3rd Semester

Course Code	Course Title	Load Allocation			Marks Distribution		Total Marks	Credits
		L	T	P	Internal	External		
EC-17301	Engineering Mathematics-III	3	1	-	40	60	100	4
EC-17302	Object Oriented Programming Using C++ and Data Structures	3	1	-	40	60	100	4
EC-17303	Electronics Devices & Circuits - I	3	1	-	40	60	100	4
EC-17304	Electronic Measurement & Instrumentation	3	1	-	40	60	100	4
EC-17305	Network Analysis and Synthesis	3	1	-	40	60	100	4
EC-17306	Lab Electronics Devices & Circuits - I	-	-	2	30	20	50	1
EC-17307	Lab Electronic Measurement & Instrumentation	-	-	2	30	20	50	1
EC-17308	Lab Object Oriented Programming and Data Structures	-	-	2	30	20	50	1
TR-17301	Workshop Training*	-	-	-	60	40	100	2
TOTAL		**15**	**5**	**6**	**350**	**400**	**750**	**25**

***The marks will be awarded on the basis of 4 weeks workshop training conducted after 2nd Semester.**

COURSE NAME: Engineering Mathematics – III
COURSE CODE: EC-17301
Internal Marks: 40 **L T P**
External Marks: 60 **3 1 -**
Numerical & Design Problems Content: 70%-80%
Note: The Question paper shall have three sections:
Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes
On successful completion of this course, the students should be able to:

CO	Definition	POs	PSOs
C01	Understand the use of periodic signals and Fourier series to analyze circuits.	1(M),2(M)	1(M)
C02	Analyze the Laplace transforms of commonly used signals.	1(H),2(M)	1(M)
CO3	Use appropriate numerical methods to study phenomena modeled with partial derivative equations.	1(M)	1(L)
CO4	Apply partial differential techniques to solve the physical engineering problems.	1(M)	1(M)
CO5	Identify complex functions and compute complex line integrals.	1(M)	1(M)
CO6	Demonstrate a firm understanding of the solution techniques for Linear ordinary differential equations	1(M)	1(M)

Syllabus: **[Total Contact Hours: 39+13(T) = 52]**

Unit 1. Fourier Series **[7+2=9]**
Periodic Functions, Euler formula, Even and Odd function with illustrated examples.

Unit 2. Laplace Transform **[8+3=11]**
Laplace transform of various standard functions, Properties, Inverse Laplace transform, transform of derivative and integrals, Application to solution of ordinary linear differential equations with constant coefficients, Simultaneous Differential equations.

Unit 3. Partial Differential Equations and Numerical Methods **[9+3=12]**
Formation ofPartial differential equations, First order linear and non linear partial differential equations, classification of linear second order partial differential equations, Important partial

differential equations, Wave, Laplace, Diffusion and their solution, Green Function and application ,Numerical solution of Ordinary and Partial differential equations.

Unit 4. Linear Algebra, Complex Variable and Transformation Techniques [9+3=12]
Vector spaces, Subspaces, basis, Dimension, Linear transformation. Analytic function, Line integral, Cauchy integral theorem and formula, Taylor and Laurent Series (without Proof), Residue theorem and Application, Bilinear transformation, Fourier series, Periodic function, Euler's formulae half range expansion. Fourier Transforms (Sine, Cosine).

Unit 5. Special Functions [7+1=8]
Frobenius Method, Legendre and Bessel functions, Bessel functions of first and second kind, Recurrence relations.

Text Books:

1. N.P.Bali, Manish Goyal, "A Text book of Engineering Mathematics",Laxmi Publications.

Recommended Books and References:

1. C. W. Curits, "Linear Algebra: An Introductory Approach", Springer.
2. A. D. Belegunder, T. R. Chandrupatla, "Optimization Concepts and Application in Engineering", Pearson Education Asia.
3. Ian Sneddon, "Elements of Partial Differential Equations", McGraw-Hill.
4. Rule V. Churchle, James Ward Brown, "Complex Variable and its Applications", McGraw Hills.

Ebook and other online study material:

1. https://lecturenotes.in/subject/19/mathematics-3-m-3
2. file:///C:/Users/COMP%20LAB/AppData/Local/Packages/Microsoft.MicrosoftEdge_8wekyb3d8bbwe/TempState/Downloads/EngineeringMathematics_by_H.D.Block_Vol1.pdf

MOOCS and videos course:

1. https://www.youtube.com/watch?v=P7gVp333B6M&list=PLC183993246C4F397
2. https://www.youtube.com/watch?v=Pu3tEorDyes&list=PLm_MSClsnwm8GcUuLM5ER3VD0UEZqBWcv

COURSE NAME: OBJECT ORIENTED PROGRAMMING USING C++ AND DATA STRUCTURES

COURSE CODE: EC-17302

Internal Marks: 40 **L T P**

External Marks: 60 **3 1 -**

Numerical & Design Problems Content: 50%-60%

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes

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

CO	Definition	POs	PSOs
C01	Demonstrate the basic concepts of object oriented programming and comprehend encapsulation.	1(M), 2(H)	2(H)
C02	Apply the knowledge of C++ to access data through pointers and understand memory allocation.	1(M)	2(M)
CO3	Illustrate how to apply the major object-oriented concepts to implement inheritance and polymorphism.	1(H),6(M)	1(L),2(H) 3(L)
CO4	Identify the need of constructor and destructor to implement features of object oriented programming.	3(M),9(M)	1(L),2(H) 3(L)
CO5	Understand advanced features of C++ specifically templates, exception handling and operator overloading.	1(M),5(H)	2(H)
CO6	Explain fundamentals of data structures and distinguish various data structures according to their use and implementation.	5(H),10(H)	2(H)

Syllabus: **[Total Contact Hours: 39+13(T) = 52]**

Unit 1. Principles of Objected Oriented Programming [7+2=9]

Basic concepts of object oriented programming-data types, variables, strings, functions, arrays, structures, standard input/output, classes and objects.

Unit 2. Pointers and Dynamic Memory Management [5+1=6]

Declaring and initializing pointers, accessing data through pointers, pointer arithmetic, memory allocation (static and dynamic), dynamic memory management using new and delete operators, pointer to an object, this pointer, pointer related problems - dangling/wild pointers, null pointer assignment, memory leak and allocation failures.

Unit 3. Inheritance and Polymorphism **[7+2=9]**

Types of inheritance, base classes and derived classes, public, private and protected inheritance, object slicing, overriding member functions, object composition and delegation, order of execution of constructors and destructors, virtual functions and polymorphism, dynamic binding, pure virtual functions, abstract base classes.

Unit 4. Constructors and Destructors **[6+2=8]**

Need for constructors and destructors, copy constructor, constructors and destructors in derived classes, constructors and destructors with static members, virtual destructors, initializer lists, operator overloading and type conversion.

Unit 5. Exception Handling and Templates **[3+2=5]**

Exception handling, templates and generic programming.

Unit 6. Introduction to Data Structures **[3+2=5]**

Introduction to data structures, introduction to algorithms complexity.

Unit 7. Arrays, Stacks & Queues **[8+2=10]**

Concepts; basic operations & their algorithms: transverse, insert, delete, sorting of data in these data structures, prefix, infix, postfix notations.

Text Books:

1. E. Balagurusamy, "Object Oriented Programming with C++", Tata McGraw Hill, 3rd edition,2007.
2. Ashok N.Kamthane, "Object Oriented Programming with ANSI & Turbo C++",pearson education, Fourth impression, 2008.
3. B. Stroustrup, "The C++ Programming Language", Addison Wesley, Reading Mass, USA, 4th Edition, May 2013.
4. Seymour Lipschutz, "Data Structures", Schaum's Outline Series,Tata McGraw-Hill, Special Indian edition, 2006.

