Dr. Mahalingam College of Engineering and Technology

(An Autonomous Institution)

Pollachi - 642 003

Curriculum and Syllabus for

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

SEMESTER I to VIII

REGULATIONS 2016

DR MAHALINGAM

MCET

COLLEGE OF ENGINEERING AND TECHNOLOGY

Enlightening Technical Minds

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

REGULATION 2016

Curriculum for B.E Electronics and Communication Engineering from Semester I to VIII(for the students admitted from 2017 onwards)

SEMESTER I

Course Code	Course Title	Hours/Week			Credits	Marks
		L	T	P		
THEORY						
16ENT11	Communication Skills - I	2	0	2	3	100
16MAT13	Engineering Mathematics -I	3	2	0	4	100
16PHT13	Engineering Physics	3	0	0	3	100
16GET14	C – Programming	3	0	2	4	100
16GET15*/ 16GET15R	Fundamentals of Electrical Engineering*/Introduction to Engineering	3	0	0	3	100
PRACTICAL						
16EGL13	Engineering Graphics	1	0	4	3	100
16EPL12*/ 16EPL12R	Engineering Practices Laboratory	0	0	4	2	100
PROFESSIONAL SKILLS						
16PSL12	Sports for Wellness	0	0	2	1	100
TOTAL		15	2	14	23	800

*Applicable for 2016 Batch only

Total Hours in a Week: 31

SEMESTER II

Course Code	Course Title	Hours/Week			Credits	Marks
		L	T	P		
THEORY						
16ENT21	Communication Skills - II	2	0	2	3	100
16MAT23	Engineering Mathematics - II	3	2	0	4	100
16PHT23	Material Science	3	0	0	3	100
16GET24	Electron Devices	3	0	0	3	100
16CYT22	Engineering Chemistry	3	0	0	3	100
PRACTICAL						
16PCL21	Engineering Physics and Chemistry Laboratory	0	0	4	2	100
16EDL21	Electron Devices Laboratory	0	0	4	2	100
PROFESSIONAL SKILLS						
16PSL22	Promotion of Students' Wellness	0	0	2	1	100
TOTAL		**14**	**2**	**12**	**21**	**800**

Total Hours in a Week: 28

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SEMESTER III

Course Code	Course Title	Hours/Week			Credits	Marks
		L	T	P		
THEORY						
16MAT32	Linear Algebra and Numerical Methods	3	2	0	4	100
16ECT31	Network Theory	3	2	0	4	100
16ECT32	Electronic Circuits -I	3	0	0	3	100
16EET31	Digital Electronics	3	0	2	4	100
16ECT33	Electro Magnetic Fields	4	0	0	4	100
16CST35	Data structures and Object Oriented Programming with C++	3	0	0	3	100
PRACTICAL						
16ECL31	Electronic Circuits - I Laboratory	0	0	4	2	100
16CSL32	Data structures and Object Oriented Programming with C++ Laboratory	0	0	4	2	100
XXXX	One Credit Course	0	0	2	1	100
PROFESSIONAL SKILLS						
16PSL31	Personal Effectiveness	0	0	2	1	100
TOTAL		**19**	**4**	**14**	**28**	**1000**

Total Hours in a Week: 37

SEMESTER IV

Course Code	Course Title	Hours/Week			Credits	Marks
		L	T	P		
THEORY						
16MAT42	Probability Theory and Statistics	3	2	0	4	100
16ECT41	Electronic Circuits - II	3	0	0	3	100
16ECT42	Transmission lines and Wave guides	4	0	0	4	100
16ECT43	Linear Integrated Circuits	3	0	0	3	100
16ECT44	Signals and Systems	3	2	0	4	100
16ECT45	Electrical Machines and Instrumentation	3	0	0	3	100
PRACTICAL						
16ECL41	Electronic Circuits - II Laboratory	0	0	4	2	100
16ECL42	Linear Integrated Circuits Laboratory	0	0	4	2	100
XXXX	One Credit Course	0	0	2	1	100
PROFESSIONAL SKILLS						
16PSL41	Ethical and Moral Responsibility	0	0	2	1	100
TOTAL		**19**	**2**	**14**	**27**	**1000**

Total Hours in a Week: 35

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SEMESTER V

Course Code	Course Title	Hours/Week			Credits	Marks
		L	T	P		
THEORY						
16ECT51	Communication Theory	3	0	0	3	100
16ECT52	Digital Signal Processing	3	2	0	4	100
16ECT53	Control Systems	4	0	0	4	100
16ECT54	Microprocessor and Microcontroller	3	0	0	3	100
16ECT55	Antenna and Wave Propagation	3	0	0	3	100
XXXX	**Professional Elective - I**	3	0	0	3	100
PRACTICAL						
16ECL51	Digital Signal Processing Laboratory	0	0	4	2	100
16ECL52	Microprocessor and Microcontroller Laboratory	0	0	4	2	100
XXXX	One Credit Course	0	0	2	1	100
PROFESSIONAL SKILLS						
16PSL51	Teamness and Interpersonal Skills	0	0	2	1	100
TOTAL		**19**	**2**	**12**	**26**	**1000**

Total Hours in a Week: 33

SEMESTER VI

Course Code	Course Title	Hours/Week			Credits	Marks
		L	T	P		
THEORY						
16ECT61	Digital Communication	3	0	0	3	100
16ECT62	VLSI Design	3	0	0	3	100
16ECT63	Computer Communication Networks	3	0	0	3	100
16ECT64	Embedded System Design	3	0	2	4	100
16CET65	Environmental Studies	3	0	0	3	100
XXXX	**Professional Elective - II**	3	0	0	3	100
PRACTICAL						
16ECL61	Communication Systems Laboratory	0	0	4	2	100
16ECL62	VLSI Laboratory	0	0	4	2	100
XXXX	One Credit Course	0	0	2	1	100
PROFESSIONAL SKILLS						
16PSL61	Campus to Corporate	0	0	2	1	100
TOTAL		**18**	**0**	**14**	**25**	**1000**

Total Hours in a Week: 32

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SEMESTER VII

Course Code	Course Title	Hours/Week			Credits	Marks
		L	T	P		
THEORY						
16ECT71	Optical Communication	3	0	0	3	100
16ECT72	RF and Microwave Engineering	3	0	0	3	100
XXXX	**Professional Elective - III**	3	0	0	3	100
XXXX	**Open Elective - I**	3	0	0	3	100
PRACTICAL						
16ECL71	Microwave and Optical Communication Laboratory	0	0	4	2	100
16ECL72	Networks Laboratory	0	0	4	2	100
16ECL73	Innovative and Creative Project	0	0	8	4	100
TOTAL		**12**	**0**	**16**	**20**	**700**

Total Hours in a Week: 28

SEMESTER VIII

Course Code	Course Title	Hours/Week			Credits	Marks
		L	T	P		
THEORY						
XXXX	**Professional Elective – IV**	3	0	0	3	100
XXXX	**Professional Elective – V**	3	0	0	3	100
XXXX	**Professional Elective – VI**	3	0	0	3	100
PRACTICAL						
16ECL81	**Project**	0	0	20	10	200
TOTAL		**9**	**0**	**20**	**19**	**500**

Total Hours in a Week: 29

Total credits -189

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PROFESSIONAL ELECTIVES (PE)

Communication and Networking

Course Code	Course Title	Hours/Week			Credits	Marks
		L	T	P		
16ECE01	Wireless Communication	3	0	0	3	100
16ECE02	High Speed Networks	3	0	0	3	100
16ECE03	Electromagnetic Interference and Compatibility	3	0	0	3	100
16ECE04	Blue Tooth Technology	3	0	0	3	100
16ECE05	Multimedia Communication	3	0	0	3	100
16ECE06	Satellite Communication	3	0	0	3	100
16ECE07	Cognitive Networks	3	0	0	3	100
16ECE08	OFDM and MIMO Concepts	3	0	0	3	100
16ECE09	Telecommunication and Digital Switching Techniques	3	0	0	3	100
16ECE10	Advanced Wireless Communication	3	0	0	3	100
16ECE11	Advanced Networking Technologies	3	0	0	3	100
16ECE12	Wireless Networks	3	0	0	3	100
16ECE13	Cryptography and Network Security	3	0	0	3	100
16ECE14	Television and Video Systems	3	0	0	3	100

Design Engineering

Course Code	Course Title	Hours/Week			Credits	Marks
		L	T	P		
16ECE15	Advanced Digital Signal Processing	3	0	0	3	100
16ECE16	Digital Image Processing	3	0	0	3	100
16ECE17	Testing of VLSI Circuits	3	0	0	3	100
16ECE18	ASIC Design	3	0	0	3	100
16ECE19	Computer Architecture	3	0	0	3	100
16ECE20	CMOS Analog IC Design	3	0	0	3	100
16ECE21	Speech Signal Processing	3	0	0	3	100
16ECE22	Medical Electronics	3	0	0	3	100
16ECE23	Advanced Microcontrollers	3	0	0	3	100
16ECE24	Low Power VLSI Design	3	0	0	3	100
16ECE25	Digital System Design and Verification	3	0	0	3	100

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Control and Automation

16EIE02	Automotive Electronics	3	0	0	3	100
16EIE19	Virtual Instrumentation	3	0	0	3	100
16EIE21	Industrial Automation	3	0	0	3	100

Software Engineering

16ITE42	Data Base Management Systems	3	0	0	3	100
16ITE43	Data Mining and Analytics	3	0	0	3	100
16CSE25	Java Programming	3	0	0	3	100
16CSE26	Software Testing	3	0	0	3	100
16ITE44	Python Programming	3	0	0	3	100
16ECE26	Deep Learning	3	0	0	3	100

Management

16MEE40	Principles of Management	3	0	0	3	100
16MEE49	Engineering Economics and Cost Analysis	3	0	0	3	100
16ECE27	Disaster Management	3	0	0	3	100

Basic Sciences

16MAE02	Calculus of Variations and Integral Equations	3	0	0	3	100
16MAE03	Discrete Mathematics	3	2	0	4	100
16MAE04	Operations Research	3	0	0	3	100

OPEN ELECTIVES (OE)

16OE009	Data Science using Hadoop with R	3	0	0	3	100
16OE010	Artificial Intelligence	3	0	0	3	100
16OE0111	Soft Computing	3	0	0	3	100

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Semester I

Course Code:16ENT11	Course Title: COMMUNICATION SKILLS - I (Common to all B.E/B.Tech Programmes)	
General	L:T:P:C	2: 0 : 2 :3
Type:Theory	Total Contact hours:	60

Pre-requisites: The student should have undergone the course(s):

- The student should have undergone English as his/her first or second language in school.

Course Objectives:

The course is intended to:

1. Listen to conversations, comprehend and answer questions.
2. Answer questions about oneself and business-related themes.
3. Read passages, infer and respond to the questions.
4. Write appropriate business e-mail, note, memo and letter.
5. Write simple and grammatically correct sentences.

UNIT I – LISTENING 6+6

Short conversations/monologues - numbers and spelling (dates, prices, percentages, figures, etc.) - and locate specific information - longer monologue and guided note taking - gap filling - Understanding the gist and extracting the main idea.

UNIT II –SPEAKING 6+6

Answering questions about oneself, agreeing and disagreeing, expressing preferences - mini-presentation on a business theme (Oral) - Giving information and expressing opinions - discussion on business related topics – initiate a conversation and respond appropriately -business vocabulary - collocation.

UNIT III –READING 6+6

Read short texts and understand the main message (signs, messages, postcards, notes, emails, labels) - Read and find specific information - Interpreting visual information - Comprehend detailed factual information - gather gist –cloze test

UNIT IV- WRITING 6+6

Internal written communication - short messages to colleagues -note, message, memo, email- External communication -letter, email, notice - set phrases for letters and e-mails- Discourse markers, sign post words.

UNIT V – GRAMMAR 6+6

Types of sentences – Declarative, interrogative, imperative and exclamatory – Usage of tenses (Simple and continuous forms) - Voices – Concord (Subject and verb) - Auxiliary - Infinitive and Gerunds –Article - Preposition - Comparative and superlative adjectives.

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Course Outcomes:

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

CO1. Listen to conversations, comprehend and answer questions equivalent to BEC preliminary listening exercises.

CO2. Answer questions about oneself and business-related themes on par with BEC preliminary speaking tests.

CO3. Read passages, infer and respond to the questions from BEC preliminary reading exercises.

CO4. Write appropriate business e-mail, note, memo and letter on par with BEC preliminary writing tests.

CO5. Write simple and grammatically correct sentences.

Text Books:

1. Whitby Norman, "Business Benchmark Pre-intermediate to Intermediate Students", Book CUP Publications, Second Edition, 2014
2. Wood Ian, Williams Anne, Cowper Anna, "Pass Cambridge BEC Preliminary",Cengage Learning, Second Edition, 2015.

Reference Books:

1. BEC-Preliminary,"Cambridge Handbook for Language Teachers", Second Edition, CUP, 2000
2. Hewings Martin - Advanced Grammar in use - Upper-intermediate Proficiency, CUP, Third Edition, 2013

Web References:

1.www.cambridgeenglish.org/exams/business.../business-preliminary/
2. http://www.pearsonlongman.com/intelligent_business/bec_tests/preliminary.html

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Course Code:16MAT13	Course Title: ENGINEERING MATHEMATICS - I (Common to ECE, EEE and EIE)	
General	L:T:P:C	3 : 2 : 0 : 4
Type:Theory	Total Contact hours:	75

Pre-requisites: The student should have undergone the course(s):

- NIL

Course Objectives:

This course is intended to:

1. Use Eigen values and Eigen vectors of a real matrix.
2. Use different testing methods to check the convergence and divergence.
3. Apply partial derivatives for functions of several variables.
4. Apply multiple integrals to find area and volume.
5. Solve first order ordinary differential equations.

UNIT I - EIGENVALUES AND EIGENVECTORS **9+6**

Eigenvalues and Eigenvectors of a real matrix – Properties of Eigenvalues and Eigenvectors Diagonalization of symmetric matrices by orthogonal transformation- Reduction of a quadratic form to canonical form by orthogonal transformation –Nature of quadratic forms- Applications to Engineering problems.

UNIT II -SEQUENCES AND SERIES **9+6**

Sequences: Definition and examples – Series: Types and Convergence – Series of positive terms–Tests of convergence: Comparison test, Integral test, Cauchy's root test and D'Alembert's ratio test – Alternating series –Leibnitz's test – Series of positive and negative terms – Absolute and conditional convergence.

UNIT III -FUNCTIONS OF SEVERAL VARIABLES **9+6**

Partial derivatives – Homogeneous functions and Euler's theorem –Total derivative –Change of variables –Jacobian and properties – Taylor's series for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers with single constraint.

UNIT IV-MULTIPLE INTEGRALS **9+6**

Double integrals in Cartesian and polar coordinates – Change of order of integration – Area enclosed by plane curves – Change of variables from Cartesian to polar, spherical and cylindrical coordinates – Triple integrals- Volume of Solids.

UNIT V -ORDINARY DIFFERENTIAL EQUATIONS OF FIRST ORDER **9+6**

Formation of ordinary differential equation-Solution of differential equations of first order and first degree: homogeneous form, linear form and exact differential equations - Applications to circuit problems.

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Course Outcomes:

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

CO1. Use Eigen values and Eigenvectors of a real matrix to reduce quadratic form to canonical form.
CO2. Use different testing methods to check the convergence and divergence of infinite series.
CO3. Apply partial derivatives for functions of several variables.
CO4. Apply multiple integrals to find area of plane curves and volume of solids.
CO5. Apply first order ordinary differential equations for solving electric circuit problems.

Text Books:

1. Srimanta Pal &Subodh C Bhunia,"Engineering Mathematics", First Edition, Oxford University Press, 2015.
2. Ervin Kreyszig,"Advanced Engineering Mathematics", Tenth Edition, Wiley India,2015.

Reference Books:

1. Peter V. O'Neil,"Advanced Engineering Mathematics", Seventh Edition, Thomson Nelson Toronto, 2012
2. K. A. Stroud & Dexter J. Booth, "Advanced Engineering Mathematics", Fifth Edition, Palgrave Macmillan, 2011.

Web References:

1. http://nptel.ac.in/video.php?subjectId=122107036

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Course Code:16PHT13	Course Title: ENGINEERING PHYSICS (Common to ECE, EEE and EIE)	
General	L:T:P:C	3 : 0 : 0 : 3
Type: Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- NIL

Course Objectives:

This course is intended to:

1. Explain the properties, generation and applications of ultrasonics.
2. Interpret the thermal properties and their significance.
3. Identify the applications of LASER.
4. Explain the principles of fiber optics.
5. Calculate the crystal parameters and analyze different crystal structures and defects.

UNIT I -CRYSTAL PHYSICS 9

Amorphous and Crystalline materials. Lattice - Unit cell - Bravais lattices. Crystal structures: SC, BCC, FCC and HCP – Calculation of number of atoms per unit cell, Coordination number, nearest neighbor distance, Atomic radius and packing factor- Miller indices – Interplanar distance, Crystal defects: point, line and surface defects and their influence on the electronic and optical properties of materials.

UNIT II -THERMAL PHYSICS 9

Thermal expansion-thermal stress - expansion joints - bimetallic strips - modes of heat transfer -thermal conductivity- Lee's disc method for bad conductors - flow of heat through compound media - radial flow of heat- Cylindrical flow of heat - Thermal management of electronic devices and systems: Heat sink, heat pipes and electrostatic fluid acceleration.

UNIT III -LASER TECHNOLOGY 9

Laser principles: Stimulated and spontaneous emissions of radiations - Population inversion and pumping methods – Properties of lasers – Types: Nd: YAG laser, Homo-junction and Hetero-junction semiconductor lasers- Applications: Lasers in electronic industry: scribing, soldering and trimming- Holography: construction, reconstruction and applications.

UNIT IV-FIBER OPTICS 9

Principle of light propagation in optical fibres - Numerical aperture and acceptance angle -Types of fibres: based on material, refractive index and mode of propagation - Losses in fibers- Dispersion and Attenuation- Light sources: LED - Detectors: PN, PIN and Avalanche photo diodes. Fibre optic communication system and its advantages.

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UNIT V -QUANTUM PHYSICS 9

Basics of quantum physics – de Broglie wave, postulates of quantum physics – Schrodinger's time independent and time dependent equations (no derivation) – application: particle in a box, tunneling. Applications – Tunnel diode, Gun diode and Electron microscope.

Course Outcomes:

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

CO1. Calculate the crystal parameters and analyze different crystal structures and defects.
CO2. Interpret the thermal properties and their significance in electronic devices and systems
CO3. Identify the applications of LASER in electronic industry based on its property.
CO4. Explain the principles of fiber optics in communication systems.
CO5. Explain the working of electron devices using quantum mechanical concepts.

Text Books:

1. M.N.Avadhanulu and P.G.Kshirsagar, "Text Book of Engineering Physics", S. Chand &Company Ltd., New Delhi, 2014.
2. R.K.Gaur and S.L.Gupta, "Engineering Physics", Dhanpat Rai publications, New Delhi, Eighth edition, 2011.

Reference Books:

1. Balasubramaniam "Callister's Material Science and Engineering", John Wiley and Sons Inc.,Second Edition, 2015.
2. Wayne Tomasi, "Electronic Communications System: Fundamentals Through Advanced",Pearson Education India, Fifth Edition, 2009
3. Arthur Beiser, "Modern Physics", Tata McGraw-Hill Co, New Delhi, Seventh Edition, 2015

Web References:

1. http://www.physicsclassroom.com/class/thermal
2. http://nptel.ac.in/course.php?disciplineId=115
3. http://ocw.mit.edu/resources/res-6-005-understanding-lasers-and-fiberoptics-spring-2008/laser- fundamentals-i/

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Course Code:16GET14	Course Title: C- PROGRAMMING (Common to ECE, EEE and EIE)	
Core	L:T:P:C	3 : 0 : 2 : 4
Type: Theory	Total Contact hours:	75

Prerequisites: The student should have undergone the course(s):

- NIL

Course Objectives:

This course is intended to:

1. Explain about computer systems and problem solving techniques.
2. Write programs using appropriate programming constructs.
3. Write programs using arrays and functions
4. Write programs using pointers and structures
5. Write programs using files and pre-processor directives.

UNIT I –INTRODUCTION **8**

Generation and Classification of Computers, Computer Systems, Basic Organization of a Computer, Computer languages, Software development life cycle, Need for logical analysis and thinking, Problem formulation, Problem Solving, Algorithm, Pseudo code, Flow Chart

UNIT II -C PROGRAMMING BASICS **10**

Introduction to C programming, Structure of a C program, Compilation and linking processes, Identifier, Keywords, Constants, Variables, Data Types, Operators and Expressions, Managing input and output operations, Decision making, Branching and Looping statements, Type casting

UNIT III -ARRAYS, STRINGS AND FUNCTIONS **9**

Arrays: Declaration, Initialization, One dimensional and Two dimensional arrays, Strings: String operations, Arrays of Strings, Functions: Built in function, User defined function, Declaration and Definition of function, Pass by value, Pass by reference, Recursion

UNIT IV-POINTERS AND STRUCTURES **10**

Pointers: Definition, Initialization, Relationship between Array and Pointers, Array of Pointers, Structure: Defining a structure, Declaring structure objects, Accessing structure elements, Array of structures, Union: Accessing Union elements

UNIT V - FILES **8**

Introduction to Files, File access: Sequential access, Random access, File organization, File operations (open, close, read, write, name) Command line arguments, Pre-processor directives, Features, Macro expansion: File inclusion, Conditional compilation

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Course Outcomes:

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

CO1. Explain about computer systems and problem solving techniques.
CO2. Write programs using appropriate programming constructs
CO3. Write programs using Arrays and Functions
CO4. Write programs using Pointers and Structures
CO5. Write programs using Files and Pre-Processor Directives.

Text Books:

1. Ajay Mittal, "Programming in C – A Practical Approach", Pearson Education, 2010.
2. R.K.Gaur and S.L.Gupta, "Engineering Physics", Dhanpat Rai publications, New Delhi, Eighth edition, 2011.

Reference Books:

1. Yashavant.P. Kanetkar "Let Us C",BPB Publications,2011.
2. PradipDey, ManasGhosh, "Computer Fundamentals and Programming in C", Second Edition,Oxford University Press,2013.
3. Byron S Gottfried,"Programming with C ",Schaum 's Outlines,Second Edition,Tata McGraw –Hill,2006.

Web References:

1. http://www.cprogramming.com/tutorial/c-tutorial.html
2. http://www.programiz.com/c-programming
3. http://www.w3schools.in/c/
4. http://www.tutorialspoint.com/sdlc/index.htm

List of Experiments: **30**

1. Text formatting, Tables and Mathematical equations in MS Word
2. Calculation and Charting in MS Excel
3. Programs to evaluate an expression using various types of operators (Any 1)
   a. To find the area of a rectangle/circle/square
   b. To find the simple interest and compound interest
   c. To find the roots of a quadratic equation
4. Programs using Decision Making and Branching statements (Any 1)
   a. Calculation of electricity bill
   b. To identify the grade of the student
   c. To find the maximum number among 3 numbers
5. Programs using Loops (Any 2)
   a. To display the total and average of N students
   b. To display the floyd's triangle
   c. To display the Fibonacci series
   d. To display the sum of first N prime numbers
   e. To calculate the following series $1^2 + 2^2 + 3^2 + \ldots\ldots + N^2$

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6. Program using Arrays (Any 2,1 from 1D array and another from 2D array)
    a. To sort N Numbers in ascending/descending order
    b. To find the greatest number among N numbers
    c. To search for a particular number among N Numbers
    d. To compute the Matrix addition / multiplication / transpose
7. Program using Strings (Any 2)
    a. To manipulate strings using string functions.
    b. To calculate the length of the String without using built-in functions.
    c. To check whether the string is Palindrome or not.
    d. To sort a given set of strings in alphabetical order.
8. Programs using Functions (Any 1)
    a. To find the square and cube of a number.
    b. To find the factorial of a number.
    c. To swap two numbers.
9. Programs using Pointers (Any 1)
    a. To display the address of each element in an array
    b. To perform arithmetic operations using pointers
10. Programs using Structures (Any 1)
    a. To display the employee details using .(dot) operator
    b. To display the book details using ->(reference) operator
    c. To display the information of N Students
11. Programs using Files (Any 1)
    a. To write a string into a text file
    b. To read the contents of a text file
    c. To copy the contents from one file into another.

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Course Code:16GET15	Course Title: FUNDAMENTALS OF ELECTRICAL ENGINEERING (Common to ECE, EEE and EIE)	
Core	L:T:P:C	3 : 0 : 0 : 3
Type: **Theory**	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- NIL

Course Objectives:

This course is intended to:

1. Explain the various terminologies of electrical quantities.
2. Identify the required passive components.
3. Analyze the electrical quantities for the simple DC circuits.
4. Determine the electrical quantities for the simple AC circuits.
5. Apply domestic wiring.

UNIT I - ELECTRICAL QUANTITIES **8**

Need of S.I.Units - Definitions of Electrical quantities: Charge, Resistivity, Conductivity, Voltage, Current, Power, Energy. Fundamental Laws: Law of conservation of energy, Coulombs law. Classification of electrical elements: Active and passive, Unilateral and Bilateral, Linear and Non-linear, Lumped and distributed.

UNIT II - PASSIVE COMPONENTS **10**

Resistor, Temperature coefficient of Resistance, Types - Fixed resistors: Carbon composition, Thin film, wire wound - variable resistors - colour coding.
Inductors: Types-Fixed Inductors and variable Inductors - chokes
Capacitors: Types -Fixed Capacitors and variable Capacitors - Dissipation factor.

UNIT III - DC CIRCUITS **9**

Circuit Laws: Ohms Law, Kirchhoff's Current Law and Voltage Law. Behavior of R, L, C in DC circuits, Series resistive circuit-Voltage division rule, Parallel resistive circuit-Current division rule and series-parallel resistive circuit.

UNIT IV- AC CIRCUITS **10**

Faradays laws of electromagnetic induction. Alternating Quantities: Time period, Cycle, frequency, Angular frequency, Expression of average value, RMS value, Form factor, peak factor of sinusoidal waveform.
Behavior of R, L, C circuit. Power factor concepts in series RL, RC and RLC circuit. Power triangle – Active power, Reactive power and Apparent power.

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UNIT V - DOMESTIC WIRING 8

Voltage and frequency of single phase & three phase supply standards.
Types of wiring system, materials and accessories. House wiring - Stair case wiring, Fluorescent tube wiring and fan wiring.
Electrical safety-Rules for wiring, Earthing - Pipe earthing and Plate earthing.

Course Outcomes:

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

CO1. Explain the various terminologies of electrical quantities.
CO2. Identify the required passive components for the given applications.
CO3. Analyze the electrical quantities for the simple DC circuits.
CO4. Determine the electrical quantities for the simple AC circuits.
CO5. Apply appropriate domestic wiring for the given specification.

Text Books:

1. V.Jegatheesan, K.Vinoth Kumar and R.Saravanakumar, "Basic Electrical and Electronics Engineering",Wiley India, First Edition,2011.
2. John Hiley, Keith Brown, "Hughes Electrical and Electronic Technology", Pearson Education Limited, Tenth Edition,2010

Reference Books:

1. T.Thyagarajan, K.P.SendurChelvi, T.R.Rangaswamy, "Engineering Basics(Electrical Electronics & Computer Engineering)",New Age Int. Pvt. Ltd, Second Revised Edition,1999.
2. V.K.Mehta, Rohit Mehta, "Principles of Electrical Engineering", Chand & Company Ltd, 2007.
3. R. Muthusubramanian and S Salivahanan, "Basic Electrical and Electronics Engineering", Mc-Graw Hill, New Delhi, 2010.
4. Giorgio Rizzoni, "Fundamentals of Electrical Engineering", Mc. Graw Hill, New Delhi, First Edition, 2008

Web References:

1. http://www.instructables.com/
2. http://www.allaboutcircuits.com/textbook/reference/chpt-2/resistor-color-codes/
3. http://www.electrical4u.com/fluorescent-lamp-its-working-principle/
4. http://www.edisontechcenter.org/
5. http://electronicsforu.com/
6. http://www.physicsclassroom.com/

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Course Code:16EGL13	Course Title: ENGINEERING GRAPHICS (Common to ECE, EEE and EIE)	
Core	L:T:P:C	1:0:4:3
Type: **Practical**	Total Contact hours:	**75**

Prerequisites: The student should have undergone the course(s):

- NIL

Course Objectives:

The course is intended to:

1. Sketch different curves and explain its application.
2. Prepare orthographic projection.
3. Draw the projection of solids
4. Draw the projection of sectioned solids.
5. Draw the development of surfaces of simple solids.

UNIT I - CURVES USED IN ENGINEERING PRACTICES **13**

Application of curves in Engineering- Conics – Construction of ellipse, Parabola and hyperbola by eccentricity method – Construction of cycloids and involutes of square and circle

UNIT II - ORTHOGRAPHIC PROJECTION **18**

First angle projection – layout of views – Developing visualization skills through free hand sketching of multiple views from pictorial views of objects - Orthographic projection of solids

UNIT III - PROJECTION OF SOLIDS **18**

Projection of solids – Types of solids- Polyhedra and solids of revolution- Orthographic views of solids- Axis inclined to one reference plane.

UNIT IV- SECTION OF SOLIDS **13**

Sectional view -Types of section planes-True shape of section-Orthographic views of sectioned solids -Section plane inclined to one reference plane and perpendicular to the other.

UNIT V - DEVELOPMENT OF SURFACES **13**

Development of lateral surfaces of simple and truncated solids –Parallel line method - Radial Line method.

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Course Outcomes:

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

CO1. Sketch different curves and explain its application.
CO2. Prepare orthographic projection from pictorial views and models
CO3. Draw the projection of solids
CO4. Draw the projection of sectioned solids.
CO5. Draw the development of surfaces of simple solids with cuts and slots.

Text Books:

1. K. V. Natrajan, "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2013.

Reference Books:

1. Dhananjay A. Jolhe, "Engineering Drawing with an introduction to Auto CAD", Tata McGrawHill Publishing Company Limited, 2008.
2. Cencil Jensen, Jay D. Helsel and Dennis R, "Short Engineering Drawing and Design", Tata McGraw Hill Publishing Company Limited, 2012.

Web References:

1. http://www.engineeringdrawing.org
2. http://nptel.ac.in
3. http: //iitd.ac.in

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Course Code:16EPL12	**Course Title: ENGINEERING PRACTICES LABORATORY** (Common to CSE, ECE, EEE, EIE and IT)	
Core	**L:T:P:C**	**0 : 0 : 4 : 2**
Type:**Practical**	Total Contact hours:	**60**

Prerequisites: The student should have undergone the course(s):

- NIL

Course Objectives:

This course is intended to:

1. Draw the basic symbols of Electrical and Electronic components and identify the elements.
2. Execute soldering practice.
3. Verify basic laws and demonstrate basic wiring.
4. Demonstrate the basic plumbing, carpentry, fitting, sheet metal and welding operations.
5. Demonstrate the hand forging and sand moulding process.

List of Experiments:

Electrical & Electronics: **30**

1. Symbols of Electrical and Electronic components.
2. Identification of Resistor and Capacitor Values.
3. Soldering practice of simple circuits and checking the continuity.
4. Verification of Ohms law.
5. Verification of Kirchhoff's current & voltage law.
6. Fluorescent tube, Stair case and House wiring

Civil & Mechanical: **30**

1. Make a wooden Tee joint to the required dimension.
2. Assemble the pipeline connections with different joining components for the given layout.
3. Make a tray in sheet metal to the required dimension.
4. Make a "V" fitting to the required dimension using fitting tools.
5. Weld a butt joint using welding process to the required dimension.
6. Demonstration on hand forging and sand moulding process.

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Course Outcomes:

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

CO1. Draw the basic symbols of Electrical and Electronic components and identify the elements.
CO2. Execute soldering practice for electrical and Electronics circuits.
CO3. Verify basic laws and demonstrate basic wiring.
CO4. Demonstrate the basic plumbing, carpentry, fitting, sheet metal and welding operations.
CO5. Demonstrate the hand forging and sand moulding process.

Reference Books:

1. Jeyachandran.K, Natarajan.S. &Balasubramanian.S, "A Primer on Engineering Practices Laboratory", Anuradha Publications, 2007.
2. Rajendra Prasad. A &Sarma.P.M.M.S, "Workshop Practice", SreeSai Publication, 2002.
3. Kannaiah.P & Narayana.K.L, "Manual on Workshop Practice", Scitech Publications, 1999.
4. MCET - Engineering Practices Laboratory Manual.

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Course Code:16PSL12	Course Title: SPORTS FOR WELLNESS (Common to CSE,ECE and IT)	
General	L:T:P:C	0 : 0 : 2 : 1
Type:PS	Total Contact hours:	30

Course Objectives:

This course is intended to:

1. Explain the significance of physical fitness.
2. Maintain physical fitness.
3. Exhibit mental agility.

UNIT I - HEALTH

Meaning of health - Components of health - physical, mental, social, emotional, spiritual -importance of health - Personal hygiene - Heredity and environment – Adopting healthy habits.

UNIT II - FITNESS & WELLNESS

Fitness and wellness – what is physical fitness - categories - components of health related physical fitness- components of skill related physical fitness- values of physical fitness – Physical fitness development.
What is wellness - importance of wellness for engineers –factors promoting wellness – Physiology and health: cardio-respiratory, muscular and nervous systems – ageing

UNIT III - FOOD & HEALTH

Energy balance and body composition – nutrients- problems of surplus and deficiency- balanced diet - good food habits for better health – hazards of junk food - food and the gunas.

UNIT IV -FITNESS & DEVELOPMENT I

Exercises related ailment and injuries - safety and precautions - first aid. Muscular strength – exercises (calisthenics): pull-up, sit-up, push-up and weight training. Explosive power – exercises: vertical jump, long jump, Cardio respiratory endurance– exercises: walking, jogging, treadmill, stair climbing, bicycling, skipping. Flexibility –exercises: stretching

UNIT V -FITNESS & DEVELOPMENT II

Speed, agility, balance and coordination – exercises: sprint, cone drill, ladder drill, hurdle drill, ball throw - mental agility tests. Dexterity - 12 minutes cooper test – long run – adventure games Team games.

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Course Outcomes:

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

CO1. Explain the significance of physical fitness for healthy living.
CO2. Maintain physical fitness through exercises.
CO3. Exhibit mental agility.

Reference Books:

1. Tony Buzan, Harper Collins, The Power of Physical Intelligence (English)
2. Padmakshan Padmanabhan, Handbook of Health & Fitness, Indus Source Books, First Edition, 2014.

OPERATIONAL MODALITIES:

Orientation programme

Special lectures by invited resource persons at semester beginning
3 lectures x 4 hours = 12 hours

Follow-up practice

12 weeks x 2 hours/week = 24 hours

Evaluation

Continuous evaluation:

Physical Exercises	= 40 marks
Assessment of students workbook	= 20 marks
Total	= 60 marks

Semester end examination:

Written test (MCQ and short answers)	= 30 marks
Physical exercises	= 50 marks
Viva-voce	= 20 marks
Total	= 100 marks

End semester mark out of 100 is reduced to 40 marks

The student should get a total of 50 marks put together for a pass.

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MEASUREMENTS:
At the Beginning + At Semester End

SCHEDULE OF EXERCISES FOR STUDENTS WITH DIFFERENT PHYSICAL CONDITIONS

Underweight	Normal	Obese
Flexibility exercises - stretching	Flexibility exercises - stretching	- Brisk walking
Minor games -forward running relay -backward running relay - over & under relay -circle games, etc.	-Walking - Walking-cum-jogging	- Minor games
Strength Training - Calisthenics	Cardio/Functional Fitness - Skipping - Stair climbing - jogging - bicycling - long distance running	flexibility exercises - stretching - Cycling (static)
Cardio/Functional Fitness - Skipping - Stair climbing - jogging - bicycling	Agility - ladder drills - hurdle drill - cone drill	Cardio/Functional Fitness Skipping Jogging bicycling
Agility exercises - ladder drills - hurdle drill - cone drill	Strength Training -Calisthenics -gym workout for major muscles	Strength Training - Calisthenics - gym workouts
Diet Considerations	Diet considerations	Diet considerations
Measurements		
BMI Hand grip strength test 12 m Cooper run Sit & reach	BMI 12 m Cooper run Sit & reach test Illinois agility test	BMI Body fat percentage Waist-to-hip ratio Sit & reach

END OF SEMESTER I

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Course Code:16GET15R	Course Title: INTRODUCTION TO ENGINEERING (Common to ECE, EEE and EIE)	
Core	L:T:P:C	3:0:0:3
Type: Theory	Total Contact hours:	45

Pre-requisites: The student should have undergone the course(s):

- NIL

Course objectives:

This course is intended to:

1. Select the best material for the required construction
2. Select the suitable foundation for the required construction
3. Explain different manufacturing processes like welding and machining operations.
4. Discuss the construction and working of IC engines and refrigerators.
5. Determine the electrical quantities for simple DC circuits.
6. Determine the electrical quantities for simple AC circuits.

CIVIL **15**

Scope of Civil Engineering - Functions of civil Engineer and Basic areas in Civil Engineering.

Civil Engineering Materials and their properties: - Stones, bricks, sand, aggregate, cement, steel, concrete and Reinforcement cement concrete.

Building Components :Sub structure: - Bearing capacity of soil – Type of foundation - Selection of foundation based on soil conditions – Requirement of good foundation – Introduction for various types of foundations – failure of foundation and remedial measures.

Super structure: Vertical Components such as brick masonry, stone masonry in footing and walls - columns – Horizontal components such as plinth beam, Lintels, beam, sun shades – various types of roofs and floors- staircase.

MECHANICAL **15**

Manufacturing Processes : Metal Joining processes - Welding, Metal machining – Turning, Milling, Drilling, 3D printing

Thermal Engineering: Refrigeration - Principle of vapour compression system – Layout of typical domestic refrigerator, Refrigerants – types and properties. Air conditioning : Definition, working principle of Window and Split type room air conditioners. Internal combustion engines – Working principle of Petrol and Diesel Engines –Two stroke and Four stroke cycles – Comparison of two stroke and four stroke engines.

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FUNDAMENTALS OF CIRCUITS 15

DC Circuits: Passive Components: Resistor, Temperature coefficient of Resistance, - colour coding , Inductors, Capacitors, Dissipation factor. Circuit Laws: Ohms Law, Kirchhoff's Current Law and Voltage Law. Behavior of R, L, C in DC circuits, Series resistive circuit-Voltage division rule, Parallel resistive circuit-Current division rule and series-parallel resistive circuit.

AC circuits: Faradays laws of electromagnetic induction. Alternating Quantities:Time period, Cycle, frequency, Angular frequency, Expression of average value, RMS value, Form factor, peak factor of sinusoidal waveform. Behavior of R, L, C circuit. Power factor concepts in series RL, RC and RLC circuit. Power triangle – Active power, Reactive power and Apparent power.

Course outcomes:

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

CO1. Select the best material for the required construction
CO2. Select the suitable foundation for the required construction
CO3. Explain different manufacturing processes like welding and machining operations.
CO4. Discuss the construction and working of IC engines and refrigerators.
CO5. Determine the electrical quantities for simple DC circuits.
CO6. Determine the electrical quantities for simple AC circuits.

Text Books:

1. Jayagopal.L.S & Rudramoorthy.R, "Elements of Civil and Mechanical Engineering", Vikas Publishing House, New Delhi, 2010.
2. John Hiley, Keith Brown, Hughes Electrical and Electronic Technology, Pearson Education Limited, Tenth Edition,2010.

Reference Books:

1. Shanmugam.G and Palanichamy.M.S, "Basic Civil and Mechanical Engineering", Tata McGraw Hill Publishing Co., New Delhi, 1996.
2. Bindra.S.P and Arora.S.P, "The text book of Building construction", Dhanpat Rai Publications (P) Ltd., New Delhi, 2011.
3. Ananthanarayanan.P, "Basic Refrigeration and Air Conditioning", Tata McGraw Hill Publishing Co., New Delhi, 2003.
4. V.Jegatheesan, K.Vinoth Kumar & R.Saravanakumar, Basic Electrical and Electronics Engineering, Wiley India, First Edition,2011.
5. V.K.Mehta, Rohit Mehta, "Principles of Electrical Engineering", Chand & Company Ltd,2007
6. R.Muthusubramanian and S.Salivahanan, "Basic Electrical and Electronics Engineering", McGraw Hill, New Delhi, 2010.

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7. Giorgio Rizzoni,"Fundamentals of Electrical Engineering", McGraw Hill, New Delhi, First Edition, 2008.

