution, Image file formats, Basic relationships between pixels, Distance Measures. Basic operations on images: image addition, subtraction, logical operations, scaling, translation, rotation. Image Histogram.	6 Hrs.	**ET319A.1**
Unit-II	**Image Enhancement**	No. of Hours	COs
	Spatial domain enhancement: Point operations: Log transformation, Power-law transformation, Piecewise linear transformations, Histogram equalization. Filtering operations: Image smoothing, Image sharpening. Frequency domain enhancement: 2D DFT, Smoothing and Sharpening in frequency domain. Color models–RGB, YUV, HSI; Color transformations– formulation, color complements, color slicing, tone and color corrections.	8 Hrs.	**ET319A.2**
Unit-III	**Image Segmentation**	No. of Hours	COs
	Image Segmentation: Point Detections, Line detection, Edge Detection-First order derivative –Prewitt and Sobel. Second order derivative – LoG, DoG, Canny. Edge linking, Hough Transform, Thresholding – Global, Adaptive. Otsu's Method.	6 Hrs.	**ET319A.3**
Unit-IV	**Image Compression**	No. of Hours	COs
	Types of redundancy, Fidelity criteria, Lossless compression – Runlength coding, Huffman coding, Bit-plane coding, Arithmetic coding. Introduction to DCT, Wavelet transform. Lossy compression – DCT based compression, Wavelet based compression. Image and Video Compression Standards – JPEG, MPEG.	6 Hrs.	**ET319A.4**
Unit-V	**Morphological Image Processing**	No. of Hours	COs
	Erosion, dilation, opening, closing, Duality, Some Basic Morphological Algorithms: Boundary Extraction, Hole filling, Extraction of connected components, Convex Hull, Thinning, Thickening, Skeletons, Pruning, Morphological Reconstruction, Gray scale Morphology: Erosion and dilation, opening and closing, some basic Gray scale Morphological Algorithms, Gray-Scale Morphological Reconstruction.	8 Hrs.	**ET319A.5**

Unit-VI	**Object recognition**	No. of Hours	COs
	Need for object recognition system, automated object recognition system, patterns and pattern class, representation of pattern class, selection of measurement parameters, relationship between image processing and object recognition, approaches to object recognition.	8 Hrs.	**ET319A.6**

Books:

Text Books:

1. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", Third Edition, - Pearson Education.
2. A.K. Jain, "Fundamentals of digital image processing," Prentice Hall, 1989.
3. S. Murat Tekalp, Digital Video processing, Prentice Hall.

Reference Books:

1. Rafael C. Gonzalez, Richard E. Woods, and Steven L. Eddins, "Digital Image Processing Using MATLAB", Second Edition, - Tata McGraw Hill Publication.
2. S Sridhar, "Digital Image Processing", Oxford University Press.
3. S Jayaraman, S Esakkirajan, T Veerakumar, "Digital Image Processing", Tata McGraw Hill Publication.
4. K.R. Castleman, "Digital image processing," 2nd Ed., Pearson, 2012.
5. W.K. Pratt, "Digital image processing," 4th Ed., Wiley India, 2007.
6. Al Bovik, "Handbook of Image and Video processing", Academic press, second Edition.
7. M.C.Trivedi, Digital Image Processing, Khanna book publishing house
8. Fundamental of Digital Image Processing by Anil K. Jain, PHI Pub.
9. Image Processing, Analysis and Machine Vision , by Milan Sonka ,Vaclav Hlavac , Roger Boyle Cengage Learning 3rd Edition

Online Resources:

1. https://www.sciencedirect.com/topics/engineering/image-processing
2. https://www.mygreatlearning.com/blog/digital-image-processing-explained/
3. https://sisu.ut.ee/imageprocessing/book/1

Guidelines for Continuous Assessment: 10 marks based on students performance in class tests and remaining 10 marks on Self learning / Project based Learning (PBL)/ Programming Assignment

List of suggested programming assignment (using MALAB/Scilab/Python Programming)

1. Program for Basic Image Processing Techniques: Image resizing and rotation, quantization and histogram algorithms
2. Program for Image Filtering: Computation of convolution by two methods – direct method (in spatial domain) and indirect method (in frequency domain)
3. Study of DFT Properties: Periodicity property of DFT, Conjugate Symmetry property
4. program for Convolution
5. program for Unsharp masking
6. program for display of gray scale images

7. program for Histogram Equalization
8. Program for determination of edge detection using operation
9. Program for display of color images
10. Program for conversion between color images
11. Program to extract different attributes of an image
12. Program for Histogram mapping and equalization
13. Program for morphological operations on Binary images
14. Program for image smoothening and sharpening

Suggested case study for CIA activity: Bayes' parametric classification, Structural method-shape numbers, string matching, Face recognition.

PEC2 – Web Technologies (ET319B)

Teaching Scheme
Lectures: 3 Hrs. / Week

Credits: 03

Examination Scheme
InSem Exam: 30 Marks
CIA: 20 Marks
End Sem Exam: 50 Marks
Total: 100 Marks

Prerequisite: Programming Fundamentals

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Course Objectives:

1. To learn the principles and methodologies of web based applications development process.
2. To understand current client side web technologies
3. To understand current server side web technologies.
4. To understand current client side and server side frameworks.
5. To understand web services and content management.
6. To learn XML concept and its usage.

Course Outcomes (COs): After successful completion of the course, student will be able to

CO	Course Outcome Statements	Bloom's Taxonomy	
		Level	Descriptor
ET319B.1	Design dynamic and interactive web-pages using HTML5 in a simplified way.	3	Apply
ET319B.2	Design web based application using suitable client side technologies	3	Apply
ET319B.3	Implement interactivity with jQuery.	3	Apply
ET319B.4	Design web based application using suitable server side technologies	3	Apply
ET319B.5	Design dynamic and interactive web-pages using PHP in a simplified way.	2	Understand
ET319B.6	Design web based application using Content Management, frameworks	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET319B.1	3	--	3	--	2	--	--	--	--	--	--	1	2	--
ET319B.2	2	--	2	--	3	--	--	--	--	--	--	2	2	--
ET319B.3	2	--	1	--	2	--	--	--	--	--	--	3	3	--
ET319B.4	2	--	3	--	1	--	--	--	--	--	--	2	2	--

ET319B.5	1	--	2	--	3	--	--	--	--	--	--	1	3	--
ET319B.6	1	--	2	--	3	--	--	--	--	--	--	2	2	--

Course Contents

Unit-I	**Introduction to Web Technologies**	No. of Hours	COs
	Internet, WWW, Webpage, Website, Types of Web, Applications, Web Application Architecture, Web Servers, Roles and responsibilities of Web Developer, Challenges in Web App Development. **HTML**: Structure of Web Page, Text Formatting tags, Image, tables, links, frames, forms and HTML 5.	06 Hrs.	ET319B.1
Unit-II	**Client Side Technologies**	No. of Hours	
	CSS: Need of CSS, Types of CSS, CSS Selectors, CSS for basic HTML tags, responsive CSS framework: Bulma **XML**: Introduction to XML, XML key component, Transforming XML into XSLT, DTD: Schema, elements, attributes, Introduction to JSON. **Java Script**: JS in an HTML (Embedded, External), Data types, Control Structures, Arrays, Functions and Scopes, Objects in JS.	06 Hrs.	ET319B.2
Unit-III	**Client Side Technologies and Frameworks**	No. of Hours	
	DOM: DOM levels, DOM Objects and their properties and methods, Manipulating DOM **JQuery**: Introduction to JQuery, Loading JQuery, Selecting elements, changing styles, creating elements, appending elements, removing elements, handling events. Bootstrap framework.	06 Hrs.	ET319B.3
Unit-IV	**Server side Technologies**	No. of Hours	
	Introduction to CGI **Servlet**: introduction, life cycle of servlet, servlet directory structure, servlet example, form handling, cookies and session tracking. **JSP :** life cycle, JSP tags, built in objects, Directives, File uploading and page redirecting. Database connectivity using servlet and JSP.	06 Hrs.	ET319B.4
Unit-V	**Introduction to PHP**	No. of Hours	
	PHP : Introduction to PHP, Features, sample code, PHP script working, PHP syntax, conditions & Loops, Functions, String manipulation, Arrays & Functions, Form handling, Cookies & Sessions, using PostgreSQL/MySQL with PHP.	06 Hrs.	ET319B.5

Unit-VI	**Frameworks**	No. of Hours	
	MVC, AngularJS: Overview, directives, expression, controllers, filters, tables, modules, forms, includes, views, scopes, services, dependency injection, custom directives, Internationalization **Java Struts**: Overview, architecture, configuration, sample code. Web Hosting example. **CMS**: Joomla/wordpress	06 Hrs.	ET319B.6

Books:

Text Books:

1. Kogent Learning Solutions Inc,Web Technologies: HTML, JAVASCRIPT, PHP, JAVA, JSP, XML and AJAX, Blackbook, Dreamtech Press.
2. Raymond Camden, Andy Matthews, jQuery Mobile Web Development Essentials, Packet Publishing, Second Edition.
3. Achyut Godbole & Atul Kahate, "Web Technologies: TCP/IP to Internet Application Architectures", McGraw Hill Education publications**. (AICTE)**

Reference Books:

1. Ivan Bayross,"Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML and PHP, BPB Publications,4th Edition.
2. Sandeep Panda, "Angular JS: Novice To Ninja", SPD, First Edition
3. Robin Nixon, "Learning PHP, Mysql and Javascript with JQuery, CSS & HTML5", O'REILLY.
4..Rajkamal," Internet and Web Technologies", McGraw Hill Education publications.**(AICTE)**

Guidelines for Continuous Assessment:

10 Marks based on Students' performance in class tests and remaining 10 marks on class assignments /Quiz. These evaluation components should be carried out on completion of each unit and average should be taken.

PEC2 – Renewable Energy Systems (ET319C)

Teaching Scheme
Lectures: 03 Hrs. / Week

Credits: 03

Examination Scheme
In-Sem Exam: 30 Marks
End Sem Exam: 50 Marks
CIA: 20 Marks
Total: 100 Marks

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Prerequisite: Power Electronics

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Course Objectives:-

1. To understand the need, importance, scope of conventional & alternate energy resources.
2. To inculcate about the energy scenario, energy policies & schemes of Government.
3. To understand the significance role of solar energy.
4. To get the utilization of bio energy.
5. To provide importance of wind energy.
6. To acquire the knowledge of energy conservation.

Course Outcomes (COS):-

After completion of course students will be able to

COS	Statement	Blooms Taxonomy	
		Level	Descriptor
ET319C.1	Categorize the conventional & non-conventional energy resources.	2	Understand
ET319C.2	Survey the energy scenario & energy policies at national level.	4	Analyze
ET319C.3	Design the solar PV system for rural area.	3	Apply
ET319C.4	Descrie the importance of wind energy.	2	Understand
ET319C.5	Discuss the utilization of bio energy with the various plants.	2	Understand
ET319C.6	Plan the different energy conservation methods.	3	Apply

Mapping Of Course Outcomes to Program Outcomes (POS) & Program Specific Outcomes (PSOS):-

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET319C.1	2	-	-	-	-	1	2	-	-	-	-	1	-	-
ET319C.2	1	-	1	2	-	2	2	-	-	-	-	1	-	-
ET319C.3	2	2	2	1	-	2	2	-	1	-	1	1	2	-
ET319C.4	2	2	1	1	-	1	2	-	-	-	-	1	1	-
ET319C.5	1	1	1	1	-	1	2	-	-	-	-	1	1	-
ET319C.6	2	2	1	1	-	1	2	-	-	-	-	1	2	-

Course Contents

Unit-I	Conventional & Non-Conventional Energy Sources	No. of Hours	COS
	Definition, unit of energy & power, fossil fuels, solar energy, wind energy, geothermal energy, bio-energy, OTEC [Ocean Thermal Energy Conversion], tidal energy.	06 Hrs.	ET319C.1
Unit-II	Energy Scenario & Energy Policies	No. of Hours	COS
	National & international level, primary energy consumer countries, developing countries, developed countries, commercial & non-commercial forms of energy, energy use patterns in India & the world, demand, role of energy in economic development, social and environmental aspects, India's energy scenario & energy policies, impact of energy on development, private sector in renewable power generation.	06 Hrs.	ET319C.2
Unit-III	Solar Energy	No. of Hours	COS
	Solar radiation, advantages & disadvantages of solar energy, fundamentals of solar photo voltaic conversion, solar cells, I-V characteristic, solar PV power generation, solar PV applications, efficiency measurements, affecting output of a PV module (temperature, irradiance, tilt angle, cell area shadowing, dust mismatch, PV module configurations, MPTT operation etc.), India's solar energy mission programme.	06 Hrs.	ET319C.3
Unit-IV	Bio-Energy	No. of Hours	COS
	Sources of biomass, process of extraction of energy from biomass, biogas, applications of bio-diesel, bio-ethanol, bio-fuels in India, their utilization pattern, bio-fuels: importance, production & applications, types of bio-fuels, bio-based chemicals and materials, Government policy & status of bio fuel technologies.	06 Hrs.	ET319C.4
Unit-V	Wind Energy	No. of Hours	COS
	Wind resource assessment, power conversion technologies, wind power estimation techniques, principles of aerodynamics of wind turbine blade, various aspects of wind turbine design, wind turbine generators: induction, synchronous machine, applications of wind energy, wind energy estimation, types of wind energy systems, performance, site selection.	06 Hrs.	ET319C.5
Unit-VI	Energy Conservation	No. of Hours	COS

	Energy conservation techniques, need & importance of energy conservation, principles of energy conservation, methods of energy conservation, batteries & inverters, energy management system, economic approach of energy conservation, energy efficiency & energy conversion relation with difference.	06 Hrs.	ET319C.6

Books:-

Text Books:-

1. Tiwari & Ghosal "Renewable Energy Resources", Narosa Publication.
2. Kreith F, Kreider J F, "Principles of Solar Engineering", McGraw Hill.
3. Shobh Nath Singh, "Non –Conventional Energy Resources", Pearson India, 2015.

Reference Books:-

1. Twidell & Weir, "Renewable Energy Sources", CRC Press.
2. Chethansingh Solanki "Solar Photovoltaics-Fudmentals, Technologies And Applications"- PHI II Edition -2012.
3. D. Yogi Goswami, "Principles of Solar Engineering", 3rd Edition, CRC Press.
4. Boyle, Godfrey, "Renewable Energy", 2nd Edition, Oxford University Press, 2004.

Continuous Internal Assessment:-

1. Unit test on six units.
2. Poster presentation on first three & last three units.
3. Case study of energy plant.

Microprocessors and Microcontrollers Laboratory (ET320)

Teaching Scheme
Practical: 2Hrs/Week
Credits: 01

Examination Scheme
PR: 50 Marks

Prerequisite: - Knowledge of Computer architecture and embedded C programming

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Course Objectives:

1. To introduce the fundamentals of microprocessor and microcontroller
2. To study the applications of microprocessors and microcontrollers
3. To introduce the architecture and features of typical microprocessor and microcontrollers
4. To interface real world input and output devices
5. To Study hardware and software development tools for developing embedded applications
6. To understand need of microprocessors and microcontrollers in embedded system

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

Course Outcomes	Statement	Bloom's Descriptor	
		Level	Descriptor
ET320.1	Implement the concepts of assembly language programming in microprocessors	3	Apply
ET320.2	Develop programs in assembly language for interfacing peripherals using 8051 microcontroller	3	Apply
ET320.3	Demonstrate the use of embedded C language for interfacing peripherals using PIC microcontroller	3	Apply

Mapping of course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET320.1	2	2	-	2	-	-	-	-	-	-	-	-	-	2
ET320.2	2	3	-	-	-	-	-	-	-	-	-	-	-	1
ET320.3	2	1	2	-	-	-	-	-	-	-	-	-	-	2

Practical Course Contents (Minimum 08 Experiments) :

Sr. No.	Title of Practical	COs
1	Write an assembly language program for Arithmetic operations using 8085	ET320.1

2	Write an assembly language program for interfacing of LED's with 8085 and Simulate using PROTEUS	ET320.1
3	Write an assembly language program to display message using 8085	ET320.1
4	Write an assembly language program for interfacing of LCD with 8051	ET320.2
5	Write an assembly language program for interfacing of Stepper motor with 8051	ET320.2
6	Write an assembly language program for interfacing of 4X4 keypad with 8051	ET320.2
7	Write an assembly language program for generation of various waveforms using DAC interfaced to 8051	ET320.2
8	Write an embedded C program for interfacing of switch, LED, relay & buzzer with PIC18F	ET320.3
9	Write an embedded C program for generation of PWM signal for DC Motor control using PIC18F	ET320.3
10	Write an embedded C program for interfacing serial port of PIC18F to PC	ET320.3
11	Write an embedded C program for interfacing in built ADC using PIC 18F	ET320.3

Note: Exp. 1, 2 and 3 will be conducted using simulation.

Electromagnetics Tutorials (ET321)

Teaching Scheme
Tutorials: 01 Hr/ Week
Credits: 01

Examination Scheme
Oral: 50 Marks
Total: 50 Marks

Prerequisite: Co-ordinate Geometry (Cartesian, Cylindrical and Spherical), Vector Calculas

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Course Objectives:

1. To Illustrate the study Basic concepts of Electrostatic Laws and Theorems.
2. To describe the concepts of Magnetostatic Laws and Theorems.
3. To distinguish the time varying electric and magnetic fields.
4. To summarize transmission line fundamentals and apply them to the basic problem
5. To compare the fundamentals of Antenna and its parameters

Course Outcomes (COs):

After successful completion of this course, students will be able to:

Course Code	Course Outcome (s)	Bloom's Taxonomy	
		Level	Descriptor
ET321.1	Solve the principles of electrostatics, magnetostatics to the problems related to electric field, magnetic field and boundary conditions	3	Apply
ET321.2	Distinguish the electromagnetic problem and solve using Maxwell's equations.	4	Analyze
ET321.3	Solve the EM waves in different media and identify the polarization	3	Apply
ET321.4	Describe the transmission line problem and use the Smith chart for impedance calculations	2	Understand
ET321.5	Classify the given antenna and its various parameters	4	Analyze

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET321.1	3	2	-	-	-	-	1	1	-	2	-	-	3	1
ET321.2	3	2	-	-	-	-	1	1	-	2	-	-	2	1
ET321.3	3	2	-	-	-	-	1	1	-	2	-	-	3	1
ET321.4	3	2	3	-	-	-	1	1	-	2	-	-	3	2
ET321.5	3	3	2	-	-	-	1	1	-	2	-	-	-	2

Course Contents

Tutorial No.	List of Tutorials (Any 8)	COs

1	Application of Gauss's law , Faraday's Law , Ampere's Law	ET321.1, ET321.2
2	Electric and Magnetic boundary conditions	ET321.1, ET321.2
3	Numerical on Power and Poynting theorem	ET321.1, ET321.2
4	Numerical on Uniform Plane waves, Skin depth	ET321.3
5	Numerical on Polarization	ET321.3
6	Numerical on Transmission line parameters	ET321.4
7	Numerical on Transmission line : Input impedance, reflection coefficient, standing wave ratio	ET321.4
8	Numerical on Smith Chart	ET321.4
9	To Measure Radiation pattern, Return Loss, Impedance, Gain, Beam width for the following antennas (Any Two) a. Dipole antenna b. Folded Dipole c. Yagi-Uda d. Horn Antenna e. Microstrip Patch Antenna	ET321.5
10	Simulation of following antenna arrays, plotting radiation pattern and Plot Standing Wave pattern and Measure SWR (Any Two) a. Broad side linear array with uniform spacing and amplitude b. End fire linear array with uniform spacing and amplitude c. Binomial array d. Dolph-Tchebyshev Microstrip Patch Antenna Array	ET321.5

Books:

Text Books:

1. Mathew N. O. Sadiku, _Principles of Electromagnetics ', 4th Edition, Oxford University Press Inc, 2009.
2. William H. Hayt and John A. Buck, _Engineering Electromagnetics ', Tata McGraw Hill, 8th Revised edition, 2011.