Reference books and other resources:

1. Lafore R., "Object Oriented Programming in C++", Indianapolis, Ind. :Sams Publ., 4th edition, 2005.
2. *Michael Goodrich*, Roberto Tamassia& David Mount "*Data structures* and *algorithms* in *C++", Copyright © 2004* by John *Wiley*& Sons, 2010.

E books and online learning materials.

1. http://fac.ksu.edu.sa/sites/default/files/ObjectOrientedProgramminginC4thEdition.pdf
2. https://archive.org/details/EBalagurusamyObjectOrientedProgrammingWithC

MOOCS and Video Course.

1. https://www.youtube.com/watch?v=WpJ_yiwbGyk&list=PL3wYxbt4yCi5WymYaVLSpCto_LNbVNNA
2. https://www.youtube.com/watch?v=xnh7ip5gpzc&list=PLfVsf4Bjg79DLA5K3GLbIwf3baNVFO2Lq

COURSE NAME: ELECTRONICS DEVICES & CIRCUITS - I
COURSE CODE: EC-17303

	L	T	P
Internal Marks: 40			
External Marks: 60	**3**	**1**	**-**

Numerical & Design Problems Content: 20%-30%

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes

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

CO	Definition	POs	PSOs
CO1	Apply the basic mechanism of semiconductors in various types of diodes, bipolar junction transistors and field effect transistors.	1(H)	1(M)
CO2	Analyze the behavior of different electronic components in terms of V-I characteristics.	1(H), 2(H)	1(L)
CO3	Select suitable techniques to provide stabilization in electronic circuits against external factors like temperature and component variations.	1(H), 5(M)	1(M)
CO4	Design solutions for problems pertaining to electronic circuits under given operating conditions and specifications.	1(H), 3(H)	1(M)
CO5	Comprehend the operation of small signal transistors using h-parameters.	1(M)	1(L)
CO6	Illustrate the applications of electronic circuits by inspecting the function of each discrete electronic component.	1(H), 2(H), 3(L)	1(M)

Syllabus: **[Total Contact Hours: 39+13(T) = 52]**

Unit 1. Introduction **[4+2=6]**

Energy bands in silicon, intrinsic and extrinsic silicon, carrier transport in silicon: diffusion current, drift current, mobility, and resistivity, generation and recombination of carriers.

Unit 2. Diode Circuits **[9+3=12]**

Theory of PN junction diode, volt ampere characteristics, band structure of open circuited PN junction, small signal equivalent circuit of diode, temperature dependence of PN diode, rectifiers,

filter circuits, special purpose diodes: zener diode as voltage regulator, tunnel diode, LED, LCD and photodiodes.

Unit 3. Transistor Biasing and Stabilization [13+3=16]

PNP & NPN transistor, construction and characteristics in CB, CE and CC modes, transistor as an amplifier, transistor series and shunt regulators, UJT, photo- transistors, operating point, bias stability, various biasing circuits, stabilization against I_{CO}, V_{BE} and beta, bias compensation methods, thermal resistance.

Unit 4. Field Effect Transistors [5+2=7]

Construction and characteristics of junction field effect transistor (JFET), MOSFETs, MOS capacitor, FET parameters, Biasing of FETs, applications of FETs.

Unit 5. Small Signal Low Frequency Transistor [8+3=11]

Determination of h parameters from transistor characteristics, h parameter equivalent circuit of transistor, conversion of h parameter from CB to CE and CC configuration,analysis of transistor amplifier using h-parameters in CB, CE and CC configuration, frequency response of amplifier, effect of an emitter bypass capacitor, coupling capacitor, emitter resistance and shunt capacitors on frequency response of amplifier, analysis of emitter follower using Miller's theorem.

Text Books:

1. J. Millman, C. C. Halkias, "Electronic Devices & Circuits", Tata McGraw Hill.
2. R. L. Boylestad, "Electronic Devices & Circuits Theory", Prentice Hall India.

Reference books and other resources:

1. A. Mottorshead, "Electronic Devices & Circuits", Prentice Hall India.
2. A. Malvino, D. J. Bates, "Electronics Principles", Tata McGraw Hill, 2007.
3. J. Millman, C. C. Halkias, "Integrated Electronics: Analog & Digital Circuits and Systems", Tata McGraw Hill.

E-books and other online Material:

1. http://www.rtna.ac.th/departments/elect/Data/EE304/Electronic%20Devices%20and%20Circuit%20Theory.pdf
2. http://nptel.ac.in/courses/117103063/1
3. https://www.scribd.com/doc/281044230/EDC-BAKSHI-pdf

MOOCS and online videos:

1. https://www.youtube.com/playlist?list=PL-b2akM-9CLjRGEcR-Zg01-2DM3hH5F-t
2. http://freevideolectures.com/Course/2261/Basic-Electronics-and-Lab/2

COURSE NAME: ELECTRONIC MEASUREMENT & INSTRUMENTATION
COURSE CODE: EC-17304

Internal Marks: 40	**L**	**T**	**P**
External Marks: 60	**3**	**1**	**-**

Numerical & Design Problems Content: 20%-30%

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes

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

CO	Definition	POs	PSOs
C01	Define generalized instrumentation system and characterize electronic measuring instruments.	1(L)	(1L)
C02	Measure the parameters of signal using different electronic meters and measuring instruments.	4(H),5(M)	1(M)
CO3	Design the bridges for calculations of resistance, inductance and capacitance.	1(H),3(H)	1(H)
CO4	Examine and analyze various waveforms using different electronic devices.	4(M)	1(L)
CO5	Explain the working of various recorders and display devices.	1(L)	(1L)
CO6	Illustrate the working and application of transducers, telemetry system and data	1(L)	(1L)

Syllabus: **[Total Contact Hours: 42+13(T) = 55]**

Unit 1. Fundamentals: Generalized Instrumentation System [6+2=8]

Units and standards, calibration methods, standards of measurements, classification of errors, error analysis, static characteristics- accuracy, precision, sensitivity, linearity, resolution, hysteresis, threshold, input impedance, loading effects etc. dynamic characteristics.

Unit 2. Electronic Meters and Electronic Analog Voltmeter [8+3=11]

DC voltmeters-choppers type-DC amplifier, solid state voltmeter, differential voltmeter, peak responding voltmeter, true RMS voltmeter, calibration of DC voltmeters. digital voltmeter introduction, ramp techniques, dual slope, integrating type DVM, successive approximation type DVM, resolution and sensitivity of digital meters, general specification of a DVM. CRO‟ s study of various stages in brief, measurement of voltage, current phase and frequency, special purpose oscilloscope.

Unit 3. Measuring Instruments [8+3=11]

Principle of operation of galvanometer, PMMC, potentiometer, moving iron instruments, resistance measurements using Wheatstone bridge, Kelvin double bridge, Ohm meter, AC bridges: Maxwell bridge, Maxwell wein bridge, Hey's bridge, Schering bridge, Anderson bridge, Campbell bridge.

Unit 4. Instrumentation for Generation and Analysis of Waveforms [7+2=9]

Signal generators: fixed and variable AF oscillators, AF sine and square wave generator, function generator: square and pulse generator, sweep generator, wave analyzer, harmonic distortion analyzer, spectrum analyzer, spectrum analysis.

Unit 5. Storage and Display Devices [7+2=9]

Necessity of recorders, recording requirements, graphic recorders, strip chart recorders, magnetic tape recorders, digital tape recorders, electronic indicating instruments, seven segment display, fourteen segmental display Nixie tube.

