Baba Ghulam Shah Badshah University
Rajouri (J&K)-185243

Syllabus First to Eighth Semester
B.Tech. ECE Degree Course

Department of Electronics and Communication Engineering
School of Engineering and Technology

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Curriculum Structure
(2018 – 2022)

Assessment Procedure

For each theory course the total weightage is 100 marks and the assessment pattern is shown in table 1. For laboratory courses the total weightage is 50 marks and the assessment pattern is shown in table 2.

Continuous Assessment		University Examination	
Component	**Weightage**	**Component**	**Weightage**
Cyclic Test 1	10	Written Examination	60
Cyclic Test 2	10		
Assignment 1	05		
Assignment 2	05		
Attendance	10		
Total	**40**		**60**

Table 1: Distribution of weightage for theory courses.

Continuous Assessment		University Examination	
Component	**Weightage**	**Component**	**Weightage**
Continuous assessment of practical work, timely submission of lab records.	15	Lab experiment / procedure/ writing/ tabulation/ innovation as applicable	20
Test	05		
Attendance	05	Viva Voce	05
Total	**25**		**25**

Table 2: Distribution of weightage for laboratory courses.

Semester-I

Theory Courses									
Course Code	Title	Scheme of Examination				Hrs./Week			Credits
		Duration (hrs.)	IA*	UE*	Total Marks	L*	T*	P*	
BSC-ECE-101	Mathematics-I	3	40	60	100	3	1	0	4
ESC-ECE-101	Basic Electrical Engineering	3	40	60	100	2	1	0	3
HSMC-ECE-101	Communication Skills	3	40	60	100	2	0	0	2
ESC-ECE-102	Engineering Mechanics	3	40	60	100	3	1	0	3
ESC-ECE-103	Computer Fundamentals and Programming	3	40	60	100	3	1	0	4
MC-ECE-101	Indian Constitution**	3	40	60	100	2	0	0	0
Total (Theory)			**200**	**300**	**500**				
Laboratory Courses									
ESC-ECE-111	Basic Electrical Engineering Lab	2	25	25	50	0	0	2	1
HSMC-ECE-111	Communication Skills Lab	2	25	25	50	0	0	2	1
ESC-ECE-112	Engineering Mechanics Lab	2	25	25	50	0	0	2	1
ESC-ECE-113	Computer Fundamentals and Programming Lab	2	25	25	50	0	0	2	1
ESC-ECE-114	Workshop Practice	2	50	-	50	0	0	2	2
MC-ECE-111	Induction Program**	-	-	-	-	-	-	-	0
Total (Lab)			**150**	**100**	**250**				
Total (Theory + Lab)			**350**	**400**	**750**	**Total Credits**			**22**

Semester-II

Theory Courses									
Course Code	Title	Scheme of Examination				Hrs./Week			Credits
		Duration (hrs.)	IA*	UE*	Total Marks	L*	T*	P*	
BSC-ECE-201	Mathematics-II	3	40	60	100	3	1	0	4
ESC-ECE-201	Basic Electronics	3	40	60	100	2	1	0	3
BSC-ECE-202	Engineering Physics	3	40	60	100	3	1	0	4
BSC-ECE-203	Engineering Chemistry	3	40	60	100	3	1	0	4
MC-ECE-201	Environmental Science**	3	40	60	100	2	0	0	0
Total (Theory)			**160**	**240**	**400**				
Laboratory Courses									
ESC-ECE-211	Basic Electronics Lab	2	25	25	50	0	0	2	1
BSC-ECE-211	Engineering Physics Lab	2	25	25	50	0	0	2	1
BSC-ECE-212	Engineering Chemistry Lab	2	25	25	50	0	0	2	1
ESC-ECE-212	Engineering Graphics Lab***	3	40	60	100	1	0	2	3
Total (Lab)			115	135	200				
Total (Theory + Lab)			**275**	**375**	**650**	**Total Credits**			**21**

* IA: Internal Assessment; UE: University Examination; L: Lecture; T: Tutorial; P: Practical

** In Non-Credit courses, the student has to get at-least minimum pass marks to qualify the subject. Non Credit Course marks aren't included in total marks. The student has to qualify induction program course by attending the training which will be verified by concerned teacher.

*** The examination pattern of engineering graphics shall be same as of other theory courses.

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Semester-III

Theory Courses									
Course Code	Title	Scheme of Examination				Hrs./Week			Credits
		Duration (hrs.)	IA*	UE*	Total Marks	L*	T*	P*	
BSC-ECE-301	Mathematics-III	3	40	60	100	3	1	0	4
PCC-ECE-301	Network Analysis & Synthesis	3	40	60	100	3	0	0	3
PCC-ECE-302	Advanced Electronic Circuit	3	40	60	100	3	1	0	4
PCC-ECE-303	Signals & Systems	3	40	60	100	3	1	0	4
PCC-ECE-304	Digital Electronics	3	40	60	100	3	1	0	4
HSMC-ECE-301	Disaster Preparedness & Planning	3	40	60	100	3	0	0	3
Total (Theory)			**240**	**360**	**600**				
Laboratory Courses									
PCC-ECE-311	Advanced Electronic Circuits Lab	2	25	25	50	0	0	2	1
PCC-ECE-312	Digital Electronics Lab	2	25	25	50	0	0	2	1
PCC-ECE-313	Network Analysis Lab	2	25	25	50	0	0	2	1
Total (Lab)			**75**	**75**	**150**				
Total (Theory + Lab)			**315**	**435**	**750**	**Total Credits**			**25**

Semester-IV

Theory Courses									
Course Code	Title	Scheme of Examination				Hrs./Week			Credits
		Duration (hrs.)	IA	UE	Total Marks	L	T	P	
BSC-ECE-401	Numerical Techniques	3	40	60	100	3	1	0	4
PCC-ECE-401	Solid State Electronic Devices	3	40	60	100	3	0	0	3
PCC-ECE-402	Linear Control Systems	3	40	60	100	3	0	0	3
PCC-ECE-403	Analog Communication Systems	3	40	60	100	3	1	0	4
PCC-ECE-404	Linear Integrated Circuits & Pulse Switching	3	40	60	100	3	1	0	4
PCC-ECE-405	Electronic Measurements and Instrumentation	3	40	60	100	3	0	0	3
Total (Theory)			**240**	**360**	**600**				
Laboratory Courses									
PCC-ECE-411	Linear Control Systems Lab	2	25	25	50	0	0	2	1
PCC-ECE-412	Analog Communication Systems Lab	2	25	25	50	0	0	2	1
PCC-ECE-413	Linear Integrated Circuits Lab	2	25	25	50	0	0	2	1
Total (Lab)			**75**	**75**	**150**				
Total (Theory + Lab)			**315**	**435**	**750**	**Total Credits**			**24**

* IA: Internal Assessment; UE: University Examination; L: Lecture; T: Tutorial; P: Practical

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(Dean SoET)	**(Head, ECE)**	**(A.P., ECE)**	**(A.P., ECE)**

Semester-V

Theory Courses									
Course Code	Title	Scheme of Examination				Hrs./Week			Credits
		Duration (hrs.)	IA*	UE*	Total Marks	L*	T*	P*	
PCC-ECE-501	Introduction to Microprocessors	3	40	60	100	3	0	0	3
PCC-ECE-502	Digital Communication Systems	3	40	60	100	3	0	0	3
PCC-ECE-503	EM Wave Theory	3	40	60	100	3	0	0	3
PCC-ECE-504	Computer Organization and Architecture	3	40	60	100	3	0	0	3
PEC-ECE-50X	Professional Elective I	3	40	60	100	3	0	0	3
OEC-XXX-XXX	Open Elective – I	3	40	60	100	3	0	0	3
Total (Theory)			**240**	**360**	**600**				
Laboratory Courses									
PCC-ECE-511	Microprocessor Lab	2	25	25	50	0	0	2	1
PCC-ECE-512	Digital Communication System Lab	2	25	25	50	0	0	2	1
PCC-ECE-513	Modelling and Simulation Lab	2	25	25	50	0	0	2	1
PROJ-ECE-511	Industrial Training – I	-	25	-	25	-	-	-	1
Total (Lab)			**100**	**75**	**175**				
Total (Theory + Lab)			**340**	**435**	**775**	**Total Credits**			**22**

Semester-VI

Theory Courses									
Course Code	Title	Scheme of Examination				Hrs./Week			Credits
		Duration (hrs.)	IA	UE	Total Marks	L	T	P	
PCC-ECE-601	Digital Signal Processing	3	40	60	100	3	1	0	4
PCC-ECE-602	Micro-Controller and Embedded Systems	3	40	60	100	3	0	0	3
PCC-ECE-603	Antenna and Wave Propagation	3	40	60	100	3	0	0	3
PEC-ECE-60X	Professional Elective – II	3	40	60	100	3	0	0	3
PEC-ECE-60X	Professional Elective – III	3	40	60	100	3	0	0	3
OEC-XXX-XXX	Open Elective – II	3	40	60	100	3	0	0	3
Total (Theory)			**240**	**360**	**600**				
Laboratory Courses									
PCC-ECE-611	Digital Signal Processing Lab	2	25	25	50	0	0	2	1
PCC-ECE-612	Micro-Controller and Embedded Systems Lab	2	25	25	50	0	0	2	1
PCC-ECE-613	Antenna Lab	2	25	25	50	0	0	2	1
Total (Lab)			**75**	**75**	**150**				
Total (Theory + Lab)			**315**	**435**	**750**	**Total Credits**			**22**

Semester-VII

Theory Courses									
Course Code	Title	Scheme of Examination				Hrs./Week			Credits
		Duration (hrs.)	IA*	UE*	Total Marks	L*	T*	P*	
PCC-ECE-701	RF and Microwave Engineering	3	40	60	100	3	0	0	3
PEC-ECE-70X	Professional Elective – IV	3	40	60	100	3	0	0	3
PEC-ECE-70X	Professional Elective – V	3	40	60	100	3	0	0	3
HSMC-ECE-701	Entrepreneurship Development & Management	3	40	60	100	3	0	0	3
OEC-XXX-70X	Open Elective-III	3	40	60	100	3	0	0	3
PROJ-ECE-701	Major Project Phase – I	-	100	0	100	0	0	3	3
Total (Theory)			**240**	**360**	**600**				
Laboratory Courses									
PCC-ECE-711	Microwave Engineering/ Optical Communication Lab	2	25	25	50	0	0	2	1
PCC-ECE-712	PCB and Troubleshooting Lab	2	25	25	50	0	0	2	1
PROJ-ECE-711	Industrial Training-II & Seminar	-	25	-	25	-	-	-	1
Total (Lab)			**75**	**50**	**125**				
Total (Theory + Lab)			**315**	**410**	**725**	**Total Credits**			**21**

Semester-VIII

Theory Courses									
Course Code	Title	Scheme of Examination				Hrs./Week			Credits
		Duration (hrs.)	IA	UE	Total Marks	L	T	P	
PROJ-ECE-801	Major Project Phase – II	-	250	200	450	0	0	9	9
PEC-ECE-80X	Professional Elective – VI	3	40	60	100	3	0	0	3
OEC-XXX-XXX	Open Elective - IV	3	40	60	100	3	0	0	3
Total (Theory)			**330**	**320**	**650**	**Total Credits**			**15**

At the end of semesters IV and VI students are required to attend an Industrial Training for 6 weeks, during summer vacations. After the completion of training every student is required to prepare a detailed report of the training work which he/she has attended in an Organization/Industry/Company. Industrial Trainings shall be an essential component of curriculum to fulfil the eligibility criteria for appearing in semesters V and VII university examinations. The examination of Industrial Trainings shall be conducted during semester V and VII examinations.

After the university examination of semester VI every student shall be allotted a Major Project pertaining to his/her area of interest under the supervision of an allotted mentor. Students are required to report to their respective mentors to do preliminary exercise of survey of literature and preparation of a road map of the selected Major project. Students are required to complete the phase I of Major project work during semester VII and phase II in Semester VIII. Depending upon the infrastructure, computing and other laboratory facilities the student shall be offered in-house project in campus or they can complete their project work in any organization/Industry outside the campus. Major Project shall be evaluated externally through the quality of work carried out, the report submission content and presentation.

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Professional Elective Courses

The choice of electives will rest with the students. However, in no case will the department run more than two subjects for one elective paper.

Professional Elective Courses	Course Code	Course Title
I	PEC-ECE-501	Industrial Electronics
	PEC-ECE-502	Electronic Multimedia Engineering
	PEC-ECE-503	Smart Material Systems & MEMS
	PEC-ECE-504	Engineering Material Science
II	PEC-ECE-601	Mobile and Wireless Communication
	PEC-ECE-602	VLSI Design
	PEC-ECE-603	Electrical Machines
III	PEC-ECE-604	Data Communication and Computer Networks
	PEC-ECE-605	Optoelectronic Devices
	PEC-ECE-606	Non-Conventional Energy Sources
	PEC-ECE-607	Power Electronics
IV	PEC-ECE-701	Device Modeling for Circuit Simulations
	PEC-ECE-702	Advanced 3G and 4G Wireless & Mobile Communication
	PEC-ECE-703	Satellite Communication
	PEC-ECE-704	Optical Communication
V	PEC-ECE-705	Random Process and Information Theory
	PEC-ECE-706	Radar Engineering
	PEC-ECE-707	Biomedical Instrumentation
	PEC-ECE-708	Analog and Mixed Signal Design
VI	PEC-ECE-801	RF IC Design
	PEC-ECE-802	Adaptive Signal Processing
	PEC-ECE-803	Digital Image Processing
	PEC-ECE-804	Advanced Communication Systems
	PEC-ECE-805	Digital System Design
	PEC-ECE-806	Nanotechnology
	PEC-ECE-807	Optical Networks

Open Elective Courses

Courses that other departments will offer. The choice of electives will rest with the students.

Open Elective Courses	Course Code	Course Title
I	OEC-ECE-501/PCC-CSE-302	Object Oriented Programming using C++
	OEC-ECE-502/PCC-ITE-504	Java Programming
	OEC-ECE-503/PEC-EE-501	Power Engineering
	OEC-ECE-504/PCC-CE-502	Environmental Engineering
	OEC-ECE-505/PEC-CSE-705	Natural Language Processing
II	OEC-ECE-601/PCC-CSE-402	Python Programming
	OEC-ECE-602/PCC-EE-403	Power System – I
	OEC-ECE-603/PCC-ITE-404	Discrete Mathematics
	OEC-ECE-604/PCC-CE-405	Building Materials and Construction
	OEC-ECE-605/PEC-CSE-611	Wireless Networks
	OEC-ECE-606/PCC-ITE-601	Computer Graphics and Multimedia
III	OEC-ECE-701/PCC-CSE-702	Artificial Intelligence
	OEC-ECE-702/PCC-EE-501	Power System – II
	OEC-ECE-703/PCC-ITE-502	Internet and Web Technologies
	OEC-ECE-704/PEC-CE-749	Flood Control and Rural Engineering
	OEC-ECE-705/PEC-CSE-702	Internet of Things
IV	OEC-ECE-801/PEC-CSE-806	Neural Networks
	OEC-ECE-802/PEC-EE-603	Energy Audit and Management
	OEC-ECE-803/PEC-CE-648	Industrial Waste Treatment
	OEC-ECE-804/PEC-ITE-605	Data Mining and Warehousing
	OEC-ECE-805/PEC-CSE-601	Machine Learning
	OEC-ECE-806/PEC-CSE-808	Bio-Informatics

Semester – I

Semester I

Course Title: Mathematics-I **Max. Marks:100**
Course Code: BSC-ECE-101 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 4 [3-1-0]

Objective: The course is designed to impart elementary knowledge of theory of calculus, linear algebra and sequence & series to engineering students that will serve them to solve various engineering problems.

Unit-I

Differential Calculus: Rolle's Theorem, Mean value theorems, indeterminate forms and L'Hospital's rule; Successive differentiation and Leibnitz's theorem, Taylor's and Maclaurin's series of function of single variable, Expansion of functions of single variable.

Unit-II

Multivariable Calculus: Limit, continuity and partial derivatives, physical significance of partial derivative, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, directional derivatives, curl and divergence.

Unit-III

Integral Calculus: Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

Unit-IV

Sequences and series: Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem.

Unit-V

Matrices: Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.

Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Understand the significance of Rolle's Theorem, Mean Value theorem, Taylor's and Maclaurin's series for differentiable functions.
- **CO2.** Identify the extrema of a function on an interval and classify them as minima, maxima or saddles using the first derivative test.

CO3. Use basic the integral rules to evaluate both definite and indefinite integrals and apply the same to find areas and volume of revolutions. Apart from these, they have a basic understanding of Beta and Gamma functions.

CO4. Apply the tools of power series and Fourier series to deal with functions of several variables that are essentials in most branches of engineering.

CO5. Learn the essential tools of matrices and linear algebra in a comprehensive manner.

Text Books:

1. **Erwin kreyszig**, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. **D. Zill,** Advanced Engineering Mathematics, Jones & Bartlett

Reference Books:

1. **G.B. Thomas and R.L. Finney**, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. **Erwin kreyszig**, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester I

Course Title: Basic Electrical Engineering **Max. Marks:100**
Course Code: ESC-ECE-101 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: The course has been designed to provide basic knowledge to the students about the principles of electric circuit analysis, electromagnetism and transformers.

Unit-I

Review of Electric Circuits: Basic Electrical circuit terminology, concept of charge and energy, circuit parameters (resistance, inductance. Capacitance), ohm's law, Kirchoff's current law (KCL), Kirchoff's voltage law (KVL), series and parallel combinations of resistance, inductance& capacitance. Ideal and practical voltage & current sources and their transformations, dependent voltage and current sources.

Unit-II

D.C Circuit Analysis: Power & energy relations, analysis of series parallel DC circuits, Star Delta transformations (ΔY), Loop & Nodal methods, Network Theorems: Thevenin's, Norton's, Maximum Power Transfer and Superposition Theorems (D.D Analysis only).

Unit-III

A.C. Circuit Analysis: Basic terminology and definitions, phasor and complex number representations, power energy relations in AC circuits, application of Network Theorems to AC circuits ,Resonance in series and parallel circuits, Concepts of active & reactive powers, Introduction to 3 phase circuits.

Unit-IV

Electromagnetism: Review of Fundamentals of Electromagnetism, Ampere's Law, analogies between electric circuits and magnetic circuits, Faraday's laws of electromagnetic induction, direction of induced emf, Lenz's law, magnetic saturation and leakage fluxes.

Unit-V

Basic Electrical Installation: Transformers, Concept of Inductance, Self & Mutual Inductance, Conventions for magnetically coupled circuits, Transformers: introduction, classification & construction of single phase transformer, emf equation and phasor diagrams.
Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing.

Course Outcomes:

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

- **CO1.** To understand the concepts and applications of different laws used in the networks and circuits.
- **CO2.** To study and analyze the D.C. Circuit and A.C. Circuit with different theorem.
- **CO3.** To study the concepts related to electromagnetism.

CO4. To understand the principle and working of transformers and power converters.

CO5. To study and understand different types of electrical installations.

Text Books:

1. **D. P. Kothari and I. J. Nagrath**, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. **D. C. Kulshreshtha**, "Basic Electrical Engineering", McGraw Hill, 2009.

Reference Books:

1. **L. S. Bobrow**, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
2. **E. Hughes**, "Electrical and Electronics Technology", Pearson, 2010.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester I

Course Title: Communication Skills | **Max Marks: 100**
Course Code: HSMC-ECE-101 | **University Examination: 60**
Duration of Exams: 3 hours | **Internal Assessment: 40**
Credits: 2 [2-0-0]

Objective: This subject is designed to attain the general proficiency in English for the engineering students.

Unit-I

Vocabulary Building: The concept of Word Formation, Root words from foreign languages and their use in English, Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives., Synonyms, antonyms, and standard abbreviations.

Unit-II

Basic Writing Skills: Use of phrases and clauses in sentences, Importance of proper punctuation, Creating coherence, Organizing principles of paragraphs in documents, Techniques for writing precisely.

Unit-III

Identifying Common Errors in Writing: Subject-verb agreement, Noun-pronoun agreement, Articles, Prepositions, Redundancies and Clichés.

Unit-IV

Nature and Style of sensible Writing: Describing, Defining, Classifying, Providing examples or evidence, writing introduction and conclusion.

Unit-V

Writing Practices: Comprehension, Précis Writing, Essay Writing

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Course Outcomes:

At the end of this course, the students will be able to:

- **CO1.** To acquire basic proficiency in English including reading, listening comprehension, writing and speaking skills.
- **CO2.** To make the students authoritative in self-expression in their day to day life in this fast-changing world.
- **CO3.** To identify the common errors involved in writing.
- **CO4.** To understand the nature and style of sensible writing.
- **CO5.** To write effective and coherent paragraphs.

Reference Books

1. **Michael Swan**, Practical English Usage. OUP. 1995.
2. Remedial English Grammar**. F.T. Wood. Macmillan**.2007

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester I

Course Title: Engineering Mechanics **Max. Marks:100**
Course Code: ESC-ECE-102 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [2-1-0]

Objective: This course has been designed to make the students acquainted about forces and its effects, kinematics and statics.

Unit-I

Two Dimensional force System: Basic Concepts, principal of transmissibility, resultant of a force System, Free body Diagrams, Equilibrium and equation of equilibrium Applications. Moment of a force about a point, Varrigon theorem, friction, law of friction, equilibrium of body lying on horizontal and inclined plane, Static and Dynamic Friction, wedge friction, Ladder friction applications.

Unit-II

Centroid and Centre of gravity: Centroid and moment of inertia; centroid of plane area and solid bodies. Moment of inertia of plane area. Theorem of parallel axis, Theorem of perpendicular axis, radius of gyration composite ideas. Mass moment inertia of circular plate, Cylinder, Sphere.

Unit-III

Member forces in Trusses: Planer truss structure, trust joint identification, strategy for planer truss analysis, Statistical determinacy and stability of planer trusses. Numerical truss analysis (Method of joints and sections)

Unit-IV

Kinematics of Particles: Velocity and acceleration in rectilinear motion along a plane and curved path. Tangential and normal components of velocity and acceleration motion curves. Kinematics of rigid bodies' rotation, absolute motion, relative motion. Newton's 2nd law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique).

Unit-V

Virtual Work and Energy Method: Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for equilibrium. Stability of equilibrium.

Course Outcomes:

Upon successful completion of the course, student should be able to:

- **CO1.** Use scalar and vector analytical techniques for analyzing forces in statically determinate structures
- **CO2.** Understand basic kinematics concepts – displacement, velocity and acceleration (and their angular counterparts);

CO3. Understand basic dynamics concepts – force, momentum, work and energy;
CO4. Understand and be able to apply Newton's laws of motion;
CO5. Learn to solve dynamics problems. Appraise given information and determine which concepts apply, and choose an appropriate solution strategy.

Text Books:

1. **Bansal R.K.**(2010), A Text Book of Engineering Mechanics, Laxmi Publications
2. **Khurmi R.S.** (2010), Engineering Mechanics, S. Chand & Co.

Reference Books:

1. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall
2. F. P. Beer and E. R. Johnston, Vector Mechanics for Engineers, Vol I ,Vol II, 9th Ed, TMHill

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester I

Course Title: Computer Fundamentals and Programming **Max. Marks:100**
Course Code: ESC-ECE-103 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 4 [3-1-0]

Course Objective: This subject is provided aiming to achieve a common knowledge of programming among engineering students.

Unit-I

Introduction: History and Generations of Computers, Classification and Applications of Computers. **Computer Hardware**: Components of a computer system, Input and Output devices, Memory Hierarchy, Primary and Secondary memory.

Software and Languages: Computer Software, System and Application Software, Operating systems, Booting Process. **Programming Languages**: Generations and types of Languages, Compilers, Interpreter, Assemblers, Introduction to algorithm and Flow chart.

Unit-II

Introduction to C Programming: History of C, Structure of a C Program, Compiling & Executing a C program. Constants, Variables and Data Types, Storage classes, Operators and Expressions, Data Input and Output.

Control Statements: Decision making and branching, IF statement, IF-ELSE statement, nested IF-ELSE statement, Switch statement, break statement, continue statement. Looping: while statement, do-while statement, for statement.

Unit-III

Introduction to arrays: One dimensional arrays, Two dimensional arrays and Multidimensional arrays, basic operations on arrays, strings, basic string operations.

Functions: Introduction to Function, Types of functions, function declaration, calling a function, passing arguments to functions, passing arrays to functions, Recursion.

Unit-IV

User defined data types: Structure, Defining structures, Array of Structures, Introduction to Union and enumerated data types.

Introduction to Pointers & Files: Operations on pointer, pointers & multidimensional arrays, pointers & character strings. Dynamic Memory Allocation in C: malloc, calloc, realloc and free functions. Introduction to File, Operations on files: open, close, read and write.

Unit-V

Networking: Introduction to networking, Applications, types of computer networks, Network Topology, LAN, MAN, WAN. Networking devices: Hub, switch, router, repeater, and gateway. History of internet, internet, extranet and intranet, WWW. E-mail, ISPs, surfing, phishing.

Course Outcomes:

The student will be able to:

- **CO1.** Assemble a computer system and troubleshoot problems.
- **CO2.** Formulate simple algorithms for arithmetic and logical problems.
- **CO3.** Translate the algorithms to programs (in C language).
- **CO4.** Test and execute the programs and correct syntax and logical errors.
- **CO5.** Solve the problems using control statements.
- **CO6.** Decompose a problem into functions and synthesize a complete program.
- **CO7.** Use arrays, pointers and structures to formulate algorithms and programs.
- **CO8.** Be familiar with the concept of computer networking.

Text Books:

1. **Pradeep K. Sinha and Preeti Sinha,** "Computer Fundamentals", Fourth Edition, BPB Publication.
2. **Yashavant P. Kanetkar ,** Let Us C, BPB Publication, 15th Edition.

Referenced Books:

1. **B Ram and Sanjay Kumar,** "Computer Fundamentals: Architecture and organization", New age international publication.
2. **E. Balaguruswamy**, Programming in ANSI C, Tata McGraw-Hill.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester I

Course Title: Indian Constitution | **Max Marks: 100**
Course Code: MC-ECE-101 | **University Examination: 60**
Duration of Exams: 3 hours | **Internal Assessment: 40**
Credits:0

Course Objective: The basic purpose of this subject is to make a general awareness about our constitution.

Unit-I:

Constitutional Framework: Historical Background, Making of the constitution, Salient features of the Indian Constitution, Preamble to the Constitution, Union and its territory, Citizenship, Fundamental rights, Directive principles of state policy, Fundamental duties, Amendment of the constitution, Basic structure of the constitution.

Unit-II:

System of Government: Parliamentary system, Federal System, Centre-state relations, Inter-state relations, Emergency provisions

Unit-III

Central government: President, Vice-President, Prime Minister, Central Council of Ministers, Cabinet committees, Parliament, Parliamentary committees, Parliamentary forums, Supreme Court
State Government: Governor, Chief Minister, State Council of Ministers, State legislature, High court, Subordinate Courts, Special status of Jammu and Kashmir, Special provision for some states
Local Government: Panchayati raj, Municipalities

Unit-IV:

Constitutional Bodies: Election commission, Union Public service commission, State Public service Commission, Finance Commission, National Commission for SC's, National Commission for ST's, Special officer for Linguistic minorities, Comptroller and auditor general of India, Attorney General of India, Advocate General of India.

Unit-V

Non-Constitutional Bodies: Planning Commission, National Development Council, National Human Rights Commission, State Human Rights Commission, Central Information Commission, State Information Commission, Central vigilance Commission, Central Bureau of Investigation, Lokpal and Lokayuktas
Other Constitutional Dimensions: Co-operative societies, Official Language, Public services, Tribunals, Rights and Liabilities of the Government, Authoritative text of the Constitution in Hindi Language, Special Provision relating to certain classes.

Course Outcome:

Upon the completion of this, the students will able to know:

CO1. About the constitutional framework.
CO2. About the government system

CO3. Various type of government

CO4. About Constitutional bodies: Election commission, UPSC, SPSC, Commission for ST/SC etc.

CO5. Non-constitutional bodies: Planning Commission, NDC, NHRC, SHRC, CBI, Vigilance Commission and other dimensions of constitution.

Text/ Reference Books:

1. Indian Constitutional Law, M.P. Jain, 7th Edition.
2. Introduction to the Constitution of India, B. K. Sharma, PHI.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester I

Course Title: Basic Electrical Engineering Lab | **Max. Marks:50**
Course Code: ESC-ECE-111 | **University Exam: 25**
Duration of Exam: 2 Hours | **Internal Assessment: 25**
Credits: 1 [0-0-2]

Objective: The lab has been designed to provide and implement basic knowledge about the principles of electric circuit analysis, electromagnetism and transformers to the students.

List of experiments:

1. Introduction to Circuit Elements.
2. Verification of Ohms Law.
3. Verification of Kirchhoff's Current and Voltage Law (KCL & KVL)
4. Verification of Thevenin's Theorem & Norton's Theorem.
5. Transformation of Star & Delta Networks.
6. Measurement of Power using 2-Wattmeter method.
7. Verification of Superposition Theorem.
8. Verification of reciprocity theorem.
9. To plot the Resonance curve for a Series & Parallel Resonance.
10. Determination of resonance frequency using LCR Meter.

Laboratory Outcomes

- **CO1.** To study and analyze different circuit elements
- **CO2.** To study and implements different laws and theorems of electrical circuits.
- **CO3.** To make the students aware about the principles and applications of basic electrical laws.
- **CO4.** To measure the power using two wattmeter method.
- **CO5.** To study and analyze the phenomenon of Resonance in Series and Parallel circuits.

Semester I

Course Title: Communication Skills Lab | **Max Marks: 100**
Course Code: HSMC-ECE-111 | **University Examination: 25**
Duration of Exams: 2 hours | **Internal Assessment: 25**
Credits: 1 [0-0-2]

Course Objective: The Language Lab focuses on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations and contexts.