C. A. Balanis, "Antenna Theory - Analysis and Design", John Wiley.

Reference Books:

1. Kraus and Fleish, _Electromagnetics with Applications ', McGraw Hill International Editions, 5th edition, 2010.
2. Jordan and Balmain, —Electromagnetic Waves and Radiating Systems‖, PHI, 1964
3. K. D. Prasad, "Antenna & Wave Propagation", Satya Prakashan, New Delhi

John D Kraus, " Antenna& Wave Propagation", 4th Edition, McGraw Hill, 2010

Online Resources

1. https://www.wiziq.com/tutorials/electromagnetism
2. https://www.classcentral.com/course/swayam-introduction-to-electromagnetic-theory-14146
3. https://www.coursera.org/lecture/electrodynamics-introduction/1-1-introduction-to-electromagnetism-qiIQb

Mandatory Course VI :- Electronic Waste Management (MC322)

Teaching Scheme
Lectures: 1 Hrs. / Week
Credits: 0

Examination Scheme

Prerequisites: Nil

COURSE OBJECTIVE

1. To Introduce the concept of solid waste handling
2. To get an understanding of different solid waste collection systems.
3. To learn various waste treatment methods
4. To get an understanding of e-waste control measures
5. To highlight the e-waste hazards on global trade.
6. To get introduce various e-waste legislation

COURSE OUTCOMES

The Students are able to

COs	Course Outcomes	Bloom's Taxonomy	
		Level	Descriptor
MC322.1	List various characteristics of solid wastes	1	Remember
MC322.2	Name different systems for collections of solid wastes	1	Remember
MC322.3	Compare among different treatment methods for waste materials	2	Understand
MC322.4	Summarize different kinds of e-wastes	2	Understand
MC322.5	Explain essential factors in global waste trade economy	2	Understand
MC322.6	List different legislation on e-waste management and handling	1	Remember

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
MC322.1	2	-	-	-	-	3	3	-	-	-	-	-	-	-
MC322.2	2	-	-	-	-	3	3	-	-	-	-	-	-	-
MC322.3	2	-	-	-	-	-	3	-	-	-	-	-	-	-
MC322.4	2	-	-	-	-	2	3	-	-	-	-	2	-	-
MC322.5	2	-	-	-	-	2	2	-	-	-	-	-	-	-
MC322.6	2	-	-	-		3	-	-	-	-	-	2	-	-

COURSE CONTENTS

Unit-I	INTRODUCTION TO SOLID WASTES:	No. of Hours	COs

1	Definition of solid wastes, Sources, classification and characteristics of solid wastes, Municipal Solid Waste (Management and Handling) Rules,		MC322.1
Unit-II	**COLLECTION OF SOLID WASTE:**	**No. of Hours**	**COs**
2	Systems of collection of solid wastes, transfer stations, collection equipment's, route optimization techniques and numerical problems on route optimization. Processing techniques of solid wastes (principle of operation and function only).		MC322.2
Unit-III	**TREATMENT METHOD**	**No. of Hours**	**COs**
3	Autoclave, Hydroclave, Microwave, Chemical Disinfection, Solidification and stabilization, Bio-remediation, Thermal Conversion Technologies, accumulation and storage of hazardous waste, land disposal of hazardous waste, other treatment and disposal method. Common Hazardous Waste Treatment facilities (TSDF).		MC322.3
Unit-IV	**E-waste control measures**	**No. of Hours**	**Cos**
4	Need for stringent health safeguards and environmental protection laws in India, Extended Producers Responsibility (EPR), Import of e-waste permissions, Producer-Public-Government cooperation, Administrative Controls & Engineering controls, monitoring of compliance of Rules, Effective regulatory mechanism strengthened by manpower and technical expertise, Reduction of waste at source.		MC322.4
Unit-V	**E-waste hazardous on Global trade**	**No. of Hours**	**Cos**
5	Essential factors in global waste trade economy, Waste trading as a quint essential part of electronic recycling, Free trade agreements as a means of waste trading. Import of hazardous e-waste in India; India's stand on liberalizing import rules, E-waste economy in the organized and unorganized sector. Estimation and recycling of e-waste in metro cities of India.		MC322.5
Unit-VI	**E- waste legislation**	**No. of Hours**	
6	E-waste (Management and Handling) Rules, 2011; and E-Waste (Management) Rules, 2016 - Salient Features and its likely implication. Government assistance for TSDFs. The international legislation: The Basel Convention; The Bamako Convention. The Rotterdam Convention. Waste Electrical and Electronic Equipment (WEEE) Directive in the European Union, Restrictions of Hazardous Substances (RoHS) Directive.		MC322.6

Books:

Text Book(s)

1. George Tchobanoglous et.al., "Integrated Solid Waste Management", Mc-Graw-Hill, Inc. New York, 1993.
2. 2. Howard S.Peavy et.al., "Environmental Engineering", Mc-Graw-Hill Book Company, New York, 1985.

References Books

1. Besselviere, E and Schwartz,"Treatment of Industrial Wastes",. McGraw Hill. 1975.

2. F Dougal and P WhiteIntegrated "Solid waste Management", John Wiley and Sons, 2001.

3. A.D. Bhide and B.B.Sudareshan, "Solid Waste management in Developing Countries", NEERI, Nagpur 1983.

Guidelines: Industrial Visit to e-waste treatment plant will be organized once in the semester and report for the same will be prepared

Tech Honors in Embedded Systems & IoT
w. e. f. Academic Year 2021-22

T. Y. B. TECH SEMESTER-VI

Course			Teaching Scheme Hours/week				Evaluation Scheme-Marks						
Cat	Code	Title	L	T	P	Credits	Theory			OR	PR	TW	Total
							ISE	ESE	CIA				
PCC	ET8102	Embedded system hardware and software design	4	-	-	4	30	50	20	-	-	-	100
LC	ET8103	Embedded system hardware and software design Lab	-	-	2	1	-	-	-	-	50	-	50
		Total	**4**	**-**	**2**	**5**	**30**	**50**	**20**	**-**	**50**	**-**	**150**

Embedded system hardware and software design (ET8102)

Teaching Scheme
Lectures: 4 Hrs. / Week

Credits: 4

Examination Scheme
In-Sem Exam: 30 Marks
End-Sem Exam: 50 Marks
CIA: 20 Marks
Total: 100 Marks

Prerequisite:- Basics of Microcontroller and Embedded C Programming

Course Objectives:

1. To create awareness about different hardware platforms available for embedded system design along with list of features and selection criteria.
2. To create awareness about different software platforms available for real-time and non-real-time embedded system design along with list of features and selection criteria.

Course Outcomes (COs): After successful completion of the course, student will be able to

COs	Course Outcome Statement	Bloom's Taxonomy	
		Level	Descriptor
ET8102.1	Identify design aspects of embedded system	2	Understand
ET8102.2	Utilize capabilities of modern hardware in designing embedded systems	3	Apply
ET8102.3	Foster step by step design process of embedded systems for specified application using waterfall model.	3	Apply
ET8102.4	Explain the structure and working of real-time operating systems (RTOS).	4	Analyse
ET8102.5	Use embedded Linux for developing embedded system products	3	Apply
ET8102.6	Design embedded systems for different application by using waterfall model.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET8102.1	1	2	1	-	2	-	-	-	-	-	-	-	1	-
ET8102.2	-	-	-	-	3	-	-	-	-	-	-	-	3	-

ET8102.3	-	3	3	-	3	-	-	-	-	-	-	-	1	-
ET8102.4	-	-	-	-	3	-	-	-	-	-	-	-	3	-
ET8102.5	-	-	-	-	3	-	-	-	-	-	-	-	3	-
ET8102.6	-	2	3	-	-	-	-	-	-	-	-	-	1	-

COURSE CONTENT

Unit-I	**Basics of Embedded Systems**	No. of Hours	COs
	Introduction to Embedded Systems, Applications and recent trends, Definition, Block diagram, Embedded system Architecture, Hardware and software Architecture of embedded System, Characteristics, classification, Key Design challenges, Design Metrics, Optimization of Design metrics, Design constraints. Techno-Economical prospective of embedded system,	6	ET8102.1
Unit-II	**Recent trends in Embedded System Hardware**		
	Embedded processor technology **IC technology** **Design technology** Microcontroller selection criteria, Introduction to advanced microcontroller, ARM family of microcontroller, Generalized block diagram of ARM Processor, Concept and working principle of multi core processors, SoC.	7	ET8102.2
Unit-III	**Embedded Technology and development cycle**		
	Embedded System Development Cycle: Requirement engineering, requirement Specification, Hardware-Software Partitioning, Hardware Software co-design, Integration, Testing, Quality Assurance, Maintenance, and Electronics Waste Management.	5	ET8102.3
Unit-IV	**µCOS-II Real Time Operating System**		
	Concept and necessity of RTOS, Types of RTOS, Features, Architecture, File structure of µCOS-II, Concept of Task, Clock tick, Assign static and dynamic priority to the tasks, concept and Types of kernel services:- System Services, application of multitasking, Task management Services, Time management services, Shared resources/critical section of code and related issues, Concept of deadlock, Protection mechanisms, IPC mechanisms.	7	ET8102.4
Unit-V	**Basics of Embedded Linux**		
	Use of Embedded Linux in embedded application development, Embedded Linux development setup, Development tool chain insights (GNU), Minicomp, **Different components of Embedded Linux:** Bootloader, Kernel, File System, Device Drivers, application program. Survey of different applications empowered with Embedded Linux Operating System	7	ET8102.5

Unit-VI	**Case study of Embedded System Design**		
	Mobile Phone /smart phone, Home automation, Self driving cars, Voice operated devices like Amazon Echo Dot-Alexa, Google home mini. Google Glass.	5	ET8102.6

Text Books:

1. Frank Vahid, Tony Givargis, "Embedded System Design: A Unified Hardware/Software Introduction", Wiley- India,(2009) ISBN:- 978-81-265-0837-2.
2. Andrew Sloss, "ARM System Developer's Guide: Designing and Optimizing System Software", Morgan Kaufmann, 2004, ISBN: 978-15-586-0874-0
3. Jean J. Labrosse, "MicroC/OS-II: The Real Time Kernel", CRC Press; 2nd edition, 2002, ISBN: 978-15-782-0103-7
4. Christopher Hallinan, "Embedded Linux Primer: A Practical Real-World Approach", 2nd edition, Prentice Hall; 2 edition, 2010, Pearson Open Source Software Development Series,

Reference Books:

1. David E. Simon, "An Embedded Software Primer", Addison Wesley; 2nd edition, ISBN: 978-02-016-1569-2
2. Dr. K. V. K. K. Prasad, "Embedded Real Time Systems: Concepts, Design and Programming", Dreamtech Press, 2003 ISBN: 978-81-772-2461-0
3. Raj Kamal, "Embedded Systems: Architecture, Programming and Design", Tata McGraw-Hill Education (India), 2011.

Online Resources:

1. https://www.micrium.com/rtos/kernels/
2. NPTEL Course on RTOS https://nptel.ac.in/courses/106/105/106105172/
3. NPTEL Course on Embedded system design using ARM https://nptel.ac.in/courses/106/105/106105193/
4. Coursera course https://www.coursera.org/specializations/real-time-embedded-systems

CIA Activity

Sr. No	**Title**	Marks	Schedule	COs
1.	MCQ Test Unit 1	10	After completion of unit I	ET8102.1
2.	MCQ Test Unit 2	10	After completion of unit II	ET8102.2
3.	MCQ Test Unit 3	10	After completion of unit III	ET8102.3
4.	MCQ Test Unit 4	10	After completion of unit IV	ET8102.4
5.	MCQ Test Unit 5	10	After completion of unit V	ET8102.5
6.	MCQ Test Unit 6	10	After completion of unit VI	ET8102.6
7.	Perform survey of different processors used in recent smart phones. Prepare the detailed consolidated report.	20	Semester start to INSEM	ET8102.2
8.	Develop any application using µCOS-II OS justifying need of RTOS. OR	20	INSEM to semester end	ET8102.4

	Develop any application using Embedded Linux OS exploring capabilities of the same.			ET8102.4 ET8102.5 ET8102.6

Embedded system hardware and software design Laboratory (ET8103)

Teaching Scheme		Examination Scheme		
Practical:	**02 Hrs./ Week**	**PR**	**:**	**50 Marks**
Credits: 01		**Total**	**:**	**50 Marks**

Prerequisite:- Basics of Microcontroller and Embedded C Programming

Course Objectives:

1. To create awareness about different hardware platforms available for embedded system design along with list of features and selection criteria.
2. To create awareness about different software platforms available for real-time and non-real-time embedded system design along with list of features and selection criteria.

Course Outcomes (COs): After successful completion of the course, student will be able to

	Course Outcome (s)	Bloom's Taxonomy	
		Level	Descriptor
ET8103.1	Acquire a basic knowledge about different hardware tools used for designing embedded system	2	Understand
ET8103.2	Acquire a basic knowledge about different software tools used for designing embedded system	2	Understand
ET8103.3	Asses embedded Operating System's behaviour and performance under different circumstances.	5	Evaluate
ET8103.4	Foster ability to design and implement embedded system as per specifications	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET8103.1	1	-	-	-	3	-	-	-	-	-	-	1	1	-
ET8103.2	1	-	-	-	3	-	-	-	-	-	-	1	1	-
ET8103.3	2	1	-	-	-	-	-	-	-	-	-	-	2	-
ET8103.4	3	2	2	1	-	-	-	-	2	-	-	-	3	-

Course Contents

Experiment. No	Title	COs
1.	Program Arduino Uno board to perform different operations on GPIO using Arduino IDE tool.	ET8103.1 ET8103.2
2.	Case study of Temperature control application on Arduino Uno board	ET8103.2
3.	Porting of µCOS-II on ARM7 controller.	ET8103.1 ET8103.2
4.	Implementation of multitasking with µCOS-II on ARM7 microcontroller for three tasks.	ET8103.3
5.	Porting of Embedded Linux components Bootloader, Kernel and File System on ARM 9 board.	ET8103.3
6.	Writing simple application using Embedded Linux on ARM9 board.	ET8103.4
7.	Design any one embedded system from Unit 6.	ET8103.4
8.	Implement any one embedded system from Unit 6.	ET8103.4

Important guidelines

1. All experiments are compulsory
2. Students should prepare the brief document elaborating aim, objectives, apparatus, equipment, theory, observation table, circuit diagram, block diagram, calculations, result, graph, conclusion etc. whichever is applicable.
3. Software Platform to be used:- Experiment 1 & 2 on Arduino IDE, Experiment 3 & 4 on Keil Software, Experiment 5 on Linux Platform. Experiment 7 & 8 will be proposed by student.
4. Hardware Platform to be used:- Experiment 1 & 2 on Arduino Uno Board, Experiment 3 & 4 on ARM 7 development board, Experiment 5 on ARM9 Prototyping Board. Experiment 7 & 8 will be selected by student.
5. Assessment of each experiment is strictly as per rubric defined and communicated with the students in the start of semester.
6. Timely submission of experiment write-up is highly recommended

Text Books:

1. Massimo Banzi, “Make Getting Started With Arduino” 3rd edition, 2009, Publisher O’Reilly Media, Inc. ISBN: 9780596155513
2. Jean J. Labrosse, “MicroC/OS-II: The Real Time Kernel”, CRC Press; 2nd edition, 2002, ISBN: 978-15-782-0103-7
3. Christopher Hallinan, “Embedded Linux Primer: A Practical Real-World Approach”, 2nd edition, Prentice Hall; 2 edition, 2010, Pearson Open Source Software Development Series,

Reference Books:

1. Andrew Sloss, “ARM System Developer's Guide: Designing and Optimizing System Software”, Morgan Kaufmann, 2004, ISBN: 978-15-586-0874-0
2. David E. Simon, “An Embedded Software Primer”, Addison Wesley; 2nd edition, ISBN: 978-02-016-1569-2
3. Raj Kamal, “Embedded Systems: Architecture, Programming and Design”, Tata McGraw-Hill Education (India), 2011.
4. Dr. K. V. K. K. Prasad, “Embedded Real Time Systems: Concepts, Design and Programming”, Dreamtech Press, 2003 ISBN: 978-81-772-2461-0

Online Resources:

1. https://www.micrium.com/rtos/kernels/

2. https://www.arduino.cc/
3. https://www.ti.com/lit/ds/symlink/lm35.pdf

B Tech Honors in Industrial Automation and Robotics

w. e. f. Academic Year 2021-22

T. Y. B. TECH SEMESTER-VI

Course			Teaching Scheme Hours/week				Evaluation Scheme-Marks						
							Theory			OR	PR	TW	Total
Cat	Code	Title	L	T	P	Credits	ISE	ESE	CA				
PCC	ET8203	Robotics	4	-	-	4	30	50	20	-	-	-	100
		Total	**4**	**-**	**-**	**4**	**30**	**50**	**20**				**100**

Robotics (ET8203)

Teaching Scheme
Lectures: 04 Hrs./ Week

Credits: 04

Examination Scheme
End-Sem Exam: 50 Marks
In Sem Exam : 30 Marks
CIA: 20 Marks
Total: 100 Marks

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Prerequisite : Basic knowledge of sensors, actuators and concepts of dynamics

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Course Objectives:

1. To introduce the basic concepts and principles of robotics
2. To learn about various types of grippers and sensors used in robotics
3. To get an understanding of different types of drives and their controls employed in robotics
4. To introduce the basic mathematical principles in developing a robotic system
5. To introduce different programming practices used in robotics
6. To get an understanding on the economic and socio-economic aspects of design and implementation of robotic systems

Course Outcomes (COs):

After successful completion of this course, the students should be able to:

COs	Course Outcomes	Blooms Taxonomy	
		Level	Descriptor
ET 8203.1	Classify Robotic systems on the basis of various parameters	2	Understand
ET 8203.2	Summarize the characteristics of different types of grippers and sensors employed in Robotic systems	2	Understand
ET 8203.3	Classify different types of drives and associated controllers used in Robotic systems	2	Understand
ET 8203.4	Solve mathematical equations related to transformation operations in Robotic systems	3	Apply
ET 8203.5	Solve basic programming examples applicable to Robotic systems	3	Apply
ET 8203.6	Recognize the economic and socio-economic aspects of robot design and safety for robot standards	1	Remember

Mapping of Course Outcomes to Program Outcomes (POs):

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
ET 8203.1	1	-	-	-	-	-	-	-	-	-	-	-

ET 8203.2	2	1	-	-	-	-	-	-	-	-	-	-
ET 8203.3	2	1	-	-	-	-	-	-	-	-	-	-
ET 8203.4	3	2	2	-	-	-	-	-	-	-	-	-
ET 8203.5	3	2	2	-	2	-	-	-	-	-	-	-
ET 8203.6	1	1	-	-	-	-	-	-	-	-	-	-

Course Contents

Unit No.		No. of Hours	COs
Unit-I	**Introduction to Robotics**	08	ET 8203.1
	Brief History, Basic Concepts of Robotics, Definition , Three laws, Elements of Robotic Systems, Robot anatomy, DOF, Misunderstood devices , Classification of Robotic systems on the basis of various parameters such as work volume, type of drive etc., Associated parameters, resolution, accuracy, repeatability, dexterity, compliance, RCC device etc., Introduction to principles and strategies of automation, Types and levels of automations, Need of automation, Industrial applications of robot.		
Unit-II	**Grippers and Sensors for Robotics**	08	ET 8203.2
	Grippers for Robotics - Types of Grippers, Guidelines for design for robotic gripper, Force analysis for various basic gripper system, Sensors for Robots - Types of Sensors used in Robotics, Classification and applications of sensors, Characteristics of sensing devices, Selections of sensors. Need for sensors and vision system in the working and control of a robot.		
Unit-III	**Drives and Controls for Robotics**	08	ET 8203.3
	Drives - Types of Drives, Types of transmission systems, Actuators and its selection while designing a robot system. Control Systems: Types of Controllers, Introduction to closed loop control		
Unit-IV	**Mathematical Preliminaries of Robotics**	08	ET 8203.4
	Spatial Descriptions: positions, orientations, and frame, mappings: changing description from frame to frame, Operators: translations, rotations and transformations, transformation arithmetic, compound Transformations, inverting a transform, transform equations, Euler Angles, Fixed Angles, Euler Parameters.		