Unit 6. Transducers and DATA Acquisition Systems [6+1=7]

Strain gauge, LVDT, thermocouple, piezoelectric crystal and photoelectric transducers and their applications, data acquisition systems, introduction to telemetry system

Text Books:

1. K. Sawhney, "Electrical and Electronic Measurements and Instrumentation", DanpatRai Publication.
2. D. Cooper, "Electronic Instrumentation and Measurement Techniques", Prentice Hall.

Reference books and other resources:

1. H. S. Kalsi, "Electronic Instrumentation", Tata McGraw Hill.
2. D. Buchla, Wayne Melachlan, "Applied Electronics Instrumentation and Measurement", Prentice Hall.
3. B. H Oliver, J. M. Cag, "Electronics Measurement and Instrumentation", McGraw Hill.
4. Carr, "Element of Electronic Instrumentation &Measurment", Pearson Education.
5. Kishore, "Electronic Measurments& Instrumentation", Pearson Education.
6. Terry L. Bartelt, "Process Control Systems and Instrumentation", Cengage Learning.

Ebooks and other online material:

1. http://www.mlrinstitutions.ac.in/sites/default/files/lecture_notes/a5c7f6f7cb405bd2f20c0eefa2cb2551-EMI-1-UNIT.pdf
2. https://www.scribd.com/doc/141456001/Instrumentation-H-S-KALSI

MOOCS and online video course:

1. https://www.youtube.com/watch?v=xLjk5DrScEU&list=PL_V7oErzqHVN8VqnMUps8lCSHgD4pCrAZ
2. https://www.youtube.com/watch?v=QaNDC44ADHY&list=PLZ4xobG3heC__o1hIRzTlQI58c0ERlyui

COURSE NAME: NETWORK ANALYSIS AND SYNTHESIS
COURSE CODE: EC-17305

	L	T	P
Internal Marks: 40			
External Marks: 60	**3**	**1**	**-**

Numerical & Design Problems Content: 30%-40%

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes

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

CO	Definition	POs	PSOs
CO1	Comprehend different types of signals used in electrical systems	1(H), 3(H)	1(L)
CO2	Analyze the circuits using various network theorems	1(H),2(H),3(H)	1(H)
CO3	Analyze the transient and steady state response of networks using Laplace transforms	1(H),2(H),3(H)	1(H)
CO4	Synthesizetwo terminal networks	1(H), 3(H)	1(H)
CO5	Design basic cut set and tie set matrices for planar networks.	1(H), 3(H)	1(L)
CO6	Formulate and design filter networks for different systems	2(H), 3(H)	1(L)

Syllabus: **[Total Contact Hours: 39+13(T) = 52]**

Unit 1. Circuit Concepts **[9+2=11]**

Independent and dependent sources, signals and wave forms, periodic and singularity voltages, step, ramp, impulse, doublet, loop currents and loop equations, node voltage and node equations, network theorems, superposition, Thevenin's, Norton's, maximum power transfer, and reciprocity.

Unit 2. Time and Frequency Domain Analysis **[8+3=11]**

Representation of basic circuits in terms of generalized frequency and their response, Laplace transform of shifted functions, transient and steady response, time domain behaviors from poles and zeros, convolution theorem

Unit 3. Network Synthesis **[10+4=14]**

Network functions, impedance and admittance function, transfer functions, relationship between transfer and impulse response, poles and zeros and restrictions, network function for two terminal pair network, sinusoidal network in terms of poles and zeros, real liability condition for impedance synthesis of RL and RC circuits, network synthesis techniques for 2-terminal network, Foster and Cauer forms.

Unit 4. Filters **[8+3=11]**

Classification of filters, characteristics impedance and propagation constant of pure reactive network, ladder network, T-section, π-section, terminating half section, pass bands and stop bands, design of constant-K, m-derived filters, composite filters.

Unit5. Network Topology **[4+1=5]**

Definitions, graph, tree, twigs, basic cut-set and basic tie set matrices for planar network.

Text Books:

1. A. Chakraborty, "Circuit Theory", DhanpatRai.
2. A. Sudhakar, Shyammohan S. Pali, "Circuits and Networks: Analysis and Synthesis", Tata McGraw Hill.

Reference books and other resources:

1. J. Bird, "Electrical Circuit Theory and Technology", Newnes.
2. D. Roy Chaudhury, "Networks and Synthesis", New Age International.
3. M. Nahvi, J. A. Edminister, "Electric Circuits (Schaum's outline series)", Tata McGraw Hill.
4. T. S. K. V. Iyer, "Circuit Theory", Tata McGraw Hill.
5. M. E. Van Valkenberg, "Network Analysis and Synthesis", PHI Learning.

E books and online learning materials.

1. https://bookstackweb.files.wordpress.com/2017/07/alexander-sadiku-fundamentals-of-electric-circuits.pdf
2. https://archive.org/details/NetworkAnalysisSynthesis

MOOCS and Video Course.

1. https://www.youtube.com/watch?v=UMhBgyK8F0U&list=PLByCtUEqH47zpwbHOog_UIItHmtMIT0FO
2. https://www.youtube.com/watch?v=5Zw8776D04A&list=PL-DyDJ8dpGDOZjYPFBL214EcvYBfE4tSW

COURSE NAME: LAB ELECTRONICS DEVICES & CIRCUITS - I
COURSE CODE: EC-17306

	L	T	P
Internal Marks: 30			
External Marks: 20	**-**	**-**	**2**

NOTE: Do all Experiments. Evaluation of the lab work shall be done as per the approved Rubric.

Course Outcomes

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

CO	Definition	POs	PSOs
CO1	Examine the role of active and passive electronic components for different applications like rectification, filtering and amplification.	1(H), 2(H), 4(H), 5(M)	1(M)
CO2	Assess the behavior of special purpose zener diode and photodiode.	1(M), 2(M), 4(H), 5(M)	1(L)
CO3	Demonstrate the current-voltage characteristics of bipolar junction transistor and field effect transistor in different mode.	1(H), 2(M), 4(H), 5(M)	1(L)
CO4	Conduct experiments to deduce the stability of various transistor biasing circuits.	1(M), 2(M), 4(H), 5(M)	1(L)
CO5	Distinguish the response of electronic circuits for given specifications.	1(H), 2(H), 3(H), 4(H), 5(H)	1(M)
CO6	Work as an individual or in a team to demonstrate the applications of electronic components.	1(H), 2(H), 4(H), 5(H), 9(M), 12(M)	1(M)

Syllabus:

Experiment 1. To perform the operation of half wave rectifier.

Experiment 2. To perform full wave & bridge rectifiers and calculate efficiency and ripple factor.

Experiment 3. To study simple capacitive, T & π filters.

Experiment 4. To observe the application of Zener diode as voltage regulator.

Experiment 5. To implement any one application of photodiode.

Experiment 6.	To plot the input and output characteristics of CE configuration.
Experiment 7.	To plot the input and output characteristics of CB configuration.
Experiment 8.	To determine h- parameters of a transistor using output characteristics.
Experiment 9.	To design fixed bias circuit.
Experiment 10.	To design potential divider transistor biasing circuit.
Experiment 11.	To observe the operation of an emitter follower circuit.
Experiment 12.	To plot JFET characteristics in CS configuration.

Reference Books and Other Resources:

Lab manuals available in lab.

E-books and other online materials:

1. http://ece.anits.edu.in/EDC%20manual.pdf
2. http://www.sircrrengg.ac.in/images/Others/ECE/EDCLAB.pdf

MOOCS and Video Course.