Web References:

1. www.electrical4u.com/power-plants-types-of-power-plant/
2. www.thelibraryofmanufacturing.com/
3. http://www.instructables.com/
4. http://www.allaboutcircuits.com/textbook/reference/chpt-2/resistor-color-codes/
5. http://www.electrical4u.com/fluorescent-lamp-its-working-principle/
6. http://www.edisontechcenter.org/
7. http://electronicsforu.com/
8. http://www.physicsclassroom.com/

OPERATIONAL MODALITIES

<table>
<tr><th colspan="5">Hrs/week</th><th>Evaluation</th><th>Internal</th></tr>
<tr><td colspan="5"><u>Civil:</u> 15 hours: 3 Hrs/week (for 5 weeks)
(CO1 & CO2)</td><td>CCET-I
TQA-I</td><td>20</td></tr>
<tr><td colspan="5"><u>Mechanical:</u> 15 hours: 3 Hrs/week (for 5 weeks)
(CO3 & CO4)</td><td>CCET-II
TQA-II</td><td>20</td></tr>
<tr><td colspan="5"><u>Fundamentals of Circuits</u>
15 hours: 3 Hrs/week (for 5 weeks)
(CO5 & CO6)</td><td>CCET-III
TQA-III</td><td>20</td></tr>
<tr><td></td><td>Part-A</td><td>Part-B</td><td>Part-C</td><td>Part-D</td><td rowspan="4">End Semester</td><td rowspan="4">40</td></tr>
<tr><td>Civil:30 Marks</td><td>5X1=5</td><td>1X2=2</td><td>1X8=8</td><td>1X15=15</td></tr>
<tr><td>Mechanical:
30 Marks</td><td>6X1=6</td><td>1X2=2</td><td>1X8=8</td><td>1X15=15</td></tr>
<tr><td>Fundamentals of Circuits:40 Marks</td><td>4X1=4</td><td>3X2=6</td><td>-</td><td>2X15=30</td></tr>
</table>

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Course Code:16EPL12R	Course Title ENGINEERING PRACTICES LABORATORY (Common to ECE, EEE and EIE)	
Core	L:T:P:C	0:0:4:2
Type: **Practical**	Total Contact hours:	60

Pre-requisites: The student should have undergone the course(s):

- NIL

Course Objectives:

The course is intended to

1. Draw the basic symbols of Electrical and Electronic components and identify the elements.
2. Perform soldering practice for electrical and electronics circuits.
3. Verify basic laws and demonstrate basic wiring.
4. Demonstrate the basic plumbing, carpentry, fitting, sheet metal and welding operations.
5. Demonstrate the hand forging and sand moulding process.

LIST OF EXPERIMENTS

Electrical & Electronics: **30**

1. Symbols of Electrical and Electronic components.
2. Identification of various types of passive components and its values(R,C).
3. Soldering practice of simple circuits and checking the continuity.
4. Verification of Kirchhoff's current & voltage law.
5. Study of electrical safety and rules for wiring.
6. Fluorescent tube, Stair case and House wiring
7. Demonstrate earthing.

Civil & Mechanical: **30**

1. Make a wooden Tee joint to the required dimension.
2. Assemble the pipeline connections with different joining components for the given layout.
3. Make a tray in sheet metal to the required dimension.
4. Make a "V" fitting to the required dimension using fitting tools.
5. Weld a butt joint using welding process to the required dimension.
6. Demonstration on hand forging and sand moulding process.

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Course Outcomes:

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

CO1: Draw the basic symbols of Electrical and Electronic components and identify the elements.

CO2: Execute soldering practice for electrical and electronics circuits.

CO3: Verify basic laws and demonstrate basic wiring.

CO4: Demonstrate the basic plumbing, carpentry, fitting, sheet metal and welding operations.

CO5: Demonstrate the hand forging and sand moulding process.

Reference Books:

1. Jeyachandran.K, Natarajan.S. & Balasubramanian.S, "A Primer on Engineering Practices Laboratory", Anuradha Publications, 2007.
2. Rajendra Prasad. A & Sarma.P.M.M.S, "Workshop Practice", SreeSai Publication, 2002.
3. Kannaiah.P & Narayana.K.L, "Manual on Workshop Practice", Scitech Publications,1999.
4. "Engineering Practices Laboratory Manual", prepared by faculty of MCET.

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Semester II

Course Code:16ENT21	Course Title: COMMUNICATION SKILLS - II (Common to all B.E/B.Tech Programmes)	
General	L:T:P:C	2 : 0 : 2 : 3
Type: Theory	Total Contact hours:	60

Prerequisites: The student should have undergone the course(s):

- 16ENT11-Communication skills - I

Course Objectives:

The course is intended to:

1. Listen to monologues or dialogues, comprehend and answer questions.
2. Answer questions about oneself and business-related themes.
3. Read business correspondence, infer and respond to the questions.
4. Write appropriate business e-mail, memo, proposal, report and letter.
5. Write complex sentences.

UNIT I -LISTENING 6+6

Listening to monologues or dialogues and noting specific information - Listening to identify topic, context, and function -Listening for details and main ideas - Gap filling and matching job descriptions and titles.

UNIT II -SPEAKING 6+6

Giving personal information -Talking about present circumstances, past experiences and future plans, expressing opinions, speculating -mini-presentation on a business theme -Giving information and expressing and justifying opinions -discussion on a business-related topic -Expressing and justifying opinions, speculating, comparing and contrasting, agreeing and disagreeing, etc. – negotiating and persuading.

UNIT III - READING 6+6

Reading - skimming for gist and scanning for specific information(Newspaper and magazine articles, reports, advertisements, letters, messages, brochures, guides, manuals) -Reading and understanding text structure – Comprehension –Reading for vocabulary and structure -understanding sentence structure and finding errors.

UNIT IV-WRITING 6+6

Internal written communication – Writing a message, memo or an email: giving instructions, explaining development, asking for comments, requesting information, agreeing to requests –External Communication (e.g. explaining, apologizing, reassuring, complaining), reports (e.g. describing, summarizing) or proposals (e.g. describing, summarizing, recommending, persuading and negotiating).

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UNIT V –GRAMMAR **6+6**

Conditional sentences – Modals and their usage- common errors – Linkers and discourse markers – concord (pronoun and antecedent)

Course Outcomes:

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

CO1. Listen to monologues or dialogues, comprehend and answer questions equivalent to BEC vantage listening exam.
CO2. Answer questions about oneself and business-related themes on par with BEC vantage speaking exam.
CO3. Read business correspondence, infer and respond to the questions similar to BEC vantage reading exam.
CO4. Write appropriate business e mail, memo, proposal, report and letter on par with BEC vantage writing exam.
CO5. Write complex sentences using appropriate discourse markers.

Text Books:

1. Whitby Norman, "Business Benchmark Upper Intermediate Students Book", CUP Publications, Second Edition, 2014.

Reference Books:

1. Cambridge BEC Vantage - Practice Tests, Self-study Edition, Cambridge University Press, 2002.
2. Hewings Martin, "Advanced Grammar in use - Upper-intermediate Proficiency", CUP, Third Edition, 2013

Web References:

1. www.cambridgeenglish.org/exams/business.../business-preliminary/
2. http://www.examenglish.com/BEC/BEC_Vantage.html
3. www.splendid-speaking.com/exams/bec_speaking.html

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Course Code:16MAT23	Course Title: ENGINEERING MATHEMATICS - II (Common to ECE, EEE and EIE)	
General	L:T:P:C	3 : 2 : 0 : 4
Type: **Theory**	Total Contact hours:	75

Prerequisites: The student should have undergone the course(s):

- 16MAT13-Engineering Mathematics - I

Course Objectives:

1. Solve second and higher order ordinary differential equations.
2. Explain the concepts of vector differentiation and integration.
3. Apply the Laplace transform techniques to solve differential equations.
4. Construct analytic functions.
5. Evaluate contour integrals.

UNIT I - DIFFERENTIAL EQUATIONS OF SECOND AND HIGHER ORDER 9+6

Second and higher order linear differential equations with constant coefficients-Method of variation of parameters- First order simultaneous differential equations-Application to circuit problems.

UNIT II - VECTOR CALCULUS 9+6

Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields –Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem(excluding proofs) – evaluation of integrals using Green's ,Gauss's and Stoke's theorems.

UNIT III -LAPLACE TRANSFORM 9+6

Laplace transforms –Sufficient condition for existence–Transform of elementary functions-Basic properties – Transforms of derivatives and integrals of functions - Transforms of unit step function and impulse function – Transform of periodic functions-Inverse Laplace transforms - Statement of Convolution theorem - Solution of linear ODE of second order-solution to simple circuit problems.

UNIT IV -COMPLEX DIFFERENTIATION 9+6

Functions of a complex variable – Analytic functions- Necessary conditions – Cauchy-Riemann equations and sufficient conditions (excluding proofs) – Properties of analytic functions – Harmonic conjugate – Construction of analytic functions-Conformal mapping: w = z+ a, az, 1/z – Bilinear Transformation.

UNIT V - COMPLEX INTEGRATION 9+6

Statement and applications of Cauchy's integral theorem and integral formula – Taylor's and Laurent's series expansions – Types of Singularity– Residues – Cauchy's residue theorem – Evaluation of real definite integrals as contour integrals around unit circle and semi-circle (excluding poles on the real axis).

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Course Outcomes:

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

CO1. Solve second and higher order ordinary differential equations.
CO2. Explain the concepts of vector differentiation and integration.
CO3. Apply the Laplace transform techniques to solve differential equations.
CO4. Use the functions of a complex variable and construct analytic functions.
CO5. Use the concept of complex integration to evaluate contour integrals.

Text Books:

1. Srimanta Pal &Subodh C Bhunia,"Engineering Mathematics", First Edition, Oxford University Press, 2015.
2. Ervin Kreyszig, "Advanced Engineering Mathematics", TenthEdition, Wiley India, 2015.

Reference Books:

1. Peter V. O'Neil, "Advanced Engineering Mathematics", Seventh Edition, Thomson Nelson Toronto, 2012.
2. K. A. Stroud & Dexter J Booth,"Advanced Engineering Mathematics", FifthEdition, Palgrave Macmillan, 2011.

Web References:

1. http://nptel.ac.in/video.php?subjectId=122107036

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Course Code:16PHT23	Course Title: MATERIAL SCIENCE (Common to ECE, EEE and EIE)	
Core	L:T:P:C	3 : 0 : 0 : 3
Type: **Theory**	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- NIL

Course Objectives:

The course is intended to:

1. Analyze the types of electron emission and electron ballistics.
2. Calculate the electrical properties of conductors and relate with superconductors.
3. Demonstrate the nature of semiconducting material.
4. Calculate the dielectric properties of materials and discuss their application in electronic components.
5. Explain the properties and applications of magnetic materials.

UNIT I -ELECTRON EMISSION AND BALLISTICS 9

Electron Emission: Work function – Types of Electron Emission (Qualitative): Thermionic, Photoelectric, Field and Secondary Emissions.

Electron Ballistics: Uniform Electric Field Parallel to Electron Motion - Energy acquired by electron in the electric field – Uniform electric field perpendicular to electron motion – Motion of an electron in a uniform magnetic field – Magneto-static deflection – Electric and Magnetic fields in crossed configuration.

UNIT II -CONDUCTING AND SUPERCONDUCTING MATERIALS 9

Conducting Materials: Formation of bands (qualitative) - Classification of solids based on bands - Classical free electron theory, Expression for electrical and thermal conductivity, Wiedemann Franz law - Sources of resistivity - Mattheissen's rule – Properties and applications of low and high resistivity materials.

Superconductors: Properties – Type I & II superconductors - High temperature superconductors - Applications: – Cryotron – Josephson Effect - SQUID - Magnetic levitation.

UNIT III -SEMICONDUCTING MATERIALS 9

Elemental and compound semiconductors – Direct and indirect band gap semiconductors - Intrinsic and extrinsic semiconductors - Expression for carrier concentration in n type semiconductor - Variation of carrier concentration and Fermi level with temperature for n - type - Hall Effect: Hall coefficient in n-type extrinsic semiconductor, experimental determination of Hall coefficient and applications of Hall Effect - LDR - Solar Cells - Strain gauge.

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UNIT IV -DIELECTRIC MATERIALS 9

Polarization - Polarizability - Polarization vector, Electrical susceptibility, Dielectric constant – Polarization mechanisms (Qualitative) -Internal Field in solids –Clausius Mossotti relation-Frequency and temperature dependence of polarization – Dielectric loss - Dielectric breakdown mechanisms - Types of Dielectrics: Active and Passive (Qualitative) – Selection of dielectric materials - Applications of Dielectrics: Capacitors and Transformers.

UNIT V - MAGNETIC MATERIALS 9

Introduction to magnetic materials – Types and Properties of Magnetic materials: Dia, Para, Ferro, Anti-ferro and Ferri magnetic materials - Domain theory of ferromagnetism - Hysteresis based on domain theory - Hard and soft magnetic materials – Properties and applications of Ferrites- Materials for permanent magnets- Applications: Transductor– Hard disc – Magneto optical recording.

Course Outcomes:

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

CO1. Analyze the types of electron emission and electron ballistics.
CO2. Calculate the electrical properties of conductors and relate with superconductors
CO3. Demonstrate the nature of semiconducting material.
CO4. Calculate the dielectric properties of materials and discuss their application in electronic Components.
CO5. Explain the properties and applications of magnetic materials.

Text Books:

1. M.N.Avadhanulu and P.G.Kshirsagar, "Text Book of Engineering Physics", S. Chand &Company Ltd., New Delhi, 2014.
2. Balasubramaniam "Callister's Material Science and Engineering", John Wiley and Sons Inc.,Second Edition, 2015.

Reference Books:

1. S.O. Pillai," A text book of solid state physics", New Age International, Seventh Edition,2015.
2. S.O. Kasap, "Principles of Electronics Materials and Devices", McGraw Hill Higher Education, New Delhi, Third Edition, 2007.
3. V Rajendran, "Engineering Physics", Tata McGraw-Hill Co, New Delhi, 2011.
4. P.K Palanisamy, "Materials science", Scitech publications, Chennai, 2007.
5. S. Jayakumar, "Materials science", R.K. Publishers, Coimbatore, 2008.

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Web References:

1. http://nptel.ac.in/courses/115102014/1
2. http://nptel.ac.in/course.php?disciplineId=115
3. https://www.khanacademy.org/science/physics/magnetic-forces-and-magnetic-fields
4. http://physics.info/dielectrics/

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Course Code:16GET24	Course Title: ELECTRON DEVICES (Common to ECE and EEE)	
Core	L:T:P:C	3 : 0 : 0 : 3
Type:**Theory**	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16PHT13 - Engineering Physics

Course Objectives:

The course is intended to:

1. Explain the construction and characteristics of PN junction diode.
2. Differentiate special diodes from PN junction diodes.
3. Explain the construction and characteristics of bipolar junction transistors.
4. Explain the construction and operation of Junction Field effect transistors.
5. Describe the operation of MOSFETs and basic power devices.

UNIT I - SEMICONDUCTOR DIODE 9

PN junction - forward and reverse bias conditions. Ideal diode - Practical diode - V-I Characteristics of a diode – Temperature dependence of the V-I Characteristics – Diode specifications – Diode Resistance – Static and dynamic – Diode junction Capacitance – Transition and Diffusion capacitances - Diode Equivalent circuits.

UNIT II - SPECIAL DIODES 9

Zener diode - Characteristics of Zener diode - Avalanche and Zener breakdown - Application of Zenerdiode.Varactor diode, Tunnel diode, Schottky Diode, Light emitting diodes – Photo diodes – Diode numbers and lead identification – Diode testing.

UNIT III -BIPOLAR JUNCTION TRANSISTORS 9

Bipolar Junction Transistor and its types – NPN and PNP Transistor – Transistor operation – Configurations of BJT – Input and output characteristics of CE, CB and CC configurations.Eber-Moll Model of transistors – Transistor as a switch - Transistor specifications – lead identification – Package types – Transistor testing.

UNIT IV -FIELD EFFECT TRANSISTORS 9

BJT versus FET - JFET and its types, construction and operation of n- channel and p-channel JFETs – characteristics curves – Effect of temperature on JFET parameters – FET characteristic parameters and specifications – FET data sheet specifications. FET applications – Testing of FETs.

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UNIT V - MOSFETS AND POWER DEVICES 9

MOSFETs: Depletion MOSFETs and Enhancement MOSFETs – Differences between JFETs and MOSFETs – Precaution in handling MOSFETs, MOSFET as a switch. Construction and operation of Power transistor, UJT, SCR, Diac, Triac and IGBT.

Course Outcomes:

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

CO1. Explain the construction and characteristics of PN junction diode.
CO2. Differentiate special diodes from PN junction diodes.
CO3. Explain the construction and characteristics of bipolar junction transistors.
CO4. Explain the construction and operation of Junction Field effect transistors.
CO5. Describe the operation of MOSFETs and basic power devices.

Text Books:

1. Millman.J, Halkias.C and SatyebrantaJit, "Electronic Devices & Circuits", TMH, 2nd Edition,New Delhi, 2008
2. Anil K.Maini, VarshaAgarwal, "Electronic Devices and Circuits", Wiley India Private Ltd, New Delhi, First Edition, 2015.

Reference Books:

1. Salivahanan.S, Suresh Kumar.N and Vallavaraj.A, "Electronic Devices and Circuits", Second Edition, TMH, New Delhi,2008.
2. Robert Boylestad and Louis Nashelsky, "Electron Devices and Circuit Theory", Pearson PrenticeHall, TenthEdition,2008.
3. Streetman Ben G. and Banerjee Sanjay, "Solid State Electronic devices", PHI, Sixth Edition, 2006
4. David A. Bell, "Electronic Devices and Circuits", Oxford, Fifth Edition, 2008

Web References:

1. http://nptel.ac.in/video.php?subjectId=117103063
2. http://nptel.ac.in/video.php?subjectId=117106091
3. www.youtube.com/watch?v=Wf19II0ts84

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Course Code:16CYT22	Course Title **ENGINEERING CHEMISTRY** (Common to ECE, EEE and EIE)	
General	**L:T:P:C**	**3 : 0 : 0 : 3**
Type:**Theory**	Total Contact hours:	**45**

Course Objectives:

The course is intended to:

1. Select batteries based on the life cycle, working principle and their applications.
2. Determine the rate of corrosion of a metal and identify appropriate control techniques.
3. Explain photo physical law and spectroscopic method of chemical analysis.
4. Explain the chemistry of water and specify the water treatment process.
5. Identify the behaviour of nanomaterials.

UNIT I -ELECTROCHEMISTRY AND BATTERIES **9**

Cells – Types of cells– Electrochemical and electrolytic cells – emf and its measurement – Nernst equation – Types of electrodes. Batteries – Characteristics, Classifications of batteries, Construction, working and applications - dry cells, Alkaline battery, Lead –Acid battery, Nickel-Cadmium battery, Lithium ion battery, Hydrogen -Oxygen Fuel Cell. Battery hazards and maintenance.

UNIT II - CORROSION AND ITS CONTROL **9**

Corrosion – dry and wet corrosion – mechanism of electrochemical corrosion – galvanic corrosion and concentration cell corrosion, Factors influencing corrosion. Corrosion Control methods – Cathodic protection methods, Corrosion inhibitors- Inorganic coating- Metallic coating – Galvanizing, Tinning – Organic coating. Electroplating of Silver and Electroless plating of Nickel

UNIT III -PHOTOCHEMISTRY AND SPECTROSCOPY **9**

Photo physical laws – Grotthus Draper law, Stark Einstein law and Beer Lamberts law, Photo process – Fluorescence, Phosphorescence, Chemi luminescence and Photosensitization (Phenomenon only). Spectroscopy – Electromagnetic spectrum, Absorption and Emission spectroscopy – UV – Visible Spectroscopy, Atomic Absorption Spectroscopy – Principle, Instrumentation and applications.

UNIT IV - WATER TECHNOLOGY **9**

Water quality parameters – Physical, Chemical and Biological characteristics of potable water, Water quality standards –WHO, Central Pollution Control Board, Hardness of water – types, expression of hardness – Determination of

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hardness by EDTA method –Boiler feed water and Boiler troubles. Water conditioning methods – Internal conditioning- Carbonate, Phosphate and Calgon Conditioning. External conditioning – demineralization, Reverse osmosis.Domestic Water Treatment.

UNIT V -SYNTHESIS AND APPLICATIONS OF NANO MATERIALS 9

Introduction – Difference between bulk and Nano materials – size dependent properties.Nano scale materials –particles, clusters, rods and tubes. Synthesis of Nanomaterials: Sol-gel process, Electro deposition, Hydrothermal and Self-combustion methods. Applications of Nano materials in Electronics and communication, Energy science and medicines.Risk and future perspectives of nanomaterials.

Course Outcomes:

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

CO1. Select batteries based on the life cycle, working principle and their applications.

CO2. Determine the rate of corrosion of a given metal in a given environment and identify appropriate control techniques to avoid corrosion.

CO3. Explain photo physical law and spectroscopic method of chemical analysis.

CO4. Explain the chemistry of water and specify the water treatment process.

CO5. Identify the behavior of nanomaterials based on size.

Text Books:

1. P. C. Jain and Monica Jain, "Engineering Chemistry", Sixteenth Edition, DhanpatRai Pub, Co., NewDelhi, 2006.
2. Engineering Chemistry, Second Edition, Wiley India Pvt. Ltd. New Delhi, 2011

Reference Books:

1. Larry Brown and Tom Holme, "Chemistry for Engineering Students", Third Edition, Cengage Learning, 2015
2. P.W. Atkins and de Paula Julio, "Physical Chemistry", Oxford University Press, Ninth Edition, (IndianStudent Edition) 2011
3. S.S. Dara, "A Text book of Engineering Chemistry", S. Chand & Co. Ltd., New Delhi, 2006.
4. Charles P. Poole, Jr., Frank J. Owens, "Introduction to Nanotechnology" Wiley India Pvt. Ltd. New Delhi,2003

Web References:

1. http://nptel.ac.in/courses/122101001/downloads/lec-23.pdf
2. http://nptel.ac.in/courses/118104008/
3. http://nptel.ac.in/courses/104105039/

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Course Code:16PCL21	Course Title : **ENGINEERING PHYSICS AND CHEMISTRY LABORATORY** (Common to ECE, EEE and EIE)	
General	**L:T:P:C**	**0 : 0 : 2 : 2**
Type:**Practical**	Total Contact hours:	**60**

Course Objectives:

The course is intended to:

1. Measure optical parameters of laser and optical fiber.
2. Estimate electrical properties of metal and semiconductor.
3. Estimate the total hardness of water.
4. Measure corrosion rate of a mild metal.
5. Determine the concentration of a solution through electrical method.

LIST OF EXPERIMENTS:

Engineering Physics Lab

1. Diode Laser-Determination of Wavelength and Particle size
2. Optical Fiber- Determination of Numerical aperture and acceptance angle
3. Lee's Disc Method – Determination of Thermal Conductivity of a bad conductor
4. Determination of Band gap of a semiconducting material
5. Characteristic of Light Dependent Resistor-Resistance –Illumination Characteristics
6. Carey Foster's Bridge-Determination of specific resistance of an alloy
7. Solar Cell- V-I Characteristics
8. Hall effect-Determination of Hall coefficient
9. Determination of dielectric constant

Engineering Chemistry Lab

1. Estimation of total hardness of water by EDTA method.
2. Estimation of iron in water by colorimetric method- verification of Beer- Lambert's Law.
3. Estimation of Fe2+ by potentiometric titration
4. Determination of strength of acid by pH metry
5. Determination of corrosion rate by weight loss method
6. Measurement of emf of electrochemical cell – potentiometry

Course Outcomes:

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

CO1. Measure optical parameters of laser and optical fiber
CO2. Estimate electrical properties of metal and semiconductor
CO3. Estimate the total hardness of water
CO4. Measure corrosion rate of a mild metal
CO5. Determine concentration of a solution through electrical method

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Text Books:

1. Engineering Physics Laboratory Manual by Dr.R.Jayaraman, V.Umadevi, S. Maruthamuthu and B.Saravanakumar.
2. Engineering Chemistry Laboratory Manual by Faculty, Chemistry Department, MCET.

Web References:

1. http://www.iitg.ernet.in/scifac/qip/public_html/cd_cell/chapters/p_k_giri_lab_manual/Physics_Lab_manual.pdf
2. http://www.gitam.edu/eresource/images/Engineering-Chemistrylab-Manual-GU.pdf

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Course Code:16EDL21	Course Title : ELECTRON DEVICES LABORATORY (Common to ECE, EEE and EIE)	
Core	L:T:P:C	0 : 0 : 4 : 2
Type: **Practical**	Total Contact hours:	**60**

Course Objectives:

The course is intended to:

1. Compute the forward and reverse resistances of a diode.
2. Analyze the input and output characteristics of a Bipolar Junction Transistor.
3. Examine the drain and transfer characteristics of JFET and MOSFET.
4. Observe the negative resistance region of a UJT.
5. Analyze the characteristics of Power devices.

LIST OF EXPERIMENTS:

1. Characteristics of PN junction diode
2. Characteristics of Zener diode
3. Testing of Transistors and Diodes.
4. Characteristics of CE configuration of a Transistor
5. Characteristics of CC configuration of a Transistor
6. Characteristics of JFET
7. Characteristics of MOSFET
8. Characteristics of UJT
9. Characteristics of SCR
10. Characteristics of Diac and Triac

Course Outcomes:

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

CO1. Compute the forward and reverse resistances from the acquired diode characteristics.

CO2. Analyze the input and output characteristics of a given bipolar junction transistor

CO3. Examine the drain and transfer characteristics of a given JFET and MOSFET

CO4. Observe the negative resistance region of a given UJT

CO5. Analyze the characteristics of power devices such as SCR, Diac and Triac.

Reference Books:

1. "Electron Devices Laboratory" manual prepared by Department of Electronics andCommunication Engineering.
2. David.A.Bell "Fundamentals of Electronic Devices and Circuits Lab manual", FifthEdition, Oxford University Press, New Delhi, 2009

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Course Code:16PSL22	Course Title: PROMOTION OF STUDENTS' WELLNESS (Common to CSE,ECE and IT)	
General	L:T:P:C	0 : 0 : 2 : 1
Type:PS	Total Contact hours:	30

Course Objectives:

The course is intended to:

1. Maintain physical wellbeing.
2. Maintain mental wellbeing.
3. Maintain social wellbeing.

UNIT I -PHYSICAL HEALTH

Physical structure and functions of human body – simplified physical exercises (hand exercises, Leg exercises, breathing exercises, eye exercises – kapalapathi – Maharasanas 1-2 – Massages – Acupuncture – relaxation – importance and benefits. Suryanamaskar.

UNIT II -MENTAL HEALTH

Maintenance of youthfulness and life force – kayakalpa yoga – anti ageing process – benefits. Mind and its functions – mind wave frequency – meditation process – Agna, shanthi, thuriam – benefits

UNIT III -PERSONALITY DEVELOPMENT – I

Purpose of life and analysis of thought – philosophy of life – introspection – practice. Moralization of desires and neutralization of anger – practices

UNIT IV -PERSONALITY DEVELOPMENT – II

Eradication of worries and benefits of blessings – wave theory –practices. Genetic centre – purification – cause and effect theory.

UNIT V –SOCIAL HEALTH

Greatness of guru – cultural education – love and compassion – fivefold culture.Greatness of friendship and social welfare – individual, family and world peace.

Course Outcomes:

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

CO1. Maintain physical wellbeing - grooming, BMI, flexibility, muscle strength, body compositions (vatha, pitha, kapa)

CO2. Maintain mental wellbeing - perceptions, attention/concentration, memory, gunas

CO3. Maintain social wellbeing - etiquettes, emotional and psychological aspects, stress management, morality and values

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Text Books:

1. Vethathiri Maharishi Institute for Spiritual and Intuitional Education, Aliyar "Value education for harmonious life (Manavalakalai Yoga)", Vethathiri Publications, Erode, First Edition,2010

Reference Books:

1. Dr.R.Nagarathna, Dr.H.R.Nagendra, "Integrated approach of yoga therapy for positive health", Swami Vivekananda Yoga Prakashana, Bangalore, 2008 Edition.
2. Dr.R.Nagarathna, Dr.H.R.Nagendra, "New perspectives in stress management", Swami Vivekananda Yoga Prakashana, Bangalore, First Edition, June 1986.

OPERATIONAL MODALITIES

Orientation programme

Theory and practice demonstration

3 days - 7 hours /day for syllabus coverage

Follow-Up Practice

12 weeks x 2 hours/week: 24 hours

Evaluation:

Continuous evaluation:

Physical Exercises, Kaya kalpa practice, meditation	= 40 marks
Introspection (assessment of students workbook)	= 20 marks
Total	= 60 marks

Semester end examination:

Written test (MCQ and short answers)	= 30 marks
Physical exercises, meditation	= 50 marks
Viva-voce	= 20 marks
Total	= 100 marks

End semester mark out of 100 is reduced to 40 marks

The student should get a total of 50 marks put together for a pass.

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DIMENSIONS AND TOOLS IN MEASUREMENT

Dimension	Sub dimension	Measurement tools
Physical	BMI	Electronic Weighing Machine, Height Measurement
	Flexibility	Sit & Reach
	Muscle Strength	Handgrip Dynamometer
	Prakruti	Dr Ramakrishna's Prakruti Questionnaire
Mental	Perception	Critical Flicker Fusion
	Attention	Digit Letter substitution Test
		Six Letter Cancellation Test
		Stroop Test
	Memory	Digit backward & Forward
Social	Interpersonal Effectiveness & Self Concept	FIRO B
	Psychological Well Being	Short wellbeing scale
		Short Happiness scale
		Barrat Impulsive Scale

END OF SEMESTER II

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Course Code:16MAT32	Course Title : LINEAR ALGEBRA AND NUMERICAL METHODS (Common to III sem ECE, IV sem EEE & EIE)	
Core	L:T:P:C	3:2:0:4
Type:Theory	Total Contact hours:	75

Prerequisites: The student should have undergone the course(s):

- 16MAT13-Engineering Mathematics – I
- 16MAT23-Engineering Mathematics - II

Course Objectives:

The course is intended to:

1. Explain the basic concepts of vector spaces.
2. Formulate orthonormal basis.
3. Solve the system of equations &Calculate the dominant Eigen value.
4. Predict the unknown values from the given set of data &Compute derivatives and integrals.
5. Solve ordinary and partial differential equations.

UNIT I -VECTOR SPACES **9+6**

System of linear equations -Vector spaces- Subspace of a vector space- basis and dimension of vector space - linear combination and spanning sets of vectors -linear independence and linear dependence of vectors-Row space, Column space and Null space- Rank and nullity of subspaces.Applications to linear equations: Simple electrical network problems to find loop current using Kirchhoff's voltage law.

UNIT II -ORTHOGONALITY AND INNER PRODUCT SPACES **9+6**

Inner product of vectors: length of a vector, distance between two vectors, and orthogonality of vectors-Orthogonal projection of a vector-Gram-Schmidt process to produce orthogonal and orthonormal basis -Inner product spaces-Fourier approximation of continuous functions using inner product spaces.

UNIT III - SOLUTION OF EQUATIONS AND CURVE FITTING **9+6**

Solution of system of linear equations-Direct method: Gaussian elimination method, Iterative methods: Gauss-Seidel - sufficient conditions for convergence. Power method to find the dominant Eigen value and the corresponding Eigen vector. Non-linear equation: Newton method, order of convergence. Curve fitting: Method of least squares.

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UNIT IV -INTERPOLATION, NUMERICAL DIFFERENTIATION AND INTEGRATION 9+6

Unequal intervals: Lagrange's interpolation, Equal intervals: Newton's forward, backward interpolation – Numerical Differentiation. Numerical Integration – Trapezoidal rule – Simpson's 1/3 rule

UNIT V -NUMERICAL SOLUTION OF ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 9+6

Solution of first order ordinary differential equations: Taylor's series, Euler's method, Runge-Kutta method of fourth order- Multistep method: Adam's method.Classification of Partial differential equations- Numerical solution of Laplace equation and Poisson equation by Liebmann's method - solution of one dimensional heat flow equation - Bender - Schmidt recurrence relation.

Course Outcomes:

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

CO1. Explain the basic concepts of vector spaces.
CO2. Formulate orthonormal basis using inner product of vectors
CO3. Solve the linear and non-linear equations & Calculate the dominant Eigen value using numerical techniques
CO4. Predict the unknown values from the given set of data &Compute derivatives and integrals by applying various numerical techniques
CO5. Solve ordinary and partial differential equations using numerical techniques.

Text Books:

1. David C Lay, "Linear Algebra and its Applications", ThirdEdition, Pearson Education, 2009.
2. Simantha Pal and Subodh C. Bhunia, "Engineering Mathematics", First Edition, Oxford University Press, New Delhi, 2015.

Reference Books:

1. Gilbert Strang, "Linear algebra and its Applications", Fourth Edition, Cengage Learning IndiaPrivate Limited, 2012.
2. Jain M. K., Iyengar, S. R. and Jain, R. K, "Numerical Methods for Scientific and EngineeringComputation", Fifth Edition., New age International Publications, 2007.
3. Gerald C.F., and Wheatley P.O., "Applied Numerical Analysis", Sixth Edition, Pearson EducationAsia, New Delhi, 2006.
4. Grewal, B.S. and Grewal, J. S., Numerical methods in Engineering and Science, Sixth Edition,Khanna Publishers, New Delhi, 2004.

Web References:

1. http://nptel.ac.in/courses/122104018/node2.html
2. http://nptel.ac.in/courses/111105038/

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Course Code:16ECT31	Course Title : NETWORK THEORY	
Core	L:T:P:C	3:2:0:4
Type:**Theory**	Total Contact hours:	**75**

Prerequisites: The student should have undergone the course(s):

- 16GET15*- Fundamentals of Electrical Engineering
- 16GET15R – Introduction to Engineering

Course Objectives:

The course is intended to:

1. Analyze DC circuits
2. Analyze AC circuits
3. Explain the significance of resonance and coupled circuits
4. Compute steady state and transient response
5. Describe the two port network parameters &Design constant - k filters

UNIT I -DC CIRCUIT ANALYSIS **9+6**

Kirchoff's laws –Mesh and node method of analysis– Source transformation - Star delta conversion – Network theorems–Thevenin's and Norton's theorem, Superposition Theorem, Maximum power transfer theorem, Reciprocity theorem.

UNIT II -AC CIRCUIT ANALYSIS **9+6**

Mesh and node method of analysis – Source transformation - Star delta conversion – Network theorems–Thevenin's and Norton's theorem, Superposition Theorem, Maximum power transfer theorem, Reciprocity theorem

UNIT III -RESONANCE AND COUPLED CIRCUITS **9+6**

Series resonance-Voltage and Current in a series resonance, Impedance and phase angle. Parallel resonance-Resonant frequency - Variation of Impedance with frequency, Q factor, coupled circuits- mutual inductance, Coefficient of coupling, Tuned circuits. (Single tuned only)

UNIT IV -TRANSIENT RESPONSE OF NETWORKS **9+6**

Steady state and Transient response - DC response of an R-L, R-C and R-L-C circuits. Sinusoidal response of R-L, R-C and R-L-C circuits (using differential equations only for both DC and AC).

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UNIT V -TWO PORT NETWORKS AND FILTERS 9+6

Two port Network - Network parameters, Impedance, Admittance, ABCD and Hybrid parameters.
Classification of filters – Ideal filters- Cut off frequencies – Attenuation – Characteristic impedance – Constant-k filters: Design of Low pass and High pass filters. Bandpass and Band elimination filters.

Course Outcomes:

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

CO1. Analyze DC circuits using various network theorems
CO2. Analyze AC circuits using various network theorems
CO3. Explain the significance of resonance and coupled circuits in the network.
CO4. Compute steady state and transient response of AC and DC circuits using differential equations.
CO5. Describe the two port network parameters and design the different types of constant –k filters.

Text Books:

1. William H. Hayt and Jack E. Kemmerly, "Engineering Circuit Analysis ", McGraw HillEdition, 2006.
2. A Sudhakar, S Shyammohan and Pillai, "Circuits and Network (Analysis and synthesis)",TataMcGraw-Hill, 2004.

Reference Books:

1. SmarajitGhosh,"Network Theory Analysis and Synthesis", Prentice Hall of India, New Delhi, 2011.
2. Soni ML. & Gupta J.C., "A Course in Electrical Circuit Analysis ", Dhanpath Rai and Sons, New Delhi, 2000.
3. M.Arumugham and N.Premkumar, "Electric Circuit Theory", Khanna publishers, 2010.
4. Joseph Edminister and MahmoodNahri, "Electric Circuits ", Third Edition,TataMcGrawHill, New Delhi, 1999.

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1. http://nptel.ac.in/video.php?subjectId=108102042
2. http://nptel.ac.in/courses/108102042/
3. http://nptel.ac.in/courses/108105053/
4. http://freevideolectures.com/Course/2336/Circuit-Theory/

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Course Code:16ECT32	Course Title : ELECTRONIC CIRCUITS-I	
Core	L:T:P:C	3:0:0:3
Type:**Theory**	Total Contact hours:	**45**

Prerequisites: The student should have undergone the course(s):

- 16GET15-Fundamentals of Electrical Engineering
- 16GET15R – Introduction to Engineering
- 16GET24-Electron Devices

Course Objectives:

The course is intended to:

1. Choose appropriate biasing circuits
2. Analyze the low frequency amplifier circuits
3. Calculate bandwidth and gain of amplifiers
4. Choose the relevant power amplifiers
5. Design fixed voltage power supply circuits

UNIT I - TRANSISTOR BIASING **9**

Need for biasing - DC and AC Load lines - Biasing Techniques: Fixed Bias, Feedback Bias and Self-Bias–Bias stabilization - Bias Compensation - Thermistor and Sensistor Compensation. JFET and MOSFET Biasing: Voltage divider bias.

UNIT II -SMALL SIGNAL ANALYSIS OF AMPLIFIERS **9**

Small signal Analysis of BJT Amplifiers: h-parameter model of BJT- Analysis of Transistor amplifier - CE Amplifier- CB Amplifier- CC Amplifier. BJT Differential amplifier – CMRR-Small signal analysis of FET Amplifiers: Common source and Common drain amplifiers.

UNIT III -HIGH FREQUENCY ANALYSIS OF AMPLIFIERS **9**

HF response of Common emitter amplifier-Hybrid π model- short circuit current gain – Definition of Cut off frequencies and bandwidth- CE current gain with resistive load.Miller's Theorem- HF response of Common collector amplifier.High frequency response of Common source FET amplifier.

UNIT IV -LARGE SIGNAL AMPLIFIERS **9**

Classification of Large signal amplifiers: Class A- direct coupled and transformer coupled.Class B- push pull and complementary symmetry –Cross over distortion- Class AB and Class C Power amplifiers.

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UNIT V - RECTIFIERS AND POWER SUPPLIES 9

Rectifiers: Half wave rectifier, Full wave rectifier and Bridge rectifier – Filters: Capacitor, Inductor, LC filter and CLC filter- Voltage regulators: series and shunt- Switched Mode Power Supply.

Course Outcomes:

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

CO1. Choose appropriate biasing circuits for BJT and MOSFET amplifiers
CO2. Analyze the low frequency amplifier circuits using h – parameters
CO3. Calculate the bandwidth and gain of the amplifiers using hybrid π model
CO4. Choose the relevant power amplifiers for the required application
CO5. Design fixed voltage power supply circuits using suitable regulators

Text Books:

1. Millman J, Halkias .C and Satyabratajit, "Electronic Devices and Circuits", Second Edition,TataMcGraw-Hill, New Delhi, 2007
2. Anil K.Maini and Varsha Agarwal, "Electronic Devices and Circuits", Wiley India Private Ltd, New Delhi, 2009.

Reference Books:

1. S. Salivahanan, N. Suresh Kumar and A. Vallavaraj, "Electronic Devices and Circuits", Second Edition, Tata McGraw-Hill, New Delhi, 2007
2. David A. Bell, "Electronic Devices and Circuits", Fourth Edition, PHI, New Delhi, 2007
3. Robert L Boylestead and Louis Nashelsky, "Electronic Devices and Circuit Theory"Ninth Edition Pearson Education, New Delhi, 2006.
4. Theodove F. Bogart, Jeffry.S.Beaslen and Guillermo Rico, "Electronic Devices and Circuits"Pearson Education, New Delhi, 2004

Web References:

1. http://nptel.ac.in/video.php?subjectId=117103063
2. http://www.vidyarthiplus.in/2011/11/electronic-device-and-circuits-edc.html
3. http://nptel.ac.in/video.php?subjectId=122106025

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Course Code:16EET31	Course Title : DIGITAL ELECTRONICS (Common to ECE, EEE& EIE)	
Core	L:T:P:C	3:0:2:4
Type: **Theory**	Total Contact hours:	**75**

Prerequisites: The student should have undergone the course(s):

- 16GET24-Electron Devices

Course Objectives:

The course is intended to:

1. Illustrate the number systems, Boolean laws and logic families.
2. Design combinational Circuits.
3. Design synchronous sequential circuits.
4. Design asynchronous sequential circuits.
5. Develop Verilog programming.

UNIT I- BOOLEAN ALGEBRA AND LOGIC FAMILIES **9**

Number System: Review of decimal, binary, octal and hexadecimal numbers – Complements: 1's and 2's – Arithmetic operation of Signed binary numbers - Digital Logic Gates – Universal gate Implementation.
Boolean algebra: Basic Theorems, properties and simplification of Boolean functions– Representation of Boolean functions in Canonical and standard forms.
Digital Logic Families: Characteristics and operation of TTL, ECL and CMOS.