The following course content is prescribed for the English Language Laboratory sessions:

Syllabus

1. Introduction to the Sounds of English- Vowels, Diphthongs & Consonants.
2. Introduction to Stress and Intonation.
3. Situational Dialogues / Role Play.
4. Oral Presentations- Prepared and Extempore.
5. 'Just A Minute' Sessions (JAM).
6. Describing Objects / Situations / People.
7. Information Transfer
8. Debate
9. Telephoning Skills.
10. Giving Directions.

Course Outcomes:

CO1. To facilitate computer-aided multi-media instruction enabling individualized and independent language learning

CO2. To sensitize the students to the nuances of English speech sounds, word accent, intonation and rhythm

CO3. To bring about a consistent accent and intelligibility in their pronunciation of English by providing an opportunity for practice in speaking

CO4. To improve the fluency in spoken English and neutralize mother tongue influence

CO5. To train students to use language appropriately for interviews, group discussion and public speaking

Semester I

Course Title: Engineering Mechanics Lab | **Max. Marks:50**
Course Code: ESC-ECE-112 | **University Exam: 25**
Duration of Exam: 2 Hours | **Internal Assessment: 25**
Credits: 1 [0-0-2]

Objective: The objective of the Engineering mechanics Lab is to perform experiments which are related to Statics and Dynamics Loading in order to understand the behavior of different mechanical equipment's which students study in theory.

List of Experiments:

1. To conduct tensile test and determine the ultimate tensile strength, percentage elongation and reduction.
2. To conduct the compression test and determine the ultimate compressive strength for a specimen.
3. To determine centroid of Lamina.
4. To determine the hardness of a given specimen using vicker/ brinel/ Rockwell hardness testing machine.
5. To verify Lami's theorem.
6. To verify polygon law of forces.
7. Friction experiment on inclined plane.
8. Experiment on screw Jack.
9. To verify reactions at the supports of a simply supported beam.
10. To determine moment of inertia of various shapes.

Laboratory Outcomes

After the completion of the lab course, the students will be:

- **CO1.** Able to understand different engineering mechanics apparatus.
- **CO2.** Able to understand the mechanical properties of materials.
- **CO3.** Able to understand the moment of inertia of various shapes.
- **CO4.** Get the practical idea of frictional forces.
- **CO5.** Get working principle of screw jack.

Semester I

Course Title: Computer Fundamentals and Programming Lab **Max. Marks:50**
Course Code: ESC-ECE-113 **University Exam: 25**
Duration of Exam: 2 Hours **Internal Assessment: 25**
Credits: 1 [0-0-2]

Lab. objectives: The course is designed to provide practical foundation for the computer programming and to familiarize students with components of computer and its troubleshooting.

List of Experiments:

1. Assembling and Troubleshooting of computer system.
2. Introduction and working on MS office Packages like word, power point, excel etc.
3. Familiarization with programming environment.
4. Simple computational problems using arithmetic expressions.
5. Problems involving if-then-else structures.
6. Iterative problems e.g., sum of series.
7. Performing operations on 1D Array.
8. Performing operations on 2D Array.
9. Performing operations on String.
10. Function declaration and calling.
11. Implementation of Mathematical function
12. Programming for solving Numerical methods problems.
13. Recursive functions.
14. Pointers and structures.
15. File operations.

Laboratory Outcomes

- **CO1.** To understand the working and troubleshooting of computer system.
- **CO2.** To formulate the algorithms for simple problems
- **CO3.** To be able to correct syntax and logical errors as reported by the compilers and run time.
- **CO4.** To be able to write iterative as well as recursive programs
- **CO5.** To be able to represent data in arrays, strings and structures and manipulate through a program
- **CO6.** To be able to declare pointers of different types and use them in defining self-referential structures.
- **CO7.** To be able to create, read and write to and from simple text files.

Semester I

Course Title: Workshop Practice | **Max Marks: 100**
Course Code: ESC-ECE-114 | **University Examination: 25**
Duration of Exams: 2 hours | **Sessional Assessment: 25**
Credits: 2 [1-0-2]

Detailed contents

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods
2. Fitting operations & power tools
3. Electrical & Electronics
4. Carpentry
5. Plastic moulding, glass cutting
6. Metal casting
7. Welding (arc welding & gas welding), brazing

Upon completion of this course, the students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.

1. Machine shop
2. Fitting shop
3. Carpentry
4. Welding shop
5. Smithy

Course Outcomes:

Upon completion of this laboratory course, students will be able to:

- **CO1.** Fabricate components with their own hands.
- **CO2.** Gain practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
- **CO3.** Produce small devices of their interest by assembling different components.

Text/References Books:

1. **Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., —**Elements of Workshop Technology‖, Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. **Kalpakjian S. And Steven S. Schmid**, —Manufacturing Engineering and Technology,4th edition, Pearson Education India Edition, 2002.

Semester I

Course Title: Induction Training **Max. Marks:0**
Course Code: MC-ECE-111 **University Exam: 0**
Internal Assessment: 0
Credits: 0 [0-0-0]

Induction program

Induction program for students to be offered right at the start of the first year. It should include but not limited to following Activities:

1. Physical activity
2. Creative Arts
3. Universal Human Values
4. Literary
5. Proficiency Modules
6. Lectures by Eminent People
7. Visits to local Areas
8. Familiarization to Dept./Branch & Innovations

Semester – II

Semester II

Course Title: Mathematics-II | **Max. Marks:100**
Course Code: BSC-ECE-201 | **University Exam: 60**
Duration of Exam: 3 Hours | **Internal Assessment: 40**
Credits: 4 [3-1-0]

Course Objective: This course is designed to impart advanced knowledge of multivariable integration, theory of differential equations and complex variable to engineering students that will serve them to solve real life engineering problems.

Unit- I

Multivariable Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Triple integrals (Cartesian), orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes' (without proofs).

Unit- II

First order ordinary differential equations: Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type. Second order linear differential equations with variable coefficients, method of variation of parameters.

Unit- III

Partial Differential Equations: Partial differential equations and its formation, Linear and non-linear partial differential equations of first order and their solutions, Charpit's method, Lagrange's method, Homogenous and non-homogenous linear partial differential equations with constant coefficients and their solutions, Applications of Partial Differential Equations with initial and boundary conditions, Solution by the method of separation of variables.

Unit- IV

Complex Variable – Differentiation: Differentiation, Cauchy-Riemann equations, analytic functions, elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.

Unit- V

Complex Variable – Integration: Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem (without proof) and Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine.

Course Outcomes:

Upon the completion of this course, the students will be able to:

- **CO1.** Compute double and triple integrals over rectangular and spherical domains and memorize important theorems: Green, Gauss divergence and Stokes with their applications in various engineering problems.
- **CO2.** Distinguish between linear and non-linear equations. Recognize and solve equations of Bernoulli, Euler and Clairaut.
- **CO3.** Solve partial differential equations of various kinds and apply the same to solve problems of real world.
- **CO4.** Understand the significance of differentiability for complex functions and be familiar with the Cauchy-Riemann equations and conformal mapping.
- **CO5.** Apply the Cauchy Residue theorem to evaluate definite integrals, compute the Taylor and Laurent expansions of simple functions and determine the nature of the singularities and calculating residues.

Text Books

1. **Erwin Kreyszig**, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. **D. Zill,** Advanced Engineering Mathematics**,** Jones & Bartlett.

Reference Books

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester II

Course Title: Basic Electronics | **Max Marks: 100**
Course Code: ESC-ECE-201 | **University Examination: 60**
Duration of Exams: 3 hours | **Internal Assessment: 40**
Credits: 3 [2-1-0]

Course Objective: This course aims to provide students with solid background of semiconductors and some basic solid state electronic devices used in circuits.

Unit-I

Semiconductors: Classification, semiconductor bonds, Energy band description, Semiconductor types, Energy band diagram for Semiconductors, Drift and Diffusion Current, Mobility of Charged particles, Current density and Conductivity, Conductivity of Semiconductors, Hall Effect.

Unit-II

P-N Junction and applications: Basic structure, PN junction Diode and Characteristics, Current components in p-n junction, temperature dependence, equivalent circuits. Rectifiers, half wave, full wave rectifiers, bridged rectifiers (efficiency, ripple factor). Clipping and clamping circuits. Basic operations of Zener, Avalanche and Photo Diodes.

Unit-III

Transistors: Types of transistors, operation& characteristics, CE, CB and CC configurations, Input output characteristics, biasing and bias stability, use of transistor as an amplifier and switch.

Unit-IV

Junction Field Effect Transistors: Operation and characteristics. JFET configurations and biasing. JFET as amplifier

Unit-V:

MOSFET: Types (Depletion and Enhancement), Operation and Characteristics (no derivation), Introduction to MOSFET Scaling and types, Introduction to Short-Channel Effects (V_{TH} roll-off, DIBL, Hot-carrier injection)

Course outcomes:

At the end of the course, the student will be able to:

- **CO1.** Describe the energy bands and the scientific principles behind conductivity in semiconductors.
- **CO2.** Analyze the working of PN junction diode and apply diode in various applications such as rectifiers and other wave shaping circuits.
- **CO3.** Analyze the working of various traditional transistors such as BJT and FET along with the recently used MOSFET based transistors as well as the concept of biasing in these transistors.
- **CO4.** Understand various feedback systems and oscillators.

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CO5. Design basic analog circuits

Text Books:

1. **Millman & Halkias**, Electronic Devices & Circuits, TMH
2. **Boylestad** and **Nashelky,** Electronic Devices & Circuits, PHI.

Reference Books:

1. **Floyd T. L.,** Electronic Devices, Pearson Education.
2. **Sedra & Smith,** Microelectronic Circuits, Oxford Printing Press.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester II

Course Title: Engineering Physics **Max Marks: 100**
Course Code: BSC-ECE-202 **University Examination: 60**
Duration of Exams: 3 hours **Internal Assessment: 40**
Credits: 4 [3-1-0]

Course Objective:

1. To understand the importance of applications of Applied Physics in daily life
2. To provide the students with a basic understanding of Physics that may be required by engineers in the course of their careers
3. To acquaint students with the fundamentals of vibrations, acoustics and ultrasonic and how they help in mankind by using engineering skills.
4. To enhance knowledge related to principle working of Lasers and its different components to make it suitable for various purposes
5. To introduce the learners to the basics of Quantum Mechanics

Unit-I

Waves, Oscillations and Introduction to Acoustics: Wave motion, its types, Equations of wave motion, Energy and Intensity of a progressive wave, Introduction to ultrasonic waves, magnetostriction and piezoelectric effect, productions of ultrasonic waves, their detections and applications. A brief introduction to the acoustics of a hall, factors affecting the acoustics of the buildings, Reverberation Period, Sabine's Formula for calculating Reverberation Time.

Unit-II

Electrostatics in a linear dielectric medium & Magnetostatics: Electrostatic field and potential of a dipole. Bound charges due to electric polarization; Electric displacement; boundary conditions on displacement; Solving simple electrostatics problems in presence of dielectrics – Point charge at the centre of a dielectric sphere, charge in front of a dielectric slab, dielectric slab and dielectric sphere in uniform electric field. Magnetostatics: Bio-Savart law, Divergence and curl of static magnetic field; vector potential and calculating it for a given magnetic field using Stokes' theorem; the equation for the vector potential and its solution for given current densities.

Unit -III

Quantum Mechanics for Engineers: Introduction to Quantum mechanics, Wave nature of Particles, Time-dependent and time independent Schrodinger equation for wavefunction, Born interpretation, probability current, Expectation values, Free-particle wavefunction and wave-packets.

Unit-IV

Applying the Schrodinger equation: Solution of stationary-state Schrodinger equation for one dimensional problems– particle in a box, particle in attractive delta-function potential, square-well potential, linear harmonic oscillator.

Unit-V

Optics: Interference: Introduction, Interference due to division of wave front: Fresnel's Biprism, Interference due to division of amplitude: wedge shaped film, Newton's rings. Diffraction: Introduction, Difference between Fresnel and Fraunhofer diffraction, Single slit diffraction, Transmission diffraction grating, Absent spectra. Spontaneous and stimulated emissions, Einstein's coefficients, Laser and its principle, He-Ne laser.

Course Outcomes:

After completing of the course, the students will:

- **CO1.** Understand the importance of Applied Physics in describing the technology we are using today in different engineering fields
- **CO2.** Acquired knowledge of Waves, Vibration and acoustics, helps the students to develop the acoustically good hall.
- **CO3.** Knowledge of basic Quantum Mechanics can help the students for further research applications as they can be applied to any quantum, mechanical situation to find energy, momentum etc.
- **CO4.** Acquired knowledge of Optics help the students to:
    a) Know more about propagation of light and wave optics.
    b) Describe the requirements for a system to act as a laser.
    c) Differentiates the various types of lasers and their means of excitation.
    d) Able to explain, which laser would best meet the need for an industrial or research task.
    e) Demonstrate an awareness of the safety responsibilities involved in working with lasers.

Suggested Books:

1. **Pathania K. S. & Khera S. K.,** Waves and Vibration,
2. **Beiser, Arthur**, Concepts of Modern physics, TMH.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester II

Course Title: Engineering Chemistry | **Max Marks: 100**
Course Code: BSC-ECE-203 | **University Examination: 60**
Duration of Exams: 3 hours | **Internal Assessment: 40**
Credits: 4 [3-1-0]

Course Objective: The course is designed to familiarizing the students of engineering with Water treatment, polymerisation, photochemistry, corrosion and transition metal chemistry.

Unit-I

Water Treatment; Water quality measurement, Hardness of water, Estimation of hardness of water, Disadvantages of hard water ,Scale and sludge formation; disadvantages, prevention and treatment, Desalination method, reverse osmosis ,Electro dialysis, Domestic water treatment.

Unit-II

Polymerisation: Basic concept of polymerisation, Broad classification and industrial applications (Buna-N, Buna-S, Polyester, Polyethene, Polypropene, Polystyrene,), Thermosetting plastic and its softening, Biodegradable and non-biodegradable wastes.

Unit-III

Photochemistry: Photo excitation, Luminescence and types, Norrish-I and Norrish-II reactions, Application examples of photolysis, Photosynthesis Z –Diagram, Chemistry of vision, MRI equipment and procedure of working.

Unit-IV

Transition Metal Chemistry: Structure of organic compounds up to coordination no 6, Isomerism (geometrical, optical, ionisation, linkage and coordination isomerism, bonding in coordination compounds by CFT, VBT. Application of coordination compounds in organic synthesis and Medical fields.

Unit-V

Cement and Lime: Introduction and types of cement, Manufacture of Portland Cement, Setting and hardening of cement, Introduction and properties of Lime, Setting and hardening of lime.

Course Outcome:

At the end of course, the student will be able to

- **CO1.** Apply the methods to produce soft water for industrial use and potable water at cheaper cost.
- **CO2.** Substitute metals with conducting polymers and also produce cheaper
- **CO3.** Bio-degradable polymers to reduce environmental pollution,
- **CO4.** Apply knowledge about photochemical and photo physical processes and the reactivity of excited states to explain applications in photochemical energy conversion.
- **CO5.** Understand structure of organic compounds and transition metal compound synthesis,

CO6. Understand the manufacturing process of cement and lime.

Text Books:

1. **Odion G.G**-Principles of Polymerisation, John Wiley and sons.
2. **S.S Dara**-A Text Book of Engg. Chemistry.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester II

Course Title: Environmental Science | **Max. Marks:100**
Course Code: MC-ECE-201 | **University Exam: 50**
Duration of Exam: 3 Hours | **Internal Assessment: 50**
Credits: 0

Course Objective: This course is designed to make the engineering students to understand the significance of environment and ecology in human survival and growth. It also aims to connect the budding engineers to nature.

Unit-I

Elements of Ecology: Definition, Scope and basic principles of ecology and environment. Biological levels of organization, population, community, ecosystem and biosphere. Climatic factors - Solar radiations, temperature, water and precipitation.

Unit-II

Environmental pollution: Types of pollution, Air pollution, Noise pollution, Water pollution, Soil pollution, Thermal pollution, Radiation pollution

Unit-III

Biogeochemical Cycles: Importance, gaseous and sedimentary cycles. Carbon, Nitrogen, Phosphorus and Sulphur Cycles. Global Oxygen Cycles. Hydrological cycles.

Unit-IV

Succession: Concepts of succession, Types of Succession, Trends in succession, Climax and stability, Co-evolution and group selection.

Unit-V

Major biomes of the world, Characteristics of terrestrial fresh water and marine ecosystems; Forests, grasslands, lake, river and marine ecosystems of India.

Course Outcomes:

Upon the completion of the course, students will able to:

- **CO1.** Learn about the environment and ecology.
- **CO2.** Understand different types of pollution. Air, Noise, Water, Soil, Thermal and Radiation pollution.
- **CO3.** Understand biogeochemical cycles and human contribution in it.
- **CO4.** Learn succession and various types of succession.
- **CO5.** Demonstrate the ability to understand the biomes of world and its importance in human survival.

Books Suggested:

1. **J.S.Singh, S.P. Singh and S.R. Gupta**. Ecology, Environment and Resource Conservation. Anamaya Publications (New Delhi), 2008.

2. **S.C. Santra**. Environmental Science. New Central Book Agency, 2011.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester II

Course Title: Basic Electronics Lab | **Max Marks: 50**
Course Code: ESC-ECE-211 | **University Examination: 25**
Duration of Exams: 2 hours | **Internal Assessment: 25**
Credits: 1 [0-0-2]

Objective: The course is designed to provide experimental foundation for the theoretical concepts and to familiarize students with basic electronic devices, their applications and characteristics.

List of Experiments:

1. To plot the Resonance curve for a series & parallel resonance.
2. To determine and plot operating characteristics of a PN junction diode
3. To study the input / output waveforms of Half wave and bridge wave rectifiers
4. To suppress the ripple in rectifiers using RC filters.
5. To study the clipper and clamper circuits.
6. To study the Zener characteristics and its application as voltage regulator
7. To plot characteristics of transistor in CE/CB configuration
8. To plot characteristics of a BJT.
9. To plot MOSFET characteristics.
10. To study frequency response of RC Coupled Oscillators.

Laboratory Outcomes:

- **CO1.** Determine the characteristics of PN Junction and Zener diode.
- **CO2.** Design various rectifiers configuration and evaluate its various performance parameters.
- **CO3.** Design and analyze various wave shaping circuits.
- **CO4.** Determine the characteristics of a BJT and MOSFET
- **CO5.** Design and analyze the frequency response of RC Coupled Oscillators

Note: These are only the suggested list of experiments. Instructor may add or change some experiments relevant to the course contents. Experimentation to be supported by computer simulations.

Semester II

Course Title: Engineering Physics Lab | **Max. Marks:50**
Course Code: BSC-ECE-211 | **University Exam: 25**
Duration of Exam: 2 Hours | **Internal Assessment: 25**
Credits: 1 [0-0-2]

Objective: The course is designed to provide experimental foundation for the theoretical concepts and to familiarize students with experimental apparatus, the scientific method and method of data analysis.

List of Experiments:

1. Measurement of Resistance.
2. Measurement of e/m by Helical method/Thomson's method.
3. Determination of Resistivity of a given wire.
4. Determination of Band Gap of a semiconductor.
5. To determine the refractive index of the prism material using spectrometer.
6. To determine Young's modulus of a bar.
7. To determine the wavelength using Fresnel's bi-prism/diffraction grating.
8. To Determine Plank's Constant.
9. Verify the Stefan's law by incandescent lamp
10. To determine the susceptibility of a ferromagnetic material
11. Study of nano TiO2 solar cell
12. Ultrasound measurement a given liquid
13. Joule's constant experiment
14. Determination of unknown capacitance of a capacitor by de-Sauty bridge method.
15. Refractive index of a glass slab/ water by travelling microscope
16. To determine the frequency of an ac supply by using electrical vibrator
17. To find the inner and outer diameter of a hollow cylinder by using Vernier caliper.
18. To determine the diameter of a thin wire by using screw gauge and its area of crossection.
19. Measurement of 'g' and Time period by using compound pendulum.
20. To find the viscosity of a liquid using stoke's method.

Laboratory Outcomes:

- **CO1.** Develop skills to impart practical knowledge in real time solution.
- **CO2.** Understand principle, concept, working and application of new technology and comparison of results with theoretical calculations.
- **CO3.** Design new instruments with practical knowledge.
- **CO4.** Gain knowledge of new concept in the solution of practical oriented problems and to understand more deep knowledge about the solution to theoretical problems.
- **CO5.** Understand measurement technology, usage of new instruments and real time applications in engineering studies.

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Semester II

Course Title: Engineering Chemistry Lab | **Max Marks: 50**
Course Code: BSC-ECE-212 | **University Examination: 25**
Duration of Exams: 2 hours | **Internal Assessment: 25**
Credits: 1 [0-0-2]

Lab. Objective: The course is designed to provide experimental foundation for the scientific method for analysis, synthesis and determination of various chemicals

List of Experiments:

1. Acid Base Titrations.
2. Viscosity of Solutions, Determination of composition of sugar solutions from Viscosity.
3. Synthesis of Aspirin.
4. Determination of Functional Groups in Organic Compounds.
5. Synthesis pf p-Nitro Aniline from Acetanilide.
6. Conductometric Titrations.
7. Determination of Proteins in given sample of Food.
8. Determination of Flash and Fire Point of a Lubricant.

Laboratory Outcome:

At the end of practical course the students will be able to:

- **CO1.** Perform Titrations
- **CO2.** Synthesize organic compounds,
- **CO3.** Do protein determination and viscosity of solutions
- **CO4.** Learn temperature dependent properties of lubricant.
- **CO5.** Work as a team.

Semester II

Course Title: Engineering Graphics Lab | **Max Marks: 100**
Course Code: ESC-ECE-212 | **University Examination: 60**
Duration of Exams: 3 hours | **Internal Assessment: 40**
Credits: 3 [1-0-4]

Objective: The course is designed to develop the ability to visualize and communicate three-dimensional shapes and train the students to create drawings following the engineering graphics conventions.

Unit-I

Introduction to Engineering Graphics: Engineering drawing as language of Engineers. Drawing instruments and their uses. Projections: The planes of projections, first and third angle projections, projection of points lying in any quadrant. Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scale: needs and importance, to find representative factor of a scale, drawing of simple and diagonal scales.

Unit-II

Projection of Straight line and their Traces: projection of planes. Planes parallel to reference plane; plane perpendicular to both reference planes; planes perpendicular to one and inclined to other reference plane. Projection of solids with their axes perpendicular or inclined to one reference plane but parallel to other.

Unit-III

Section of Solids & Development of Surfaces: Definition of sectioning and its purpose, Procedure of sectioning, Illustration through examples, types of sectional planes. sectional orthographic views of geometrical solids, Purpose of development, Development of prism, cylinder, cone and pyramid surface

Unit-IV

Orthographic Projections: Theory of orthographic projections (Elaborate theoretical instructions) Drawing 3 views of given objects (Non-symmetrical objects and blocks may be selected for this exercise) Exercises on both first angle are third angle.

Unit-V

Isometric Projection: Classification of pictorial views, Basic Principle of Isometric projectionIsometric

Views of lines, Planes, Simple and compound Solids; Difference between isometric projection and Isometric view, Isometric projection of solids such as cube, prism, pyramid and cylinder. Introduction to computer aided drafting (CAD)

Text Books:

1. Bhat, N. D. & Panchal, V. M, *Engineering Drawing*, Charotar Publishers, Anand.

2. Narayana, K. L. & Kannaiah P, *Engineering Graphics*, Tata McGraw Hill, New Delhi.

Reference Books:

1. Gill P. S., *Engineering Graphics and Drafting*, Katria and Sons, Delhi.
2. Luzzadde Warren J., *Fundamentals of Engineering Drawing*, PHI.

Laboratory Outcome:

At the end of practical course the students will be able to:

- **CO1.** To read Engineering Drawing and execute the construction work with the help of available drawing
- **CO2.** To represent three dimensional objects by two dimensional views.
- **CO3.** Be in a position to show hidden details of objects or underground constructions work by drawing sectional views.
- **CO4.** Exposure to creating working drawings
- **CO5.** Exposure to the visual aspects of engineering design

Note for paper setter: The Question paper shall comprise of 10 questions and two questions shall be set from each Unit. The student has to attempt five questions, selecting one from each Unit. Questions must be set in such a way that the students be able to answer 5 questions within 3 hours.

Semester – III

Semester III

Course Title: Mathematics-III **Max. Marks:100**
Course Code: BSC-ECE-301 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 4 [3-1-0]

Objective: The objective of this course is to familiarize the students with various transform. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling various problems in the discipline.

Unit-I

Integral Transform-I: Introduction, Laplace transform, Existence theorem, Properties and theorem of Laplace transform, Laplace transform of unit-step function, impulse function, periodic function and error functions, Inverse Laplace transform, Convolution theorem. Applications of Laplace transform in solving differential and integro-differential equations.

Unit-II

Integral Transform-II: Fourier integral, Fourier Sine and Cosine integrals, Complex form of Fourier integral, Fourier transform, Inverse Fourier transform, Fourier Sine and Cosine transforms, Properties of Fourier transform, Inverse Fourier transform, Convolution theorem, Parseval's identities for Fourier transforms, Fourier transform of the derivatives of a function, Applications of F-transform to Boundary Value Problems.

Unit-III

Z-Transform: Introduction and definition of z-transform, some standard forms, Linearity property, Damping rule Some standard results, shifting u_n to the right and to the left, Multiplication by n. Two basic theorems, Inverse Z-Transform, Convolution theorem, Application to difference equations.

Unit-IV

Basic Probability: Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables,

Unit-V

Basic Statistics: Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation. Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas.

Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Understand the basic concepts and techniques to solve Laplace transform and also learn to apply the same to solve various problems of engineering which are modelled through differential equations
- **CO2.** Demonstrate the ability to understand the basic concepts and techniques to solve Fourier's transform and also learn to apply the same to find solutions of boundary value problems (BVP).
- **CO3.** Apply the concepts of the z-transform in solving difference equations and other discreet signal system.
- **CO4.** Learn the ideas of probability and random variables and various discrete and continuous probability distributions and their properties.
- **CO5.** Understand the basic ideas of statistics including measures of central tendency, correlation and regression and apply various statistical methods in engineering problems.

Text Books:

1. **Erwin kreyszig**, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. **Ross, A:** First Course in Probability, 6th Ed., Pearson Education India, 2002.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester III

Course Title: Network Analysis & Synthesis | **Max Marks: 100**
Course Code: PCC-ECE-301 | **University Exam: 60**
Duration of Exam: 3 Hours | **Internal Assessment: 40**
Credits: 4 [3-1-0]

Objective: The course has been designed to get student acquainted with basic concepts, principles and applications of electrical networks and their synthesis.

Unit-I

Network Theorems & Network Topology: Network Theorems Superposition, Reciprocity and Millman's, theorems, Thevenin's and Norton's theorems; Maximum Power transfer theorem (A.C Analysis only)

Network Topology: Graph of a network, Concept of tree and co-tree, incidence matrix, tie-set, and cut-set schedules, Formulation of equilibrium equations in matrix form, Solution of resistive networks, Principle of duality.

Unit-II

Capacitive, Inductive Transients & First Order Circuits: Capacitive Transients, Inductive Transients, Combination of Capacitance & Inductance, Initial and Final Conditions, Exponential Functions, Timing Intervals of First and 2^{nd} Order Circuits. Laplace Transform application to solve differential equations and analysis of electric circuits.

Unit-III

Two Port Networks Parameters: Z Parameter, Y parameter, h – parameter, ABCD parameter, Equivalent circuit using these parameters. Condition for reciprocity and symmetry of two port network in different parameters. Interconnection of two port networks. Cascade connection of two port networks parallel connection of two port networks. Series and series parallel connections. Inter conversion of parameters.

Unit-IV

Network Synthesis: Transfer Functions, Natural and Forced Responses, Poles and Zeros of Transfer Functions, Foster and Caure's Forms, Stability, Hurwitz's Polynomials.

Unit-V

Filter Synthesis: Introduction, Classifications of filters, Characteristic Impedance and propagation constant of pure reactive networks, Ladder network, T–Section, Pie Section, Terminating Half Section, Pass Bands and Stop Bands, Design of constant K, n – Derived Filters, Composite Filters.

Course Outcomes:

After completion of the course student will be able to:

CO1. Apply network theorems for the analysis of electrical circuits

CO2. Provide solution for first and second order networks and obtain the transient and steady-state response of electrical circuits.

CO3. Analyze two-port circuit behavior

CO4. To synthesize various networks using different synthesis techniques.

CO5. To understand and synthesize different types of filters.

Text Books:

1. **M.E. Van Valkenburg, "**Network Analysis", Prentice Hall, 2006.
2. D. Roy Choudhary, "Networks and Systems", New Age International Publications, 1998

Reference Books:

1. **Stanley,** Network Analysis with Applications, Pearson Education.
2. **Mittal G. K.**, Network Analysis, Khanna Publications.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester III

Course Title: Advanced Electronic Circuits | **Max Marks: 100**
Course Code: PCC-ECE-302 | **University Exam: 60**
Duration of Exam: 3 Hours | **Internal Assessment: 40**
Credits: 4 [3-1-0]

Objective: The course is designed to introduce the students with advance electronic circuits and applications in fabrications of various devices.

Unit-I

Low Frequency Transistor Analysis: complete h parameter model of BJT, Analysis and Design of transistor amplifier circuits using h parameters, frequency response of amplifiers, Multistage Amplifier, Darlington compound configuration, low-frequency small-signal analysis of MOSFETs.

Unit-II

High Frequency Transistor Analysis: High frequency hybrid – pi model, analysis and design of transistor amplifier circuits, approximate CE high frequency model with resistive load, CE short circuit current gain, high-frequency model of MOSFETs.

Unit-III

Power Amplifier: Classification of power amplifiers, Class A, Transformer Coupled Amplifier, Transformer Coupled Audio Amplifier, Push Pull Amplifier, Complimentary Symmetry Circuits, Class B, Class AB, Class D operation.