Unit-V	**Robot Programming**	08	ET 8203.5
	Robot Programming: Methods of robot programming, WAIT, SIGNAL and DELAY commands, Subroutines, Programming Languages: Generations of Robotic Languages, Introduction to various types such as VAL, RAIL, AML, Python, ROS etc.		
Unit-VI	**AI in Robotics**	08	ET 8203.6
	Introduction to Artificial Intelligence, AI techniques, Robotics application using AI-Assembly, Packaging, Customer service, Open source robotics, AI based medical robots, Recent trends in robotics.		

Text Books:

1. S.K.Saha, "Introduction to Robotics", 2nd Edition, Tata Mc-Graw Hill
2. Dilip Kumar Prathihar, "Fundamentals of Robotics", Narosa Publishing House

Reference Books:

1. Astava Ghosal, "Robotics: Fundamental Concepts and Analysis", Oxford University Press
2. S. B. Niku, "Introduction to Robotics-Analysis, Control and Applications" 3rd Edition, John Wiley & Sons
3. Mikell Groover, Mitchell Weiss, Roger N. Nagel, Nicholas Odrey, Ashish Dutta, "Industrial Robotics", Mc-Graw Hill Education (India) Pvt. Ltd.
4. J.J.Graig,"Introduction to Robotics, Mechanics and Control", 3rd Edition, Addison Wesley

Web Resources:

https://nptel.ac.in/courses/112/105/112105249

Guidelines for Continuous Assessment

MCQ Quiz on all six units
Assignments on Units #4 &5
PBL based on the design of a simple robotic system

Sanjivani Rural Education Society's

Sanjivani College of Engineering, Kopargaon

(An Autonomous Institute Affiliated to Savitribai Phule Pune University, Pune)

B. Tech. Electronics and Telecommunication Engineering

2019 pattern

Proposed Program Structure

(B. Tech. with effect from Academic Year 2019-2020)

(Final Year B. Tech. w.e..f. 2022-2023)

At. Sahajanandnagar, Post. Shingnapur Tal. Kopargaon Dist. Ahmednagar,

Maharashtra State, India PIN 423603

List of Abbreviations			
Abbreviation	**Full Form**	**Abbreviation**	**Full Form**
BSC	Basic Science Course	OEC	Open Elective Course
CIA	Continuous Internal Assessment	OR	End-Semester Oral Examination
EFC	Engineering Foundation Course	P	Practical
ESE	End-Semester Evaluation	PCC	Professional Core Course
HSMC	Humanities/Social Sciences/Management Course	PEC	Professional Elective Course
IP	Induction Program	PR	End-Semester Practical Examination
ISE	In-Semester Evaluation	PROJ	Project
L	Lecture	T	Tutorial
MLC	Mandatory Learning Course	TW	Continuous Term Work Evaluation

Final Year B. TECH. (Electronics and Telecommunication Engineering) SEMESTER-VII

Course			Teaching Scheme (Hours/week)				Evaluation Scheme/Max Marks						
							Theory						
Cat	Code	Title	L	T	P	Credits	ISE	ESE	CIA	OR	PR	TW	Total
PROJ	ET401	Professional Internship-III	-	-	-	2	-	-	-	50	-	-	50
PCC	ET402	Microwave and Optical Communication	3	-	-	3	30	50	20	-			100
PCC	ET403	Embedded Systems and RTOS	3	-	-	3	30	50	20	-	-	-	100
PEC	ET404	Refer List of PEC3	3	-	-	3	30	50	20	-	-	-	100
OEC	ET405	OE-II: The Joy of Computing using Python	3	-	-	3	-	75	25	-	-	-	100
OEC	ET406	OE-III: Online Course Through MOOCs	2	-	-	2	-	30	20	-	-	-	50
LC	ET407	Microwave and Optical Communication Laboratory	-	-	2	1	-	-	-	-	50	-	50
LC	ET408	Embedded Systems and RTOS Laboratory	-	-	2	1	-	-	-	50		-	50
PROJ	ET409	Project Stage I	-	-	4	2				50	-	-	50
MC	MC410	Mandatory Course-VII	-	-	2	No	-	-	-	-	-	-	-
		Total	**14**	**-**	**10**	**20**	**90**	**255**	**105**	**150**	**50**	**-**	**650**

MC410	**Mandatory Course-VII**	**Embedded System Design using MSP430**

SEMESTER-VIII

Course			Teaching Scheme (Hours/week)				Evaluation Scheme/Max Marks						
							Theory						
Cat	Code	Title	L	T	P	Credits	ISE	ESE	CIA	OR	PR	TW	Total
PCC	ET411	VLSI Design Technology	3	-	-	3	30	50	20	-	-	-	100
PCC	ET412	Mobile Communication	3	-	-	3	30	50	20	-	-	-	100
PCC	ET413	Computer Networks & Security	3	-	-	3	30	50	20	-	-	-	100
PEC	ET414	Refer List of PEC4	3	-	-	3	30	50	20	-	-	-	100
LC	ET415	VLSI Design Technology Laboratory	-	-	2	1	-	-	-	-	50	-	50
LC	ET416	Mobile Communication Laboratory	-	-	2	1	-	-	-	50	-		50
PROJ	ET417	Project Stage II	-	-	8	4	-	-	-	50	-	100	150
MC	MC418	Mandatory Course-VIII	1	-	-	No	-	-	-	-	-	-	-
		Total	**13**	**-**	**12**	**18**	**120**	**200**	**80**	**100**	**50**	**100**	**650**

MC418	**Mandatory Course-VIII**	**Role of Electronics in Biomedical Engineering**

Professional Elective Course 3 (PEC3):
ET404A Video Processing
ET404B Data Mining
ET404C Robotics & Automation

Professional Elective Course 4 (PEC4):-
ET414A Audio and Speech Processing
ET414B Data Analytic
ET414C Automotive Electronics

Total Credits: 38 **Total Marks: 1300**

Professional Internship III (ET401)

Teaching Scheme

Examination Scheme
OR: 50 Marks

Credits: 02

Total: 50 Marks

Prerequisite: Engineering Knowledge

Course Objectives:

1. To encourage and provide opportunities for students to get professional/personal experience through internships.
2. To learn and understand real life/industrial situations.
3. To get familiar with various tools and technologies used in industries and their applications.
4. To nurture professional and societal ethics.
5. To create awareness of social, economic and administrative considerations in the working environment of industry organizations.
6. To learn integration of conceptual aspects & practical word.

Course Outcomes (COs): After completion of course students will be able to

CO	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
ET401.1	Explain professional competence through industry internship.	2	Understand
ET401.2	Apply knowledge gained through internships to complete academic activities in a professional manner.	3	Apply
ET401.3	Classifying the appropriate technology and tools to solve given problem.	2	Understand
ET401.4	To demonstrate abilities of a responsible professional and use ethical practices in day-to-day life.	2	Understand
ET401.5	Creating network and social circle and developing relationships with industry people.	3	Apply
ET401.6	To analyze various career opportunities and decide carrier goals.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET401.1	2	2	2	2	3	1	1	1	1	2	1	1	1	1
ET401.2	1	2	2	2	3	2	1	1	1	2	2	1	2	1
ET401.3	-	-	-	-	-	1	-	-	2	2	1	1	1	2
ET401.4	2	-	-	-	-	2	2	3	-	1	-	2	2	1
ET401.5	-	-	-	-	-	1	2	1	1	1	2	1	1	2
ET401.6	-	-	-	-	-	1	-	-	2	1	-	2	1	1

Internship provides an excellent opportunity to learner to see how the conceptual aspects learned in classes are integrated into the practical world. Industry internship provides much more professional experience as value addition to classroom teaching.

Guidelines:

Internships are educational and career development opportunities, providing practical experience in a field or discipline. Internships are far more important as the employers are looking for employees who are properly skilled and having awareness about industry environment, practices and culture. Internship is structured, short-term, supervised training often focused around particular tasks or projects with defined time scales.

Core objective is to expose technical students to the industrial environment, which cannot be simulated/experienced in the classroom and hence creating competent professionals in the industry and to understand the social, economic and administrative considerations that influence the working environment of industrial organizations.

Engineering internships are intended to provide students with an opportunity to apply conceptual knowledge from academics to the realities of the field work/training. The following guidelines are proposed to give academic credit for the internship undergone as a part of the Final Year Engineering curriculum.

Duration:

Internship is to be completed after semester 6 and before commencement of semester 7 of at least 4 to 6 weeks; and it is to be assessed and evaluated in semester 7.

Internship work Identification:

Student may choose to undergo Internship at Industry/Govt. Organizations/NGO/MSME/Rural Internship/ Innovation/IPR/Entrepreneurship. Student may choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry/NGO's/Government organizations/Micro/Small/ Medium enterprises to make themselves ready for the industry [1].

Students must register at Intern Shala [2]. Students must get Internship proposals sanctioned from college authority well in advance. Internship work identification process should be initiated in the VIth semester in coordination with training and placement cell/ industry institute cell/ internship cell. This will help students to start their internship work on time. Also, it will allow students to work in vacation period after their VIth semester examination and before academic schedule of semester VII.

Student can take internship work in the form of the following but not limited to:

- Working for consultancy/ research project,
- Contribution in Incubation/ Innovation/ Entrepreneurship Cell/ Institutional Innovation Council/ startups cells of institute /
- Learning at Departmental Lab/Tinkering Lab/ Institutional workshop,
- Development of new product/ Business Plan/ registration of start-up,
- Industry / Government Organization Internship,
- Internship through Internshala,
- In-house product development, intercollegiate, inter department research internship under research lab/group, micro/small/medium enterprise/online internship,
- Research internship under professors, IISC, IIT's, Research organizations,
- NGOs or Social Internships, rural internship,
- Participate in open-source development.

Internship Diary/ Internship Workbook:

Students must maintain Internship Diary/ Internship Workbook. The main purpose of maintaining diary/workbook is to cultivate the habit of documenting. The students should record in the daily training diary the day-to-day account of the observations, impressions, information gathered and suggestions given, if any. The training diary/workbook should be signed every day by the supervisor.

Internship Diary/workbook and Internship Report should be submitted by the students along with attendance record and an evaluation sheet duly signed and stamped by the industry to the Institute immediately after the completion of the training.

Internship Work Evaluation:

Every student is required to prepare a maintain documentary proofs of the activities done by him as internship diary or as workbook. The evaluation of these activities will be done by Programme Head/Cell In-charge/ Project Head/ faculty mentor or Industry Supervisor based on- Overall compilation of internship activities, sub-activities, the level of achievement expected, evidence needed to assign the points and the duration for certain activities.

Assessment and Evaluation is to be done in consultation with internship supervisor (Internal and External – a supervisor from place of internship.

Recommended evaluation parameters:

Internship Diary/Workbook and Internship Report - 50 Marks

Evaluation through Seminar Presentation/Viva-Voce at the Institute-

The student will give a seminar based on his training report, before an expert committee constituted by the concerned department as per norms of the institute. The evaluation will be based on the following criteria:

- Depth of knowledge and skills
- Communication & Presentation Skills
- Team Work
- Creativity
- Planning & Organizational skills
- Adaptability
- Analytical Skills
- Attitude & Behavior at work
- Societal Understanding
- Ethics
- Regularity and punctuality
- Attendance record
- Diary/Work book
- Student's Feedback from External Internship Supervisor

After completion of Internship, the student should prepare a comprehensive report to indicate what he has observed and learnt in the training period.

Internship Diary/workbook may be evaluated on the basis of the following criteria:

- Proper and timely documented entries
- Adequacy & quality of information recorded
- Data recorded
- Thought process and recording techniques used
- Organization of the information

The report shall be presented covering following recommended fields but limited to,

- Title/Cover Page
- Internship completion certificate
- Internship Place Details- Company background-organization and activities/Scope and object of the study / Supervisor details
- Index/Table of Contents
- Introduction
- Title/Problem statement/objectives
- Motivation/Scope and rationale of the study
- Methodological details
- Results / Analysis /inferences and conclusion
- Suggestions / Recommendations for improvement to industry, if any
- Attendance Record

•Acknowledgement
•List of references (Library books, magazines and other sources)

Feedback from internship supervisor (External & Internal)

Post internship, faculty coordinator should collect feedback about student with recommended parameters include as- Technical knowledge, Discipline, Punctuality, Commitment, Willingness to do the work, Communication skill, individual work, Team work, Leadership….

Reference:

https://www.aicte-india.org/sites/default/files/AICTE%20Internship%20Policy.pdf

https://internship.aicte-india.org/

Microwave and Optical Communication (ET402)

Teaching Scheme
Lectures: 3 Hrs/Week

Credits: 03

Examination Scheme
ISE: 30 Marks
ESE:50 Marks
CIA: 20 Marks
Total: 100 Marks

Prerequisite course: Electromagnetics Engg. and Communication Engineering

Course Objectives:
1. To understand the various parameters of transmission lines and waveguides.
2. To learn working of passive components.
3. To understand the working of active components..
4. To introduce the fundamental theory of optical source and detector.
5. To describe the concept of optical communication systems.
6. To explain the working of different optical networks.

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

COs	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
ET402.1	Calculate various parameters of transmission line and waveguide	3	Apply
ET402.2	Explain the working principle of passive components.	2	Understand
ET402.3	Describe the working of microwave tubes and measurement.	2	Understand
ET402.4	Classification of optical source and detector.	4	Analyze
ET402.5	Design of a simple optical communication system.	3	Apply
ET402.6	Compare the working of different optical networks.	4	Analyze

Mapping of course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET402.1	2	2	--	--	--	--	1	--	-	--	--	2	-	2
ET402.2	2	2	--	-	-	-	1	-	-	-	-	1	-	2
ET402.3	2	1	--	-	-	-	2	-	-	-	-	1	-	2
ET402.4	3	2	-	-	-	-	--	-	-	-	-	1	-	2
ET402.5	2	1	-	-	-	-	-	-	-	-	-	1	-	2
ET402.6	3	1	-	-	-	-	-	-	-	-	-	1	-	2

Course Content

Unit No		No. of Hours	CO's
Unit I	**Transmission Lines and Waveguides**	6	ET402.1
	Introduction of electromagnetic spectrum,Review of TEM, TE, and TM mode equations; TEM mode in transmission lines. Waveguides: Rectangular waveguide, Analysis of Rectangular WaveGuide TEM mode lines: Fields in micro-striplines and strip lines, losses in micro strips, micro strip discontinuities, coupled lines, slot lines, coplanar lines and its applications.		
Unit II	**Microwave passive Components**	6	ET402.2
	Waveguide cavity resonators. Construction and Principles of E-plane Tee, H plane Tee, hybrid Tee, Faraday's rotation Principle isolator, circulator, directional couplers,		
Unit III	**Microwave Active Components and Measurements**	6	ET402.3
	Microwave tubes: Limitations of conventional tubes in the microwave frequency ranges. Working principles of Klystron amplifier, Reflex klystron oscillator, Magnetrons, Traveling wave tubes. Introduction of microwave filters. Microwave measurements: fundamentals of power meter, VSWR meter and their principle transmission measurements and reflection measurements. Vector network analyzer		
Unit IV	**Optical Sources and Detectors**	6	ET402.4
	Optical Sources: Absorption and emission of radiation, population inversion and laser oscillation, p-n junction, recombination and diffusion, stimulated emission and lasing, hetero-junctions, single-frequency injection lasers and their characteristics, light emitting diode structures and their characteristics. **Optical Detectors:** Optical detection principles, p-n, p-i-n, and avalanche photodiodes.		
Unit V	**Optical Communication System**	6	ET402.5
	Optical Communication System: System description and design, considerations of an optical fibre communication system, noise in detection process, power budgeting, rise time budgeting, maximum, transmission distance.		
Unit VI	**Optical networks**	6	ET402.6
	Optical networks: WDM concepts and principles, basic networks, SONET/SDH, broadcast-and-select WDM networks, wavelength-routed networks, nonlinear effects on network performance, performance of ,WDM & EDFA systems, Optical CDMA.		

Text Books :

1. S. M. Liao; Microwave devices and Circuits, 3rd Ed.; Prentice Hall of India
2. Collin, R.E., "Foundations for Microwave Engineering", 2nd Ed., John Wiley & Sons
3. Annapurna Das and Sisir K. Das, ―Microwave Engineering", Second edition, Tata McGraw Hill.
4. Microwave circuits & passive devices- Sisodia and Raghuvanshi, New Age International.
5. John Senior, ―Optical Fiber Communication" Prentice Hall of India Publication 4th edition.

6. Gred Keiser, ―Optical Fiber Communication‖, Mc- Graw Hill Publication. 2007
7. Pal B.P, ―Fundamentals of Fibre Optics in Telecommunication and sensor System", New Age International. 2007

Reference Books :

1. D. M. Pozar; Microwave Engineering, 3rd Ed.; John Wiley & Sons Inc
2. M. Kulkarni, ―Microwave and Radar engineering‖, 3rd edition, Umesh Publication
3. Govind P. Agrawal, ―Fiber -Optic Communication Systems‖, Wiley, 3rd edition.
4. Dennis Roody, ―Satellite Communications‖, McGraw Hill

Online Resources :

For Optical Fiber:-Online Resource: https://nptel.ac.in/courses/117101002/

Guidelines for CIA:

Self learning topic

Embedded Systems and RTOS (ET403)

Teaching Scheme
Lectures: 3 Hrs/Week

Credits:3

Examination Scheme
ISE: 30 Marks
ESE: 50 Marks
CIA: 20 Marks
Total: 100 Marks

Prerequisite Course: Microcontroller fundamentals, OS fundamentals, C Programming.

Course Objectives:

1. To consciousness among students towards different embedded applications around them.
2. To understand step by step process of designing embedded systems application using waterfall model.
3. To recognize hardware platforms used for designing embedded system for specified application.
4. To realize design of real time system using µCOS-II RTOS and inspect various designing issues of real time system with respect to specific application.
5. To become competent in design of real time and non real time embedded system application using RTOS and Embedded Linux respectively.
6. To develop skills for implementing application specific embedded systems.