UNIT II - COMBINATIONAL LOGIC **9**

Minimization Techniques: Simplifications of Boolean expression using K map method and McCluskey method.
Combinational Circuits: Design Procedure of Adder, Subtractor, Comparators, Code converters, Encoders, Decoders, Multiplexers and De-multiplexers – System level design.

UNIT III- SYNCHRONOUS SEQUENTIAL LOGIC **9**

SR Latch - **Flip flops**: SR, JK, T, D – Level and Edge Triggering – Analysis of sequential circuits - Design of sequential circuits with state diagram, state table, state reduction and state assignment – **Registers:** Shift registers – **Counters:** Ripple counter, Synchronous counter, Design of synchronous counter.

UNIT IV - ASYNCHRONOUS SEQUENTIAL LOGIC **9**

Analysis of Asynchronous Sequential Circuits - Design of Asynchronous Sequential Circuits with primitive flow table, state reduction and state assignment – Races, Cycles and Hazards: Static, Dynamic, Essential, Hazards elimination.

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UNIT V- INTRODUCTION TO VERILOG HDL

Basic concepts: Operators, arrays - modules and port definitions –**Modeling:** Gate level, data flow and behavioral- **Design of Combinational and Sequential circuits:** 4 bit Full Adder, 3 x 8 Decoders,8 x 3 Encoders, 4 to 1 Multiplexer, 1 to 4 De-multiplexer and Flip-flops.

Course Outcomes:

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

CO1. Illustrate the number systems, Boolean laws and logic families used in digital design

CO2. Design combinational Circuits using simplification techniques

CO3. Design synchronous sequential circuits using flip-flops

CO4. Design an asynchronous sequential circuit eliminating hazards and races.

CO5. Develop Verilog programming to design combinational and sequential circuits.

Text Books:

1. Morris Mano. M., "Digital Design", Third Edition, Pearson Edn., 2001.
2. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis, Volume 1", Second Edition, Prentice Hall Professional, 2003.

Reference Books:

1. Anil.K.Maini, "Digital Electronics", First Edition, Wiley India Pvt, Ltd., 2011
2. Donald D. Givone, "Digital Principles and Design", TMH, 2003
3. Salivahanan. S and Arivazhagan. S., "Digital Circuits and Design", FourthEdition, Vikas Publishing House Pvt. Ltd, New Delhi, 2012.
4. Bhasker. J., "A Verilog HDL Primer", Second Edition, B.S.Publications,2001

Web References:

1. http://web.iitd.ac.in/~shouri/eel201/lectures.php
2. http://www.learnabout-electronics.org//Digital/dig10.php
3. http://nptel.ac.in/courses/117103064/
4. http://www.ni.com/example/14493/en/
5. http://www.electrical4u.com/digital-electronics/
6. http://www.allaboutcircuits.com/textbook/digital/

LIST OF EXPERIMENTS: **30**

1. Simplification of the Boolean expression using K-Map and its implementation.
2. Design of full adder and subtractor using logic gates.
3. Design of Encoder using logic gate
4. Design of Multiplexer using logic gates
5. Design of binary counter
6. Simulation of Shift registers
7. Design of Simple Programs for Combinational circuits using verilog HDL and verify using simulation
8. Design of Simple Programs for Synchronous Sequential Circuits using verilog HDL and verify using simulation

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Course Code:16ECT33	Course Title : ELECTRO MAGNETIC FIELDS	
Core	L:T:P:C	4:0:0:4
Type:**Theory**	Total Contact hours:	**60**

Prerequisites: The student should have undergone the course(s):

- 16MAT23-Engineering Mathematics – II
- 16PHT23 -Material Science

Course Objectives:

The course is intended to:

1. Apply vector calculus to examine static electric fields.
2. Apply vector calculus to examine static magnetic fields.
3. Distinguish the effects of electric and magnetic fields.
4. Examine time varying electric and magnetic fields.
5. Analyze the phenomena of wave propagation.

UNIT I- STATIC ELECTRIC FIELD **12**

Review of vector algebra, Introduction to co-ordinate systems , Gradient , Divergence , Curl , Divergence theorem, Stokes theorem , Coulombs law , Electric field intensity , Principle of superposition , Electric scalar potential, Electric flux density, Gauss's law and its application, Numerical examples.

UNIT II- STATIC MAGNETIC FIELD **12**

The Biot – Savart law and applications, Magnetic flux Density and Field intensity, Gauss law for magnetic fields, Amperes law and its applications. Torque, Magnetic moment and Magneto motive force - Numerical examples.

UNIT III- ELECTRIC AND MAGNETIC FIELDS IN MATERIALS **12**

Nature of dielectric materials, Permittivity, Polarization, Boundary relation, Capacitance, Dielectric strength, Energy and Energy density, Poisson and Laplace equation and their application.

Nature of magnetic materials, Permeability, Vector potential, Boundary relation, Inductance, Energy in an Inductor and Energy density.

UNIT IV-TIME VARYING ELECTRIC AND MAGNETIC FIELDS **12**

Faraday's law – Displacement current density - Maxwell's equations in point form and integral form, Applications of Maxwell's equations, Poynting Vector and its interpretation.

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UNIT V- UNIFORM PLANE EM WAVES IN ISOTROPIC MEDIA

Uniform plane waves in perfect dielectric, conductors, free space, Linear, Elliptical and Circular polarization, Normal incidence of Uniform Plane waves: Conductor-Conductor interface, Dielectric-Dielectric interface, Dielectric-Conductor interface. Oblique incidence on a plane boundary for perpendicular polarization, Dielectric-Conductor interface.

Course Outcomes:

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

- CO1. Apply vector calculus to examine static electric fields in the given situation.
- CO2. Apply vector calculus to examine static magnetic fields in the given situation.
- CO3. Distinguish the effects of electric and magnetic fields in the boundary of different media.
- CO4. Examine time varying electric and magnetic fields using Maxwell's Equation.
- CO5. Analyze the phenomena of wave propagation in different media and it's interfaces using wave equations.

Text Books:

1. W.H.Hayt and A.Buck, "Engineering ElectroMagnetics", Fifth Edition, Mcgraw Hill, 2010.
2. Edward C Jordan and Keith G Balmain, "Electromagnetic Waves and Radiating Systems", Second Edition,Prentice Hall of India,2006.

Reference Books:

1. David. K.Cheng, "Field and wave Electromagnetics", Second Edition, Pearson education, 2004.
2. Karl E.Longman and Sava V.Savov, "Fundamentals of Electro-Magnetics", Prentice Hall of India, 2006
3. Kraus, Fleisch, "Electromagnetics with Applications", McGraw-Hill, 2005
4. Mathew.N.O.Sadiku, "Elements of Electromagnetics", Fourth edition, Oxford University Press, 2009

Web References:

1. http://nptel.ac.in/video.php?subjectId=108106073
2. http://ocw.mit.edu/resources/res-6-001-electromagnetic-fields-and-energy-spring-2008/
3. http://nptel.ac.in/courses/117103065/

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Course Code:16CST35	Course Title : DATA STRUCTURES AND OBJECT ORIENTEDPROGRAMMINGWITH C++ (Common to ECE &EEE)	
Core	L:T:P:C	3:0:0:3
Type:**Theory**	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16GET14- C- Programming

Course Objectives:

The course is intended to:

1. Write simple C++ programs.
2. Write advanced C++ programs.
3. Implement linear data structures and sorting & searching algorithms.
4. Implement non-linear data structures such as Trees and Graphs.
5. Explain Data mining in Knowledge discovery process.

UNIT I – PRINCIPLES OF OBJECT ORIENTED PROGRAMMING 8

Introduction - Tokens - Control Structures – Functions &Pointers – Concepts of OOP-Classes and Objects - Constructors and Destructors - Inheritance.

UNIT II-ADVANCED OBJECT ORIENTED PROGRAMMING 9

Polymorphism – Overloading: Function loading & Operator overloading - Overriding-Virtual Functions - File Handling: Read & Write operations – Introduction to Exception Handling.

UNIT III-LINEAR DATA STRUCTURES 11

Algorithm Analysis - Abstract Data Types - List ADT- Array and Linked List Implementation – Stack ADT - Queue ADT – Applications of Linear Data structure-Sorting Techniques: Bubble sort - Merge sort - Quick sort -Searching Techniques: Linear Search – Binary Search.

UNIT IV-TREES AND GRAPHS 9

Trees: Binary Trees - Binary Search Tree ADT - Graph Algorithms: Topological Sort – Single Source Shortest Path Algorithm - All Pairs Shortest Path Algorithm – Minimum Spanning Tree - Prim's and Kruskal's Algorithm.

UNIT V-INTRODUCTION TO DATA MINING 8

Data Mining Overview – Knowledge Discovery in Databases process – Different Kinds of Data – Kinds of Patterns Mined – Technologies Used – Kinds of Applications – Issues in Data Mining – Data Warehouse Basic Concepts.

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Course Outcomes:

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

CO1. Write C++ programs using Inheritance paradigms.

CO2. Write C++ programs using polymorphism, File and Exception handling operations.

CO3. Implement linear data structures and Sorting & Searching algorithms

CO4. Implement non-linear data structure such as Trees, Graphs

CO5. Explain Data mining in Knowledge discovery process and its applications

Text Books:

1. Robert Lafore,ObjectorientedprogramminginC++,GalgotiaPublication,NewDelhi, Third Edition, 2001
2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Pearson Education Asia, New Delhi, Third Edition, 2007.
3. Jiawei Han,Micheline Kamber,Jian Pei, "Data Mining concepts and Techniques",Elsevier,Third Edition, 2012.

Reference Books:

1. Balagurusamy.E,"Object Oriented Programming withC++", Tata McGraw Hill, New Delhi, Fourth Edition, 2008.
2. AlfredV.Aho,JohnE.HopcroftandJeffryD.Ullman,DataStructuresandAlgorithms, Pearson Education, New Delhi, 2006
3. Ellis Horowitz, sartaj Sahni,Dinesh Mehta "Fundamentals of Data Structures in C++", Galgotia Publication, NewDelhi, Third Edition,2009.
4. Seymour Lipschutz, "Data Structures", McGraw-Hill, New Delhi, Third Edition, 2007.
5. MichaelBerthold,David J.Hand,"IntelligentDataAnalysis",Springer,Second Edition, 2007.

Web References:

1. http://www.tutorialspoint.com/cplusplus/cpp_object_oriented.html
2. http://www.nptel.ac.in/syllabus/syllabus.php?subjectId=10610127
3. http://www.cosc.canterbury.ac.nz/mukundan/dsal/appldsal.html
4. https://www.cs.usfca.edu/~galles/visualization/Algorithms.html
5. http://freevideolectures.com/Course/2279/Data-Structures-And-Algorithms

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Course Code:16ECL31	Course Title : ELECTRONIC CIRCUITS- I LABORATORY	
Core	L:T:P:C	0:0:4:2
Type: **Practical**	Total Contact hours:	**60**

Prerequisites: The student should have undergone the course(s):

- 16EDL21-Electron Devices Laboratory

Course Objectives:

The course is intended to:

1. Examine the output waveforms of Rectifiers
2. Estimate the bandwidth of Transistor amplifiers
3. Construct CC and CD amplifiers
4. Construct power amplifiers using BJTs
5. Construct voltage regulators

LIST OF EXPERIMENTS:

1. Half wave and Full wave rectifier with simple capacitor filter.
2. Fixed Bias amplifier circuit using BJT
3. Common Emitter amplifier using voltage divider bias
4. Common Source amplifier using voltage divider bias
5. Frequency response characteristics of Two stage RC coupled amplifier
6. Common Collector amplifier
7. Common Drain amplifier
8. Class A Power Amplifier
9. Class B Complementary symmetry power amplifier
10. Series and Shunt voltage regulators

Course Outcomes:

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

1. Examine the output waveforms of Rectifiers with simple capacitor filter
2. Estimate the bandwidth of fixed and self-biased Transistor amplifiers
3. Construct CC and CD amplifiers& draw their frequency response characteristics
4. Construct power amplifiers using BJTs and estimate their efficiencies.
5. Construct voltage regulators and sketch their regulation characteristics.

Reference Books:

1. "Electronics Circuits – I Laboratory" manual prepared by Department of Electronics and Communication Engineering.
2. David.A.Bell, "Fundamentals of Electronic Devices and Circuits Lab manual", FifthEdition, Oxford University Press, New Delhi, 2009.

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Course Code:16CSL32	Course Title : DATA STRUCTURES AND OBJECT ORIENTEDPROGRAMMING WITH C++ LABORATORY(Common to ECE & EEE)	
Core	L:T:P:C	0:0:4:2
Type: **Practical**	Total Contact hours:	**60**

Prerequisites: The student should have undergone the course(s):

- 16GET14 -C Programming

Course Objectives:

The course is intended to:

1. Implement object oriented concepts.
2. Implement linear and non-linear data structures.
3. Implement sorting methods.
4. Implement searching methods.
5. Implement classification and clustering methods.

LIST OF EXPERIMENTS:

1. Basic Programs for C++ Concepts using classes and objects.
2. Basic Programs for C++ Concepts using Inheritance, Constructors, Destructors, Polymorphism
3. Array based implementation of List ADT
4. Array based implementation of Stack ADT and Queue ADT
5. Linked list implementation of Singly / Double Linked List
6. Implementation of Binary Search Tree
7. Implementation of Dijkstra's / Floyd's Algorithms
8. Implementation of Prim's / Kruskal's Algorithms
9. Implementation of Sorting / Searching Algorithms
10. Implementation of Classification / Clustering Method

Course Outcomes:

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

CO1. Implement object oriented concepts.
CO2. Implement linear and non-linear data structures.
CO3. Implement sorting methods.
CO4. Implement searching methods.
CO5. Implement classification and clustering methods.

Reference Books:

1. "Data structures and object oriented Programming with C++ Laboratory" manual prepared by Department of Computer Science and Engineering.

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Course Code:16PSL31	Course Title : PERSONAL EFFECTIVENESS	
General	L:T:P:C	0:0:2:1
Type:PS	Total Contact hours:	30

Course Objectives:

The course is intended to:

1. Identify the strengths, weaknesses and opportunities
2. Set goals for academics, career, and personal aspirations
3. Establish the road map for goals
4. Apply time management techniques
5. Create time and pursue activities of self-interest

UNIT I- THE IMPORTANCE OF ENVISIONING

Importance of positive self-perception – Principle of dual creation (Everything gets created twice – Envisioning) - Understanding vision and mission statements - Writing personal mission statements – 'Focus' as a way of life of most successful people – Importance of goal setting –Importance of planning and working to time.

UNIT II-FUNDAMENTAL PRINCIPLES OF GOAL SETTING AND WORKING TO TIME

Clarifying personal values, interests and orientations – Awareness of opportunities ahead – Personal SWOT analysis - Principles driving goal setting: Principle of response and stimuli, Circle of influence and circle of concern, what you see depends on the role you assume.

UNIT III-GOAL SETTING AND ACTION ORIENTATION

Potential obstacles to setting and reaching your goals - Five steps to goals setting: SMART goals, Inclusive goals, Positive stretch, Pain vs. gain, Gun-point commitment – Importance of action orientation - Converting goals to actionable tasks – Establishing road map – Using Gantt chart for planning and progress.

UNIT IV- TIME MANAGEMENT - TOOLS AND TECHNIQUES

. Pareto 80-20 principle of prioritization – Time quadrants as a way to prioritize weekly tasks – The glass jar principle - Handling time wasters – Assertiveness, the art of saying 'NO' – Managing procrastination.

UNIT V-PUTTING INTO PRACTICE

Practical's: Using the weekly journal – Executing and achieving short term goals – Periodic reviews

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Course Outcomes:

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

CO1. Identify the strengths, weaknesses and opportunities

CO2. Set well-articulated goals for academics, career, and personal aspirations

CO3. Establish the road map to realize the goals

CO4. Apply time management techniques to complete planned tasks on time

CO5. Create time and pursue activities of self-interest that add value

Course Handouts: (compiled by PS team, MCET)

1. Learner's workbook
2. Personal efficiency Journal
3. Reading material for Personal Effectiveness

Further Reading:

1. Stephen R Covey, "First things first", Simon & Schuster UK, Aug. 1997.
2. Sean Covey, "Seven habits of highly effective teenagers", Simon & Schuster UK, 2004
3. College student's guide to time management (e-book)
4. Michael S Dobson, Susan B Wilson, "Goal setting" (e-book)

OPERATIONAL MODALITY

Enablement through learning workshops	Conducted by external experts and trained internal faculty	2 days7 hours each	14 hours
Progress monitoring (face to face interaction with student and checking workbook/Journal	Internal faculty	1 hour per week for a minimum of 10 weeks	10 hours
Mid semester reinforcement-workshop	External expert	1 day	6 hours
Total			30 hours
No: of credits			1

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ASSESSMENTS:

Assessment	Details	Weig htage	Administ ration	By Whom	When
Knowledge Test*	Multiple choice questions (20)	20%	Pen and paper	Internal team	Immediately after the initial workshop
Final comprehensi ve Knowledge test*	Multiple choice questions (40)	30%		Internal team	End of semester
Scenario based knowledge test*	Multiple choice scenario responses (15)	30%	Pen and paper	Internal team	Immediately after mid-semester reinforce-ment
Review of student journal	Student held journal with enough pages for the whole semester	10%	Student journals to be reviewed	Trained Internal faculty	Once in a week.
Review of student journal by external expert		10%	Student journal compre-hensive review	External expert and Internal reviewer	End of semester

END OF SEMESTER III

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SEMESTER IV

Course Code:16MAT42	Course Title : PROBABILITY THEORY AND STATISTICS (Common to IV sem ECE & Elective – EEE)	
General	L:T:P:C	3 : 2 : 0 : 4
Type:Theory	Total Contact hours:	75

Prerequisites: The student should have undergone the course(s):

- 16MAT13-Engineering Mathematics-I
- 16MAT23-Engineering Mathematics-II

Course Objectives:

The course is intended to:

1. Explain the concepts of discrete and continuous random variables.
2. Calculate probability for the given target:
3. Compute Correlation, Covariance and regression coefficients for the given data.
4. Test the hypothesis for the given small and large samples.
5. Test the samples based on the analysis of variance for design experiments.

UNIT I- PROBABILITY THEORY AND RANDOM VARIABLES **9+6**

Probability theory –Axioms of probability- conditional probability- Baye's Theorem.

Random Variables – Discrete random variables – Probability mass function, cumulative distribution function, expectations, variances-Moment generating functions.

Continuous random variables - Probability density functions- expectations and variances of continuous random variables-Moment generating functions.

UNIT II- STANDARD DISTRIBUTIONS **9+6**

Discrete Distributions- Binomial, Poisson and Geometric distributions – Properties - moment generating functions.

Continuous Distributions - Normal, Uniform and Exponential and Rayleigh distributions, distribution – Properties - Moment generating functions.

UNIT III- TWO DIMENSIONAL RANDOM VARIABLES **9+6**

Two dimensional Random Variables – Marginal and conditional distributions – Covariance – Correlation- Regression.

UNIT IV- TEST OF HYPOTHESES **9+6**

Statistical hypothesis –Large sample test based on Normal distribution for single mean, proportion and difference of means, proportions.

Small sample test based on t distribution- Mean and difference of means-

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F test for variances-Chi-square for Goodness of fit and independence of attributes.

UNIT V- DESIGN OF EXPERIMENTS **9+6**

Aim of Design of experiments- Basic Principles of Experimental Design – Completely Randomized Design (C.R.D) - Analysis of variance (ANOVA) - Analysis of variance for one factor of Classification – Randomized Block Design (R.B.D) – Latin square Design (L.S.D) – Comparison of RBD and LSD.

Course Outcomes:

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

CO1. Explain the concepts of discrete and continuous random variables.
CO2. Calculate probability for the given target of discrete and continuous probability distributions based on their properties.
CO3. Compute Correlation, Covariance and regression coefficients for the given data in two dimensional random variables based on their properties.
CO4. Test the hypothesis for the given small and large samples based on their mean and variance.
CO5. Test the samples based on the analysis of variance for design experiments such as completely randomized design, Randomized Block Design and Latin square Design using ANOVA table.

Text Books:

1. J. Ravichandran, "Probability and Statistics for Engineers", Wiley India, New Delhi, 2012.
2. T.Veerarajan, "Probability, statistics and Random process", Tata McGraw Hill, New Delhi, 2007.

Reference Books:

1. R.E. Walpole, R.H. Myers, S.L. Myers, and K Ye, "Probability and Statistics for Engineers AndScientists", Pearson Education, Asia, EigthEdition, 2007.
2. M.R. Spiegel, J. Schiller and R.A. Srinivasan, "Schaum's Outlines Probability and Statistics", Tata McGraw Hill edition, 2004.
3. Johnson.A and Gupta. C.B., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education Asia, Seventh Edition, 2007.
4. Peyton Peebles, "Probability, Random variables and Random signal principles", Fourth Edition, Tata McGraw Hill, New Delhi, 2002.

Web References:

1. http://nptel.ac.in/courses/111105041/1
2. http://ocw.mit.edu/courses/mathematics/18-05-introduction-to-probability-and-statistics- spring-2014/

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Course Code:16ECT41	Course Title : ELECTRONIC CIRCUITS- II	
Core	L:T:P:C	3 : 0 : 0 : 3
Type:Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16ECT32- Electronic Circuits - I

Course Objectives:

The course is intended to:

1. Design feedback amplifiers.
2. Design Oscillators.
3. Analyze Tuned Amplifiers.
4. Design wave shaping circuits.
5. Analyze blocking oscillators.

UNIT I- FEEDBACK AMPLIFIERS 9

Introduction- Types of Feedback- The four basic feedback topologies - Input and Output resistances with Negative feedback - Method of identifying feedback topology - Analysis of feedback amplifiers.

UNIT II- OSCILLATORS 9

Classification of Oscillators - Barkhausen Criterion – General form of an LC Oscillator – Hartley and Colpitts oscillators- RC Phase shift Oscillator – Wein bridge oscillator - Crystal Oscillators

UNIT III- TUNED AMPLIFIERS 9

Introduction-Single tuned amplifier— Effect of cascading single tuned amplifiers on bandwidth – Stagger tuned amplifiers –Class C tuned amplifier- Stability of tuned amplifiers - Neutralization - Hazeltine neutralization and Rice neutralization

UNIT IV- WAVE SHAPING AND MULTIVIBRATOR CIRCUITS 9

Integrator and Differentiator circuits- Diode clippers and clampers- Collector coupled Astable multivibrator- Monostable multivibrator- Bistable multivibrator- Schmitt Trigger. Voltage time base generators: Miller and Bootstrap circuits - UJT saw tooth waveform generator.

UNIT V- BLOCKING OSCILLATORS 9

Blocking Oscillator – Free running blocking oscillator - Astable Blocking Oscillators with base timing – Push-pull Astable blocking oscillator with emitter timing, Frequency control using core saturation, Triggered blocking oscillator – Monostable blocking oscillator with emitter timing.

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Course Outcomes:

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

1. Design various feedback amplifiers using appropriate feedback topologies.
2. Design the different types of Oscillators for various frequency ranges.
3. Analyze the frequency response characteristics and stability of Tuned Amplifiers.
4. Design the appropriate wave shaping circuit for the given application.
5. Analyze the characteristics of different blocking oscillators with base and emitter timing circuits.

Text Books:

1. Sedra / Smith, "Micro Electronic Circuits" Oxford University Press, 2004.
2. S. Salivahanan, N. Suresh Kumar and A. Vallavaraj, "Electronic Devices and Circuits",Second Edition, Tata McGraw-Hill, New Delhi, 2007

Reference Books:

1. Anil K.Maini and Varsha Agarwal, "Electronic Devices and Circuits", Wiley India PrivateLtd, New Delhi, 2009.
2. David A. Bell, "Solid State Pulse Circuits", Prentice Hall of India, New Delhi 1992
3. Robert L. Boylestad and Louis Nasheresky, "Electronic Devices and Circuit Theory", Ninth Edition, Pearson Education / PHI, New Delhi 2002
4. David A. Bell, "Electronic Devices and Circuits", Fifth Edition, Oxford University Press, 2008

Web References:

1. http://nptel.ac.in/video.php?subjectId=122106025
2. http://nptel.ac.in/courses/117106030/2
3. http://nptel.ac.in/courses/122106025/35

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Course Code:16ECT42	Course Title : TRANSMISSION LINES AND WAVEGUIDES	
Core	L:T:P:C	4 : 0 : 0 : 4
Type: **Theory**	Total Contact hours:	**60**

Prerequisites: The student should have undergone the course(s):

- 16ECT34 -Electromagnetic fields

Course Objectives:

The course is intended to:

1. Analyze the basic transmission line parameters.
2. Analyze power measurement in transmission lines.
3. Select appropriate matching sections.
4. Analyze various modes of wave propagation in parallel plane and rectangular waveguides.
5. Analyze various modes of wave propagation in circular waveguides and cavity resonators.

UNIT I- TRANSMISSION LINE THEORY AND PARAMETERS **12**

Introduction to different types of transmission lines, Transmission line Equation– Solution–Characteristic impedance –Infinite line concept- Distortion less line– loading– input impedance, Losses in Transmission lines– Reflection loss, Insertion loss, ohmic loss, Introduction to planar transmission lines.

UNIT II- TRANSMISSION LINE AT RADIO FREQUENCIES **12**

Approximations at high frequency, Parameters of open wire line and coaxial line at high frequencies, Line of Zero dissipation, Voltage and current on the dissipation less line, Standing Waves, Standing Wave Ratio , Input impedance of the dissipation less line, Input impedance of Open and short circuited lines, Power and impedance measurement on lines.

UNIT III- IMPEDANCE MATCHING AND TRANSFORMATION **12**

Reflection loss on unmatched lines, impedance matching sections- eighth wave line, quarter wave line, half wave line, Impedance transformation using tapped quarter wave line, Stub Matching– Single stub (quantitative analysis only) and Double Stub– Smith Chart and Applications.

UNIT IV- RECTANGULAR WAVE GUIDES **12**

Waves between Parallel Planes – characteristics of TE, TM and TEM waves, Velocities of propagation , Solution of wave Equation in Rectangular guides, TE and TM modes, Characteristics-Dominant Mode, Attenuation, Wave Impedance , Mode excitation, Impossibility of TEM waves in hollow wave guides.

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UNIT V- CIRCULAR WAVE GUIDES AND CAVITY RESONATOR 12

Solution of wave equation in circular guides, TE and TM wave in circular guides, Wave impedance, mode excitation, Applications.
Wave guide cavity resonator– Rectangular cavity, TE mode and TM mode, Cavity excitation and tuning, cut-off frequency, dominant mode, Q factor – Q for dominant mode.

Course Outcomes:

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

CO1. Analyze the basic transmission line parameters using the analogy between lumped and distributed model.
CO2. Analyze power measurement in transmission lines at high frequencies by approximating their parameters.
CO3. Select appropriate matching sections to minimize the impedance mismatch in a transmission line.
CO4. Analyze various modes of wave propagation in parallel plane and rectangular waveguides by using wave equations.
CO5. Analyze various modes of wave propagation in circular waveguides and cavity resonators using wave theory approach.

Text Books:

1. John D Ryder, "Networks, Lines and Fields", PHI, Second Edition New Delhi, 1999.
2. Jordan. E.C. and Balmain.K.G, "Electromagnetic Waves and Radiating Systems", Second Edition, PHI, New Delhi, 1995.

Reference Books:

1. Umesh Sinha, "Transmission Lines and Networks", Satya Prakashan (Tech. India Publications, New Delhi), 2001.
2. David M. Pozar, "Microwave Engineering", Third Edition, John Wiley, 2009.
3. David K. Cheng, "Field and Wave Electromagnetics", Pearson Education, Second Edition,2004.
4. B.Somanathan Nair, "Transmission lines and Waveguides", Sanguine Technical Publishers, 2006.

Web References:

1. http://www.nptel.ac.in/courses/117101057/
2. http://www.amanogawa.com/archive/transmissionB.html
3. http://www.falstad.com/circuit/e-tl.html
4. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-013-electromagnetics-and-applications-fall-2005/lecture-notes/
5. http://www.indiabix.com/electronics-circuits/simple-transmission-lines/

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Course Code:16ECT43	Course Title : LINEAR INTEGRATED CIRCUITS (Common to IV sem ECE & V sem EEE)	
Core	L:T:P:C	3 : 0 : 0 : 3
Type: Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16GET24 - Electron Devices
- 16ECT32 - Electronic Circuits -I
- 16EET31 - Digital Electronics

Course Objectives:

The course is intended to:

1. Explain the fabrication process of Linear ICs.
2. Analyze the characteristics of operational amplifier.
3. Design rectifiers, amplifiers and filters.
4. Design comparators and data converters.
5. Design special function ICs.

UNIT I- IC FABRICATION 9

IC classification - Fundamentals of monolithic ICs –Basic Planar Processes - Construction of a typical Integrated circuit– Active and Passive Components of ICs: Monolithic transistors, Monolithic diodes, Integrated Resistors, Integrated Capacitors and Inductors. Thin and Thick film Technology.

UNIT II- CIRCUIT CONFIGURATION AND CHARACTERISTICS OF OPAMP 9

Block Diagram of Op-amp - Current mirror and Current source - Widlar current source -Wilson current source - Ideal Op-amp characteristics and its equivalent circuit – DC characteristics - AC characteristics – Concept of frequency compensation-methods of improving slew rate

UNIT III- APPLICATIONS OF OPAMP 9

Ideal Inverting and Non-inverting amplifier - Voltage Follower - Adder– Subtractor - Instrumentation Amplifier - Integrator – Differentiator – Precision rectifiers: Half wave and Full wave rectifier - Fundamentals of Log and Antilog Amplifiers - Low Pass & High Pass Butterworth Filters - Sine wave generators.

UNIT IV- COMPARATORS AND CONVERTERS 9

Basic Comparators – Zero crossing detectors – Schmitt trigger– Window detector - DAC: specifications - weighted resistor type, R-2R Ladder type. ADC: Specifications - Flash type - Successive Approximation type - Dual Slope type.

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UNIT V- SPECIAL FUNCTION ICs AND ITS APPLICATIONS 9

Timer IC 555 – Astable and Monostable multivibrators - Voltage Controlled Oscillator (VCO)- PLL IC 565: Principle of operation -Application of PLL for AM, FM and FSK demodulation - Voltage regulators - IC 78XX, IC79XX, LM317 and General purpose regulator IC 723

Course Outcomes:

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

CO1. Explain the fabrication process of Linear ICs.
CO2. Analyze the characteristics of operational amplifier in terms of AC and DC parameters.
CO3. Design rectifiers, amplifiers and filters using operational amplifier.
CO4. Design comparators and data converters using operational amplifier.
CO5. Design special function ICs such as Timers, PLL circuits, Voltage regulator ICs using operational amplifier.

Text Books:

1. Roy Choudhary.D., Sheil B. Jani, "Linear Integrated Circuits", II edition, New Age, 2003
2. Ramakant A. Gayakward,"Op-amps and Linear Integrated Circuits", IV edition, Pearson Education, 2003

Reference Books:

1. Robert F.Coughlin, Fredrick F.Driscoll, "Op-amp and Linear ICs", 6th edition, PHI learning, 2012
2. Jacob Millman, Christos C.Halkias, "Integrated Electronics - Analog and Digital circuits system", Tata McGraw Hill, 2003
3. James M.Fiore, "OP-AMPS and linear Integrated circuits concepts and Applications", 2nd edition, Cengage learning, 2012
4. S.Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", (3/e) TMH, 2003
5. David A. Bell, "Op-amp & Linear ICs", 2nd edition, Prentice Hall of India, 2005

Web References:

1. http://www.nptel.ac.in/courses/Webcourse-contents/IIT ROORKEE/Analog%20circuits/index.htm
2. http://www.555-timer-circuits.com
3. http://www.technologystudent.com
4. http://freevideolectures.com/Course/2915/Linear-Integrated-Circuits#

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Course Code:16ECT44	Course Title : SIGNALS AND SYSTEMS	
Core	L:T:P:C	3 : 2 : 0 : 4
Type: **Theory**	Total Contact hours:	75

Prerequisites: The student should have undergone the course(s):

- 16MAT13-Engineering Mathematics-I
- 16MAT23-Engineering Mathematics-II

Course Objectives:

The course is intended to:

1. Classify various Continuous time and Discrete time signals and systems.
2. Interpret spectral characteristics of continuous time periodic and aperiodic signals.
3. Analyze Linear Time Invariant-Continuous Time System.
4. Perform Sampling of continuous time signals and Fourier analysis of discrete time signals.
5. Analyze Linear Time Invariant-Discrete Time System.

UNIT I- CLASSIFICATION OF SIGNALS AND SYSTEMS **9+6**

Classification of Signals: Continuous time(CT) signals - Discrete time(DT) signals – Periodic and Aperiodic signals – Even and odd signals – Energy and power signals –Deterministic and random signals –Complex exponential and Sinusoidal signals .Unit step, Unit ramp, Unit impulse – Representation of signals in terms of unit impulse.

Classification of Systems: Continuous time systems- Discrete time systems - Linear system – Time Invariant system – causal system – BIBO system – Systems with and without memory – LTI system.

Operation on signals: Time Shifting, Scaling and Folding.

UNIT II- ANALYSIS OF CONTINUOUS TIMESIGNALS **9+6**

Fourier series: Representation of Continuous time Periodic signals – Properties of Continuous time Fourier series – Parseval's relation –Frequency spectrum – Power density spectrum –Band limited signals – complex analytic signals.

Fourier transform: Representation of Continuous time signals- Properties of Continuous time Fourier transform – Energy density spectrum.

UNIT III- LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS **9+6**

System modeling: Differential equation – impulse response – Convolution – Analysis and characterization of LTI system using Laplace transform and Fourier methods.

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UNIT IV- ANALYSIS OF DISCRETE TIME SIGNALS **9+6**

Sampling of CT signals, Sampling Theorem, Effect of under Sampling- Aliasing- Reconstruction of CT signal from Samples.
Discrete Time Fourier Transform (DTFT):Representation of Discrete time signals, Magnitude and Phase spectrum, properties of DTFT.

UNIT V - LINEAR TIME INVARIANT –DISCRETE TIME SYSTEMS **9+6**

Z Transform: properties, Inverse Z Transform, stability.
System modeling: Difference equation- impulse response – Convolution sum, Analysis and characterization of LTI system using Z transform and Fourier methods.

Course Outcomes:
At the end of the course students will be able to:

1. Classify various Continuous time and Discrete time signals and systems based on their properties
2. Interpret spectral characteristics of continuous time periodic and aperiodic signals using Fourier analysis.
3. Analyze Linear Time Invariant-Continuous Time System based on impulse response, Laplace transform and Fourier methods.
4. Perform Sampling of continuous time signals and Fourier analysis of discrete time signals.
5. Analyze Linear Time Invariant-Discrete Time System based on impulse response, Z-transform and Fourier methods.

Text Books:

1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab "Signals and Systems", Pearson Education, 2007.
2. Simon Haykins and Barry Van Veen, Signals and Systems John Wiley &sons,Inc, 2004.

Reference Books:

1. H.P Hsu, RakeshRanjan" Signals and Systems", Schaum's Outlines, Tata McGraw Hill, Indian Reprint, 2007
2. Edward W Kamen& Bonnie's Heck, "Fundamentals of Signals and Systems", Pearson Education, 2007.
3. Vinay K. Ingle and John G. Proakis "Digital Signal Processing Using MATLAB", Cengage Learning, 3rd edition, 2011.
4. Sanjit .K. Mithra "Digital Signal Processing Laboratory Using MATLAB", TataMc.Graw Hill, 1999.

Web References:

1. http://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/
2. http://nptel.ac.in/courses/117104074/
3. http://www.nptel.ac.in/courses/117101055/

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Course Code:16ECT45	Course Title : ELECTRICAL MACHINES AND INSTRUMENTATION	
Core	L:T:P:C	3:0:0:3
Type:Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16GET15*- Fundamentals of Electrical Engineering
- 16GET15R - Introduction to Engineering

Course Objectives:

The course is intended to:

1. Explain the working principles of D.C Machines.
2. Explain the working principles of transformer and induction motor.
3. Choose the relevant measurement system.
4. Select the appropriate transducers
5. Choose the suitable measuring Instruments and analyzers.

UNIT I- D.C MACHINES 9

D.C Generator - Laws of magnetic circuit - Principle of operation - Constructional details - EMF equation - Classification of generators - Efficiency and losses. DC Motor- Principle of operation - Constructional details - Torque equation - Classification of motors-3 point starter – Efficiency.

UNIT II- A.C MACHINES AND TRANSFORMERS 9

A.C Machines - Principle of operation of single phase induction motor - Three phase induction motor, Transformers-Principle of operation - Constructional features - Classification of Transformers - EMF equation - Equivalent circuit - Efficiency.

UNIT III- BASIC MEASUREMENT SYSTEMS 9

Measurement systems – Static and dynamic characteristics – Standards of measurements – Moving coil, Moving iron meters – Multimeters. Bridges - Maxwell, Hay, Schering, Anderson bridge.

UNIT IV- TRANSDUCERS 9

Classification of transducers - Selecting a transducer - Strain gauges, Temperature transducer-LVDT – Capacitive transducers - Piezoelectric transducers – Optoelectronic transducers - Application of transducers.

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UNIT V- MEASURING INSTRUMENTS AND ANALYZERS 9

Function generators- Cathode ray oscilloscopes – Block schematic – Applications - Digital Storage Oscilloscope and Mixed signal Oscilloscope. Analyzers- Harmonic distortion analyzer – Logic analyzer - Spectrum analyzer- Network analyzer

Course Outcomes:

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

CO1. Explain the working principles of D.C Machines.
CO2. Explain the working principles of transformer and induction motor.
CO3. Choose the relevant measurement system based on the required application.
CO4. Select the appropriate transducers for the measurement of physical Phenomenon.
CO5. Choose the suitable measuring Instruments and analyzers for the given application

Text Books:

1. Sawhney .A.K, "A Course in Electrical and Electronic Measurement and Instrumentation", Dhanpat Rai & Sons, New Delhi, Eighteenth Edition, 2001.
2. Theraja.B.L, "Electrical Technology Volume-II AC/DC Machines", S.Chand and Company Ltd., New Delhi(India),2008.

Reference Books:

1. Albert D.Helfrick and William D.Cooper – "Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, New Delhi, 2003.
2. Kalsi .H.S, "Electronics Instrumentation", 3rd Edition (copyright 2010, Second Reprint 2011) Tata McGraw Hill, New Delhi, 2010
3. Bhattacharya.S.K, "Electrical Machines", Second edition, Tata McGraw Hill publishing company Ltd, Uttar Pradesh (India), 2007.
4. Murugesh Kumar.K, "DC Machines & Transformers", Second Edition, Vikas publishing house Pvt. Ltd., New Delhi (India), 2004.

Web References:

1. http://nptel.ac.in/courses/108108076/
2. http://nptel.ac.in/syllabus/syllabus.php?subjectId=108105018
3. http://nptel.ac.in/courses/108105017/

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Course Code: 16ECL41	Course Title : ELECTRONICS CIRCUITS – II LABORATORY	
Core	L:T:P:C	0:0:4:2
Type: **Practical**	Total Contact hours:	60

Prerequisites: The student should have undergone the course(s):

- 16ECL31 - Electronic Circuits - I Laboratory

Course Objectives:

The course is intended to:

1. Design differential amplifier.
2. Compute bandwidth of feedback and tuned amplifiers.
3. Design oscillators and verify their output frequencies.
4. Examine the output waveforms of wave shaping circuits.
5. Observe the output of Amplifiers, oscillators and wave shaping circuits using simulation.

LIST OF EXPERIMENTS:

1. BJT differential amplifier
2. Feedback amplifier circuits-current series and voltage shunt
3. Frequency Response of Tuned Amplifiers
4. RC Phase Shift Oscillator
5. Hartley and Colpitts Oscillators
6. Integrator and Differentiator
7. Clippers and Clampers
8. Astable and Monostable Multivibrators
9. Bistable Multivibrators
10. Simulation of above experiments using Multisim

Course Outcomes:

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

CO1. Design differential amplifier using BJT and calculate its CMRR.
CO2. Compute bandwidth of feedback and tuned amplifiers.
CO3. Design oscillators and verify their output frequencies.
CO4. Examine the output waveforms of wave shaping circuits such as integrators, differentiators, clippers, clampers and multivibrators.
CO5. Observe the output of Amplifiers, oscillators and wave shaping circuits using Multisim simulation tool.

Reference Books:

1. "Electronics Circuits – II Laboratory" manual prepared by Department of Electronics and Communication Engineering.
2. David.A.Bell "Fundamentals of Electronic Devices and Circuits Lab manual" Fifth Edition, Oxford University Press, New Delhi, 2009

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Course Code: 16ECL42	Course Title: LINEAR INTEGRATEDCIRCUITS LABORATORY (Common to IV sem ECE and V sem EEE)	
Core	L:T:P:C	0:0:4:2
Type: **Practical**	Total Contact hours:	**60**

Prerequisites: The student should have undergone the course(s):

- 16ECL31 - Electronic Circuits -I Laboratory
- 16ECT33 - Digital Electronics

Course Objectives:

The course is intended to:

1. Design basic electronic circuits.
2. Examine the characteristics of filters.
3. Design op-amp circuits.
4. Analyze the application of PLL.
5. Verify the output of multi-vibrators and power supplies.