Unit-IV

Feedback Amplifier: Feedback concept, characteristics of negative and positive feedback. Effect of negative and positive feedback on performance parameters. Negative Feedback: Voltage series, Voltage shunt, Current series, Current shunt types of Negative feedback, Typical transistor circuits effects of Negative feedback on Input and Output impedance, Voltage and Current gains, Bandwidth, Noise and Distortion. Principle of positive feedback, concept of stability in electronics circuits.

Unit-V

Oscillator: Basic Oscillator operation, Barkhausen's criteria, Phase shift Oscillator, Wien bridge Oscillator, Hartley Oscillator, Colpitt Oscillator, Tuned Oscillator circuits, Crystal Oscillator (BJT version only)

Course Outcomes:

After completion of the course student will be able to:

CO1. Analyze and design BJT and MOSFET based circuits in different configurations at low frequencies.

CO2. Analyze and design BJT and MOSFET based circuits in different configurations at high frequencies.
CO3. Classify and analyze the performance of different power amplifiers.
CO4. Understand different feedback amplifier configurations and evaluate the performance parameters.
CO5. Analyze and design different types of oscillators.

Text Books:

1. **Millman & Halkias** -Integrated devices & circuits.
2. **Sedra and Smith**- Microelectronics.

Reference Books:

1. **Boylestad**- Electronic Devices & Circuit.
2. **David A. Bell**- Electronics Devices and Circuits.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester III

Course Title: Signals & Systems | **Max Marks: 100**
Course Code: PCC-ECE-303 | **University Exam: 60**
Duration of Exam: 3 Hours | **Internal Assessment: 40**
Credits: 4 [3-1-0]

Objective: The objective of this course is to study and analyse the characteristics of continuous and discrete signals and systems**.**

Unit-I

Introduction: Definitions of a signal and a system, classification of signals, elementary signals, and basic Operations on signals, Systems viewed as Interconnections of operations, properties of systems.

Unit-II

Time-domain representations for LTI systems: Convolution and its significance, impulse response representation, Convolution Sum and Convolution Integral. Relationship between LTI system properties and the impulse response i.e., Causality, Stability, Step response.

Unit-III

Fourier representation for signals: Fourier representation for signals, Continuous -time Fourier series and their properties, Application of Fourier Series to LTI systems, Continuous –time Fourier Transform & its properties, Applications of Fourier Transform to LTI systems, Fourier transform of periodic signals, Discrete-time Fourier Transform and its properties, Relationship of Fourier Transform to other transforms.

Unit-IV

Laplace Transforms–1: Introduction, Laplace transform, ROC and its properties, properties of Laplace transforms, inverse Laplace transform using partial fraction method. Transform analysis of LTI Systems, unilateral Laplace Transform and its application to solve differential equations. Initial and final value theorems, Poles and Zeros of a system.

Unit-V

The Z Transform: Z-Transform- Unilateral and Bilateral, Region of convergence; Properties of the Z-transform; inverse Laplace transforms using long division and partial fraction method. Transform analysis of LTI Systems, Unilateral Z-transform and its application to difference equations with zero and non-zero initial condition. Block diagram representation in Z-Domain.

Course Outcomes:

After completion of the course student will be able to:

CO1. Represent different Signals in mathematical form and apply basic operations on Signals. Also, Student's must know physical significance of various elementary signals.

CO2. Classify systems based on their properties and determine the response of LTI system using convolution.

CO3. Represent Signals in frequency domain i.e. Analyze the spectral characteristics of continuous-time periodic and aperiodic signals using Fourier analysis.

CO4. Apply the Laplace transform and Z- transform for analysis of continuous-time and discrete-time signals and systems.

Text Books:

1. **Simon Haykin and Barry Van Veen,** "Signals and Systems", Wiley & Sons, 2001.Reprint 2002.
2. **B. P. Lathi,** "Linear Systems and Signals", Oxford University Press, 2005.

Reference Books:

1. **V. Oppenheim Alan,** Signals and Systems, PHI, 2nd Ed., 1997
2. **H. P Hsu, R. Ranjan,** "Signals and Systems", Scham's outlines, TMH, 2006.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester III

Course Title: Digital Electronics | **Max Marks: 100**
Course Code: PCC-ECE-304 | **University Exam: 60**
Duration of Exam: 3 Hours | **Internal Assessment: 40**
Credits: 4 [3-1-0]

Objective: The objective of this subject is to enable the students to know basic concepts of digital electronics design and build digital hardware.

Unit-I

Review of number systems, BCD, Excess-3, Gray and Alphanumeric codes. Boolean algebra, Boolean Theorems, De-Morgan's Theorems, Standard Forms of Boolean Expressions, Simplification techniques and Minimization methods: K-MAPS, Q-M (Tabulation) method.

Unit-II

Combinational Logic Circuits: Design and Analysis of Basic Combinational Logic Circuits, Combinational Logic Using Universal Gates. Basic Adders, Subtractors, Parity-Checkers and Generators, Comparators, Decoders, Encoders, Code Converters, Multiplexer (Data Selector), De-multiplexers, seven segment display.

Unit-III

Sequential Circuits: Latches, Flip-flops (SR, JK, T, D, Master/Slave FF), Edge-Triggered Flip-Flops, characteristic tables and excitation tables, conversion of flip-flops, Design of Flip-Flops using state diagrams and state tables, state reduction and assignment.

Unit-IV

Basic Flip-Flop Applications: Shift registers and Functions, Serial In - Serial Out Shift Registers, Serial In - Parallel Out Shift Registers, Parallel In - Serial Out Shift Registers, Parallel In -Parallel Out Shift Registers, Bidirectional Shift Registers, Synchronous and Asynchronous Counter Operation, Mod-n Counters, Design of counters.

Unit-V

Basics of Semiconductor Memories: Random-Access Memories (RAM), Read Only Memories (ROMs), Programmable ROM's (PROMs and EPROM's), PAL, PLA, IEEE notations

Introduction to digital logic families: brief background and comparison of various logic families-TTL, ECL, MOS, CMOS.

Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Examine the structure of various number systems and its application in digital design.
- **CO2.** Understand, analyze and design various combinational and sequential circuits.
- **CO3.** Analyze different types of registers and design counter circuits.
- **CO4.** Analyze different logic families, their characteristics and performances

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CO5. Design solutions to real world problems.

Text Books:

1. **Morris Mano**, Digital Logic Design, TMH.
2. **Anil K Miani**, Digital Electronics, Wiley publications.

Reference Books:

1. **Tocci R. J.** &**Widner**, Digital Systems: Principles and Applications, PHI.
2. **P. Malvino**, Digital principles and applications, Tata McGraw.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester III

Course Title: Disaster Preparedness & Planning **Max Marks: 100**
Course Code: HSMC-ECE-301 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: To increase the knowledge and understanding of the disaster phenomenon, its different contextual aspects, impacts and public health consequences and to ensure skills and abilities to analyse potential effects of disasters and of the strategies and met to deliver public health response to avert these effects.

UNIT -I

Disaster-historical overview: Disaster and hazards, definition of basic terms such as-vulnerability, risk, capacity, impact, prevention, mitigation. ecological fragility, Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land-use changes, urbanization etc.), sustainable and environmental friendly recovery; reconstruction and development.

UNIT-II

Classification of Disaster: natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.), Causes and concern of natural disasters, manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills etc), Causes and concern of manmade disasters

UNIT-III

Disaster Impacts: Disaster impacts- Global (Climate change), regional (urban disasters) and local-environmental impacts (physical, social, ecological, economical, political, etc.), health impacts, psycho-social issues; demographic aspects (gender, age, special needs), Impact evaluation and analysis.

UNIT-IV

Disaster Risk Reduction: Disaster management cycle phases; prevention, mitigation, preparedness, relief and recovery; structural and nonstructural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post-disaster environmental response, Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

UNIT-V

Disasters management and control: Management of natural disasters (Earthquake, flood and drought), various components and their functions, Man-made disasters (Industrial and nuclear

disaster)-management and control, preventives measures, regulatory aspects.

Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Capacity to integrate knowledge and to analyze, evaluate and manage the different public health aspects of disaster events at a local and global levels, even when limited information is available.
- **CO2.** Capacity to describe, analyse and evaluate the environmental, social, cultural, economic, legal and organisational aspects influencing vulnerabilities and capacities to face disasters.
- **CO3.** Capacity to work theoretically and practically in the processes of disaster management (disaster risk reduction, response, and recovery) and relate their interconnections, particularly in the field of the Public Health aspects of the disasters.
- **CO4.** Capacity to manage the Public Health aspects of the disasters.
- **CO5.** Capacity to obtain, analyse, and communicate information on risks, relief needs and lessons learned from earlier disasters in order to formulate strategies for mitigation in future scenarios with the ability to clearly present and discuss their conclusions and the knowledge and arguments behind them.

Text Books:

1. http://ndma.gov.in/ (Home page of National Disaster Management Authority). 64
2. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.

Reference Books:

1. Singh B.K., 2008, Handbook of Disaster Management: techniques & Guidelines, Rajat Publication.
2. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester III

Course Title: Advanced Electronic Circuits Lab | **Max Marks: 50**
Course Code: PCC-ECE-311 | **University Exam:25**
Duration of Exam: 2 Hours | **Internal Assessment: 25**
Credits: 1 [0-0-2]

List of Experiments:

1. To study bipolar transistor as a switch.
2. To plot a load line for a CE amplifier and show effect of input signal on Q-point.
3. To demonstrate use of a BJT in a CE amplifier circuit configuration and study its frequency response.
4. To demonstrate use of a BJT in a CC amplifier circuit configuration and study its frequency response.
5. Wiring of RC coupled Single stage & double stage BJT amplifier and determination of the gain- frequency response, input and output impedances.
6. Wiring of RC coupled Single stage & double stage FET amplifier and determination of the gain- frequency response, input and output impedances
7. Wiring of BJT Darlington Emitter follower with and without bootstrapping and determination of the gain, input and output impedances (Single circuit).
8. To study the various coupling techniques for transistor amplifiers.
9. To study the characteristics of a Class- A amplifier.
10. To study the characteristics of Class- B amplifier.
11. To study the characteristics of Class-C amplifier.
12. To study the characteristics of Class- AB amplifier.
13. To study the characteristics of Class- B push-pull amplifier.
14. To study the HARTLEY and COLPITS oscillator
15. Experimentation to be supported by computer simulations

Course Outcomes:

After completion of the course student will be able to:

CO1. Verify the characteristics of BJT in CC, CE, CB configurations by measuring output response of each.

CO2. Determine gain- frequency response, input and output impedances of RC coupled Single stage & double stage BJT amplifier.

CO3. Determine gain- frequency response, input and output impedances of RC coupled Single stage & double stage FET amplifier.

CO4. Determine gain, input and output impedances of BJT Darlington Emitter follower with and without bootstrapping.

CO5. Function effectively as a team.

Semester III

Course Title: Digital Electronics Lab | **Max Marks: 50**
Course Code: PCC-ECE-312 | **University Exam:25**
Duration of Exam: 3 Hours | **Internal Assessment: 25**
Credits: 1 [0-0-2]

List of Experiments:

1. Study of pin diagram of various ICs and to test the logic gates and verify their truth tables.
2. Implementation of following combinational circuits using Logic Gates.
    a. Half and Full Adder.
    b. Half and Full Subtractor.
3. Implementation of Multiplex, De-multiplexer, Decoder and Encoder.
4. Implementation of Boolean functions using MUX.
5. To add two 4-bit binary numbers using IC 7483.
6. To verify the operation of different modes of shift register using IC 7495.
7. Design of BCD to 7 segment display using logical gates.
8. Implementation of different Flip-Flops.
9. Implementation of Shift registers and Counters using Flip-Flops.
10. Simulations
    a. Introduction to circuit maker and electronic work bench.
    b. Implementation of experiments from Serial No. 1 to 9 through simulations.

Course Outcomes:

After completion of the course student will be able to:

CO1. Test and verify logic gates with its truth.
CO2. Implement basic arithmetic circuits.
CO3. Implement Multiplexer, De-Multiplexer, Encoder & Decoder circuits.
CO4. Use modern engineering and IT tools for circuit simulations.
CO5. Function effectively as a team.

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Semester III

Course Title: Network Analysis Lab | **Max Marks: 50**
Course Code: PCC-ECE-313 | **University Exam: 25**
Duration of Exam: 3 Hours | **Internal Assessment: 25**
Credits: 1 [0-0-2]

List of Experiments

1. Verification of Thevenin's theorem, Norton's theorem.
2. Verification of Maximum power transfer theorem, Superposition theorem.
3. Verification of Reciprocity theorem.
4. Design and implementation of T and Π passive filters.
5. Determination of h-parameters of a network.
6. Study of sinusoidal steady state response of a network.
7. Study of transient response of a network.
8. Study of passive integrator and differentiator.
9. Synthesis of RC-network for a given network function.
10. Verification of equivalence of star and delta transformation.

Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Verify various network Theorems.
- **CO2.** Design various types of Filter using bread board.
- **CO3.** Evaluate steady and transient state response of a network.
- **CO4.** Synthesize RC-networks.
- **CO5.** Function effectively as a team.

Semester – IV

Semester IV

Course Title: Numerical Techniques **Max Marks: 100**
Course Code: BSC-ECE-401 **University Exam:60**
Duration of Exam: 3 Hours **Internal Assessment:40**
Credits: 4 [3-1-0]

Course Objective: This Course aims at providing the necessary basic concepts of a numerical techniques and give procedures for solving numerically different Kinds of problems occurring in engineering and technology.

Unit-I

Solutions to Algebraic and Transcendental Equations:

Solutions to algebraic and transcendental equations by iterative, Bisection, Regula-Falsi, Newton-Raphson methods and Secant Methods.

Unit-II

Interpolation: Finite-differences and operators, Relation between operators, Interpolation With Equal Intervals – Newton's Forward And Backward Difference Formulae, Interpolation With Unequal Intervals – Lagrange's Interpolation – Newton's Divided Difference Interpolation .

Unit-III

Numerical Differentiation & Integration

Introduction to Numerical differentiation and integration, Errors in Numerical differentiation, Trapezoidal rule, Simpson's one-third rule, Simpson's third-eight rule, Boole's rule and Weddle's rule, Newton-Cote integration formula.

Unit-IV

Matrix and Linear System of Equations

Direct Methods: Gauss and Gauss-Jorden method, Crout's Triangularization method, Iterative methods: Gauss –Jacobi and Gauss Seidel method, Newton method for nonlinear simultaneous equations

Unit-V

Numerical Solutions to Ordinary Differential Equations:

Numerical solution of ordinary differential equations by Taylor's Series, Picard's method, Euler's method, Modified Euler's method and Runge-Kutta method of 4^{th} order, Finite-difference method for Boundary value problems

Course Outcomes:

After completion of the course student will be able to:

CO1 Comprehend of the Power of Numerical Techniques, and Ideas.

CO2 Apply these techniques to problems drawn from Industry, Management and other engineering fields.

CO3 Demonstrate the ability to solve linear system of equations.

CO4 Solve various problem of linear and nonlinear differential equations by using numerical methods.

Text Books

1. Numerical Methods in Engineering and Science: (C, and C++, and MATLAB), B. S. Grewal, Khanna Publication
2. Jain, M. K & Iyengar. S.R.K, numerical method for scientific and engineering computation, 3rd edition, New Age Publishers

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester IV

Course Title: Solid State Electronic Devices **Max Marks: 100**
Course Code: PCC-ECE-401 **University Exam:60**
Duration of Exam: 3 Hours **Internal Assessment:40**
Credits: 3 [3-0-0]

Objective: The course is designed to develop an understanding of Solid State Devices.

Unit-I

Free Electron Theory: Energy bands in solids, metals insulators, semiconductors and semimetals, free electron in a box, free electron and density of states, Fermi-Dirac distribution function, Fermi energy and contact potential, electronic conductivity and mean free time.

Unit-II

Band Theory of Electronic Conductor: Koenig-penny model, Block wave, Block Theorem, Brillion zones, effective mass, density of states, & energy discontinuity.

Unit-III

Semiconductor Physics: Intrinsic & Extrinsic semiconductors, P type and N type semiconductors, Homogeneous structures, free carrier concentration & Fermi level, donor & acceptor states, derivation of Fermi level, carrier concentration and mobility, scattering mechanisms, semiconductor materials & their energy band structures.

Unit-IV

Transport and Recombination Phenomenon: Concepts of Drift and Diffusion, Drift velocity, Diffusion current, thermal equilibrium condition, charge neutrality equation, carrier recombination processes, continuity equation & time dependent diffusion equations, concepts of deep level & shallow levels.

Unit-V

Semiconductor Devices: Working, Structure and I-V characteristics of PN junction Diodes and BJTs, MOSFETs –Structure, working and characteristics, Fabrication of MOSFETs- Diffusion, Epitaxial Fabrication, Photolithography, Twin Tub Techniques and Silicon on Insulator (SoI)

Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Differentiate the energy bands in metals, insulators & semi-conductors; calculate Fermi-Dirac function, Fermi energy and contact potential, electronic conductivity and mean free time of metals, insulators & semiconductors.
- **CO2.** Derive of Fermi level & calculate the carrier concentration and mobility, and analyze the scattering mechanisms, the energy band structures of p-type and n-type semiconductors.
- **CO3.** Apply concepts of diffusion and drift currents and thereby calculate diffusion current & drift velocity.
- **CO4.** Plot I-V characteristics of diode, BJTs, FETS & MOSFETs.

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Text Books:

1. **Streetman, Ben G. & Banerjee, Sanjan,** Solid State Electronic Devices (5th Edition) PHI Private Ltd, 2003 Ed.

Reference Books:

1. **Yannis, Tsividis,** Operation & Mode line of The MOS Transistor (2nd Edition) Oxford University Press, 1999 Ed.
2. **Gupta, Nandita Das & Gupta, Aamitava Das**, Semiconductor Devices Modeling a Technology, PHI, 2004 Ed.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester IV

Course Title: Linear Control Systems **Max Marks: 100**
Course Code: PCC-ECE-402 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: The course puts an emphasis on the Linear control systems. The course content has been designed to give a practical shape to the basic courses.

Unit–I

Introduction: Concepts of Control Systems- Open Loop and closed loop control systems and their differences- Different examples of control systems- Classification of control systems, Feed-Back Characteristics, Effects of feedback. Mathematical models: Differential equations, Impulse Response and transfer functions. Block diagram representation of systems, Reduction using Block diagram algebra, Representation by Signal flow graph, Reduction using mason's gain formula.

Unit-II

Time Response Analysis: Standard test signals, Time response of first order systems, Characteristic Equation of Feedback control systems, Transient response of second order systems, Time domain specifications, Steady state response, Steady state errors, PID Controllers.

Unit-III

Stability Analysis in S-Domain: The concept of stability - Routh stability criterion – qualitative stability and conditional stability. **Root Locus Technique:** The root locus concept - construction of root loci-effects of adding poles and zeros to G(s)H(s) on the root loci.

Unit-IV

Frequency Response Analysis: Introduction, Frequency domain Specifications-Bode Diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Phase margin and Gain Margin-Stability Analysis from Bode Plots. **Stability Analysis in Frequency Domain:** Polar Plots, Nyquist Plots and applications of Nyquist criterion to find the stability.

Unit-V

Introduction to State variable analysis: Concepts of state, state variable and state models for electrical systems, Solution of state equations.

Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Define concept of control systems & analyze characteristics equation as well as mathematical models.
- **CO2.** Plot the time response of different control systems and explain PID controllers.
- **CO3.** Analyze the different stability scheme in S-Domain and plot root- locus of control systems.

CO4. Perform stability analysis in frequency domain using different techniques.

CO5. Solve control system using state space equations.

Text Books:

1. **Nise S-** Control Systems engineering 4th edition John Wiley and son's.
2. **Ogata Katsuhiko**- Modern Control Engineering Prentice Hall of India Pvt. Ltd., 3rd edition.

Reference Books:

1. **Magrath. J and Gopal M**- Control Systems Engineering –New Age International (P) Limited Publishers, 2nd edition.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester IV

Course Title: Analog Communication Systems **Max Marks: 100**
Course Code: PCC-ECE-403 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 4 [3-1-0]

Objective: The main thrust in this course is on making students familiar with basic communication principles and Technologies in vogue. The stress is on the applied Communication with reference to the relevant technologies.

Unit-I

Introduction to communication systems: Elements of an Analog Communication System, Communication Media and their Characteristics, channel capacity, Bandwidth, Shannon Capacity Relationship. Concept of time domain and frequency domain representation of signals. Fourier series expansion and Fourier Transform of some fundamental Signals.

Unit-II

Amplitude Modulation (AM): Concept of Modulation, Need for modulation, Amplitude modulation, Frequency spectrum of AM Waves, Representations of AM waves, Power relation in AM waves, Types of AM- Double sideband techniques and Single Sideband Techniques. SSB generation and Detection, DSB Generation and Detection, Numerical on Power calculations and Spectral analysis of AM.

Unit-III

Frequency Modulation (FM): Concept of Angle Modulation, Introduction to FM, Expression for Monotone FM, Types of FM, Power relations in FM, Spectrum of wideband FM, Bandwidth calculation in FM, Generation Methods of FM- Direct and Indirect, Detection methods of FM signal, PLL as FM detector. Numerical on power calculations, Bandwidth calculations and Spectral analysis of FM.

Unit-IV

Radio Transmitters and Receivers: Block Diagram of AM/FM radio Transmitter, Characteristics of Radio receivers- Sensitivity, Selectivity, Fidelity, Image Rejection (IFRR), Block Diagram for TRF Radio Receiver and Super-Heterodyne Receiver, ACG Controller and its configurations.

Unit-V

Noise analysis: Source of noise in analog communication systems, classification of noise - external noise, internal noise, Noise figure, signal to noise ratio (SNR), SNR and noise figure calculation in AM/FM systems, Concept of Pre-emphasis & De-emphasis. Numerical on noise and SNR calculations

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Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Characterize different components of communication systems and find time domain and frequency domain representation of different signals.
- **CO2.** Apply concept of modulation and carry out power calculations & spectral analysis of AM wave.
- **CO3.** Carry out power calculations, Bandwidth calculations and Spectral analysis of FM wave.
- **CO4.** Calculate Noise figure, signal to noise ratio (SNR) in AM/FM systems and analyze different noises present in communication systems.

Text Books:

1. **Taub and Schilling**, Principles of communication systems, TMH
2. **Simon Haykin**, Communication Systems, John Wiley & Sons.

Reference Books:

1. **Roddy and Coolen**, Electronic comm., PHI, New Delhi, 4th Edition, 2003.
2. **Bruce Carlson et al**, Comm. systems, McGraw Hill Int., 4th Ed., 2002.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester IV

Course Title: Linear Integrated circuits & Pulse Switching **Max Marks: 100**
Course Code: PCC-ECE-404 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 4 [3-1-0]

Objective: The course has been designed to get student acquainted with basic concepts, principles and applications of OPAMP based linear and Non-linear circuits and different wave shaping circuits.

Unit-I

Op-Amplifier Fundamentals: Op-amp Block Diagram, ideal and practical Op-amp specifications, DC and AC characteristics, 741 op-amp & its features, Basic Op -Amp circuit, Op-Amp parameters – Input and output voltage, CMRR and PSRR, offset voltages and currents, Input and output impedances, Slew rate and Frequency limitations; Biasing of Op-Amps.

Unit-II

Linear applications of OP-Amps: Voltage Followers, Non-inverting & Inverting amplifiers, Summing amplifiers, Difference amplifier, Instrumentation amplifier, AC amplifier, V to I, I to V converters. Linear wave shaping circuits: High Pass circuits, Low pass circuits, Differentiator, Integrator, RLC circuits, Ringing circuits.

Unit-III

Non-Linear applications of OP-Amps: Basic comparator & its characteristics, zero crossing detector, Inverting and non-inverting Schmitt trigger circuits, Monostable & Astable multivibrator, Triangular and Square wave generators, Log and Anti log amplifiers, Precision rectifiers.

Unit-IV

Switching and wave shaping circuits: Design of transistor switch, transistor-switching times. Steady state and transient behaviors of electronic (Diode & transistor) Switches, switching characteristics, Delay time, Rise time, Storage time and fall time. Non- Linear wave shaping circuits: Clipping circuits-series diode clipper, shunt diode clipper, transistor clipper. Two level clipping. Comparators, clamping circuit, Clamping Theorem. **Time- base Generators:** Time- base Generators, Methods of generating a time –base waveform, exponential sweep circuit, sweep circuit using UJT, sweep circuit using a transistor switch, Miller and Bootstrap time base generators-basic principles.

Unit-V

Timers, Blocking Oscillators & Phase Locked Loops: Introduction to 555 timer- its applications as Monostable and Astable multivibrators, Linear voltage regulators- protection mechanism- LM 723 functional diagram, functional operation of 78xx series IC and design of fixed and adjustable regulators. Blocking- Oscillator, Astable transistor blocking oscillator (Diode-controlled and RC-controlled), Application of blocking oscillator. Phase Locked Loop, frequency multiplication, frequency translation.

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Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Solve Input and output voltage, CMRR and PSRR, offset voltages and currents, Input and output impedances, Slew rate of op-amps.
- **CO2.** analyze and design Voltage Followers, Non-inverting & Inverting amplifiers, Summing amplifiers, Instrumentation amplifier, AC amplifier, V to I, I to V converters using Op-Amps
- **CO3.** Analyze and design zero crossing detector, Inverting and non-inverting Schmitt trigger circuits, Monostable & Astable multivibrator, Triangular and Square wave generators, Log and Anti log amplifiers, Precision rectifiers using Op-amps
- **CO4.** Analyze Time- base Generators, Timers, Blocking Oscillator and Phase Locked Loops

Text Books:

1. C**howdhury D. Roy**, Linear Integrated Circuits, New Age International (p) Ltd, 2nd Ed., 2003.
2. **Gayakwad Ramakanth** - Op-Amps & Linear ICs, PHI,1987.

Reference Books:

1. **Sergio Franco** -Design with Operational Amplifiers & Analog Integrated Circuits.
2. **Coughlin R.F. & Driscoll Fredrick**- Operational Amplifiers & Linear Integrated Circuits, PHI.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester IV

Course Title: Electronic Measurements & Instrumentation **Max Marks:100**
Course Code: PCC-ECE-405 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: The objective of this course is to expose the students to a broad knowledge of experimental methods and measurement techniques.

Unit-I

Measurement Systems and Characteristics of Instruments: Introduction- Measurements, Significance of measurements, Methods of measurements, Instruments and measurement system, Electronic instruments, Classification of instruments, Deflection and Null type instruments, Comparison Analog and Digital Modes of operation, Application of measurement system, Errors in measurements, Types of errors, Accuracy and Precision, Noise, Resolution or discrimination, loading effects, Units, Absolute units, Fundamental and Derived units.

Unit-II

Electromechanical Indicating Instruments: D'Arsonaval Galvanometer- Construction of D'Arsonaval Galvanometer, Torque equation, Dynamic behavior of Galvanometer, Ballistic galvanometer- Construction and theory, Introduction to PMMC Instruments and Moving iron instruments, Instrument transformers.

Unit-III

Bridge Circuits for RLC Measurements & Potentiometers: Measurement of R, L and C, Wheatstone, Kelvin, Maxwell, Anderson, Schering and Wien bridges Measurement of Inductance, Capacitance, Effective resistance at high frequency, Q-Meter. Potentiometers: principle of operation, DC and AC potentiometers. Application of potentiometers.

Unit-IV

Transducers: Principles of operation, Classification of transducers based upon principle of transduction, Summary of factors influencing the choice of transducer, Qualitative treatment of Strain Gauge, LVDT, Thermocouple, Piezo-electric crystal and photoelectric transducers.

Unit-V

Electronic Instruments: Introduction-Electronic Voltmeter, VTVM Transistor voltmeter, Electronic multimeter, Digital multimeter.

Cathode Ray Oscilloscope: Introduction- CRO, Cathode ray tube, Block diagram of CRO, Measurement of voltage, phase and frequency using CRO, Special purpose oscilloscopes

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Course Outcomes:

After completion of the course student will be able to:

CO1. Test and Measure various electronics quantities with accuracy and precision

CO2. Select accurate galvanometer for different applications and apply concepts of electromagnetic theory to calculate current flowing through galvanometer.

CO3. Measure R, L & C accurately using bridges.

CO4. Apply principles of transducer for selecting different types of transducer appropriate in different engineering applications.

CO5. Select proper instruments such as electronic voltmeter, digital multimeter, CRO which will properly verify theoretically proposed data or for carrying out experiments.

Text Books:

1. **Sawhney A. K.** Electrical & Electronic Measurements &Instrumentation, Dhanpat Rai & Sons
2. **Gupta J. B** -Measurements and Instruments, S. K Kataria & Sons, Delhi, First Edition. (2003).

Reference Books:

1. **Cooper W. D, Helfrick A. D**. Modern Electronic Instruments & Measurement Tech, PHI.
2. **R. K. Rajput**, Electrical Measurements & Measuring Instruments, S Chand.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester IV

Course Title: Linear Control Systems Lab | **Max Marks: 50**
Course Code: PCC-ECE-411 | **University Exam: 25**
Duration of Exam: 3 Hours | **Internal Assessment: 25**
Credits: 1 [0-0-2]

List of Experiments

1. To study the performance of Relay Control Combination of P, I and D control schemes in a typical thermal system. (oven)
2. To study the torque-speed characteristics of an AC servomotor.
3. To study the time response of a variety of simulated linear systems.
4. To study the role of feedback in a DC speed control system.
5. To study the role of feedback in a DC position control system.
6. To study the role of a combination of P, I and D control actions in a variety of simulated linear systems.
7. To study the computer simulation of a number of systems.
8. Use of MATLAB / SIMULINK /Control System tool boxes.