Course Outcomes (COs): After successful completion of the course, students will be able to

CO	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
ET403.1	Know different design aspects of embedded system	2	Understand
ET403.2	Foster step by step design process of embedded systems for specified application using waterfall model.	3	Apply
ET403.3	Utilize capabilities of modern hardware in designing embedded systems	4	Analyse
ET403.4	Explain the structure and working of real-time and non real-time Operating Systems used in embedded system design.	4	Analyse
ET403.5	Apply formal methods of RTOS for the design of real-time systems.	3	Apply
ET403.6	Design embedded systems for different domestic and industrial application by applying waterfall model.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
ET403.1	2	-	-	-	-	-	-	-	-	-	-	-	1	-
ET403.2	2	-	-	-	-	-	-	-	-	-	-	-	3	-
ET403.3	2	-	-	-	2	-	-	-	-	-	-	-	3	-
ET403.4	2	-	-	-	2	-	-	-	-	-	-	-	3	-
ET403.5	2	-	-	-	2	-	-	-	-	-	-	-	3	-
ET403.6	2	-	-	-	3	-	-	-	-	-	-	-	1	-

Course Contents

Unit-I	**Basics of Embedded Systems**	No. of Hours	COs
	Introduction to Embedded Systems, definition, Applications and recent trends, Block diagram, Architecture of embedded system Characteristics, Classification, Design Metrics, Optimization of Design metrics, Key Design challenges, Design constraints, Techno-Economical prospective of embedded system.	07 Hrs.	ET403.1
Unit-II	**Embedded System Development Cycle**	No. of Hours	
	Requirement engineering, requirement Specification, Hardware-Software Partitioning, Hardware-Software co-design, Integration, Testing, Quality Assurance, Aesthetic Design, Maintenance, and Electronics Waste Management. Iterative model, Agile, Kano's model of customer satisfaction.	06 Hrs.	ET403.2
Unit-III	**Embedded System Hardware Design**	No. of Hours	
	Hardware Architecture of embedded System, Sensors, Signal Conditioning circuits, Actuators, device drivers, Microcontrollers/ microprocessors/ reconfigurable hardware, Introduction to advanced microcontrollers, ARM family of microcontroller, Multi core processors & SoC, Open Source prototyping boards(Arduino & Raspberry Pi), Communication mechanisms, Mechanical Assembly & aesthetic design, Specifications & Selection criteria of all components.	05 Hrs.	ET403.3
Unit-IV	**Embedded System Software Design**	No. of Hours	
	Software Architectures of embedded System, Concept and necessity of RTOS, Non Real-time Operating Systems, Introduction to Embedded Linux, Introduction to Vxworks, Embedded Linux architecture, Types of RTOS, µCOS-II :- Features, Architecture, File structure, Concept of Task, Assign static and dynamic priority to the tasks, Multitasking, Clock tick	06 Hrs.	ET403.4
Unit-V	**µCOS-II Real Time Operating System**	No. of Hours	
	Concept and Types of services: - System Services, Task management Services, Time management services, Shared resources/critical section of code, Concept of deadlock, Protection mechanisms, ITC/IPC Services.	06 Hrs.	ET403.5
Unit-VI	**Applications of Embedded System Design**	No. of Hours	
	Digital Camera, Automatic Chocolate vending machine, Mobile Phone/smart phone, Home/farm/industrial automation, Voice operated devices like Alexa, etc.	06 Hrs.	ET403.6

Text Books:

1. Frank Vahid, Tony Givargis, "Embedded System Design: A Unified Hardware/Software Introduction", Wiley- India,(2009) ISBN:- 978-81-265-0837-2.
2. Andrew Sloss, "ARM System Developer's Guide: Designing and Optimizing System Software", Morgan Kaufmann, 2004, ISBN: 978-15-586-0874-0
3. Jean J. Labrosse, "MicroC/OS-II: The Real Time Kernel", CRC Press; 2nd edition, 2002, ISBN: 978-15-782-0103-7
4. Christopher Hallinan, "Embedded Linux Primer: A Practical Real-World Approach", 2nd edition, Prentice Hall; 2 edition, 2010, Pearson Open Source Software Development Series

Reference Books:

1. David E. Simon, “An Embedded Software Primer”, Addison Wesley; 2nd edition, ISBN: 978-02-016-1569-2
2. Raj Kamal, “Embedded Systems: Architecture, Programming and Design”, Tata McGraw-Hill Education (India), 2011.
3. Dr. K. V. K. K. Prasad, “Embedded Real Time Systems: Concepts, Design and Programming”, Dreamtech Press, 2003 ISBN: 978-81-772-2461-0

e- Resources:

1. https://www.micrium.com/rtos/kernels/
2. https://www.arduino.cc/
3. https://www.raspberrypi.org/
4. NPTEL Course on RTOS https://nptel.ac.in/courses/106/105/106105172/
5. NPTEL Course on Embedded system design using ARM https://nptel.ac.in/courses/106/105/106105193/
6. COURSERA course https://www.coursera.org/specializations/real-time-embedded-systems

CIA : CIA evaluation is strictly as per rubrics. Timely submission is highly recommended. CIA is Project Based Learning

Video Processing (ET404A)

Teaching Scheme
Lectures: 3 Hrs. / Week

Credits: 03

Examination Scheme
In-Sem Exam: 30 Marks
End-Sem Exam: 50 Marks
CIA: 20 Marks
Total: 100 Marks

Prerequisite: Digital Signal Processing

Course Objectives:

1. To learn the fundamental concepts of video processing.
2. To study basic video processing operations.
3. To introduce video analysis algorithms.
4. To introduce scope and current applications of video processing.
5. To explore students with video processing techniques.

Course Outcomes (COs): After successful completion of the course, student will be able to

CO	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
ET404A.1	Explain Basics of video Processing	2	Understand
ET404A.2	Use Time-Varying Image Formation Models for video processing applications	3	Apply
ET404A.3	Utilize Three-Dimensional Motion Estimation And Segmentation for video processing applications.	3	Apply
ET404A.4	Demonstrate Stereo And Motion Tracking techniques	3	Apply
ET404A.5	Demonstrate basics of video filtering	2	Understand
ET404A.6	Use video Compression technique.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET404A.1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
ET404A.2	2	1	1	-	2	-	-	-	-	-	-	-	2	-
ET404A.3	2	1	1	-	2	-	-	-	-	-	-	-	2	-
ET404A.4	2	1	1	-	2	-	-	-	-	-	-	-	2	-
ET404A.5	2	-	-	-	-	-	-	-	-	-	-	-	2	-
ET404A.6	2	1	1	-	2	-	-	-	-	-	-	-	-	-

Course Contents

Unit-I	**Basics of video processing**	No. of Hours	COs
	Analog Video , Analog Video Signal, Analog Video Standards, Analog Video Equipment, Digital Video, Digital Video Signal, Digital Video Standards, Digital Video Processing.	6 Hrs.	ET404A.1

Unit-II	**Time-Varying Image Formation Models**	No. of Hours	COs
	Three-Dimensional Motion Models: Rigid Motion in the Cartesian Coordinates, Rigid Motion in the Homogeneous Coordinates, Deformable Motion. **Geometric Image Formation**: Perspective Projection, Orthographic Projection. **Photometric Image Formation:** Lambertian Reflectance Model Photometric Effects of 3-D Motion.	6 Hrs.	ET404A.2
Unit-III	**Three-Dimensional Motion Estimation And Segmentation**	No. of Hours	COs
	Modeling the Projected Displacement Field, Orthographic Displacement Field Model, Perspective Displacement Field Model, Methods Based on the Orthographic Model, Two-Step Iteration Method from Two Views , An Improved Iterative Method , Methods Based on the Perspective Model, The Epipolar Constraint and Essential Parameters , Estimation of the Essential Parameters, Decomposition of the E-Matrix, Algorithm, The Case of 3-D Planar Surfaces, The Pure Parameters, Estimation of the Pure Parameters, Estimation of the Motion and Structure Parameters .	8 Hrs.	ET404A.3
Unit-IV	**Stereo And Motion Tracking**	No. of Hours	COs
	Motion and Structure from Stereo, Still-Frame Stereo Imaging, Feature Matching for Motion Estimation , Stereo-Motion Fusion, Extension to Multiple Motion, Motion Tracking, Basic Principles, 2-D Motion Tracking, 3-D Rigid Motion Tracking.	6 Hrs.	ET404A.4
Unit-V	**Video Filtering**	No. of Hours	COs
	Motion Compensated Filtering, Spatio-Temporal Fourier Spectrum, Global Motion with Constant Velocity, Global Motion with Acceleration, Sub-Nyquist Spatio-Temporal Sampling., Sampling in the Temporal Direction Only., Sampling on a Spatio-Temporal Lattice, Critical Velocities, Filtering Along Motion Trajectories, Arbitrary Motion Trajectories, Global Motion with Constant Velocity, Accelerated Motion, Applications, Motion-Compensated Noise Filtering, Motion-Compensated Reconstruction Filtering.	8 Hrs.	ET404A.5
Unit-VI	**Video Compression**	No. of Hours	COs
	Interframe Compression Methods: Three-Dimensional Waveform Coding, Transform Coding., 3-D Subband Coding, Motion-Compensated Waveform Coding, MC Transform Coding, MC Vector Quantization, MC Subband Coding, Model-Based Coding, Object-Based Coding, Knowledge-Based and Semantic Coding	8 Hrs.	ET404A.6
Text Books:			

1. Yao wang, Joem Ostarmann and Ya – quin Zhang, ”Video processing and communication “,1st edition , PHI
2. S. Murat Tekalp, Digital Video processing, Prentice Hall.

Reference Books:

1. Iain E. G. Richardson, “Video Codec Design,” John Wiley and Sons, 2002.
2. Iain E.G. Richardson, “H.264 and MPEG-4 Video Compression,” John Wiley and Sons, 2003.
3. Al Bovic, “Handbook of Image and Video Processing,” Elsevier, 2005.
4. K.R. Rao and J. J. Hwang ,”Techniques and Standards for Image, Video and Audio Coding,” Prentice Hall,
   Upper Saddle River, New Jersey.
5. Yun Q. Shi and Huifang Sun, “Image and Video Compression for Multimedia Engineering,” CRC Press, 2000.

Online Resources:

1. https://www.sciencedirect.com/topics/engineering/video-processing
2. https://processing.org/tutorials/video
3. https://www.coursera.org/learn/digital

CIA :

10 marks based on students performance in class tests and remaining 10 marks on Self learning / Project based Learning (PBL)/ Programming Assignment

Data Mining (ET404B)

Teaching Scheme
Lectures: 03 Hrs/Week

Credits: 03

Examination Scheme
In-Sem Exams: 30Marks
End-Sem Exam:50 Marks
CIA: 20Marks
Total: 100 Marks

Prerequisite: Statistics

Course Objectives:

1. To Introduce an Artificial Neural Networks used for creating intelligent machines which can process data for solving complex real-world problems.
2. To learn different activation functions, Artificial Neural Networks and their applications.
3. To understand Fuzzy Logic.
4. To learn Fuzzy relation, composition, Fuzzification, Defuzzification and Fuzzy Inference System.
5. To introduce data Mining concepts.
6. To study Data objects, visualization, warehousing concepts and Data Mining applications.

Course Outcomes (COs): After successfully completing the course students will be able to

CO	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
ET404B.1	Explain the Artificial Neural Network	2	Understand
ET404B.2	Interpret the artificial neural network	3	Apply
ET404B.3	Explain what is Fuzzy Logic	2	Understand
ET404B.4	Identify possible solution for automation tasks	2	Understand
ET404B.5	Explain what is Data Mining	2	Understand
ET404B.6	Interpret Data Warehousing and data mining applications	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET404B.1	3	2	-	-	-	-	-	-	-	-	-	-	2	-
ET404B.2	3	2	-	-	-	-	-	-	-	-	-	-	2	-
ET404B.3	3	2	-	-	-	-	-	-	-	-	-	2	3	-
ET404B.4	2	2	3	-	-	-	-	-	-	-	-	2	3	-
ET404B.5	3	3	2	-	-	-	-	-	-	-	-	-	2	-
ET404B.6	2	3	3	-	-	-	-	-	-	-	-	2	2	-

Course Contents

Unit-I	**Fundamentals of Artificial Neural Networks (ANN)**	No. of Hours	COs
	Biological neuron, Artificial neuron model, concept of bias and threshold, McCulloch‐ Pitts Neuron Model, implementation of logical AND, OR, XOR functions, Soft Topologies of neural networks, learning paradigms: supervised, unsupervised, reinforcement, Linear neuron model: concept of error, gradient descent algorithm and application of linear neuron for linear regression.	06Hrs.	ET404B.1
Unit-II	**ANN Learning Rules and their types**	No. of Hours	COs
	Activation functions: Identity function, binary step function, signum function, binary sigmoid (log sigmoid) function, bipolar sigmoid (tan sigmoid) function, Learning mechanisms: Hebb learning rule, Perceptron learning rule for single output neuron and for multiple output neurons, Delta learning rule for single output neuron and for multiple output neurons. Back propagation neural network and its applications. Unsupervised learning networks: Kohonen Self‐organizing Feature Maps.	06Hrs.	ET404B.2
Unit-III	**Fundamentals of Fuzzy Logic**	No. of Hours	COs
	What is Fuzzy Logic?, set theory, classical or crisp sets, operations on classical sets, fuzzy sets, membership function, their types and fuzzy set operations.	06 Hrs.	ET404B.3
Unit-IV	**Fuzzy Inference\ Systems (FIS)**	No. of Hours	Cos
	Classical relations and fuzzy relations, operations on fuzzy relations, properties of fuzzy relations, fuzzy composition, fuzzy equivalence relation, fuzzy tolerance relation, extension principle and fuzzy relation, fuzzification and defuzzification, fuzzy if-then rules, fuzzy inference system, Mamdani model,	07 Hrs.	ET404B.4
Unit-V	**Introduction to Data Mining**	No. of Hours	Cos
	Why Data Mining?, what is data mining, knowledge discovery and data mining, data compression, information retrieval, text mining, web mining, image mining, classification, clustering, rule mining, string matching and major issues in data mining.	07 Hrs.	ET404B.5
Unit-VI	**Data Warehousing and Applications of Data mining**	No. of Hours	Cos
	Data objects and attribute types, basic statistical descriptions of data, data visualization, measuring data similarity and dissimilarity, data prepossessing, data warehousing basic concepts, data mining applications for science, engineering and telecommunication industries.	06 Hrs.	ET404B.6

Text Books:

1. Laurene Fausett, “Fundamentals of Neural Networks: Architectures, Algorithms and Applications”, Pearson Education, Inc, 2008, ISBN: 9788131700532.
2. S. N. Sivanandam and S. N. Deepa, “Principles of Soft Computing”, 2nd Edition, Wiley India Pvt. Ltd.
3. Susmita Mitra and Tinku Acharya, “Data Mining:Multimedia, Soft Computing and Bioinformatics”, Wiley Student Edition.
4. Jiawei Han, Micheline Kambar and Jian Pai, “Data Mining Concepts and Techniques”, 3rd Edition, Morgan

Kaufmann Publishers.

Reference Books:

1. Simon Haykin, “Neural Networks: A Comprehensive Foundation”, 2nd Edition Pearson Education
2. J.-S. R. Jang, C.-T. Sun, E. Mizutani, “Neuro-Fuzzy & Soft Computing”, Pearson India
3. B. Yegnanarayana, “Artificial Neural Networks”, PHI Learning Pvt. Ltd.
4. Margaret H. Dunham, “Data Mining Introductory and Advanced Topics”, Pearson Education
5. N. P. Gopalan and B. Sivaselvan, “Data Mining Techniques and Trends”, PHI
6. Mehmed Kantardzic, “Data Mining Concepts, Models, Methods and Algorithms”, Wiley Interscience

Online Resources :

https://onlinecourses.nptel.ac.in/noc20_cs62/preview
https://cse.iitkgp.ac.in/~pabitra/course/cs698v.html
https://www.coursera.org/specializations/data-mining

CIA : - MCQ Tests and Self Study

Robotics and Automation (ET404C)

Teaching Scheme
Lectures: 03 Hrs. / Week

Credits: 03

Examination Scheme
ISE : 30 Marks
ESE : 50 Marks
CIA : 20 Marks
Total: 100 Marks

Prerequisite Course: Basic knowledge of Sensors and Actuators

Course Objectives:

1. To introduce the basic concepts and principles of robotics
2. To learn about various types of grippers and sensors used in robotics
3. To get an understanding of different types of drives and their controls employed in robotic
4. To know about the basic concepts in industrial automation
5. To know about transfer lines and automated assembly
6. To design automated systems.

Course Outcomes (COs): After successfully completing the course students will be able to:

COs	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
ET404C.1	Classify Robotic systems on the basis of various parameters	2	Understand
ET404C.2	Summarize the characteristics of different types of grippers and sensors employed in Robotic systems	3	Analysis
ET404C.3	Classify different types of drives and associated controllers used in Robotic systems	2	Understand
ET404C.4	Get the concept of Automation process	2	Understand
ET404C.5	Knowledge of industrial automation by transfer lines and automated assembly lines.	3	Apply
ET404C.6	Ability to design an automated system	4	Analysis

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET404C.1	3	-	-	----	---	----	---	----	----	-----	----	…..	1	---
ET404C.2	2	2	-	2	---	----	---	----	----	-----	----	…….	2	---
ET404C.3	2	2	-	----	----	---	----	---	----	----	---	…..	2	---
ET404C.4	3	-	1	----	----	---	----	---	----	----	-----	…..	2	---
ET404C.5	2	-	-	3	----	----	----	----	----	----	----	----	2	---
ET404C.6	2	2	3	2	----	----	----	2	----	----	----	----	2	---

Course Contents

Unit-I	**Basic concepts in robotics**	No.of Hours	COs
	Definition; anatomy of robot, Brief History, basic structure of robot, Specifications and Classification of robot, Three laws, Safety Measures in robotics, Industrial Applications of Robots, Introduction to RPA Bots.	6	ET404C.1
Unit-II	**Robot drivers, Sensors and Vision**	No.of Hours	COs
	Drives for robots: Electric, hydraulic and pneumatic. Sensors: Internal-External, Contact-noncontact, position, velocity, force, torque, proximity and range. Vision: Introduction to techniques, Image acquisition and processing	6	ET404C.2
Unit-III	**End Effectors and Actuators**	No.of Hours	COs
	Different types of grippers-Mechanical, Magnetics, vacuum, Adhesive, Gripper force Analysis &Gripper Design, overview of actuators, Power and torque, Acceleration and velocity Specifications and characteristics of Stepper motors, AC motors, DC motors and servomotors.	6	ET404C.3
Unit-IV	**Introduction to Automation**	No.of Hours	COs
	Introduction: Definition, automation principles and strategies, scope of automation, socio-economic consideration, low-cost automation, basic elements of advanced functions, Information processing in manufacturing industry, Production concepts and automation strategies.	6	ET404C.4
Unit-V	**Transfer Lines and Automated Assembly**	No.of Hours	COs
	General terminology and analysis, analysis of transfer lines without storage, partial automation. Automated flow lines with storage buffers. Automated assembly-design for automated assembly, types of automated assembly systems, part feeding devices, analysis of multi-station assembly machines. AS/RS, RFID system, AGVs, modular fixturing. Flow line balancing.	8	ET404C.5
Unit-VI	**Design For High-Speed Automatic Assembly**	No.of Hours	COs
	Introduction, Design of parts for high-speed feeding and orienting, high speed automatic insertion. Analysis of an assembly. General rules for product design for automation.	6	ET404C.6

Text Books:

1. Introduction to Robotics By S.K.Saha , Tata McGraw Hill
2. Robotics Control ,Sensing ,Vision and Intelligence by K.S. Fu, R.C .Gonzalez, C.S.G.Lee , Tata McGraw Hill

Reference Books:

1. J. Hirchhorn: Kinematics and Dynamics of Machinery, McGraw Hill book co.
2. Robert J. Schilling , Fundamentals of Robotics- Analysis and Control, Prentics Hall india.