LIST OF EXPERIMENTS:

1. Design and verification of Inverting, Non inverting and differential amplifiers.
2. Design and verification of Integrator and Differentiator.
3. Design and verification of Instrumentation amplifier.
4. Design and verification of Active low-pass and High-pass filters.
5. Design and verification of RC Phase shift and Wien bridge oscillators using op-amp.
6. Design and verification of open loop applications of op-amp
   (i) Basic comparator (ii) Zero crossing detector
   (iii) Window detector (iv) Schmitt trigger
7. Design and verification of weighted resistor and R-2R ladder type DACs
8. Design and verification of Frequency Multiplier using PLL IC565
9. Design and verification of Astable and Monostable multivibrators using NE555 Timer
10. Design and verification of DC power supply using LM723

Course Outcomes:

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

CO1. Design basic electronic circuits using op-amps and verify their outputs.
CO2. Examine frequency response characteristics of filters.
CO3. Design op-amp circuits for open loop applications and verify their outputs.
CO4. Analyze the application of PLL.
CO5. Verify the output of multi-vibrators and power supplies.

Reference Books:

1. "Linear Integrated Circuits Laboratory" manual prepared by Department of Electronics and Communication Engineering.

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Course Code:16PSL41	Course Title : ETHICAL AND MORAL RESPONSIBILITY	
General	L:T:P:C	0: 0 : 2 :1
Type:PS	Total Contact hours:	30

Course Objectives:

The course is intended to:

1. Articulate the importance of ethical and moral responsibilities
2. Explain the fundamental aspects of ethical practices
3. Validate one's appropriate and inappropriate behaviors
4. Elaborate code of conduct of professional bodies
5. Explain the importance of professional practices

UNIT I- ETHICAL PRACTICES – IMPORTANCE 8*

Why ethical practices: The current day scenario of ethical practices – parents, society, politics & business; Awareness of skewedness of information – news, advertisements and other media; The need for ethical and moral responsibility on a personal level; Handling oneself amidst peer pressure and societal pressure;

UNIT II- ETHICAL PRACTICES – FUNDAMENTALS 6*

Morality & Ethics; Moral issues, inquiry, moral dilemmas; Moral autonomy – Kohlberg's theory and Gilligan's refinement; Theories on "right action" – virtue ethics, utilitarianism, duty ethics, rights ethics – resolving moral dilemmas; justifying moral obligations;

UNIT III- CODES OF CONDUCT 8*

Importance of code of conduct and its role; Evolving draft Code of conduct for different roles – son/daughter, student, future employee & citizen; Reflection on real time incidences at the college.

Engineers as responsible experimenters; Faith of the Engineer (ABET); Pledge and Code of ethics as per National Society of Professional Engineers (NSPE); Code of Ethics of Institution of Engineers (India); Case studies and discussions in professional context

UNIT IV- PROFESSIONAL PRACTICES AT WORK 8*

Transition from a student to a professional; Importance of professional practices at work; Integrity as the topmost virtue of a professional; Self-awareness: Where competence ends and professionalism takes over; Professional qualities;

Need to align oneself to culture & values of organizations; Need to embrace diversity in organizations.

*- Includes review sessions

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Course Outcomes:

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

CO1. Articulate the importance of ethical and moral responsibilities
CO2. Explain the fundamental aspects of ethical practices
CO3. Validate one's appropriate and inappropriate behaviors in various roles
CO4. Elaborate code of conduct of professional bodies
CO5. Explain the importance of professional practices as a future employee/entrepreneur

Course Handouts (compiled by Professional Skills team, MCET)

1. Instructor's Manual (for the faculty)
2. Learner's workbook (for the student)

Reference Books:

1. Mike W Martin & Roland Schinzenger, "Ethics in Engineering", Latest Edition, Tata McGraw-Hill
2. Code of conduct document, MCET student handbook
3. Gail D Baura, "Engineering Ethics - an industrial perspective", Academic Press, Elsevier,
4. SubratoBagchi, "The professional - Defining the new standard of Excellence at work", Penguin Books India.

ASSESSMENTS:

Assessment	Details	Wt:	Administration	When
Class room participation	Group assignments presentation; Case discussions participation	70%	Continuous assessment in class	During class
Knowledge test	Multiple choice questions	10%	Pen and Paper	End of course
Scenario based assessments	Multiple choice questions	20%	Pen and Paper	End of course

NO. OF HOURS& CREDITS:

Enablement through class room lecture, case discussions and group presentations	Conducted by trained internal faculty	30 hours – 1 credit
At least two guest lectures	Delivered by senior people from Industries/Government organizations	

END OF SEMESTER IV

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SEMESTER V

Course Code:16ECT51	Course Title: COMMUNICATION THEORY	
Core	L:T:P:C	3:0:0:3
Type:Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16GET24 - Electron Devices
- 16MAT42 - Probability Theory and Statistics
- 16ECT44 - Signals and Systems

Course Objectives:

The course is intended to:

1. Categorize Amplitude modulation systems.
2. Compare frequency and phase modulation systems.
3. Apply the concepts of Random Process in Communication systems.
4. Analyze the noise performance of AM and FM systems.
5. Explain the concepts of information Theory.

UNIT I –AMPLITUDE MODULATION SYSTEMS 9

Need for modulation, Amplitude Modulation–time domain and frequency domain description – AM power distribution – Generation of AM waves: DSBSC– SSB-VSB, Detection of AM waves: Super heterodyne Receiver, Frequency Division Multiplexing.

UNIT II-ANGLE MODULATION SYSTEMS 9

Phase Modulation - Frequency Modulation-Narrow band and wideband FM, Generation of FM waves: Direct Method-Indirect Method-Detection of FM waves: Balanced slope detector - Foster Seeley discriminator - Ratio detector - Phase locked loop.

UNIT III- RANDOM PROCESS 9

Random variables, Central limit Theorem, Random Process, Stationary Processes, Mean, Correlation and Covariance functions, Power Spectral Density, Ergodic Processes, Gaussian Process, Transmission of a Random Process Through a LTI filter.

UNITIV - NOISE CHARACTERIZATION 9

Noise sources and types – Signal to noise ratio - Noise figure and noise temperature – Noise in cascaded systems–Noise performance in AM systems – Noise performance in FM systems – Pre-emphasis and de-emphasis – Capture effect and threshold effect.

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UNIT V - INFORMATION THEORY 9

Uncertainty, Information and entropy, source coding theorem, Discrete Memoryless channels, Mutual Information, Channel capacity, Channel coding theorem, Differential entropy, Information capacity theorem

Course Outcomes:

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

CO1. Categorize Amplitude modulation systems with their spectrum.
CO2. Compare frequency and phase modulation systems.
CO3. Apply the concepts of Random Process in Communication systems.
CO4. Analyze the noise performance of AM and FM systems.
CO5. Explain the concepts of information Theory.

Text Books:

1. Simon Haykin, "Communication Systems", John Wiley and Sons, Inc, 4th Edition, 2010.
2. George Kennedy, Bernard Davis, "Electronic Communication Systems", Tata McGraw-Hill, 4thEdition, 2008.

Reference Books:

1. Wayne Tomasi, "Electronic communication systems", Prentice Hall of India Ltd., New Delhi, 2004.
2. Roy Blake," Electronic Communication Systems", Thomson publishers 2002..
3. Frenzel, Louis E., Jr., "Principles of Electronic Communication Systems",4thEdition, McGraw-Hill, 2008
4. H Taub and D. Schilling, Gautam Sahe, "Principles of Communication Systems", TMH, 3rd Edition, 2007.

Web References:

1. http://www.vssut.ac.in/lecture_notes/lecture1428643367.pdf
2. http://www.gatestudy.com/wp-content/uploads/2015/06/Noise-In-Communication-Systems.pdf
3. http://textofvideo.nptel.iitm.ac.in/117102062/lec22.pdf
4. https://web.stanford.edu/class/ee278/lectures/lect07-2.pdf

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Course Code:16ECT52	Course Title: DIGITAL SIGNAL PROCESSING	
Core	L:T:P:C	3:2:0:4
Type: Theory	Total Contact hours:	75

Prerequisites: The student should have undergone the course(s):

- 16ECT44 - Signals and Systems

Course Objectives:

The course is intended to:

1. Compute Discrete Fourier Transform (DFT) and Inverse Discrete Fourier Transform (IDFT).
2. Design linear phase Finite Impulse Response (FIR) digital filters.
3. Design Infinite Impulse Response (IIR) digital filters.
4. Analyze the effects of finite word length.
5. Design digital filters for real time applications.

UNIT I - FAST FOURIER TRANSFORM **9+6**

Introduction to DFT – Properties of DFT – FFT algorithms – Radix-2 FFT algorithms – Decimation in Time (DIT-FFT) and Decimation in Frequency (DIF-FFT) algorithms – DFT analysis of sinusoidal signals. Fast convolution- overlap save method – overlap add method.

UNIT II - FINITE IMPULSE RESPONSE DIGITAL FILTERS **9+8**

Linear phase filters – Windowing techniques for design of linear phase FIR filters: Rectangular- Hamming- Hanning – Blackman Windows. Realization of FIR filters: Direct and Cascade form -Introduction to Adaptive FIR filter.

UNIT III - INFINITE IMPULSE RESPONSE DIGITAL FILTERS **9+8**

Design of analog Butterworth and Chebyshev Filters – Frequency transformation in analog domain – Design of IIR digital filters – impulse invariance technique – bilinear transformation – Frequency transformation in digital domain – IIR Filter Realization: Direct form I, Direct form II and Cascade form.

UNIT IV - FINITE WORD LENGTH EFFECTS **9+4**

Number representations – Quantization – Truncation and Rounding– Quantization noise – Oversampling A/D and D/A Conversion – Quantization of filter coefficients – Effects of finite word length on digital filters and FFT algorithms.

UNIT V - APPLICATIONS **9+4**

Parametric resonators and equalizers – Notch and Comb filters – Design of filter to eliminate Power line interference and harmonics –Applications of adaptive filtering in Echo cancellation.

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Course Outcomes:

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

CO1. Compute Discrete Fourier Transform (DFT) and Inverse Discrete Fourier Transform (IDFT) of a given discrete time sequence using Fast Fourier Transform algorithms.

CO2. Design linear phase Finite Impulse Response (FIR) digital filters using windowing techniques.

CO3. Design Infinite Impulse Response (IIR) digital filters from analog Butterworth and Chebyshev filters for a given specification.

CO4. Analyze the effects of finite word length on filter implementation.

CO5. Design digital filters for real time applications.

Text Books:

1. John G. Proakis and Dimitris G. Manolakis, "Digital Signal Processing: Principles, Algorithms and Applications", Third Edition, Pearson Education/ Prentice Hall, 2003.
2. Allan V. Oppenheim and Ronald W. Schafer, "Discrete Time Signal Processing", Prentice Hall, Third Edition, 2002.
3. Lonnie C. Ludeman, "Fundamentals of digital signal processing", John Wiley and Sons Network, 2004.

Reference Books:

1. Emmanuel C. Ifeachor and Barrie. W. Jervis, "Digital Signal Processing", Second Edition, Pearson Education/Prentice Hall, 2002
2. Ashok Ambardar, "Digital Signal Processing: A Modern Introduction", Thomson Learning, 2007
3. Li Tan, "Digital Signal Processing: Fundamentals and Applications", Academic Press, 2008
4. Johnny R. Johnson, "Introduction to Digital Signal Processing", Prentice-Hall of India, 2001
5. Steven W. Smith, "The Scientist and Engineer's Guide to Digital Signal Processing", California Technical Publications, 1999.
6. Sanjit.K. Mitra, " Digital Signal Processing: A computer based approach", Tata McGraw Hill, 2011.

Web References:

1. http://nptel.ac.in/courses/117102060/
2. http://nptel.ac.in/courses/108105055/

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Course Code:16ECT53	Course Title: CONTROL SYSTEMS	
Core	L:T:P:C	4 : 0 : 0 : 4
Type:**Theory**	Total Contact hours:	60

Prerequisites: The student should have undergone the course(s):

- 16MAT13 - Engineering Mathematics - I
- 16ECT44 - Signals and Systems

Course Objectives:

The course is intended to:

1. Compute transfer function of Electrical and Mechanical Control systems.
2. Calculate the time response and time domain specifications.
3. Determinefrequency domain specifications from frequency response curves.
4. Analyze the stability of a control system.
5. Derive various state space models & test Controllability and Observability of a system.

UNIT I - CONTROL SYSTEM MODELING 12

Basic elements of Control systems – Open loop and closed loop systems – Transfer function- Mathematical modelling of mechanical and Electrical systems – Analogies between mechanical and electrical systems - Block diagram reduction technique - Signal flow graphs.

UNIT II - TIME DOMAIN ANALYSIS 12

Standard test signals - type and order of the systems - Impulse and step response of first order and second order systems -Transient and steady state response - Time domain specifications - Steady state errors and error constants

UNIT III - FREQUENCY DOMAIN ANALYSIS 12

Frequency Response- Frequency Domain specifications – correlation between time and frequency domain specifications - Bode Plot, Polar plots. Basic concepts of compensators: Lag, Lead and Lead-lag.

UNIT IV - STABILITY ANALYSIS 12

Stability: characteristic equation, location of roots in S-plane - Routh-Hurwitz Stability Criterion - Concept of Root Locus Technique: Construction of Root Locus - Application of Root Locus - Nyquist Stability Criterion

UNIT V - STATE SPACE MODEL OF CONTINOUS TIME SYSTEMS 12

Concepts of state, state variables and state model-Canonical form: controllable and observable form, State Transition matrix and its properties – Concepts of Controllability and Observability

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Course Outcomes:

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

CO1. Compute transfer function of Electrical and Mechanical control systems Through Signal flow graph and Block diagram reduction techniques.
CO2. Calculate the time response and time domain specifications of first order and second order systems.
CO3. Determinefrequency domain specifications from frequency response curves of given system using Bode plots and polar plots.
CO4. Analyse the stability of a control system by using Root locus, Routh Hurwitz and Nyquist stability criteria.
CO5. Derive various state space models& test Controllability and Observability of the given system.

Text Books:

1. Benjamin.C.Kuo, "Automatic control systems", PHI, New Delhi, 7th Edition, 1995.
2. S.Palani, "Control Systems Engineering", TMH, New Delhi, 2nd Edition, 2010.

Reference Books:

1. Norman S. Nise, "Control Systems Engineering", Wiley, 4th Edition, 2003
2. Gopal M., "Control System – Principles and Design", TMH, New Delhi, 2nd Edition, 2002.
3. Ogata.K, "Modern Control Engineering", 5th Edition, Pearson Education India, New Delhi, 2010
4. NagrathJ. and Gopal M.," Control System Engineering", New Age International Publishers, 5th Edition, 2007

Web References:

1. http://www.electrical4u.com/mathematical-modelling-of-various-system
2. http://nptel.ac.in/courses/101108056/23
3. http://www.egr.msu.edu/classes/me451/jchoi/2012/notes/ME451_L10_RouthHurwitz.pdf
4. http://web.mit.edu/2.14/www/Handouts/StateSpace.pdf

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Course Code:16ECT54	Course Title: MICROPROCESSOR AND MICROCONTROLLER	
Core	L:T:P:C	3:0:0:3
Type:Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16EET31 - Digital Electronics

Course Objectives:

The course is intended to:

1. Explain the basic architecture of microprocessors.
2. Choose appropriate technique to interface the peripheral devices with microprocessor.
3. Write PIC18/PIC16 microcontroller programs.
4. Develop on-chip peripherals' programs.
5. Design a microcontroller system.

UNIT I - MICROPROCESSOR ARCHITECTURE 9

Evolution of Microprocessor - Introduction to 8 bit Microprocessor : ALU – Registers - System buses – Memory –Data Format - Opcode format - Instruction sets - Addressing modes -Introduction to 16 bit microprocessor : 8086 architecture.

UNIT II -8086 PERIPHERALS INTERFACING 9

External Memory interfacing - Parallel Peripheral Interface - Keyboard/Display controller – USART-Interrupt controller - DMA controller.

UNIT III - PIC MICROCONTROLLER AND PROGRAMMING 9

PIC18FX Pin connection - Architecture: WREG register – File register – Status register - I/O Ports - Data type and Time delay in embedded C - Logical operation - Data serialization - Program ROM Allocation - Data RAM allocation.

UNIT IV - INTERRUPTS AND TIMER 9

Programming Timer and Counter - Basics of Serial communication: Serial port programming - Interrupt: Timer Interrupt - External Hardware Interrupts - ADC characteristics: ADC Programming - Compare and Capture Mode - PWM Programming.

UNIT V - SYSTEM DESIGN AND APPLICATION 9

LCD interfacing, Keyboard interfacing - SPI bus protocol - DS1306 RTC interfacing and programming - Relay interfacing - stepper motor interfacing - DC motor interfacing - PWM motor control with CCP.

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Course Outcomes:

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

CO1. Explain the basic architecture of 8 bit and 16 bit microprocessors.
CO2. Choose appropriate technique to interface the peripheral devices with Microprocessor.
CO3. Write PIC18/PIC16 microcontroller programs using Embedded C.
CO4. Develop embedded C programs for PIC on-chip peripherals programs for on-chip peripherals.
CO5. Design a system using PIC microcontroller for given application.

Text Books:

1. R.S.Gaonkar, "Microprocessor Architecture, Programming and Applications with the 8085", Fifth Edition, Prentice Hall, 2002.
2. Muhammad ALI Mazidi, RolinD. Mckinlay, Danny Causery, "PIC Microcontroller and Embedded systems: Using Assembly and C for PIC18", Pearson international edition, 2008.

Reference Books:

1. A.K.Ray, K.M.Bhurchandi, "Advanced Microprocessors and peripherals", McGraw Hill Education, 3rd edition, 2012.
2. Douglas V.Hall, "Microprocessor and Interfacing, Programming and Hardware", Revised Second Edition, Tata McGraw Hill, Indian Edition 2007.
3. Krishna Kant, "Microprocessor and Microcontroller Architecture, Programming and System Design using 8085, 8086, 8051 and 8096", PHI, 2011.
4. John B Peatman, "Designing with PIC Micro Controller", 1st Edition, Pearson, 2003.
5. MykePredko, "Programming and Customizing the PIC Microcontroller", 3rd edition, Tata McGraw Hill, 2008.

Web References:

1. http://nptel.ac.in/courses/Webcourse-contents/IIT-KANPUR/microcontrollers/micro/ui/ TOC.htm
2. https://www.tutorialspoint.com/microprocessor/microprocessor_8086_overview.htm
3. http://www.microchip.com/design-centers/microcontrollers
4. https://electrosome.com/category/tutorials/pic-microcontroller/hi-tech-c/

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Course Code: 16ECT55	Course Title: ANTENNA AND WAVE PROPAGATION	
Core	L:T:P:C	3:0:0:3
Type: **Theory**	Total Contact hours:	**45**

Prerequisites: The student should have undergone the course(s):

- 16ECT33 - Electro Magnetic Fields
- 16ECT42 -Transmission Lines and Wave Guides

Course Objectives:

The course is intended to:

1. Compute the Power radiation from Dipole antennas.
2. Analyze Antenna arrays.
3. Explain the concept of Aperture antennas.
4. Describe the construction of Special antennas and measurement of antenna parameters.
5. Discuss the propagation of Radio waves.

UNIT I - ANTENNA FUNDAMENTALS AND DIPOLE ANTENNAS 9

Antenna parameters: Radiation pattern: Field pattern- Power pattern and dB pattern. Radiation intensity - Radiation resistance - Beam solid angle - Antenna gain - Directivity - Efficiency - Beam width - Radiation from Dipole antennas: Short electric dipole, Half wave dipole and monopole- field components and radiation resistance.

UNIT II - ANTENNA ARRAYS 9

Types of antenna arrays - Broad-side array, End-Fire array, Pattern Multiplication, Binomial Array and Yagi array.

UNIT III - APERTURE ANTENNAS 9

Huygen's principle - Slot antenna - Relation between dipole and Slot antenna. Horn Antenna: Sectorial and Pyramidal horn - Parabolic reflector and its feed systems.

UNIT IV - SPECIAL ANTENNAS AND ANTENNA MEASUREMENTS 9

Special Antennas: Rhombic Antenna, Helical Antenna- Axial mode helix- Normal mode helix, Log periodic Dipole Array, Micro strip Patch Antennas and its feed systems.
Antenna Measurements: Radiation Pattern, Impedance, Gain and Directivity Measurements.

UNIT V - RADIO WAVE PROPAGATION 9

Ground wave propagation: Attenuation characteristics for ground wave propagation – wave tilt-Calculation of field strength at a distance.
Sky wave propagation: Structure of the ionosphere- Critical frequency- Virtual height - Skip distance - Effect of earth's magnetic field - Refractive index - fading- diversity reception.

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Space wave propagation: Reflection characteristics of earth- Calculation of LOS distance and field strength at a distance, Duct propagation.

Course Outcomes:

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

CO1. Compute the Power radiation from Dipole antennas using their field Components.

CO2. Analyze Antenna arrays using their Radiation patterns.

CO3. Analyze the working principle of Aperture antennas using Huygen's principle.

CO4. Select an appropriate antenna for the given application based on their characteristics and a method for measuring the parameters of antenna.

CO5. Analyze the propagation of Radio waves as ground wave, sky wave and Space wave.

Text Books:

1. Kraus, J.D. and Marhefka, R., "Antennas", 3rd edition, Tata McGraw-Hill, 2002.
2. Jordan, E.C. and Balmain, "Electro Magnetic Waves and Radiating Systems", 2nd edition, PHI, 1968, Reprint 2003

Reference Books:

1. Collin, R.E., "Antennas and Radio Propagation", McGraw-Hill College, 1987.
2. Balanis, C.A., "Antenna Theory ", 2nd Edition, John Wiley & Sons, 2003.
3. Warren, I. S. and Gary, A.T., "Antenna Theory and Design", 2nd Edition, John Wiley & Sons, 1998.
4. Harish, A.R., and Sachidanada, M., "Antennas and Wave propagation", Oxford University Press, 2007.

Web References:

1. http://nptel.ac.in/courses/117107035/16
2. https://onlinecourses.nptel.ac.in/noc17_ee03
3. www.antenna-theory.com/
4. www.radio-electronics.com
5. www.radartutorial.eu

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Course Code:16ECL51	Course Title: DIGITAL SIGNAL PROCESSING LABORATORY	
Core	L:T:P:C	0:0:4:2
Type: **Practical**	Total Contact hours:	60

Prerequisites: The student should have undergone the course(s):

- 16ECT44 - Signals and Systems

Course Objectives:

The course is intended to:

1. Write a program to plot the basic discrete time signals.
2. Apply Fast Fourier Transform (FFT) to plot the spectrum of a sinusoidal signal.
3. Write a program to compute the impulse and step response of a given system.
4. Design Finite Impulse Response (FIR) and Infinite Impulse Response (IIR) filters.
5. Demonstrate the effects of quantization on the frequency response of digital filter.
6. Implement signal processing algorithms.

LIST OF EXPERIMENTS:

1. Generation of basic signals: unit impulse, unit step, exponential, ramp and sinusoidal
2. Spectrum analysis of sinusoidal signals with multiple frequency components
3. Verification of System Properties: Linearity, Time Invariance, Causality and Stability
4. Impulse and step response of a system
5. Overlap add and overlap save method for convolution
6. FIR filter design
7. IIR filter design
8. Effect of coefficient quantization on the frequency response of digital filters
9. Notch filter design based on pole zero placement
10. Convolution using digital signal processor
11. Implementation of FFT algorithm using digital signal processor
12. Implementation of FIR filter using digital signal processor

Course Outcomes:

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

CO1. Write a program to plot the basic discrete time signals

CO2. Apply Fast Fourier Transform (FFT) to plot the spectrum of a sinusoidal signal with multiplefrequency components.

CO3. Write a program to compute the impulse and step response of a given system.

CO4. Design Finite Impulse Response (FIR) and Infinite Impulse Response (IIR) filters for the given specifications.

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CO5. Demonstrate the effects of quantization on the frequency response of digital filter using pole-zero plots
CO6. Implement signal processing algorithms in a given digital signal processor

Reference Books:

1. "Digital Signal Processing Laboratory", manual prepared by ECE department
2. Vinay K. Ingle & John G. Proakis, "Digital Signal Processing using MATLAB", Third edition, Cengage Learning, 2012.

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Course Code:16ECL52	Course Title: MICROPROCESSOR AND MICROCONTROLLER LABORATORY	
Core	L:T:P:C	0:0:4:2
Type: Practical	Total Contact hours:	60

Prerequisites: The student should have undergone the course(s):

- 16EET31 - Digital Electronics

Course Objectives:

The course is intended to:

1. Execute Assembly Language program
2. Design PIC microcontroller experimental setup
3. Develop Timers' / counters' programs.
4. Test Serial communication
5. Design real time system

LIST OF EXPERIMENTS:

Microprocessor

1. Simple Arithmetic Programming using 8086
2. Interfacing 8255 and 8279 with 8086

PIC16FXX/18FXX Microcontroller

1. Study of IDE
2. Building a PIC16FXX/18FXX Microcontroller based CPU in PCB.
3. Control the LED using switch
4. Buzzer interfacing using Timer/Counter
5. Relay Interfacing using transistor driver circuit
6. Transmission and Reception of a byte using on chip serial port
7. Read the temperature sensor value using ADC and display it in LCD
8. Speed and direction control of DC motor

Course Outcomes:

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

CO1. Execute Assembly Language programming to interface 8255 and 8279using 8086.

CO2. Design the experimental setup for PIC16FXX/18FXX microcontroller board.

CO3. Develop a Program for operation of Timers / counters.

CO4. Test the serial communication using on chip serial port.

CO5. Design the real time system using PIC16FXX/18FXX.

Reference Books:

1. "Microprocessor and Microcontroller Laboratory Manual", MCET, Pollachi

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Course Code:16PSL51	Course Title: TEAMNESS AND INTERPERSONAL SKILLS	
General	L:T:P:C	0:0:2:1
Type: PS	Total Contact hours:	30

Course Objectives:

The course is intended to:

1. Be aware of attitudinal, behavioral and emotional aspects of self.
2. Learn continuously and be in harmony with self.
3. Understand others' preferences, values, roles & contexts.
4. Identify barriers to harmoniousrelationships.
5. Work collaboratively as a team.

UNIT I - HARMONY WITH SELF

Importance of learning about self continuously; Approaches to learn about self: introspection, being open to feedback, critical incidences as opportunities; Understanding life stages and challenges associated with them; Healthy ways of handling self in response to life's challenges;
Instruments/inventories to understand self and others: A) Know your temperament, B) Mayer Briggs Type Indicator, C) Interpersonal Needs Inventory

UNIT II - HARMONY WITH OTHERS

Importance of living in harmony with others; What it takes to live in harmony with others; Understanding preferences, values, roles and contexts of others; Approaches to navigating through differences between self and others;
Barriers to harmonious relationships - Perceptions, Judgments, and Emotional instability; Ways to handle each of the barriers; Importance of reaching-out to others

UNIT III - GROUP DYNAMICS AND CONFLICTS RESOLUTION

Group dynamics: overt and covert processes at micro and macro levels; Understanding the basis of conflicts; Understanding one's own conflict handling style; Methods to handling conflicts effectively.

UNIT IV - WORKING IN TEAMS

Effectiveness in communication; Forming – storming – norming and performing model; Competition Vs collaboration – impact of both on team tasks; TEAM Questionnaire – components of a healthy team and approaches to improving them.

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Course Outcomes:

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

CO1. Be aware of attitudinal, behavioral and emotional aspects of self.
CO2. Prefer to learn continuously about self and be in harmony with self.
CO3. Understand others' preferences, values, roles & contexts and be in harmony with others.
CO4. Identify barriers to harmonious relationships and derive ways to Handlethem.
CO5. Work collaboratively as a team to deliver expected outcomes.

MODE OF DELIVERY:

1. A 2-day learning workshop
    1. Activities (experiential learning)
    2. Audio visuals (affective learning)
    3. Case discussions (cognitive learning)
    4. Instruments/questionnaires (reflective learning) guided by Learner's work book.
2. Continuous learning guided by learning journal, and reviews by faculty
3. Half-day reinforcement session towards the end of the semester

EVALUATION:

Sl. No.	Evaluation	Criterion	Total marks		Remarks
1	Continuous Evaluation	KT SKT Evaluation during workshop Weekly review of journal	KT SKT Work book Journal	- 10 marks - 15 marks - 20 marks - 30 marks	KT=Knowledge Test SKT=Scenario based Knowledge Test
			Total	- 75 marks	
2	End semester Evaluation	Comprehensive Examination and Viva voce	KT & SKT, short questions Viva voce	- 10 marks - 15 marks	Conducted for 25 marks
			Total	- 25 marks	
		Total marks for the course	100 marks		
		Condition for clearing the course	50 marks as a whole; but student should have attended the ESE.		

END OF SEMESTER V

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SEMESTERVI

Course Code:16ECT61	Course Title: DIGITAL COMMUNICATION	
Core	L:T:P:C	3:0:0:3
Type: **Theory**	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16ECT51 - Communication Theory

Course Objectives:

The course is intended to:

1. Categorize the different pulse modulation systems.
2. Compare the various waveform coding techniques.
3. Analyze the characteristics of the line codes.
4. Estimate the performance of digital modulation and spread spectrum techniques .
5. Analyze various error correcting codes.

Unit I -SAMPLING AND QUANTIZATION 9

Low pass sampling – Aliasing- Signal Reconstruction-Quantization - Uniform & non-uniform quantization - quantization noise - Logarithmic Companding of speech signal, Analog Pulse modulation techniques: PAM– PPM– PWM, TDM

Unit II -WAVEFORM CODING 9

PCM -Prediction filtering and DPCM - Delta Modulation - ADPCM & ADM principles-Linear Predictive Coding.

Unit III - BASEBAND TRANSMISSION 9

Properties of Line codes, Power Spectral Density of Unipolar, Polar and Bipolar RZ & NRZ Manchester, ISI, Nyquist criterion for distortion less transmission, Correlative coding, M-ary schemes, Eye pattern

Unit IV -DIGITAL MODULATION SCHEME 9

Generation, detection, PSD & BER of Coherent BPSK, BFSK & QPSK - QAM - Principle of DPSK, Pseudo noise sequences, Discrete sequence spread spectrum with coherent BPSK, Frequency hop spread spectrum modulation

UNIT V-ERROR CONTROL CODING 9

Channel coding theorem, Linear block codes, Hamming codes, Cyclic codes, Convolutional codes, Viterbi decoding, Trellis coding.

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Course Outcomes:

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

CO1. Categorize the different pulse modulation systems.
CO2. Compare the various waveform coding techniques.
CO3. Analyze the characteristics of the line codes used for Digital Data Transmission.
CO4. Estimate the performance of digital modulation techniques and spread spectrum techniques.
CO5. Analyze various error correcting codes.

Text Books:

1. S. Haykin, "Digital Communications", John Wiley, 2005
2. B.P.Lathi, Zhi Ding, "Modern Digital and Analog Communication Systems" 4th Edition, Oxford University Press 2011.

Reference Books:

1. Bernard Sklar, "Digital Communications: Fundamentals and Applications", 2nd Edition, Prentice Hall,2009.
2. J.G Proakis, "Digital Communication", 4th Edition, Tata McGraw Hill Company, 2001
3. H P Hsu, Schaum Outline Series - "Analog and Digital Communications", TMH 2006
4. Leon W Couch , "Digital and Analog Communication Systems" , 6th Edition, Prentice Hall ,2001.

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1. http://www.nptel.ac.in/downloads/117105077/
2. https://www.smartzworld.com/notes/digital-communication-dc/
3. https://everythingvtu.wordpress.com/2014/02/25/digital-communication-notes-by-arunkumar-g-for-6th-sem-ece/
4. http://www.alljntuworld.in/download/digital-communication-materials-notes/

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Course Code:16ECT62	Course Title: VLSI DESIGN	
Core	L:T:P:C	3:0:0:3
Type: **Theory**	Total Contact hours:	**45**

Prerequisites: The student should have undergone the course(s):

- 16ECT32 - Electronic Circuits -I
- 16EET31 - Digital Electronics

Course Objectives:

The course is intended to:

1. Explain the VLSI design flow and CMOS design processes
2. Describe the characteristics of MOS transistors and CMOS inverter
3. Apply the various CMOS logic style.
4. Design digital sub systems.
5. Categorize the faults identified in VLSI circuit testing.

Unit I - INTRODUCTION 9

VLSI Design process: Design specification- design entry – functional simulation – planning, placement and routing – timing simulation, fabricating into chip- CMOS processing technologies - nWell - pWell - Twin tub - Silicon on insulator.

Unit II - MOS TRANSISTORS AND INVERTERS 9

Basic MOS Transistors and Operation: NMOS enhancement transistor - PMOS enhancement transistor - Threshold Voltage-Derivation of drain current-Channel length modulation- Body Effect –Trans conductance – MOSFETs as Switches - CMOS Inverter – Latch-up in CMOS Circuit - Power dissipation in CMOS Circuits.

Unit III - LOGIC DESIGN WITH CMOS 9

Combinational Circuit Design: Logic gates in Static CMOS - Transistor sizing – Stick diagram, Layout diagrams and design rules – Rationed circuits: Pseudo NMOS – cascode voltage switch logic - Dynamic CMOS logic: domino logic, dual rail domino logic –Transmission gate - pass-transistor circuits - Scaling of MOSFETs and its effects.

Unit IV - VERILOG HDL FOR SUBSYSTEM DESIGN 9

Introduction to Verilog HDL: Basic Concepts – Operators – Identifiers and keywords – data types – arrays – modules and ports – gate level modeling – data flow modeling – Behavioral Modeling – Tasks and Functions – procedural continuous assignments –Verilog Constructs - Introduction to test bench. Simple circuit design: Adder, Encoder, Multiplexer.

UNIT V - TESTING OF DIGITAL CIRCUITS 9

Need for testing – Failures and Faults – Modeling of faults : Stuck at faults – Bridging faults – Break and transistor stuck on / open faults– Delay faults – Temporary faults – Design for testability : Ad-hoc testing, Scan design, BIST, IDDQ testing, Boundary scan.

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Course Outcomes:

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

CO1. Explain the VLSI design flow and CMOS design processes with appropriate fabrication technologies.
CO2. Describe the characteristics of MOS transistors and CMOS inverter with relevance to power dissipation.
CO3. Apply the various CMOS logic style to realize real time layout for combinational circuit design.
CO4. Design digital sub systems using Verilog concepts.
CO5. Categorize the faults in VLSI circuits using suitable testing methods.

Text Books:

1. Weste and Harris, "CMOS VLSI Design", Third edition, Pearson Education, 2005.
2. Samir Palnitkar, "Verilog HDL", Second edition, Pearson Education, Ninth Impression 2010.
3. Neil H.E. Weste and Kamrán Eshraghian, "Principles of CMOS VLSI Design", Pearson Education ASIA, 2nd edition, 2000.

Reference Books:

1. John P.Uyemura "Introduction to VLSI Circuits and Systems", John Wiley and Sons, Inc.,2002
2. Eugene D.Fabricius, "Introduction to VLSI Design", McGraw Hill International Edition,1990
3. Pucknell, "Basic VLSI Design", Prentice Hall of India Publication, 1995
4. Wayne Wolf, "Modern VLSI Design System on chip", Pearson Education, 2002
5. P.K. Lala, "Digital Circuit Testing and Testability", Academic Press, 2002

Web References:

1. http://nptel.ac.in/downloads/117101058/
2. http://www.nptel.ac.in/downloads/117106093/
3. https://www.youtube.com/watch?v=VUSTLyPtPgk

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Course Code:16ECT63	Course Title: COMPUTER COMMUNICATION NETWORKS	
Core	L:T:P:C	3:0:0:3
Type:Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16CST35 - Data structures and OOPS with C++

Course Objectives:

The course is intended to:

1. Compare the layers of OSI model with TCP/IP protocol suite.
2. Illustrate error control techniques in networks.
3. Analyze the network routing algorithms.
4. Apply congestion control algorithms in Communication networks.
5. Analyze the Application layer services.

Unit I - PHYSICAL LAYER 9

Data Communications – Network Edge - Network Core – Performance metrics - Networks models: OSI model – TCP / IP protocol suite – Addressing – Transmission Media: Twisted pair, Coaxial Cable – Error detection: Parity Checks, Cyclic Redundancy Check (CRC) – Case study: SOHO Networks.

Unit II - DATA LINK LAYER 9

Framing – Flow Control and Error control techniques: Stop and wait – Go back N ARQ – Selective repeat ARQ – sliding window techniques – Multiple Access Techniques: Random access protocol, Controlled access protocol – Ethernet: IEEE 802.3 – Wireless LANS: IEEE802.11.

Unit III - NETWORK LAYER 9

Internetworking devices: hub, repeater, bridge, switch, router, Gateway – Basic Internetworking (IP, ARP, DHCP, ICMP), IPV4, IPV6 – Routing: Link State Routing, Distance Vector Routing– Case study: Capture packets using wire shark.

Unit IV - TRANSPORT LAYER 9

Process – to – Process delivery – User Datagram Protocol (UDP) – Transmission Control Protocol (TCP) – Congestion Control -Quality of services (QoS) – Techniques to improve QoS– Integrated Services – Differentiated Services.

UNIT V - APPLICATION LAYER 9

Traditional Applications: Domain Name System (DNS) – E-mail (MIME, SMTP, POP3, IMAP) – WWW – HTTP – SNMP – Telnet.

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Course Outcomes:

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

CO1. Compare the layers of OSI model with TCP/IP protocol suite using their functions

CO2. Illustrate error control techniques in networks using appropriate protocols

CO3. Analyze the network routing algorithms using appropriate protocols.

CO4. Apply congestion control algorithms in Communication Networks to improve the quality of service

CO5. Analyze the Application layer services based on its protocols.

Text Books:

1. Behrouz A. Forouzan, "Data communication and Networking", Fourth edition, Tata McGraw- Hill, 2007
2. James .F. Kurouse& W. Rouse, "Computer Networking: A Top down Approach Featuring", Third Edition, Pearson Education, 2007

Reference Books:

1. Andrew S. Tannenbaum, "Computer Networks", Pearson Education, Fourth Edition, 2003.
2. Larry L.Peterson and Peter S. Davie, "Computer Networks" Fourth edition, Harcourt Asia Pvt. Ltd, 2007.
3. Wayne Tomasi, "Introduction to Data Communication and Networking", First Edition, Pearson Education, 2007.
4. William Stallings, "Data and Computer Communication", Eighth Edition, Pearson Education, 2007.

Web References:

1. http://nptel.ac.in/courses/IIT- MADARS /ComputerNetworks/pdf/Lecture43 _Networksecurity.pdf
2. http: // www.cse.iitk.ac.in/users/dheeraj/cs425

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Course Code:16ECT64	Course Title: EMBEDDED SYSTEM DESIGN	
Core	L:T:P:C	3:0:2:4
Type: Theory	Total Contact hours:	75

Prerequisites: The student should have undergone the course(s):

- 16EET31- Digital Electronics
- 16ECT54 - Microprocessor and Microcontroller

Course Objectives:

The course is intended to:

1. Describe the ARM Processor Architecture.
2. Design ARM processor Peripherals.
3. Explainthe significance of operating systems.
4. Select the suitable communication technique.
5. Analyze the system architecture.

Unit I - INTRODUCTION TO EMBEDDED SYSTEM AND ARM PROCESSOR 9

Definition of Embedded System, Features of Embedded System ,Types of Embedded System , List of Embedded System Devices, LPC 2148 ARM Block diagram, Memory and on chip peripheral devices, ARM 7 TDMI-S, Debug and Emulation Trace facility, Memory Map – Memory re-map and Boot Block, CPU registers, Modes of Operation, PSW, Instruction set, Assembly Language Program for Addition, Subtraction, Multiplication and Division.

Unit II - ARM PROCESSOR INTERFACING TECHNIQUES 9

GPIO register map – Pin Connect Block, 8 bit LEDs, 8bit Switches, Buzzer, Relay, Stepper Motor interfaces, Timer/Counter, Vector Interrupt Controller (VIC), PWM - generating single ended PWM , ADC - Temperature sensor interfacing.

Unit III - REAL TIME OPERATING SYSTEMS 9

Tasks and states, scheduling, Inter Process Communication- Semaphore(s), Shared data problem, Priority Inversion Problem and Deadlock Situations, Message Queues, Mailboxes, Pipes, Introduction to µC OS II, Porting of µC OS II, RTOS functions – OS_STK – OS_EVENT – OSInit() –OSStart() – OSTaskCreate() – OSTaskDel() – OSSemCreate() – OSSemPend() – OSSemPost() - OSTimeDly(), Application programs using the above Functions.