1. https://www.youtube.com/watch?v=rHWzLrmwBCk&list=PLVWMpzyFYi-8HTzhgyThdpSmyg5ekL1zu
2. https://www.youtube.com/channel/UC7BL0zGAkS6-Amv9STOvdvw

COURSE NAME: LAB ELECTRONIC MEASUREMENT & INSTRUMENTATION
COURSE CODE: EC-17307

	L	T	P
Internal Marks: 30			
External Marks: 20	**-**	**-**	**2**

Note: The evaluation of the Lab work shall be done as per the approved Rubrics.

Course Outcomes

CO	Definition	POs	PSOs
CO1	Measure different electrical quantities using digital multimeter.	4(M)	1(M)
CO2	Measure inductance, resistance, capacitance and various parameters of signal using different bridges .	1(M),4(M)	1(M)
CO3	Calculate the value of Q of a coil using LCR-Q meter.	1(M),4(M)	1(M)
CO4	Determine the frequency & phase angle of signals using C.R.O	1(M),4(M)	1(M)
CO5	Explain the phenomenon of resonance.	1(L)	
CO6	Examine the characteristics and operate various transducers and potentiometer	1(M)	

Syllabus:

Experiment 1. To be familiar with the working of digital multimeter

Experiment 2. Measurement of inductance by Maxwell‟ sbridge.

Experiment 3. Measurement of small resistance by Kelvin‟ s bridge.

Experiment 4. Measurement of capacitance by Schering Bridge.

Experiment 5. Measurement of frequency by Wein Bridge

Experiment 6. Measurement of medium resistance by Wheat Stone's bridge

Experiment 7. Determination of frequency & phase angle using C.R.O

Experiment 8. To find the Q of a coil using LCR-Q meter

Experiment 9. Study of resonance

Experiment 10. To determine output characteristic of a VDT and determine its sensitivity.

Experiment 11. Study characteristics of temperature transducer like thermocouple, thermistor and RTD with implementation of small project using signal conditioning circuit.

Reference Books and Other Resources:

Lab manuals available in lab.

Online videos:

1. https://www.youtube.com/watch?v=GeET9Z1dbnA&index=8&list=PLv_Pw5IjPpkKm9RACkDUrzr4RnoE1YdKv
2. https://www.youtube.com/watch?v=_Z9ZKCQJhiU

COURSE NAME: LAB OBJECT ORIENTED PROGRAMMING AND DATA STRUCTURES
COURSE CODE: EC-17308

	L	T	P
Internal Marks: 30			
External Marks: 20	-	-	2

NOTE: Do all Experiments.Evaluation of the lab work shall be done as per the approved Rubric.

Course Outcomes

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

CO	Definition	Pos	PSOs
C01	Create programs with basic object-oriented concepts and implement important features of C++.	1(M),5(H) 9(M)	2(H)
C02	Apply the knowledge of C++ to access data through constructors and initializer list.	1(H),6(H)	2(M)
CO3	Develop the object oriented skills like inheritance and polymorphism to solve real world problems.	3(H),4(M) 10(H)	2(H),3(M)
CO4	Compile codes with good coding practices on advanced features of C++.	2(H),4(H), 5(M)	1(L),2(H) 3(M)
CO5	Understand how several fundamental algorithms work particularly those concerned with Array, Stack and Queue.	1(H),2(H), 5(L)	2(H)
CO6	Work in a team to demonstrate an application of object oriented programming by engaging in self-learning.	4(M),9(H), 10(M),12(H)	1(L),2(H) 3(M)

Syllabus:

Write following programs in C++:

Experiment 1. Using basic statements like control statements, looping statements, various I/O statements and various data structures.

Experiment 2. To create classes in C++ for understanding of basic OOPS features.

Experiment 3. To demonstrate the use of static and const data members.

Experiment 4. To demonstrate the use of various types of constructors and destructors.

Experiment 5. To create programs in C++ for understanding initializer list.

Experiment 6. To demonstrate unary and binary operator overloading.

Experiment 7. To demonstrate the use of memory management operators.

Experiment 8. To create programs in C++ to understand various forms of inheritance.

Experiment 9. To demonstrate the use of virtual keyword.

Experiment 10. To create programs in C++ to understand exception handling and templates.

Experiment 11. To implement following operations (using separate functions) on a linear array:

- Insert a new element at end as well as at a given position
- Delete an element from a given whose value is given or whose position is given
- To find the location of a given element
- To display the elements of the linear array

Experiment 12. To demonstrate the use of stack (implemented using linear array) in converting arithmetic expression from infix notation to postfix notation.

Experiment 13. To demonstrate the use of stack (implemented using linear linked array) in evaluating arithmetic expression in postfix notation.

Experiment 14. To demonstration the implementation of various operations on a linear queue represented using a linear array.

Experiment 15. To demonstration the implementation of various operations on a circular queue represented using a linear array.

Reference Books and Other Resources:

Lab manuals available in lab.

Video Course

1. https://www.youtube.com/watch?v=Y00J1EE49Fg
2. https://www.youtube.com/watch?v=HGE0V2uQ--U

4th Semester

Course Code	Course Title	Load Allocation			Marks Distribution		Total Marks	Credits
		L	T	P	Internal	External		
EC-17401	Linear Control Systems	3	1	-	40	60	100	4
EC-17402	Electronics Devices & Circuits - II	3	1	-	40	60	100	4
EC-17403	Signals & Systems	3	1	-	40	60	100	4
EC-17404	Electromagnetic Field Theory	3	1	-	40	60	100	4
EC-17405	Digital Electronics	3	1	-	40	60	100	4
EC-17406	Pulse Wave Shaping and Switching	3	1	-	40	60	100	4
EC-17407	Lab Electronics Devices & Circuits - II	-	-	2	30	20	50	1
EC-17408	Lab Digital Electronics	-	-	2	30	20	50	1
EC-17409	Lab Signals & Systems	-	-	2	30	20	50	1
GF-17401	**General Fitness**				100	NA	100	1
TOTAL		**18**	**6**	**6**	**430**	**420**	**850**	**28**

COURSE NAME: LINEAR CONTROL SYSTEMS
COURSE CODE: EC-17401

	L	T	P
Internal Marks: 40			
External Marks: 60	**3**	**1**	**-**

Numerical & Design Problems Content: 50%-60%

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes

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

CO	Definition	POs	PSOs
CO1	Classify different types of control system and analyze their use in various practical applications	1(M)	1(M)
CO2	Use different techniques for mathematical modelling of various types of physical systems	1(H)	1(M)
CO3	Analyze the nature of time response of feedback control systems and find out system stability using Routh Hurwitz's criteria and root locus technique	2(H), 4(M)	1(H)
CO4	Discuss procedure for determining the stability of a control system based on sinusoidal frequency response	2(M), 4(M)	1(M)
CO5	Design a stable network meeting desired needs within realistic constraints using concept of feedback compensation	3(M)	1(M)
CO6	Demonstrate the domain knowledge of various control system components such as error detectors, synchros, potentiometers etc.	1(M)	3(L)

Syllabus: **[Total Contact Hours: 42+14(T) =56]**

Unit 1. Introductory Concepts **[7+2=9]**

Plant, Systems, Servomechanism, regulating systems, disturbances, Open loop control system, closed loop control systems, linear and non-linear systems, time variant & invariant, continuous and sampled data control systems, Block diagrams, some illustrative examples.

Unit 2. Modelling **[6+2=8]**

Formulation of equation of linear electrical, mechanical, thermal, pneumatic, hydraulic system, electrical, mechanical analogies, Transfer function, Block diagram representation, Signal flow graphs and associated algebra, characteristics equation.

Unit 3. Time domain analysis **[6+2=8]**

Typical test–input signals, Transient response of first and second order systems, Time domain specifications, Dominant closed loop poles of higher order system, Steady state error and coefficients, pole- zero location and stability, Routh-Hurwitz Criterion.