3. Robotics Technology and Flexible Automation by S.R.Deb, S. Deb, Tata McGraw Hill
4. Robot Motion and Control (Recent Developments) by M.Thoma& M. Morari

e-Resources:

1. **https://onlinecourses.nptel.ac.in/noc22_me123/preview**
2. **https://onlinecourses.nptel.ac.in/noc19_me74/preview**
3. **https://onlinecourses.nptel.ac.in/noc20_de11/preview**

Guidelines for Continuous Internal Assessment:- CASE Study

(The activity will be CASE Study of specific topic from course and its presentation. The CASE Study activity marks should be given on the basis of standard rubrics).

Open Elective-II (ET405)
The Joy of Computing using Python

Teaching Scheme	**Examination Scheme**
Lectures: 03 Hrs. / Week	CIA : 25 Marks
	End-Sem Exam: 75 Marks
Credits: 03	Total: 100 Marks

Every student has to complete the NPTEL online course on

"The Joy of Computing using Python"

The contents of course are as follows:

- Motivation for Computing
- Welcome to Programming!!
- Variables and Expressions : Design your own calculator
- Loops and Conditionals : Hopscotch once again
- Lists, Tuples and Conditionals : Lets go on a trip
- Abstraction Everywhere : Apps in your phone
- Counting Candies : Crowd to the rescue
- Birthday Paradox : Find your twin
- Google Translate : Speak in any Language
- Currency Converter : Count your foreign trip expenses
- Monte Hall : 3 doors and a twist
- Sorting : Arrange the books
- Searching : Find in seconds
- Substitution Cipher : What's the secret !!
- Sentiment Analysis : Analyse your Facebook data
- 20 questions game : I can read your mind
- Permutations : Jumbled Words
- Spot the similarities : Dobble game
- Count the words : Hundreds, Thousands or Millions.
- Rock, Paper and Scissor : Cheating not allowed !!
- Lie detector : No lies, only TRUTH
- Calculation of the Area : Don't measure.
- Six degrees of separation : Meet your favourites
- Image Processing : Fun with images
- Tic tac toe : Let's play
- Snakes and Ladders : Down the memory lane.
- Recursion : Tower of Hanoi
- Page Rank : How Google Works !!

Open Elective-III (ET406)
Programming Foundation with JavaScript, HTML and CSS

Teaching Scheme	**Examination Scheme**
Lectures: 02 Hrs. / Week	CIA : 20 Marks
	End-Sem Exam: 30 Marks
Credits: 02	Total: 50 Marks

Every student has to complete the COURSERA online course on

"Programming Foundation with JavaScript, HTML and CSS"

The contents of course are as follows:

Designing a Web Page with HTML (Hypertext Markup Language) and CSS (Cascading Style Sheets)

Algorithms and Programming Concepts

JavaScript for Web Pages

Mini Project: Image Filters on the Web

Microwave and Optical Communication Laboratory (ET407)

Teaching Scheme
Practical : 02 Hrs/Week
Credits: 01

Examination Scheme
PR : 50 Marks
Total: 50 Marks

Prerequisite: Electromagnetics Engg. and Communication Engineering

Course Objectives:
1. To introduce the concept of microwave test bench set up.
2. To learn working of active components.
3. To understand the working of passive components.
4. To introduce the fundamental theory of optical source and detector.
5. To describe the concept of optical communication systems.
6. To explain the working of different optical networks.

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

CO	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
ET407.1	Compare various parameters of transmission line and wave guide	2	Understand
ET407.2	Explain the working principle of Active components.	2	Understand
ET407.3	Describe the working of microwave passive components.	2	Understand
ET407.4	Analyze the concept of optical source and detector.	4	Analyze
ET407.5	Apply the knowledge to learn the concept of optical communication system.	3	Apply
ET407.6	Explain the working of different optical networks.	2	Understand

Mapping of course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET407.1	2	2	1	1	-	2	2	-	2	-	-	2	-	2
ET407.2	2	2	1	-	-	2	2	-	2	-	-	2	-	2
ET407.3	2	1	1	-	-	2	2	-	2	-	-	2	-	2
ET407.4	3	1	1	1	-	2	1	-	2	-	-	1	-	2
ET407.5	2	1	1	1	-	-	-	-	2	-	-	1	-	2
ET407.6	3	1	1	1	-	-	-	-	2	-	-	2	-	2

Students should perform a minimum of 8 experiments (04 experiments from each group.)

Sr. No	Name of Experiment	Cos
GROUP A		
1	To measure wavelength of the microwave using a microwave test bench and verify its theoretical value.	ET407.1
2	To measure and plot mode characteristics of the reflex klystron.	ET407.3

3	To measure and verify port characteristics of microwave tees (E, H, E-H or magic planes).	ET407.2
4	To measure and verify port characteristics of directional coupler and calculate coupling factor, insertion loss and directivity.	ET407.2
5	To measure and verify port characteristics of isolator and circulator and calculate insertion loss and isolation in dB.	ET407.2
GROUP B		
6	Plot the characteristics of various sources and detectors.	ET407.4
7	Estimation of Numerical aperture of fiber.	ET407.4
8	Measure attenuation of MMSI and SMSI fiber and comment on the result based on attenuation due to increase in length as well as loss due to bend.	ET407.6
9	Set up a digital link and analyze.	ET407.5
10	Tutorial on power budget and time budget analysis of optical fiber systems.	ET407.5

Embedded Systems and RTOS Laboratory (ET408)

Teaching Scheme
Practical: 02 Hrs./ Week
Credits: 01

Examination Scheme
OR : 50 Marks
Total : 50 Marks

Prerequisite : Microcontroller fundamentals, OS Basics, Embedded C Programming, Sensors.

Course Objectives:

1. To consciousness among students towards different embedded applications used in day to day life.
2. To create awareness about different hardware platforms available for embedded system design along with list of features and selection criteria.
3. To create awareness about different software platforms available for real-time and non-real-time embedded system design along with list of features and selection criteria.

Course Outcomes (COs): After successful completion of the course, students will be able to

CO	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
ET408.1	Acquire a basic knowledge about different hardware tools used for designing embedded system	2	Understand
ET408.2	Acquire a basic knowledge about different software tools used for designing embedded system	2	Understand
ET408.3	Asses embedded Operating System's behaviour for different circumstances.	5	Evaluate
ET408.4	Foster ability to design and implement embedded system as per specifications and need of an application.	6	Create

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET408.1	2	-	-	-	3	-	-	-	-	-	-	-	1	-
ET408.2	2	-	-	-	3	-	-	-	-	-	-	-	1	-
ET408.3	2	-	-	-	3	-	-	-	-	-	-	-	2	-
ET408.4	2	-	-	-	3	-	-	-	-	-	-	-	3	-

Course Contents

Experiment. No	Title	COs
1.	Program Arduino Uno board to perform different operations on GPIO using Arduino IDE tool.	ET408.1 ET408.2
2.	Case study of Temperature control application on Arduino Uno board	ET408.1
3.	Interfacing of Node MCU 8266 with Arduino	ET408.1
4.	Porting of µCOS-II on ARM7 controller.	ET408.1 ET408.2 ET408.3
5.	Simulation of multitasking with µCOS-II on ARM7 microcontroller for three tasks to blink 3 LEDs with 3 different rates.	ET408.2 ET408.3
6.	Observing effect of change in priority and change in delays for simple multitasking application with µCOS-II on ARM7.	ET408.3
7.	Implementation of semaphore service for signalling and synchronization	ET408.3

	application with µCOS-II on ARM7 controller.	
8.	Implementation of mailbox service for Inter task communication with µCOS-II on ARM7 controller.	ET408.3
9.	Implementation of message queue service for Inter task communication with µCOS-II on ARM7 controller.	ET408.3
10.	Porting of Embedded Linux components Boot-loader, Kernel and File System on ARM 9 board.	ET408.1 ET408.2 ET408.3
11.	Writing simple application using Embedded Linux on ARM9 board.	ET408.3
12.	Implementation of a kernel space code for device driver with Embedded Linux.	ET408.3
13.	Case study of designing any simple embedded system.	ET408.4
14.	Implementation of embedded application designed in above experiment	ET408.4

Text Books:

1. Massimo Banzi, "Make Getting Started With Arduino" 3rd edition, 2009, Publisher O'Reilly Media, Inc. ISBN: 9780596155513
2. Jean J. Labrosse, "MicroC/OS-II: The Real Time Kernel", CRC Press; 2nd edition, 2002, ISBN: 978-15-782-0103-7
3. Christopher Hallinan, "Embedded Linux Primer: A Practical Real-World Approach", 2nd edition, Prentice Hall; 2 edition, 2010, Pearson Open Source Software Development Series,

Reference Books:

1. Andrew Sloss, "ARM System Developer's Guide: Designing and Optimizing System Software", Morgan Kaufmann, 2004, ISBN: 978-15-586-0874-0
2. David E. Simon, "An Embedded Software Primer", Addison Wesley; 2nd edition, ISBN: 978-02-016-1569-2
3. Raj Kamal, "Embedded Systems: Architecture, Programming and Design", Tata McGraw-Hill Education (India), 2011.
4. Dr. K. V. K. K. Prasad, "Embedded Real Time Systems: Concepts, Design and Programming", Dreamtech Press, 2003 ISBN: 978-81-772-2461-0

e- Resources:

1. https://www.micrium.com/rtos/kernels/
2. https://www.arduino.cc/
3. https://www.ti.com/lit/ds/symlink/lm35.pdf

Important guidelines

1. Perform any 8 experiments out of given list of experiments
2. Students should prepare the brief document elaborating aim, objectives, apparatus, equipment, theory, observation table, circuit diagram, block diagram, calculations, result, graph, conclusion etc. whichever is applicable.
3. Software Platform to be used:- Experiment 1 & 2 on Arduino IDE, Experiment 3 to 8 on Keil Software, Experiment 8 to 11 on Linux Platform. Experiment 10 &11 will be proposed by student.
4. Hardware Platform to be used:- Experiment 1 & 2 on Arduino Uno Board, Experiment 3 to 8 on ARM 7 development board, Experiment 8 to 11 on ARM9 Prototyping Board. Experiment 10 will be selected by student.
5. **Student should perform at least one experiment on each platform.**
6. Assessment of each experiment is strictly as per rubric defined and communicated with the students in the start of semester.
7. Timely submission of experiment write-up is highly recommended

Project Stage I (ET409)

Teaching Scheme
Practical: 04 Hrs./Week
Credits: 02

Examination Scheme
OR : 50 Marks

Prerequisite:- Technical core knowledge and software skills.

Course Objectives:

1. To understand the Product Development Process including budgeting through Project.
2. To plan for various activities of the project and distribute the work amongst team members.
3. To inculcate electronic hardware or software implementation skills by artwork design, effective trouble-shooting practices, algorithm and model design.

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

CO	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
ET409.1	Recognize the technical aspect and cost-estimation of the project.	1	Remember
ET409.2	Organize engineering problems based on experimental, statistical and computational methods to meet desired needs.	2	Understand
ET409.3	Design and simulate the project by using EDA tools or processes to meet desired needs within realistic constraints.	3	Apply

Mapping of course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET409.1	2	2	2	2	3	2	1	3	2	3	3	3	2	2
ET409.2	2	2	2	2	3	2	1	3	2	2	2	2	2	2
ET409.3	2	2	2	2	3	2	1	3	1	2	2	1	2	2

RULES AND REGULATIONS OF PROJECT:

1. Every student has to undertake project of professional nature and interest at various levels of study. The topic of project may be related to theoretical analysis, an experimental investigation, a prototype design, new concept, analysis of data, fabrication and setup of new equipment etc. The student shall be evaluated for his/her project through the quality of work carried out, the novelty in the concept, the report submitted and presentation(s) etc.

2. The project should be undertaken preferably by group of 3/4 students who will jointly work and implement the project in the two semesters.

3. A student has to carry out project under the guidance of a faculty from the same discipline unless specifically permitted by the Department Monitoring Committees (DMCs)* of the concerned departments in case of interdisciplinary projects or DMC* of the parent department in case of industry sponsored projects.

4. The project is divided into two stages. The first stage shall be carried out in Semester-VII while the second stage shall be carried out in Semester-VIII.

5. The quantum of work expected to be carried out by a student in each stage shall be in accordance with the division of credits given in Project Evaluation Scheme.

6. Students are expected to avoid plagiarism during the project work to secure full credits.

7. All claims should be supported by valid references in the report.

8. The decisions taken by the evaluators and examiners will be final.

9. The dissertation report (Synopsis, Project) is to be submitted in the prescribed format.

10. The Project report must be submitted by the prescribed date usually two weeks before the end of the academic session of the semester.

11. Different domains of the project: The students can choose any domain to work on as a project. The different domains are as follows;

- Communication Engineering,
- Computer/Communication Networking
- WSN and IOT
- Microcontroller based/Embedded systems
- VLSI Technology,
- Power electronics and drives
- Instrumentation,
- Signal Processing
- Agriculture Engineering
- Biomedical Engineering
- Robotics/Mechatronics/Process Automation
- Automotive Electronics
- Artificial Neural Networks/Fuzzy logic
- Artificial Intelligence and machine learning
- Mobile computing
- Data analysis.

12. The project stage-I and Project Stage-II reports should be submitted as per the prescribed format approved by the DMC.

Assessment of Project:-

Semester-VII Project Stage-I					
Sr. No	**Details**	**Evaluation By**	**Evaluation Type**	**Schedule**	**Marks**
1	Synopsis Approval Presentation	DMC	Approved/Not Approved	2nd Week of July	Y/N
2	Demonstration of 15% project Completion (Literature survey and block Diagram)	Project Guide + DMC	SE1 by GA	2nd Week of August	25 Marks (10+15)
3	Demonstration of 35% project Completion (Circuit Diagram, power Supply design, Module Design, Simulation)	DMC	SE2 by GA	3rd Week of September	50 Marks
4	Presentation and demonstration of 50% Project Completion	Panel of Examiners comprising of guide, external examiner and chairman	ESE	2nd week of November	50 marks

DMC- Department Monitoring Committee
GA- Group Activity
SE- Shuffle Examination
ESE-End Sem Examination

Embedded System Design using MSP430 (MC410)

Teaching Scheme
Practical: 02 Hrs/Week

Examination Scheme
Not applicable

Credits: No Credits

Prerequisite: - Knowledge of computer architecture and Embedded C programming

Course Objectives:

1. To learn the use of different software development tools for the MSP430
2. To interface input and output devices with MSP430
3. To interface advanced peripherals with TI's MSP430.

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

CO	CO Statement	Bloom's Descriptor	
		Level	Descriptor
MC410.1	Demonstrate the use of different software development tools for the MSP430	2	Understand
MC410.2	Interface input and output devices with TI's MSP430	3	Apply
MC410.3	Interface the advanced peripherals with TI's MSP430	3	Apply

Mapping of course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs)

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
MC410.1	2	2	-	2	-	-	-	-	-	-	-	-	-	2
MC410.2	2	3	-	-	-	-	-	-	-	-	-	-	-	1
MC410.3	2	1	2	-	-	-	-	-	-	-	-	-	-	2

Course Contents (Minimum 08 Experiments) :

Sr. No.	Title of Experiment	COs
1	Interface LED with MSP430	MC410.2
2	Interface LCD with MSP430 to display name on LCD	MC410.2
3	Interface push buttons and Buzzer with MSP430 such that when 1st button is pressed buzzer is ON and when 2nd button is pressed buzzer is OFF	MC410.2
4	Interface LDR with MSP430 and display the reading on serial window	MC410.2
5	PWM implementation using MSP430	MC410.2
6	Interfacing ultrasonic sensor with MSP430	MC410.2
7	In built ADC interfacing with MSP430	MC410.2
8	Interface GSM module with MSP430	MC410.3
9	Interface GPS module with MSP430	MC410.3
10	Implement the SPI protocol using MSP430	MC410.3
11	Implement the I2C protocol using MSP430	MC410.3

Sanjivani Rural Education Society's

Sanjivani College of Engineering, Kopargaon

(An Autonomous Institute Affiliated to Savitribai Phule Pune University, Pune)

B. Tech. Electronics and Telecommunication Engineering

2019 pattern

Program Structure

(B. Tech. with effect from Academic Year 2019-2020)

(Final Year B. Tech. Sem-VIII w.e..f. 2022-2023)

At. Sahajanandnagar, Post. Shingnapur Tal. Kopargaon Dist. Ahmednagar,

Maharashtra State, India PIN 423603

Sanjivani Rural Education Society's

Sanjivani College of Engineering, Kopargaon

(An Autonomous Institute Affiliated to Savitribai Phule Pune University, Pune)

DECLARATION

We, the Board of Studies in Electronics and Telecommunication Engineering, hereby declare that, We have designed the Curriculum up to Final Year. B. Tech. Semester-VIII of 2019 Pattern w.e.f A.Y 2022-2023 as per the guidelines. This document also contains the proposed structure Electronics and Telecommunication Engineering. So, we are pleased to submit and publish this FINAL copy of the curriculum for the information of all the concerned stakeholders.

Recommended by

(Dr. B. S. Agarkar)
Chairman
BoS Electronics and Telecommunication Engineering

Approved by

(Dr. A. G. Thakur)
Chairman
Academic Council
SRES Sanjivani College of Engineering, Kopargaon

Vision of the Institute

To Develop World Class Professionals through Quality Education.

Mission of the Institute

To create Academic Excellence in the field of Engineering and Management through Education, Training and Research to improve quality of life of people.

Vision of the Department

Our vision is to produce quality professionals in the field of Electronics & Telecommunication Engineering with knowledge and skillsets to meet diversifying needs of industry and society.

Mission of the Department

M1- To impart the technology of Electronics and Telecommunication Engineering through an effective teaching-learning process.
M2- To establish linkages between industry and academia for overall development of students.
M3- To promote innovative ideas in solving multi-disciplinary engineering problems having social relevance.
M4- To develop technical human resources exhibiting professional and ethical attitudes.

Program Educational Objectives (PEOs)

PEO1: Involve in design, manufacturing, integration and testing of products, software and systems in the field of Electronics & Computer engineering and allied disciplines.

PEO2: Solve engineering problems having social relevance by applying knowledge and skill sets related to Electronics and Computer engineering.

PEO3: Pursue higher Education/Research in the field of Engineering/Management or become a successful entrepreneur in the related areas.

PEO4: Work effectively as an individual and/or a team member of multi-disciplinary assignments involving people across different cultures and national boundaries.

Program Outcomes (POs)

Engineering Graduates will be able to:

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

11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

PSO1: Design, test and implement electronic systems and appliances related to signal processing, embedded systems, industrial automation and IoT using the state of the art components and software.

PSO2: Architect, classify and select appropriate technologies for the implementation of wired and wireless communication systems.