Unit IV - COMMUNICATION DEVICES AND BUS STANDARDS 9

I/O Devices: Types and Examples of I/O devices, Synchronous, Iso-synchronous and Asynchronous Communications from Serial Devices, Internal Serial-Communication Devices: SPI, UART - Timer and Counting Devices – Serial Communication using: 'I^2C'- 'CAN'- Advanced I/O Serial high speed buses

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UNIT V - SYSTEM DESIGN TECHNIQUES 9

Design Methodologies, Requirement Analysis, Specification, System Analysis and Architecture Design. Design Examples: Telephone PBX- System Architecture - Ink jet printer - Hardware Design and Software Design- Personal Digital Assistants- Set-top Boxes.

Course Outcomes:

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

CO1. Describe the ARM Processor Architecture with programming concepts

CO2. Design ARM processor Peripherals using Embedded 'C' Concept.

CO3. Explainthe significance of operating systems in embedded system design.

CO4. Select the suitable communication technique to interface peripherals and sensors.

CO5. Analyze the system architecture using existing product design.

Text Books:

1. Rajkamal, "Embedded Systems Architecture, Programming and Design, Tata McGraw-Hill, First reprint 2003
2. Wayne Wolf, "Computers as Components: Principles of Embedded Computing System Design" Morgan Kaufman Publishers, First Indian Reprint 2001

Reference Books:

1. David E. Simon, "An Embedded Software Primer", Pearson Education Asia, First IndianReprint, 2000
2. K.V.K.K.Prasad "Embedded /Real-Time Systems: Concepts, Design and Programming", Dream tech, Wiley 2003
3. Andrew N Sloss, Dominic Symes and Chris Wright, "ARM System Developer's Guide Designing and optimizing system Software", Morgan Kaufmann publisher, Elsevier-2004
4. Steve Furber, "ARM System –On –Chip architecture", Addision Wesley, 2000
5. Dave, "Embedded Systems: Concepts Design and Programming", 1st edition, Pearson Education, 2015

Web References:

1. http://www.nxp.com/documents/user_manual/UM10139.pdf
2. http://nptel.ac.in/courses/108102045
3. http://www.nptelvideos.in/2012/11/real-time-systems.html

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LIST OF EXPERIMENTS:

Write the Programs in Embedded C for the following experiments

1. 8-bit LED and switch Interface
2. Buzzer, Relay and Stepper Motor Interface
3. Time delay program using built in Timer / Counter feature
4. Generation of PWM Signal

RTOS based experiments

5. Blinking two different LEDs
6. Reading temperature from LM 35 interface

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Course Code:16CET65	Course Title: **ENVIRONMENTAL STUDIES** (Common to all B.E / B.Tech Programmes)	
General	**L: T: P: C**	**3 : 0 : 0: 3**
Type: **Theory**	Total Contact hours:	**45**

Pre-requisites: The student should have undergone the course(s):

- Nil

Course Objectives:

The course is intended to:

1. Describe the multidisciplinary nature of environmental studies.
2. Explain the importance of ecosystem and biodiversity.
3. Identify the causes and propose suitable methods of control for various types of environmental pollution.
4. Describe the importance of environmental protection in social and global context.
5. Explain the relationship between environment and human beings.

Unit I - MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES 9

Definition, scope and importance; Need for public awareness; Natural resources and associated problems - Forest resources, Water resources, Mineral resources, Food resources, Energy resources, Land resources; Role of individual in conservation of natural resources; Equitable use of resources for sustainable lifestyles.

Unit II - ECOSYSTEMS AND BIODIVERSITY 9

Concept of an ecosystem; Structure and function of an ecosystem; Producers, consumers and decomposers; Energy flow in the ecosystem; Ecological succession; Food chains, food webs and ecological pyramids; Introduction, types, characteristic features, structure and function of the following ecosystem - Forest, Grassland, Desert, Aquatic; Biodiversity and its conservation: Introduction; Biogeographically classification of India; Value of biodiversity; Biodiversity at global, national and local levels; India as a mega diversity nation; Threats to biodiversity; Endangered and endemic species of India; Conservation of biodiversity : In-situ and Ex-situ conservation.

UNIT III - ENVIRONMENTAL POLLUTION 9

Definition; Cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear pollution; Solid waste Management: Causes, effects and control measures of urban and industrial wastes; Role of an individual in prevention of pollution; Pollution case studies; Disaster management : floods, earthquake, cyclone and landslides

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Unit IV - SOCIAL ISSUES AND THE ENVIRONMENT 9

From Unsustainable to Sustainable development; Urban problems related to energy; Water conservation, rain water harvesting, watershed management; Environmental ethics: issues and possible solutions; Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Wasteland reclamation ; Consumerism and waste products; Environment Protection Act; Air Act; Water Act ; Wildlife Protection Act; Forest Conservation Act; Issues involved in enforcement of environmental legislation; Public awareness.

Unit V - HUMAN POPULATION AND THE ENVIRONMENT 9

Population growth, variation among nations; Population explosion - Family Welfare Programme; Environment and human health; Human Rights; Value Education; HiV / AiDS; Women and Child Welfare; Role of information Technology in Environment and human health; Case studies; Field work – Visit to a local area to document environmental assets – river / forest / grass land / hill/ mountain; Visit to a local polluted site – Urban / Rural / Industrial / Agriculture; Study of simple ecosystems – pond, river, hill, slopes, etc.

Course Outcomes:

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

CO1. Describe the multidisciplinary nature of environmental studies.

CO2. Explain the importance of ecosystem and biodiversity.

CO3. Identify the causes and propose suitable methods of control for various types of environmental pollution.

CO4. Describe the importance of environmental protection in social and global context.

CO5. Explain the relationship between environment and human beings.

Text Books:

1. Benny Joseph, "Environmental Studies", Tata McGraw Hill, New Delhi, 2006.

2. Mackenzie Davis and Susan Masten, "Principles of environmental engineering and science", Mc-Graw Hill, 3rd edition, 2014.

Reference Books:

1. Trivedi R.K. "Handbook of Environmental Laws, Rules, Guidelines, Compliances andStandards", Vol. I and II, Enviro Media.
2. Cunningham, W.P.Cooper., T.H. Gorhani, "Environmental Encyclopedia", Jaico Publishing House, Mumbai, 2001.
3. Rajagopalan. R, "Environmental Studies - From Crisis to Cure", Oxford University Press,2005.

Web References:

1. 1.http://nptel.ac.in/courses/122102006

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Course Code:16ECL61	Course Title: COMMUNICATION SYSTEMS LABORATORY	
Core	L:T:P:C	0:0:4:2
Type: Practical	Total Contact hours:	60

Prerequisites: The student should have undergone the course(s):

- 16ECL42 - Linear Integrated Circuits Laboratory
- 16ECL52 - Digital Signal Processing Laboratory

Course Objectives:

The course is intended to:

1. Analyze the various analog modulation systems.
2. Categorize different pulse modulation techniques.
3. Verify various error control coding schemes.
4. Analyze the various digital modulation schemes.
5. Analyze the various analog and digital modulation methods using software tools.

LIST OF EXPERIMENTS:

1. Perform Amplitude modulation & Demodulation.
2. Perform Frequency modulation & Demodulation.
3. Carry out Pre emphasis and de emphasis
4. Verification of Sampling Theorem
5. Calculate Signal to Noise Ratio, Noise Figure and Figure of merit using MATLAB
6. Carry out PAM, PPM and PWM
7. Perform PCM encoding /decoding operation
8. Carry out Delta Modulation and Demodulation
9. Perform ASK,FSK,PSK - Modulation and Demodulation
10. Perform Quadrature phase shift keying - Modulation and Demodulation
11. Carry out Convolutional and CRC error control coding schemes
12. Perform AM,FM,PM,ASK,FSK and PSK modulation methods using MATLAB

Course Outcomes:

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

CO1. Analyze the various analog modulation systems using their appropriate characteristics

CO2. Categorize different pulse modulation techniques based on their characteristics.

CO3. Verify various error control coding schemes by using a suitable encoding and decoding methods.

CO4. Analyze the various digital modulation schemes using their appropriate characteristics

CO5. Analyze the various analog and digital modulation methods using MATLAB.

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Reference Books:

1. "Communication Systems Laboratory manual", prepared by the ECE Department .
2. John G.Prokias, Masoud Salehi and Gerhard Bauch, "Contemporary Communication Systems using MATLAB", 3rd Edition, Cengage learning, 2012.

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Course Code:16ECL62	Course Title: VLSI LABORATORY	
Core	L:T:P:C	0:0:4:2
Type: Practical	Total Contact hours:	60

Prerequisites: The student should have undergone the course(s):

- 16EET31 - Digital Electronics

Course Objectives:

The course is intended to:

1. Design and simulate Combinational circuits.
2. Design and simulate Sequential circuits.
3. Demonstrate a Test bench program.
4. Demonstrate Combinational circuits.
5. Demonstrate Sequential circuits.

LIST OF EXPERIMENTS:

1. Design and implementation of Adders (Half adder, full adder, Ripple carry adder).
2. Design and simulation of Encoder and Decoder using Test bench.
3. Design and implementation of a Combinational Circuit using FPGA.
4. Design and implementation of a 1 to 32 DEMUX Circuit using advanced FPGA.
5. Design and implementation of Flip-flops (RS FF, JK FF, T FF, D FF).
6. Design and implementation of Counters (Synchronous and Asynchronous).
7. Design and implementation of Shift registers (SISO, SIPO, PISO, and PIPO) using FPGA.
8. Design and Simulation of various logic gates using CMOS Design.
9. Design and implementation of a Sequential Circuit using FPGA.
10. Implement a 3 tap FIR filter on FPGA.

Course Outcomes:

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

CO1. Design and simulate Combinational circuits for functional verification.
CO2. Design and simulate Sequential circuits for functional verification.
CO3. Demonstrate a Test bench program for a digital circuit.
CO4. Demonstrate Combinational circuits using FPGA.
CO5. Demonstrate Sequential circuits using FPGA.

Reference Books:

1. "VLSI Laboratory manual", prepared by the ECE department.
2. Morris Mano.M, "Digital Design", 3rd edition, Prentice Hall of India Pvt.Ltd, / Pearson Education Pvt.Ltd, 2003.
3. Douglas L. Perry, "VHDL: Programming by Example" Fourth Edition, McGraw-Hill.

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Course Code:16PSL61	Course Title: CAMPUS TO CORPORATE	
General	L:T:P:C	0:0:2:1
Type: PS	Total Contact hours:	30

Course Objectives:

The course is intended to:

1. Display gratitude and social responsibility.
2. Understand various business environments.
3. Explain the transition from a campus mindset to corporate mindset.
4. Be prepared to the work culture.
5. Choose to be presentable and agile.

Unit I -GRATITUDE AND SOCIAL RESPONSIBILITY

Importance of gratitude; Finding opportunities to give back to society; Responsible behavior in public places; Volunteerism during calamities; Social relevancy during engineering design and manufacturing – how social issues could be tackled by engineering solutions;

Unit II -THE WORLD OF BUSINESS (GET TO THE SPECIFICS OF BEHAVIORAL RESPONSES TO CERTAIN SPECIFIC CONTEXTS

World of business - Perceptions vs reality; Various business types - B2B, B2C, & other business models; Various industry verticals – fundamentals, dynamics & nuances; Nature of work as per various functions – Sales & Marketing, Service, Research & Development, Production etc; Self-reflective questionnaire to identify the fitment to a particular field/function;

Unit III -TRANSITION FROM A CAMPUS MINDSET TO CORPORATE MINDSET

ROCK as an acronym (Responsibility, Ownership, Contribution, Knowledgeable (continuous learning)); Responsibility – ways in which responsibility should be demonstrated; Ownership – owning one's career, owning mistakes, desisting from complaining; Contribution – focus on creating value, giving more than receiving (salary & perks); Knowledgeable(continuous learning) – learning just begins after campus, aspects of learning mindset, various opportunities to learn and how they can be utilized at work;

Unit IV -PREPAREDNESS TO ADAPT TO WORK CULTURE

Skills to get through selection process – Interview conversations, resume writing, group discussion & presentation; Handling Cultural differences; Handling Gender dynamics; Alignment to Ethics and values; Alignment to work processes & code of conduct; Handling multiple (often conflicting) demands; Handling peer influence; Conducting sensitively with subordinates, peers &boss; Managing personal finance; Maintaining work-life balance – work & social life, hobbies etc;

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UNIT V -PRESENTABLE AND AGILE

Dressing & grooming – Reasons for good dressing & grooming; Professional etiquette – what is etiquette, professional etiquette vs social etiquette, Aspects of professional etiquette; Wellness – Healthy eating habits, Importance of sleep, Importance of fitness; Importance of cleanliness of surroundings – desk, work area, place of stay (5S);

Course Outcomes:

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

CO1. Display gratitude and social responsibility.
CO2. Understand various business environments – industry & function wise.
CO3. Explain the transition from a campus mindset to corporatemindset.
CO4. Be prepared to adapt to the future work culture.
CO5. Choose to be presentable and agile.

MODE OF DELIVERY:

1. A 2-day learning workshop guided by Learner's workbook.
2. Continuous learning guided by learning journal, and reviews by faculty

ASSESSMENTS AND EVALUATION:

Assessment	Details	Weigh tage	Administrat ion	By Whom	When
Workbook record assessment	Assess the necessary elements to be entered in the workbook	20%	Individual workbooks reviewed by the faculty		Immediately after the learning workshop
Initial Knowledge Test and Scenario based knowledge test	Multiple choice questions (20)	25%	Pen and paper,	Internal team	Immediately after the learning workshop
Review of student journal	Student held journal for the whole semester	30%	Individual journals reviewed by the faculty	Trained faculty members	Once in a week.
Final Knowledge test and Scenario based knowledge test	Multiple choice questions (40)	10%		Internal team	End of semester
Review of student journal by external expert		15%	Student journal comprehens ive review	Trained faculty members	End of semester

END OF SEMESTER VI

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SEMESTER VII

Course Code:16ECT71	Course Title: OPTICAL COMMUNICATION	
Core	L:T:P:C	3 : 0 : 0 : 3
Type:**Theory**	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16ECT51 - Communication Theory
- 16ECT61 - Digital Communication

Course objectives:

The course is intended to:

1. Design optical fiber communication systems.
2. Describe the channel impairments.
3. Explain the construction and characteristics of optical sources.
4. Classify optical detectors based on construction and characteristics.
5. Explain the design concepts and operating principles of modern optical communication system networks.

UNIT I - INTRODUCTION TO OPTICAL FIBERS 9

Introduction, Ray theory transmission- Total internal reflection-Acceptance angle – Numerical aperture – Skew rays – Electromagnetic mode theory of optical propagation – EM waves – modes in Planar guide – phase and group velocity – cylindrical fibers – SM fibers.

UNIT II - SIGNAL DEGRADATION IN OPTICAL FIBERS 9

Attenuation – Material absorption losses in silica glass fibers – Linear and Non linear Scattering losses - Fiber Bend losses – Intra and inter Modal Dispersion – Polarization- PMD- RI profiles. Optical fiber connectors, Fiber alignment and Joint Losses – Fiber Splices – Fiber connectors – Expanded Beam Connectors – Fiber Couplers.

UNIT III - FIBER OPTICAL SOURCES 9

Optical sources: Light Emitting Diodes - LED structures - surface and edge emitters, mono and hetero structures - internal - quantum efficiency, injection laser diode - Single mode laser - comparison of LED and ILD.

UNIT IV - FIBER OPTICAL DETECTORS 9

Optical Detectors: PIN Photo detectors-Avalanche photo diodes-construction, characteristics and properties- Comparison of performance-Photo detector noise – Noise sources - Signal to Noise ratio - Detector response time.

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UNIT V - OPTICAL NETWORKS 9

Basic Networks – SONET / SDH – WDM – Non linear effects on Network performance – Performance of WDM + EDFA system – Solitons.

Course Outcomes:

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

CO1. Design optical fiber communication systems using the fundamental principles of optics and light wave.
CO2. Describe the channel impairments such as losses and dispersion
CO3. Explain the construction and characteristics of optical sources
CO4. Classify optical detectors based on construction and characteristics
CO5. Explain the design concepts and operating principles of modern optical communication system networks.

Text Books:

1. Gerd Keiser, "Optical Fiber Communication" McGraw -Hill International, 4th Edition., 2009.
2. John M. Senior , "Optical Fiber Communications: Principles and Practice", Second Edition, Pearson Education, 2010.

References Books:

1. J.Gower, "Optical Communication System", Prentice Hall of India, 2001.
2. Ramaswami, Sivarajan and Sasaki "Optical Networks", Morgan Kaufmann, 2008.
3. Govind P. Agrawal, "Fiber-optic communication systems", 3rd Edition, John Wiley &Sons, 2004.
4. R.P. Khare, "Fiber Optics and Optoelectronics", Oxford University Press, 2007

Web References:

1. https://www.techopedia.com/definition/24942/optical-communication
2. http://www.redbooks.ibm.com/redbooks/pdfs/sg245230.pdf
3. http://www.worldscientific.com/worldscibooks/10.1142/5160
4. http://nptel.ac.in/courses/117101002/

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Course Code:16ECT72	Course Title: RF AND MICROWAVE ENGINEERING	
Core	L:T:P:C	3 : 0 : 0 : 3
Type:**Theory**	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16ECT33 - Electromagnetic Fields
- 16ECT42 - Transmission lines and Wave guides

Course objectives:

The course is intended to:

1. Analyze the given High Frequency networks.
2. Explain the working principle of microwave passive components.
3. Analyze the characteristics of microwave solid state devices.
4. Explain the operation of microwave tubes and measuring techniques.
5. Design Impedance matching networks.

UNIT I - TWO PORT NETWORK THEORY 9

Review of Low frequency parameters: Impedance, admittance, hybrid and ABCD parameters – High Frequency parameters, Formulation of S parameters for a Two port Network, Scattering Matrix representation of N port Network, Properties and proof of S parameters: Reciprocal and lossless Network, Components at high frequencies – Wire, Resistor, Capacitor, Inductor, Transmission Lines.

UNIT II - MICROWAVE PASSIVE COMPONENTS 9

Microwave frequency range, Applications-Principles of Operation and S Matrix derivation of Microwave junctions: E-plane Tee, H-plane Tee, Magic Tee – Corners, bends, twists and matched terminations - Directional couplers–Two hole directional coupler-Isolator- Phase shifters -Three port Circulator - Attenuator

UNIT III - MICROWAVE SOLID STATE DEVICES 9

Microwave Transistors: Operation, characteristics and application of BJTs and FETs -Principles of tunnel diodes, Varactor diodes – Transferred Electron Devices: Gunn diode- Avalanche Transit time devices: IMPATT Diode. Parametric devices: Principles of operation, Applications of parametric amplifier - Microwave monolithic integrated circuit (MMIC): Materials and fabrication techniques

UNIT IV - MICROWAVE TUBES AND MEASUREMENTS 9

Microwave tubes- High frequency limitations - Principle of operation of Two cavity Klystron, Reflex Klystron, Helix Traveling Wave Tube and Cylindrical Magnetron. Microwave measurements: Measurement of VSWR, Power, Impedance, Attenuation

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UNIT V - RF AMPLIFIER DESIGN AND MATCHING NETWORKS 9

Amplifier power relation, stability considerations, Stabilization Methods, Noise figure, Impedance matching networks: Impedance Matching Using Discrete Components-T and π matching networks-Microstrip line matching networks.

Course Outcomes:

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

CO1. Analyze the given High Frequency network using S parameters.
CO2. Explain the working principle of microwave passive components using S-matrix.
CO3. Analyze the characteristics of microwave solid state devices with its Application.
CO4. Explain the operation of microwave tubes and measuring techniques.
CO5. Design Impedance matching networks for RF amplifiers.

Text Books:

1. Liao, S.Y., "Microwave Devices & Circuits", Prentice Hall of India, 2006.
2. Ludwig, R and Bretshko, P., "RF Circuit Design", Pearson Education, Inc., 2006.

References Books:

1. Robert E. Collin, "Foundations for Microwave Engineering", 2nd edition, John Wiley & Sons, 2009.
2. Annapurna Das and Das, S. K., "Microwave Engineering", Tata McGraw Hill Inc., 2009.
3. Radmanesh, M. M., "RF & Microwave Electronics Illustrated", Pearson Education, 2007.
4. Pozar, D. M., "Microwave Engineering", John Wiley & sons, Inc., 2006.
5. Dunsmore, J. P.,"Handbook of Microwave Component Measurements: with Advanced VNA Techniques", 2nd edition, John Wiley & Sons,2012.

Web References:

1. http://home.sandiego.edu/~ekim/e194rfs01/
2. http://nptel.ac.in/courses/117105130/
3. http://nptel.ac.in/syllabus/117105029/
4. http://nptel.ac.in/courses/117101119/23
5. https://www.microwaves101.com

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Course Code:16ECL71	Course Title: MICROWAVE AND OPTICAL COMMUNICATION LABORATORY	
Core	L:T:P:C	0 : 0 : 4 : 2
Type:**Practical**	Total Contact hours:	**60**

Prerequisites: The student should have undergone the course(s):

- 16ECT55 - Antenna and Wave Propagation

Course objectives:

The course is intended to:

1. Measure the losses in optical fibre and its numerical aperture.
2. Examine the characteristics of optical sources
3. Analyze the working Principle of Microwave sources.
4. Analyze the characteristics of optical fibre.
5. Measure the performance parameters of microwave components and devices.

LIST OF EXPERIMENTS:

1. Measurement of Numerical Aperture and bending losses in Optical fiber.
2. Measurement of Power Distribution in directional coupler and Magic Tee.
3. VI characteristics of LED and LASER Diode.
4. Characteristics of Gunn Diode Oscillator
5. Characteristics of Reflex Klystron Oscillator
6. Frequency and wavelength measurement using Klystron.
7. Impedance measurement by Slotted Line Method.
8. Radiation pattern measurement of Horn Antenna.
9. Optical Time Domain Reflect meter
10. Measurement of characteristics of RF passive components (Directional coupler, Power divider and circulator) using Network Analyzer.
11. Design of low pass and high pass filters using ADS

Course Outcomes:

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

CO1. Measure the losses in optical fibre and its numerical aperture.
CO2. Examine the characteristics of optical sources used in optical communication systems.
CO3. Analyze the working Principle of Microwave sources with its design mechanism.
CO4. Analyze the characteristics of optical fibre using OTDR.
CO5. Measure the performance parameters of microwave components and devices using appropriate equipment.

Reference Book:

1. Microwave and Optical Communication Laboratory manual prepared by the ECE department.

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Course Code:16ECL72	Course Title: NETWORKS LABORATORY	
Core	L:T:P:C	0 : 0 : 4 : 2
Type:**Practical**	Total Contact hours:	**60**

Prerequisites: The student should have undergone the course(s):

- 16ECT63 - Computer Communication Networks

Course Objectives:

The course is intended to:

1. Choose an appropriate network topology.
2. Analyze the behavior of MANET.
3. Evaluate system, network, and security requirements.
4. Demonstrate TCP and UDP.
5. Select an appropriate Networking tool and work in a team project.

LIST OF EXPERIMENTS:

1. Simulation of Stop and Wait and Sliding window Protocols.
2. Simulation of IP subnet using subnet calculator.
3. Simulation of Link state and Distance vector Routing Protocol.
4. Simulation of Data encryption and decryption.
5. Implementation of Token Ring and Token Bus.
6. Simulation and Analysis of various routing protocols.
7. Evaluation of the Impact of network attack on MANET.
8. Simulation of Wi-Fi Networks.
9. Simulation based comparison of TCP variants.
10. Simulation of a wired and wireless network consisting of TCP , UDP Traffic using NS2 &Calculation of throughput using AWK script.

Course Outcomes:

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

CO1. Choose an appropriate Topology for setting up the network.
CO2. Analyze the behavior of MANET under different circumstances.
CO3. Evaluate system, network, and security requirements.
CO4. Demonstrate TCP and UDP using open source software.
CO5. Select an appropriate Networking tool and work in a team project.

Reference Books:

1. "Networks Laboratory manual", prepared by the ECE department.

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PROFESSIONAL ELECTIVES (PE)

Communication and Networking

Course Code:16ECE01	Course Title:WIRELESS COMMUNICATION	
Elective	L:T:P:C	3:0:0:3
Type: Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16ECT61- Digital Communication

Course Objectives:

The course is intended to:

1. Explain the spectrum allocation for wireless communication
2. Analyze various propagation models.
3. Design various signaling schemes.
4. Analyze the performance of multipath mitigation techniques.
5. Analyze the performance multiple antenna techniques.

UNIT I - CELLULAR ARCHITECTURE 9

Multiple Access techniques: FDMA- TDMA- CDMA, Cellular concept: Frequency reuse - channel assignment- hand off- interference and system capacity- trunking and grade of service – Coverage and capacity improvement.

UNIT II - WIRELESS CHANNELS 9

Large scale path loss: Path loss models- Free Space propagation model- Two Ray model, Link Budget design, Small scale fading: Parameters of mobile multipath channels: Time dispersion parameters-Coherence bandwidth – Doppler spread and Coherence time, Fading due to Multipath time delay spread: flat fading – frequency selective fading, Fading due to Doppler spread: fast fading – slow fading.

UNIT III - DIGITAL SIGNALING FOR FADING CHANNELS 9

Structure of a wireless communication link, Modulation formats: Principles of Offset QPSK -π/4DQPSK, Minimum Shift Keying, Gaussian Minimum Shift Keying, Error performance in fading channels, OFDM: principle - Cyclic prefix -Channel estimation - PAPR.

UNIT IV - MULTIPATH MITIGATION TECHNIQUES 9

Equalization – Adaptive equalization, Linear and Non-Linear equalization, Zero forcing and LMS Algorithms. Diversity – Micro and Macro diversity, Diversity combining techniques, Error probability in fading channels with diversity reception, Rake receiver.

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UNIT V - MULTIPLE ANTENNA TECHNIQUES 9

Smart antenna: Capacity increase - Receiver structure, MIMO systems: spatial multiplexing -System model - Channel state information - capacity in fading and non-fading channels - diversity- Pre-coding - Beam forming.

Course Outcomes:

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

CO1. Explainthe spectrum allocation for wireless communication using Multiple access techniques.
CO2. Analyze various propagation models for wireless channels.
CO3. Design various signaling schemes for wireless communication.
CO4. Analyze the performance of multipath mitigation techniques for reliable wireless communication.
CO5. Analyze the performance multiple antenna techniques for improving channel capacity.

Text Books:

1. T.S.Rappaport, "Wireless Communications: Principles and Practice, Second Edition, Prentice Hall of India, Tenth Impression, 2013.
2. Andreas.F. Molisch, "Wireless Communications", Second Edition, John Wiley –India, 2007.

Reference Books:

1. David Tse and Pramod Viswanath, "Fundamentals of Wireless Communication", Cambridge University Press, 2005.
2. Upena Dalal, "Wireless Communication", Oxford University Press, 2010.
3. Van Nee, R. and Ramji Prasad, "OFDM for wireless multimedia communications", Artech House publisher, 2000.
4. Simon Haykinsand Michael Moher, "Modern Wireless Communications", Pearson Education, 2007.

Web References:

1. https://www.cyut.edu.tw/~yfahuang/huang/EX0387CH07.pdf
2. http://nptel.ac.in/courses/117102062 /
3. http://textofvideo.nptel.iitm.ac.in/video.php?courseId=117104099
4. http://www.ifp.illinois.edu/~pramodv/Chapters_PDF/Fundamentals_Wireless_Communication_chapter1.pdf

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Course Code:16ECE02	Course Title: HIGH SPEED NETWORKS	
Elective	L:T:P:C	3:0:0:3
Type: Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16ECT63 - Computer Communication Networks

Course Objectives:

The course is intended to:

1. Describe ATM and Frame relay operation.
2. Analyze queuing models
3. Explain TCP and ATM congestion control techniques
4. Select a suitable quality of services.
5. Identify the different protocols for quality of service.

UNITI - HIGH SPEED NETWORKS **9**

Frame Relay Networks – Asynchronous transfer mode – ATM Protocol Architecture, ATM logical Connection, ATM Cell – ATM Service Categories – AAL, High Speed LANs:Fast Ethernet, Gigabit Ethernet, Fiber Channel – Wireless LANs: applications,requirements – Architecture of 802.11

UNIT II - CONGESTION AND TRAFFIC MANAGEMENT **9**

Queuing Analysis- Queuing Models – Single Server Queues – Effects of Congestion Congestion Control – Traffic Management – Congestion Control in Packet Switching Networks – Frame Relay Congestion Control.

UNIT III- TCP AND ATM CONGESTION CONTROL **9**

TCP Flow control – TCP Congestion Control — KARN's Algorithm – Window management – Performance of TCP over ATM. Traffic and Congestion control in ATM – Requirements – Attributes –Traffic Management Frame work, Traffic Control – ABR traffic Management – ABR ratecontrol, RM cell formats, ABR Capacity allocations GFR traffic management.

UNITIV - INTEGRATED AND DIFFERENTIATED SERVICES **9**

Integrated Services Architecture – Approach, Components, Services- Queuing Discipline, FQ, PS, BRFQ, GPS, WFQ – Random Early Detection, Differentiated Services.

UNIT V - PROTOCOLS FOR QOS SUPPORT **9**

RSVP – Goals and Characteristics, Data Flow, RSVP operations, Protocol Mechanisms –Multiprotocol Label Switching – Operations,Label Stacking, Protocol details–RTP–Protocol Architecture,Data Transfer Protocol,RTCP.

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Course Outcomes:

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

CO1. Describe ATM and Frame relay operation of high speed networks.
CO2. Analyze queuing models for congestion and traffic management using congestion control techniques.
CO3. Explain TCP and ATM congestion control using algorithms and traffic management techniques.
CO4. Select a suitable quality of services for end applications.
CO5. Identify the different protocols for quality of service support to different applications.

Text Books:

1. WilliamStallings,"High Speed Networks and Internet", Pearson Education, Second Edition, 2002.
2. Uyless Black,"MPLS and Label Switching Networks", Pearson Education, Second Edition, 2001.

Reference Books:

1. Warland, PravinVaraiya, "High performance communication networks", SecondEdition, Jean Harcourt Asia Pvt. Ltd., 2001.
2. IrvanPepelnjk, Jim Guichard, Jeff Apcar,"MPLS and VPN architecture", CiscoPress,Volume I and II,2003.
3. SumitKasera and PankajSethi, "ATM Networks", Second Edition,TataMcGraw-Hill-New Delhi,2006.
4. Rainer Handel,ManfredN.Huber and Stefan Schroder, "ATM Networks",ThirdEdition,Pearson Education Asia,2002.

Web References:

1. http://nptel.ac.in/courses/106105081/1
2. http://nptel.ac.in/courses/106105082/30

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Course Code:16ECE03	Course Title: ELECTRO MAGNETIC INTERFERENCE AND COMPATIBILITY	
Elective	L:T:P:C	3:0:0:3
Type: Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16ECT33 - Electro Magnetic Fields
- 16ECT42 - Transmission Lines and Wave Guides
- 16ECT55 - Antenna and Wave Propagation

Course Objectives:

The course is intended to:

1. Identify various sources of EMI and their impacts on society.
2. Discuss various EMI coupling techniques in Electromagnetic Environment.
3. Differentiate the various EMI mitigation techniques.
4. Select a suitable EMC standard for given products.
5. Choose an appropriate EMI measurement techniques for given products.

Unit I - BASICS OF EMI/ EMC CONCEPTS 9

Definition of EMI and EMC, Intra and Inter system EMI, Sources and victims of EMI, Conducted and Radiated EMI emission and susceptibility, Transient and ESD, Case Histories: Radiation Hazards to humans.

Unit II -COUPLING MECHANISM 8

Coupling: Common mode coupling- Differential mode coupling- Common impedance coupling- Ground loop coupling, Field to cable coupling, Cable to cable coupling, Power mains and Power supply coupling.

Unit III -EMI CONTROL TECHNIQUES 10

Shielding – principle, choice of materials for H, E and free space fields and thickness, EMI gaskets, Bonding, Grounding: circuits- system and cable grounding, Filtering, Transient EMI control devices and applications, PCB Zoning, Component selection, mounting, trace routing.

Unit IV - STANDARDS AND REGULATION 9

National and International standardizing organizations, Common EMC Standards: FCC, CISPR, ANSI, Frequency assignment, spectrum conversation.

UNIT V - EMI MEASUREMENTS 9

Open area test site, TEM cell, EMI test shielded chamber and shielded ferrite lined anechoic chamber, Tx /Rx Antennas, Sensors, Injectors / Couplers, and coupling factors, EMI Rx and Spectrum analyser.

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Course Outcomes:

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

CO1. Identify various sources of EMI and their impacts on society.
CO2. Discuss various EMI coupling techniques in Electromagnetic Environment
CO3. Differentiate the various EMI mitigation techniques
CO4. Select a suitable EMC standard for given products
CO5. Choose an appropriate EMI measurement techniques for given products

Text Books:

1. Kodali.V. P., "Engineering EMC Principles, Measurements and Technologies", 2nd edition, IEEE Press, Newyork, 2001.
2. Henry W. Ott. "Electromagnetic Compatibility Engineering", John Wiley and Sons, Inc., 2009.

Reference Books:

1. Keiser B., "Principles of Electromagnetic Compatibility", 3rdedition, Artech house, Norwood, 1987.
2. Archambeault B. R., BrenchC. and Ramahi O. M., "EMI/EMC Computational Modeling Handbook", 2nd edition, Springer, 2001.
3. Paul R. C., "Introduction to Electromagnetic compatibility", 2ndedition, Wiley India PVT Limited, 2010.
4. W Scott Bennett, "Control and Measurement of Unintentional Electromagnetic Radiation", John Wiley and Sons Inc., 1997.

Web References:

1. https://www.nasa.gov/centers/johnson/pdf/639521main_EMI-EMC_User_Test_Planning_Guide.pdf
2. https://ocw.mit.edu/courses/physics/8-311-electromagnetic-theory-spring-2004/
3. http://www.iec.ch/emc/explained/
4. https://www.dare.eu/testing/emc

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Course Code:16ECE04	Course Title: BLUETOOTH TECHNOLOGY	
Elective	L:T:P:C	3:0:0:3
Type: Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16ECT63 - Computer Communication Networks

Course Objectives:

The course is intended to:

1. Explain the basic operation of Bluetooth and its architecture.
2. Classify Protocol and its functions.
3. Analyze Bluetooth link, Power Control and QoS.
4. Explain the different levels of logic link control.
5. Describe the various security methods.

UNIT I - BASIC CONCEPTS 9

Bluetooth: Origin, Advantages, Technology, Evolution, Topology, Problems, Basic Concepts: Spread Spectrum-Circuit and Packet Switching-Time Division duplexing-Physical Links-Peeking into Packets-Bluetooth Packets-Logical Channels-Client Server Architecture-Service Discovery.

UNIT II - BLUETOOTH PROTOCOL ARCHITECTURE 9

Bluetooth network Architecture, Open System Interconnection: Bluetooth Protocol Stack, Bluetooth core Protocols, Cable Replacement Protocols, Telephony Control Protocol, Adopted Protocols, Usage Models and Profiles.

UNIT III - BLUETOOTH LINK MANAGEMENT 9

Types of PDUs, General Response messages, Authentication, Pairing, Changing the Link Key, Encryption, Clock offset request, Slot offset information, Timing accuracy information Request, LMP version, Supported features, Switching of master-Slave Role, Name Request, Detach, Hold, Sniff, Park Mode, Power Control, QoS, Paging Scheme, Link Supervision, Connection establishment, Test Modes.

UNIT IV - LOGICAL LINK CONTROL 9

L2CAP Functions: Basic operation-State Machine-Data packet format – Signaling-Configuration Parameter Options-Service primitives.

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UNIT V - BLUETOOTH SECURITY 9

Security Modes: Link level security – Implementation-Architecture overview-Security level of Services-Connection setup-Connectionless L2CAP, Security Manager, Interface to L2CAP, Interface to other Multiplexing Protocols.

Course Outcomes:

At the end of the course the student should be able to:

CO1. Explain the basic operation of Bluetooth and its architecture.
CO2. Classify Protocol and its functions for information exchange between Various interconnected devices.
CO3. Analyze Bluetooth link, Power Control and QoS.
CO4. Explain the different levels of logic link control.
CO5. Describe the various security methods of Bluetooth technology.

Text Books:

1. Nathan J Muller,"Bluetooth Demystified",1st Edition, Tata McGraw-Hill, New Delhi, 2000.
2. Brent A. Miller, ChatschikBisdikian "Bluetooth Revealed", 2nd Edition, Prentice Hall, 2001.

Reference Books:

1. Jennifer Bray and Charles F. Sturman, "Bluetooth 1.1 Connect without Cables", 2nd edition, Prentice Hall, 2001.
2. Christian Gehrmann, JoakimPersson, Ben Smeets, "Bluetooth security", 1st edition, Arch tech House Inc, 2004.
3. C.S.R.Prabhu, A.PrathapReddi, "Bluetooth Technology and its Applications with Java and J2ME", 1st edition, Prentice -Hall of India Private Limited, New Delhi, 2004.
4. Robert Morrow, "Bluetooth operation and Use", 1st edition, McGraw-Hill, 2000.

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1. http://www.nptel.ac.in/courses/106105080
2. http://www.engineersgarage.com/articles/bluetooth-technology
3. http://searchmobilecomputing.techtarget.com/definition/Bluetooth
4. https://www.bluetooth.com

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Course Code:16ECE05	Course Title: MULTIMEDIA COMMUNICATION	
Elective	L:T:P:C	3:0:0:3
Type: Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16ECT61 - Digital Communication

Course Objectives:

The course is intended to:

1. Identify different multimedia systems and their requirements
2. Apply various coding techniques for Audio and Video compression
3. Apply various coding techniques for text and image compression
4. Explain the concept of VOIP Technology
5. Explain the process of multimedia streaming

UNIT I- MULTIMEDIA COMPONENTS 9

Introduction - Multimedia skills - Multimedia components and their characteristics - Text, sound, images, graphics, animation, video, hardware.

UNIT II - AUDIO AND VIDEO COMPRESSION 9

Audio compression–DPCM-Adaptive PCM –adaptive predictive coding-linear Predictive coding-code excited LPC-perpetual coding - Video Compression: Principles, H.261, H.264, MPEG 1, 2, and 4.

UNIT III - TEXT AND IMAGE COMPRESSION 9

Compression principles- Source Encoders and Destination Encoders- Lossless and Lossy Compression- Entropy encoding – Source encoding -Text Compression: Static and Dynamic Huffman coding– Arithmetic Coding –Lempel-ziv-welch Compression- Image Compression.

UNIT IV - VOIP TECHNOLOGY 9

Basics of IP transport, VoIP challenges, H.323/ SIP –Network Architecture, Protocols, Call establishment and release, VoIP and SS7, Quality of Service-CODEC Methods- VOIP applicability.

UNIT V - MULTIMEDIA NETWORKING 9

Multimedia networking – Applications- streamed stored and audio-making the best Effort service- protocols for real time interactive Applications-distributing multimedia-beyond best effort service- scheduling and policing Mechanisms.

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Course Outcomes:

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

CO1. Identify different multimedia systems and their requirements.
CO2. Apply various coding techniques for Audio and Video compression.
CO3. Apply various coding techniques for text and image compression.
CO4. Explain the concept of VOIP Technology.
CO5. Explain the process of multimedia streaming across networks.

Text Books:

1. Fred Halshall, "Multimedia communication - Applications, Networks, Protocols and Standards", Pearson Education, 2007.
2. Khalid Sayood, "Introduction to Data Compression", 2nd Edition, Morgan Kauffman Harcourt India, 2000.

Reference Books:

1. Tay Vaughan, "Multimedia: Making it work", 7th Edition, TMH 2008.
2. Kurose and W.Ross "Computer Networking - A Top Down Approach", 6th Edition, Pearson Education, 2005.
3. KR. Rao, Z S Bojkovic, D A Milovanovic, "Multimedia Communication Systems: Techniques, Standards, and Networks", Pearson Education,2007.
4. R.Steinmetz, K.Nahrstedt, "Multimedia Computing, Communications and Applications", 6th Edition, Pearson Education, 2009.

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1. http://nptel.ac.in/downloads/117105083/
2. http://nptel.ac.in/courses/117105081/
3. http://nptel.ac.in/courses/106105082/38
4. http://nptel.ac.in/courses/117105081/32

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Course Code:16ECE06	Course Title: SATELLITE COMMUNICATION	
Elective	L:T:P:C	3:0:0:3
Type:Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16ECT51 - Communication Theory
- 16ECT61 - Digital Communication

Course Objectives:

The course is intended to:

1. Describe Satellite orbits and launching.
2. Identify the components required for space and earth segment.
3. Design link power budget for Satellite communication link.
4. Compare various multiple access techniques used in Satellite communication.
5. Select an appropriate satellite for the given application.

UNIT I- SATELLITE ORBITS AND LAUNCHING **9**

Kepler's three laws of Planetary motion, orbital terms for Earth Satellites, orbital perturbations, Geo stationary orbit: Look Angle determination, limits of visibility, Earth Eclipse of Satellite, Sun transit outages, Launces and launch vehicles.