Unit 4. Root Locus Technique **[6+2=8]**

The extreme points of the root loci for positive gain, Asymptotes to the loci, Breakaway points, intersection with imaginary axis, location of roots with given gain, sketch of the root locus plot.

Unit 5. Frequency Domain Analysis **[7+2=9]**

Closed loop frequency response, Bode plots, stability and loop transfer function. Frequency response specifications, Relative stability, Relation between time and frequency response for second order systems, Log. Magnitude versus Phase angle plot, Nyquist criterion for stability.

Unit 6. Compensation **[5+2=7]**

Necessity of compensation, series and parallel compensation, compensating networks, applications of lag and lead- compensation.

Unit 7. Control Components **[5+2=7]**

Error detectors – potentiometers and synchros, servo motors, ac and dc techno generators, magnetic amplifiers.

Text Books:

1. B. S. Manke, "Linear Control Systems", Khanna Publishers, 11th Edition, 2012.
2. I. J. Nagrath and M. Gopal, "Control System Engineering", Wiley Eastern Ltd, 3rd Edition, 2000.

Reference Books:

1. R. C. Dorf and R. H. Bishop, "Modern Control System", Addison –Wesley, Pearson Education, 8th Edition, 2004.
2. K. Ogata, "Modern Control Engineering", Prentice Hall, 5th Edition, 2010.
3. B. C. Kuo, "Automatic Control System", Prentice Hall, 7th Edition, 2000.
4. S. Janardhanan and Y. Singh, "Modern Control Engineering", Cengage Learning, 2010.

E books and online learning materials:

1. http://www.ece.mcmaster.ca/~davidson/EE3CL4/slides/Feedback_handout.pdf.
2. https://www3.nd.edu/~pantsakl/Publications/348A-EEHandbook05.pdf.

MOOCS and Video Course:

1. http://nptel.ac.in/courses/108101037/3.
2. http://nptel.ac.in/courses/108101037/15

COURSE NAME: ELECTRONICS DEVICES & CIRCUITS-II
COURSE CODE: EC-17402
Internal Marks: 40 **L T P**
External Marks: 60 **3 1 -**
Numerical & Design Problems Content: 20%-30%
Note: The Question paper shall have three sections:
Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes
On successful completion of this course, the students should be able to:

CO	Definition	POs	PSOs
CO1	Comprehend and categorize amplifiers on the basis of coupling and tuning concepts.	1(H)	1(M)
CO2	Analyze the behavior of different large signal amplifiers and evaluate their efficiency.	1(H), 2(H)	1(L)
CO3	Apply different feedback topologies to amplifier and examine its impact on circuit performance.	1(H), 2(H)	1(M)
CO4	Select suitable oscillator type for applications under specific frequency range.	1(H), 5(M)	1(L)
CO5	Comprehend the operation of transistors at high frequencies.	1(H)	1(L)
CO6	Engage in self-study to demonstrate applications of electronic circuits.	1(H), 2(H), 3(M), 12(H)	1(H)

Syllabus: **[Total Contact Hours: 39+13(T) =52]**

Unit 1. Multistage Amplifiers **[9+3=12]**
Coupling of transistor amplifiers, frequency response of coupled amplifiers, Types of coupling: RC coupling, Transformer coupling, direct coupling, Cascode amplifier, Darlington amplifier. Tuned Amplifiers: single tuned, double tuned and stagger tuned amplifiers.

Unit 2. Large Signal Amplifiers **[9+3=12]**
Class A direct coupled with resistive load, Transformer coupled with resistive load, harmonic

distortion, variation of output power with load, push-pull amplifiers, operation of Class A push-pull amplifier, Class B push-pull amplifier, crossover distortion, Class AB push-pull amplifier, Transistor phase inverter, Complementary- symmetry amplifier.

Unit 3. Feedback in Amplifiers [7+2=9]

Types of feedback, effect of negative feedback on gain, input impedance, output impedance, bandwidth, stability, distortion and frequency response, voltage series, current series, voltage shunt, current shunt feedback circuits and their analysis.

Unit 4. Oscillators [7+2=9]

Sinusoidal oscillators, Criterion for oscillation, Different types of oscillators: RC Phase Shift, Wien Bridge, Hartley, Colpitt, Crystal Oscillators and Derivation of frequency for these oscillators.

Unit 5. High Frequency Transistor [7+3=10]

High frequency T model, common base short circuit current frequency response, alpha cutoff frequency, common emitter short circuit current frequency response, hybrid pi CE transistor model, hybrid pi conductance in terms of low frequency h parameters, CE short circuit current gain obtained with hybrid pi model, current gain with resistive load.

Text Books:

1. J. Millman, C. Halkias and C. D. Parikh, "Integrated Electronics: Analog and Digital Circuits and Systems", McGraw Hill Education, 2nd Edition, 2010.
2. R. Boylested and L. Nashelsky, "Electronic Devices and Circuit Theory", Prentice Hall of India, 10th Edition, 2009.

Reference books:

1. S. Salivahanan, N. Suresh Kumar and A. Vallavaraj, "Electronic Devices and Circuits", Tata McGraw Hill, 2nd Edition, 2011.
2. A. Malvino and D. J. Bates, "Electronic Principles", Tata McGraw-Hill, 7th Edition, 2007.
3. T. L. Floyd, "Electronic Devices", Pearson Education, 9th Edition, 2012.
4. J. Millman, C. C. Halkias and S. Jit, "Electronic Devices and Circuits", Tata McGraw- Hill, 3rd Edition, 2010.

E books and online learning materials:

1. https://lecturenotes.in/subject/429/electronic-devices-and-circuits-edc
2. https://hristotrifonov.files.wordpress.com/2012/10/electronic-devices-9th-edition-by-floyd.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/117103063/20
2. http://nptel.ac.in/courses/117103063/33

COURSE NAME: SIGNALS AND SYSTEMS
COURSE CODE: EC-17403

	L	T	P
Internal Marks: 40			
External Marks: 60	**3**	**1**	**-**

Numerical & Design Problems Content: 40%-50%

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes

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

CO	Definition	POs	PSOs
CO1	Apply various operations on the signals and classify continuous and discrete time signals and systems.	1(M)	1(L)
CO2	Make use of Fourier series and Fourier transform tools for the analysis of continuous and discrete time signals.	1(H), 2(H), 5(H)	1(M)
CO3	Analyze various techniques to classify LTI systems and develop solutions for mathematical representation of systems.	1(H), 2(H), 3(M), 5(M)	1(M)
CO4	Predict the behavior of random signals using probability theory.	1(H), 2(M), 5(M)	1(M)
CO5	Examine the effect of noise sources on system performance.	1(H), 2(M)	1(M)
CO6	Test real-time systems using self-study and engage in life-long learning.	1(H), 2(H), 4(M), 12(H)	1(H)

Syllabus: **[Total Contact Hours: 39+13(T) =52]**

Unit 1. Classification of Signals and Systems [11+3=14]

Introduction, Elementary signals in continuous and discrete domain, Operations on Signals: scaling, shifting and folding. Classification of Continuous-time and Discrete-time signals, Classification of Continuous-time and Discrete-time systems.

Unit 2. Analysis of Continuous-time and Discrete-time signals [12+3=15]

Representation of Continuous-time and discrete-time signals using Fourier series: Trigonometric Fourier series, Polar Form of Fourier series and Exponential Fourier Series, concept of negative frequency, Properties of Fourier Series, Aperiodic Continuous-time and discrete-time signal representation using Fourier Transform, Properties of Fourier Transform, Fourier Transform of Periodic Power Signals, Power Spectral Density, Energy Spectral Density, Parseval's Theorem and correlation.