List of Abbreviations			
Abbreviation	**Full Form**	**Abbreviation**	**Full Form**
BSC	Basic Science Course	OEC	Open Elective Course
CIA	Continuous Internal Assessment	OR	End-Semester Oral Examination
EFC	Engineering Foundation Course	P	Practical
ESE	End-Semester Evaluation	PCC	Professional Core Course
HSMC	Humanities/Social Sciences/Management Course	PEC	Professional Elective Course
IP	Induction Program	PR	End-Semester Practical Examination
ISE	In-Semester Evaluation	PROJ	Project
L	Lecture	T	Tutorial
MLC	Mandatory Learning Course	TW	Continuous Term Work Evaluation

Final Year B. TECH. 2019 Pattern (Electronics and Telecommunication Engineering) SEMESTER-VII

Course			Teaching Scheme (Hours/week)				Evaluation Scheme/Max Marks						
							Theory						
Cat	Code	Title	L	T	P	Credits	CIA	ISE	ESE	OR	PR	TW	Total
PROJ	ET401	Professional Internship-III	-	-	-	2	-	-	-	50	-	-	50
PCC	ET402	Microwave and Optical Communication	3	-	-	3	20	30	50	-			100
PCC	ET403	Embedded Systems and RTOS	3	-	-	3	20	30	50	-	-	-	100
PEC	ET404	Refer List of PEC3	3	-	-	3	20	30	50	-	-	-	100
OEC	ET405	OE-II: The Joy of Computing using Python	3	-	-	3	25	-	75	-	-	-	100
OEC	ET406	OE-III: Online Course Through MOOCs	2	-	-	2	20	-	30	-	-	-	50
LC	ET407	Microwave and Optical Communication Laboratory	-	-	2	1	-	-	-	-	50	-	50
LC	ET408	Embedded Systems and RTOS Laboratory	-	-	2	1	-	-	-	50		-	50
PROJ	ET409	Project Stage I	-	-	4	2				50	-	-	50
MC	MC410	Mandatory Course-VII	-	-	2	No	-	-	-	-	-	-	-
		Total	**14**	**-**	**10**	**20**	**105**	**90**	**255**	**150**	**50**	**-**	**650**

MC410	**Mandatory Course-VII**	**Embedded System Design using MSP430**

SEMESTER-VIII

Course			Teaching Scheme (Hours/week)				Evaluation Scheme/Max Marks						
							Theory						
Cat	Code	Title	L	T	P	Credits	CIA	ISE	ESE	OR	PR	TW	Total
PCC	ET411	VLSI Design Technology	3	-	-	3	20	30	50	-	-	-	100
PCC	ET412	Mobile Communication	3	-	-	3	20	30	50	-	-	-	100
PCC	ET413	Computer Networks & Security	3	-	-	3	20	30	50	-	-	-	100
PEC	ET414	Refer List of PEC4	3	-	-	3	20	30	50	-	-	-	100
LC	ET415	VLSI Design Technology Laboratory	-	-	2	1	-	-	-	-	50	-	50
LC	ET416	Mobile Communication Laboratory	-	-	2	1	-	-	-	50	-		50
PROJ	ET417	Project Stage II	-	-	8	4	-	-	-	50	-	100	150
MC	MC418	Mandatory Course-VIII	1	-	-	No	-	-	-	-	-	-	-
		Total	**13**	**-**	**12**	**18**	**80**	**120**	**200**	**100**	**50**	**100**	**650**

MC418	**Mandatory Course-VIII**	**Role of Electronics in Biomedical Engineering**

Professional Elective Course 3 (PEC3):
ET404A Video Processing
ET404B Data Mining
ET404C Robotics & Automation

Professional Elective Course 4 (PEC4):-
ET414A Audio and Speech Processing
ET414B Data Analytic
ET414C Automotive Electronics

Total Credits: 38 **Total Marks: 1300**

VLSI Design Technology (ET411)

Teaching Scheme
Lectures: 03 Hrs. / Week

Credits: 03

Examination Scheme
ISE : 30 Marks
ESE : 50 Marks
CIA : 20 Marks
Total: 100 Marks

Prerequisite Course : Digital Systems

Course Objectives:

1. To explore HDL and related FSM design approach.
2. To understand PLD architectures with advanced features.
3. To nurture students with CMOS circuit designs
4. To realize importance of testability in logic circuit design

Course Outcomes (COs): After completion of course students will able to

COs	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
ET411.1	Explain the language constructs	2	Understand
ET411.2	Write HDL coding for digital design	3	Apply
ET411.3	Apply knowledge of HDL in FSM design	3	Apply
ET411.4	Model digital circuit with HDL, simulate, synthesis and prototype in PLDs.	3	Apply
ET411.5	Design CMOS circuits for specified applications	3	Apply
ET411.6	Get the knowledge of testability in design and build self-test circuit	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET411.1	1	-	-	-	3	-	-	-	-	-	-	2	1	3
ET411.2	1	2	2	-	3	-	-	-	-	-	-	2	1	3
ET411.3	2	-	-	-	-	-	-	-	-	-	-	2	1	3
ET411.4	2	2	2	-	2	-	-	-	-	-	-	2	1	3
ET411.5	2	-	-	-	-	-	-	-	-	-	-	2	1	3
ET411.6	2	-	-	-	-	-	-	-	-	-	-	2	1	3

Course Contents

Unit-I	**Introduction to VHDL**	No. of Hours	COs
	Introduction to HDL, Comparison of HDL with other language, Fundamental VHDL units: Library, Entity, architecture, Language constructs, Data objects, Data types, Signals and variables, Operators in VHDL, Types of modeling : Behavioral, Data-flow, Structural, Sequential statements, Concurrent statements	06	ET411.1
Unit-II	**VHDL coding**	No. of Hours	COs
	Packages, Sub programs, Attributes, HDL modeling of Combinational, Sequential circuits, VHDL code using packages, subprograms, attributes.	06.	ET411.2
Unit-III	**FSM Design**	No. of Hours	COs
	Sequential synchronous machine design, Moore and Mealy machines, HDL code for Machines, FIFO.	06	ET411.3
Unit-IV	**PLD Architectures and ASIC**	No. of Hours	COs
	Design Flow. CPLD Architecture, Features, Specifications, Applications. FPGA Architecture, Features, Specifications, Applications. The Simulation and Synthesis Tools, FPGA synthesis and implementation. ASIC design flow.	06	ET411.4
Unit-V	**Digital CMOS circuits**	No. of Hours	COs
	N-MOS, P-MOS and CMOS, MOSFET parasitic, Technology scaling, Channel length modulation, Hot electron effect, Velocity saturation, CMOS Inverter, Device sizing, CMOS combinational logic design, CMOS Fabrication, Power dissipations, Power delay product, Body Effect, Rise and fall times, Latch Up effect, transmission gates.	06 .	ET411.5
Unit-VI	**VLSI Testing**	No. of Hours	COs
	Types of fault, Need of Design for Testability (DFT), DFT Guideline, Testability, Fault models, Path sensitizing, Test pattern generation, Sequential circuit test, Built-in Self-Test, JTAG & Boundary scan, TAP Controller.	06	ET411.6

Text Books:

1. Jayaram Bhasker, “A VHDL Primer”, McGraw Hill Education India
2. Brown, Vranesic, “Fundamentals of digital logic design with VHDL”, McGraw Hill.

Reference Books:

1. E. Weste, David Money Harris, “CMOS VLSI Design: A Circuit & System Perspective”, Pearson Publication. 2017
2. R. Jacob Baker, “CMOS Circuit Design, Layout, and Simulation”, 3E, Wiley-IEEE Press

3. CemUnsalan, Bora Tar, “Digital System Design with FPGA: Implementation Using Verilog and VHDL” , McGraw-Hill
4. Charles H. Roth, “Digital systems design using VHDL”, PWS.
5. Steve Kilts “Advanced FPGA Design Architecture, Implementation and Optimization”, Wiley.

e-Resources:

1. https://nptel.ac.in/courses/106105161
2. https://nptel.ac.in/courses/117106092

Guidelines for Continuous Internal Assessment:-

Activity in a group of 4 students will be conducted.
(The activity will contain writing the VHDL code other than a practical list or collecting the information on other HDL programming languages or Details of other tools used in VLSI design).

Mobile Communication (ET 412)

Teaching Scheme
Lectures: 3 Hrs/Week

Credits:3

Examination Scheme
ISE: 30 Marks
ESE :50 Marks
CIA: 20 Marks
Total: 100 Marks

Prerequisite Course: Analog and digital Communication Engineering

Course Objective:-

1. To nurture students about the concepts of different generations.
2. To realize the importance of propagation mechanisms and different modeling.
3. To realize importance of cellular concepts
4. To understand the architecture of the GSM system.
5. To understand the importance of the CDMA system.
6. To overview 4G LTE and 5G technologies

Course Outcomes (COs): After completion of course students will able to

COs	Course Statement	Bloom's Taxonomy	
		Level	Descriptor
ET 412.1	Explore the different generations of Mobile	4	Analyze
ET 412.2	Apply the concepts propagation to design different models of the networks	3	Apply
ET 412.3	Analyze radio channel and cellular capacity.	4	Analyze
ET 412.4	Explore the architecture of GSM	4	Analyze
ET 412.5	Explain and apply the concept of CDMA	2	Understand
ET 412.6	Differentiate thoroughly the generations of mobile technologies.	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET412.1	2	-	-	-	-	-	1	-	-	-	-	1	-	1
ET412.2	2	2	-	-	-	-	1	-	-	-	-	1	-	2
ET412.3	2	2	-	-	-	2	2	-	-	-	-	1	-	2
ET412.4	2	-	-	-	-	2	2	-	-	-	-	1	-	2
ET412.5	2	-	-	-	-	2	2	-	-	-	-	1	-	2
ET412.6	2	-	-	-	-	-	-	-	-	-	-	1	-	2

Course Contents

Unit No		No. of Hours	CO's
Unit I	**Introduction to mobile Communication**		
	Introduction to wireless communication systems: Evolution of mobile radio communication, Examples of wireless communication system, Requirements for the services and economic and social aspects, Modern wireless communication system: Introduction of First Generation 1G, Second Generation 2G, Third Generation 3G and Fourth generation 4G. Comparison of 1G to 4G, Road map of 5G.	6 Hrs	ET 412.1
Unit II	**Mobile radio propagation and fading**	6 Hrs	ET 412.2
	Introduction to Radio Wave Propagation, Free Space Propagation Model, The Three Basic Propagation Mechanisms, Reflection, Ground Reflection (Two Ray) Model, Diffraction, Scattering, small scale fading and large scale fading, Indoor and outdoor models.		
Unit III	**Cellular concepts**	6 Hrs	ET 412.3
	Cell, Small cell, Pico cell,Cell geometry, Concept of Frequency Reuse, Co-Channel and adjacent channel Interference, Co-Channel Interference Reduction Factor, Desired C/I from a Normal Case in Omni, Directional Antenna System, System Capacity Improving Coverage and Capacity in Cellular Systems- Cell Splitting, Sectoring, Microcell Zone Concept.		
Unit IV	**Global System for Mobile Communication (GSM)**		
	Introduction, Architecture of GSM, GSM Services and Features, GSM Radio Subsystem, Data Transmission of GPRS Radio System,GSM Channel Types, Example of a GSM Call, Frame Structure for GSM. GSM time hierarchy, Security in GSM. Handover mechanism in GSM.	6 Hrs	ET 412.4
Unit V	**Spread Spectrum techniques & CDMA**		
	Advantages of SS, Process Gain, Jam Margin, J/S ratio, Multipath Fading and its avoidance, PN Sequences, Techniques: Direct Sequence (DSSS) & Frequency Hopping (FHSS), The Near Far Problem ,DS-CDMA & FH-SS CDMA. CDMA Digital Cellular Standard (IS-95): Frequency and Channel Specifications, Forward CDMA Channel, Reverse CDMA Channel, MIMO,Massive MIMO.	6Hrs	ET 412.5
Unit VI	**Evolution of Mobile Technologies**		

	Evolution of Mobile Generation and its comparison (GSM & CDMA) Overview of LTE: LTE basics, LTE frame structure, LTE Design parameters with Standardization and Architecture of LTE. Overview of 5 G Networks : Comparison of 4G and 5G technology, Opportunities and requirements in 5G network, Open Wireless Architecture of 5G network and Disruptive technologies for 5G.	6 Hrs	ET 412.6

Books:

Text Books

1. Theodore Rappaport, ―Wireless Communications Principles and Practice, Second Edition, Pearson Education
2. Krzysztof Wesolowski, "Mobile Communication Systems," Wiley Publication

Reference Books

1. Fei Hu, ―Opportunities in 5G Networks : A research& development perspective, CRC Press
2. Vijay K garg, Joseph E Wilkes, "Principle and Application of GSM" Pearson Education
3. Vijay K garg, Joseph E Wilkes, "IS-95 CDMA and CDMA 2000 Cellular/PCS system implementation" Pearson Education.
4. Aditya Jagannatham, Principles of Modern Wireless Communication Systems.

Online Resources

1. Online Resource: https://nptel.ac.in/courses/117104115/

Guideline for continuous Assessment

Self learning: extempore of technical topic

Computer Networks and Security (ET413)

Teaching Scheme
Lectures: 3 Hrs. / Week

Examination Scheme
ISE: 30 Marks
ESE: 50 Marks
CIA: 20 Marks
Total: 100 Marks

Credits : 3

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Prerequisite Course: Digital Electronics

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Course Objectives:

1. To understand state-of-the-art in network protocols, architectures, and applications
2. To provide students with a theoretical and practical base in computer networks issues
3. To outline the basic network configurations
4. To understand security issues involved in LAN and Internet.
5. To recognize the individual components of computer networks

Course Outcomes (COs):

After successful completion of the course students should be able to:

COs	CO Statement	**Bloom's Taxonomy**	
		Level	**Descriptor**
ET413.1	Explain fundamentals underlying principles of computer networking.	2	Understand
ET413.2	Demonstrate Data Link layer services, flow control and error control.	3	Apply
ET413.3	Demonstrate Network layer services and different routing algorithm.	3	Apply
ET413.4	Explore the transport layer services and data flow control with its characteristics	3	Apply
ET413.5	Ensure basic knowledge of installing and configuring networking applications with network management.	4	Analyze
ET413.6	Describe basic knowledge of the use of cryptography and network security.	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET413.1	2	2	1	-	-	-	-	-	-	-	-	3	1	1
ET413.2	3	3	2	1	1	-	-	-	-	-	-	1	1	2
ET413.3	3	3	2	1	1	-	-	-	-	-	-	1	1	2
ET413.4	3	3	2	1	1	-	-	-	-	-	-	1	1	2
ET413.5	2	3	3	2	3	-	-	-	-	-	-	1	1	2
ET413.6	2	2	1	1	3	-	-	-	-	2	-	3	1	2

Course Contents

Unit-I	**Physical Layer**	No. of Hours	**Cos**
	Data Communications, Networks, Network types, Protocol layering, TCP / IP protocol suite, Addressing, OSI model, OSI Vs. TCP/IP, Guided and Unguided Transmission media. Switching: Circuit switched networks, Packet Switching.	6	ET413.1
Unit-II	**Data Link Layer**	No. of Hours	**Cos**
	Introduction to Data link Layer, DLC Services, DLL protocols, HDLC, PPP, Media Access Control: Random Access, Controlled Access, Channelization. Wired LAN: Ethernet Protocol, Standard Ethernet, Fast Ethernet (100 Mbps), Gigabit Ethernet, 10 Gigabit Ethernet. Wireless LAN : Introduction, IEEE 802.11 Project, Bluetooth	7	ET4131.2
Unit-III	**Network Layer**	No. of Hours	**Cos**
	Introduction to Network Layer: Network-Layer Services, Network-Layer Performance, IPv4 addresses, Forwarding of IP Packets, Network Layer Protocols: Internet Protocol (IP), ICMPv4, Unicast and Multicast Routing: Introduction, Routing Algorithms, Unicast Routing Protocols, Introduction, Multicasting Basics, Intra-domain Multicast Protocols, Inter-domain Multicast Protocols, IGMP. Next Generation IP: IPv6 Addressing, Ipv6 Protocol, T ICMPv6 Protocol, Transition from IPv4 toIPv6.	6	ET413.3
Unit-IV	**Transport Layer**	No. of Hours	
	Introduction, Transport layer protocols and services, Port numbers, User Datagram Protocol (UDP), Transmission Control protocol (TCP), SCTP, Quality of services: Dataflow characteristics, Flow Control.	5	ET413.4
Unit-V	**Application Layer**	No. of Hours	**Cos**
	Introduction to Application Layer, Standard Client Server Protocols: World Wide Web and HTTP, FTP, Electronic Mail, Telenet, SSH, Domain Name System (DNS).Network Management: Introduction, SNMP.	5	ET413.5
Unit-VI	**Network Security**	No. of Hours	**Cos**
	Cryptography and Network Security: Introduction, Symmetric key ciphers and Asymmetric key Ciphers, Confidentiality, Other Aspects	6	ET413.6

	of Security. Internet Security: Network-Layer Security, Transport-Layer Security, Application-Layer Security, Firewalls. Virtual Private Network (VPN)		

Books:

Text Books:

1. Behrouz A. Forouzan, “Data Communications and Networking”,MacGraw Hill, 5th edition.
2. S.Keshav,“An Engineering approach to computer Networking”, Pearson Education

Reference Books:

1. Andrew S. Tannenbaum, Computer Networks, Pearson Education, Fourth Edition,2003
2. Wayne Tomasi, Introduction to Data Communication and Networking, 1st edition, Pearson Education
3. Natalia Olifer, Victor Olifer, Computer Networks‖ Wiley Student Edition
4. James F. Kurouse & W. Rouse, ―Computer Networking: A Top down Approach, 6th Edition Pearson Education

e-Resources: **https://cag.gov.in/uploads/media/Network-20210426203825.ppt**
https://www.computernetworkingnotes.com/

Guidelines for Continuous Assessment:-
Unit test, MCQ Test, Home assignments, Self-Learning Presentation activity

PEC4. Audio and Speech Processing (ET414A)

Teaching Scheme
Lectures: 3 Hrs. / Week

Examination Scheme
ISE: 30 Marks
ESE: 50 Marks
CIA: 20 Marks
Total: 100 Marks

Credits: 3

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Prerequisite Course: Digital signal processing

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Course Objectives:

1. To familiarize the basic mechanism of speech production and speech analysis.
2. To learn the mechanism of speech and audio perception.
3. To know the behavior of speech and audio signal in time and frequency domain.
4. To extract the information of the speech or audio signals in terms of features.
5. To introduce student's with large vocabulary continuous speech recognition.
6. To provide a foundation for developing applications in this field.