Course Outcomes:

After completion of the course student will be able to:

CO1. Apply concept of P, I and D control scheme in different engineering applications.
CO2. Plot torque & speed characteristics of AC servomotor.
CO3. Analyze roll of feedback in DC speed and DC position control system.
CO4. Gain ability to plot time response of variety of simulated linear control system.
CO5. Simulate different linear control system in software such as LabVIEW/MATLAB.

Semester IV

Course Title: Analog Communication Systems Lab | **Max Marks: 50**
Course Code: PCC-ECE-412 | **University Exam: 25**
Duration of Exam: 3 Hours | **Internal Assessment: 25**
Credits: 1 [0-0-2]

List of Experiments

1. To study and calculate the modulation index of AM wave.
2. To study the demodulation of AM wave and find out modulation frequency.
3. To study and observe frequency modulation.
4. Study of DSB-TC and SSB AM modulation and demodulation.
5. Study of PAM, PPM & PWM modulation & demodulation.
6. Study of voice communication using various types of modulation techniques.
7. Study of signal Sampling and reconstruction techniques.
8. Study of Nyquist criteria and aliasing.
9. Comparison of frequency response of 2^{nd} order and 4^{th} order Butterworth low pass filter.
10. Study of AM/FM Transmitter and Receiver.

Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Simulate amplitude modulated wave, DSB-SC, SSB-SC wave by selecting different frequencies for carrier wave and modulating wave.
- **CO2.** Simulate PWM, PAM, PPM modulation and de-modulation and thereby can analyze their characteristics.
- **CO3.** Compare frequency response of 2^{nd} order and 4^{th} order Butterworth low pass filter
- **CO4.** Apply Nyquist theorem and thereby analyze the phenomena of aliasing.
- **CO5.** Function effectively as a team.

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Semester IV

Course Title: Linear Integrated Circuits Lab | **Max Marks: 50**
Course Code: PCC-ECE-413 | **University Exam: 25**
Duration of Exam: 3 Hours | **Internal Assessment: 25**
Credits: 1 [0-0-2]

List of Experiments

1. Study of OP AMPs – IC 741, IC 555, – Functioning, Parameters and Specifications.
2. To demonstrate the relationship between input and output for the inverting and non-inverting configuration of the Op-Amp 741
3. To perform the Application operation – Adder, Subtractor, Comparator Circuits using IC 741.
4. To design a square wave and triangular wave generator using Op-amp's.
5. Active Filter Applications – LPF, HPF (first order & 2^{nd} order)
6. Active Filter Applications – BPF, Band Reject (Wideband) and Notch Filters.
7. IC 741 Oscillator Circuits – Phase Shift and Wien Bridge Oscillators.
8. IC 555 Timer – Monostable Operation Circuit.
9. IC 555 Timer – Astable Operation Circuit.
10. Schmitt Trigger Circuits – using IC 741 and IC 555.
11. IC 565 – PLL Applications.

Course Outcomes:

After completion of the course student will be able to:

CO1. Establish relationship between input and output for the inverting and non-inverting configuration of the Op-Amp 741
CO2. Perform arithmetic operation using IC-741
CO3. Design 1^{st} order and 2^{nd} order active filters using IC-741
CO4. Implement Schmitt trigger circuits using IC-741 & IC-555
CO5. Design square wave and triangular wave generators using op-amps

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Semester – V

Semester V

Course Title: Introduction to Microprocessors **Max Marks: 100**
Course Code: PCC-ECE-501 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: The objective of this course is to introduce to the students the fundamental of 8085 and 8086 microprocessors and their interfacing.

Unit-I

Introduction to 8085: History and Evolution, types of microprocessors, 8085 Microprocessor, Architecture, Bus Organization, Registers, ALU, Control section, Instruction set of 8085, Instruction format, Addressing modes, Types of Instructions.

Unit-II

8085 Assembly Language Programming and Interrupts: Assembly language programming in 8085, Microprocessor timings, Machine cycles, T states, Timing diagram for different machine cycles. Interrupts in 8085, RST instructions, multiple interrupts and priorities, Interrupt handling in 8085 with RIM and SIM, Enabling, disabling and masking of interrupts

Unit-III

8085 Interfacing: Parallel data transfer using 8155. Programmable parallel ports and handshake input/output, Asynchronous and Synchronous data transfer using 8251A. DMA transfer, cycle stealing and burst mode of DMA, 8257 DMA Controller. Interfacing of memory, keyboard, LED and seven segment displays with 8085.

Unit-IV

8086 Microprocessor: Overview of 8086 features, architecture of 8086: execution unit and bus interface unit, flags and general purpose register, 8086 pin diagram, Memory segmentation, Minimum and Maximum mode operation, Memory Interfacing.

Unit-V

8086 Assembly Language Programming and Interrupts: 8086 addressing modes, instruction set, assembler directives, macros. Assembly language programming involving arithmetic, logical, branch & call instructions, string manipulations. 8086 interrupts.

Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Describe the various architectural aspects of 8085 Microprocessor.
- **CO2.** Understand 8085 interrupt phenomenon, timing diagram and write basic assembly language programs

CO3. Elaborate the synchronous and asynchronous data transfer and Direct Memory Access in 8085 and interfacing of 8085 with external devices.

CO4. Describe the various architectural aspects of 8086 Microprocessor.

CO5. Understand the interrupt phenomenon and write basic assembly language programming in 8086

Text Books:

1. **R. S. Gaonkar**, Microprocessor Architecture, Programming & applications with the 8085/8086A, Wiley Eastern Ltd.
2. **A.K. Ray and K.M. Bhurchandi**, "Advanced Microrprocessors and Peripherals," TMH, 2000.

Reference Books:

1. **A. P. Mathur**, Introduction to Microprocessor, Tata McGraw Hill.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester V

Course Title: Digital Communication Systems **Max Marks: 100**
Course Code: PCC-ECE-502 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: To provide the basic understanding of Digital Communication Systems.

Unit-I

Pulse Digital Modulation: Elements of digital communication systems, advantages of digital communication systems, Elements of PCM: Sampling of analog signals, Quantization, Quantization error, signal to noise ratio due to Quantization, PCM Coding, Companding in PCM systems. Differential PCM systems, Delta modulation and its drawbacks; adaptive delta modulation.

Unit-II

Line Coding Schemes: Basic definition, requirements of line coding schemes, different line coding techniques like NRZ (unipolar and bipolar), RZ, Manchester, Alternate mark and Inversion, HDBn, B8ZS, 4B/5B etc. coding schemes. Their properties and advantages.

Unit-III

Digital Carrier Modulation Transmission and Reception: Introduction, Amplitude Shift keying (ASK), ASK Spectrum, ASK Modulator, Coherent ASK Detector, Frequency Shift Keying(FSK), Bandwidth and Frequency spectrum of FSK, Coherent FSK detector, FSK detection using PLL, Binary Phase Shift Keying, Binary PSK spectrum, Coherent PSK Detection, Quadrature phase shift keying (QPSK), QPSK Demodulator, Differential PSK.

Unit-IV

Performance of Digital Communication Systems: A base band signal receiver, Gaussian probability distribution function, power spectral density function, Additive white noise probability of error, the optimum filter, the matched filter, probability of error of the matched filter. Calculation of error probability of Amplitude Shift Keying, Binary Phase Shift Keying, Binary Frequency Shift Keying, QPSK.

Unit-V

Spread Spectrum Modulation: Spread spectrum, Advantages of Spread Spectrum, pseudo-noise sequences – Linear feedback shift register and generation of PN sequences, Direct sequence spread spectrum, Frequency hop spread spectrum, maximum length and gold codes, problem in spread spectrum systems.

Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Understand different pulse digital modulations and their advantages, disadvantages.
- **CO2.** Understand different line coding techniques and their properties.

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CO3. Differentiate between various digital modulation techniques and their advantages & disadvantages.

CO4. Know about white Gaussian noise, mathematical modelling for different types of filters used to reduce noises in communication system.

CO5. Understand different spread spectrum techniques.

Text Books:

1. **Simon Haykin**, Digital communications, John Wiley, 2005.
2. **H. Taub and D. Schilling**, Principles of Communication Systems, TMH, 2003.

Reference Books:

1. **John Proakis**, Digital Communications TMH, 1983.
2. **B.P. Lathi**, Modern Analog & Digital Communication Oxford reprint, 3rd edition, 2004.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester V

Course Title: Electromagnetic Wave Theory | **Max. Marks:100**
Course Code: PCC-ECE-503 | **University Exam: 60**
Duration of Exam: 3 Hours | **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: The course has been designed to acquaint the students with basic concepts of Electromagnetic theory.

Unit-I

Vector Calculus: Review of vector analysis, Scalar & vector products, gradient, divergence and curl of a vector, Rectangular, Cylindrical and Spherical co-ordinate system, Transformation amongst rectangular, cylindrical and spherical co-ordinate system.

Unit-II

Electrostatics: Coulomb's law, application of coulombs law, electric field intensity from point charges, field due to continuous distribution of charges, gauss's law, application of gauss's law, Electric displacement and displacement density potential function, potential field of a point charge, Laplace's and Poison's equations, Divergence Theorem.

Unit-III

Magnetostatics: Magnetic field intensity and magneto motive force, Ampere's Circuital law, applications of ampere's circuital law, Biot-savart law and its application, vector potential, magnetic dipole. Ampere's work law in differential vector form, continuity of currents, conduction and displacement current, Strokes Theorem.

Unit-IV

Time Varying Fields: Faradays law, Maxwell's equations (Differential, Integral and Phasor forms). Uniform plane waves. Representation of wave motion in free space, perfect dielectrics and Lossy dielectrics (Wave equations). Pointing Theorem and Power density. Propagation in good conductor and Skin effect. Reflection of Uniform plane waves.

Unit-V

Introduction To Transmission Line and Wave Guides: Introduction, Circuit representation of parallel plane transmission lines, Transmission lines with losses, Characteristic impedance, Characteristic impedance at radio frequencies, Propagation constant, Attenuation constant and phase constant, Waves between parallel plane, Transverse Electric wave, Transverse magnetic waves; characteristics of TE & TM waves; velocity of propagation; Attenuation in parallel plane guides; wave impedance.

Course Outcomes:

After completion of the course student will be able to:

CO1. Apply vector calculus to static electric-magnetic fields in different engineering situations

CO2. To understand behaviour of Electric field.
CO3. To understand behaviour of Magnetic field.
CO4. Analyze Maxwell's equation in different forms (differential and integral) and apply them to diverse engineering problems.
CO5. Analyze the nature of electromagnetic wave propagation in guided medium.

Text Books:

1. **Hayt W.**, Engineering Electromagnetics, TMH. (5^{th} or 7^{th} edition).
2. **Prasad K. D.**, Antenna and Wave Propagation, Satya Prakashan.

Reference Books:

1. **Guru & Hizirogli**, Electromagnetic field theory fundamental, Thomson Publication.
2. **Kraus J. D.**, Electromagnetics, TMH, 4^{th} Edition.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

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Semester V

Course Title: Computer Organization & Architecture **Max Marks: 100**
Course Code: PCC-ECE-504 **University Exam: 60**
Duration of Exam: 3 hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objectives: A student should grasp the basic concepts of computer organization and architecture and articulate design issues in the development of processor or other components.

Unit-I

Basic structure of computer: Basics of Computer Architecture and Organization, Stored Program Organization (Von Neumann Architecture), Instruction Formats, Addressing Modes, Stack and Queue Organization.

Unit-II

Arithmetic: Integer and Floating-Point Representation, Fixed Point Arithmetic: Addition, Subtraction, Multiplication and Division, Hardware Implementations, Floating Point Arithmetic, IEEE 754 floating point formats.

Unit-III

Basic Processing Unit: Fundamental Concepts: Single Bus Organization, Execution of a Complete Instruction, Multiple Bus Organization, Hard-Wired & Micro-Programmed Control Units, Hard-Wired Design Methods, State Table Method, Multiplier Control, Control Memory, Address Sequencing. Concept of parallel processing, Pipelining

Unit-IV

Memory systems: Memory Hierarchy, Main Memory: RAM, ROM, Virtual Memory Concepts, Virtual Memory Address Translation, Interleaved Memories, Cache Memory: Mapping Functions, Replacement Algorithm, Secondary Storage: Magnetic Hard Disks.

Unit-V

Input/output Organization: Accessing I/O Devices, Input/ Output Mechanism: Memory-Mapped I/O, Programmed I/O, Interrupts, Direct Memory Access, Standard I/O Interfaces

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Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Understand the basic architecture and organization of computers.
- **CO2.** Understand and perform computer arithmetic operations.
- **CO3.** Understand control unit operations.
- **CO4.** Understand memory hierarchy and its impact on performance and cost.
- **CO5.** Understand the concept of I/O organization.

Text Books:

1. **Carl Hamacher**, Computer Organization, McGraw Hill.

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2. **Morris Mano**, Computer system Architecture, PHI.

Reference Books:

1. **David Peterson**, Computer Architecture, Morgan Kaufman Publishers.
2. **Tannenbaum A. S.**, Structured Computer Organization, PHI.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester V

Course Title: Microprocessor Lab | **Max Marks: 50**
Course Code: PCC-ECE-511 | **University Exam: 25**
Duration of Exam: 3 Hours | **Internal Assessment: 25**
Credits: 1 [0-0-2]

List of Experiments

1. Study of 8085 and 8086 Microprocessor Kit.
2. Write a program to add and subtract two 8-bit and 16-bit number using 8085.
3. Write a program to multiply two 8 bit numbers by repetitive addition and rotation method using 8085.
4. Write a program to generate Fibonacci series using 8085.
5. Write a program to sort series using bubble sort algorithm using 8085.
6. To find the largest signed number in a given series of data using 8085.
7. To copy a block of data from one memory to another using 8085.
8. Write a program to add and subtract two 8-bit and 16-bit number using 8086.
9. Write a program to multiply two 8 bit numbers by repetitive addition and rotation method using 8086.
10. Write a program to generate Fibonacci series using 8086.
11. Write a program to sort series using bubble sort algorithm using 8086.
12. To find the largest signed number in a given series of data using 8086.
13. To copy a block of data from one memory to another using 8086.

Course Outcomes:

After completion of the course student will be able to:

CO1. Understand the various features of 8085 and 8086 microprocessor kits.
CO2. Write various arithmetic and logical based assembly language programs in 8085 and 8086.
CO3. Write various string manipulation based assembly language programs in 8085 and 8086.
CO4. Write basic data transfer programs using 8085 and 8086.
CO5. Function effectively as a team.

Semester V

Course Title: Digital Communication Systems Lab | **Max Marks: 50**
Course Code: PCC-ECE-512 | **University Exam: 25**
Duration of Exam: 3 Hours | **Internal Assessment: 25**
Credits: 1 [0-0-2]

List of Experiments

1. Study of Pulse Amplitude Modulation and demodulation.
2. Study of Pulse Width Modulation and demodulation.
3. Study of Pulse Position Modulation and demodulation.
4. Sampling Theorem – verification.
5. Study of Time division multiplexing.
6. Pulse code modulation.
7. Study of Differential pulse code modulation.
8. Study of Delta modulation.
9. Frequency shift keying.
10. Study of Phase shift keying.
11. Study of Differential phase shift keying.

Course Outcomes:

After completion of the course student will be able to:

CO1. Understand basic theories of Digital communication system in practical.
CO2. understand sampling theorem and modulation techniques in practical.
CO3. design and implement different modulation and demodulation technique.
CO4. Analyze modulation techniques using MATLAB tool.
CO5. Function effectively as a team.

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Semester V

Course Title: Modelling and Simulation Lab | **Max Marks: 50**
Course Code: PCC-ECE-513 | **University Exam: 25**
Duration of Exam: 3 Hours | **Internal Assessment: 25**
Credits: 1 [0-0-2]

List of Experiments

1. Write a MATLAB program for Generation of Various Signals and Sequences (Periodic and Aperiodic), such as Unit impulse, unit step, square, saw tooth, triangular, sinusoidal, ramp, sinc
2. Write a MATLAB program to perform operations like addition, multiplication, scaling, shifting, and folding on signals and sequences and computation of energy and average power.
3. Write a MATLAB program to perform convolution between signals and sequences.
4. Write a MATLAB program to perform autocorrelation and cross correlation between signals and sequences.
5. Write a MATLAB program for verification of linearity and time invariance properties of a given continuous/discrete system
6. Write a MATLAB program for computation of unit samples, unit step and sinusoidal response of the given LTI system and verifying its physical realiazability and stability properties.
7. Write a MATLAB program to find the Fourier transform of a given signal and plotting its magnitude and Phase spectrum.
8. Write a MALTAB program for locating the zeros and poles and plotting the pole zero maps in Z plane for the given transfer function.
9. Write a MATLAB program for Sampling theorem verification.
10. Modeling of differential equations in SIMULINK.
11. Modeling of AM and FM in SIMULINK
12. Modeling of BPSK and QPSK in SIMULINK

Course Outcomes:

After completion of the course student will be able to:

CO1. Perform various operations on continuous and discrete signals

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CO2. Validate various systems properties
CO3. Perform various frequency transforms on signals solve differential equations
CO4. Model various modulation schemes in SIMULINK
CO5. Function effectively as a team.

Semester – VI

Semester VI

Course Title: Digital Signal Processing **Max Marks: 100**
Course Code: PCC-ECE-601 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 4 [3-1-0]

Objective: The course has been designed for explaining the basic concepts and principles to the students. Applied and Industrial Aspects have been taken care of in an appropriate manner.

Unit-I

Signals and Systems: Basic elements of DSP, Concept of frequency in Analog and Digital Signals, Sampling theorem, Discrete time signals, Systems, Analysis of discrete time LTI systems.

Unit-II

The Discrete Fourier Transform: Discrete Fourier transform (DFT), Properties of DFT: Periodicity, Linearity and Symmetry, Multiplication of two DFT's and Circular Convolution, Efficient Computation of the DFT: Computational complexity, FFT algorithms: Decimation-in-time and decimation-in-frequency.

Unit-III

Design of Digital IIR Filters: Discrete time IIR Filter from Analog Filter, IIR Filter Design: by Impulse Invariance, Bilinear Transformation, Approximation of derivatives (LPF, HPF, BPF), Structure for IIR Systems: Direct-Form Structures, Signal Flow Graphs and Transposed Structures, Cascade-Form Structures, Structures, Parallel-Form Structures.

Unit-IV

Design of Digital FIR Filters: Design of FIR Filters, Symmetric and Antisymmetric FIR Filters, Design of Linear-Phase FIR Filters: Using Windows (Rectangular Window, Hamming Window, Hanning Window) and by the Frequency-Sampling Method. Structures for FIR Systems: Direct-form structures, Cascade-form Structures.

Unit-V

Finite Word Length Effects in Digital Filters: Binary fixed point and floating point number representations. Quantization noise, Truncation and rounding, Quantization noise power, Input quantization error, Coefficient quantization error.

Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Understand the basic concepts of Discrete Fourier transform and its application to linear filtering.
- **CO2.** Understand and explain FFT algorithms and their computational efficiency in comparison to DFT.
- **CO3.** Understand and explain the design of IIR filters by approximation of derivatives, impulse invariance and bilinear transformation.

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CO4. Understand and explain the design of FIR filters by windowing and frequency sampling technique and provide a basic overview of special type of FIR filters.

CO5. Understand and explain the realization of filters using cascade and parallel structures as well as signal flow graphs and provide brief overview of the application areas of DSP.

Text Books:

1. **J. G. Proakis and D. G. Manolakis**: DSP, 3rd Edition, Pearson Education, 2007.
2. **Johnny Johnson**: Digital Signal Processing, 3rd Edition, PHI.

Reference Books:

1. **Emmanuel C. Ifeachor, and Barrie. W. Jervis,** "Digital Signal Processing", 2nd Edition, Pearson Education, Prentice Hall, 2002.
2. **Sanjit K. Mitra**, "Digital Signal Processing-A Computer Based Approach" TMH, 2007.
3. **A. Oppenheim,** R.W. Schafer and J.R. Buck, Discrete-Time Signal Processing, 8th Indian Reprint, Person, 2004.
4. **Andreas Antoniou,** "Digital Signal Processing", Tata McGraw Hill, 2006.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester VI

Course Title: Micro-Controller and Embedded Systems | **Max Marks: 100**
Course Code: PCC-ECE-602 | **University Exam: 60**
Duration of Exam: 3 Hours | **Internal Assessment: 40**
Credits: 3 [3-0-0]

Unit-I

Introduction to Embedded Systems: Overview of Embedded System Architecture, Application areas, Categories of embedded systems, specialties of embedded systems. Recent trends in embedded systems. Brief introduction to embedded microcontroller cores CISC, RISC, ARM, DSP and SoC.

Unit-II

The Microcontroller Architecture: Introduction to 8051 Microcontroller, Architecture, Pin configuration, Memory organization, Input /Output Ports, Counter and Timers, Serial communication, Interrupts.

Unit-III

Assembly Language Programming of 8051: Instruction set, Addressing modes, Development tools, Assembler Directives, Programming based on Arithmetic & Logical operations, I/O parallel and serial ports, Timers & Counters, and ISR.

Unit-IV

ARM 7 architecture: Architectural inheritance, Detailed study of Programmer's model, ARM Development tools, Instruction set: Data processing, Data transfer, Control flow. Addressing modes. Writing simple assembly language programs. Pipelining, Brief introduction to exceptions and interrupts handling.

Unit-V

Embedded / Real Time Operating System: Architecture of kernel, Task and Task scheduler, Interrupt service routines, Semaphores, Mutex, Mailboxes, Message queues, Event registers, Pipes, Signals, Timers, Memory management, Priority inversion problem. Off-the-Shelf Operating Systems, Embedded Operating Systems, Real Time Operating System (RTOS) and Handheld Operating Systems.

Course outcomes:

After completion of the course student will be able to:

- **CO1.** Ability to understand basic structure embedded systems
- **CO2.** Ability to understand basic structure microcontroller.
- **CO3.** Ability to understand basic concepts used in embedded system.
- **CO4.** Ability to program microcontroller.
- **CO5.** Ability to design conceptual embedded system.

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Text Books:

1. **M. A. Mazidi, J. G. Mazidi, R. D. McKinlay** The 8051 microcontroller & Embedded systems, Pearson.
2. **Dr. K. V. K. K. Prasad**, Embedded / real – time systems: concepts, design & programming, Black Book, Dreamtech press, Reprint edition 2013.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester VI

Course Title: Antenna and Wave Propagation **Max Marks: 100**
Course Code: PCC-ECE-603 **University Exams: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: The course has been designed to get student acquainted with basic concepts, principles and applications related to antenna field. Emphasis is given to latest technologies and recent trends.

Unit-I

Introduction to Antennas: Radiation Fundamental, Retarded Potential, induction and radiation fields, radiated power from a current element, short antennas, Radiation from a quarter wave monopole and half wave dipole.

Unit-II

Fundamentals of Antennas & Arrays of Antennas: Basic ideas of reciprocity properties of antennas, Radiation resistance, Radiation patterns, directional properties of dipole antennas. Antenna gain, Antenna aperture and its relation to gain, antenna terminal impedance, Antenna temperature and signal to noise ratio.

Antenna Arrays -Arrays of two point sources, linear arrays of n-point sources. Broadside and end fire arrays, pattern multiplication, effect of earth on vertical and horizontal patterns, Binomial array.

Unit-III

Special Purpose Antennas -Reflector type antennas, Lens antenna, V and Rhombic antennas, Yagi antenna, slotted and horn antennas, microstrip antennas.

Unit-IV

Ground Wave Propagation, Basic ideas of ground wave, propagation, reflection at the surface of conducting plane, earth (on ground), space and surface waves, tilt of the surface wave, troposphere waves-reflection, refraction, duct propagation.

Unit-V

Ionosphere Propagation: The ionosphere, formation of the various layers, their effective characteristics, reflection and refraction of waves by ionosphere, virtual height, maximum frequency, skip distance, regular and irregular variation of ionosphere, ordinary and extraordinary waves.

Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Understand the important and fundamental antenna parameters and terminology.
- **CO2.** Explain the working of antennas and formation of antenna patterns for different cases.
- **CO3.** Explain loop, slot, patch and horn antennas. Derive expressions for the parameters of loop and slot antennas.

CO4. Explain ionosphere and troposphere propagation.

CO5. Develop the basic skills for designing a wide variety of practical antennas and antenna arrays.

Text Books:

1. **Prasad K. D -** Antenna and Wave Propagation, Satya Prakashan.
2. **Jorden F.C. & Balmann B.C**-Electromagnetic waves & radiating System, PHI.

Reference Books:

1. **Kraus J.D,** Antennas, McGraw Hill.
2. **Rao Narayan** - Basic Electromagnetics with application, PHI.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester VI

Course Title: Digital Signal Processing Lab | **Max Marks: 50**
Course Code: PCC-ECE-611 | **University Exam: 25**
Duration of Exam: 3 Hours | **Internal Assessment: 25**
Credits: Credits: 1 [0-0-2]

List of Experiments

USING MATLAB

1. Generation of Signals
2. Linear and circular convolution of two sequences
3. Sampling and effect of aliasing
4. Design of FIR filters
5. Design of IIR filters
6. Calculation of FFT of a signal

USING TMS320C5X

1. Study of various addressing modes of DSP using simple programming examples
2. Sampling of input signal and display
3. Implementation of FIR filter
4. Calculation of FFT

Course Outcomes:

After completion of the course student will be able to:

CO1. Analyze basic signals using MATLAB.
CO2. Carry out linear and circular convolution of different signals.
CO3. Carry out DFT and FFT of various signals.
CO4. Design FIR and IIR filters using various techniques.
CO5. Function effectively as a team.

Semester VI

Course Title: Micro-Controller and Embedded Systems Lab | **Max Marks: 50**
Course Code: PCC-ECE-612 | **University Exam: 25**
Duration of Exam: 3 Hours | **Internal Assessment: 25**
Credits: Credits: 1 [0-0-2]

List of Experiments

1. To study development tools/environment for 8051 microcontroller programme and Architecture
2. 8051 Data Transfer - Block move, Exchange, Sorting, Finding largest element in an array.
3. Arithmetic Instructions - Addition/subtraction, multiplication and division, square, Cube – (16 bits Arithmetic operations – bit addressable).
4. 8051 I/O port Programming: bit manipulation Programming.
5. 8051 Timer Programming.
6. Serial port programming.
7. Study and analyse the interfacing of :
    i. LED
    ii. LCD
    iii. Keyboard
    iv. ADC/DAC
    v. Sensor
8. Motor control: Relay, PWM, DC and Stepper motor

Course Outcomes:

After completion of the course student will be able to:

CO1. Understand the working of 8051 with the help of Kiel IDE.
CO2. Perform Data transfer, Arithmetic and Logical Operations.
CO3. Interface various devices with 8051 Microcontroller.
CO4. Develop embedded systems for real world problems.
CO5. Function effectively as a team.

Semester VI

Course Title: Antenna Lab | **Max Marks: 50**
Course Code: PCC-ECE-613 | **University Exam: 25**
Duration of Exam: 3 Hours | **Internal Assessment: 25**
Credits: 1 [0-0-2]

List of Experiments:

1. Drive antenna by voltage.
2. Radiation pattern of half wave dipole.
3. Radiation pattern of monopole.
4. Effective height of antenna.
5. Directional radiation from two composite antennas.
6. Radiation from conducting sheet with slot.
7. Radiation polar diagram of directional antenna.

Course Outcomes:

After completion of the course student will be able to:

CO1. Understand the working of antenna
CO2. Understand the radiation pattern of half wave dipole and monopole antenna
CO3. Develop understanding of conducting sheet with slot
CO4. Function effectively as a team.

Semester – VII

Semester VII

Course Title: RF & Microwave Engineering **Max Marks: 100**
Course Code: PCC-ECE-701 **University Exam: 60**
Duration of Exam: 3 hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: The course has been designed for explaining the basic concepts and principles of high frequency signal propagation. Applied and Industrial Aspects have been taken care of in an appropriate manner.

UNIT- I

Two Port RF Networks-Circuit Representation: Introduction to transmission lines. Low frequency parameters-impedance, admittance, hybrid and ABCD. Introduction to component basics, wire, resistor, capacitor and inductor, applications of RF parameters, properties of S Parameters-Reciprocal and lossless networks, transmission matrix Relation of Z, Y and ABCD parameter with S-parameters.

UNIT-II

Microwave Tubes: Microwave Frequency Bands, General Applications of Microwaves, Advantages of Microwaves, UHF limitations in conventional tubes, Analysis and operation of multi-cavity and reflex, Klystron, admittance diagram of Klystron. Analysis and operation of a traveling wave Magnetron, Performance charts of Magnetron tubes; Principle of operation of Traveling Wave Tube.

UNIT-III

Microwave Semiconductor Devices: Classification of Microwave Devices. Tunnel diode, Gunn diode, two valley structures, mode of operation, circuit realization. IMPATT diode, TRAPATT diodes, BARITT diodes, circuit realization. PIN diode, basic principle of operation, equivalent circuit, and application as switch, modulator and phase shifter. Microwave Bi-polar and Field Effect Transistors-characteristics and performance. Parametric amplifiers.

UNIT-IV

Microwave Components: Coupling-probes and loops Apertures, Attenuators, phase shifters. Waveguide corners, bends and twists. Matched terminators, short circuit plunger, Waveguide Tees-E, H, hybrid. Hybrid rings. Directional coupler, two-hole directional coupler. Isolator, circulator.

UNIT-V

Microwave Measurements: Tunable detector, slotted line carriage. Measurement of VSWR and Reflection coefficient, impedance using slotted line. Use of Smith Chart. Impedance Matching, Double and Triple stub Tuners, Quarter wave Transformer. Measurement of frequency and wavelength. Measurement of Microwave power - low and high, use of bolometer, thermistors, calorimeter.

Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Understand the basic concepts and principles of high frequency signal propagation with the importance of using s-parameter in microwave circuits.
- **CO2.** Know the demerits of vacuum tubes and their solution using cavity based klystron at microwave frequencies.
- **CO3.** Understand different solid state microwave devices with and their use in different microwave circuits.
- **CO4.** Understand the principle of operation of different passive waveguide components.
- **CO5.** Measure different parameters like frequency, VSWR, power etc. at microwave frequencies.