Unit 3. Continuous-Time Linear Time Invariant Systems [5+2=7]

Definitions and Properties of LTI Systems, Impulse and step response, Convolution integral, Transfer function.

Unit 4. Random Signal Theory [6+2=8]

Introduction to Probability Theory, Definitions, Probability of Random Events, Joint and Conditional Probability, Probability Mass Function, Probability Density Function, Statistical Averages, Examples of Probability Density Functions, Transformation of Random Variables, Random Process: Stationary and Non-stationary, Ergodicity.

Unit 5. Signal Transmission through Systems [5+3=8]

Sampling Theorem, Thermal Noise, Shot noise, Partition noise, Flicker noise, Gaussian Noise, Noise in Bipolar Junction Transistors (BJTs), FET noise. Equivalent input noise, Signal to Noise Ratio (SNR), Noise Temperature, Noise equivalent Bandwidth, Noise Figure, Experimental determination of Noise Figure, Matched Filter.

Text Books:

1. S. Haykins and B. V. Veen, "Signals and Systems", John Wiley & Sons, 2nd Edition, 2008.
2. S. Haykin, "Communication Systems", John Wiley & Sons, 3rd Edition, 2008.

Reference books:

1. H. P. Hsu, "Signals and Systems", McGraw Hill Education Pvt. Ltd., 2nd Edition, 2008.
2. A. V. Oppenheim, S. Wilsky and S. H. Nawab, "Signals and Systems", Pearson Education, 2007.
3. M. J. Roberts, "Signals and Systems: Analysis using Transform Methods and MATLAB", Tata McGraw-Hill, 2nd Edition, 2012.
4. D. Sundararajan, "A Practical Approach to Signals and Systems", John Wiley & Sons, 2008.
5. S. Ghosh, "Signals and Systems", Pearson Education, 2006.
6. W.V. Etten, "Introduction to Random Signals and Noise", John Wiley & Sons, 2005.

E books and online learning materials:

1. http://www.di.univr.it/documenti/OccorrenzaIns/matdid/matdid744681.pdf
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-003-signals-and-systems-fall-2011/lecture-notes/

MOOCS and Video Course:

1. http://nptel.ac.in/courses/117104074/1
2. http://nptel.ac.in/courses/117104074/2

COURSE NAME: ELECTROMAGNETIC FIELD THEORY
COURSE CODE: EC-17404

Internal Marks: 40	**L**	**T**	**P**
External Marks: 60	**3**	**1**	**-**

Numerical & Design Problems Content: 30%-40%

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes

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

CO	Definition	POs	PSOs
C01	Apply the Maxwell's equations to solve boundary conditions in different media	1(H), 5(H)	2(H)
C02	Demonstrate the concept of electromagnetic wave propagation and its sinusoidal variation in different media	1(H) ,12(H)	2(H)
CO3	Analyze the characteristics of guided waves in parallel planes	1(H), 11(H),12(H)	1(H)
CO4	Explain the propagation of waves in rectangular and circular waveguides	1(H), 3(H), 11(H),12(H)	1(H)
CO5	Describe and analyze parallel plane transmission lines with Smith charts	1(H), 3(H), 11(H),12(H)	1(H)
CO6	Use knowledge of waveguides and transmission lines to design communication mediums.	1(H), 4(H)	1(H)

Syllabus: **[Total Contact Hours: 39+13(T) =52]**

Unit 1. Introduction to Time varying fields **[4+2=6]**

Maxwell's equations in differential and integral forms, Concept of displacement current and conduction current, Boundary conditions.

Unit 2. Electromagnetic Waves **[9+3=12]**

Wave equation and its solution in different media, Plane wave, Sinusoidal time variations,

Polarization, Reflection of waves by perfect dielectrics and by perfect insulators, Surface impedance, Poynting theorem and Poynting vector.

Unit 3. Guided Waves **[9+3=12]**

Waves between parallel planes, TE, TM waves and their characteristics, TEM waves, Velocities of propagation, Attenuation in parallel plane guides, Wave impedance.

Unit 4. Wave Guides **[9+3=12]**

Rectangular and circular wave guides, TE and TM waves in rectangular waveguides, Impossibility of TEM wave in wave guides, Wave impedance and Characteristic impedance, Transmission line analogy for wave guides, Attenuation factor of wave guides.

Unit 5. Transmission Lines **[8+2=10]**

Circuit representation of parallel plane transmission lines, Parallel plane transmission line with losses, Lossless line, Low loss RF and UHF transmission lines, Distortionless line, Transmission line charts-impedance matching.

Text Books:

1. E. C. Jordan & K. G. Balmain, Electromagnetic Waves and Radiating Systems, 2nd edition , PHI, 2011.
2. P. V. Gupta, Introductory Course In Electromagnetic Fields, 3rd edition, Dhanpat Rai & Sons Company Limited.

Reference Books / Study material:

1. W. H. Hayt & J.A. Buck, Engineering Electromagnetics, 8th edition, TATA McGraw-Hill, 2014.
2. W. H. Hayt & J.A. Buck, Problem and solutions in Electromagnetics, 8th edition TATA McGraw-Hill, 2014.
3. John Krauss, Electromagnetics and applications, 4th edition ,TATA McGraw-Hill, 2010.
4. Matthew, N. O. Sadiku, Elements of Engineering Electromagnetics, 4th edition, Oxford University Press, 2007.

E books and online learning materials:

1. https://www.calvin.edu/~pribeiro/courses/engr315/EMFT_Book.pdf
2. https://www.photonics.ethz.ch/fileadmin/user_upload/Courses/EM_FieldsAndWaves/Intro.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/108106073/3
2. http://nptel.ac.in/courses/108106073/5

COURSE NAME: DIGITAL ELECTRONICS
COURSE CODE: EC-17405
Internal Marks: 40 **L T P**
External Marks: 60 **3 1 -**
Numerical & Design Problems Content: 40-50%
Note: The Question paper shall have three sections:
Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes
On successful completion of this course, the students should be able to:

CO	Definition	POs	PSOs
CO1	Apply the knowledge of number systems, codes, minimization techniques like Boolean Algebra, K-Map and Q.M. method to analyze and design digital circuits.	1 (H)	
CO2	Identity, formulates, and solves engineering problems in the area of digital electronics.	2 (H) & 3 (H)	
CO3	Apply appropriate techniques to design digital circuits with minimum hardware components to meet the desired application within realistic constraints.	5 (M)	
CO4	Identify and use the appropriate type of analog to digital converters and digital to analog converters for the specified design problems.	4 (M)	
CO5	Apply domain knowledge to select the relevant semiconductor memories to meet the design specifications.	3 (M)	
CO6	Apply reasoning informed by the contextual knowledge to assess the merit and demerits of different logic families for optimal and sustainable circuit design.	3 (M)	

Syllabus: **[Total Contact Hours: 40+13(T) =53]**

Unit 1. Number Systems and Binary Codes **[7+2=9]**

Introduction, Binary, Octal and hexadecimal number system. Binary operations–addition, Subtraction, Multiplication and division, Signed binary numbers, Subtractions using 1's and 2's compliment, ASCII code, Excess 3 code, Gray code, Octal code, BCD code and BCD additions.

Unit 2. Minimization of Logic Function [7+2=9]

Logic Gates: OR, AND, NOT, NOR, NAND, EX-OR, Pin diagram and description of ICs of logic gates, Boolean algebra, Basic theorem of Boolean algebra, Minimization using Boolean algebra, Standard representations of logic functions, K-map representation of Logic Functions, Minimization using K-map and Q-M method, Incompletely specified functions/Don't care Conditions.