UNIT II - SPACE SEGMENT AND EARTH SEGMENT **9**

Space Segment: Power Supply – Attitude Control – Spinning Satellite Stabilization –Momentum Wheel Stabilization – Station Keeping – Thermal Control – TT&C Subsystem – Transponders: The wideband receiver, input Demultiplxer, power amplifier – Antenna Subsystem, Receive-Only Home TV Systems: Outdoor Unit – Indoor Unit for Analog TV -Master Antenna TV System – Community Antenna TV System

UNIT III - SPACE LINK **9**

Equivalent isotropic radiated power – Transmission losses – Free-space transmission – Feeder losses – Antenna misalignment losses – Fixed atmospheric and ionospheric losses – Link power budget equation – System noise – Antenna noise – Amplifier noise temperature – Amplifiers in cascade – Noise factor – Noise temperature of absorptive networks – Overall system noise temperature – Carrier to- Noise ratio – Uplink – Saturation flux density – Input back off – The earth station - HPA – Downlink – Output back off – Satellite TWTA output.

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UNIT IV - SATELLITE ACCESS 9

Modulation and Multiplexing: Voice - Data - Video - Analog - digital transmission system, Digital video Broadcast, multiple access: FDMA - TDMA - CDMA, Assignment Methods, Spread Spectrum communication.

UNIT V - SATELLITE APPLICATIONS 9

INTELSAT Series, INSAT - VSAT, mobile satellite services: GSM- GPS- INMARSAT-LEO - MEO, Satellite Navigational System,Direct Broadcast satellites, Direct to home Broadcast, Digital audio broadcast, GRAMSAT, Specialized services: Email -Video conferencing - Internet.

Course Outcomes:

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

CO1. Describe Satellite orbits and launching.
CO2. Identify the components required for space and earth segment.
CO3. Design link power budget for Satellite communication link.
CO4. Compare various multiple access techniques used in Satellite communication.
CO5. Select an appropriate satellite for the given application.

Text Books:

1. Dennis Roddy, "Satellite Communications", Fourth Edition, McGraw Hill International Editions, 2014.
2. Wilbur L. Pritchard, Hendri G. Suyderhoud, Robert A. Nelson,'Satellite Communication Systems Engineering', Second Edition,Pearson, 2007.

Reference Books:

1. Tri T.Ha, "Digital satellite communication", 2nd Edition, McGraw Hill, New york,1990.
2. Timothy Pratt, Charles Bostian& Jeremy Allmuti "Satellite Communications", 2nd Edition,John Wiley & Sons (Asia) Pvt Ltd, 2004.
3. M.Richharia, "Satellite Communication Systems-Design Principles", 2nd Edition,Macmillan/BSPBooks, 2012.
4. Bruce R.Elbert, "The Satellite Communication Applications Hand Book", 2nd Edition Artech House Boston, 2003.

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1. http://www.nptelvideos.com/video.php?id=507
2. http://nptel.ac.in/syllabus/117107036/
3. http://nptel.ac.in/courses/106105082/33

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Course Code:16ECE07	Course Title: COGNITIVE NETWORKS	
Elective	L:T:P:C	3:0:0:3
Type:Theory	Total Contact hours:	45

Prerequisites:The student should have undergone the course(s):

- 16ECE01- Wireless Communication

Course Objectives:

The course is intended to:

1. Describe the basics of the Software defined Radio.
2. Explain the concepts of spectrum management in Software defined Radio.
3. Explain the need for cognitive radio communication technologies.
4. Explain the functions of the Cognitive Radio.
5. Select a suitable methodology to minimize the channel interference.

UNIT I- INTRODUCTION TO SOFTWARE DEFINED RADIO **9**

Need for software defined radio, definition, characteristics and benefits of SDR, design principles of SDR, The ideal Software Radio - The Software Radio Functional Architecture.

UNIT II - SDR ARCHITECTURE **9**

History of SDR, Basic SDR- hardware architecture, computational processing resources, software architecture, Spectrum management.

UNITIII - COGNITIVE RADIO TECHNOLOGIES **9**

Introduction: Brief concept of Cognitive Radio-Definition, Functions and applications of CRN, Policy challenges: Dynamic spectrum access-Security, Available Technologies for CRs.

UNIT IV - COGNITIVE RADIO ARCHITECTURE **9**

Functions, components and design rules:AACR Functional component Architecture-Design rules- Flexible functions of component Architecture, Cognition cycle: observe, orient, plan, decide and act phases.

UNIT V - SPECTRUM AWARENESS **9**

Interference avoidance problem, cognitive radio role, spectrum sensing, Channel awareness and multiple signals in space, adaptive spectrum implications for Cognitive Radio hardware.

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Course Outcomes:

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

CO1. Describe the basics of the Software defined Radio using its functional architecture.
CO2. Explain the concepts of spectrum management in Software defined Radio.
CO3. Identify the need for cognitive radio communication technologies.
CO4. Explain the functions of the Cognitive Radio using its functional architecture.
CO5. Select a suitable methodology to minimize the channel interference for Efficient usage of spectrum.

Text Books:

1. Bruce A. Fette, "Cognitive Radio Technology", Elsevier, 2009.
2. Software Radio: A Modern Approach to Radio Engineering By Jeffrey H. Reed Pearson Education,2002

Reference Books:

1. Joseph Mitola III, "Software Radio Architecture: Object-Oriented Approaches to Wireless System Engineering", John Wiley and Sons Ltd. 2000
2. Thomas W.Rondeau, Charles W. Bostain, "Artificial Intelligence in Wireless communication", ARTECH HOUSE .2009.
3. Markus Dillinger, KambizMadani, Nancy Alonistioti, "Software Defined Radio", John Wiley, 2003.
4. Alexander M. Wyglinski, Maziarnekovee, Y. Thomas Hu, "Cognitive Radio Communication and Networks", Elsevier, 2010.

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1. http://link.springer.com/chapter/10.1007/978-1-4020-5542-3_2.
2. http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=4644051

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Course Code:16ECE08	Course Title: OFDM AND MIMO CONCEPTS	
Elective	L:T:P:C	3:0:0:3
Type:Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16ECE01–WirelessCommunication

Course Objectives:

The course is intended to:

1. Describe the effects of fading in wireless channels.
2. Analyze the characteristics of wireless channels.
3. Discuss the need for multiple antenna systems and the effects of channelcharacteristics.
4. Discuss the various concepts of MIMO.
5. Analyze the OFDM system performance.

UNIT I - INTRODUCTION TO WIRELESS SYSTEMS 9

Evolution of Wireless Communication Technologies- Modeling Wireless Channel, Wireless Fading Channel Model- Fading Channel Distribution, Rayleigh Fading Channel- Bit Error Rate (BER) of Fading Channels.

UNIT II - WIRELESS CHANNEL CHARACTERIZATION 9

Max Delay Spread, RMS Delay Spread and Inter Symbol Interference- Coherence Bandwidth of Wireless Channel- Mobility and Doppler Effect in Wireless Channels- Impact of Doppler Effect on Wireless Channel.

UNIT III - MULTIPLE ANTENNA WIRELESS SYSTEMS AND DIVERSITY 9

Diversity: Principle, Multiple Antenna Diversity, Maximal-Ratio Combining-BER of Multiple Antenna Wireless Systems, Approximate BER for Multiple Antenna Wireless System- Deep Fade in Multi Antenna Systems.

UNIT IV - MIMO WIRELESS COMMUNICATION 9

Multiple Input Multiple Output (MIMO) Systems: Examples of MIMO Systems, Duplexer, Diplexer, Triplexers, MIMO Receivers – Space Time Block Codes, Alamouti Code, BER of Alamouti Coded System-SVD in MIMO- Capacity of MIMO Wireless Systems.

UNIT V - OFDM WIRELESS COMMUNICATION 9

Transmission in Multicarrier Systems: FFT/IFFT Processing in OFDM, Cyclic Prefix in OFDM Systems- Schematic Representation of OFDM Transmitter and Receiver- BER Performance of OFDM Systems.

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Course Outcomes:

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

CO1. Describe the effects of fading in wireless channels.
CO2. Analyze the characteristics of wireless channels.
CO3. Discuss the need for multiple antenna systemsand the effects of channel characteristics.
CO4. Discuss the various concepts of MIMO.
CO5. Analyze the OFDM system performance.

Text Books:

1. David Tse and PramodViswanath, "Fundamentals of Wireless Communication", Cambridge University Press, 2005
2. Andrea Goldsmith, "Wireless Communications", Cambridge University Press, 2005

Reference Books:

1. Ramjee Prasad, "OFDM for Wireless Communications Systems", Universal personal communications, 2004
2. Mischa Schwartz, "Mobile Wireless Communications", Cambridge University Press, 2005
3. Andreas F. Molisch, "Wireless Communications",2nd Edition, John Wiley and Sons, 2011.
4. EzioBiglieri, Robert Calder bank, Anthony Constantinides, Andrea Goldsmith, "MIMO Wireless Communications", Cambridge University Press, 2008.

Web References:

1. https://ep.jhu.edu/programs-and-courses/525.735-mimo-wireless-communications
2. http://nptel.ac.in/courses/117104115/
3. www.ee.iitm.ac.in/~giri/pdfs/EE6002/book-cho
4. www.keysight.com/upload/cmc_upload/All/20Sept2012Webcast.pdf

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Course Code:16ECE09	Course Title: TELECOMMUNICATION AND DIGITAL SWITCHING TECHNIQUES	
Elective	**L:T:P:C**	**3:0:0:3**
Type:**Theory**	Total Contact hours:	**45**

Prerequisites:The student should have undergone the course(s):

- 16ECT51- Communication Theory
- 16ECT63 - Computer Communication Networks

Course Objectives:

The course is intended to:

1. Explain various multiplexing and switching techniques.
2. Analyze different digital switching systems.
3. Identify the need for network synchronization and management.
4. Discuss the essential concepts of ISDN and various types of Digital subscriber loops.
5. Apply Traffic theory to understand the characteristics of the telephone systems

UNIT I - EVOLUTION OF SWITCHING SYSTEMS **9**

Digital transmission : Frequency division multiplexing - Time division multiplexing - Message switching - Circuit switching - Packet switching, Manual switching system, Strowger or step by step system, Electronic switching, Control of switching systems.

UNIT II - DIGITAL SWITCHING **9**

Switching Functions: Space Division Switching - Time Division Switching, Two-dimensional Switching: STS Switching - TST Switching, No.4 ESS Toll Switch, Digital Cross-Connect Systems, Digital Switching in an Analog Environment, Elements of SSN 07 Signaling.

UNIT III - NETWORK SYNCHRONIZATION CONTROL AND MANAGEMENT 9

Timing: Timing Recovery - Phase Locked Loop, Clock Instability, Jitter Measurements: Systematic Jitter, Timing Inaccuracies: Slips, Asynchronous Multiplexing, Network Synchronization, U.S. Network Synchronization, Network Control, Network Management.

UNIT IV - DIGITAL SUBSCRIBER ACCESS **9**

ISDN:ISDN Basic Rate Access Architecture - ISDN D Channel Protocol- Digital Subscriber Loops: High Data Rate DSL -Asymmetric DSL - VDSL.

Digital Loop Carrier Systems: Universal Digital Loop Carrier Systems - Integrated Digital Loop Carrier Systems - Next-Generation Digital Loop Carrier, Fiber in the Loop, Hybrid Fiber Coax Systems, Voice band Modems: PCM Modems, Local Microwave Distribution Service, Digital Satellite Services.

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UNIT V - TRAFFIC ANALYSIS 9

Traffic Characterization, Traffic Measurements: Arrival time Distributions - Holding Time Distributions, Loss Systems, Network Blocking Probabilities: End-to-End Blocking Probabilities, Overflow Traffic, Delay Systems: Exponential service Times - Constant Service Times, Finite Queues, Tandem Queues.

Course Outcomes:

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

CO1. Explain various multiplexing and switching techniques.
CO2. Analyze different digital switching systems.
CO3. Identify the need for network synchronization and management.
CO4. Discuss the essential concepts of ISDN and various types of Digital Subscriber loops.
CO5. Apply Traffic theory to understand the characteristics of the telephone systems.

Text Books:

1. Bellamy John, "Digital Telephony", 3rd Edition, John Wiley & Sons, 2000.
2. ThiagarajanViswanathan, "Telecommunication switching systems and Networks",2nd edition,PHI Learning Pvt. Ltd -2015.

Reference Books:

1. D N Krishna Kumar, "Telecommunication and Switching"- Sanguine Technical Publishers,Bangalore, 2008.
2. J.E Flood, "Telecommunication switching, Traffic and Networks", 1st edition, PearsonEducation Ltd, 2011.
3. Syed R Ali, "Digital switching systems", McGraw-Hill, 1998.
4. Behrouz A. Forouzan, "Data Communication and Networking", 5th Edition, TataMcGrawHill,2016.

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1. http://nptel.ac.in/courses/117105076/
2. http://nptel.ac.in/courses/106105082/19
3. http://nptel.ac.in/courses/117104104/

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Course Code:16ECE10	Course Title: ADVANCED WIRELESS COMMUNICATION	
Elective	L:T:P:C	3:0:0:3
Type:Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16ECE01 - Wireless Communication

Course Objectives:

The course is intended to:

1. Explain the essentials of various cellular networks.
2. Analyze the BER for various modulation techniques
3. Illustrate adaptive techniques in modulation and coding.
4. Interpret OFDM and Multi antenna systems.
5. Explain Cognitive Radio and Relaying techniques.

UNIT I- CELLULAR SYSTEMS AND STANDARDS 9

Advanced Mobile Phone Systems (AMPS), Global System for Mobile Communication: Frequency Bands and Channels, International Mobile Telecommunications (IMT-2000): Spectrum Allocation - Services provided by 3G Cellular Systems - Harmonized 3G Systems Universal Mobile Telecommunications Systems (UMTS): 3G UMTS signal processing - WCDMA - HSPA - HSPA+, Towards 4th G: LTE and LTE advanced.

UNIT II - PERFORMANCE OF DIGITAL MODULATION OVER WIRELESS CHANNELS 9

AWGN Channels: Error Probability for BPSK and QPSK - Error Probability for MPSK - Error Probability for FSK and CPFSK, BER analysis of Fading Channels: Outage Probability - Average Probability of Error - Moment generating function approach to average error probability - Combined outage and average error probability.

UNIT III- ADAPTIVE MODULATION AND CODING 9

Adaptive Transmission System, Adaptive Techniques: Variable-Rate Techniques - Variable-error Techniques, Variable Error Probability, Variable-Coding Techniques, Hybrid Techniques, Variable-Rate Variable Power MQAM, General M-ary Modulations: Continuous Rate Adaptation - Discrete Rate Adaptation - Average BER Target.

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UNIT IV - MULTIUSER COMMUNICATION 9

Orthogonal Frequency Division Multiplexing (OFDM): Principle - Implementation of Transceivers - Frequency-Selective Channels - Channel Estimation: Pilot-Symbol-Based Methods, Peak-to-Average Power Ratio, Inter Carrier Interference, Multiple Access – OFDMA, Multicarrier Code Division Multiple Access, Multiantenna Systems: Smart Antennas - Multiple Input Multiple Output Systems.

UNIT V - STANDARDIZED WIRELESS SYSTEMS 9

Cognitive Radio: Cognitive Transceiver Architecture - Principles of Interweaving - Spectrum Sensing - Spectrum Management - Spectrum Sharing - Overlay - Ultra Wide Bandwidth System Communications, Relaying: Principle of Relaying - Fundamental Protocols: Decode-and-Forward - Amplify-and-Forward - Compress-and-Forward, Relaying with Multiple, Parallel Relays.

Course Outcomes:

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

CO1. Explain the essentials of various cellular networks.
CO2. Analyze the BER for various modulation techniques used in wireless Communication.
CO3. Illustrate adaptive techniques in modulation and coding.
CO4. Interpret OFDM and Multi antenna systems.
CO5. Explain Cognitive Radio and Relaying techniques.

Text Books:

1. Andrea Goldsmith, "Wireless Communications", Cambridge University Press, 2007.
2. Andreas F Molisch , "Wireless Communications", John Wiley & Sons, 2010.

Reference Books:

1. Dharma PrakashAgarwal and Qing- Anzeng, "Introduction to Wireless and Mobile Systems", Vikas Publishing House, New Delhi, 2004.
2. Singal T L, "Wireless Communications" Tata McGraw Hill, 2010.
3. Theodore S Rappaport, "Wireless Communications", Pearson Education, Asia, New Delhi, 2009.

Web References:

1. http://nptel.ac.in/courses/117104099/
2. http://nptel.ac.in/courses/117102062/2
3. http://web.cs.ucdavis.edu/~liu/289I/Material/book-goldsmith.pdf
4. https://researchpapers4scolars.files.wordpress.com/2015/06/andreas-f-molisch-wireless-comm.pdf

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Course Code:16ECE11	Course Title: ADVANCED NETWORKING TECHNOLOGIES	
Elective	L:T:P:C	3:0:0:3
Type:Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16ECT63 - Computer Communication Networks

Course Objectives:

The course is intended to:

1. Describe the security issues related in the design of IPV6.
2. Compare MPLS and VPN with their architecture.
3. Analyze the QOS requirements in VOIP.
4. Explain the various client layers of Synchronous optical networks.
5. Explain the various survivability techniques used in WDM networks

UNIT I - INTERNETWORKING 9

IPV6-Design Issues-scalability - Addressing – headers – Routing - Auto configuration -IPV4 Vs IPV6, Transition from IPV4 to IPV6 – Interoperability - QOS in IPV6 - Multicast report - ICMPV6 - Security in IPV6

UNIT II - MPLS AND VPN 9

Virtual private network-Remote access VPN, site-to-site VPN, tunneling and PPP, Security in VPNs, Multiprotocol Label Switching-MPLS operation, Routing in MPLS domains, Tunneling and use of FEC, Traffic engineering, MPLS based VPNs.

UNIT III - QUALITY OF SERVICE 9

Application requirements – VOIP - RT video conferencing - Entertainment video - QOS taxonomy - Resource allocation – Scheduling - Queuing disciplines - Integrated Services -Differentiated Services – RSVP

UNIT IV- CLIENT LAYERS OF THE OPTICAL NETWORKS 9

SONET/SDH- Multiplexing, VCAT and LCAS, SONET/SDH layers, SONET frame structure, SONET/SDH Physical layer, Elements of a SONET/SDH Infrastructure-Optical transport Network – Frame structure , Multiplexing – Generic framing procedure.

UNIT V - WDM NETWORKS 9

WDM: Traffic grooming WDM-Network survivability- Survivability techniques or optical WDM networks-Restoration strategies in optical WDM networks

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Course Outcomes:

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

CO1. Describe the security issues related in the design of IPV6.
CO2. Compare MPLS and VPN with their architecture.
CO3. Analyze the QOS requirements in VOIP.
CO4. Explain the various client layers of Synchronous optical networks.
CO5. Explain the various survivability techniques used in WDM networks.

Text Books:

1. Larry L.Peterson, Bruce S.Davie, "Computer Networks A Systems Approach", Fifth edition, Morgan Kaufmann publishers, 2011
2. Rajiv Ramaswami and Kumar N. Sivarajan, "Optical Networks: A Practical Perspective", Third Edition, Morgan Kaufmann publishers, 2010.

Reference Books:

1. C. Siva Ram Moorthy and Mohan Gurusamy, "WDM Optical Networks : Concept, Design and Algorithms", Prentice Hall of India, Ist Edition, 2002
2. J.F. Kurose and K.W. Ross, "Computer Networking- A top down approach Featuring the internet", Pearson, 2nd edition, 2003.
3. Hersent Gurle and Petit, "IP Telephony, packet Pored Multimedia Communication Systems", Pearson education, 2003.
4. Nader F.Mir , "Computer and Communication Networks", first edition, Pearson education, 2003.

WebReferences:

1. http://www.networktutorials.info/networkhowto/what_is_optical_networking.html
2. https://www.cse.iitb.ac.in/~varsha/allpapers/network-misc/mplsvpns.pdf

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Course Code:16ECE12	Course Title: WIRELESS NETWORKS	
Elective	**L:T:P:C**	**3:0:0:3**
Type:**Theory**	Total Contact hours:	**45**

Prerequisites: The student should have undergone the course(s):

- 16ECT63 - Computer Communication Networks

Course Objectives:

The course is intended to:

1. Identify a suitable wireless network for a given transmission technique.
2. Describe the various operating techniques of wireless networks
3. Describe the concepts of local broadband networks.
4. Select the routing protocols in ADHOC and Sensor networks.
5. Explain the concepts of Wireless Personal Area Network.

UNIT I - INTRODUCTION TO WIRELESS NETWORKS **9**

Overview of Wireless Networks – Introduction and Generation of networks, Characteristics of Wireless medium – Radio propagation mechanism: Physical Layer alternatives – Considerations in the design of Wireless Modems, Short distance baseband Transmission, UWB Pulse Transmission, Carrier modulated transmission, Broadband modems for higher speeds – Wireless medium access alternatives: fixed assignment access for voice oriented networks, random access for data oriented networks.

UNIT II - PRINCIPLES OF WIRELESS NETWORK OPERATION **9**

Network Planning: Network Topologies, Network planning for CDMA Systems – Wireless network operation: Mobility management, Radio resources and power Management, Security in Wireless networks.

UNIT III - LOCAL BROADBAND NETWORKS **9**

Wireless home networking, IEEE 802.11 Standards: Architecture, PHY Layer, MAC Sublayer, MAC Management Sublayer – Wireless ATM networks – HIPERLAN-1: requirements and architecture, PHY and MAC layer – Wireless application protocol.

UNIT IV - AD-HOC AND SENSOR NETWORKS **9**

Adhoc networks: Routing protocols, Hybrid routing protocols, scalable routing strategies, Multipath routing, Clustering protocols. Sensor networks: Introduction, Sensor Networks parameters, Architecture – Security: Authentication, Security Architecture.

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UNIT V - WIRELESS PERSONAL AREA NETWORK 9

Introduction, IEEE 802.15 WPAN, Home RF, Bluetooth: Overall architecture, protocol stack, physical connection, MAC mechanism,frame formats, Connection management,Security.

Course Outcomes:

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

CO1. Identify a suitable wireless network for a given transmission technique.
CO2. Describe the various operating techniques of wireless networks.
CO3. Describe the concepts of local broadband networks using its architecture.
CO4. Select the routing protocols in ADHOC and Sensor networks for security applications.
CO5. Explain the concepts of Wireless Personal Area Network using its architecture.

Text books:

1. Kaveth Pahlavan,K. Prashanth Krishnamurthy, "Principles of Wireless Networks", Prentice Hall of India, 2006.
2. Savo G. Glisic, "Advanced Wireless Networks 4G Technologies", Wiley Publishers, England, 2006.

Reference Books:

1. William Stallings, "Wireless Communications and networks" Pearson / Prentice Hall of India, 2nd Edition, 2007.
2. C.K.Toh, "AdHoc Mobile Wireless Networks", First Edition, Pearson Education, 2002.
3. Gary. S. Rogers and John Edwards, "An Introduction to Wireless Technology", Pearson Education, 2007.
4. SumitKasera and NishitNarang, "3G Networks – Architecture, Protocols and Procedures", Tata McGraw Hill, 2007.
5. Vijay. K. Garg, "Wireless Communication and Networking", Morgan Kaufmann Publishers, 2007.

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1. http://nptel.ac.in/courses/117102062/36
2. http://nptel.ac.in/courses/106105080/pdf/M5L7.pdf

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Course Code:16ECE13	Course Title: CRYPTOGRAPHY AND NETWORK SECURITY	
Elective	L:T:P:C	3:0:0:3
Type:Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16ECT63 - Computer Communication Networks

Course Objectives:

The course is intended to:

1. Apply classical encryption and decryption techniques.
2. Apply the concept of number theory.
3. Analyze the role of MAC functions.
4. Explain the various authentication algorithms.
5. Identify an appropriate security system.

UNIT I- INTRODUCTION AND SYMMETRIC CIPHERS 9

Security goals – Cryptographic attacks - Services and mechanisms – Classical encryption techniques – Block Cipher Design Principles and Modes of Operation – Data Encryption Standard – Triple DES ,Advanced Encryption Standard.

UNIT II - NUMBER THEORY AND PUBLIC KEY CRYPTOGRAPHY 9

Introduction to number theory: Prime numbers, Fermat and Euler's theorem, testing for primality, Chinese Remainder theorem, Quadratic Congruence, Exponentiation and logarithm– Public Key Cryptography and RSA– Key management: Diffie–Hellman key Exchange.

UNIT III - AUTHENTICATION AND HASH FUNCTION 9

Authentication requirements – Authentication functions– Message Authentication Codes– Hash Functions – Security of Hash Functions and MACs – MD5 message Digest algorithm – Secure Hash Algorithm.

UNIT IV - NETWORK SECURITY 9

Authentication Applications: Kerberos – X.509 Authentication Service – Electronic Mail Security – PGP – S/MIME – IP Security – ISAKMP.

UNIT V - SYSTEM LEVEL SECURITY 9

Worms, Viruses, Intrusion detection System (IDS) – Firewall Design Principles, Cryptographic Solutions: A case Study.

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Course Outcomes:

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

CO1. Apply classical encryption and decryption techniques for networksecurity.
CO2. Apply the concept of number theory in cryptography.
CO3. Analyze the role of MAC functions in Information Security.
CO4. Explain the various authentication algorithms for network security.
CO5. Identify an appropriate security system to provide system levelsecurity.

Text Books:

1. William Stallings, "Cryptography and Network Security - Principles and Practices", Prentice Hall of India, Third Edition, 2003.
2. Behrouz A. Forouzan, "Cryptography and Network Security", Tata McGraw Hall, Second Edition,2011.

Reference Books:

1. AtulKahate, "Cryptography and Network Security", Tata McGraw-Hill, 2003.
2. BruceSchneier, "Applied Cryptography", John Wiley and Sons Inc, 2001.
3. Charles P. Pfleeger, Shari Lawrence Pfleeger, "Security in Computing", Third Edition, Pearson Education, 2003.
4. Wenbo Mao, "Modern Cryptography: Theory and Practice", Pearson Education, Second edition, 2007.

Web References:

1. http://nptel.ac.in/courses/106105031/
2. http://www.cse.iitk.ac.in/users/braman/cs425/slides/security-overview.pdf

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Course Code:16ECE14	Course Title: TELEVISION AND VIDEO SYSTEMS	
Elective	L:T:P:C	3:0:0:3
Type: Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16ECT32 - Electronic Circuits - I
- 16ECT41 - Electronic Circuits - II
- 16ECT51- Communication Theory
- 16ECT55 - Antenna and Wave Propagation

Course Objectives:

The course is intended to:

1. Identify the basic requirements for Television broadcasting system.
2. Categorize various blocks of Monochrome TV Transmitter and Receiver.
3. Differentiate the Monochrome and Colour Television systems.
4. Categorize the standards of Colour Television system.
5. Identify the modules of advanced Television system.

Unit I - FUNDAMENTALS OF TELEVISION 9

Geometry form and Aspect Ratio - Image Continuity - Number of scanning lines - Interlaced scanning -Picture resolution - Camera tubes: Image orthicon – Vidicon – Plumbicon- Monochrome picture tubes - Iontrap and Pincushion magnets, Composite video signal - Horizontal and Vertical sync details, Picture signal transmission: positive and negative modulation – VSB transmission – standard channel bandwidth.

Unit II - MONOCHROME TELEVISION TRANSMITTER AND RECEIVER 8

TV transmitter: Low level IF modulated TV transmitter - Visual exciter - Aural exciter – Diplexer, TV signal propagation: Interference - TV transmission Antennas, Monochrome TV receiver: RF tuner - UHF and VHF tuner- Sound inter carrier detection - Vision IF subsystem- video amplifiers requirements - Video amplifier circuits- Sync separation - EHT generation

Unit III -ESSENTIALS OF COLOUR TELEVISION 10

Compatibility – Colour perception - Three colour theory - Luminance, Hue and Saturation - Colour television cameras - values of luminance and colour difference signals - Colour television display tubes: Delta gun, Precision-in-line and Trinitron colour picture tubes - purity and convergence - automatic degaussing circuit, Colour signal transmission: bandwidth - modulation of colour difference signals – weighting factors - Formation of chrominance signal.

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Unit IV - COLOUR TELEVISION SYSTEMS 9

NTSC colour TV system: NTSC colour receiver - limitations of NTSC system , PAL colour TV system: cancellation of phase errors, PAL-D colour system: PAL coder – Pal-D colour receiver - chromo signal amplifier - Ident and colour killer circuits - Colour signal matrixing - merits and demerits of the PAL system, SECAM system: merits and demerits of SECAM system

UNIT V - ADVANCED TELEVISION SYSTEMS 9

Evolution of Television - Cable TV – CCTV - Digital television:Transmission and reception –DTH - DVB - Flat panel display – LCD, LED and Plasma screen receivers - 3D TV–HDTV

Course Outcomes:

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

CO1. Identify the basic requirements for Television broadcasting system in terms of scanning process, camera tubes, picture tubes andtransmission bandwidth.
CO2. Categorize various blocks of Monochrome TV Transmitter and Receiver with their functionalities.
CO3. Differentiate the Monochrome and Colour Television systems with their essential requirements.
CO4. Categorize the standards of Colour Television system with their appropriate specifications.
CO5. Identify the modules of advanced Television system in comparison with fundamental system.

Text Books:

1. R.R.Gulati, " Monochrome Television Practice, Principles, Technology and servicing , 3rd Edition, New age International Publishes, 2010
2. R.R.Gulati, "Monochrome and Colour television ", New age International Publisher, 2003

Reference Books:

1. A.M Dhake, "Television and Video Engineering", 2nd Edition, TMH, 2003.
2. S.P.Bali, " Colour Television, Theory and Practice", TMH, 1994
3. R.G.Gupta, "Television Engineering and Video systems", 1st Edition, TMH India 2007.
4. Bernard Grob, "Basic Television Principles and servicing", 2nd Edition, New age International Publisher, 2004

Web References:

1. http://www.ntsc-tv.com/
2. http://dmcitarsi.com/television-transmission/
3. http://www.tech-faq.com/how-television-broadcasting-works.html
4. http://2012books.lardbucket.org/pdfs/mass-communication-media-and-culture/s12-television.pdf

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Design Engineering

Course Code:16ECE15	Course Title: ADVANCED DIGITAL SIGNAL PROCESSING	
Elective	L:T:P:C	3:0:0:3
Type:Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16ECT44 - Signals and Systems
- 16ECT52 - Digital Signal Processing

Course Objectives:

The course is intended to:

1. Categorize different parameters used to analyze random process.
2. Compute the Power Spectrum Density.
3. Apply adaptive algorithms.
4. Design Multirate DSP systems.
5. Explain Wavelet Transform and its applications.

UNIT I - DISCRETE-TIME RANDOM SIGNALS 9

Discrete time signals and systems – Discrete time random process: Ensemble averages, Stationary and Ergodic processes, Autocorrelation – White noise, Power Spectral Density – Spectral Factorization– Filtering random processes – ARMA, AR and MA processes.

UNIT II - POWER SPECTRUM ESTIMATION 9

Periodogram – Modified Periodogram – Blackman-Tukey method – Parametric methods of spectral estimations: Yule-Walker method, The Burg Method, least-squares method.

UNIT III - ADAPTIVE SIGNAL PROCESSING 9

FIR adaptive filters: steepest descent adaptive filter, LMS algorithm, RLS algorithm,convergence of LMS & RLS algorithms – Application: noise cancellation – channel equalization.

UNIT IV - MULTIRATE SIGNAL PROCESSING 9

Decimation by a factor D –Interpolation by a factor I – Sampling rate conversion by a rational factor I/D – Polyphase filter structure – Quadrature Mirror Filter Bank – Application: Subband Coding of speech signals.

UNIT V - WAVELET TRANSFORMS 9

Short Time Fourier Transform – The Gabor Transform– Continuous and Discrete time Wavelet Transform:Haar Wavelet, Daubechies Wavelet– Multiresolution Analysis – Application: signal compression.

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Course Outcomes:

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

CO1. Categorize different parameters used to analyze random process
CO2. Compute the Power Spectrum Density of random signals
CO3. Apply adaptive algorithms to solve real world problems.
CO4. Design Multirate DSP systems
CO5. Explain Wavelet Transform and its applications.

Text Books:

1. John G.Proakis, DimitrisG.Manolakis, "Digital Signal Processing:Principles,Algorithms and Applications", Third edition, 2000 PHI.
2. Monson H.Hayes "Statistical Digital Signal Processing and Modeling", Wiley, 2002.

Reference Books:

1. Sophocles J. Orfanidis, "Optimum Signal Processing, An Introduction", McGraw Hill, 1990.
2. P. P. Vaidyanathan, "Multirate Systems and Filter Banks", Prentice Hall, 1992.
3. Roberto Crist, "Modern Digital Signal Processing", Thomson Brooks/Cole 2004.
4. Raghuveer. M. Rao, AjitS.Bopardikar, "Wavelet Transforms, Introduction to Theory and applications", Pearson Education, Asia, 2000.

Web References:

1. http://www.nptelvideos.in/2012/12/advanced-digital-signal-processing.html
2. http://www.101science.com/dsp.htm
3. http://www.comm.toronto.edu/~dimitris/ece1511/
4. http://cau.ac.kr/~mhhgtx/courses/dsp/

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Course Code:16ECE16	Course Title: DIGITAL IMAGE PROCESSING (Common to ECE & EEE)	
Elective	L:T:P:C	3:0:0:3
Type: Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16ECT44 - Signals and Systems
- 16ECT52 - Digital signal Processing

Course Objectives:

The course is intended to

1. Analyze the digital images in frequency domain.
2. Analyze the given Digital Image by applying various filtering techniques.
3. Analyze the given digital images using restoration model.
4. Select the techniques for segmenting digital images.
5. Apply the various compression schemes.

Unit I - DIGITAL IMAGE FUNDAMENTALS 9

Elements of digital image processing systems, Digital Camera, Elements of visual perception, brightness, contrast, hue, saturation, Mach band effect, Color image fundamentals - RGB,HSI models, Image sampling, Quantization, 2D transforms - DFT, DCT, KLT and SVD

Unit II - IMAGE ENHANCEMENT 9

Spatial Domain techniques: Intensity transformations, contrast stretching, Histogram equalization and specification techniques, Smoothing filters, sharpening filters, gradient and laplacian. Frequency domain techniques: Smoothening filters, sharpening filters and Homomorphic filtering

Unit III -IMAGE RESTORATION 9

Model of Image restoration process - Noise models- Restoration in the presence of noise (both spatial and frequency domain) Linear Image restoration techniques: Inverse filtering- Wiener filtering. Restoration from projections: Projections and the Radon transform

Unit IV - IMAGE SEGMENTATION 9

Edge detection, Edge linking-Region based segmentation – Region growing – Region splitting and Merging. Clustering techniques: K-means clustering. Basic Morphological operations for Image Processing.

UNIT V - IMAGE COMPRESSION 9

Need for data compression - Classification of Image compression schemes - Run length coding Huffman coding - Arithmetic coding - LZW coding, Transform based compression – Image compression standards.

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Course Outcomes:

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

CO1. Analyze the digital images in frequency domain by applying 2D transforms.
CO2. Analyze the given Digital Image by applying various filtering techniques in both spatial and frequency domains.
CO3. Analyze the given digital images using an appropriate restoration model.
CO4. Select the appropriate techniques for segmenting digital images.
CO5. Apply the various compression schemes for the given image.

Text Books:

1. Rafael C.Gonzalez and Richard E. Woods, "Digital Image Processing", 2nd Edition, Pearson Education, 2002.
2. Anil K. Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India, 2009

Reference Books:

1. Dr.Jayaraman, S., Essakirajan, S., and Veerakumar, T.,"Digital Image Processing", Tata McGraw Hill, New Delhi, 2012.
2. David Salomon, "Data Compression – The Complete Reference", 3rd edition, Springer Verlag New york, 2004.
3. William K-Pratt, "Digital Image Processing", 4th edition, John Wiley and Sons, 2007.
4. Kenneth R.Castleman, "Digital Image Processing", Pearson Education, 1996.

Web References:

1. https://en.wikipedia.org/wiki/Digital_image_processing
2. www.tutorialspoint.com/dip/
3. www.imageprocessingplace.com/
4. nptel.ac.in/courses/117105079/

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Course Code:16ECE17	Course Title: TESTING OF VLSI CIRCUITS (Common to ECE &EEE)	
Elective	L:T:P:C	3:0:0:3
Type:Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16EET31 - Digital Electronics
- 16ECT62- VLSI Design

Course Objectives:

The course is intended to:

1. Identify the faults in the digital circuits
2. Create Test Patterns for combinational logic circuit
3. Create Test Patterns for sequential logic circuit
4. Explain the different testability techniques for Testing.
5. Explain various BIST Architecture and test algorithms

UNIT I- TESTING AND LOGIC SIMULATION 9

Introduction to testing – Faults in Digital Circuits – Modeling of faults – Logical Fault Models – Fault detection and redundancy – Fault equivalence and fault Location – Fault dominance – Logic simulation – Types of simulation – Delay models – Gate Level Event – driven simulation.

UNIT II -TEST GENERATION FOR COMBINATIONAL CIRCUITS 9

Test generation for combinational logic circuits – Testable combinational logic circuit design.

UNIT III - TEST GENERATION FOR SEQUENTIAL CIRCUITS 9

Test generation for sequential circuits – design of testable sequential Logic circuits.

UNIT IV - DESIGN FOR TESTABILITY 9

Design for Testability – Ad-hoc design – generic scan based design – classical scan based design – system level DFT approaches.

UNIT V - SELF TEST AND TEST ALGORITHMS 9

Built-In-Self-Test – test pattern generation for BIST – Circular BIST – BIST Architectures – Testable Memory Design – Test Algorithms – Test generation for Embedded RAMs

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Course outcomes:

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

CO1. Identify the faults in digital the circuits.
CO2. Create test pattern for combinational logic circuit.
CO3. Create test pattern for sequential logic circuit.
CO4. Explain the different testability techniques for testing.
CO5. Explain various BIST Architecture and test algorithms.

Text Books:

1. M.Abramovici, M.A.Breuer and A.D. Friedman, "Digital systems and Testable Design",Jaico Publishing House, 2002.
2. P.K. Lala, "Digital Circuit Testing and Testability", Academic Press, 2002

Reference Books:

1. M.L.Bushnell and V.D.Agrawal, "Essentials of Electronic Testing for Digital, Memory andMixed-Signal VLSI Circuits", Kluwer Academic Publishers, 2002.
2. A.L.Crouch, "Design Test for Digital IC's and Embedded Core Systems", Prentice HallInternational, 2002.
3. Robert J., Jr. Feugate, Steven M. McIntyre," Introduction to VLSI Testing" Prentice HallInternational, 1988.
4. Angela Krstic and Kwang-Ting Cheng,"Delay fault testing for VLSI Circuits", KluwerAcademic Publishers, 1998.
5. Mike Tien and Chien Lee, "High-Level Test Synthesis of Digital VLSI Circuits", ArtechHouse, Inc., 1997.

Web References:

1. http://onlinelibrary.wiley.com/doi/10.1002/0471457787.fmatter/pdf
2. http://nptel.ac.in/courses/106103016/30
3. www.cs.colostate.edu/~malaiya/530/08/resources.html

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Course Code:16ECE18	Course Title: ASIC DESIGN (Common to ECE,EEE & EIE)	
Elective	L:T:P:C	3:0:0:3
Type:Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16EET31 - Digital Electronics
- 16ECT62 - VLSI Design

Course Objectives:

The course is intended to:

1. Explain the different types of ASICs and logic cells used in ASIC design
2. Explain the architecture of various programmable logic cells
3. Explain thevariousinterconnects in programmable logic cells and design software.
4. Develop a digital circuit using HDL.
5. Explain thevarious functional blocks in an ASIC.

UNIT I - INTRODUCTION TO ASICS 9

Types of ASICs - Design flow – CMOS transistors- CMOS Design rules – Combinational logic Cell - Sequential logic cell - Transistor as Resistor - Transistor parasitic capacitance – Library cell design.

UNIT II - PROGRAMMABLE ASICS, LOGIC CELLS AND I/O CELLS 9

Anti-fuse - Static RAM - EPROM and EEPROM technology - Actel ACT - Xilinx LCA, Xilinx I/O blocks –Altera MAX 5000 - Altera FLEX.

UNIT III - ASIC INTERCONNECT AND DESIGN SOFTWARE 9

Actel ACT -Xilinx LCA - Xilinx EPLD - Altera MAX 5000 - Altera FLEX –Design systems - Logic Synthesis - Half gate ASIC -Low level design language - PLA tools

UNIT IV - LOGIC SYNTHESIS 9

A logic synthesis example: Adder and MUX units, FSM synthesis in VHDL, Memory synthesis in VHDL.

UNIT V - FLOOR PLANNING, PLACEMENT AND ROUTING 9

Floor planning, Placement, Routing- Global routing-detailed routing- special routing-Parasitic extraction, LVS and DRC.

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Course Outcomes:

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

CO1. Explain the different types of ASICs and logic cells used in ASIC design.
CO2. Explain the architecture of various programmable logic cells.
CO3. Explain the various interconnects in programmable logic cells and design software.
CO4. Develop a digital circuit using HDL.
CO5. Explain the various functional blocks in an ASIC.