Text Books:

1. **Collin R E**, *"*Fundamentals of Microwave Engg.", McGraw- Hill.
2. **Liao S Y**, *"*Microwave Devices and Circuits*"*, Prentice Hall of India, (1995).

Reference Books:

1. **Das A and Das S K**, *"*Microwave Engineering*"* TMH.
2. **K C Gupta,** *"*Microwaves", New Age International, New Delhi, (1983).

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester VII

Course Title: Entrepreneurship Development & Management **Max Marks: 100**
Course Code: HSMC-ECE-701 **University Exam: 60**
Duration of Exam: 3 hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: To give an overview of who the entrepreneurs are and what competences are needed to become an entrepreneur and to create an awareness of the need for systematic management of projects.

Unit-I

Entrepreneurship Development: Meaning, objectives, type of entrepreneurs, importance of entrepreneurship training, factors affecting entrepreneurship, linkage between entrepreneurship and economic development, problem of increasing unemployment, balanced regional growth, harnessing locally available resources, New Industrial Policy and innovation in enterprises.

Unit-II

Entrepreneurship Support System: Small Industries Development Bank of India, Small Industries Service Institute, State Small Industries and Export Corporation, District Industrial Centers and Other supporting agencies.

Unit-III

Project Report Preparation: Identifying business opportunities, Project report and its importance, various contents of project report: managerial and entrepreneurial capabilities, socio-economic benefits, Demand analysis, technical feasibility and financial viability.

Unit-IV

Introduction to Marketing Management: Brief introduction to various types of product strategies, Pricing strategies, Channel strategies and Promotional strategies.

Introduction to Production Management: Types of production systems, production planning and control, functions of Production Manager and Materials Management.

Unit-V

Introduction to Human Resource Management: Manpower Planning, Recruitment, selection, placement and induction, training and development, compensation.

Introduction to Financial Management: source of finance and Working Capital management.

Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Understand the basic development of entrepreneurship as a profession.
- **CO2.** Understand marketing strategies for any business enterprise.
- **CO3.** Acquire basic knowledge of human resource management for small business.
- **CO4.** Understand the social responsibilities of business managers.
- **CO5.** Know how to establish and manage a business enterprise.

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Text Books:

1. **Holt David H**, Entrepreneurship: New Venture Creation, PHI (4000).
2. **Saini Jasmer Singh**, Entrepreneurship Development Programmes and Practices, Deep and Deep Publications, New Delhi (1997).

Reference Books:

1. **Dollinger**, Entrepreneurship Strategies and Resources, Pearson Education (4003).
2. **Jose Paul & Kumar Ajith N**, Entrepreneurship Development and Management, Himalaya Publishers, New Delhi (4000).

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester VII

Course Title: Microwave Engineering /Optical Communication Lab | **Max Marks: 50**
Course Code: PCC-ECE-711 | **University Exam: 25**
Duration of Exam: 3 Hours | **Internal Assessment: 25**
Credits: 1 [0-0-2]

Microwave Engineering Experiments

1. Study of microwave components and instruments.
2. Measurement of klystron characteristics.
3. Measurement of VSWR and standing wave ratio.
4. Measurement of Dielectric constants.
5. Measurement of Directivity and coupling coefficient of a directional coupler.
6. Measurement of Q of a cavity.
7. Calibration of the attenuation constant of an attenuator.
8. Determination of the phase-shift of a phase shifter.
9. Determination of the standing wave pattern on a transmission line and finding the length and position of the short circuit stub.

Optical Communication Experiments

10. Setting up a fiber analog link and study of propagation and bending losses in optic fiber.
11. Study of characteristics of fiber optic, LED and detector.
12. Setting up a fiber optic digital link.
13. Study of modulation/demodulation of light source by PWM & PPM techniques.
14. Study of TDM using 16 data channels.
15. Voice communication through Laser TX. & RX.

Course Outcomes:

After completion of the course student will be able to:

CO1. Analyze and explore different Microwave devices physically.
CO2. Perform microwave measurements with modern digital instruments such as spectrum analyzer using different techniques and with different microwave devices.
CO3. Analyze the performance of optical devices: light sources like laser and LED's, fibers and detectors.
CO4. Understand and explain different losses and plot the loss characteristics of optical fibers.
CO5. Function effectively as a team.

Semester VII

Course Title: PCB and Troubleshooting Lab | **Max Marks: 50**
Course Code: PCC-ECE-712 | **University Exam: 25**
Duration of Exam: 3 Hours | **Internal Assessment: 25**
Credits: 1 [0-0-2]

List of Experiments

1. Design a PCB for 555 astable Multi vibrator Circuit.
2. Design a PCB for Schmitt Trigger Circuit.
3. Design a PCB for Operational Amplifier Circuit.
4. Design a PCB for a circuit (Application Based, Using 8086 and 8255)
5. Design a PCB for a circuit (Application Based, Using 8085 and 8255)
6. Design a PCB for a Full Wave Rectifier Circuit.
7. Design a PCB for a Half wave rectifier Circuit.
8. Design a PCB for a Simple Clipping Circuit.
9. Design a PCB for a Simple Clamping Circuit.
10. Design of a PCB for a Bridge Circuit.

Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Perform hand-on the PCB design procedures for various circuit components.
- **CO2.** Perform PCB design for Microprocessor and interface ICs.
- **CO3.** Perform PCB design for Diodes circuits, Rectifiers, ICs like 555, Schmitt Trigger etc.
- **CO4.** Execute troubleshooting procedures for the any given PCB design to pinpoint the problem.
- **CO5.** Function effectively as a team.

Professional Electives

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Semester V

Course Title: Industrial Electronics **Max Marks: 100**
Course Code: PEC-ECE-501 **University Exam: 60**
Duration of Exam: 3 hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: The course has been designed for explaining the basic concepts and principles to the students. Applied and Industrial Aspects have been taken care of in an appropriate manner.

Unit-I

D.C. Motor Control: Control of DC motor using half controlled and fully-controlled single-phase and three-phase thyristor converters, control of DC motor using choppers of different configurations.

Unit-II

A.C. Motor Control: Stator voltage control of induction motors, control of induction motors using voltage source and current source inverters, slip-ring induction motor control.

Unit-III

Industrial circuits: Temperature control circuit, AC voltage regulators, fan regulators/ lamp dimmers, uninterrupted power supplies (UPS). Relays and Timers: The relay (basic construction), AC relay, Reed relay, Solid state relay, 555 timer and its industrial applications.

Unit-IV

Design of Printed Circuit Boards: Introduction to technology of printed circuit boards (PCB), General lay out and rules and parameters, PCB design rules for Digital, High Frequency, Analog, Power Electronics and Microwave circuits, Computer Aided design of PCBs.

Unit-V

Industrial Appliances Design: Power Transformers and Voltage Stabilizers, Design of 0.5 and 1.0KVA Voltage Stabilizers, Design of Inverters and Battery Chargers for domestic use.

Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Control speed of DC motors.
- **CO2.** Control speed of AC motors.
- **CO3.** Gain knowledge of various Industrial Components.
- **CO4.** Understand PCB design rules. Design of PCB using computer aided tools.
- **CO5.** Design Power transformers, voltage stabilizer, inverter and battery charger.

Text Books:

1. **Mohan N Undeland, T.M. Robins, W.P**. "Power electronics- converters, application & design", John Wiley 1989
2. **Bose B.K**., "Power electronics and A.C Drives", Prentice Hail 1986.

Reference Books:

1. **Dubey G.K. Asarbada, E.R, K**., "Power electronics devices", IETE book, TMH.

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2. **Murphy J. M. D Turnnbull, F.G,** "Power electronics control of A.C motors".

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester V

Course Title: Electronic Multimedia Engineering | **Max Marks: 100**
Course Code: PEC-ECE-502 | **University Exam: 60**
Duration of Exam: 3 Hours | **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: The course has been designed to get student acquainted with basic concepts, principles and applications related to field. Emphasis is given to latest technologies.

Unit-I

Electro-acoustical Transducers: A microphone, Types of microphones their polar frequency response: moving coil, crystal microphone, Ribbon microphone, Single button microphone, condenser microphone, Principle characteristics of microphone, Magnetic microphone, Useful frequency range for microphones, Comparison of microphones, Loudspeakers, mounting of direct radiator loudspeakers, Earphones, Considerations in the design of circuits for hearing aids, A three stages direct coupled circuit for hearing.

Unit-II

Disks and Magnetic Recording and Reproduction: Sound recording, disk recording, and monophonic disk sound recording system, monophonic disk sound reproducing system, Stereophonic disk recording system, stereophonic disk reproducing system, Magnetic recording, Digital recording Pickups.

Unit-III

Recording: Video Cassette recorders, Video Tape characteristics, Tape recording and play back. Basic principal of video recording on Disc, Digital Video Disc (DVD): DVD technology, Disc and data details DVD Audio- DVD Video, Dolby digital sound, Blue ray disc

Unit-IV

Display Fundamentals: Television basics, Composite video signal, Modulation requirement, TV standards requirement, NTSC and PAL colour system, Advanced DTH system, cable TV, IP TV in multimedia, digital TV-HD (High definition) display.

Unit-V

Principle of Vision and Application of Visual Properties: Luminance and Colour, response of eye, Colour representation, Video system characteristics, Function of digital Camera, charged coupled device(CCD), Principle and display application of LED, Liquid crystal and plasma devices, 3D display concept, Touch screen basics.

Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Understand and analyse various microphones and loudspeakers.
- **CO2.** Know the basic principle of recording and reproduction system like stereo recording and playback.
- **CO3.** Explain the modern digital systems like DVD, Dolby digital sound, Blue ray disc.
- **CO4.** Understand the basics of television standards and advanced HD TV and advanced DTH.

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CO5. Acquire knowledge about advanced digital cameras, LED display, 3D display and touch screen.

Text Books:

1. **Ajay**- Dhanpat Rai & Sons Pub Audio Video and T.V Engineering.
2. **Gupta K.G-** Audio and Video Systems, Tata McGraw Hill Publication.

Reference Books:

1. **Kinsler**- Fundamentals of Acoustics, John Wiley & Sons. Inc.
2. **Whitaker Jerry** - Electronic Displays Technology, Design, and Applications, McGraw-Hill International Editions. 1994.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester V

Course Title: Smart Material Systems & MEMS **Max Marks: 100**
Course Code: PEC-ECE-503 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: The course is designed to introduce the concept of micro electro mechanical systems, enable students to learn the principles of MEMS fabrication, impart design principles of micro electro mechanical systems

Unit-I

Introduction: Introduction to smart systems, Components of smart system- "Smartness", Sensors, actuators, transducers, Micro electromechanical systems (MEMS), Control algorithms, Modeling approaches, Effects of scaling, Optimization schemes

Unit-II

Processing of Smart Material: Semiconductors and their processing, Metals and metallization techniques, Ceramics, Silicon micromachining techniques, Polymers and their synthesis, UV radiation curing of polymers, Deposition techniques for polymer thin films, Properties and synthesis of carbon nanotubes

Unit-III

Sensors for Smart Systems: Introduction, Conductometric sensors, Capacitive sensors, Piezoelectric sensors, Magnetostrictive sensors, Piezo-resistive sensors, Optical sensors, Resonant sensors, Semiconductor-based sensors, Acoustic sensors, Polymeric sensors, Carbon nanotube sensors

Unit-IV

Actuators for Smart Systems: Introduction, Electrostatic transducers, Electromagnetic transducers, Electrodynamic transducers, Piezoelectric transducers, Electrostrictive transducers, Magnetostrictive transducers, Electro-thermal actuators, Comparison of actuation schemes

Unit-V

System Case studies: Pressure Sensor – MEMS micro phone – Gyros- Accelerometer (In these case studies the principle, design consideration and one typical commercial device has to be studied)

Fabrication case studies: PVDF based transducer for structural health monitoring – SAW based accelerometers – cantilever based piezoelectric sensor.

Course Outcomes:

After completion of the course student will be able to:

- **CO1.** State the importance of miniaturized structure and importance of MEMS
- **CO2.** Outline step-wise processing of smart material systems
- **CO3.** Apply principles of different sensors and actuators for obtaining their MEMS models
- **CO4.** Sketch the fabrication & design considerations of commercial products

Text Books:

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1. **V. K. Varadan, K. J. Vinoy, S. Gopalakrishnan**, “Smart material systems and MEMS” Wiley India, 2011(Reprint).
2. **Chang Liu**, “Foundations of MEMS” Pearson, 2012.

Reference Books:

1. **Stephen D. Senturia**, "Microsystem Design", Kluwer Academic Publishers, 2001.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

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(Dean SoET)	(Head, ECE)	(A.P., ECE)	(A.P., ECE)

Semester V

Course Title: Engineering Material Science **Max Marks: 100**
Course Code: PEC-ECE-504 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: This course has been designed to get the student acquainted with the different types of materials, their crystal structure, their characterization techniques and their latest engineering applications.

Unit-I

Crystallography: crystal structure, Atomic Structure and Interatomic Bonding, Crystalline and Amorphous Solids, the 7 crystal systems, the 14 Bravais lattices, properties of cubic crystals: simple cubic, face-centered cubic, body-centered cubic and diamond cubic.

Unit-II

Classification of materials: Metals & Alloys, Ceramics, Polymers, Composites, Semiconductors. Smart materials, nano-materials, Biomaterials their molecular structure, properties and manufacture.

Unit-III

Characterization Techniques: Optical Microscope, Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM), Field Ion Microscope (FIM), Scanning Tunneling Microscope (STM), Scanning probe microscopy (SPM), Atomic Force Microscope (AFM), X-ray diffraction topography (XRT).

Unit-IV

Micro and Nano fabrication: Processing of bulk, thin film and nano scale materials for applications in electronic, magnetic, electro-mechanical and photonic devices and micro systems. Growth of bulk, thin film and nano scale single crystals via vapor and liquid phase processes, epitaxy, formation and processing of thin films, their structures and properties.

Unit-V

Applications: Examples from materials processing for applications in photonic devices, MEMS, NEMS, Biomaterials and high performance integrated electronic circuits, integrated sensors and data storage systems.

Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Understand the basic structures of Crystal, Atom & Interatomic Bonding
- **CO2.** Understand the various classifications of materials
- **CO3.** Understand various characterization Techniques like SEM, TEM etc.
- **CO4.** Understand the various fabrication techniques
- **CO5.** Understand the applications in MEMS, NEMS & Integrated Electronic Circuits

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Text Books:

1. **W. D. Callister, Jr.** Materials Science & Engineering- An Introduction, John Willey & Sons, Inc., New York.
2. **V Raghavan**, Materials Science & Engineering. Prentice Hall of India Pvt. Ltd., New Delhi.

Reference Books:

1. **L.H. Van Vlack**, "Elements of Materials Science & Engineering", Addison-Wesley Publishing Company, New York.
2. **J. W. Mayer and S. S. Lau**, Electronic Materials Science - Maxwell Macmillan International Editions, Singapore.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

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(Dean SoET)	**(Head, ECE)**	**(A.P., ECE)**	**(A.P., ECE)**

Semester VI

Course Title: Mobile and Wireless Communication **Max Marks: 100**
Course Code: PEC-ECE-601 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: The course has been designed to get student acquainted with basic concepts, principles and applications related to field. Emphasis is given to latest technologies

Unit-I

Cellular Mobile Radio Systems: Introduction to Cellular Mobile System, evolution of mobile communication systems, Performance criteria, operation of cellular systems, The cellular Concept: Frequency reuse; The basic theory of hexagonal cell layout; Spectrum efficiency. FDM/TDM Cellular systems; Cell splitting and cell sectoring, hand off.

Unit-II

Interference: Introduction to Co-Channel Interference, real time Co-Channel interference, Co-Channel measurement, fading in mobile environment, inter symbol interference (ISI) and rejection using Near-Maximum Likelihood detection.

Unit-III

Wireless Communication: Major challenges in wireless communication, Radio propagation characteristics; Propagation mechanisms: Reflection, Diffraction and scattering, Effect of human made structures, phase difference between direct and reflected paths, Multipath propagation, Models for path loss, Shadowing and multipath fading (delay spread, coherence bandwidth, coherence time, Doppler spread).

Unit-IV

Multiple Access Techniques & Wireless Systems: Multiplexing techniques- FDMA, TDMA and CDMA. Spread spectrum systems: Frequency hopping multiple access and its principle, Code division multiple access-principle behind CDMA, Basic principle behind the Direct Sequence Spread Spectrum.

Unit-V:

OFDM and Multi antenna Systems: Introduction and Principle of OFDM, Orthogonality and its Physical significance, Implementation of transceivers, cyclic prefix, Advantages and disadvantages of OFDM, OFDMA. Smart Antennas, MIMO-Basic Introduction and system model.

Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Understand cellular mobile system, formulate its performance criteria.
- **CO2.** Characterize the trade-off among frequency reuse, signal to interference ratio, capacity& able to understand interferences in cellular communication.
- **CO3.** Apply the knowledge of mathematics to find out the average received signal strength at a distance from the transmitter using different propagation model.
- **CO4.** Identify the advantages & disadvantages of different mobile antennas.

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CO5. Understand multiple access method, spread spectrum techniques, wireless communication system.

Text Books:

1. **Lee-** Mobile Cellular Telecommunications, McGraw Hill, 2nd Edition, 1989.
2. **Theodore, Rapport**-Wireless Communications Pearson education, 2nd Edition, 2002.

Reference Books:

1. **Blake R-** Wireless Communication Technology, Thompson Asia Pvt. Ltd., 2004.
2. **Mark Jon W and Weihua Zhqung -**Wireless Communication and Networking, PHI, 2005.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester VI

Course Title: VLSI Design | **Max Marks: 100**
Course Code: PEC-ECE-602 | **University Exam: 60**
Duration of Exam: 3 Hours | **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: To familiarize students with various fundamental technologies required in VLSI design

Unit-I

Review of MOSFET: Constructional & Operational features of MOSFET, I-V Equation, 2ND Order Effects, MOS Capacitor, C-V Characteristics, MOSFET Switch, Transmission gate, CMOS Inverter (Pull-up & Pull-down), Inverter Static Characteristics, ßn/ ßp Ratio, Noise Margin, switching characteristics of Inverter (Fall Time, Rise Time, Delay Time), Dynamic Characteristics, Power Dissipation.

Unit-II

VLSI Technology: Wafer Processing, Oxidation, Epitaxy, Deposition, Ion-Implantation & Diffusion, The Silicon Gate Process, n-well CMOS Process, p-well Process, Twin-Tub Process, Silicon on Insulator.

Unit-III

CMOS Logic Design (Gates): CMOS Logic Gate Design (NAND & NOR Logic), Switching Characteristics (Delay Time, Power, Fan-in, Fan-out), Transistor Sizing, The Compound Gates.

Unit-IV

CMOS Logic Structures: CMOS Logic, Pseudo-nMOS Logic, Dynamic CMOS Logic, C2MOS Logic, BiCMOS Logic, NP Domino Logic.

Unit-V

Layout: Design Rules/Floor planning, Simple Layout Examples.

VHDL programming: RTL Design – Combinational Logic – Types – Operators – Packages – Sequential Circuit – Sub-programs – Test benches. (Examples: Address, Counters, Flip-Flops, FSM, Multiplexers/De-multiplexers).

Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Describe the operational characteristics of MOSFET and its application as capacitor and switch.
- **CO2.** Design CMOS Inverters and analyze its static and dynamic characteristics
- **CO3.** Understand the complete CMOS fabrication process
- **CO4.** Design various CMOS based logic gates and logic structures
- **CO5.** Understand and draw the layout of basic CMOS based circuits.

Text Books:

1. **Weste & Eshraghian**-Principles of CMOS VLSI design (2/e) Addison Wesley.
2. **Samir Palnitkar-**Verilog HDL - Guide to Digital design and synthesis, 3rd edition, Pearson Education, 2003.

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Reference Books:

1. **M. J. S. Smith**- Application Specific integrated circuits, Pearson Education, 1997.
2. **Wayne Wolf**- Modern VLSI Design, Pearson Education 2003.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester VI

Course Title: Electrical Machines **Max Marks: 100**
Course Code: PEC-ECE-603 **University Exam: 60**
Duration of Exam: 3 hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: The course has been designed to get student acquainted with basic concepts, principles and applications related to electrical machines**.**

Unit-I

Transformers: Construction and working principle, classification, concept of ideal transformer, emf equation, transformer on load, phasor diagram on no load and on load, equivalent circuit, O.C and S.C tests. Losses and efficiency, All day efficiency, Voltage Regulation. Parallel operation of single phase transformer. Auto Transformer: Principle of operation, advantages, phasor diagram.

Unit-II

D C Generators: Principle of operation, construction, EMF & torque equation, power stages, losses & efficiency classification of D.C. generators, various characteristics, parallel operation of D.C. Generators, commutation & armature reaction.

Unit-III

D. C. Motors: Construction and principle of operation, classification, emf & torque equation, characteristics of D.C. motors and their applications, Electric Braking and speed control of various types of dc motors.

Unit-IV

Single Phase Induction Motors: Construction and principle of operation, Types of single phase induction motors, equivalent circuit based on double revolving field theory, Universal motors, fractional horse power motors.

Unit-V

Alternators: Basic Principle of operation, construction, emf equation, rotating magnetic field, factors effecting alternator size, Alternator on load, synchronous reactance, determination of voltage regulation, parallel operation of alternators.

Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Understand the basic concepts and principle of operation of transformers and their types.
- **CO2.** Explain the concept of DC generators.
- **CO3.** Explain the principle of DC motors and characteristics of different DC motors.
- **CO4.** Understand the operation of Single phase induction motors.
- **CO5.** Understand principle of operation of Alternators.

Text Books:

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1. **Fitzegerald A F, Kingsley C and Umans S D-** "Electrical Machinery", McGraw Hill.
2. **Nagrath I J and Kothari D P-** "Electric Machines", Tata McGraw Hill.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester VI

Course Title: Data Communication & Computer Networks **Max Marks: 100**
Course Code: PEC-ECE-604 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: The course has been designed for explaining the basic concepts and principles to the students. Applied and Industrial Aspects have been taken care of in an appropriate manner.

Unit-I

Introduction: Data Communications, Networks, Protocols and Standards, Network models: OSI model, TCP/IP Protocol suite, Addresses.

Unit-II

Data Transmission: Concepts and Terminology, Analog and digital data Transmission, Transmission Impairment, Channel Capacity and performance, Transmission media: guided, unguided.

Unit-III

Data link Layer: Design issues of Data Link layer, framing, error detection and correction, CRC, Elementary Protocol-stop and wait, Sliding Window, SLIP, Data link layer in HDLC, Contention based media access protocols (ALOHA, Slotted ALOHA, CSMA and CSMA/CD) MAC addresses.

Unit-IV

Network Layer: Logical addressing, Internet protocols: Internetworking, IPv4, IPv6, Transition from IPv4 to IPv6, Internet control protocols (ICMP, ARP, RARP)

Unit-V

Network Layer: Delivery, Forwarding, Forwarding Techniques and Processes, Routing Table, Unicast Routing Protocols: Distance Vector and Link state routing, Path Vector Routing; Multicast Routing Protocols.

Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Understand the fundamental concepts of Data Communication.
- **CO2.** Understand and explain digital transmission over different types of communication media.
- **CO3.** Understand the principles of framing, flow control, error control and access control mechanisms.
- **CO4.** Understand the concept of logical addressing and building the skills of sub-netting.
- **CO5.** Understand and explain the principles and protocols for route calculations.

Text Books:

1. **Behrouz A. Forouzan**, "Data Communication and Networking", McGraw Hill, 4th Edition.
2. **Tanenbaum A S**, "Computer Networks", 4th Edition, Prentice Hall.

Reference Books:

1. **Micheal A. Gallo, William M. Hancock** - Computer Communications & Networking Technologies, Cengage India.
2. **Larry L. Peterson and Bruce S. Davie -** Computer Networks: A systems approach, Morgan Kaufman, 2nd Edition.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester VI

Course Title: Optoelectronic Devices | **Max Marks: 100**
Course Code: PEC-ECE-605 | **University Exam: 60**
Duration of Exam: 3 hours | **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: The aim of this course is to give a deeper understanding of the physics, characterization and application of novel optoelectronic devices.

Unit-I

Review of Semiconductor Device Physics: Energy bands in Solids, the E-k Diagram, concept of effective mass, free electron theory, Fermi level and quasi Fermi levels, Review of reciprocal lattice, Brillouin zone, Direct-Indirect band gap semiconductors.

Unit-II

Optoelectronic Device Physics: Optical materials – electron-hole recombination, bandgap engineering. Light interaction with materials-transparency, translucency and opacity, refraction and refractive index, reflection, absorption and transmission. Carrier generation recombination processes, R-G statistics. Carrier lifetimes, Principles of emission and absorption, Einstein's equation, Optical absorption; luminescence-photo luminescence, electroluminescence. Hetero structures and Quantum wells.

Unit-III

Semiconductor Photon Sources: PN Junction Diode, LED: Device structure, materials and characteristics. Semiconductor Laser: Basic Structure, theory and device characteristics; direct current modulation, axial and transverse laser modes, heterojunction lasers, distributed feedback lasers, quantum well lasers, tunneling based lasers, modulation of lasers. Quantum-well lasers: DFB, DBR and VCSEL; Laser diode arrays.

Unit-IV

Semiconductor Photodetectors: Principle of detection, Types of photodetectors, single junction under illumination: photon and carrier-loss mechanisms, Noise in photo detection; PIN diodes and APDs: structure, characteristics and device performance. Photo-transistors.

Unit-V

Semiconductor Optical Amplifiers & Modulators: Semiconductor Optical Amplifiers (SOA), SOA characteristics and some applications, Quantum-confined Stark Effect and Electro-Absorption Modulators, Solar cells and CCDs.

Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Describe the principles of light generation and detection, operation, and design of state-of-the-art optoelectronic and photonic devices.
- **CO2.** Explain key concepts in quantum and statistical mechanics relevant to physical, electrical and optoelectronic properties of materials and their applications to optoelectronic devices and photonic integrated circuits

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CO3. Describe fundamental and applied aspects of optoelectronic device physics and its applications to the design and operation of laser diodes, light-emitting diodes, and photodetectors.

CO4. Describe techniques to improve the operation of optoelectronic devices and device characteristics that have to be optimized for new applications by employing their understanding of optoelectronic device physics.

CO5. Explain and analyse the working principles of optoelectronic devices like CCD,SOA, solar cell etc.

Text Books:

1. **J.M. Senior**, "Optical Fiber Communication: Principles and Practice", Prentice Hall of India.
2. **Street B G and Banerjee S**, "Solid State Electronic Devices", PHI New Delhi, (2004).

Reference Books:

1. **Donald A. Neamen**, "Semiconductor Physics and Devices," McGraw.
2. **Pallab Bhattacharya**, "Semiconductor Optoelectronic Devices", 2nd Edition.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester VI

Course Title: Non-Conventional Energy Sources **Max Marks: 100**
Course Code: PEC-ECE-606 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: The aim of the course is to provide the students adequate knowledge of Power Generation from Renewable Energy Sources.

Unit-I

Introduction to Energy Sources: Energy scenario in India, Classification of Energy Resources, Renewable and Non-renewable Energy sources, Environment, Economy, Energy for sustainable development, Direct Energy conversion systems.

Unit-II

Hydro Energy: Renewable Hydro – potential, flow, duration and storage, Hydro Electric Power Plants, mini-micro hydro, small hydro power, types of turbines, generators & controls.

Unit-III

Wind Energy: Wind energy, potential, Site selection, Expression of power in the wind, Wind energy Conversion Systems. Types of wind Mills (Horizontal and Vertical Axis Wind Mill). Forces on Blades and Torque of Wind Mill. Lift Forces & drag Forces, wind mill generator, local control and storage.

Unit-IV

Solar Energy: Solar energy, Principle Of conversion of solar radiations into heat. Extra-terrestrial and inter-terrestrial regions, solar photovoltaic Cell, Applications of solar energy systems, Solar Water Heater, Solar Cookers, Solar Pumping

Unit-V

Other Renewable forms of energy: Bio energy, Biomass energy conversion Technologies. Methods for obtaining energy from Biomass, wave & tidal energy, ocean thermal energy systems (OTEC). Magneto Hydro Dynamic Power Generation (MHD) & fuel cells, geothermal resources, Geothermal Energy Conversions.

Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Understand the importance of non-conventional energy resources for the present energy scenario.
- **CO2.** Understand the working criteria of hydro power generation.
- **CO3.** Acquire knowledge about wind energy conversion system for power generation.
- **CO4.** Analyze solar energy conversion technologies.
- **CO5.** Study other non-conventional sources of energy like geothermal resources, biomass, etc.

Text Books:

1. **Sukhatme S. P. and Nayak J. K.** Solar Energy, Tata McGraw Hill, New Delhi.
2. **Elgerd O. I.** Electrical Energy System Theory, Tata McGraw Hill, New Delhi.

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Reference Books:

1. **Singal R. K.,** Non-Conventional Energy Sources, Kataria Sons, New Delhi.
2. **Gupta B. R.,** Generation of Electrical Energy, Khanna Publications.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester VI

Course Title: Power Electronics | **Max Marks: 100**
Course Code: PEC-ECE-607 | **University Exam: 60**
Duration of Exam: 3 Hours | **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: The objective of this course is familiarizing students with working of power electronic converters under various loads.

Unit-I

Power Semiconductor Devices & Their Characteristics: Application of power electronics, classification of power semiconductor devices, ideal switch, power diodes & thyristors with characteristics, two transistor model of thyristor, di/dt, dv/dt limitations and snubber circuits, other power semiconductor devices (DIAC, TRIAC, IGBT, MOSFET) with their characteristics.