Course Outcomes (COs): After successful completion of the course, student will be able to

COs	CO statement	Bloom's Taxonomy	
		Level	Descriptor
ET414A.1	Explain fundamentals of speech processing.	**2**	**Understand**
ET414A.2	Describe the properties of acoustic signals and human hearing.	**2**	**Understand**
ET414A.3	Explain audio processing in time and frequency domain.	**2**	**Understand**
ET414A.4	Demonstrate speech signal and use it for development of interactive voice response systems.	**3**	**Apply**
ET414A.5	Develop a reliable isolated speech recognition system for a limited vocabulary.	**6**	**Create**
ET414A.6	Use Speech and audio processing applications.	**3**	**Apply**

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET414A.1	2	2	1	-	-	-	-	-	-	-	-	3	2	1
ET414A.2	3	3	2	1	1	-	-	-	-	-	-	1	2	3
ET414A.3	3	3	2	1	1	-	-	-	-	-	-	1	2	3
ET414A.4	3	3	2	1	1	-	-	-	-	-	-	1	2	3
ET414A.5	3	3	3	2	3	-	-	-	-	-	-	1	2	3
ET414A.6	2	2	1	1	3	-	-	-	-	2	-	-	3	3

Course Contents

Unit-I	**Fundamentals of speech**	No. of Hours	COs
	Anatomy and physiology of speech production, Human speech production mechanism, LTI model for speech production, Nature of speech signal, linear time varying model, articulatory phonetics, acoustic phonetics, Voiced and Unvoiced speech. Review of Digital Signal Processing concepts; Short-Time Fourier Transform, Filter-Bank and LPC Methods.	8	ET414A.1
Unit-II	**Human auditory system**	No. of Hours	COs
	Human auditory system, simplified model of cochlea. Sound pressure level and loudness. Sound intensity and Decibel sound levels. Concept of critical band and introduction to auditory system as a filter bank, uniform, non-uniform filter bank, mel scale and bark scale. Speech perception: vowel perception. Linear Separable equivalent circuit model, Vocal Tract and Vocal Cord Model.	8	ET414A.2
Unit-III	**Audio processing in time and frequency domain**	No. of Hours	COs
	Time-dependent speech processing. Short-time energy, short time average magnitude, Short time average zero crossing rate. Speech Vs. silence discrimination using energy and zero crossing rate. Short-time autocorrelation function, short-time average magnitude difference function. Pitch period estimation using autocorrelation method. Audio feature extraction, Spectral centroid, spectral spread, spectral entropy, spectral flux, spectral roll-off. Spectrogram: narrow band and wide band spectrogram.	8	ET414A.3
Unit-IV	**Feature Extraction and Pattern Comparison**	No. of Hours	COs
	Features, Feature Extraction and Pattern Comparison Techniques: Speech distortion measures – mathematical and perceptual – Log Spectral Distance, Cepstral Distances, Weighted Cepstral Distances and Filtering, Likelihood Distortions, Spectral Distortion using a Warped Frequency Scale, LPC, PLP and MFCC Coefficients, Time Alignment and Normalization – Dynamic Time Warping, Multiple Time – Alignment Paths.	8	ET414A.4
Unit-V	**Speech Recognition**	No. of Hours	COs
	Large Vocabulary Continuous Speech Recognition: Architecture of a large vocabulary continuous speech recognition system – acoustics and language models – ngrams, context dependent sub-word units; Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-estimation, Implementation issues ,Applications and present status.	8	ET414A.5

Unit-VI	**Speech and audio processing applications**	No. of Hours	COs
	Speech recognition: complete system for an isolated word recognition with vector quantization /DTW. Speaker recognition: Complete system for speaker identification, verification. Introduction to speech enhancement, Speech enhancement using spectral subtraction method, Introduction to Text to speech conversion, Introduction to Musical instrument classification, Musical Information retrieval.	6	ET414A.6

Books:

Text Books:

1. Shaila D. Apte, Speech and audio processing, 2nd Edition, Wiley India
2. Lawrence Rabinerand Biing-Hwang Juang, "Fundamentals of Speech Recognition", Pearson Education, 2003.
3. Rabiner and Juang, "Fundamentals of Speech Recognition", Pearson Education.

Reference Books:

1. Bali & bali, Audio Video Systems, Khanna Publishing House
2. L. R. Rabiner and S.W. Schafer, "Digital processing of speech signals" Pearson Education.
3. Thomas F. Quateri , "Discrete-Time Speech Signal Processing: Principles and Practice" Pearson
4. Deller J. R. Proakis J. G. and Hanson J. H., "Discrete Time Processing of Speech Signals", Wiley Interscience.
5. Ben Gold and Nelson Morgan, "Speech and audio signal processing" Wiley

e-Resources: **https://appen.com/blog/an-introduction-to-audio-speech-and-language-processing/**
https://signalprocessingsociety.org/publications-resources/ieeeacm-transactions-audio-speech-and-language-processing

Guidelines for Continuous Assessment:-
Unit Test, Home Assignments, Self-Learning Presentation etc.

Data Analytics (ET414B)

Teaching Scheme
Lectures: 03 Hrs. / Week

Credits: 03

Examination Scheme
ISE: 30 Marks
ESE: 50 Marks
CIA: 20 Marks
Total: 100 Marks

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Prerequisite Course: Python Programming

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Course Objectives:

1. To learn different types of data and its visualization
2. To understand computational statistics in Data Analytics
3. To get acquainted with data visualization techniques for exploratory analysis
4. To learn different linear regression methods used in machine learning
5. To learn different Classification models used in machine learning
6. To get familiar with data visualization tools and libraries

Course Outcomes (COs): After successful completion of the course, student will be able to

COs	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
ET414B.1	Apply different data visualization techniques to analyze the data	3	Apply
ET414B.2	Apply appropriate statistical measure for data analytics applications	3	Apply
ET414B.3	Apply appropriate data exploration techniques on data	3	Apply
ET414B.4	Analyze regression data analytical methods for real life problems.	4	Analyze
ET414B.5	Apply appropriate machine learning algorithms for classification & clustering	3	Apply
ET414B.6	Analyze appropriate data analytics library and tools for real life problems	4	Analyze

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET414B.1	2	--	1	--	--	--	--	--	--	--	--	2	-	1
ET414B.2	1	2	2	--	3	--	--	--	--	--	--	1	-	2
ET414B.3	1	--	2	--	1	--	--	--	--	--	--	1	-	2
ET414B.4	1	2	2	--	2	--	--	--	--	--	--	2	-	3
ET414B.5	2	2	2	--	3	--	--	--	--	--	--	2	-	2
ET414B.6	1	2	3	--	2	--	--	--	--	--	--	1	-	3

Course Contents

Unit-I	**Data Analysis & Visualization**	No. of Hours	COs
	Introduction:Data,Types of Data: Structured vs. Unstructured Data, Quantitative vs. Categorical Data. **Data Gathering and Data Discovery**:Identifying potential data sources, Gathering data, Data discovery- understanding the data, assessing data, data formats. **Visualization**: Introduction to data visualization, challenges of data visualization, Data visualization using Basic Charts and Plots Life cycle of data analytics project, Role of Data Analyst	06	ET414B.1
Unit-II	**Statistics for Data Analysis**	No. of Hours	COs
	Introduction: Types of Statistical Inference, Descriptive Statistics, Inferential Statistics, Need of statistics in Data Analytics **Measures of Central Tendency:** Mean, Median, Mode, Mid-range. **Measures of Dispersion**: Range, Variance, Mean Deviation, Standard Deviation. Basics and need of hypothesis and hypothesis testing, Pearson Correlation, Chi-Square Tests, t-test,ANOVA	06 .	ET414B.2
Unit-III	**Exploratory Data Analysis**	No. of Hours	COs
	Data Preprocessing: Removing Duplicates,outlier treatment,missing value imputation,Feature Extraction & Transformation. Scaling of Data. **Measures of relationshIp & skewness**:Covariance,Pearson's and Spearman's Rank Correlation. Identify skewness of data distribution. binomial and normal distribution, uniform distribution,exponential distribution **Measures of Position**: Percentile, Z-score, Quartiles Data Exploration through Summary Statistics, Dimensionality reduction,Curse of dimensionality.	06.	ET414B.3
Unit-IV	**Regression Models**	No. of Hours	COs
	Regression: Simple Linear Regression, Multiple Linear Regression, Non-linear Regression, Model Evaluation in Regression Models, Evaluation Metrics in Regression Models Optimizing Simple Linear Regression with Gradient Descent Algorithm. Performance enhancement with Regularization techniques.	6 Hrs.	ET414B.4
Unit-V	**Classification Models**	No. of Hours	COs

	Classification: K-Nearest Neighbour, Decision Trees, Logistic Regression, Support Vector Machines, Logistic regression vs Linear regression, Evaluation Metrics in Classification Ensemble methods: Bagging and Boosting	06	ET414B.5
Unit-VI	**Libraries and Tools for Data Preparation and Visualization**	No. of Hours	COs
	Python visualization libraries: matplotlib, pandas, seaborn, ggplot, plotly Introduction to Data Visualization Tool: **Microsoft Power BI** Web scraping, Data from social networks, Open-source tools for data preparation. Industry challenges and applications of analytics.	06.	ET414B.6

Text Books:

1.Salvador García, Julián Luengo, Francisco Herrera, "Data Preprocessing in Data Mining" ,Springer International Publishing,2016.
2.Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education.
3. S.P. Gupta, Statistical Methods, Sultan Chand and Sons, New Delhi, 2009
4. Douglas Montgomery, Elizabeth A. Peck, and G. Geoffrey Vining, "Introduction to Linear Regression Analysis", 5th edition, Wiley publication.
5. Maheshwari Anil, Rakshit, Acharya, "Data Analytics", McGraw Hills.

Reference Books:

1.Wes McKinney, "Python for Data Analysis" O' Reilly media.
2.Kevin P Murphy: Machine Learning – A Probabilistic Perspective, MIT Press, August 2012.
3.Stephen Marsland, Machine Learning An Algorithmic Perspective, CRC Press.
4.Douglas C. Montgomery, George C. Runger ," Applied Statistics & Probability for Engineering. ",John Wiley & Sons, Inc
5.Glenn J. Myatt, "Making Sense of Data I: A Practical Guide to Exploratory Data Analysis and Data Mining",Wiley–Blackwell

e-Resources:

https://onlinecourses.nptel.ac.in/noc23_cs08/course

Guidelines for Continuous Assessment:-

Activity in a group of 4 students will be conducted.

(As a part of activity students will be given dataset(csv file) from online platforms like kaggle and they are expected to get insights from the data and plot the same using python libraries and Data Visualisation tool Power BI)

Automotive Electronics (ET414C)

Teaching Scheme
Lectures: 3 Hrs. / Week

Credits: 3

Examination Scheme
ISE: 30 Marks
ESE: 50 Marks
CIA: 20 Marks
Total: 100 Marks

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Prerequisite Course: Nil

Course Objectives :

1. To realize the concepts of Automotive Electronics and it's evolution and trends in Automotive systems & subsystems overview.
2. To investigate sensors and sensor monitoring mechanisms aligned to automotive systems, different signal conditioning techniques, interfacing techniques and actuator mechanisms.
4. To study various automotive control systems using Model based development technique.
5. Study of controllers in ECU {Engine control unit}design and choice of appropriate Hardware,various communication systems, wired and wireless protocols used in vehicle networking.
6. To realize Safety standards, advances in towards autonomous vehicles,on board and off board.

Course Outcomes (COs):

After successfully completing the course students will be able to:

COs	**Statement**	Bloom's Taxonomy	
		Level	Descriptor
ET414C.1	Defining automotive components, subsystems, design cycles, communication protocols and safety systems employed in today's automotive industry.	1	Remember
ET414C.2	Examining automotive sensors and actuators with microcontrollers	3	Apply
ET414C.3	Implement and integrate control for ECUs with hardware	3	Apply
ET414C.4	Summarizing different communication Protocols	2	Understand
ET414C.5	Investigate model base learning of automotive control systems	3	Apply
ET414C.6	Determining Safety Systems in Automobiles Systems such as Active Safety Systems, Assistance Application,Functional Safety and Diagnostics.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET414C.1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
ET414C.2	3	-	3	2	3	-	-	-	-	-	-	-	-	3
ET414C.3	3	-	3	2	3	-	-	-	-	-	-	-	2	3
ET414C.4	3	-	-	-	3	-	-	-	-	-	-	-	-	-
ET414C.5	3	-	-	-	3	-	-	-	-	-	-	-	2	-
ET414C.6	3	-	-	-	-	3	-	-	-	-	-	-	2	-

Course Contents

Unit-I	**Automotive Systems, & Automotive Industry Overview**	**6 Hrs**	ET414.1
	Overview of Automotive Industry: Leading players, Automotive supply chain, Global challenges, Role of technology in Automotive Electronics and interdisciplinary design, Tools and processes. Introduction to Modern Automotive Systems and need for electronics in automobiles and application areas of electronic systems in modern automobiles.**Vehicle systems:** Ignition systems, Fuel delivery systems, Engine control functions, Fuel control, Electronic systems in engines. **Automotive transmissions:** Transmission fundamentals, Types MT, AT, CVT and DCT. **Vehicle Braking Fundamentals:** Hydraulic brake system components, Introduction to antilock braking systems. **Steering Control:** Steering system basics, Fundamentals of electronically controlled power steering, Electronically controlled hydraulic systems and electric power steering systems. **ECU :** Components of ECU, Examples of ECU on chassis, and in body electronics.	Hrs.	
Unit-II	**Automotive Sensors and Actuators**	**6 Hrs**	ET414.2
	Systems Approach to Control and Instrumentation: Concept of a system, Analog and digital systems, Basic measurement systems, Analog and digital signal processing, Sensors, Sensor characteristics, Sensor response, Sensor error, Redundancy of sensors in ECU'S, Avoiding redundancy, Sensor modeling, Smart Nodes. **Examples of Sensors:** Accelerometer's, Wheel speed, Brake pressure, Seat occupancy, Engine speed, Steering wheel angle, Vehicle speed, Throttle position, Turbine speed, Temperature, Differential exhaust gas pressure and Air bag sensors etc. **Actuators used:** Solenoids, Various types of electric motors and piezoelectric force generators.	Hrs.	
Unit-III	**Microcontrollers /Microprocessors in Automotive domain,**	**6 Hrs**	ET414.3
	Critical review and overview of development within the automotive context of microprocessors, microcontrollers and digital signal processors. Criteria to choose the right microcontroller/processor for various automotive applications. Automotive grade processors	Hrs.	
Unit-IV	**Communication protocols, Infotainment systems**	**8 Hrs**	
	Communication protocols: Overview of automotive communication protocols, CAN, MOST , Ethernet, D2B and DSI, Communication interface with ECU'S, Interfacing techniques and Interfacing with infotainment gadgets, Relevance of Protocols such as TCP/IP for automotive applications, Wireless LAN standards such as Bluetooth, IEEE 802.11x communication protocols for automotive applications. **Infotainment Systems:** Global positioning systems (GPS) and General packet radio service (GPRS).	Hrs.	ET414.4

Unit-V	**Future trends in Automotive Control Systems and Model Based Development**	**6 Hrs**	ET414.5
	Control system approach in Automotive Electronics, Analog and digital control methods, Modelling of linear systems, System responses. Model based Development: (Arduino / Rasberry Pi, Zynq-7000, MC33975 etc)Study of modeling of any one Automotive System.	Hrs.	
Unit-VI	**Safety Systems in Automobiles and Diagnostic Systems**	**6 Hrs**	ET414.6
	Active Safety Systems: ABS, TCS, ESP, Brake assist, etc. Passive Safety Systems: Airbag systems, **Advanced Driver Assistance Systems (ADAS):** Combining computer vision techniques as pattern recognition, feature extraction, learning, tracking, 3D vision, etc. **Assistance Applications:** Lane Departure Warning, Collision Warning, Automatic Cruise Control, Pedestrian Protection, Headlights Control.**Functional Safety:** Need for safety systems, Safety concept, Safety process for product life cycle.**Diagnostics:** Fundamentals of Diagnostics, Basic wiring system and Multiplex wiring system, Preliminary checks and adjustments, Self-diagnostic system, Fault finding and corrective measures, Electronic transmission checks.	Hrs.	

Books:

Text Books:

1. Williams. B. Ribbens: “Understanding Automotive Electronics”, 6th Edition, Elsevier Science, Newnes Publication, 2003.

2. Robert Bosch: “Automotive Electronics Handbook”, John Wiley and Sons, 2004.

Reference Books:

1. Ronald K Jurgen: “Automotive Electronics Handbook”, 2nd Edition, McGraw-Hill, 1999.

2. James D. Halderman: “Automotive Electricity and Electronics", PHI Publication.

3. Terence Rybak & Mark Stefika: “Automotive Electromagnetic Compatibility (EMC)”, Springer, 2004.

4. Allan Bonnick: “Automotive Computer Controlled Systems, Diagnostic Tools and Techniques”, Elsevier Science, 2001.

CIA evaluation is strictly as per Rubrics. CIA is Project Based Learning activity.

VLSI Design Technology Laboratory (ET415)

Teaching Scheme
Practical : 02 Hrs. / Week
Credits: 01

Examination Scheme
PR : 50 Marks
Total: 50 Marks

Prerequisite Course : Digital Systems

Course Objectives:

1. To introduce the basics of VHDL.
2. To write VHDL code for combinational circuits
3. To write VHDL code for Sequential circuits
4. To nurture students with CMOS circuit designs

Course Outcomes (COs): After completion of course students will able to

Course code	Course Outcome	Bloom's Taxonomy	
		Level	Descriptor
ET415.1	Understand VHDL language constructs	2	Understand
ET415.2	Write HDL coding for combinational circuits design	3	Apply
ET415.3	Write HDL coding for Sequential circuits design	3	Apply
ET415.4	Design the layout of CMOS circuits for specified applications	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET415.1	1	-	-	-	3	-	-	-	-	-	-	2	1	3
ET415.2	1	2	2	-	3	-	-	-	-	-	-	2	1	3
ET415.3	2	-	-	-	-	-	-	-	-	-	-	2	1	3
ET415.4	2	2	2	-	2	-	-	-	-	-	-	2	1	3
ET415.5	2	-	-	-	-	-	-	-	-	-	-	2	1	3
ET415.6	2	-	-	-	-	-	-	-	-	-	-	2	1	3

List of Practical

Sr. No.	Title of Experiment	CO
Group A. To write VHDL code, simulate with test bench, synthesis, implement on PLD.		
1	Basic gates, half adder, full adder, 1,2 bit Comparator	ET415.1, ET415.2
2	4 bit ALU for add, subtract, AND, NAND, XOR, XNOR, OR, & ALU pass.	ET415.1, ET415.2
3	J K FlipFlop, D FilpFlop	ET415.1, ET415.3
4	4 Bit Up down counter	ET415.1, ET415.3
5	Universal shift register with mode selection input for SISO, SIPO, PISO, & PIPO modes	ET415.1, ET415.3
6	FIFO memory	ET415.1, ET415.3
7	LCD interface	ET415.1, ET415.3
8	Keypad interface	ET415.1, ET415.3

Group B. To prepare CMOS layout in selected technology, simulate with and without capacitive load, comment on rise, and fall times.		
1	Inverter, NAND, NOR gates	ET415.4
2	Half Adder	ET415.4
3	2:1 Multiplexer using logic gates	ET415.4
4	2:1 Multiplexer using transmission gates.	ET415.4
5	To implement combinational logic of 4 variable	ET415.4

(Minimum 5 form group A and minimum 3 form group B)

Text Books:

1. Jayaram Bhasker, “A VHDL Primer”, McGraw Hill Education(India
2. Brown, Vranesic ―Fundamentals of digital logic design with VHDL‖, McGraw Hill.

Reference Books:

1. E. Weste, David Money Harris, ―CMOS VLSI Design: A Circuit &System Perspective‖, Pearson Publication.
2. R. Jacob Baker, ―CMOS Circuit Design, Layout, and Simulation‖, 3E, Wiley-IEEE Press
3. CemUnsalan, Bora Tar, ―Digital System Design with FPGA: Implementation Using Verilog and VHDL‖, McGraw-Hill
4. Charles H. Roth, ―Digital systems design using VHDL‖, PWS.
5. Steve Kilts “Advanced FPGA Design Architecture, Implementation and Optimization‖, Wiley.