Text Books:

1. Michael John Sebastian Smith, "Application Specific Integrated Circuits" Pearsoneducation, 2008.
2. Norman G. Einspruch, "Application Specific Integrated Circuit (ASIC)Technology",AcademicPress, 2012.

Reference Books:

1. Morris Mano.M, "Digital Design", 3rd edition, Pearson Education India, 2013.
2. Douglas L. Perry, "VHDL: Programming by Example" McGraw Hill Education, 4th edition,2002.

Web References:

1. www.vlsi.wpi.edu/cds/explanations/lvs.html
2. http://www.eng.auburn.edu/
3. http://www.geoffknagge.com/fyp/index.shtml#asic

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Course Code:16ECE19	Course Title: COMPUTER ARCHITECTURE (Common to ECE & EEE)	
Elective:	L:T:P:C	3:0:0:3
Type: Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16ECT54 - Microprocessor and Microcontroller

Course Objectives:

The course is intended to

1. Identify the various computer system modules.
2. Design high speed Arithmetic and logic unit.
3. Analyze the occurrence of hazards.
4. Classify various memories used in computer system.
5. Analyze the data transfer modes.

UNIT I - BASIC STRUCTURE OF COMPUTERS 9

Functional units- Basic Operational Concepts, Bus Structures, Software Performance – Memory locations and addresses – Memory operations – Instruction and instruction sequencing – addressing modes – assembly language – Basic I/O operations, Stacks and queues

UNIT II - ARITHMETIC UNIT 9

Addition and subtraction of signed numbers – Design of fast adders – multiplication of positive numbers- signed operand multiplication and fast multiplication – Integer division, Floating point numbers and operations.

UNIT III -BASIC PROCESSING UNIT 9

Fundamental concepts – Execution of a complete Instruction – Multiple bus organization – Hardwired control – micro programmed control, Pipelining – Basic concepts – data hazards – instruction hazards – influence on Instruction sets – Data path and control consideration, Superscalar operation.

UNIT IV -MEMORY SYSTEM 9

Basic concepts – semiconductor RAMs, ROMs – Speed, size and cost – cache memories - Performance consideration – Virtual memory- Memory Management requirements, Secondary storage.

UNIT V - I/O ORGANIZATION 9

Accessing I/O devices – Interrupts – Direct Memory Access – Buses – Interface circuits – Standard I/O Interfaces (PCI, SCSI, and USB)

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Course Outcomes:

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

CO1. Identify the various modules of the computer system.
CO2. Design high speed Arithmetic and logic unit to perform various arithmetic operations
CO3. Analyze the occurrence of hazards during the execution of machine instructions.
CO4. Classify various memories used in computer system based on their characteristics.
CO5. Analyze the data transfer modes of I/O devices through different buses.

Text Books:

1. Carl Hamacher, SafwatZaky, ZvonkoVranesic, "Computer Organization", Tata McGraw-Hill Education Pvt. Ltd, Fifth Edition 2011.
2. William Stallings, "Computer Organization and Architecture" – Designing for Performance Eighth Edition Pearson Education, 2010.

Reference Books:

1. David A. Patterson and John L. Hennessey, "Computer organization and design", Morgan Kauffman, 2014.
2. Vincent P. Heuring, Harry F. Jordan, "Computer System Architecture", Second Edition, Pearson Education, 2005.
3. Govindarajalu B, "Computer Architecture and Organization, Design Principles and Applications", Second edition, Tata McGraw Hill, New Delhi, 2010.
4. AharonYadin, " Computer Systems Architecture", Chapman and Hall/CRC, 2016

Web References:

1. http://nptel.ac.in/courses/106102062/
2. https://www.cis.upenn.edu/~milom/cis501-Fall11/lectures/00_intro.pdf
3. https://inspirit.net.in/books/academic/Computer%20Organisation%20and%20Architecture%208e%20by%20William%20Stallings.pdf
4. http://www.nptelvideos.in/2012/11/computer-architecture.html
5. http://www.learnerstv.com/Free-Computer-Science-Video-lectures-ltv086-Page1.html

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Course Code:16ECE20	Course Title: CMOS ANALOG IC DESIGN (Common to ECE & EEE)	
Elective	L:T:P:C	3:0:0:3
Type: Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16ECT32 - Electronic Circuits - I
- 16EET31 - Digital Electronics
- 16ECT41- Electronic Circuits - II
- 16ECT43 - Linear Integrated Circuits

Course Objectives:

The course is intended to:

1. Analyze the concept of CMOS Technology and Analog MOSFET models.
2. Analyze basic Analog circuits.
3. Describe the design of differential amplifier and Op-amp circuit.
4. Describe the design of dynamic analog circuits and various nonlinear circuits
5. Compare the performance of different forms of data conversion techniques.

UNIT I - INTRODUCTION TO CMOS TECHNOLOGIES AND ANALOG MOSFET MODELS 9

MOSFET- Structure, MOSFET Capacitances, Threshold Voltage , IV Characteristics , SPICE modeling, DC equations , Short Channel MOSFET . MOS Passive Elements – Capacitors and Resistors, Temperature and Voltage dependence of Capacitors and Resistors. ANALOG MOSFET MODELS - Low frequency model, High frequency model, Temperature effects, Noise in MOSFET.

UNIT II - ANALOG MOS MODELING 9

Current Mirror, Current sources, Self biasing techniques, Band gap voltage references, Beta multiplier based references. Common Drain and Common Gate amplifiers, Voltage dividers.

UNIT III - DIFFERENTIAL AMPLIFIERS AND OPAMP DESIGN 9

Differential Amplifier – Source coupled pair, Source cross coupled pair, Cascode load, Wide swing differential amplifiers. Operational Amplifiers – Basic CMOS Op-amp, Fully differential Op-amp, Operational Trans-conductance amplifier.

UNIT IV - DYNAMIC ANALOG CIRCUITS AND NON LINEAR CIRCUITS 9

Dynamic Analog Circuits – MOSFET switch, Switched capacitor circuit. Non Linear Analog Circuits – CMOS comparator, Analog multiplier, Level shifting circuit, Multiplier using squaring circuit, Challenges in analog design.

UNIT V - MIXED SIGNAL CIRCUITS 9

Data Conversion Fundamentals – Analog Vs Discrete time signal, Converting analog to digital signal - Sample and hold circuit, mixed signal layout issues. Data Conversion Architecture – DAC, ADC, Mixed signal layout issues.

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Course Outcomes:

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

CO1. Analyze the concept of CMOS Technology and Analog MOSFET models using MOSFET structure.
CO2. Analyze basic Analog circuits using CMOS technology.
CO3. Describe the design of differential amplifier and Op-amp circuit.
CO4. Describe the design of dynamic analog circuits and various nonlinear circuits.
CO5. Compare the performance of different forms of data conversion techniques using mixed signal MOSFET circuits.

Text Books:

1. Jacob Baker.R., Li.H.W., and Boyce.D.E., CMOS Circuit Design ,Layout and Simulation,Prentice-Hall of India,1998.
2. Mohammed Ismail and Terri Faiz, Analog VLSI Signal and Information Process,McGraw-Hill Book company,1994.

Reference Books:

1. Paul R. Gray and Meyer.R.G., Analysis and design of Analog Integrated circuits, John Wiley and Sons inc., USA, 3rd Edition, 1993.
2. David. A. Johns and Martin. K., Analog Integrated Circuit Design, Wiley, 1997.
3. MalcomR.Haskard, LanC.May, "Analog VLSI Design - NMOS and CMOS ", Prentice Hall, 1998.
4. Jose E.France, YannisTsividis, "Design of Analog-Digital VLSI Circuits for Telecommunication and signal Processing ", Prentice Hall, 1994.
5. Randall L Geiger, Phillip E. Allen, Noel K.Strader, "VLSI Design Techniques for Analog and Digital Circuits ", McGraw Hill International Company, 1990.

Web References:

1. http://nptel.ac.in/courses/117101105/
2. http://www.nptel.ac.in/syllabus/117101006/
3. http://www.siliconmentor.com/analog-vlsi-design/

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Course Code:16ECE21	Course Title: SPEECH SIGNAL PROCESSING	
Elective	L:T:P:C	3:0:0:3
Type:Theory	Total Contact hours:	45

Pre-requisites: The student should have undergone the course(s):

- 16ECT44 - Signals and Systems
- 16ECT52 - Digital Signal Processing

Course Objectives:

The course is intended to:

1. Describe the mechanism of speech production and perception.
2. Analyse speech signals using the time domain parameters for voiced and unvoiced signal classification.
3. Explain various frequency domain techniques used for speech signal processing.
4. Explain the various techniques for extracting the features from speech signals.
5. Apply the various speech processing techniques for real time systems.

UNIT I -MECHANICS OF SPEECH 9

Speech production mechanism – Nature of Speech signal – Discrete time modelling of Speech production – Representation of Speech signals – Classification of Speech sounds – Articulatory features, Auditory perception – Anatomical pathways from the ear to the perception of sound – Peripheral auditory system.

UNIT II - TIME DOMAIN METHODS FOR SPEECH PROCESSING 8

Time domain parameters of speech: Short-time energy and average magnitude, Short-time average zero crossing rate, Speech and Silence discrimination using energy and zero-crossings, Short-time auto correlation function, Pitch period estimation using the autocorrelation function.

UNIT III -FREQUENCY DOMAIN METHODS FOR SPEECH PROCESSING 9

Short-time Fourier Transform, Speech spectrogram, Short-time Fourier synthesis, Cepstrum, Short-time Cepstrum, Computation of the Cepstrum, Short-time Homomorphic filtering of speech, Application to pitch detection

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UNIT IV -FEATURE EXTRACTION OF THE SPEECH SIGNAL **10**

Endpoint detection-Dynamic time warping- Pitch frequency estimation using autocorrelation- Linear predictive co-efficient- Line spectral frequencies- Functional blocks of the ear- Mel frequency cepstral co-efficients- Spectrogram-Time resolution versus frequency resolution-Discrete wavelet transformation.

UNIT V -SPEECH PROCESSING FOR MAN–MACHINE COMMUNICATION **9**

Voice Response Systems – Multiple outputs Digital Voice Response System – Speech and speaker Recognition Systems – Isolated Digit Recognition System – Large Vocabulary word Recognition System – Text To Speech (TTS) Synthesis

Course outcomes:

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

CO1. Describe the mechanism of speech production and perception.
CO2. Analyse speech signals using the time domain parameters for voiced and Unvoiced signal classification.
CO3. Explain various frequency domain techniques used for speech signal processing.
CO4. Explain the various techniques for extracting the features from speech Signals.
CO5. Apply the various speech processing techniques for real time systems.

Text Books:

1. L.R.Rabiner and R.W.Schafer, "Digital processing of speech signals", Pearson Education, 2004
2. T.F.Quatieri, "Discrete-time Speech Signal Processing", Pearson Education, 2005

Reference Books:

1. L.R.Rabiner and R.W.Schafer, "Introduction to Digital speech processing", Now publishers,USA,2007
2. E.S.Gopi, "Digital speech processing using Matlab", Springer,2014.
3. L.Hanzaetal, "Voice Compression and Communications", Wiley/ IEEE, 2001.
4. Ben Gold, Nelson Morgan, Dan Ellis, "Speech and Audio Signal Processing: Processing and Perception of Speech and Music", John Wiley and Sons, Inc., 2011.

Web References:

1. http://www.ece.ucsb.edu/Faculty/Rabiner/ece259/speech%20course.html
2. http://practicalcryptography.com/miscellaneous/machine-learning/guide-mel-frequency-cepstral-coefficients-mfccs/
3. http://practicalcryptography.com/miscellaneous/machine-learning/tutorial-cepstrum-and-lpccs/

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Course Code:16ECE22	Course Title: MEDICAL ELECTRONICS	
Elective:	L:T:P:C	3:0:0:3
Type:Theory	Total Contact hours:	45

Prerequisites : The student should have undergone the course(s):

- 16ECT43 - Linear Integrated Circuits
- 16ECT45 - Electrical Machines and Instrumentation

Course Objectives

The course is intended to:

1. Explain the basic concepts of Medical Electronics.
2. Categorize the various techniques involved in the Electro physical measurements.
3. Describe Non-Electrical Biomedical parameter measurements.
4. Illustrate medical imaging techniques and patient monitoring systems
5. Explain the Therapeutic and Prosthetic Devices

UNIT I - BASIC CONCEPTS OF MEDICAL ELECTRONICS 9

Cells and their structure – Characteristics of the Human Cell - Origin of bio potentials-Electrical activity of excitable cells, Action and Resting Potentials. Different systems of Human body: Skeletal, Circulatory, Respiratory, Digestive, Excretory, Regulatory, Reproductive and Muscular system.

UNIT II - ELECTRO PHYSICAL MEASUREMENTS 9

Electrodes: Half Cell potential, Electrode paste, polarizable and non-polarizable, surface, Depth,needle and micro electrodes and their equivalent circuits. Bio potential amplifiers-Basic Requirements, Medical Pre amplifiers. ECG, EEG, EMG - Lead systems and recording methods.

UNIT III - NON-ELECTRICAL MEASUREMENTS 9

Measurement of Blood Pressure, blood flow, cardiac output and heart sounds, respiratory rate, lung volumes and capacities, Plethysmography, gas volume: measurement of pH of blood, PO_2, PCO_2.

UNIT IV - MEDICAL IMAGING AND MONITORING SYSTEMS 9

Radiography, Computed Tomography, Magnetic Resonance Imaging, Ultra sonography, Endoscopy, Thermography, Biotelemetry and Patient monitoring, Electrical Safety-Macro shock and Micro shock Hazards, Methods of Accident prevention.

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UNIT V - THERAPEUTIC AND PROSTHETIC DEVICES 9

Cardiac Pacemakers : Energy requirements, Methods of stimulation, types : Fixed rate and Demand, Defibrillators : Internal and External: AC defibrillator and Double square Pulse defibrillator, Ventilators, Diathermy, Stimulators, Heart Lung Machine, Dialyzers.

Course Outcomes:

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

CO1. Explain the basic concepts of Medical Electronics.
CO2. Categorize the various techniques involved in the Electro physical measurements using Bio-potential recording methods.
CO3. Describe Non-Electrical Biomedical parameter measurements.
CO4. Illustrate medical imaging techniques and patient monitoring systems.
CO5. Explain the Therapeutic and Prosthetic Devices

Text Books:

1. Khandpur R.S, "Handbook of Biomedical Instrumentation", 2nd Edition, Tata McGraw-Hill, New Delhi, 2003.
2. Leslie Cromwell, "Biomedical Instrumentation and Measurement", prentice hall of India, New Delhi, 2nd Edition, 2004.

Reference Books:

1. Arumugam M., "Biomedical Instrumentation", 2nd Edition,Anuradha Publications, Chennai,2006.
2. Joseph J.Carr and John M. Brown, "Introduction to Biomedical Equipment Technology",4th EditionJohn Wiley and sons, New York, 1997.
3. Geddes L A and L.E.Baker, "Principles of Applied Bio-medical Instrumentation", 3rd Edition,John Wiley & Sons, 1975.
4. John G. Webster, "Medical Instrumentation Application and Design", 4th Edition, John Wiley and sons, New York, 1998.

Web References:

1. http://nptel.ac.in/courses/117108037/15
2. http://nptel.ac.in/courses/1021030441

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Course Code:16ECE23	Course Title: ADVANCED MICROCONTROLLERS	
Elective	L:T:P:C	3:0:0:3
Type: Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16ECT54 - Microprocessor and Microcontroller

Course Objectives:

The course is intended to

1. Select an appropriate microcontroller for an application.
2. Analyze the features of MSP430 microcontroller.
3. Write assembly language programs for MSP430 Processor.
4. Write programs for PIC 18 series Microcontroller.
5. Create simple projects using PIC Microcontroller.

UNIT I - OVERVIEW OF MICROCOMPUTER SYSTEMS 9

RISC Verses CISC Processor - Microcontrollers – Types – Selection of Microcontrollers – Architecture (8048) - Resources of Microcontrollers – Applications.

UNIT II - MSP430 MICROCONTROLLER 9

The Texas Instruments MSP430: Pin-Out- Functional Block Diagram- Memory- Central Processing Unit- Memory-Mapped Input and Output- Clock Generator- Exceptions: Interrupts and Resets- Watchdog Timer.

UNIT III -ARCHITECTURE OF THE MSP430 PROCESSOR 9

Central Processing Unit- Addressing Modes- Constant Generator and Emulated Instructions- Instruction Set- Examples- Resets- Clock System

UNIT IV - PIC 18 MICROCONTROLLER 9

PIC Architecture: The WREG Register, File Register, Status Register, Data Format and Directives – PIC Programming in C: Data types and Time delays, I/O Programming, Logic Operations, Data serialization, Program ROM and Data RAM Allocation.

UNIT V - APPLICATIONS OF PIC MICROCONTROLLER-CASE STUDY AND PROJECTS 9

Model Train Traffic Light Control using a Hall Effect Sensor, Serial LCD Interfacing, Switch Matrix Key Matrix, Blinking Light and Music, TV IR Remote Control Robot, DC Motor Control Application.

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Course Outcomes

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

CO1. Select an appropriate microcontroller for the given application based on its requirements.
CO2. Analyze the features of MSP430 microcontroller using its functional block diagram.
CO3. Write assembly language programs for MSP430 Processor using its instruction set .
CO4. Write programs for PIC 18 series Microcontroller using C and assembly language for simple operations.
CO5. Create simple projects using PIC Microcontroller for the given applications.

Text Books:

1. Muhammad Ali Mazidi , Rolin D. McKinlay , Danny Causey, "PIC Microcontroller and Embedded Systems: Using Assembly and C for PIC18",Pearson Education, 2008.
2. John H. Davies "MSP430 Microcontroller Basics"Elsevier,2008.

Reference Books:

1. Raj Kamal, "Microcontrollers – Architecture, Programming, Interfacing and System Design", Pearson Education, 2007
2. Daniel Tabak, "Advanced Microprocessors" McGraw Hill.Inc., 2008.
3. MykePredko, "Programming and Customizing the PIC Microcontroller", Tata McGraw-Hill, 2008
4. Barry B. Brey , "Applying PIC18 Microcontrollers: Architecture, Programming, and Interfacing Using C and Assembly", Pearson/Prentice Hall, 2008

Web References:

1. http://nptel/ac.in/courses/117104072/1
2. http://www.te.kmutnb.ac.th/ptt/lectures/01_Microprocessors/03_MSP430/05_Tutorialv0_3.pdf

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Course Code:16ECE24	Course Title: LOW POWER VLSI DESIGN (Common to ECE & EEE)	
Elective	L:T:P:C	3:0:0:3
Type:Theory	Total Contact hours:	45

Pre-requisites: The student should have undergone the course(s):

- 16GET24 - Electron Devices
- 16EET31 - Digital Electronics
- 16ECT62 - VLSI Design

Course Objectives:

The course is intended to:

1. Explain the sources and the effect of MOS device parameters.
2. Discuss the circuit and logic level low power design techniques
3. Explain the power reduction design techniques in clock networks and busses.
4. Explain the techniques involved in low power memory design.
5. Explain the concepts of software design for low power.

UNIT I- INTRODUCTION TO LOW POWER DISSIPATION 9

Need for low power VLSI chips, Physics of power dissipation in CMOS devices. Sources of power dissipation in Digital Integrated circuits, Basic principles of low power design-probabilistic power analysis-random logic signal-probability and frequency-power analysis techniques - signal entropy

UNIT II - CIRCUIT AND LOGIC LEVEL LOW POWER DESIGN TECHNIQUES 9

Circuit - transistor and gate sizing - pin ordering - network restructuring and reorganization - adjustable threshold voltages - logic-signal gating - logic encoding. Pre-computation logic

UNIT III - SPECIAL LOW POWER VLSI DESIGN TECHNIQUES 9

Power reduction in clock networks -single driver Vs distributed buffers, Zero skew Vs tolerable skew, chip and package co-design of clock network, CMOS floating node - low power bus - delay balancing, Switching activity reduction - parallel architecture with voltage reduction - operator reduction -Adiabatic computation .

UNIT IV - LOW POWER MEMORY DESIGN 9

Basics of SRAM- Memory cell –Pre-charge and equalization circuit. Sense amplifier-Output latch-Low power SRAM technologies-types of DRAM –Basics of DRAM-Cell refresh circuit – HVG – BBG – BVG – RVG –VDC

UNIT V - SOFTWARE DESIGN AND POWER ESTIMATION 9

Low power circuit design style –Software power estimation - Co-design for low power.

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Course Outcomes:

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

CO1. Explain the sources and the effect of MOS device parameters on power dissipation.
CO2. Discuss the circuit and logic level low power design techniques.
CO3. Explain the power reduction design techniques in clock networks and busses.
CO4. Explain the techniques involved in low power memory design.
CO5. Explain the concepts of software design for low power.

Text Books:

1. Kiat-Seng Yeo, Kaushik Roy, "Low Voltage Low Power VLSI Subsystems", Tata Mc-Graw Hill,2009.
2. Gary Yeap "Practical Low Power Digital VLSI Design", Springer US, Kluwer AcademicPublishers,2002.
3. Kaushik Roy, Sharat C. Prasad, "Low power CMOS VLSI circuit design", Wiley IntersciencePublications",1987.

Reference Books:

1. Rabaey, Pedram, "Low power design methodologies" Kluwer Academic, 1997.
2. Chandrasekaran, A.P., Broadersen.R.W, "Low Power Digital CMOS VLSI Design", Kluwer 1995.
3. DimitriosSoudris, Christians Pignet, Costas Goutis, "Designing CMOS Circuits for Low Power", Kluwer, 2002
4. AbdelatifBelaouar, Mohamed.I.Elmasry, "Low power digital VLSI design", Kluwer, 1995
5. James B.Kulo, Shih-Chia Lin, "Low voltage SOI CMOS VLSI devices and Circuits", John Wiley and sons, inc. 2001.

Web References:

1. nptel.ac.in/courses/106105034/12
2. www.nptelvideos.com/course.php?id=422
3. http://www.youtube.com/watch?v=ruclwamT-Ro&list

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Course Code:16ECE25	Course Title: DIGITAL SYSTEM DESIGN AND VERIFICATION	
Elective	L:T:P:C	3:0:0:3
Type:Theory	Total Contact hours:	45

Pre-requisites: The student should have undergone the course(s):

- 16EET31 - Digital Electronics
- 16ECT62 - VLSI Design

Course Objectives:

1. Apply different design methodologies to design digital circuits.
2. Use different modeling to design digital circuits.
3. Apply various techniques and tools to verify the functionality and timing issues.
4. Use high level modeling to design digital circuits.
5. Apply test benches and simulation environment to verify the functionality and timing issues.

UNIT I INTRODUCTION TO VERILOG HDL 9

Introduction to Verilog HDL, Abstraction levels, Digital circuit designing with Verilog HDL, Need for verification, Simulation and synthesis, 4 state logic, Top down and Bottom up design methodology.

UNIT II CIRCUIT DESIGN USING VERILOG HDL 9

Gatelevel modeling – Introduction, Design of gate primitives, Basic digital design at gatelevel; Dataflow modeling – Introduction, assignment statements, simple digital circuit design using assignments, Testbench writing; Behavioural level modeling - Introduction,Procedural blocks, blocking and non-blocking assignments, simple digital circuit design at behavioural level; FSM circuit designing.

UNIT III VERIFICATION TECHNOLOGIES AND TOOLS 9

Importance of Verification - Reconvergence Model - The Human Factor - Formal and Functional Verification Approaches - Timing Verification - Testing Versus Verification - Design and Verification Reuse - Linting - Simulation - Third Party Models - Verification Intellectual Property - Waveform Viewers - Code Coverage - Functional Coverage - Issue Tracking – Metrics - Role of the Verification Plan - Levels of Verification - Verification Strategies.

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UNIT IV HIGH-LEVEL MODELING 9

High-Level Versus RTL Thinking - Structure of High-Level Code - Data Abstraction - Object-Oriented Programming - Parallel Simulation Engine - Race Conditions

UNIT V ARCHITECTING TESTBENCHES AND SIMULATION MANAGEMENT 9

Stimulus and Response -Transaction-Level Interface - Self-Checking Test benches - Directed Stimulus - Random Stimulus - Managing Simulations – Regression.

Course Outcomes:

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

CO1. Apply different design methodologies to design digital circuits using Verilog HDL.
CO2. Use different modeling to design digital circuits with Verilog HDL .
CO3. Apply various techniques and tools to verify the functionality and timing issues in digital circuits.
CO4. Use high level modeling to design digital circuits.
CO5. Apply test benches and simulation environment to verify the functionality and timing issues in HDL digital circuit models.

Text Books:

1. T.R. Padmanabhan, B Bala Tripura Sundari, Design Through Verilog HDL, Wiley 2009.
2. Zainalabdien Navabi, Verliog Digital System Design,TMH, 2nd Edition.
3. Chris Spear, Greg Tumbush, "System Verilog for Verification - A Guide to Learning the Testbench Language Features" Springer, 2012.

Reference Books:

1. Advanced Digital Logic Design using Verilog, State Machines & Synthesis for FPGA - Sunggu Lee, Cengage Learning, 2012.
2. Verilog HDL - Samir Palnitkar, 2nd Edition, Pearson Education, 2009.
3. Andreas Meyer, “Principles of Functional Verification”, Newnes, 2003.
4. Janick Bergeron, “Writing Test Benches Using System Verilog”, Springer, 2009.
5. Kropf T, “Introduction to Formal Hardware Verification”, Springer Verlag, 2010.

Web References:

1. https://onlinecourses.nptel.ac.in/noc17_cs21/preview
2. https://nptel.ac.in/syllabus/syllabus.php?subjectId=117106092

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Course Code:16EIE02	Course Title: AUTOMOTIVE ELECTRONICS (Common to ECE , EEE& EIE)	
Elective	L:T:P:C	3:0:0:3
Type:Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16ECT45 - Electrical Machines and Instrumentation
- 16ECT64 - Embedded System Design

Course Objectives:
The course is intended to:

1. Inculcate knowledge of mechanical system in Automotive systems.
2. Understand the electronic system in automobiles.
3. Know the concepts of X- by-wire technology in automobiles.
4. Understand the automotive embedded systems.
5. Disseminate the knowledge of communication protocols used in automobiles

UNIT I - AUTOMOTIVE MECHANICAL SYSTEMS 9

Vehicle Systems: Power Train System (Air System, Fuel System (Carburettor & Diesel Fuel Injection, Ignition System, Exhaust System and other Auxiliary Systems (Cooling, Lubrications & Electrical Systems)), Transmission System (Front, Rear & 4 wheel Drive, Manual, Automatic Transmission, Differential). Braking System (Drum, Disc, Hydraulic, Pneumatic), Steering System (Rack and Pinion, Power Steering)

UNIT II - ELECTRONICS IN AUTOMOTIVE SYSTEMS 9

Performance (Speed, Power, and Torque), Control (Emission, Fuel Economy, Drivability, and Safety) & Legislation (Environmental legislation for pollution & Safety Norms). Overview of Vehicle Electronic Systems: Basic electrical components and their operation in an automobile: Power train subsystem (Starting systems, Charging systems - Ignition systems – Electronic fuel control), Chassis subsystem (ABS, TCS, &ESP) – Comfort and safety subsystems (Night Vision, Airbags, Seatbelt Tensioners, Cruise Control-Lane-departure-warning, Parking).

UNIT III - DRIVE BY WIRE 9

Challenges and opportunities of X-by-wire: system & design requirements, steer-by-wire, brake-by-wire, suspension-by wire, gas-by-wire , power-by-wire, shift by wire-Future of Automotive Electronics

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UNIT IV - EMBEDDED SYSTEM IN AUTOMOTIVE APPLICATIONS 9

Gasoline / Diesel systems, various sensors used in system – Electronic transmission control - Vehicle safety system – Electronic control of braking and traction – Body electronics – Infotainment systems – Navigation systems – System level tests – Software calibration using engine and vehicle dynamometers – Environmental tests for Electronic Control Unit - Application of Control elements and control methodology in Automotive System.

UNIT V - VEHICLE COMMUNICATION PROTOCOLS 9

SPI, I2C, USB communication protocols - Introduction to CAN, LIN, FLEXRAY, MOST, KWP2000. Introduction to AUTOSAR.

Course Outcomes:

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

CO1. Explain the mechanical systems of automobiles.
CO2. Describe the electronic system in automobiles.
CO3. Summarize the X-by-wire concepts in automobiles..
CO4. Outline the embedded system applications in automobiles.
CO5. Explain the different communication protocols in embedded system for automobile.

Text Books:

1. Robert Bosch Gmbh, Automotive Electrics and Automotive Electronics, Systems and Components, Networking and Hybrid drive, 5th edition, John Wiley& Sons Ltd., 2007
2. William B. Ribbens, "Understanding Automotive Electronics", 6th Edition, SAMS/Elsevier Publishing, 2003

Reference Books:

1. Robert Bosch Gmbh, Automotive Electrics and Automotive Electronics, Systems and Components, Networking and Hybrid drive, 5th edition, John Wiley& Sons Ltd., 2007
2. Knowles.D, Automotive Electronic and Computer Controlled Ignition Systems, Reston Pub Co,1990
3. Denton.T , Automobile Electrical and Electronic Systems: Automotive Technology: Vehicle Maintenance and Repair, 2012
4. JoergSchaeuffele, Thomas Zurawka – Automotive Software Engineering – Principles, Processes, Methods and Tools, SAE,2016

Web References:

1. www.austincc.edu/autotech
2. www.austincc.edu
3. https://acconline.austincc.edu/webapps/portal/frameset.jsp

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Course Code:16EIE19	Course Title: VIRTUAL INSTRUMENTATION (Common to ECE,EEE,EIE)	
Elective	L:T:P:C	3:0:0:3
Type: Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16GET14 - C Programming

Course Objectives:

The course is intended to:

1. Discuss the importance of virtual instrumentation
2. Develop virtual instruments
3. Apply the concept of Arrays, Strings and File I/O tasks
4. Select suitable Data acquisition system interfaces
5. Examine DAQ hardware's and LabVIEW

UNIT I - GRAPHICAL SYSTEM DESIGN 9

Graphical System Design Model – Virtual Instrumentation – Virtual Instrument and Traditional Instrument – Hardware and software in virtual instrumentation – Virtual instrumentation for test, control and Design – Conventional and Graphical programming.

UNIT II - LABVIEW BASICS I 9

Front Panel and Block Diagram – Tools, Controls and Functions palette. Modular programming – SubVI. Structures – FOR, WHILE Loops, Case, Sequence, event structures, Formula node.

UNIT III - LABVIEW BASICS II 9

Arrays, Clusters, Strings, File I/O, Time and Dialog controls, Waveform chart, Graph, XY Graph and operations Report generation, Web Publishing tool.

UNIT IV - DATA ACQUISITION SYSTEM 9

Instrument control: GPIB – VISA – Instrument drivers – Serial Port communication. Data Acquisition: Review of Transducers and signal conditioning, DAQ hardware – AI, AO, DIO. DAQ Assistant and configuration.

UNIT V - LABVIEW APPLICATIONS 9

LabVIEW RT, Process control applications, Physical applications, Speed control, Data visualization, Imaging and Sound. Level, flow, temperature process, biomedical application - Pulse rate

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Course Outcomes:

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

CO1. Discuss the importance of virtual instrumentation using Lab view
CO2. Develop virtual instruments using LabVIEW graphical programming tools
CO3. Apply the concept of Arrays, Strings and File I/O tasks in Data acquisition
CO4. Select suitable Data acquisition system interfaces based on the requirement
CO5. Examine DAQ hardware's and LabVIEW in various real time environments

Text Books:

1. Jovitha Jerome, 'Virtual Instrumentation using LabVIEW' PHI Learning Private Limited, New Delhi, Second Printing, 2011
2. Gary W Johnson, Richard Jennings, 'LabVIEW Graphical Programming' Fourth Edition, McGraw Hill, 2006

Reference Books:

1. Sanjay Gupta, Joseph John, 'Virtual Instrumentation using LabVIEW' Tata McGraw Hill, 5th Reprint, 2010
2. Robert H Bishop. 'Learning with LabVIEW 2009' Pearson Education, 2010

Web References:

1. http://www.av.it.pt/conftele2009/Papers/125.pdf
2. https://www.researchgate.net/publication/3420671_What_is_virtual_instrumentation
3. http://www.ni.com/pdf/manuals/374629c.pdf

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Course Code:16EIE21	Course Title: INDUSTRIAL AUTOMATION (Common to ECE & EEE)	
Elective	L:T:P:C	3:0:0:3
Type:Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16EET31 - Digital Electronics
- 16ECT53 - Control Systems

Course Objectives:

The course is intended to:

1. Justify the need for automation in industry.
2. Describe the architecture and types of PLCused in industry automation.
3. Develop the PLC based control logic program.
4. Explain industry networking Protocols and SCADA programming.
5. Explain the applications of DCSin various power plants.

UNIT I - INTRODUCTION TO FACTORY AUTOMATION9

History and developments in industrial automation- Vertical integration of industrial automation- Building blocks in Automation: Processing systems, Multi-microprocessor systems, LAN, analog and digital I/O modules, remote terminal unit

UNIT II –PROGRAMMABLE LOGIC CONTROLLERS 9

PLC an Overview- Parts and Architecture of PLC- Principles of Operation - I /O Specifications - Memory types-Programming devices- PLC vs Computers, PLC size and Applications, Advantages of PLC, selection of PLC

UNIT III - PROGRAMMING OF PLC 9

Program scan - PLC Programming Languages-Simple process control programs using Relay Ladder Logic - Programming Timers : On delay timer, OFF delay timer-Programming counters: Up and Down counter – PLC arithmetic functions –Program Control Instructions-Math Instructions-data transfer operations-Data comparison instructions

UNIT IV INDUSTRY NETWORKING AND SCADA 9

PLC Networking- Networking standards & IEEE Standard - Protocols - Field bus - Process bus and Ethernet.SCADA-Channel scanning-conversion to engineering units- data processing –Distributed SCADA systems- HMI introduction

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UNIT V - DISTRIBUTED CONTROL SYSTEM AND APPLICATIONS 9

DCS: Evolution – Different architectures – local control unit – Operator interface – Displays – Engineering interface. **Applications:** Thermal power plant-cement plant-water treatment plant- Solar, windmill substation automation

Course Outcomes:

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

CO1. Justify the need for automation in industry.
CO2. Describe the architecture and types of PLC used in industry automation.
CO3. Develop the PLC based control logic program according to their application.
CO4. Explain industry networking Protocols and SCADA programming.
CO5. Explain the applications of DCS in various power plants.

Text Books:

1. Frank D Petruzella "Programmable Logic Controllers", McGraw Hill Education IndiaPrivateLimited, fourth edition, 2016.
2. Bolton.W, "Mechatronics", Pearson Education, Fourth edition, 2014.

Reference Books:

1. John W Webb & Ronald A Reis, "Programmable logic controllers: Principles andApplications",Prentice Hall India, fifth edition, 2006.
2. DobrivojiePopovic, Vijay P. Bhatkar,"Distributed Computer Control for IndustrialAutomation",MarcelDekkar Inc., New York, first edition, 2011.
3. Krishna Kant, 'Computer based Industrial Control', Prentice Hall of India, secondedition, 2010.
4. Rajesh Mehra and Vikrant Vij, "PLCs& SCADA- Theory and Practice",Laxmi Publications,first edition, 2016.

Web References:

1. http://www.fieldbus.org
2. www.nptel.ac.in/downloads/108105063/
3. http://nptel.ac.in/courses/108105062/18

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Software Engineering

Course Code:16ITE42	Course Title: DATA BASE MANAGEMENT SYSTEMS (Common to ECE,EEE & EIE)	
Elective	L:T:P:C	3:0:0:3
Type:Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16CST35 - Data Structures and OOPS with C++

Course Objectives:

The course is intended to:

1. Construct the Entity Relationship Model.
2. Convert ER diagram to relational database schema.
3. Apply the normalization technique to obtain the relational database design.
4. Select a query evaluation and optimization technique for a given query.
5. Implement online transactions and control concurrency.

UNIT I - AN OVERVIEW OF DATABASE SYSTEMS **9**

Introduction – Database system applications, Database versus file systems, View of data, Data models, Database languages, Database users and administrators, Database system structure, Entity – Relationship Model – Basic concepts, Constraints, Keys, Design issues, ER diagram, Weak entity sets, Design of an ER database schema.

UNIT II -DATA MODELS **9**

Relational model - Structure of relational databases – The relational algebra –Tuple relational calculus, Domain relational calculus, SQL – Background, Basic structure, Set operations, Aggregate functions, Null values, Nested sub queries, Views, Joined relations, DDL, Embedded SQL, Dynamic SQL, Integrity and security – Domain constraints, Referential integrity, Assertions, Triggers.

UNIT III - RELATIONAL DATABASES DESIGN **9**

Relational database design – First normal form, Second normal form - Pitfalls in relational database design, Functional dependencies, Decomposition, Desirable properties of decomposition, BCNF, Third normal form, Fourth normal form.

UNIT IV - INDEXING AND QUERYING **9**

Indexing and hashing – Basic concepts, Ordered indices, B+ tree index files, B tree index files – Static hashing, Dynamic hashing, Comparison of ordered indexing and hashing, Multiple key access - Query Processing – Overview, Measures of query cost, Selection operation, Sorting, Join operation - Query Optimization – Overview, Estimating statistics of expression results, Transformation of relational expressions.

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UNIT V - TRANSACTION, CONCURRENCY CONTROL AND RECOVERY MANAGEMENT 9

Transactions – Transaction concept, Transaction state, Implementation of atomicity and durability, Concurrent executions, Serializability, Recoverability, Testing for serializability - Concurrency control – Lock based protocols, Timestamp based protocols, Validation based protocols, Multiple granularity, Multiversion schemes, Recovery system – Failure classification, Storage structure, Recovery and atomicity, Log based recovery, Shadow paging, Recovery with concurrent transactions, Buffer management, Failure with loss of nonvolatile storage, Advanced recovery techniques, Remote backup systems.

Course outcomes:

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

CO1. Construct the Entity Relationship Model for obtaining the structure of a database.
CO2. Convert ER diagram to relational database schema.
CO3. Apply the normalization technique to obtain the relational database design.
CO4. Select a query evaluation and optimization technique for a given query.
CO5. Implement online transactions and control concurrency.

Text Books:

1. Silberschatz, Korth, Sudarshan, "Database System Concepts", Sixth Edition, McGrawHill International Edition, New Delhi 2010.
2. Date C.J., Kannan A, Swaminathan S, "An introduction to database systems", Eighth Edition, Pearson Education, New Delhi, 2009.

Reference Books:

1. Elmasri, R., Navathe, S.B., "Fundamentals of database systems", Sixth Edition, Pearson Education, New Delhi, 2010.
2. Raghu Ramakrishnan, Johannes Gehrke. "Database Management Systems", Third Edition, McGrawHill International Edition, New Delhi 2007
3. Bipin C Desai, "An Introduction to Database Systems", Eleventh Edition, Galgotia Publications Pvt. Ltd., New Delhi, 2001.
4. JefreyD.Ulman and Jenifer Widom, "A First Course in Database Systems", Third Edition, Prentice-Hall, New Delhi, 2007.
5. C.J.Date, A.Kannan and S.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006

Web References:

1. http://www.sanfoundry.com/database/
2. http://codex.cs.yale.edu/avi/db-book/db6/slide-dir/
3. www.nptelvideos.in/2012/11/database-management-system.html

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Course Code:16ITE43	Course Title: DATA MINING AND ANALYTICS (Common to ECE,EEE & EIE)	
Elective	L:T:P:C	3:0:0:3
Type:Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16ITE42 - Database Management Systems

Course Objectives:

The course is intended to:

1. Choose the appropriate pre-processing technique.
2. Apply the techniques of association rule.
3. Evaluate the classification algorithms.
4. Apply the clustering algorithms.
5. Analyze the requirements for a big data analytics.

UNIT I- DATA PREPROCESSING 9

Data Mining Overview – Data Objects and Attribute Types – Data Visualization. Data Preprocessing: Data Cleaning – Data Integration – Data Reduction – Data Transformation and Data Discretization.

UNIT II - ASSOCIATION 9

Mining Frequent Patterns, Associations, and Correlations: Basic Concepts and Methods –Basic Concepts – Frequent Itemset Mining Methods – Pattern Evaluation Methods. Advanced Pattern Mining: Pattern Mining: A Road Map – Pattern Mining in Multilevel, Multidimensional Space.

UNIT III - CLASSIFICATION 9

Basic Concepts: Decision Tree Induction – Bayes Classification Methods – Rule Based Classification – Model Evaluation and Selection – Techniques to Improve Classification Accuracy.

UNIT IV - CLUSTERING 9

Cluster Analysis: Partitioning Methods – Hierarchical Methods – Density Based Methods – Grid Based Methods – Evaluation of Clustering.

UNIT V - INTRODUCTION TO BIG DATA 9

Introduction to Big Data: Classification of Digital Data – Characteristics, Evolution and Definition of Big data - Challenges with Big Data – Traditional Business Intelligence (BI) vs Big Data – The Big Data Technology Landscape: Hadoop. Introduction to Hadoop: Hadoop Overview – Hadoop Distributors - Hadoop Distributed File System.