Unit-II

AC to DC Converters: Types of AC to DC converters, single phase half-wave and full-wave controlled rectifiers with resistive load, inductive load and freewheeling diode, detailed derivation of RMS, average value, harmonic factor, displacement factor, THD, crest factor. Introduction to three phase full and semi controlled rectifiers, dual converters.

Unit-III

DC to DC Converters: Principle of chopper, control techniques of chopper (TRC and CLC), switching regulators: Buck, Boost, Buck-Boost, basic principles of SMPS and UPS, Introduction to resonant converters.

Unit-IV

DC to AC Converters: Voltage-driven inverter, current-driven inverter, Single-phase inverter with resistive load, inductive load, Sinusoidal PWM Inverter, Introduction to resonant inverters, three phase inverter, 120-180 degree conduction.

Unit-V

AC to AC Converters: AC Voltage Controllers: Single and three phase AC voltage controllers. Cycloconverters: Single phase to single-phase, three-phase to single-phase, three-phase to three-phase cyclo-converter circuit and their operation.

Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Articulate the basics of power electronic devices and characteristics of SCR, IAC, TRIAC, MOSFET and IGBT.
- **CO2.** Express the design and control of converters.
- **CO3.** Design power electronic converters in power control applications.
- **CO4.** Design AC coltage controller, chopper circuit, inverter circuit and cyclo-converter.
- **CO5.** Analyze the operation of DC-DC choppers and voltage source inverters.

Text Books:

1. **N. Mohan, T.M. Undeland, and W.P. Robbins**, "Power Electronics: Converters, Applications and Design", 3rd Edition (New York: John Wiley & Sons, 2003).
2. **M.H Rashid, "**Power Electronics: Circuits, Devices and Applications", Pearson Education India, 2009.

Reference Books:

1. **B. K. Bose**, "Power Electronics and AC Drives," NJ Englewood Cliffs: Prentice-Hall 1986.
2. **M.Ramamurthy**, "An introduction to thyristor and their application**,**" Affiliated East-West Press, 1977.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester VII

Course Title: Device Modeling for Circuit Simulations | **Max. Marks: 100**
Course code: PEC-ECE-701 | **University Exam: 60**
Duration of Exam: 3 Hours | **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: To provide basic foundation of device modelling in order to design various circuits and address various circuit design issues

Unit-I
Basics Semiconductor Physics. Principle of circuit simulation and its objectives.

Unit-II
Introduction to SPICE and SIMULINK: AC, DC, Transient, noise, temperature extra analysis.

Unit-III
Semiconductor Device Models Junction Diodes: DC, small signal, large signal, high frequency and noise models of diodes. Measurement of diode model-parameters. **BJT**: DC, small signal, high frequency and noise models of bipolar junction transistors. Extraction of BJT model parameters. **MOSFETs**: DC, small signal, high frequency and noise models of MOSFETs. MOS Capacitors.

Unit-IV
Device SCALING: short and narrow channel MOSFETs. MOSFET channel mobility model, DIBL, charge sharing and other non-linear effects.

Unit-V
MOS Models: Level-1 and level-2 large signal MOSFET models. Introduction to BSIM models. Extraction of MOSFET model parameters. **JFET, MESFETs & HBTs**: modeling of JFET & MESFET and extraction of parameters. **HBTs:** Principles of hetro-junction devices, HBTs, HEMT

Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Simulate characteristics of a simple device using MATLAB, SPICE.
- **CO2.** Explain about the qualitative understanding of the physics of a new device with equations.
- **CO3.** Explain the equations, approximations and techniques available for deriving a model for any semiconductor device.
- **CO4.** Understand different MOS models like BSIM and their modelling procedure.
- **CO5.** Describe the latest devices like HBT, HEMT, MESFET etc.

Text Books:

1. **S.M. Kang & Y. Leblibici**, "CMOS Digital Integrated Circuits-Analysis & Design", TMH.
2. **S.M. Sze**, "Physics of semiconductor devices", Wiley Pub.

Reference Books:

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1. **M. H. Rashid**, "Power Electronics Circuits Devices and Applications," Pearson Education, 2004.
2. **BG Streetman**, "Solid state Electronic Devices", PHI.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester VII

Course Title: Advanced 3G and 4G Wireless & Mobile Communication **Max Marks: 100**
Course Code: PEC-ECE-702 **University Exam: 60**
Duration of Exam: 3 hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: This course is intended as an introductory course for the final year student to look at current and upcoming wireless communication technologies for broad band wireless access.

Unit-I

Cellular communication: Introduction to Cellular Communications, Frequency reuse, Multiple Access Technologies, Cellular Processes – Call Setup, Handover, etc., CDMA: Introduction to CDMA, Walsh Codes, PN Sequences, Multipath diversity, RAKE Receiver, CDMA Receiver Synchronization.

Unit-II

Wireless Communications and Diversity: Fading: Concept and its types, Fast Fading Wireless Channel Modelling, Rayleight/Ricean Fading Channels, BER Performance in Fading Channels, Diversity modelling for Wireless Communications, BER Performance Improvement with diversity, Types of Diversity – Frequency, Time, Space.

Unit-III

OFDM: Introduction to OFDM, Multicarrier Modulation and Cyclic Prefix, Channel model and SNR performance, OFDM issues - PAPR, Frequency and Timing Offset Issues, Inter Carrier Interference.

Unit-IV

MIMO: Introduction to MIMO, MIMO channel capacity, SVD and Eigen modes of the MIMO channel, MIMO special multiplexing-BLAST, MIMO diversity-Alamouti, OSTBC, MRT, MIMO-OFDM.

Unit-V

Ultra-wide band: UWB definition and features, UWB wireless channels, UWB data modulation, uniform pulse train, Bit error rate performance of UWB. 3G and 4G Wireless Standards: GSM, GPRS, WCDMA, LTE, WiMAX.

Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Understand cellular mobile system and its working.
- **CO2.** Design different wideband channel model.
- **CO3.** Understand OFDM in detail, identify different OFDM issues.
- **CO4.** Identify different ST channels and design MIMO channel.
- **CO5.** Understand Ultra-Wide Band technology, knowledge of WiMAX, WCDMA & LTE.

Text Books:

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1. **Arogyaswami Paul raj:** Introduction to space, time wireless communication. Cambridge university press
2. **John G Proakis**, Digital Communication, McGraw Hill.

Reference Books:

1. **Andreas Molisch**, Wireless communication-WILEY IEEE press
2. **Mischa Schwartz,** Mobile wireless communication- Cambridge university press

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

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(Dean SoET)	(Head, ECE)	(A.P., ECE)	(A.P., ECE)

Semester VII

Course Title: Satellite Communication | **Max. Marks: 100**
Course code: PEC-ECE-703 | **University Exam: 60**
Duration of Exam: 3 Hours | **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: To impart the technical knowledge about satellite services, link techniques and access techniques used in satellite signal propagation.

Unit-I

Orbital Parameters: Orbital parameters, Orbital perturbations, Geo stationary orbits, Low Earth and Medium orbits. Frequency selection, Frequency co-ordination and regulatory services, Sun transit outages, Limits of visibility, Attitude and orientation control, Spin stabilization techniques, Gimbal platform

Unit-II

Link Calculations: Space craft configuration, Payload and supporting subsystems, Satellite uplink -down link power budget, C/No, G/T, Noise temperature, System noise, Propagation factors, Rain and ice effects, Polarization calculations

Unit-III

Access Techniques: Modulation and Multiplexing: Voice, Data, Video, Analog and Digital transmission systems, multiple access techniques: FDMA, TDMA, T1-T2 carrier systems, SPADE, SS-TDMA, CDMA, Assignment Methods, Spread spectrum communication, Compression-Encryption and Decryption techniques

Unit-IV

Earth Station Parameters: Earth station location, propagation effects of ground, High power Transmitters-Klystron Crossed field devices, Cassegrania feeds, Measurements on G/T and Eb/No

Unit-V

Satellite Applications: INTELSAT Series, INSAT, VSAT, Remote sensing, Mobile satellite service: GSM. GPS, INMARSAT, Satellite Navigation System, Direct to Home service (DTH), Special services, E-mail, Video conferencing and Internet connectivity.

Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Explain the principles, concepts and operation of satellite communication systems.
- **CO2.** Describe the concepts of signal propagation affects, link design, rain fading and link availability and perform interference calculations.
- **CO3.** Understand modulation techniques and error correction codes for satellite communication.
- **CO4.** Use software tools to simulate and analyse the performance of satellite communication systems, and use real satellite up/down links (subject to the availability of satellite links) to conduct link experiments.

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CO5. Critically analyse the design requirements and the performance of satellite communication systems.

Text Books:

1. **Bruce R. Elbert**," The Satellite Communication Applications Hand Book, Artech House Boston, 1997
2. **Wilbur L. Pritchard, Hendri G. Suyderhood, Robert A. Nelson**, "Satellite Communication Systems Engineering", II Edition, Prentice Hall, New Jersey.1993

Reference Books:

1. **Dennis Rody,**" Satellite Communication", Regents/Prentice Hall, Eaglewood Cliff, New Jersey, 1983
2. **Tri T. Ha**, "Digital satellite communication", 2nd Edition, McGraw Hill, New york.1990

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester VII

Course Title: Optical Communication **Max Marks: 100**
Course Code: PEC-ECE-704 **University Exam: 60**
Duration of Exam: 3 hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: The course has been designed for explaining the basic concepts and principles of Optical Communication to the students. Applied and Industrial Aspects of optical communication have been taken care of in an appropriate manner.

Unit–I

Overview of Optical Fiber Communication: Brief Overview of Optical Communication, Basic concepts, light wave components, principle of light transmission, channel capacity etc. Nature of light, polarization, basic laws and definition, mode theory analysis for optical communication, optical fiber modes and configuration, wave propagation in optical fiber, operating wavelength, single mode and multimode fibers, V–numbers, mode field diameter, numerical aperture, refractive index profiles.

Unit–II

Signal Degradation in Optical Fibers: Attenuation, absorption, scattering losses, bending losses in optical fibers. Dispersion in optical waveguides, group delay, material dispersion, waveguide dispersion, intermodal dispersion and chromatic dispersion in single mode fibers, Non linearities in Fibers

Unit–III

Optical Sources: Basic concepts from semiconductor electronics, energy bands, Concept of Direct and indirect Band Devices. Light emitting diodes: Structure, principle, material, modulation response, transient response. Laser diodes: Principle of action, structure, efficiency and characteristics of laser diodes, modulation He–Ne lasers, DFB lasers.

Unit-IV

Optical Detectors: Basic Information in light detectors, Role of an optical detector, Detector Characteristics: Responsivity, Noise Equivalent Power, Detectivity, Quantum efficiency, Detector response time, Linearity, Spectral response, Noise Considerations: Johnson noise, Shot noise, 1/f noise, Photon noise. The PH junction photo diode – PIN photodetectors – Avalanche photo diode construction characteristics and properties, APD Specifications, Applications of APD – comparison of performance noise sources – simple model of photo receiver – its equivalent for circulation of noise SNR, Optical Receivers.

Unit–V

Transmission Systems and Advanced Multiplexing Strategies: Power Launching and coupling. Point to point link system consideration, Optical TDM, subscriber multiplexing (SCM), WDM and Hybrid multiplexing methods.

Course Outcomes:

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After completion of the course student will be able to:

- **CO1.** Recognize and classify the structures of Optical fiber networks and their types.
- **CO2.** Discuss the channel impediments like losses, interference and dispersion.
- **CO3.** Describe the Optical sources and detectors and thus able to illustrate their working principle.
- **CO4.** Familiar with Design considerations of fiber optic systems.
- **CO5.** perform characteristics of optical fiber, sources and detectors, design as well as conduct experiments in software and hardware, analyse the results to provide valid conclusions.

Text Books:

1. **John M Senior -**Optical Comm Techniques –PHI
2. **Keiser G-** Optical Fiber Communication, 3rd Edition, Mc Graw Hill International

Reference Books:

1. **Ghatak & Thyangarajan K**- Introduction to fiber optics, Cambridge university press,1998.
2. **Mynbacv D.F. and Scheine L -**Fiber Optic Communication Technique, Pearson.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

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Semester VII

Course Title: Random Processes & Information Theory **Max Marks: 100**
Course Code: ECE-705 **University Exam: 60**
Duration of Exam: 3 hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: The course has been designed for explaining the basic concepts and principles to the students. Applied and Industrial Aspects have been taken care of in an appropriate manner.

Unit-I

Probability and Random Variable: Axioms of probability – Joint & Conditional probability - Total probability – Baye's theorem, Independent Events, Random variable - Probability mass function - Probability density functions- Properties, Cumulative distribution function Properties, Functions of a random variable (only one dimensional).

Unit-II

Standard Distributions: Mathematical Expectations, Moments, Moment generating functions and their properties, Characteristic functions. Transformation of random variables - Central limit theorem, Expected Value, Variance & Moment of a random variable. Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions and their properties.

Unit-III

Classification of Random Processes: Definition & Classification of Random Process, First Order, Second order, strictly stationary, wide sense stationary and ergodic processes, Markov, Process, Binomial, Poisson and Normal processes.

Unit-IV

Correlation and Spectral Densities: Auto correlation - Cross correlation - Properties – Power spectral density – Cross spectral density - Properties – Wiener-Khintchine relation – Relationship between cross power spectrum and cross correlation function - Linear time invariant system - System transfer function –Linear systems with random inputs – Auto correlation and cross correlation functions of input and output.

Unit -V

Information Theory: Uncertainty, Information and entropy, Source coding theorem, Data compaction, Discrete memory less channels, mutual information, channel capacity, channel coding theorem, Differential entropy, and mutual information for continuous ensembles, information capacity theorem, implication of the information capacity theorem, rate distortion theory, Compression of information.

Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Understand the basic concepts of Probability & Random Variables & able to solve numerical problems.
- **CO2.** Understand various standard distributions used in various fields of engineering
- **CO3.** Understand different types of Random processes.

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CO4. Understand the concept of correlation & apply it on Linear time invariant systems.

CO5. Understand the concept of Information Theory in the field of communication systems & design solutions for noise free channels.

Text Books:

1. **A Papoulis & Pillai:** Probability, Random Variables & Stochastic Processes, TMH
2. **Ross, S-**A First Course in Probability, Fifth edition, Pearson Education, Delhi.

Reference Books:

1. **Stark and Woods John W -**Probability and Random Processes with Applications to Signal Processing, Pearson Education, Third edition, Delhi, 2002.
2. **Veerarajan. T-** Probability, Statistics and Random process, Tata McGraw-Hill Publications, Second Edition, New Delhi, 2002.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester VII

Course Title: Radar Engineering | **Max Marks: 100**
Course Code: PEC-ECE-706 | **University Exam: 60**
Duration of Exam: 3 hours | **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: The course has been designed for explaining the basic concepts and principles to the students. Applied and Industrial Aspects have been taken care of in an appropriate manner.

Unit-I

Introduction to Radar - Basic Radar -The simple form of the Radar Equation- Radar Block Diagram- Radar Frequencies -Applications of Radar - The Origins of Radar, The Radar Equation Introduction- Detection of Signals in Noise- Receiver Noise and the Signal-to-Noise Ratio- Probability Density Functions.

Unit-II

MTI and Pulse Doppler Radar - Introduction to Doppler and MTI Radar- Delay -Line Cancelers- Staggered Pulse Repetition Frequencies -Doppler Filter Banks - Digital MTI Processing - Moving Target Detector - Limitations to MTI Performance - MTI from a Moving Platform (AMIT) - Pulse Doppler Radar

Unit-III

Detection of Signals in Noise - Introduction - Matched -Filter Receiver -Detection Criteria - Detectors --Automatic Detector - Integrators - Constant-False-Alarm Rate Receivers - The Radar operator - Signal Management - Propagation Radar Waves - Atmospheric Refraction -Standard propagation - Nonstandard Propagation - The Radar Antenna - Reflector Antennas - Electronically Steered Phased Array Antennas - Phase Shifters Frequency-Scan Arrays.

Unit-IV

Radar Transmitters- Introduction -Linear Beam Power Tubes - Solid State RF Power Sources - Magnetron - Crossed Field Amplifiers - Other RF Power Sources - Other aspects of Radar Transmitter.

Unit-V

Radar Receivers - The Radar Receiver - Receiver Noise Figure - Superheterodyne Receiver - Duplexers and Receiver Protectors- Radar Displays.

Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Understand the essential principles of operation of radar systems.
- **CO2.** Understand the principles behind detection of Radar signals in noise.
- **CO3.** Design simple radar systems and the associated signal processing, at block diagram level.
- **CO4.** Apply the relevant design equations to phased array antennas, and understand the advantages and constraints of phased array radar.
- **CO5.** Design and describe various circuits and systems of Radar transmitters and receivers.

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Text Books:

1. **Merrill I. Skolnik**," Introduction to Radar Systems", Tata McGraw-Hill (3rd Edition) 2003

Reference Books:

1. **Peyton Z. Peebles,** "Radar Principles", John wiley, 2004.
2. **J.C Toomay**, " Principles of Radar", 2nd Edition -PHI, 2004

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester VII

Course Title: Biomedical Instrumentation | **Max Marks: 100**
Course Code: PEC-ECE-707 | **University Exam: 60**
Duration of Exam: 3 Hours | **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: The aim of the course is to get the students acquainted with the Biomedical Instrumentation.

Unit-I

Introduction to biomedical instrumentation: Introduction of Biomedical Engineering, Biometrics, Man instrument system, Components of Man instrument system. Resting potential, action potential, typical wave form of action potential, propagation of action potential, recording of action potential.

Unit-II

Electrodes, Transducer and Amplifiers: Introduction of Bio-Electrodes, Properties of Bio-Electrodes, different types of electrodes, Sensors, Diaphragms, Force sensors. Introduction of transducers, classification of transducers, Biological Amplifiers (Instrumentation amplifies, chopper amplifiers)

Unit-III

Electro Potential Recording: The heart and cardiovascular system, ECG, EEG, EMG, lead systems and recording methods, typical waveforms and signal characteristics and block diagrams of ECG, EEG, EMG.

Unit-IV

Human Assist Devices: Cardiac pacemakers, Classification of Pacemakers, Defibrillators, AC Defibrillators, DC Defibrillators, Indirect measurement, direct measurement, automated indirect method, magnetic blood flow meters, ultrasonic blood flow meter.

Unit-V

Imaging Techniques: Introduction to X-rays, Properties of X-rays, Production of X-rays, Block Diagram of X-ray Machine, Ultrasound in medicine, physics of ultrasonic waves, types, A-mode, M-Mode, Doppler mode, Introduction of Computed tomography, Introduction of MRI.

Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Understand biomedical instrumentation, propagation of action potential.
- **CO2.** Acquire knowledge of electrodes, transducers & amplifiers used in biomedical instrumentation.
- **CO3.** Apply the knowledge of science, engineering fundamentals & engineering specialization for electrode potential recording.
- **CO4.** Understand different human assist devices.
- **CO5.** Gain knowledge of different imaging techniques used in medical science.

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Text Books:

1. **Khandpur, R.S**., "Handbook of Biomedical Instrumentation", TATA McGraw-Hill, New Delhi, 1997.

Reference Books:

1. **Joseph J. Carr and John M. Brown**, Introduction to Biomedical Equipment Technology, John Wiley and Sons, New York, 1997.
2. **Leislie Cromwell**, Biomedical instrumentation and measurement, Prentice Hall of India, New Delhi, 2002

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

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Semester VII

Course Title: Analog and Mixed Signal Design | **Max. Marks: 100**
Course code: PEC-ECE-708 | **University Exam: 60**
Duration of Exam: 3 Hours | **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: The principle objective of this subject is to introduce students to various analog and mixed signal design approaches.

Unit-I:
Mixed Design Introduction: Analog Design, Digital Design, Mixed Design, Introduction to analog VLSI and mixed signal issues in CMOS technologies.

Unit-II:
MOS Models: Basic MOS models, SPICE Models and frequency dependent parameters. Basic NMOS/CMOS gain stage, cascade and cascode circuits. Frequency response, stability and noise issues in amplifiers.

Unit-III:
CMOS analog blocks: Current Sources and Voltage references. Differential amplifier and OPAMP design. Frequency Synthesizers, Voltage Controlled Oscillators and Phased lock-loop.

Unit-IV:
Non-linear analog blocks: Comparators, Charge-pump circuits and Multipliers. Data converters. Analog Interconnects. Analog Testing and Layout issues. Low Voltage and Low Power Circuits.

Unit-V:
RF-Electronics: Introduction to RF Electronics. Basic concepts in RF design, Challenges and Applications

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Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Understand the basics of analog, digital and mixed signal design
- **CO2.** Design basic cascade and cascade circuits using MOS and extract their performance parameters
- **CO3.** Analyze various CMOS based analog designs
- **CO4.** Design low power and non-linear circuits
- **CO5.** Explain the basics of RF Design and its challenges

Text Books:

1. **David Johns**, "Analog Integrated Circuit Design", John Wiley and Sons 1997
2. **M. Fakhfakh**, "Analog/RF and Mixed signal circuit systematic design", Springer, 2013

Reference Books:

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1. **Behzad Razavi**, "Design of Analog CMOS Integrated Circuits", McGraw Hill 2000
2. **Rudy van de Plassche**, "Integrated Analog to digital and digital to analog converters", Springer 2003

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester VIII

Course Title: RF IC Design | **Max Marks: 100**
Course Code: PEC-ECE-801 | **University Exam: 60**
Duration of Exam: 3 hours | **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: The aim of the subject is to help the students to understand the fundamentals of Radio Frequency Integrated Circuit Designs and make them familiar with the various circuit design techniques.

Unit-I

Introduction: Importance of RF and Wireless Technology: Complexity, design and applications. Choice of Technology. Basic concepts in RF Design: Nonlinearity and Time Variance, Inter-symbol Interference, Random Process and Noise. Definitions of Sensitivity and dynamic range, conversion gains and Distortion. Importance of RF Design, RF Behavior of Passive Components, Chip Components and Circuit Board Considerations, General Transmission Line Equation.

Unit-II

Active RF Component and Modeling: Semiconductor Basics, RF Diode, Bipolar Junction Transistor, RF FETs, High Electron Mobility Transistor, Diode Models, Transistor Models

Unit-III

Analog and Digital Modulation for RF Circuits: Comparison of various techniques for power efficiency. Coherent and Non-coherent detection. Mobile RF Communication systems and basics of Multiple Access techniques. Receiver and Transmitter Architectures and Testing Heterodyne, Homodyne, Image-reject, Direct-IF and sub-sampled receivers.

Unit-IV

Matching & Biasing Network & RF Filter: Overview of RF Filter design, Matching and Biasing Networks. Basic blocks in RF systems and their VLSI implementation, Low noise, Amplifier design in various technologies, Design of Mixers at GHz frequency range, various mixers- working and implementation. Oscillators- Basic topologies VCO and definition of phase noise, Noise power and trade off. Resonator VCO designs, Radio frequency Synthesizers- PLL, Various RF Synthesizer architectures and frequency dividers, Power Amplifier design, Design issues in integrated RF filters.

Unit-V

RF Transistor Amplifier and Oscillators: Characteristics of Amplifiers, Amplifiers Power Relation, Stability Considerations, Constant Gain, Noise Figure Circles, Constant VSWR Circles, Broad Band, High Power and Multistage Amplifiers. Basic Oscillator Model, High Frequency Oscillator Configuration, Basic Characteristics of Mixers.

Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Appreciate the importance and applications of RF and Wireless Technology.
- **CO2.** Model active RF Components used in the RF IC design.
- **CO3.** design analog and digital modulation circuits and biasing for RF Circuits.
- **CO4.** design various types of Amplifiers, oscillators and Mixers in the RF Domain.
- **CO5.** Design and simulate RF IC's using software tools and evaluate their output parameters.

Text Books:

1. **Reinhold Ludwig, Pavel Bretchko**, "RF Circuit Design", 1st Indian Reprint, 2001, Pearson Education Asia
2. **B Razavi**, "Design of Analog CMOS Integrated Circuit", McGraw Hill, 2000.

Reference Books:

1. **Y.P. Tsividis** "Mixed Analog and Digital Devices and Technology" TMH 1996
2. **Thomas H. Lee** "Design of CMOS RF Integrated Circuits" Cambridge University Press 1998.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester VIII

Course Title: Adaptive Signal Processing | **Max Marks: 100**
Course Code: PEC-ECE-802 | **University Exam: 60**
Duration of Exam: 3 hours | **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: At the end of the course, students will demonstrate the ability to:

1. Mathematically represent the 'adaptability requirement'.
2. Understand the mathematical treatment for the modeling and design of the signal processing systems
3. Appreciate the different variants of adaptive algorithms like LMS, RLS etc.

Unit-I

Introduction to Adaptive signal processing: General concept of adaptive filtering and estimation, applications and motivation, Review of probability, random variables and stationary random processes, Correlation structures, properties of correlation matrices.

Unit-II

LMS: Optimal FIR (Wiener) filter, Method of steepest descent, extension to complex valued The LMS algorithm (real, complex), convergence analysis, weight error correlation matrix, excess mean square error and mis-adjustment, Variants of the LMS algorithm: the sign LMS family, normalized LMS algorithm, block LMS and FFT based realization.

Unit-III

Frequency domain adaptive filters: Sub-band adaptive filtering. Signal space concepts - introduction to finite dimensional vector space theory, subspace, basis, dimension, linear operators, rank and nullity, inner product space, orthogonality, Gram Schmidt orthogonalization, concepts of orthogonal projection, orthogonal decomposition of vector spaces.

Unit-IV

Random Variables in filtering: Vector space of random variables, correlation as inner product, forward and backward projections, Stochastic lattice filters, recursive updating of forward and backward prediction errors, relationship with AR modeling, joint process estimator, gradient adaptive lattice.

Unit-V

RLS: Introduction to recursive least squares (RLS), vector space formulation of RLS estimation, pseudo-inverse of a matrix, time updating of inner products, development of RLS lattice filters, RLS transversal adaptive filters. Advanced topics: affine projection and subspace based adaptive filters, partial update algorithms, QR decomposition and systolic array.

Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Design and apply optimal minimum mean square estimators and compute their expected performance and verify it.
- **CO2.** Design and analyse the Wiener filters (FIR, non-causal, causal) and evaluate their performance.
- **CO3.** Identify applications in which it would be possible to use the different adaptive filtering approaches and implement them in software.
- **CO4.** Design, implement and apply LMS, RLS, and Kalman filters to given applications.
- **CO5.** Use MATLAB to implement the Wiener filter, Least Squares, LMS and RLS algorithms, and understand their convergence.

Text/Reference Books:

1. **S. Haykin**, Adaptive filter theory, Prentice Hall, 1986.
2. **C.Widrow and S.D. Stearns**, Adaptive signal processing, Prentice Hall, 1984.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester VIII

Course Title: Digital Image Processing | **Max. Marks: 100**
Course code: PEC-ECE-803 | **University Exam: 60**
Duration of Exam: 3 Hours | **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: To introduce the fundamentals of image processing and various image related operations and applications

Unit-I

Introduction and Digital Image Fundamentals

Digital Image Representation, Fundamental Steps in Image Processing, Elements of Digital image processing systems, Sampling and quantization, some basic relationships like neighbors, connectivity, Distance measure between pixels, Imaging Geometry.

Unit-II

Image Transforms

Discrete Fourier Transform, Some properties of the two-dimensional Fourier transform, Fast Fourier transform, Inverse FFT. **Image Enhancement** Spatial domain methods, Frequency domain methods, Enhancement by point processing, Spatial filtering, Low-pass filtering, High-pass filtering, Homomorphic filtering, Colour Image Processing.

Unit-III

Image Restoration

Degradation model, Diagonalization of Circulant and Block-Circulant Matrices, Algebraic Approach to Restoration, Inverse filtering, Wiener filter, Constrained Least Square Restoration, Interactive Restoration, Restoration in Spatial Domain.

Unit-IV

Image Compression

Coding, Interpixel and Psychovisual Redundancy, Image Compression models, Error free comparison, Lossy compression, Image compression standards. **Image Segmentation** Detection of Discontinuities, Edge linking and boundary detection, Thresholding, Region Oriented Segmentation, Motion based segmentation.

Unit-V

Representation and Description

Representation schemes like chain coding, Polygonal Approximation, Signatures, Boundary Segments, Skeleton of region, Boundary description, Regional descriptors, Morphology.

Course Outcomes:

After completion of the course student will be able to:

CO1. Explain the various fundamentals of digital image processing.

CO2. Perform Fourier analysis of an image and implement different image enhancement techniques.

CO3. Analyse various spatial and frequency domain image restoration approaches.

CO4. Classify various image compression techniques and implement different image segmentation techniques.

CO5. Interpret various image restoration and description techniques.

Reference Books:

1. **Rafael C. Conzalez & Richard E. Woods**, "Digital Image Processing", AWL.
2. **A.K. Jain**, "Fundamental of Digital Image Processing", PHI.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester VIII

Course Title: Advanced Communication System | **Max. Marks: 100**
Course code: PEC-ECE-804 | **University Exam: 60**
Duration of Exam: 3 Hours | **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: The principle objective of this subject is to introduce students to various advanced communication techniques and networks used in transmission and detection.

Unit-I

Spread Spectrum Communication: Direct sequence and frequency hopped spread spectrum, spreading sequences and their correlation functions, Acquisition and tracking of spread spectrum signals

Unit-II

Code Division Multiple Access (CDMA): DS-CDMA on AWGN channels, DS-CDMA on frequency selective fading channels, Performance analysis of cellular DS-CDMA, Capacity estimation, Power control effect of imperfect power control on DS-CDMA performance, Soft Hand offs, **S**preading/coding tradeoffs, multi carrier CDMA, IS95A CDMA systems, 3rd Generation CDMA systems, Multi user detection, Optimum receivers, SIC, PIC receivers and performance.

Unit-III

Networks & Services: Network Transmission System Design Services, Characterization of networks & teleservices, The Telephone Network - Past, Present & Future, and Network issues.