Unit 3. Combinational Logic Circuits [6+2=8]

Introduction, Combinational circuit design, multiplexer, Implementation of Combinational circuit using multiplexer, Dewsmultiplexer, Use of demultiplexer in combinational logic design, Adders, Subtractors, use of adders as subtractors, Adder with look-ahead carry, Encoder, Decoder, Code converters, Parity generator/checker, digital comparators, BCD to 7 segment display decoder/driver, Pin diagram and description of ICs (74150, 74154, 7483, 74147, 74148, 7442, 74184, 74180, 7485, 7447).

Unit 4. Sequential Circuits [6+2=8]

Introduction, Flip-flops, Flip-flop types, Applications of Flip-flops, Shift Registers. Types of Shift Registers, circuit diagram, timing wave form and applications, Counters, counter types, counter design with state equation and state diagrams, Pin diagram and description of ICs of Flip-flops, Shift Registers, and Counters.

Unit 5. D/A and A/D Converters [5+2=7]

Introduction, Digital to Analog Converters (DACs), Types and Specifications of DACs, Analog to Digital Converters (ADCs), Types and Specifications of ADCs.

Unit 6. Semiconductor Memories [5+2=7]

Introduction, Memory organization and Operation, Classification and characteristics of memories, Read-only memory, Read-Write memory, Content addressable memory, Charged coupled device memory.

Unit 7. Digital Logic Families [4+1=5]

Characteristics of Digital ICs, RTL, DCTL, DTL, TTL, ECL, CMOS logic families and their types, Comparison of these logic families.

Text Books:

1. R. P. Jain, **Modern Digital Electronics**, Tata McGraw–Hill Education Pvt. Limited, New Delhi.
2. Thomas L. Floyd, **Digital Fundamentals**, Pearson Education, New Delhi, 2003.

Reference books:

1. Morris Mano, **Digital Design**, Prentice Hall of India Pvt. Ltd

2. Donald P. Leach and Albert Paul Malvino, **Digital Principles and Applications**, 5 ed., Tata McGraw Hill Publishing Company Limited, New Delhi, 2003.
3. Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss, **Digital System-Principles and Applications**, Pearson Education.

E books and online learning materials:

1. https://www.nodia.co.in/image/catalog/2015/08/Digital-Electronics-sample-chapter.pd
2. https://www.cl.cam.ac.uk/teaching/0708/DigElec/Digital_Electronics_pdf.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/117106086/3
2. http://nptel.ac.in/courses/117106086/7

COURSE NAME: PULSE WAVE SHAPING AND SWITCHING
COURSE CODE: EC-17406

	L	T	P
Internal Marks: 40			
External Marks: 60	**3**	**1**	**-**

Numerical & Design Problems Content: 30%-40%

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes

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

CO	Definition	POs	PSOs
C01	Apply the knowledge of engineering fundamentals for the concept of Basic Elements and Waveforms	1(H)	1(H)
C02	Illustrate the switching characteristic of different devices.	2 (H) 1(M)	2(M)
CO3	Understand the negative resistance behavior of semiconductor devices.	2(M)	2(M),
CO4	Design the system component for clipping and clamping circuits.	3(H)	2(H)
CO5	Analyze the RC circuits for low and high pass filtering	2(H)	1(H)
CO6	Analyze voltage and current sweep circuits and identify methods to mitigate sweep errors.	2(H)	1(H)

Syllabus: **[Total Contact Hours: 39+13(T) =52]**

Unit 1. Introduction to Basic Elements and Waveforms **[5+3=8]**

Passive and Active circuit elements, AC through inductor and capacitor, AC through Resistor-inductor and resistor-capacitor in series, Series and parallel resonance circuit, Different input signals, Average and RMS value.

Unit 2. Linear Wave Shaping **[8+2=10]**

High pass and low pass circuits, Response to sine, step, pulse, square, exponential and ramp inputs with different time constants, High pass as a differentiator, Low pass as an integrator,

Attenuators- response to step input, Compensated attenuator.

Unit 3. Non-Linear Wave Shaping **[8+2=10]**

Diode clippers, Transistor clippers and two level clippers, Clamping circuits using diodes, Practical clamping circuit, Clamping theorem, Comparators, Diode- differentiator comparator.

Unit 4. Switching Circuits **[7+2=9]**

Diode and transistor as electronic switch, Switching times in diode and transistor, Bistable, Monostable and Astable Multivibrators (both collector and emitter coupled), Symmetrical and Unsymmetrical triggering, Schmitt trigger Circuits.

Unit 5. Negative Resistance Switching Circuits **[6+2=8]**

Voltage controlled and current controlled negative resistance circuits, Negative-resistance characteristics, Monostable, Bistable and Astable operations, Applications using tunnel diode and UJT.

Unit 6. Sweep Circuits **[5+2=7]**

General features of a time base signal, Linearization of sweeps, Methods of generating time base waveform, Bootstrap and Miller sweep circuits, principle of current sweeps.

Text Books:

1. Wave Generation and Shaping by L. Strauss, 3rd Edition, TMH, 1995.
2. Pulse and Switching Circuits by Sanjeev Kumar, Dhanpat Rai & Company.

Reference books and other resources:

1. Pulse and Digital Switching Circuits by Milliman, Taub, Tata Mcgraw Hill.
2. Pulse and Digital Circuits by Mothiki S. Prakash Rao,Tata Mcgraw Hill.
3. Pulse & Digital Circuits, by Rao K, Pearson Education.

E books and online learning materials:

1. http://www.introni.it/pdf/Millman%20%20Taub%20%20Pulse%20and%20Digital%20Switching%20Waveforms%201965.pdf
2. http://www.kau.edu.sa/files/0001893/files/35053_31214a.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/122106025/3
2. http://nptel.ac.in/courses/122106025/11

COURSE NAME: LAB ELECTRONICS DEVICES & CIRCUITS-II
COURSE CODE: EC-17407

	L	T	P
Internal Marks: 30			
External Marks: 20	**-**	**-**	**2**

NOTE: Do all Experiments. Evaluation of the lab work shall be done as per the approved Rubric.

Course Outcomes

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

CO	Definition	POs	PSOs
CO1	Demonstrate various coupling techniques for transistor circuits.	1(H), 2(M), 4(H), 5(H)	1(L)
CO2	Conduct experiments to observe the response of power amplifiers.	1(H), 2(M), 4(H), 5(H)	1(L)
CO3	Analyze the output waveforms of LC and RC oscillators for different oscillation frequency.	1(H), 2(H), 3(H), 4(H), 5(M)	1(L)
CO4	Assess the influence of feedback on amplifier.	1(H), 2(H), 4(H), 5(M)	1(L)
CO5	Apply the knowledge to interpret the experimental results of large signal amplifiers and tuned amplifiers.	1(H), 2(H), 4(H), 5(M)	1(M)
CO6	Work in a team to demonstrate applications of analog circuits by engaging in self-learning.	1(H), 2(H), 4(H), 5(H), 9(M), 12(H)	1(H)

Syllabus:

Experiment 1. To demonstrate RC coupling technique for transistor amplifier.

Experiment 2. To demonstrate Transformer coupling technique for transistor amplifier.

Experiment 3. To demonstrate direct coupling technique for transistor amplifier.

Experiment 4. To plot frequency response of a tuned amplifier.

Experiment 5. To observe the operation of Class A amplifier direct coupled and Transformer coupled with resistive load and calculate efficiency.

Experiment 6. To plot the characteristics of Class A push pull amplifier and calculate efficiency.

Experiment 7. To observe crossover distortion in Class B push pull amplifier and calculate efficiency.

Experiment 8. To plot the characteristics of Class AB push pull amplifier and calculate efficiency.