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Course Outcomes:

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

CO1. Choose the appropriate pre-processing technique to solve the given problem.
CO2. Apply the techniques of association rule to real world data.
CO3. Evaluate the classification algorithms with respect to their accuracy.
CO4. Apply the clustering algorithms to group the real world data.
CO5. Analyze the requirements for a big data analytics system for the organization.

Text Books:

1. Jiawei Han, MichelineKamber, Jian Pei, "Data Mining: Concepts and Techniques", 3rd Edition, Elsevier, 2012.
2. SeemaAcharya, SubhashiniChellappan, "Big Data and Analytics", 1st Edition, Wiley India, 2015.

Reference Books:

1. Jure Leskovec, AnandRajaraman, Jeffery David Ullman, "Mining of Massive Datasets", 2nd Edition, Cambridge University Press, 2014.
2. Ian H.Witten, Eibe Frank, Mark A.Hall, "Data Mining: Practical Machine Learning Tools and Techniques", 3rd Edition, Elsevier, 2011.
3. EMC Education Services, "Data Science and Big Data Analytics", Wiley, 2015.
4. DT Editorial Services, "Black Book- Big Data (Covers Hadoop 2, MapReduce, Hive, Yarn, PIG, R, Data visualization)", Dream tech Press edition 2016.
5. G.K. Gupta, "Introduction to Data Mining with Case Studies", EasternEconomy Edition, Prentice Hall of India, 2006.

Web References:

1. http://hanj.cs.illinois.edu/bk3/bk3_slidesindex.html
2. http://www.mmds.org/
3. http://www.kdnuggets.com/tutorials/index.html

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Course Code:16CSE25	Course Title: JAVA PROGRAMMING	
Elective	L:T:P:C	3:0:0:3
Type: Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16GET14 - C Programming

Course Objectives:

The course is intended to

1. Describe the distinct properties and features of Java.
2. Implement name spaces, concurrency and handle exceptions.
3. Employ Java standard library functions.
4. Apply Java utility, input/output functions.
5. Develop Java applications.

UNIT I - INTRODUCTION 9

Overview of Java – Data types, operators, control flows –Class fundamentals, objects and constructors –Method overloading- argument passing, Returning objects, recursion – Method Overriding and Dynamic Method dispatch- Abstract class

UNIT II - PACKAGES, EXCEPTIONS AND THREADS 9

Packages and access protection – Interfaces and extending interfaces – Exception fundamentals and types – Try, catch, throw, throws and finally; Chained Exceptions – Thread model, Creating threads and thread priorities – Synchronization –Inter thread communication

UNIT III -JAVA UTILITIES 9

String Handling –String Buffer class and functions – Library Functions – Math – Process – Clone – System Functions

UNIT IV - COLLECTIONS AND I/O STREAMS 9

Collections – Classes and Interfaces – Iterators and User defined collections – String Tokenizer – Java I/O classes and Interfaces - Streams – Byte Streams - Character Streams – File concepts

UNIT V - EXPLORING SWING 9

Java Swing – Features –Components and Containers – Event handling – Exploring Swing – Menus – Java Database Connectivity

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Course Outcomes:

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

CO1. Describe the distinct properties and features of Java
CO2. Implement name spaces, concurrency and handle exceptional conditions in programs
CO3. Employ Java standard library functions for solving complex problems
CO4. Apply Java utility, input/output functions and file manipulators
CO5. Develop Java applications using user interfaces and database connectivity

Text Books:

1. Herbert Schildt, "Java the Complete Reference", Mcgraw Hill Education, Ninth Edition, 2014
2. Mahmoud Parsian, "JDBC Metada, MySQL and Oracle Recipes: A Problem-Solution Approach", Apress Publications, 2006

Reference Books:

1. Bart Baesens, Aimee Backiel, SeppeVandenBrocke, "Beginning Java Programming: The Object Oriented Approach", John Wiley & Sons, 2015
2. Daniel Liang, "Introduction to Java Programming, Comprehensive Version", Pearson Education, Ninth Edition, 2014
3. James M Slack, Programming and Problem solving with JAVA, Thomson Learning, 2002
4. C Thomas Wu, An Introduction to Object Oriented programming with Java, Tata McGrawHill, 2005.
5. Cay S. Horstmann and Gary Cornell, "Core Java: Volume I – Fundamentals", EighthEdition, Sun Microsystems Press, 2008.

Web References:

1. https://docs.oracle.com/javase/tutorial/java/index.html
2. http://javabeginnerstutorial.com/core-java/
3. http://www.w3schools.in/java/

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Course Code:16CSE26	Course Title: SOFTWARE TESTING (Common to ECE,EEE & EIE)	
Elective	L:T:P:C	3:0:0:3
Type:Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16GET14 - C - Programming

Course Objectives:
The course is intended to:

1. Describe the software testing principles and its characteristics
2. Choose the appropriate testing for software development
3. Design Test cases suitable for a software development in various domains
4. Justify the importance of planning, documenting and validating the test plan.
5. Illustrate the need for automatic testing tools

UNIT I- TESTING FUNDAMENTALS **8**

Introduction to testing as Engineering Activity –Testing Fundamentals: Basic Definitions- Testing principles-Tester's role –Defects, Hypotheses and Tests

UNIT II - LEVELS OF TESTING **10**

The need for levels of Testing- Unit Test: Functions, Procedures, Classes, and Methods as Units- Unit Test: The Need for Preparation- Unit Test Planning- Designing the Unit Tests- Running the Unit Tests and Recording Results- Integration Test: Goals- Integration Strategies for Procedures and Functions- Integration Strategies for Classes- Designing Integration Tests- Integration Test Planning- System Test: The Different Types- Regression Testing- Alpha, Beta, and Acceptance Tests

UNIT III - DESIGNING TEST CASES **10**

Test case design strategies-Using Black Box approach to Test Case design- Random Testing – Equivalence class partitioning –Boundary value Analysis-Cause effect testing and state transition testing-Error Guessing - Using White Box Approach to Test case design – Test Adequacy Criteria –Coverage and Control Flow Graphs – Covering Code Logic – Paths –Additional test design approaches- code complexity testing – Evaluating Test Adequacy Criteria

UNIT IV - TEST MANAGEMENT **8**

Test Planning: Preparing a plan – scope management – deciding test strategy – responsibilities –resource requirements – test deliverables –testing tasks – Test management: standards – infrastructure management- People management – product release - Test Process – Test Reporting

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UNIT V - TEST AUTOMATION 9

Test Automation – Terms – Skills required – Scope of automation- Design and Architecture for Automation – Process Model – Selecting Test tools – automation for extreme Programming- Test Metrics and Measurements.

Course Outcomes:

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

CO1. Describe the software testing principles and its characteristics.
CO2. Choose the appropriate testing during the phases of software development.
CO3. Design Test cases suitable for a software development in various domains.
CO4. Justify the importance of planning, documenting and validating the test plan.
CO5. Illustrate the need for automatic testing tools.

Text Books:

1. Ilene Burnstein, "Practical Software Testing: A Process-Oriented Approach", SpringerInternational Edition, 2013
2. SrinivasanDesikan and Gopalaswamy Ramesh, "Software Testing – Principlesand Practices",Pearson Education, 2006

Reference Books:

1. Ron Patton, "Software Testing", Sams Publishing, Pearson Education,Second Edition,2009.
2. Boris Bezier, "Software Testing Techniques",Dreamtech, Second Edition, Reprint 2009
3. Aditya P. Mathur, "Foundations of Software Testing: Fundamental Algorithms and Techniques",Pearson Education, 2008.
4. Edward Kit," Software Testing in the Real World – Improving the Process", Pearson Education,1995.
5. RenuRajani, Pradeep Oak, "Software Testing – Effective Methods, Tools and Techniques",Tata McGraw Hill, 2004.

Web References:

1. http://nptel.ac.in/courses/106105150/
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-00-introduction-to-computer-science-and-programming-fall-2008/video-lectures/lecture-11/
3. http://www.testingtools.com/

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Course Code:16ITE44	Course Title: PYTHON PROGRAMMING	
Elective	L:T:P:C	3:0:0:3
Type:Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16CSE25 -JAVA Programming.

Course Objectives:

The course is intended to:

1. Build a console application using variables, expressions & functions.
2. Develop an application using list, tuple and dictionary.
3. Apply object oriented programming concepts to develop console applications.
4. Develop an application using Tkinter and database packages.
5. Create web based application using Model View Controller.

UNIT I- INTRODUCTION TO PYTHON 9

Variables, Expressions and Statements – Functions - Case Study: Interface Design-Conditionals and Recursion - Fruitful Functions- Iteration.

UNIT II - DATA STRUCTURES IN PYTHON 9

Strings - Case Study: Word Play – Lists – Dictionaries - Tuples-Case Study:Data Structure Selection - Files.

UNIT III - OOPS CONCEPTS IN PYTHON 9

Classes and Objects -Classes and Functions - Classes and Methods – Inheritance - Tkinter: GUI - Buttons and Callbacks - Canvas Widgets-Coordinate Sequences - More Widgets - Packing Widgets - Menus and Callable - Binding

UNIT IV - MANAGING DATA IN PYTHON 9

Storing Data Using Python - Analyzing Data with Python - Managing Data using SQL - Migrating LendyDB to an SQL Database - Exploring Other Data Management Options.

UNITV - WEB APPLICATIONS IN PYTHON 9

Python on the Web - Web Programming with Python - Python and the Web – Using Python Across the Wire - Exploring Python's Frontiers: Drawing Pictures with Python - Doing Science with Python - Playing Games with Python - Integrating with Other Languages

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Course Outcomes:

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

CO1. Build a console application using variables, expressions & functions.
CO2. Develop an application using list, tuple and dictionary.
CO3. Apply object oriented programming concepts to develop console applications.
CO4. Develop an application using Tkinter and database packages.
CO5. Create web based application using Model View Controller.

Text Books:

1. Allen Downey, "Think Python" ,Second Edition,Green Tea Press,2012
2. Laura Cassell,AlanGauld, "Python Projects",Wrox Publication,2015

Reference Books:

1. Jeffrey Elkner, Chris Meyers Allen Downey, "Learning with Python" , Fourth Edition Dream Tech Press Publication,2015
2. Mark Summerfield, "A Complete Introduction to the Python Language", Second Edition Addison-Wesley Professional,2014
3. Ryan Mitchell, "Web Scraping with Python: Collecting Data from the Modern Web", O'Reilly Media, Inc,2016.
4. Richard Lawson "Web Scraping with Python", First Edition, Packet Publishing Limited,2016.
5. John M Zelle "Python Programming: An Introduction to Computer Science"Franklin, Beedle& Associates, Inc, 2004.

Web References:

1. https://www.coursera.org/learn/python
2. https://www.fullstackpython.com/databases.html
3. http://fivedots.coe.psu.ac.th/~cj/os/slides/slide-ppt.html
4. http://www.w effbot.org/tkinterbook/tkinter-index.html

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Course Code:16ECE26	Course Title: DEEP LEARNING	
Elective	L:T:P:C	3:0:0:3
Type:Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16CSE25 -JAVA Programming.

Course Objectives:

The course is intended to:

1. Explore the basic concepts of machine learning
2. Interpret the single layer neural network
3. Illustrate the methodologies in multi layer neural network
4. Explain the techniques of recurrent neural network
5. Understand the deep learning concepts

UNIT I - MACHINE LEARNING 9

Introduction to machine learning–Challenges – Types of machine learning – Function minimization – Vectors, Matrices and Linear Programming – Probability distributions - Classification problems – Naïve Bayes classifier – Logistic regression

UNIT II–NEURAL NETWORKS 9

Introduction to neural networks – Nodes and Layers of Neural networks – Supervised learning of neural network – Training of single layer neural network – generalized delta rule – Stochastic gradient descent – Limitations of single layer neural network

UNIT III –MULTI LAYER NEURAL NETWORK 9

Back propagation neural network – XOR problem – Cost function and learning rule – Cross entropy function – L1 and L2 regularization –Learning rate – momentum – problems in multiple hidden layers

UNIT IV – RECURRENT NEURAL NETWORKS 9

Three settings of learning in recurrent neural networks – Feedback loops – Unfolding Neural networks – Elman Networks – Long term memory – Binary Classification – Multi class classification

UNIT V – DEEP NEURAL NETWORK 9

Improvement of deep neural network: vanishing gradient – over fitting – computational load – ReLU and Dropout – architecture of convolutional neural network – convolution layer – pooling layer – MNIST

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Course Outcomes:

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

CO1. Explain the basic concepts in machine learning
CO2. Train the single layer neural network using input-output data
CO3. Illustrate the methodologies in multi layer neural network for real world problems
CO4. Explain the techniques of recurrent neural networks for classification
CO5. Understand the deep learning concept using convolution neural networks

TEXT BOOKS:

1. Phil Kim "MATLAB Deep Learning: With Machine Learning, Neural Networks and Artificial Intelligence",Apress,2017.
2. SandroSkansi, "Introduction to Deep Learning: From Logical Calculus to Artificial Intelligence, Springer international publisher, Switzerland, 2018.

REFERENCES:

1. Daniel Graupe, "Deep Learning Neural Networks: Design and Case Studies",World scientific, 2016
2. Ian Goodfellow, YoshuaBengio, Aaron Courville, "Deep Learning",MIT press, 2016
3. Josh Patterson, Adam Gibson, "Deep Learning: A Practitioner's Approach",O'Reilly Media, Inc, 2017.
4. FrancoisChollet, "Deep Learning with Python", Manning Publications Company, 2017

WEB REFERENCES

1. https://www.coursera.org/learn/neural-networks-deep-learning/lecture/Cuf2f/welcome
2. https://in.udacity.com/course/deep-learning--ud730
3. https://www.edx.org/course/deep-learning-explained-microsoft-dat236x-0

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Course Code:16MEE40	Course Title: PRINCIPLES OF MANAGEMENT (Common to Mech,ECE,EEE,EIE)	
Elective	L:T:P:C	3:0:0:3
Type:Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16ENT11 - Communication Skills - I
- 16ENT21 - Communication Skills - II

Course Objectives:

The course is intended to

1. Describe the overview of management
2. Explain the planning process, policy and decision making
3. Explain the human resource structure and policy
4. Explain the motivational theories for management
5. Explain the control techniques for operations

UNIT I - OVERVIEW OF MANAGEMENT 9

Organization – Management – Role of managers – Evolution of Management thought – Organization and the environmental factors – Managing globally – Strategies for International Business.

UNIT II - PLANNING 9

Nature and Purpose planning – Planning process – Types of plans – Objectives – Managing by objective (MBO) Strategies – Types of strategies – Policies – Decision Making – Types of decision –Decision Making Process - Rational Decision Making Process – Decision Making under different conditions.

UNIT III - ORGANIZING 9

Nature and purpose of organizing – Organization structure – Formal and informal groups / organization – Line and Staff authority – Departmentation – Span of Control – Centralization and Decentralization – Delegation of authority – Staffing – Selection and Recruitment – Orientation Career Development – Career stages – Training – Performance Appraisal.

UNIT IV - DIRECTING 9

Creativity and Innovation – Motivation and Satisfaction – Motivation Theories Leadership – Leadership theories – Communication – Hurdles to effective communication – Organization Culture – Elements and types of culture – Managing cultural diversity.

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UNIT V - CONTROLLING 9

Process of controlling – Types of control – Budgetary and non-budgetary control techniques – Managing Productivity – Cost Control – Purchase Control – Maintenance Control – Quality Control – Planning operations.

Course Outcomes:

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

CO1. Describe the overview of management
CO2. Explain the planning process, policy and decision making
CO3. Explain the human resource structure and policy
CO4. Explain the motivational theories for management
CO5. Explain the control techniques for operations

Text Books:

1. Stephen P. Robbins and Mary Coulter, "Management", Prentice Hall of India, 8th edition, 2009.
2. Charles W.L Hill, Steven L McShane, "Principles of Management", Mcgraw Hill Education, 2007.

Reference Books:

1. Hellriegel, Slocum & Jackson, "Management – A Competency Based Approach", Thomson South Western, 10th edition, 2007.
2. Harold Koontz, Heinz Weihrich and mark V Cannice, "Management – A global & Entrepreneurial Perspective", Tata Mcgraw Hill, 12th edition, 2007.
3. Andrew J. Dubrin, "Essentials of Management", Thomson Southwestern, 7th edition, 2007

Web References:

1. http://www.managementstudyguide.com/all-subjects.htm

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Course Code:16MEE49	Course Title:ENGINEERING ECONOMICS AND COST ANALYSIS(Common to AUTO,MECH,ECE,EEE &EIE)	
Elective	L:T:P:C	3:0:0:3
Type:Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16MAT13 - Engineering Mathematics - I
- 16MAT23 - Engineering Mathematics - II

Course Objectives:

The course is intended to:

1. Calculate the breakeven point
2. Apply different interest formulae.
3. Compareeconomicalternatives.
4. Develop an equipment replacement policy.
5. Calculate depreciation of an equipment.

UNIT I - INTRODUCTION TO ECONOMICS 8

Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics - Elements of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis- V ratio, Elementary economic Analysis

UNIT II - VALUE ENGINEERING 10

Make or buy decision, Value engineering – Function, aims, and Value engineering procedure. Interest formulae and their applications –Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor- equal payment series capital recovery factor-Uniform gradient series annual equivalent factor, Effective interest rate, Examples in all the methods with problems.

UNIT III - CASH FLOW 9

Methods of comparison of alternatives – present worth method (Revenue dominated cash flow diagram), Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), rate of return method, Examples in all the methods.

UNIT IV - REPLACEMENT AND MAINTENANCE ANALYSIS 9

Replacement and Maintenance analysis – Types of maintenance, types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset – capital recovery with return and concept of challenger and defender, Simple probabilistic model for items which fail completely.

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UNIT V- DEPRECIATION 9

Depreciation- Straight line method of depreciation, declining balance method of depreciation-Sum of the years digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, service output method of depreciation- Evaluation of public alternatives- introduction, Examples, Inflation adjusted decisions – procedure to adjust inflation, Examples on comparison of alternatives and determination of economic life of asset. Case study

Course Outcomes:

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

CO1. Categorize different cost and calculate the breakeven point for a given business situation.
CO2. Apply different interest formulae and their application in decision making process.
CO3. Evaluate present value, future value and annual worth analysis on one or more economic alternatives.
CO4. Determine the economic value of an asset and develop a better Replacementpolicy for a given equipment.
CO5. Evaluate the depreciation of equipment per period.

Text Books:

1. PanneerselvamR, "Engineering Economics", Prentice Hall of India Ltd, NewDelhi, 2014
2. Chan S.Park, "Contemporary Engineering Economics", Prentice Hall of India, 2010.

Reference Books:

1. Donald.G. Newman, Jerome.P.Lavelle, "Engineering Economics and analysis" Engg. Press, Texas, 2010.
2. Degarmo, E.P., Sullivan, W.G and Canada, J.R, "Engineering Economy", Macmillan, New York, 2010.
3. Grant.E.L.,Ireson.W.G., and Leavenworth, R.S, "Principles of Engineering Economy", Ronald Press, New York,1990.

Web References:

1. https://en.wikipedia.org/wiki/Engineering_economics
2. https://en.wikipedia.org/wiki/Cost%E2%80%93benefit_analysis

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Course Code:16ECE27	Course Title: DISASTER MANAGEMENT (Common to ECE,EEE & EIE)	
Elective	L:T:P:C	3:0:0:3
Type:Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16ENT11 - Communication Skills - I
- 16ENT21 - Communication Skills - II

Course Objectives:

The course is intended to:

1. Distinguish the natural and manmade disasters.
2. Explain the environment hazards and level of toxicology.
3. Analyze the causes and effects of Earthquake and Tsunami formation.
4. Analyze the causes and effects of Cyclone formation.
5. Describe about modern technological tools in disaster management.

UNIT I - INTRODUCTION 9

Disaster- Disaster management- Disaster prevention and preparedness measures- Types of Disaster – Causal factor of Disaster – Natural, Manmade, creeping disaster-Disaster in the Indian context various measures – Disaster related policy goals – United Nations Development Program (UNDP) – United Nations Disaster Relief Organization (UNDRO) – Govt. of India.

UNIT II - ENVIRONMENTAL DISASTER 9

Environmental hazards – Typology – Assessment and response – the strategies– the scale of disaster – Vulnerability – Disaster trends – Paradigms towards a balanced view – Chemical hazards and Toxicology – Biological hazards –Hazard caused by world climate change – Risk analysis – other technological disasters.

UNITIII - EARTHQUAKE AND TSUNAMI 9

Earthquake – Causes of earthquake – Earthquake scales – Measures of earth – quake – Magnitude and Intensity – Earthquake Recurrence hazard assessment – Seismic zoning – Earthquake disaster mitigation – Component research focus – Forecasting techniques and Risk analysis – Tsunami – Causes of Tsunami –Effects of Tsunami – Tsunami warning system – Tsunami warning system in India – International status of Tsunami warning and communication system –Tsunami warning centers – Pacific Tsunami Warning Center (PTWC) – Pacific Tsunami Warning System (PTWS) components – Institutional arrangements and design criteria for Tsunami mitigation.

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UNIT IV - CYCLONE 9

Tropical cyclone - Warning system – Protection of buildings from cyclones - Precaution before and during cyclones – Tropical cyclone warning strategy in India – Cyclone related problems – aerial survey – Management strategy – risk reduction by public awareness and education.

UNIT V - APPLICATION OF TECHNOLOGY IN DIASTER MANAGEMENT 9

Hazard map – Multi hazard mapping – Application of satellites in Disaster Management – Application of remote sensing in forecasting and disaster relief –Use of digital image processing in disaster management – GIS in disaster management – Spatial data – GIS data base design – Convention mapping concepts and Coordinate system – Methods of spatial Interpolation in GIS.

Course Outcomes:

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

CO1. Distinguish the natural and manmade disasters.
CO2. Explain the environment hazards and level of toxicology.
CO3. Analyze the causes and effects of Earthquake and Tsunami formation.
CO4. Analyze the causes and effects of Cyclone formation.
CO5. Describe about modern technological tools in disaster management.

Text Books:

1. PardeepSahni, Madhavimalalgoda and Ariyabandu, "Disaster risk reduction in south Asia", PHI Publisher, 2010
2. AmitaSinhal, "Understanding earthquake disasters" TMH, 2010.

Reference Books:

1. PardeepSahni, AlkaDhameja and Uma medury, "Disaster mitigation: Experiences and reflections", PHIPublisher, 2001.
2. Jeff Groman, "The atlas of Natural Disasters", Friedman/Fairfax publishing, 2002
3. Jaikrishna and Chandrasekar, Elements of Earthquake Engineering", South Asian Publishers, 2000.

Web References:

1. http://nptel.ac.in/courses/122102006/mod2/5.htm
2. http://nptel.ac.in/courses/105104136/Module%201/Lecture%202.pdf

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Basic Sciences

Course Code:16MAE02	Course Title:CALCULUS OF VARIATIONS AND INTEGRAL EQUATIONS	
Elective	L:T:P:C	3:0:0:3
Type:Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16MAT13 - Engineering Mathematics - I
- 16MAT23 - Engineering Mathematics - II

Course Objectives:

The course is intended to:

1. Calculate the extremals of simple variational problems.
2. Calculate the extremals of variational problems with higher order derivatives and isoperimetric problems.
3. Solve variational problems with moving boundaries.
4. Calculate resolvent and kernel of FIE and VIE.
5. Solve Fredholm and Volterra integral equations.

UNIT I- VARIATIONAL PROBLEMS WITH FIXED BOUNDARIES **9**

Concept of Variation and its properties - Euler's equation - Variational problems for Functionals - Problem of brachistochrone- Problem of Geodesics.

UNIT II - VARIATIONAL PROBLEMS ON HIGHER ORDER AND ISOPERIMETRIC PROBLEMS **9**

Functionals dependent on higher order derivatives - Functions of several independent variables- solution of isoperimetric problems.

UNIT III - VARIATIONAL PROBLEMS WITH MOVING BOUNDARIES **9**

Variational problems with moving boundaries-Variational problem with a moving boundary for a functional dependent on two functions with its special cases- One sided variation.

UNIT IV - INTEGRAL EQUATION **9**

Integral Equations: Basic concepts, Volterra integral equations (VIE)-Fredholm integral equations-(FIE)- relationship between linear differential equations and Volterra equations- relationship between linear differential equations and Fredholmequations- resolvent and kernel.

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UNIT V - SOLUTION OF INTEGRAL EQUATION 9

Method of successive approximations, convolution type equations- Volterra equation of the first kind. Abel's integral equation- Fredholm equations of the second kind, the method of Fredholm determinants, iterated kernels, integral equations with degenerate kernels, eigen values and eigen functions of a Fredholm alternatives.

Course Outcomes:

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

CO1. Calculate the extremals of simple variational problems for functionals.
CO2. Calculate the extremals of variational problems with higher order derivatives and isoperimetric problems using Lagrange's multipliers.
CO3. Solve variational problems with moving boundaries.
CO4. Calculate resolvent and kernel of FIE and VIE.
CO5. Solve Fredholm and Volterra integral equations.

Text Books:

1. Dr. M.D. Raisinghania, "Integral equations and boundary value problems", S. Chand publishing, Ramnagar, New Delhi-110055.
2. Venkataraman. M.K, "Higher Mathematics for Engineering and Science", The National Publishing Company, 2006

Reference Books:

1. "Linear Integral Equations,Theory and Technique ", Ram P .Kanwal, 1st ed., Academic press, New York, 1971.
2. "Methods of Applied Mathematics", Francis B. Hildebrand, 2nd ed., Dover Publications, Inc. New York, 1992.
3. "Integral Equations, Practical Treatment, from Spectral Theory to Applications ", David Porter and David S.G, Stirling, 1st ed., Cambridge University Press 1990.
4. "Integral Equations and Applications", Cordumeanu, C., Cambridge University Press,1991.

Web References:

1. http://nptel.ac.in/courses/111104025/
2. Calculus_of_variationshttp://www.mathworld.wolfram.com/IntegralEquation.html
3. http://www.mathworld.wolfram.com/VolterraIntegralEquationoftheSecondKind.html

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Course Code:16MAE03	Course Title:DISCRETE MATHEMATICS (Common to ECE, EEE& EIE)	
Elective	L:T:P:C	3:2:0:4
Type:Theory	Total Contact hours:	75

Prerequisites: The student should have undergone the course(s):

- 16MAT13 - Engineering Mathematics - I
- 16MAT23 - Engineering Mathematics - II

Course Objectives:

The course is intended to:

1. Organize the concepts of propositional logic in programming languages.
2. Apply the theory of predicate calculus to test the validity of arguments.
3. Interpret the concept of various algebraic structures.
4. Classify several types of Graphs and its algorithms in computer programs.
5. Categorize the different types of trees.

UNIT I- PROPOSITIONAL LOGIC **9**

Propositions – Logical Connectives – Tautologies and Contradictions – Contra Positive – Logical Equivalences and Implications – Normal Forms – Principal Conjunctive and Disjunctive Normal Forms – Rules of Inferences

UNIT II - PREDICATE CALCULUS **9**

Predicates – Quantifiers – Free and Bounded variables – Universe of Discourse – Rules of Universal Specification and Generalization – Validity of Arguments.

UNIT III - GROUPS **9**

Algebraic Systems – Properties – Semigroups – Monoids – Homomorphism Subsemigroups and Submonoids– Cosets and Lagrange's Theorem – Normal Subgroups .

UNIT IV - GRAPHS **9**

Basic Definitions – Degree of Vertex –Matrix Representation of a Graphs - Paths Cycles and Connectivity – Eulerian and Hamiltonian Graphs.

UNIT V - TREES **9**

Introduction to Trees – Spanning Tree – Minimum Spanning Tree – Binary Trees – Rooted and Binary Trees– Tree Traversal – Expression Trees.

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Course Outcomes:

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

CO1. Organize the concepts of propositional logic in programming languages Usinglogical connectives.
CO2. Apply the theory of predicate calculus to test the validity of arguments using quantifiers.
CO3. Interpret the concept of various algebraic structures using groups and subgroups.
CO4. Classify several types of Graphs and its algorithms in computer programs using fundamental concepts of Graph Theory.
CO5. Categorize the different types of trees using fundamental concepts of Graph Theory.

Text Books:

1. T.Veerarajan, "Discrete Mathematical Structures with Graph Theory and Combinatorics", Tata McGraw–Hill Education Private Limited, New Delhi, 2011.

Reference Books:

1. Kenneth H.Rosen, "Discrete Mathematics and its Applications", Special Indian edition, Tata McGraw-Hill Pub. Co. Ltd., New Delhi, 2007.
2. Trembly J.P and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw–Hill Pub. Co. Ltd, New Delhi, 2007
3. Seymour Lipschutz and Mark Lipson, "Discrete Mathematics",2nd Edition, Schaum's Outlines, Tata McGraw-Hill Pub. Co. Ltd., New Delhi, 2007.

Web References:

1. http://nptel.ac.in/courses/111104026/
2. http://nptel.ac.in/courses/106106094/
3. http://nptel.ac.in/video.php?subjectId=106106094

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Course Code:16MAE04	Course Title:OPERATIONS RESEARCH (Common to ECE, EEE& EIE)	
Elective	L:T:P:C	3:0:0:3
Type:Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16MAT13 - Engineering Mathematics - I
- 16MAT23 - Engineering Mathematics - II
- 16GET14 - C Programming

Course Objectives:

The course is intended to:

1. Find the value of the given objective functions.
2. Solve transportation problems.
3. Solve assignment problems.
4. Find shortest path and total project cost.
5. Calculate the sequence for the given sequencing models.

UNIT I- LINEAR PROGRAMMING PROBLEM 9

Introduction to Operations Research: Basics definition, scope, objectives, phases, models and limitations of Operations Research. Linear Programming Problem – Formulation of LPP, Graphical solution of LPP. Simplex Method, Artificial variables, big-M method.

UNIT II - TRANSPORTATION MODEL 9

Transportation Problem - Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions – Northwest corner rule, least cost method and Vogel's approximation method. Optimality test: the stepping stone method and MODI method.

UNIT III - ASSIGNMENT MODEL 9

Assignment model – Formulation - Hungarian method for optimal solution.Solving unbalanced problem.Traveling salesman problem and assignment problem.

UNIT IV - NETWORK ANALYSIS 9

Network Techniques: Shortest path model, minimum spanning Tree Problem, Max-Flow problem and Min-cost problem.Project Management: Phases of project management, guidelines for network construction, CPM and PERT.

UNITV - SEQUENCING PROBLEM 9

Sequencing models. Solution of Sequencing Problem – Processing n Jobs through 2 Machines – Processing n Jobs through 3 Machines – Processing 2 Jobs through m machines – Processing n Jobs through m Machines.

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Course Outcomes:

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

CO1. Find the value of the given objective functions using linear programming techniques.
CO2. Solve transportation problems using optimality tests to minimize Transportationcost.
CO3. Solve assignment problems using Hungarian method to obtain optimal solution.
CO4. Find shortest path and total project cost using various network techniques
CO5. Calculate the sequence to optimizetime and cost for the given Sequencingmodels.

Text Books:

1. P. Sankaralyer, "Operations Research", Tata McGraw-Hill, 2008.
2. A.M. Natarajan, P. Balasubramani, A. Tamilarasi, "Operations Research", Pearson Education, 2005

Reference Books:

1. Wayne L. Winston, "Operations Research" Thomson Learning, 2003
2. Hamdy H. Taha, "Operations Research-An Introduction" Pearson Education, 2003
3. R. PanneerSelvam, "Operations Research" PHI Learning, 2008.
4. V. K. Khanna, "Total Quality Management" New Age International, 2008.

Web Reference:

1. http://nptel.ac.in/courses/112106131/1

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OPEN ELECTIVES (OE)

Course Code:16OE009	Course Title:DATA SCIENCE USING HADOOP WITH R	
Elective	L:T:P:C	3: 0 : 0 :3
Type:Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16GET14 - C-Programming
- 16CST35 - Data Structures and OOPS with C++
- 16MAT42 - Probability Theory and Statistics

Course Objectives:
The course is intended to:

1. Describe the significance of Big Data.
2. Solve the basic Analysis problem.
3. Explain the YARN architecture, configuration and containers.
4. Use suitable data types forbasic operations.
5. Choose an appropriate plot for visualizing the data.

UNIT I -INTRODUCTION TO BIG DATA 9

Data science process – roles, stages in data science project, What is Big Data-types of data-elements of big data-big data analytics. Exploring the big data stack-big data applications.

UNIT II -HADOOP ECO SYSTEM 9

Hadoop ecosystem-Hadoop Distributed File System-MapReduce framework techniques to optimize MapReduce jobs-uses of MapReduce.

UNIT III -HADOOP YARN ARCHITECTURE 9

YARN Architecture-working of YARN-YARN schedulers-backward compatibility with YARN-YARN configurations-YARN commands-YARN containers.

UNIT IV-INTRODUCTION TO R 9

Basic features of R-data types in R-reading data sets-reading and combining numeric, text-reading multiple data values from large values-reading data from R Studio-exporting data from R.

UNIT V -MANIPULATING AND PROCESSING DATA IN R 9

Creating data subset-merging datasets in R-sorting data-melting-casting-matrices-data frames-functions-arguments in functions-built-in functions in R-plots-RHadoop-integration of R and Hadooptext mining in RHadoop.

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Course Outcomes:

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

CO1. Describe the significance of Big Data.
CO2. Solve the basic Analysis problem using Map and reduce
CO3. Explain the YARN architecture, configuration and containers
CO4. Use suitable data types forbasic operations on data
CO5. Choose an appropriate plot for visualizing the data.

Text Books:

1. Black Book, "BIG DATA", DT Editorial Services, Dream tech press, Edition:2016.
2. Norman Matloff, "The Art of R Programming: A Tour of Statistical Software Design", No Starch Press, USA, 2011.

Reference Books:

1. Jimmy Lin and Chris Dyer, "Data Intensive Text Processing using Map Reduce", Morgan and Claypool Publishers, USA, 2010.
2. Nina Zumel, John Mount, "Practical Data Science with R", Manning Publications, 2014.
3. ArvindSathi, "Big Data Analytics: Disruptive Technologies for changing the game(paperback)", Mc Press, 2012.
4. Dirk deRoos, "HadoopFor Dummies", John Wiley & Sons, 2014.

Web References:

1. https://www.datascience.com/resources#.learn-data-science
2. http://home.ubalt.edu/ntsbarsh/stat-data/topics.htm#rintroduction
3. http://lintool.github.io/MapReduceAlgorithms/ed1n.html
4. https://www.tutorialspoint.com/r/r_overview.htm

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Course Code:16OE010	Course Title:ARTIFICIAL INTELLIGENCE	
Elective	L:T:P:C	3: 0 : 0 :3
Type:Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16CST35 - Data Structures and OOPS with C++

Course Objectives:

The course is intended to:

1. Identify a suitable Artificial Intelligence methods
2. Explain the knowledge representation
3. Explain the various reasoning techniques
4. Interpret the concepts of planning and machine learning
5. Explain the concepts of typical expert systems and its architectures

UNIT I -INTRODUCTION TO ARTIFICIAL INTELLIGENCE 9

Introduction to AI - Problem formulation, Problem Definition - Production systems, Control strategies, Search strategies. Problem characteristics, Production system characteristics, – Heuristic search - Depth first and Breath first, Generate and test, Hill Climbing, Best first search, Search in Game playing.

UNIT II -REPRESENTATION OF KNOWLEDGE 9

Knowledge representation issues: representation and mapping, approaches, issues Knowledge representation using Predicate logic- Introduction to predicate calculus, Resolution, Use of predicate calculus, Knowledge representation using Rules – Logic programming, Forward vs Backward knowledge, Matching.

UNIT III -REASONING 9

Introduction to Non-monotonic reasoning –Logics – Implementation issues – Implementation: depth-first search – Statistical reasoning – Probability and Bayes theorem – Bayesian networks – Dempster –Shafer theory – Fuzzy logic

UNIT IV-KNOWLEDGE ACQUISITION AND MACHINE LEARNING 9

Knowledge Acquisition process – Meta knowledge - Components of planning system – Understanding – Learning – Rote learning – Explanation based Learning – Inductive Learning - Natural language processing.

UNIT V -EXPERT SYSTEMS 9

Expert systems - Architecture of expert systems, Roles of expert systems - Knowledge Acquisition –Meta knowledge, Heuristics. Typical expert systems - MYCIN, DART, XOON, Expert systems shells. AI for robotics.

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Course Outcomes:

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

CO1. Identify a suitable Artificial Intelligence methods for solving the given problems.
CO2. Explain the knowledge representation using various logics and rule based systems
CO3. Explain the knowledge using various reasoning techniques
CO4. Interpret the concepts of planning and machine learning
CO5. Explain the concepts of typical expert systems and its architectures

Text Books:

1. Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence (SIE)", McGraw Hill- 2008.
2. R.B.Mishra, "Artificial Intelligence" PHI learning private ltd,2011.

Reference Books:

1. Peter Jackson, "Introduction to Expert Systems", 3rd Edition, Pearson Education, 2007.
2. Stuart Russel and Peter Norvig "AI – A Modern Approach", 2nd Edition, Pearson Education 2007
3. Deepak Khemani "Artificial Intelligence", Tata McGraw Hill Education 2013.
4. N.P.Padhy, "Artificial Intelligence and Intelligent systems" Oxford University press, Fourth Edition, 2008

Web References:

1. http://nptel.ac.in/courses/106105077/
2. https://in.udacity.com/course/intro-to-artificial-intelligence--cs271
3. https://www.tutorialspoint.com/artificial_intelligence/index.htm

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Course Code:16OE011	Course Title:SOFT COMPUTING	
Elective	L:T:P:C	3: 0 : 0 :3
Type:Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 16CST35 - Data Structures and OOPS with C++

Course Objectives:

The course is intended to:

1. Explain the basics of Soft computing and Fuzzy theory.
2. Apply the fuzzy theory for problem solving.
3. Explain the supervised learning of neural networks.
4. Explain the concepts of fuzzy and neural networks.
5. Optimize a problem using Genetic Algorithm.

UNIT I -INTRODUCTION TO SOFT COMPUTING 9

Introduction to Soft computing – Soft computing techniques – Types of Problems: Classification, Functional Approximation, Optimization - Modelling the problems. Introduction to classical set and fuzzy set- Classical relation and fuzzy relation – Fuzzy arithmetic - Fuzzy measures

UNIT II -APPLICATION OF FUZZY SETS 9

Fuzzy Membership function – Fuzzy Rule base and reasoning – Fuzzy Inference System – Defuzzification - Fuzzy Decision making – Fuzzy based clustering

UNIT III -ARTIFICIAL NEURAL NETWORKS 9

Introduction to Artificial Neural Networks (ANN) – Models and Terminologies of ANN – Hebb Network –Learning methods: Supervised and unsupervised learning. Supervised learning networks: Perceptrons – Adaline – Back propagation network – Radial basis function network.

UNIT IV-UNSUPERVISED LEARNING NETWORKS AND NEURO-FUZZY SYSTEMS 9

Unsupervised Learning Networks: Kohonen self-organizing network – Learning Vector quantization – Counter Propagation networks. Introduction to hybrid systems – Architecture of Adaptive Neuro Fuzzy Inference System (ANFIS) – Hybrid learning algorithm

UNIT V -OPTIMIZATION 9

Introduction to optimization – principles of optimization – Duality principle – Classification of optimization problems – Traditional optimization methods and its drawbacks – Evolutionary concepts in optimization: Genetic Algorithm (GA) – Simple GA – Binary coded GA – Limitations of Binary coded GA

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Course Outcomes:

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

CO1. Explain the basics of soft computing and Fuzzy theory
CO2. Apply the fuzzy theory for problem solving
CO3. Explain the supervised learning of neural networks
CO4. Summarize the concepts of fuzzy and neural networks
CO5. Optimize a problem using Genetic Algorithm

Text Books:

1. Sivanandam.S.N, Deepa.S.N, "Principles of soft computing",2nd Edition, Wiley India Pvt Limited, 2011.
2. Jyh - Shing Roger Jang, Cheun Tsai Sun, Eiji - Mizutani, "Neuro fuzzy and Soft computing", Prentice Hall, 1997.

Reference Books:

1. Dilip Kumar Prathiar, "Soft Computing" Narosa Publishing House Pvt Ltd, 2008
2. Anupam - shukla, RituTiwari, Rahul Kala, "Real life applications of Soft computing", CRC press, 2010.
3. Aliev,R.A, Aliev,R.R, "Soft Computing and its Application", World ScientificPublishing Co. Pvt. Ltd., 2001.
4. Mehrotra.K, Mohan.C.K, Ranka.S, "Elements of Artificial Neural Networks", The MIT Press, 2nd Edition, 2000.
5. Ronald R.Yager, Lofti - Zadeh, "An Introduction to fuzzy logic applications in intelligentSystems", Kluwer Academic, 1992.

Web References:

1. http://www.myreaders.info/html/soft_computing.html
2. https://www.tutorialspoint.com/artificial_intelligence/
3. http://www.soft-computing.de/def.html
4. http://nptel.ac.in/courses/106106046/41

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