Unit-IV

Data Communication Networks: Basic principles of data communication - synchronous and asynchronous transmission - digital data transmission formats NRZ, RZ, AMI, ASI & Manchester coding, Error correcting codes, Hamming codes, Orthogonal codes, Switching - Circuit switching, Message switching, Packet switching, Standard communication interface multipliers and concentrators, Protocols (BOP-COP – standard networks and standards, OSI, (D) ARPANET, NICNET, SNA, SELS etc. LAN types of LAN – WAN.

Unit-V

Transmission Principles: Transmission aspects, Signals and Impairments, Digital Speech Transmission Digitization of Speech & Audio. **ISDN & ATM**: Integrated Services Digital Network – ISDN, Broadband ISDN & ATM, Broadband Access Networks, Optical Networks.

Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Acquire knowledge of spread spectrum technique used in communication.
- **CO2.** Acquire knowledge of DS-CDMA, their performance analysis, capacity estimation, hand-off techniques and different CDMA systems.
- **CO3.** Acquire knowledge of Network Transmission System design services.

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CO4. Understand different line coding techniques, error detection codes, switching techniques. Analyze different protocols used in data communication network.

CO5. Gain knowledge of transmission principles.

Text Books:

1. **Andrew J Viterbi**, *"*CDMA Principles of spread spectrum communications*"*, Addition Wesley, (1995).
2. **J S Lee and L E Miller**, *"*CDMA systems engineering handbook*"*, Artech House, (1998).

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester VIII

Course Title: Digital System Design | **Max Marks: 100**
Course Code: PEC-ECE-805 | **University Exam: 60**
Duration of Exam: 3 hours | **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: The course has been designed to impart students with the basic knowledge of modern design tools and design techniques in the field of Digital Design

Unit-I:

Digital Logic Design: Review of basic digital-logic design. Introduction to Digital Logic design. Combinational logic structured logic implementation Sequential Logic Finite-state machines.

Unit-II:

Introduction to Digital Technology: Overview of digital technology Logic Families Programmable Devices PROMs PALs and PLDs, Introduction to FPGAs and Digital Integrated circuits

Unit-III:

Hardware Description Languages and Applications: Hardware description languages (HDLs, esp. VHDL), Simple Programs using VHDL, Logic compilation Two-level and multi-level logic synthesis Technology-independent optimization Technology mapping, Sequential logic synthesis Tools for mapping to PLDs and FPGAs

Unit-IV:

Introduction to Simulation Tools: Introduction to Scilab, Basic Numerical Solving using Scilab, Applications of SciLab in 2D and 3D visualizations, Statistics and Signal Processing. Introduction to Simulink and its applications. Simple model development using Simulink. Introduction to some Modern Simulations tools like Labview, CircuitMaker, Tina (PCB Maker), Network Simulators

Unit-V:

Overview of IC Design: Introduction, Moore's Law Chip Process Flow, DPW: Motivation for Increasing Wafer Diameter Chip Design Flow, Logic, Circuit, Models, Simulation, Layout Verification and Delay Extraction, Masks and Tests

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Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Design various combinational and sequential digital logics.
- **CO2.** Explain various digital programmable devices such as PALs and PLDs as well as FPGAs.
- **CO3.** Understand Hardware description language and write basic programs in VHDL.
- **CO4.** Design digital logic in various simulation tools such as SciLab and Simulink.
- **CO5.** Get familiarized with Integrated Circuit design flow and process.

Books Recommended:

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1. **Volnei A. Pedroni**. "Circuit Design and Simulation with VHDL"
2. **Charles H. Roth, Jr** and **Lizy Kurian John**, "Digital System Design Using VHDL"

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Semester VIII

Course Title: Nanotechnology | **Max Marks: 100**
Course Code: PEC-ECE-806 | **University Exam: 60**
Duration of Exam: 3 hours | **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: The aim of the subject is to help the students to understand the fundamentals of nanotechnology along with various design techniques used in this area.

Unit-I

Introduction: Definition of Technology node, Basic CMOS Process flow, MOS Scaling theory, Issues in scaling MOS transistors: Short channel effects, Description of a typical 65 nm CMOS technology. Background to Nano-technology, scientific revolutions, types of Nanotechnology and Nanomachines, MEMS and NEMS.

Unit-II

Materials: Nano powders and Nano materials: introduction, preparation. Emerging nano materials: Nanotubes, nanorods and other nano structures, LB technique, Soft lithography etc. Microwave assisted synthesis, Self-assembly etc. Nano medicines and their applications.

Unit-III

Nano-Tubes: Graphene, SWNTs and MWNTs, Structure of carbon nanotubes, Carbon nanotube reactor**,** formation/synthesis of nano tube, applications.

Unit-IV

Nano Electronics: Nano-electronics: Introduction, CNTFET, Transport in Nano MOSFET, velocity saturation, ballistic transport, injection velocity, velocity overshoot. Quantum electronic devices.

Unit-V

Characterization techniques for nanomaterials: FTIR, XRD, AFM, SEM, TEM, EDAX etc. Applications and interpretation of results.

Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Understand the basics of Nanotechnology along with MEMS and NEMS technology.
- **CO2.** Describe the preparation and applications of various nanomaterials.
- **CO3.** Explain the synthesis and application of Carbon Nanotubes.
- **CO4.** Understand various nano-electronic approaches such as CNTFET and quantum devices.
- **CO5.** Get familiarized with various nanotechnology related fabrication and characterization techniques.

Text books:

1. **Michael Wilson, Kamali Kannangara, Geoff Smith, Michelk Simon**, "Nanotechnology: Basic science and Emerging technologies."
2. "Implications of Micro and Nano technologies", committee on Implications nanotechnologies, Air force Science and Technologies.

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Reference Books:

1. **Risal Singh, ShipraMital Gupta**, "Introduction to Nanotechnology: Understanding the Essentials", Oxford University press, 2016
2. **Charles P. Pool, Frank J. Owens**, "Introduction to Nanotechnology", Wiley, 2007

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

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Semester VIII

Course Title: Optical Networks | **Max. Marks: 100**
Course code: PEC-ECE-807 | **University Exam: 60**
Duration of Exam: 3 Hours | **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objectives: This course will impart the student with deep understanding of the functionality of optical networks and its implementation.

Unit-I

Introduction to Optical Network: Services, Circuit Switching, Packet Switching, Optical Networks, Optical Layer, Transparency and All Optical Networks, Optical Packet Switching, Transmission Basics, Network Evolution.

Unit-II

Optical Amplifiers: Stimulated Emission, Spontaneous Emission, Erbium Doped Fiber amplifiers, Raman amplifiers, Semiconductor Optical Amplifiers, Cross talk in SOAs.

Unit-III

Multiplexers and Filters to Wavelength Converters: Gratings, Diffraction Pattern, Bragg Gratings, Fiber Gratings, Fabry-Perot filters, Multilayer Dielectric Thin-Film Filters, Mach-Zehnder Interferometers, Arrayed Waveguide Grating, Acousto-Optic Tunable Filter, High channel Count Multiplexer Architectures, Optoelectronics Approach, Optical Gating, Interferometric Techniques, Wave Mixing.

Unit-IV

Transmission System Engineering: System Model, Power Penalty, Transmitter, Receiver, Optical Amplifiers, Cross talk, Dispersion, Fiber Nonlinearities, Wavelength Stabilization Design of Soliton Systems, Design of Dispersion –Managed Soliton Systems.

Unit-V

WDM Network Elements & Design: Optical Line Terminals, Optical Line Amplifiers, Optical Add/Drop Multiplexers, Optical Cross connects. Cost Trade-Offs: A Detailed Ring Network Example, LTD and RWA Problems, Dimensioning Wavelength-Routing Networks, Statistical Dimensioning Models, Maximum Load Dimensioning Models

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Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Understand the different optical switching methods and transmission basics in optical networks
- **CO2.** Explain the construction and working of various optical amplifiers
- **CO3.** Get familiar with various multiplexers and filters for wavelength conversion
- **CO4.** Understand the various concepts and aspects of optical transmission systems
- **CO5.** Design wavelength division multiplexing based optical networks by considering various trade-offs

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Text / Reference Books:

1. **G.P. Agarwal**, "Fiber optic communication systems", 2nd Edition, John Wiley & Sons, New York, 1997.
2. **Franz and Jain**, " Optical communication system ", Narosa Publications, New Delhi, 1995.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

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OPEN ELECTIVES

(Offered to the Department of ECE students by Other Departments)

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(Dean SoET)	**(Head, ECE)**	**(A.P., ECE)**	**(A.P., ECE)**

Course Title: Object Oriented Programming with C++ **Max. Marks: 100**
Course code: OEC-ECE-501/PCC-CSE-302 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course Objective: The course will introduce standard tools and techniques for software development, using object oriented approach, use of a version control system, an automated build process, an appropriate framework for automated unit and integration tests.

Unit-I

Concepts of Object-Oriented Programming: Object Oriented Programming Paradigm,
Basic concepts of OOP`s, Benefits of OOPS, Introduction to object oriented analysis and design, Design steps, Design example, Object oriented languages, Comparison of structured and object-oriented programming languages.

Unit-II

Expressions, Control Structures, Arrays, Pointers and Functions: Data Types, Operators, expressions and control structures. Arrays, Storage of arrays in memory, Initializing Arrays, Multi-Dimensional Arrays, Strings, Pointers, accessing array elements through pointers, Arrays of pointers, Pointers to pointers, Void Pointers, Functions, Arguments, Passing Pointers as Function Arguments.

Unit-III

Classes and Objects: Classes and objects, access specifies in C++, constructors, destructors, Inline Functions, Friend Functions.
Polymorphism: Function Overloading, Operator Overloading, Type Conversions in C++. Dynamic memory allocation in C++.

Unit-IV

Inheritance: Inheritance, single Inheritance, Multiple Inheritance, Multi-level inheritance, hierarchical inheritance, hybrid inheritance, Virtual base classes, Virtual functions, function overriding.

Generic programming with templates: Class templates, Function Templates.

Unit-V

Exception Handling and Files: Exceptions, Types of Exceptions, throwing and catching exceptions. Streams and Files: Opening and closing a file, File Pointers and their Manipulations, sequential Input and Output Operations, multi-file Programs, Command Line Arguments.

Course Outcomes:

At the end of this course, students will be able to:

CO1. Specify simple abstract data types and design implementations, using abstraction functions to document them.

CO2. Recognise features of object-oriented design such as encapsulation, polymorphism, inheritance, and composition of systems based on object identity.

CO3. Name and apply some common object-oriented design patterns and give examples of their use.

CO4. Design applications with an event-driven graphical user interface.

CO5. Must be able to understand and use Exception handling

Text Books:

1. **Robert Lafore,** Object Oriented Programming in Turbo C++, Galgotia Publications.

2. **Balagurusamy E,** Object Oriented Programming with C++, Tata McGraw Hill.

Reference Books:

1. **Bjarne Strustrup,** The C++ programming Language, Addison Wesley.

2. **Booch,** Object Oriented Analysis and Design with Applications, Addison Wesley.

3. **Chair H. Pappas & William H. Murray**, Complete Reference Visual C++, TMH

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Course Title: Java Programming **Max. Marks: 100**
Course Code: OEC-ECE-502/PCC-ITE-504 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course Objectives: To enhance skills of student with the ever demanding programming language Core Java.

Unit-I

Overview of Java: Introduction to Java, Features of Java, Object Oriented Concepts, Lexical Issues, Data Types, Variables, Arrays, Operators, Java Virtual Machine, Byte code, Control Statements: Selection, Iteration and Jump Statements, Java Bean Standards.

Unit-II

Classes and Inheritance: Classes, Objects, Constructors, Overloading Method, Access Control, Static and Final Keywords, Nested and Inner Classes, Abstract Class, Object Class, Inheritance, Overriding Methods, Using Super, Dynamic method Dispatch. Packages, Access Protection, Importing Packages, Interfaces.

Unit-III

Exception Handling and Multithreading: Exception Handling, Multiple Catch Clauses, Nested Try and Throw. Multithreading: Thread, Creating a Thread, Creating Multiple Threads, Synchronization, Inter Thread Communication, Deadlock, Suspending, Resuming and Stopping Threads, Multithreading.

Unit-IV

I/O, Applets and String Handing Files: Files, Stream Classes, Serialization, Reading Console Input, Writing Console Output, Print Writer Class, Reading and Writing Files, Transient And Volatile Modifiers, InstanceOf, Strictfp, Native Methods. Applets: Introduction: Applet Fundamentals, Applet Architecture. Strings: String Constructors, String Operations, String Buffer, String Builder, Sting Tokenizer.

Unit-V

Collections Framework: Collections Overview, Collection Interfaces, Collection Classes, Accessing a Collection via Iterator, Map Classes and Map Interfaces, Comparators, Arrays, Legacy Classes and Interfaces, Wrapper Classes.

Course Outcomes:

At the end of this course, the students will able to do the following:

- **CO1.** Identify classes, objects, members of a class and relationships among them needed for a specific problem.
- **CO2.** Write Java application programs using OOP principles and proper program structuring.
- **CO3.** Demonstrate the concepts of polymorphism and inheritance.
- **CO4.** Write Java programs to implement error handling techniques using exception handling.

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Text Books:

1. **P. Naughton & H. Schildt,** Java2 (The Complete Reference), 3rd Edn, TMH 1999.
2. **K. Arnold & J. Gosling,** The Java Programming Language, 2nd Edn, Addison Wesley, 1996.

Reference Books:

1. **Cay S. Horstmann, Gary Cornell,** Core Java 2 Volume I Fundamentals, 5th Edn

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Course Title: Power Engineering **Max. Marks: 100**
Course code: OEC-ECE-503/PEC-EE-501 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: The objective of this course is to allow the students to grasp various methods of power generation, tariff calculations.

Unit-I

Economic Aspects and Power Factor Improvement: Economics of generation, factors affecting the cost of generation, reduction of costs by interconnection of stations, curves useful in system operation, choice of size and number of generating units. Power factor disadvantages of low power factor, methods of improving power factor, location of power factor improvement apparatus, economics of power factor improvement.

Unit-II

Power Tariff: Cost of generating station, fixed capital, running capital annual cost running charges, fixed charges, methods of depreciation, factors influencing the rate of tariff, designing tariff, different types of tariff, flat rate tariff, block rate tariff, two-part tariff maximum demand tariff, power factor tariff.

Unit-III

Thermal and Nuclear Power Plants: General layout, choice of site, super heater, air pre heater, economizer, coal handling plant, cooling towers, electrostatic precipitator, advantage and disadvantages. Introduction to nuclear energy, choice of site of the plant, advantages and disadvantages, main components of the plant and type of reactors. Introduction to Diesel power stations and gas turbine plants.

Unit-IV

Hydroelectric power plants: Hydrology, load flow duration curve, hydro graph, mass curve, choice of site of the plant, advantages and disadvantages of the plant, layout of the plant, classification of the hydroelectric plant, introduction to mini & micro hydro.

Unit-V

Substations and Grounding: Neutral grounding, solid grounding resistance grounding, reactance grounding, are suppression coil grounding earthing transformers, choice of methods of neutral grounding equipment, grounding for safety. Introduction to substations and substation equipment.

Course outcomes:

After the completion of this course student will be able to:

- **CO1.** Understand economic aspects of power generation, transmission & transmission along with the advantages of power factor improvement.
- **CO2.** Analyze different costs associated with power systems and ways to reduce it analyze various tariffs schemes.
- **CO3.** Understand the layout and design considerations of thermal and nuclear plants.

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CO4. Understand the layout and design considerations of hydroelectric plants.
CO5. Understand various types of substation groundings.

Text Books/Reference:

1. **Deshpande M.V**., Elements of power station design, TMH.
2. **H. Pratab**, The art and Science of Utilization of Electric energy, PHI.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Course Title: Environmental Engineering **Max. Marks: 100**
Course code: OEC-ECE-504/PCC-CE-502 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: This course aims to make students understand the various aspects of environment and to understand the impact of humans on environment.

Unit-I

Water quality and treatment: Water demand Residential, Commercial, Institutional, industrial and agricultural, Sources of Water, water quality parameters, Water quality standards, Water Treatment: aeration, sedimentation, coagulation flocculation, filtration, disinfection, advanced treatments like adsorption, ion exchange, membrane processes, Water Supply systems, Components of water supply system, Distribution system, Plumbing and various valves used in water supply systems.

Unit-II

Sewage Characteristics and treatment: Quantity of Sewage, Sewage flow variations, Characteristics and composition of sewage, Pollution due to improper disposal of sewage, Sewerage system and its components, Design of Sewerage system primary, secondary and tertiary treatment of sewage- description of various unit operation and processes, aerobic and anaerobic treatment systems, suspended and attached growth systems, quality requirements (Regulatory standards) for various usages.

Unit-III

Air Pollution and control: Definition of Air pollution, major pollutants- sources and impacts, Air Quality standards, Air pollution meteorology, Plum rise and plum behaviour, Introduction to air quality models and their applications, Monitoring of air pollutants, Control measures.

Unit-IV

Solid waste management: Solid waste, Municipal, industrial and hazardous solid waste, Characteristics and Composition of solid waste, Impact of improper disposal of solid waste, solid waste management, Elements of solid waste management system- generation, collection, transfer and transport, segregation, recycling, reuse, disposal, composting, vermicomposting and landfills.

Unit-V

Noise pollution and control: Noise pollution, sources (Indoor and outdoor) and impacts, Permissible limits, measurement of noise, Addition of Noise, Noise propagation, control of noise pollution- at source, during transmission and at receptor end.

Course Outcomes:

CO1. Understand the impact of humans on environment and environment on humans

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CO2. Be able to identify and value the effect of the pollutants on the environment: atmosphere, water and soil.

CO3. Be able to plan strategies to control, reduce and monitor pollution.

CO4. Be able to select the most appropriate technique for the treatment of water, waste water solid waste and contaminated air.

CO5. Be conversant with basic environmental legislation.

Text Books:

1. Peavy, H.s, Rowe, D.R, Tchobanoglous, G. Environmental Engineering, Mc-Graw-Hill International Editions, New York
2. Metcalf and Eddy Inc.: Wastewater Engineering

Reference Books:

1. Modi, P. N;Water supply Engineering. Volume-I
2. Introduction to Environmental Engineering and Science by Gilbert Masters, Prentice Hall, New Jersey.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Course Title: Natural Language Processing **Max. Marks: 100**
Course code: OEC-ECE-505/PEC-CSE-705 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course Objectives:

The main objectives of this course are:

1. To introduce the fundamental concepts and techniques of NLP
2. To examine NLP models and algorithms using both traditional symbolic and more recent statistical approaches.
3. To study the phonology, morphology, syntax and semantic of language using both linguistic and algorithmic perspective.
4. To study computational properties of natural languages and of the algorithms used to process them, as well as the match between grammar formalisms and the linguistic data that needs to be covered.

Unit-I

Introduction to Natural Language Processing, Natural Languages and Formal Languages, Regular Expressions and Automata, Words and their Analysis. Tokenization, Stemming, Part of Speech (POS) tagging, Morphological Analysis.

Unit-II

N-Grams and Part of Speech Tagging: N-grams Models of Syntax, Counting Words in Corpora, Simple (Unsmoothed) N-grams, Smoothing, Back-off, Part of speech Tagging, Rule-Based Part of Speech Tagging, Markov Models - Hidden Markov Models – Transformation based Models - Maximum Entropy Models and Conditional Random Fields

Unit-III

Syntax Parsing: Context-Free Grammars for English Syntax, Context Free Rules and Trees, Sentence, Level Constructions, Agreement, Sub Categorization, Parsing with Context-Free Grammars, Top-down Parsing, Bottom-Up Parsing, Feature Structures, Probabilistic Context-Free Grammars.

Unit-IV

Semantic Analysis: Representing Meaning, Meaning Structure of Language, First Order Predicate Calculus, Representing Linguistically Relevant Concepts, Syntax-Driven Semantic Analysis, Word-Sense disambiguation, Supervised – Dictionary based and Unsupervised Approaches – Machine Learning.

Unit-V

Applications of Natural Language Processing: Named entity recognition and relation extraction- IE using sequence labeling-Machine Translation (MT) - Basic issues in MT-Statistical translation-word alignment- phrase-based translation.

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Course outcomes:

After completing this course, the student should be able to:

- **CO1.** Understand the basic concepts of language for processing.
- **CO2.** Implement different data models for language processing.
- **CO3.** Understand parsing techniques related to English language.
- **CO4.** Process and analyse the language semantically.
- **CO5.** Understand the application of NLP.

Text Books:

1. **Daniel Jurafsky and James H. Martin,** Speech and Language Processing (2nd Edition), PHI
2. **Christopher D. Manning and Hinrich Schuetze,** Foundations of Statistical Natural Language Processing, MIT Press, 1999

Reference Books:

1. **Pierre M. Nugues**, An Introduction to Language Processing with Perl and Prolog: An Outline of Theories, Implementation, and Application with Special Consideration of English, French, and German (Cognitive Technologies) Softcover reprint, 2010

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Course Title: Python Programming **Max. Marks: 100**
Course code: OEC-ECE-601/PCC-CSE-402 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course Objective: Python is a modern language useful for writing compact code specifically for Programming in Server Side web Development, AI, data analytics and Game Programming. This course covers the basics and advanced python programming to harness its potential for modern computing requirements.

Unit-I

Introduction to Python: Introduction to Python, History of python, Status of python, Installation and Working with Python, Understanding Python variables, Python basic Operators, Understanding python blocks.

Python Data Types: Declaring and using Numeric data types: int, float, complex, Using string data type and string operations, Defining list and list slicing, Use of Tuple data type, Working with sequence.

Python Program Flow Control: Conditional blocks using if, else and else if, Simple for loops in python For loop using ranges, string, list and dictionaries, Use of while loops in python, Loop manipulation using pass, continue, break and else Programming,using Python conditional and loops block.

Unit-II

Python Functions, Modules and Packages: Organizing python codes using functions, organizing python projects into modules, Importing own module as well as external modules, Understanding Packages, Powerful Lamda function, Programming using functions, modules and external packages

Python String, List and Dictionary Manipulations: Building blocks of python programs, Understanding string in build methods, List manipulation using in build methods, Dictionary manipulation, Programming using string, list and dictionary in build function

Unit-III

Python Object Oriented Programming: Concept of class, object and instances, Constructor, class attributes and destructors, Real time use of class in live projects, Inheritance, overlapping and overloading operators, Adding and retrieving dynamic attributes of classes, Programming using Oops support.

Multithreading: Understanding threads, Forking threads, Synchronizing the threads, Programming using multithreading.

Interfacing with the OS: Working with System (sys Module), Working with Operating System (os module).

Unit-IV

Python File Operation: Reading config files in python, Writing log files in python, Understanding read functions, read(), readline() and readlines(), Understanding write functions, write() and writelines(), Manipulating file pointer using seek, Programming using file operations.

Python Regular Expression: Powerful pattern matching and searching, Power of pattern searching using regex in python, Real time parsing of networking or system data using regex, Password, email, url validation using regular expression, Pattern finding programs using regular expression

Unit-V

Python Exception Handling: Avoiding code break using exception handling, Safe guarding file operation using exception handling, Handling and helping developer with error code, Programming using Exception handling, Built-in exception.

Python Database Interaction: SQL Database connection using python, Creating and searching tables, Reading and storing config information on database, Programming using database connections

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Course Outcomes:

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

- **CO1.** To Understand data types (like character strings, integers, and real numbers)and the Operations that can be applied to each data type
- **CO2.** To write programs that get input, perform calculations, and provide output (using Conditional logic, loops, Functions).
- **CO3.** To understand the OOPs concepts with respect to fourth generation language
- **CO4.** To write well designed and well documented programs that is easily maintainable.
- **CO5.** To test and debug programs (find out what is wrong and fix it).

Text Books:

1. **R. Nageswara Rao**, "Core Python Programming", Dreamtech.
2. **Wesley J. Chun**., "Core Python Programming", -2nd Edition Prentice Hall.

Reference Books:

1. **Luke Sneeringer**, "Professional Python", Wrox.
2. **John V Gutttag**., "Introduction to Computation and Programming using Python", Prentice Hall of India.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Course Title: Power Systems-I **Max. Marks: 100**

Course code: OEC-ECE-602/PCC-EE-403 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course Objective: The objective of this course is to develop an understanding of the diverse concepts of power system generation, transmission and distribution. It also involves the study of various power transfer methods and phenomenon associated with power system.

Unit-I

Basic Concepts: Evolution of Power Systems and Present-Day Scenario. Structure of a power system: Bulk Power Grids and Micro-grids. Generation: Conventional and Renewable Energy Sources. Distributed Energy Resources. Energy Storage. Transmission and Distribution Systems: Line diagrams, transmission and distribution voltage levels and topologies (meshed and radial systems). Synchronous Grids and Asynchronous (DC) interconnections. Review of Three-phase systems. Analysis of simple three-phase circuits. Power Transfer in AC circuits and Reactive Power.

Unit-II

Power System Components: Overhead Transmission Lines and Cables: Electrical and Magnetic Fields around conductors, Corona. Parameters of lines and cables. Capacitance and Inductance calculations for simple configurations. Travelling-wave Equations. Sinusoidal Steady state representation of Lines: Short, medium and long lines. Power Transfer, Voltage profile and Reactive Power. Characteristics of transmission lines. Surge Impedance Loading. Series and Shunt Compensation of transmission lines. Per-unit System and per-unit calculations.

Unit-III

Over-voltages and Insulation Requirements: Generation of Over-voltages: Lightning and Switching Surges. Protection against Over-voltages, Insulation Coordination. Propagation of Surges. Voltages produced by traveling surges. Bewley Diagrams.

Unit-IV

Fault Analysis and Protection Systems: Method of Symmetrical Components (positive, negative and zero sequences). Balanced and Unbalanced Faults. Representation of generators, lines and transformers in sequence networks. Computation of Fault Currents. Neutral Grounding, their types, and neutral grounding transformer.

Unit-V

Introduction to DC Transmission: DC Transmission Systems: Line-Commutated Converters (LCC) and Voltage Source Converters (VSC). LCC and VSC based dc link, Real Power Flow control in a dc link. Comparison of ac and dc transmission.

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Course Outcomes:

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

- **CO1.** Understand the concepts of power systems.
- **CO2.** Understand the various power system components.
- **CO3.** Understand the generation of over-voltages and insulation coordination.
- **CO4.** Evaluate fault currents for different types of faults.
- **CO5.** Understand various DC transmission techniques.

Text/References:

1. **J. Grainger and W. D. Stevenson**, "Power System Analysis", McGraw Hill Education, 1994.
2. **O. I. Elgerd**, "Electric Energy Systems Theory", McGraw Hill Education, 1995.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Course Title: Discrete Mathematics **Max. Marks: 100**
Course code: OEC-ECE-603/PCC-ITE-404 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: Throughout the course, students will be expected to demonstrate their understanding of Discrete Mathematics by using mathematically correct terminology and notation as well construct correct direct and indirect proofs.

Unit–I

Introduction: Sets, Relation and Function: Operations and Laws of Sets, Cartesian Products, Binary Relation, Partial Ordering Relation, Equivalence Relation, Image of a Set, Sum and Product of Functions, Bijective functions, Inverse and Composite Function, Size of a Set, Finite and infinite Sets, Countable and uncountable Sets, Cantor's diagonal argument and The Power Set theorem, Schroeder-Bernstein theorem.

Unit–II

Principles of Mathematical Induction: The Well-Ordering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic. Basic counting techniques- inclusion and exclusion, pigeon-hole principle, permutation and combination.

Unit–III

Propositional Logic: Syntax, Semantics, Validity and Satisfiability, Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implication, Rules of Inference, The use of Quantifiers. Proof Techniques: Some Terminology, Proof Methods and Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency.

Unit–IV

Algebraic Structures and Morphism: Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields. Boolean Algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form.

Unit–V

Graphs and Trees: Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Eulerian and Hamiltonian Walks, Graph Colouring, Colouring maps and Planar Graphs, Colouring Vertices, Colouring Edges, List Colouring, Perfect Graph, definition properties and Example, rooted trees, trees and sorting, weighted trees and prefix codes, Bi- connected component and Articulation Points, Shortest distances.

Course Outcomes

CO1. For a given logic sentence express it in terms of predicates, quantifiers, and logical connectives.

CO2. For a given a problem, derive the solution using deductive logic and prove the solution based on logical inference.

CO3. For a given a mathematical problem, classify its algebraic structure.

CO4. Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra.

CO5. Develop the given problem as graph networks and solve with techniques of graph theory.

Text Books:

1. **Kenneth H. Rosen**, Discrete Mathematics and its Applications, Tata McGraw – Hill Susanna.
2. **S. Epp,** Discrete Mathematics with Applications,4th edition, Wadsworth Publishing Co. Inc.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Reference Books:

1. **J.P. Tremblay, R. Manohar**, Discrete Mathematical Structure and Its Application to Computer Science", TMG Edition,
2. **Norman L. Biggs**, Discrete Mathematics, 2nd Edition, Oxford University Press.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Course Title: Building Materials and Construction **Max. Marks: 100**
Course code: OEC-ECE-604/PCC-CE-405 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course Objective: The objective of this course is to make the students aware about the knowledge of the materials used in buildings and constructional forms like partitions, DPC, floors and roofs etc.

Unit-I

Stones and Bricks: Stones: Classification, requirements of good materials, Querying of stones Testing of stones. Bricks: Classification of bricks, Properties of Conventional bricks, Autoclave aerated blocks (AAC), Fly ash bricks, manufacturing and testing procedures of Conventional bricks, Autoclave aerated blocks (AAC), Fly ash bricks.

Unit-II

Cement and Admixtures: Cements: Grades, Composition, manufacturing of Portland cement, field-testing of cement, special types of cements (Introduction only), storage of cement. Admixtures: types (Fly ash, Micro silica, Ground granulated blast-furnace slag (GGBS), Chemical Admixtures etc.), Properties and their suitability, advantages, disadvantages and limitations.