Mobile Communication Laboratory (ET416)

Teaching Scheme
Lectures: 2 Hrs/Week
Credits:1

Examination Scheme
OR : 50 Mark

Prerequisite course: knowledge of Analog and digital Communication Engineering

Course Objective:-

1. To learn the fundamental knowledge of different systems used in mobile communication.
2. To Study basic modulation techniques.
3. To introduce the different indoor and outdoor propagation models.
4. To understand the working of GSM and CDMA systems.

Course Outcomes:-

On completion of the course, student will be able to,

Cos	Statement	Bloom's Taxonomy	
		Level	Descriptor
ET416.1	Explain basic knowledge of mobile communication system	2	Understand
ET416.2	Describe the concept of modulation techniques.	2	Understand
ET416.3	Analyze the various propagation model	4	Analyse
ET416.4	Explain the concept of GSM and CDMA	2	Understand

Mapping of course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET416.1	2	2	1	-	3	2	1	3	-	-	-	1	-	1
ET416.2	2	2	1	-	3	2	1	3	-	-	-	1	-	2
ET416.3	2	2	1	-	3	2	1	3	-	-	-	1	-	2
ET416.4	2	-	1	-	3	2	1	3	-	-	-	1	-	2

Students should perform minimum 8 experiments

Sr. No	List of Practical	CO's
1	Write a program to measure BER in presence of AWGN model for the BPSK modulation Scheme.	ET416.1 ET416.2
2	Demonstration of SNR Vs BER for QPSK modulation scheme	ET416.1 ET416.2
3	Write a program to simulate experiment on GMSK/QAM modulation	ET416.1 ET416.2
4	To Study GSM related events using AT commands.	ET416.4

5	To determine the free space propagation path loss model.	ET416.3
6	Write a program to measure bit error rate in presence of Hata/ Multipath propagation model for Link budget	ET416.3
7	Calculate the median path loss of Okumura Model for outdoor propagation	ET416.3
8	Set up and carry out an experiment to explain the VoIP call routing process.	ET416.4
9	Write a program to simulate OFDM transmitter and receiver to elaborate operation of OFDMA Multiple access techniques for evaluating bit error rate.	ET416.4
10	Implementation of DSSS scheme.	ET416.4
11	Study of multiple access systems.	ET416.4

Project Stage-II (ET417)

Teaching Scheme
Practical: 8 Hrs./Week
Credits: 4

Examination Scheme
Term work: 100 Marks
Oral: 50 Marks

Course Objectives:

1. Knowing the significance of aesthetics and ergonomics while designing electronic Product and modeling.
2. To develop student's abilities to transmit technical information clearly and test the same by demonstration on the Project
3. To understand the importance of document design by compiling Technical Report on the Project work carried out

Course Outcomes:-

After completion of this course students will be able to:

Cos	Statement	Bloom's Taxonomy	
		Level	Descriptor
ET 417.4	Work as a leader or productive member of a multi-disciplinary and multi-cultural team.	5	Evaluate
ET 417.5	Design, simulate, and implement desired systems (hardware and software) by using modern and appropriate tools and techniques.	6	Create
ET 417.6	Organize a technical report and demonstrate the project	3	Apply

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET417.4	2	2	2	2	3	2	1	3	2	3	3	3	2	2
ET417.5	2	2	2	2	3	2	1	3	2	2	2	2	2	2
ET417.6	2	2	2	2	3	2	1	3	1	2	2	1	2	2

The final Year project is a challenging capstone experience for Electronics & Computer engineering students. Project is a course requirement, wherein under the guidance of an instructor/Project guide, a final year

student is required to do innovative/contributory/development work with application of knowledge earned while undergoing various theory and laboratory courses in his/her course of study. A student has to exhibit both analytical and practical skills through the project work.

Assessment of Project:-

Semester-VIII Project Stage-II					
Sr. No	Details	Evaluation By	Evaluation Type	Schedule	Marks
1	Demonstration of 75% project Completion (PCB layout, component mounting, Module Testing)	Project Guide + DMC	SE1 by GA	2nd Week of February	25 Marks (10+15)
2	Demonstration of 100% project Completion and report submission	DMC	SE2 by GA	3rd Week of April	50 Marks
3	Final Viva and Presentations	Panel of Examiners comprising of guide, external examiner and chairman	ESE	2nd week of May	50 Marks

DMC- Department Monitoring Committee
GA- Group Activity
SE- Shuffle Examination
ESE-End Sem Examination

Mandatory course: Role of Electronics in Biomedical Engineering (MC418)

Teaching Scheme	**Examination Scheme**
Lectures: 1 Hrs. / Week	**ISE: 00 Marks**
	ESE: 00 Marks
	CIA: 00 Marks
Credits: NIL	**Total: 00 Marks**

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Prerequisite Course: Digital Signal Processing

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Course Objectives:

1. To understand the origin of bio-signals and the components of a biomedical instrumentation system.
2. To learn about the cardio vascular and nervous systems in the human body and associated measurements.
3. To acquire knowledge about the electrical activity of heart.
4. To acquire knowledge about the electrical activity of brain.
5. To understand various analog signal processing circuits employed in biomedical instrumentation systems.
6. To learn various digital processing techniques in biomedical instrumentation.

Course Outcomes (COs): After successfully completing the course students will be able to:

COs	**CO Statement**	**Bloom's Taxonomy**	
		Levels	**Description**
MC418.1	Extend the origin of bio-potentials and basic configuration of a biomedical engineering system	**2**	**Understand**
MC418.2	Explain the working of cardio vascular and nervous systems in a human body.	**2**	**Understand**
MC418.3	Discuss the electrical activity of heart through ECG.	**2**	**Understand**
MC418.4	Discuss the electrical activity of brain through EEG.	**2**	**Understand**
MC418.5	Describe the Modern X-ray and Imaging Equipment	**2**	**Understand**
MC418.6	Describe the Modern Imaging techniques	**2**	**Understand**

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
MC418.1	2	2	-	-	3	3	-	1	-	-	-	3	2	3
MC418.2	2	2	1	-	3	3	-	1	-	-	-	3	2	3
MC418.3	2	2	1	-	3	3	-	1	-	-	-	3	2	3
MC418.4	2	2	1	-	3	3	-	1	-	-	-	3	2	3
MC418.5	2	2	1	-	3	3	-	1	-	-	-	3	2	3
MC418.6	2	2	1	-	3	3	-	1	-	2	-	3	2	3

Course Contents

Unit-I	Introduction to Biomedical Instrumentation Systems	No. of Hours	COs
	Overview of biomedical instrumentation system: Sources of bioelectric potential, classification of biomedical signals: ECG, EEG, EMG, ERG, EOG etc., components of biomedical instrumentation systems. Sensors for bio-signal measurements: Biomedical electrodes and their characteristics, sources of noise in bio-signals, motion artifacts and skin impedance	3	MC418.1
Unit-II	Cardio Vascular and Nervous System	No. of Hours	COs
	Cardio Vascular System: Coronary and peripheral circulation, Electrical activity of the heart, Lead configurations, ECG data acquisition, ECG recorder, Cardiac output, Heart Sounds. Nervous System: Structure and functions of Neurons, Electrical activity of neurons, Reflex action and Receptors.	2	MC418.2
Unit-III	Electrical Activity of Heart	No. of Hours	COs
	ECG signal parameters & their estimation - Noise & Artifacts, ECG Signal Processing: Baseline Wandering, Power line interference, Muscle noise filtering – QRS detection, feature points of ECG and its classification for normal and abnormal state using multilayer perceptrons.	2	MC418.3
Unit-IV	Analysis of Electrical Activity of Brain	No. of Hours	COs
	Electroencephalogram – Structure of brain, EEG signal acquisition, 10-20 electrode placement, EEG rhythms & waveforms - categorization of EEG activity - recording techniques – EEG applications like Epilepsy, sleep disorders detection, Brain computer interface. Use of Fourier Transform in EEG Signal Analysis.	3	MC418.4
Unit-V	Modern X-ray and Imaging Equipment	No. of Hours	COs
	Recent developments in x ray tube technology, Tomography principle, various types and its applications Computed tomography : Principle, data acquisition concepts, image reconstruction, instrumentations, image manipulation Historical developments - Various generations, spiral/helical, single slice/multislice, CT, Electron beam CT. Virtual reality imaging, including image quality and quality control in CT Scanners.	3	MC418.5
Unit-VI	Modern “Imaging Techniques”	No. of Hours	COs
	MRI :	3	MC418.6

	Basic principle of MRI, complete imaging equipment and various requirements, Basic principle of MRI, Digital Radiography including DSA, principles, working, applications and advancements. Care and maintenance of radiological equipment. Radiographic techniques for cardio-vascular system.		

Books:

Text Books:

1. R. S. Khandpur, "Handbook of Biomedical Instrumentation", Tata McGraw Hill, New Delhi, 2nd Edition, 2003,.
2. R. Rangayan, "Biomedical Signal Analysis", Wiley, 2002.

Reference Books:

1. Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology", 4th Edition, Prentice Hall, 2000.
2. John L. Semmlow, "Bio-signal and Biomedical Image Processing", Marcel Dekker, 2004
3. Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, "Biomedical Instrumentaion and measurements", 2nd Edition, PHI
4. Bruce, "Biomedical Signal Processing & Signal Modeling," Wiley, 2001

e-Resources: https://www.nibib.nih.gov/science-education/students-resources
https://nwtc.libguides.com/c.php?g=43794&p=277944

Guidelines for Continuous Assessment:-
Unit Test, MCQ , Home Assignments, Surprise Test, Open book test

IoT and Cloud Computing for Industrial Automation (ET8206)

Teaching Scheme
Lectures: 4 Hrs. / Week

Credits: 04

Examination Scheme
ISE: 30 Marks
ESE: 50 Marks
CIA: 20 Marks
Total: 100 Marks

Prerequisite: Courses on Sensors & Signal Processing and Industrial Automation

Course Objectives:

1. To introduce the concept of Industry 4.0 and Internet of Things
2. To get familiarity with sensors, actuators and sensor networks
3. To learn IoT architecture and technologies connected with it
4. To get understanding about IoT deployment on different platforms
5. To learn about Cloud Computing and its relationships with IoT
6. To take up case studies on applications of IoT in domestic and industrial areas

Course Outcomes (COs):

After successful completion of this course, students will be able to:

Course Outcomes	Statements	Bloom's Taxonomy	
		Level	Descriptor
ET8206.1	Identify various components of an IoT system	1	Remember
ET8206.2	Classify different sensors and actuators employed in IoT and IoE	2	Understand
ET8206.3	Explain M2M and IoT technologies architecture and its technology fundamentals	2	Understand
ET8206.4	Implement IoT board interface and programs for different systems	3	Apply
ET8206.5	Summarize the cloud types and the relationship between the cloud and IoT	2	Understand
ET8206.6	Integrate IoT systems in different domestic and industrial applications	4	Analyze

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
ET8206.1	2	2	2	2	3	-	-	3	3	3	-	3
ET8206.2	2	2	2	2	3	-	-	-	3	3	-	3
ET8206.3	2	3	2	3	3	-	-	-	3	3	-	3
ET8206.4	2	32	2	3	3	-	-	-	3	3	-	3
ET8206.5	2	2	2	2	3	-	-	-	3	3	-	3
ET8206.6	2	3	3	3	3	-	-	-	3	3	-	3

Course Contents

Unit No.		No. of Hours	COs
Unit-I	**Introduction to Industry 4.0 and IoT**	8 Hrs.	ET8206.1
	Industry revolutions, Industry 4.0, Definition and characteristic of IoT, Physical Design of IoT, Logical Design of IoT, IoT enabling technologies, IoT levels and Deployment, IoT building blocks Opportunities and challenges		
Unit-II	**Sensors, Actuators and Networking**	8 Hrs	ET8206.2
	Types of sensors, Types of actuators, Examples and working, Arduino interface, RFID principles and components, Wireless sensor networks, History and context, WSN and IoT, IoE, Difference between IoT and IoE		
Unit-III	**IoT Architecture**	8 hrs	ET8206.3
	IoT-An Architectural Overview, building architecture, Main design principles and needed capabilities, standard considerations. M2M and IoT technology fundamentals, Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Anything as a Service (XaaS)		
Unit-IV	**IoT Boards and Programming**	8 hrs	ET8206.4
	Introduction to IoT Boards, Interfacing of IoT Boards, IoT deployment for Arduino/Raspberry Pi or similar platforms, Reading from Sensors, Interfacing micro controller with mobile devices – communication through Bluetooth, Wi-Fi and USB		
Unit-V	**Cloud Computing and IoT**	8 hrs	ET8206.5
	Introduction to Cloud Computing, History of Cloud Computing, Cloud types, Applications of Cloud Computing, Distributed Computing, Distributed Computing Vs Cloud Computing, Cloud Computing and IoT		
Unit-VI	**Applications of IoT**	8 hrs	ET8206.6
	Smart Home-Smart Home Technologies, Smart home implementation, Home area networks Smart Grid-Characteristics, Architecture, Smart Grid and Cloud Smart Cities-Characteristics, Framework, Challenges, Smart parking Smart Vehicles-Levels of Automation, Vehicle networking Intelligent connected vehicles Smart Health Care System-Remote monitoring, Ingestible sensor, Digital Medicine, Cloud services in health care sector		
Books:			
Text Books:			
1. Ovidiu Vermesan, Peter Friess, "Internet of Things-From Research and Innovation to Market Deployment",River Publishers 2. Oliver Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things-Key Applications and Protocols" 2nd Edition, Wiley Publications			

Reference Books:

1. Arsheep Bahga, Vijay Madisetti, “Internet of Things- A Hands on Approach”, Universities Press
2. Hakima Chaouchi, “The Internet of Things-Connecting Objects to the Web”, Wiley Publications
3. Dieter Uckelmann, Mark Harrison, Florian Michahelles,”Architecting the Internet of Things”, Springer

e-Resources

1. **https://www.libelium.com/resources/case-studies**
2. **https://nptel.ac.in/courses/106105166**
3. **https://nptel.ac.in/courses/106105195**

Guidelines for Continuous Internal Assessment

Students should undertake a case study on developing an IoT system which can be employed in any automation application**.**

Advanced Embedded System Design and IoT (ET8106)

Teaching Scheme
Lectures: 04 Hrs. / Week

Credits: 04

Examination Scheme
ISE : 30 Marks
ESE : 50 Marks
CIA : 20 Marks
Total: 100 Marks

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Prerequisite Course: Embedded System

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Course Objectives:

1. To Understand the basic concept of the IoT system and its applications.
2. To Explore the basics of an embedded system
3. To Design typical Hardware and Software components of an embedded system.
3. To Infer Networking and the Internet requirements for IoT.
5. To Develop an embedded system application.
6. To Develop an IoT applications using Azure platform

Course Outcomes (COs): After successful completion of the course, students will be able to

COs	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
ET8106.1	Understand the basic concept of IoT system and its applications	2	Understand
ET8106.2	Explore the basics of an embedded system	4	Analyze
ET8106.3	Categorize the typical Hardware and Software components of an embedded system.	4	Analyze
ET8106.4	Infer Networking and the Internet requirements for IoT.	2	Understand
ET8106.5	Implement an embedded system application	3	Apply
ET8106.6	Develop an IoT applications using Azure platform	6	Create

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
ET8106.1	2	-	-	-	3	-	-	-	-	-	-	-
ET8106.2	3	2	-	-	1	-	-	-	-	-	-	-
ET8106.3	3	2	-	-	3	-	-	-	-	-	-	-
ET8106.4	3	-	-	-	2	-	-	-	-	-	-	-
ET8106.5	2	2	3	-	3	-	-	-	-	-	-	-
ET8106.6	2	2	3	-	3	-	-	-	-	-	-	-

Course Contents

Unit -I	**Introduction to the Internet of Things (IoT)**	No. of Hours	COs
	Introduction, IoT Example: The Refrigerator, IoT Devices, IoT Devices vs. Computers, Trends in the Adoption of IoT, IoT Is Powerful and Pervasive, Societal Benefits of IoT, Risks, Privacy, and Security	06 .	ET8106.1
Unit -II	**Fundamentals of Embedded Systems**	06 .	Cos
	Introduction , What Are Embedded Systems, More on Embedded Systems Generic Embedded Systems Structure, Components of Embedded Systems More on Components of Embedded Systems, Sensors and Actuators (in the Lab), Analog/Digital Conversion, Basic Equipment		ET8106.2
Unit -III	**Embedded system's Hardware and Software design**	06	Cos
	Introduction, Hardware and Software, Integrated Circuits, Microcontroller Properties (Updated), Microcontroller Components, Compilation and Interpretation, Python vs. C/C++, Operating Systems, Task Support	.	ET8106.3
Unit -IV	**Networking and the Internet for IoT**	06	Cos
	Introduction, Why is Networking Needed, WAN Structure, Networking Components (Lab Tour), Internet Structure, Protocols Protocol Stack, TCP/IP Application Layer, MANETs, Packet Capture Demo		ET8106.4
Unit -V	**Embedded System Design Case Studies**	06	COs
	Embedded System Design Case Studies:Design Case Studies like Automated Meter Reading Systems (AMR), Digital Camera, Certification and documentation: Mechanical Packaging, Testing, reliability and failure analysis, Certification (EMI / RFI) and Documentation. Study of any two real life embedded products in detail.		ET8106.5
Unit -VI	**Azure IOT Hub: Design Case Study**	06	COs
	Create an Azure Cloud Account, Create an IOT Hub, Register an IoT device & connect it to a Raspberry pi web simulator, Register an IoT Device, Create an Azure Cloud Storage Account, create a Stream Analytics job, Download and Visualize the telemetry data, Run the Stream Analytics job and Simulator with a new IoT device		ET8106.6

Text Books:

1. The Internet of Things: From RFID to the Next-Generation Pervasive Networked Lu Yan, Yan Zhang, Laurence T. Yang, Huansheng Ning
2. Designing the Internet of Things , Adrian McEwen (Author), Hakim Cassimally

3. HakimaChouchi, “The Internet of Things Connecting Objects to the Web”, ISBN 078 -1- 84821-140-7, Wiley Publications Asoke K Talukder and Roopa R Yavagal, “Mobile Computing,” Tata McGraw Hill, 2010
4. Introduction to Embedded Systems - shibu k v, Mc Graw Hill Education.
5. Computers as Components –Wayne Wolf, Morgan Kaufmann (second edition)

Reference Books:

1. Embedded System Design -frank vahid, tony grivargis, john Wiley.
2. Embedded Systems- An integrated approach - Lyla b das, Pearson education 2012.
3. Embedded Systems – Raj Kamal, TMH

e Resources:

Cousera Course: **Introduction to the Internet of Things and Embedded Systems**
https://www.coursera.org/programs/faculty-development-program-v4v5h/browse?collectionId=&productId=CEwR00UZEeWb8RJf7Z1H0w&productType=course&query=introduction+of+iot+and+embedded+system&showMiniModal=true&source=search
https://www.coursera.org/projects/getting-started-with-azure-iot-hub

Guidelines for Continuous Internal Assessment:-

For CIA Marks Students has to complete Coursera Course on given Topic and CIA marks will be given on the basis of Coursera Course final Grade marks.