Unit-III

Steel, Timber and Polymers: Steel: Types of steel (Mild Steel, Hard Steel, Stainless Steel, Heat resistance steel, Manganese steel, Magnet Steel), Steel marketable forms of steel. Timber: Classification, Structure, Seasoning and defects. Paints and Varnishes, Constituents of paints, types of paints (oil paint, enamel paint, emulsion paint cement paint), constituents and characteristics of varnishes, Polymers: Classification, properties and applications in civil engineering of Polymeric materials viz. PVC, Polyester, HDPE, and LDPE.

Unit-IV

General Construction: Brick and Stone masonry: Various terms used, types and bonds in brick work. Partition and cavity walls: Types of non-bearing partition, brick partitions, clay block partitions, Gypsum board Partition, timber partitions and glass partitions, construction of masonry cavity walls.

Unit-V

DPC, Floors and Roofs: Dampness: Sources, effects and prevention of dampness, Materials used in damp proofing course. Floors: Components of floor, brick floors, cement concrete floors, terrazzo flooring, mosaic floorings and tiled flooring, Tiles and Terra-cotta: Manufacturing of tiles and terra-cotta (introduction only), types of terra cotta.

Doors and Windows: Locations, sizes general types of door movement, various types of doors and windows (definition only). Roofs (Single Roof: Lean-to-roof, Couple roof, Couple closed roof, Collar-beam roof) & terms used in sloping roof: king post truss, queen post truss.

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Course Outcomes:

On successful completion of this unit students will be able to:

- **CO1.** Identify various construction materials like stone and bricks
- **CO2.** Know and differentiate elemental properties of construction materials
- **CO3.** Know about the different types of materials used in construction such as steel timber polymers
- **CO4.** Demonstrate an appropriate application of construction material.
- **CO5.** Know about the different components in construction building.

Text Books:

1. **Surinder Singh**, Engineering Materials
2. **Sharma and koul**, Building Construction

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Course Title: Wireless Networks **Max. Marks: 100**
Course code: OEC-ECE-605/PEC-CSE-611 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course Objective: The aim of the subject is to make the students aware of the latest technologies in the field of Wireless Networks.

Unit-I

Cellular wireless Networks: Introduction: Applications, Replacement of wired Networks, principles of cellular networks, first generation analog, second generation TDMA, second generation CDMA and third generation systems.

Unit-II

Satellite communications: History, Applications, satellite parameters & configurations-GEO, LEO, MEO, capacity allocation (frequency division, time division), routing, localization, Handover.

Unit-III

Wireless LANS: Infrared LANS, spread spectrum LANS, narrowband microwave LANS, IEEE 802.11 wireless LAN standard, Bluetooth and IEEE 802.15, wireless local loop.

Unit-IV

Mobile Network Layer: Mobile IP, Entities and terminology, IP packet delivery, Agent advertisement and discovery, Registration, tunnelling and encapsulation, optimizations.

Unit-V

Ad Hoc wireless Networks: Ad Hoc networks, Difference between cellular and Ad Hoc wireless networks, applications, technical & research challenges, Important issues in Ad Hoc wireless networks, the need for MAC, MAC layer protocols for Ad Hoc Wireless Networks, introduction to quality of service (QoS) in Ad Hoc wireless networks.

Course Outcomes:

On successful completion of this unit students will be able to:

- **CO1.** Identify the basic concept of wireless networks, channel coding, and cellular concepts;
- **CO2.** Compare and contrast LEO, MEO and GEO. Routing and handover in satellite communication
- **CO3.** Understand various wireless LAN technologies
- **CO4.** Understand the terminologies in mobile network layers and the process of packet discovery and registration in network layer.
- **CO5.** Compare and contrast between cellular and Ad Hoc wireless networks, areas of its applications and challenges

Text Books:

1. **Stallings William**, Wireless Communications & Networking, PHI.
2. **Pahlavan Kaven**, Principles of Wireless Networks, Pearson Education India.

References:

1. **Nicopolitidis, H. S. Obaidat,** Wireless Networks, John Wiley.
2. **Stoimenovic Ivan**, Handbook of Wireless Networks & Mobile Computing, CRS Press.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

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Course Title: Computer Graphics and Multimedia **Max. Marks: 100**
Course code: OEC-ECE-606/PCC-ITE-601 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

OBJECTIVE: To understand the basics of various inputs and output computer graphics hardware devices. Exploration of fundamental concepts in 2D and 3D computer graphics. To know 2D raster graphics techniques, 3D modelling, geometric transformations, 3D viewing.

Unit-I

Basic of Computer Graphics: Introduction to computer graphics, Applications of computer graphics, Display devices, Raster scan systems, Graphics input devices, Graphics software and standards.

Unit-II

Graphics Primitives: Points, lines, circles as primitives, scan conversion algorithms for primitives, Fill area primitives including scan-line polygon filling, inside-outside test, boundary and flood-fill, character generation, line attributes.

Unit-III

2D Transformation and Viewing: Transformations, matrix representation, homogeneous coordinates, composite transformations, reflection and shearing, viewing pipeline and coordinates system, window-to-viewport transformation, clipping including point clipping, line clipping, polygon clipping.

Unit-IV

3D Concepts and Object Representation: 3D display methods, polygon surfaces, tables, equations, curved lies and surfaces, spline representation, cubic spline interpolation methods, Bazier curves and surfaces, B-spline curves. 3D transformation and viewing: 3D scaling, rotation and translation, composite transformation, viewing pipeline and coordinates, parallel and perspective transformation.

Unit-V

Introduction to Multimedia: Introduction to multimedia, Multimedia computer system, Multimedia components, Multimedia terminology: communication modes, media types, Multimedia networks, Applications of multimedia, distributed multimedia systems, Synchronization

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Course Outcomes

- **CO1.** Explain various applications of computer Graphics.
- **CO2.** To be able to understand a graphics processing system.
- **CO3.** To able to under and implement computer graphics algorithms.
- **CO4.** To be able to implement 3D graphics primitives.

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Text Books:

1. Steven Harrington, Computer Graphics, A programming approach second Edn.
2. Computer Graphics; Principles and practice; Second Edition in C; J. D. Foley, A.Van Dam, S. K. Feiner and J. F. Hughes; Addison Wesley, 1997.

Reference Books:

1. Rogers, Procedurals elements of Computer Graphics, McGraw hill.
2. Newman and Sproul, Principle of interactive Computer Graphics, McGraw Hill.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

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Course Title: Artificial Intelligence **Max. Marks: 100**
Course code: OEC-ECE-701/PCC-CSE-702 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course Objective: The objective of the course is to introduce the basic concept of Artificial Intelligence. The course is appropriate both, for students of computer science & engineering who wish to acquire general understanding of Artificial Intelligence as well as for students preparing for more advanced courses and research in Artificial Intelligence

Unit- I

Introduction to Artificial Intelligence; Foundation and history of Artificial Intelligence, intelligent agents, structure of intelligence agents; Knowledge based agent and environments.

Unit- II

Knowledge representation hypothesis, Knowledge levels, knowledge classification, Knowledge representation schemas; Logic Based, Procedural, Network and Structural representations.

Unit- III

Introduction to LISP, Syntax and Numeric Functions, Basic list manipulation functions in LISP, Functions, Predicate and Conditionals, Input, Output and Local Variables, Iteration and Recursion.

Unit- IV

Searching in problem solving, problem solving agents; Uninformed search strategies, Breadth first search, Iterative deepening search, Bidirectional search, Informed search strategies; Action and path costs, heuristic functions, Greedy best first Search, A* search, IDA* search.

Unit- V

Introduction to planning & Machine Learning: Planning components, planning in situational calculus, practical planners, non-linear planning, Baye's Rule, Supervised and Unsupervised learning, Introduction to artificial neural network, Perceptron and perceptron learning rules.

Course Outcomes:

At the end of this course, the student will be able to do following:

- **CO1.** To learn different forms of logic
- **CO2.** Deal with inconsistencies and uncertainties of logic
- **CO3.** Be familiar with informed and uniformed searching techniques
- **CO4.** To study different matching techniques
- **CO5.** To learn pattern recognition and expert systems

Text Books:

1. **Rich Night**, Introduction to Artificial Intelligence, 2nd Edition, 2005, TMH.
2. **Stuart Russel & Peter Norvig**, Artificial Intelligence, A modern Approach, 2nd Edition 2006, PHI.

Reference Books:

1. **Nilson and Springer**, Principles of Artificial Intelligence.
2. **Dan W. Patterson**, Introduction to Artificial Intelligence and Expert Systems, Indian Reprint 2005, PHI.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Course Title: Power Systems-II **Max. Marks: 100**
Course code: OEC-ECE-702/PCC-EE-501 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course Objective: This subject familiarizes a student with the system behavior and performance during normal and abnormal conditions.

Unit-I

Power Flow Analysis: Review of the structure of a Power System and its components. Analysis of Power Flows: Formation of Bus Admittance Matrix. Real and reactive power balance equations at a node. Load and Generator Specifications. Application of numerical methods for solution of non-linear algebraic equations – Gauss Seidel and Newton-Raphson methods for the solution of the power flow equations. Computational Issues in Large-scale Power Systems.

Unit-II

Stability Constraints in synchronous grids: Swing Equations of a synchronous machine connected to an infinite bus. Power angle curve. Description of the phenomena of loss of synchronism in a single-machine infinite bus system following a disturbance like a three--phase fault. Analysis using numerical integration of swing equations (using methods like Forward Euler, Runge-Kutta 4th order methods), as well as the Equal Area Criterion. Impact of stability constraints on Power System Operation. Effect of generation rescheduling and series compensation of transmission lines on stability.

Unit-III

Control of Frequency and Voltage: Turbines and Speed-Governors, Frequency dependence of loads, Droop Control and Power Sharing. Automatic Generation Control. Generation and absorption of reactive power by various components of a Power System. Excitation System Control in synchronous generators, Automatic Voltage Regulators. Shunt Compensators, Static VAR compensators and STATCOMs. Tap Changing Transformers. Power flow control using embedded dc links, phase shifters.

Unit-IV

Monitoring and Control: Overview of Energy Control Centre Functions: SCADA systems. Phasor Measurement Units and Wide-Area Measurement Systems. State-estimation. System Security Assessment. Normal, Alert, Emergency, Extremis states of a Power System. Contingency Analysis. Preventive Control and Emergency Control.

Unit-V

Power System Economics and Management: Basic Pricing Principles: Generator Cost Curves, Utility Functions, Power Exchanges, Spot Pricing. Electricity Market Models (Vertically Integrated, Purchasing Agency, Whole-sale competition, Retail Competition), Demand Side-management, Transmission and Distributions charges, Ancillary Services. Regulatory framework.

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Course Outcomes:

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

- **CO1.** Use numerical methods to analyze a power system in steady state.
- **CO2.** Understand stability constraints in a synchronous grid.
- **CO3.** Understand methods to control the voltage, frequency and power flow.
- **CO4.** Understand the monitoring and control of a power system.
- **CO5.** Understand the basics of power system economics

Text/References:

1. **J. Grainger and W. D. Stevenson**, "Power System Analysis", McGraw Hill Education, 1994.
2. **O. I. Elgerd**, "Electric Energy Systems Theory", McGraw Hill Education, 1995.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Course Title: Internet and Web Technologies | **Max. Marks: 100**
Course code: OEC-ECE-703/PCC-ITE-502 | **University Exam: 60**
Duration of Exam: 3 Hours | **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: The objective of this subject is to understand about Website Development and internet.

Unit-I

Internet & Web: History and growth of Internet and Web, Basics of Clients, Servers, and Communications, Introduction to WWW, http, Web Architecture, Web Browsers and Search Engines, Static, Dynamic and active websites and their applications, Symantec Web Technology, web hosting.

Unit-II

HTML: Introduction to HTML, Overview, Tags, Elements, Attributes, Heading, Paragraphs, Styles, Colours, Links, Images, Tables, frames and forms, Overview of DHTML, Overview of Extensible Mark-up Language(XML).

Unit-III

Cascading Style Sheets (CSS): Text or font properties, background, border, margin, padding properties, Align, Navigation Bar, Drop downs, Image Gallery, page layout properties and user interface properties, JavaScript: Overview, forms processing, objects, functions, arrays, popup and HTML DOM, AJAX.

Unit-IV

Security: Principles of web security, security threats to websites, attacks on websites and their mitigation, Cryptographic tools, Digital certificates, Digital Signatures, Secure Socket Layer, Network Security: Firewalls, IP Security, Virtual Private Networks.

Unit-V

Introduction to Server Side Programming: PHP, Overview, variable, Control statements, Arrays, functions and forms, advanced PHP. MySQL Database Connectivity.

Course Outcomes:

The Students should be able to

- **CO1.** Develop simple static websites.
- **CO2.** Static websites with CSS.
- **CO3.** Dynamic websites using java Scripting.
- **CO4.** Dynamic website with server side scripting using PHP.
- **CO5.** Address various web security related issues

Text Books:

1. Thomas Powell, Complete Reference HTML/XHTML.
2. S. Achyut Godbole and Atul Kahate, Web Technologies, Tata McGraw Hill.

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REFERENCE BOOKS:

1. H. M. Deitel, P. J. Deitel and T. R. Nieto, Internet and World Wide Web : How to Program, Pearson Education, 2000.
2. Xavier C., Web Technology & Design, New Age International Publishers.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Course Title: Flood Control and Rural Engineering **Max. Marks: 100**
Course code: OEC-ECE-704/PEC-CE-749 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: This course is meant to provide an understanding to the students about diversion works, cross drainage works and measures for flood control.

Unit-I
Flood Control: Introduction to flood and Flood problems, types of flood control measures, drainage of irrigation lands both saline and alkaline lands.

Unit-II
Diversion Headwork and Cross Drainage Works: Selection of sites and layout, parts of diversion head works, types of weirs/Barrages, design of weirs' on permeable foundations, silt excluders and silt ejectors. Necessity of cross drainage works, their types and selection design of various types of cross drainage works such as aqueduct, siphon and super passage.

Unit-III
Introduction to River Engineering: River Morphology -Bars; Bends and Meanders, Thalweg, Braiding; Bifurcations, Sediment Transport Mechanics -Bed forms, Bed Load transport, Transport of suspended sediment, Local Scour at Bridge Piers and other Hydraulic Structures.

Unit-IV
Measurements in River: Critical Shear stress, Stage measurements, Channel geometry, Discharge, Sediment samplers and suspended and bed load measurement.

Unit-V
River Protection and Training Works: Revetments, Dikes, Gabions, Spurs, Bank Protective measures and Bed control structures, Diversion and Cofferdams; River regulations systems; Dredging and Disposal, River restoration.

Course Outcomes:

The Students should be able to

- **CO1.** Understand the different flood control measures
- **CO2.** Know the different types diversion headwork and cross-Drainage work.
- **CO3.** Know the terminology of river engineering and flood control measures.
- **CO4.** Measure the discharge of a river
- **CO5.** Understand the different River Protection and Training Works

Text Books:

1. **Bharat Singh**, Fundamentals of irrigation engineering.
2. **Varshney, Gupta & Gupta**, Theory and design of irrigation structures

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

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Course Title: Internet of Things **Max. Marks: 100**
Course code: OEC-ECE-705/PEC-CSE-702 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course objectives:
The main objectives of this course are:

- To assess the vision and introduction of IoT.
- To Implement Data and Knowledge Management and use of Devices in IoT Technology.
- To Understand State of the Art - IoT Architecture.
- To classify Real World IoT Design Constraints, Industrial Automation in IoT.

Unit-I
Introduction to Internet of Things (IoT): Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.

Unit-II
Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies.

Unit-III
IP as the IoT Network Layer: The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods.

Unit-IV
Data and Analytics for IoT: An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment.

Unit-V
IoT Physical Devices and Endpoints: Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints - RaspberryPi: Introduction to RaspberryPi, Remote access to RaspberryPi, Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture. Smart City Security Architecture, Smart City Use-Case Examples.

Course Outcomes:
After completion of this course, the students will able to do following:

CO1. Interpret the vision of IoT from a global context.

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CO2. Compare and contrast the use of Devices, Gateways and Data Management in IoT.
CO3. Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
CO4. To study and analyse data and to understand the security issues in IoT
CO5. To study IoT physical devices and end points and to understand the communications between components

Textbook:

1. **Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle**, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence**",** 1st Edition, Academic Press, 2014.

Reference Books:

1. **Vijay Madisetti and ArshdeepBahga,** "Internet of Things (A Hands-on-Approach)", 1stEdition, VPT, 2014.
2. **Francis daCosta,** "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Course Title: Neural Networks **Max. Marks: 100**
Course code: OEC-ECE-801/PEC-CSE-806 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course Objective: The principal objective of this subject is to introduce students to neural networks and fuzzy theory from an engineering perspective

Unit-I

Introduction: Historical Perspective, Basic Neurobiology, Why Artificial Networks, Network Architectures, the Tasks Neural Networks Can Perform, Characteristics of Neural Networks

Unit-II

Basic Neuron Models: Mcculloch-Pitts Model, Radial Basis Function Model, etc, Learning Algorithms. Matlab Simulation Exercises.

Unit-III

Basic Neural Network Models: The Hebbian Hypothesis. Single-Layered Neural Networks, Multilayer Perceptron, Nearest Neighbor Based Multilayer Perceptron, Training of Artificial Neural Networks

Unit-IV

Basic Learning Algorithms: Supervised Learning, Constructive Algorithms, Single-Hidden Layer Algorithms. The Upstart Algorithm. The Cascade Correlation Algorithm. Neural Networks and Temporal Sequences. Sequence Recognition. Sequence Generation. Unsupervised Learning. Competitive Learning. The Back-Propagation Algorithm, Self-Organization Learning, Winner-Take-All Competitive Learning, Evolutionary Learning.

Unit-V

Applications: Character Recognition, Signal Restoration, Pattern Recognition. Matlab Simulation Exercises.

Course Outcomes:

At the end of the course, students should be able to understand and appreciate:

- **CO1.** The role of neural networks in engineering, artificial intelligence, and other areas.
- **CO2.** Understanding of basic neural network models like Mcculloch-Pitts Model, Radial Basis Function Model, resistive networks for vision models, complex dynamical learning models.
- **CO3.** Understanding of the concepts and techniques of neural networks through the study of the most important neural network models.
- **CO4.** Have knowledge of sufficient theoretical background to be able to reason about the behavior of neural networks.
- **CO5.** Able to evaluate whether neural networks are appropriate to a particular application.

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CO6. Able to apply neural networks to particular applications, and to know what steps to take to improve performance.

Text Books:

1. **Jacek M. Zurada**, Introduction to Artificial Neural Systems, PWS PublishingCompany, (2001)
2. **S. S Haykin**, Neural Networks: A Comprehensive Foundation, Pearson Education.

Reference Books:

1. **Valluru Rao**, C++ Neural Networks and Fuzzy Logic, Honary Holt & Co*(1998)*
2. **Freeman**, Neural Networks, Pearson Publication (2003).

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Course Title: Energy Audit and Management **Max. Marks: 100**
Course code: OEC-ECE-802/PEC-EE-603 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: This course gives an overview of various aspects of conservation, management & audit of electrical energy.

Unit-I

Energy Scenario: Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance, restructuring of the energy supply sector, energy strategy for the future, air pollution, climate change. Energy Conservation, Energy Conservation Act and its features.

Unit-II

Energy Management & Audit: Definition, energy audit, need, types of energy audit. Energy management (audit) approach-understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel energy substitution, energy audit instruments. Material and Energy balance: Facility as an energy system, methods for preparing process flow, material and energy balance diagrams.

Unit-III

Energy Efficiency in Electrical Systems: Electrical system: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors, performance assessment of PF capacitors, distribution and transformer losses. Electric motors: Types, losses in induction motors, motor efficiency, factors affecting motor performance, rewinding and motor replacement issues, energy saving opportunities with energy efficient motors.

Unit-IV

Energy Efficiency in Industrial Systems: Compressed Air System: Types of air compressors, compressor efficiency, efficient compressor operation, Compressed air system components, capacity assessment, leakage test, factors affecting the performance and savings opportunities in HVAC, Fans and blowers: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities. Pumps and Pumping System: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities.

Cooling Tower: Types and performance evaluation, efficient system operation, flow control strategies and energy saving opportunities, assessment of cooling towers.

Unit-V

Energy Efficient Technologies in Electrical Systems: Maximum demand controllers, automatic power factor controllers, energy efficient motors, soft starters with energy saver, variable speed drives, energy efficient transformers, electronic ballast, occupancy sensors, energy efficient lighting controls, energy saving potential of each technology.

Course Outcomes:

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

- **CO1.** Understand the current energy scenario and realize the need for new reforms to efficiently manage the energy resources.
- **CO2.** Learn various auditing techniques used for proper energy management.
- **CO3.** Realize how energy conservation could be done in Electrical Systems by managing the energy losses and malpractices.
- **CO4.** Realize how energy conservation could be done in Industrial Systems by finding out the factor affecting the performance of various industrial devices and mitigating the same.
- **CO5.** How electrical energy management could be achieved using new energy efficient devices.

Text/Reference Books:

1. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-1, General Aspects
2. **S. C. Tripathy**, "Utilization of Electrical Energy and Conservation", McGraw Hill, 1991.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Course Title: Industrial Waste Management **Max. Marks: 100**
Course code: OEC-ECE-802/PEC-CE-648 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: To impart knowledge for the various techniques employed for characterisation and quantification of waste/wastewater generated by various industrial activities, and safe disposal of treated waste/wastewater employing appropriate treatment methods in to the environment.

Unit-I

Industrial wastewaters, nature and effects, water pollution and problem pollutants
Stream sanitation, de-oxygenation and self-purification in streams

Unit-II

Sources and characteristics of industrial wastewaters, sampling and analysis In-plant waste control and water reuse

Unit-III

Different methods of treatment, aeration, sedimentation, floatation and coagulation, aerobic and anaerobic digestion

Unit-IV

Ion exchange, reverse osmosis, adsorption, combined biological, physical and chemical process

Unit-V

Application of treatment methods to some selected industries. Introduction to ISO: 14,000, Life cycle analysis etc.

Course Outcomes:

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

- **CO1.** Characterize and quantify wastewater generated from various industries
- **CO2.** Knowledge of sources and characterstic of industrial waste waters
- **CO3.** Knowledge of different methods of treatments of waste water
- **CO4.** Knowledge of different methods of treatments of waste water
- **CO5.** Design the various process for the treatment of the Industrial wastewater.

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Textbook:

1. Waste Water Engineering: Treatment and Reuse, Metcalf & Eddy, T.M.H. Publication. Environmental Engineering by Peavy H.S, Rowe D.R. and Tchobanoglous G, Tata McGraw Hills, New Delhi.

Reference Books:

1. G.M. Fair, J.C. Geyer, D.A. Okan, Elements of Water Supply and Wastewater Disposal, John Wiley and Sons Inc.
2. Terence, J. McGhee Water Supply and Sewerage, McGraw Hill Book Co.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

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Course Title: Data Mining and Warehousing **Max. Marks: 100**
Course code: OEC-ECE-804/PEC-ITE-605 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: To impart knowledge of data warehousing and data mining for Business Processes.

Unit-I

Data Warehousing: Data warehousing Components, building a Data warehouse, mapping the Data Warehouse to a Multiprocessor Architecture, DBMS Schemas for Decision Support, Data Extraction, Clean-up, and Transformation Tools, Metadata.

Unit-II

Business Analysis: Reporting and Query tools and Applications, Tool Categories, The Need for Applications, Cognos Impromptu, Online Analytical Processing (OLAP), Multidimensional Data Model, OLAP Guidelines, Multidimensional versus Multi-relational OLAP, Categories of Tools, OLAP Tools and the Internet.

Unit–III

Data Mining: Introduction, Data, Types of Data, Data Mining Functionalities, Interestingness of Patterns, Classification of Data Mining Systems, Data Mining Task Primitives, Integration of a Data Mining System with a Data Warehouse, Issues –Data Pre-processing.

Unit-IV

Association Rule Mining and Classification: Mining Frequent Patterns, Associations and Correlations, Mining Methods, Mining Various Kinds of Association Rules, Correlation Analysis, Constraint Based Association Mining, Classification and Prediction, Basic Concepts, Decision Tree Induction, Bayesian Classification, Rule Based Classification, Classification by Back propagation, Support Vector Machines, Associative Classification, Lazy Learners, Other Classification Methods - Prediction

Unit–V

Clustering and Applications and Trends In Data Mining: Cluster Analysis, Types of Data, Categorization of Major Clustering Methods, K- means, Partitioning Methods, Hierarchical Methods, Density Based Methods, Grid Based Methods, Model-Based Clustering Methods, Clustering High Dimensional Data Constraint, Based Cluster Analysis, Outlier Analysis, Data Mining Applications

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Course Outcomes:

- **CO1.** Describe the fundamental concepts, benefits and problem areas associated with data warehousing.
- **CO2.** Describe the various architectures and main components of a data warehouse.
- **CO3.** Design a data warehouse, and be able to address issues that arise when implementing a data warehouse.

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Text Books:

1. Alex Berson and Stephen J. Smith, “Data Warehousing, Data Mining & OLAP”, Tata McGraw – Hill Edition, Tenth Reprint 2007.
2. Data Mining: Concepts & Techniques - Jiawei Hun, Micheline Kamber, Academic Press, by Morgan Kanfman Publishers, 2001.

Reference Books:

1. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, “Introduction to Data Mining”, Person Education, 2007.
2. K.P. Soman, Shyam Diwakar and V. Ajay, “Insight into Data Mining Theory and Practice”, Easter Economy Edition, Prentice Hall of India, 2006.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Course Title: Machine Learning **Max. Marks: 100**
Course code: OEC-ECE-805/PEC-CSE-601 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course objectives:

The main objectives of this course are:

- To be able to formulate machine learning problems corresponding to different applications.
- To understand a range of machine learning algorithms along with their strengths and weaknesses.
- To understand the basic theory underlying machine learning.

Unit-I

Data: the backbone for making machine learn, Data pre-processing techniques, transformation, feature extraction and interpretation

Concept Learning: Overview of Issues regarding data sources, Diverse data formats

Unit-II

Supervised Machine Learning: Supervised Machine Learning concepts, techniques and algorithms, Decision Trees, KNN (K-nearest neighbours), SVM (Support vector machines), Neural Network Learning: Perceptions and gradient descent back propagation, LMS, Logistic regression, Supervised Machine learning applications in real life.

Unit-III

Probability based methods and dimensionality reduction: Cross Validation, Training and testing, Dimensionality reduction techniques, Model selection and feature selection, IDA, ICA, PCA, Bayesian Approaches: The basics Expectation Maximization, Hidden Markov Models.

Unit-IV

Un-Supervised Machine Learning: Unsupervised learning: Clustering K-means, EM (Expectation Maximization and Minimization), Mixture of Gaussians, Factor analysis, Hierarchical clustering, Un-Supervised Machine learning applications in real life.

Unit-V

Optimization techniques for Machine Learning: Genetic Algorithms (GA), Particle Swarm Optimization (PCO), Ant colony optimization (ACO), Ensemble learning.

Course Outcomes:

After completion of this course, the students will able to do following:

CO1. Ability to formulate machine learning techniques to respective problems.

CO2. Understand the basic concepts such as decision tree and neural networks.

CO3. Apply machine learning algorithms to solve problems of moderate complexity.

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CO4. Apply supervised and unsupervised learning to analyse/ interpret data.

CO5. Apply optimization techniques to solve real life problems.

Textbook:

1. Tom Michel, Machine Learning. Mc Graw Hill. 1997.
2. Trevor Hus tie, Robert Tibshirani & Jerome Friedman. The Elements of Statically Learning, Springer Veriag, 2001.

Reference Books:

1. Chris Bishop, "Pattern Recognition and Machine Learning", Cambridge, February 2006.
2. Jiawei Han Micheline Kamber Jian Pei, "Data Mining: Concepts and Techniques", Morgan Kaufmann, 3rd Edition, 2011.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Course Title: Bio-Informatics **Max. Marks: 100**
Course code: OEC-ECE-806/PEC-CSE-808 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course Objective: The basic objective is to give students an introduction to the basic practical techniques of bioinformatics. Emphasis will be given to the application of bioinformatics and biological databases to problem solving in real research problems. The students will become familiar with the use of a wide variety of internet applications, biological database and will be able to apply these methods to research problems.

Unit-I

Introduction to Bioinformatics and Computational Genomics, Biological Databases, Kinemages for Biological Structure, Dynamic Programming Sequence Alignment, BLAST, FASTA.

Unit-II

3D Structure Computations, NMR, Xtallography, RNA Secondary Structure, Introduction to Microarrays, Review of Structural Genomics, Microarray Clustering and Classification, Vector Machine Applications in Bioinformatics.

Unit-III

Terminologies and Ontologies, Multiple Sequence Alignment, 1D Motifs, Algorithms and Databases, 3D Structure Alignment, MUSTA Algorithm for Geometric Hashing and Multiple Alignments.

Unit-IV

Hidden Markov Models, Molecular Energetics and Dynamics, Protein Structure Prediction, Genetic Networks, Gene Finding Algorithms.

Unit-V

Comparative Genomics Algorithms, Genome Alignment, Phylogenetic Algorithms, Natural Language Processing, Proteomics, 3D Motifs & Final Thoughts.

Course Outcomes:

At the end of this course, the students will be able to do the following:

- **CO1.** Explain the basic principles that underpin Bioinformatics analyses, and apply these principles when analyzing biological data;
- **CO2.** Survey a selected field within Bioinformatics, synthesize information from primary literature, and coherently report your findings in a written document;
- **CO3.** Analyze biological data using a variety of Bioinformatics tools; and
- **CO4.** Interpret correctly the outputs from tools used to analyze biological data and make meaningful predictions from these outputs.

Text Books:

1. **David Mount**, Bio-informatics: Sequence and Genome analysis, 2ed, Cold Spring Harbor Laboratory Press.

Reference Books:

1. **Srinivas**, Bio-metrics: A Modern Approach, PHI.
2. **Bergen**, Bio-informatics Computing, PHI.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

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