Experiment 9. To plot the characteristics of complementary symmetry amplifier.

Experiment 10. To analyze the effect of negative feedback on amplifier gain.

Experiment 11. To observe the response of RC phase shift oscillator and determine frequency of oscillation.

Experiment 12. To observe the response of Hartley oscillator and determine frequency of oscillation.

Experiment 13. To observe the response of Colpitts oscillator and determine frequency of oscillation.

Experiment 14. To observe the response of Wien Bridge oscillator and determine frequency of oscillation.

Reference Books and Other Resources:

Lab manuals available in lab.

MOOCS and Video Course:

1. http://nptel.ac.in/courses/117103063/16
2. http://nptel.ac.in/courses/117103063/23

COURSE NAME: LAB DIGITAL ELECTRONICS
COURSE CODE: EC-17408

	L	T	P
Internal Marks: 30			
External Marks: 20	**-**	**-**	**2**

NOTE: Do all Experiments. Evaluation of the lab work shall be done as per the approved Rubric.

Course Outcomes

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

CO	Definition	POs	PSOs
CO1	Demonstrate operation of basic and universal gates.	1(H), 2(M), 4(H), 5(H)	1(L)
CO2	Design and verify the standard combinational circuits.	1(H), 2(M), 4(H), 5(H)	1(L)
CO3	Analyze and verify the operation of different types of Flip-Flops.	1(H), 2(H), 3(H), 4(H), 5(M)	1(L)
CO4	Verify the working of shift registers.	1(H), 2(H), 4(H), 5(M)	1(L)
CO5	Apply the knowledge to Design counters using Flip-Flops for given count sequence.	1(H), 2(H), 4(H), 5(M)	1(M)
CO6	Work in a team to demonstrate applications of digital circuits by engaging in self-learning.	1(H), 2(H), 4(H), 5(H), 9(M), 12(H)	1(H)

Syllabus:

Experiment 1. To verify the truth-tables of OR, AND, NOT, XOR, NAND and NOR logic gates.

Experiment 2. To realize the OR, AND, NOT and XOR functions using universal gates.

Experiment 3. To realize the Half Adder and Full Adder circuits using logic gates.

Experiment 4. To realize the Half Subtractor and Full Subtractor using logic gates.

Experiment 5. To design 4-Bit Binary-to-Gray Code Converter using logic gates.

Experiment 6. To verify the truth-table of 16:1 Multiplexer and 1:16 Demultiplexer.

Experiment 7. To design and test S-R flip-flop using NAND/NOR gates.

Experiment 8. To verify the truth-tables of J-K, D, and T flip-flops.

Experiment 9. To realize SIPO, SISO, PIPO, and PISO shift register circuits using D flip-flops.

Experiment 10. To design MOD-10 synchronous up-counter using D flip-flops.

Experiment 11. To operate the counters (using ICs 7490/7493/74192) and verify the frequency division at each stage. With a low frequency clock (say 1 Hz) display the count on LEDs.

Experiment 12. To study shift-register operations using IC 7495 chip.

Experiment 13. To verify the truth table of decoder driver 7447/7448 and operate a 7-segment LED/LCD display.

Reference Books and Other Resources:

Lab manuals available in lab.

MOOCS and Video Course:

1. http://nptel.ac.in/courses/117106086/17
2. http://nptel.ac.in/courses/117106086/21

COURSE NAME: LAB SIGNALS & SYSTEMS
COURSE CODE: EC-17409

	L	T	P
Internal Marks: 30			
External Marks: 20	**-**	**-**	**2**

NOTE: Do all Experiments. Evaluation of the lab work shall be done as per the approved Rubric.

Course Outcomes

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

CO	Definition	POs	PSOs
CO1	Make use of MATLAB tool to compute and represent data in various formats.	1(L), 5(H)	1(L)
CO2	Develop code to process the given data in continuous and discrete time domain.	1(M)	1(L)
CO3	Apply mathematical tools for given problem statement.	1(H), 5(M)	1(M)
CO4	Self-learning on enhanced topics using online help of mathworks®.	5(H), 12(H)	1(H)
CO5	Examine simulated data to estimate the behavior of systems.	1(H), 2(M), 4(M)	1(L)
CO6	Construct a project in a team or individual for given problem using MATLAB features.	1(H), 3(M), 5(H), 9(M), 12(M)	1(H)

Syllabus:

Experiment 1. Introduction to MATLAB and computation of basic mathematical quantities.

Experiment 2. To create arrays and perform arithmetic and trigonometric operations on them.

Experiment 3. To generate 2D and 3D plots.

Experiment 4. To create script and function files.

Experiment 5. To develop a program to generate unit step and unit impulse signal in continuous and discrete domain.

Experiment 6. To develop a program to plot exponential and ramp signal in continuous and discrete domain.

Experiment 7. To develop a program module to perform operations on continuous-time signals like addition, multiplication, shifting, folding and scaling.

Experiment 8. To compute Fourier transform and inverse Fourier Transform of the given

function.

Experiment 9. To develop a program to compute correlation between continuous-time signals.

Experiment 10. To develop a program to perform continuous-time convolution.

Experiment 11. To generate random sequences for the following distribution and calculate mean and variance:

- Rayleigh Distribution
- Uniform distribution
- Gaussian distribution.

Experiment 12. To plot probability density function for Rayleigh, Uniform and Gaussian Distributed random variables.

Experiment 13. To develop a program for finding response of the LTI system described by given differential equation.

Reference Books and Other Resources:

1. R. Pratap, "Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers", Oxford University Press, 2010.
2. Luis F. Chaparro, "Signals and Systems using MATLAB", Elsevier, 2nd Edition, 2015.
3. Lab manuals available in lab.

MOOCS and Video Course:

1. http://nptel.ac.in/courses/117104074/3
2. http://nptel.ac.in/courses/117104074/4

5th Semester

5th Semester

Course Code	Course Title	Load Allocation			Marks Distribution		Total Marks	Credits
		L	T	P	Internal	External		
EC-17501	Antenna and Wave Propagation	3	1	-	40	60	100	4
EC-17502	Analog Communication Systems	3	1	-	40	60	100	4
EC-17503	Digital Signal Processing	3	1	-	40	60	100	4
EC-17504	Linear Integrated Circuits	3	1	-	40	60	100	4
EC-17505	Microprocessors & Interfacing	3	1	-	40	60	100	4
DEEC-175XX	Department Elective-I	3	1	-	40	60	100	4
EC-17510	Lab Linear Integrated Circuits	-	-	2	30	20	50	1
EC-17511	Lab Analog Communication Systems	-	-	2	30	20	50	1
EC-17512	Lab Microprocessors & Interfacing	-	-	2	30	20	50	1
EC-17513	Lab Digital Signal Processing	-	-	2	30	20	50	1
TR-17501	**Industrial Training-I***				60	40	100	2
TOTAL		**18**	**6**	**8**	**420**	**480**	**900**	**30**

***The marks will be awarded on the basis of 06 weeks industrial/institutional training conducted after 4th Semester**

Department Elective-I

DEEC-17506 Intellectual Property Rights
DEEC-17507 Business Analytics
DEEC-17508 Software Project Management
DEEC-17509 Total Quality Management

COURSE NAME: ANTENNA AND WAVE PROPAGATION
COURSE CODE: EC-17501
Internal Marks: 40 **L T P**
External Marks: 60 **3 1 -**
Numerical & Design Problems Content: 20%-30%
Note: The Question paper shall have three sections:
Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes:
On successful completion of this course, the students should be able to:

CO	Definition	POs	PSOs
CO1	Comprehend the fundamental principles of antenna theory.	1(H)	1(M)
CO2	Apply the concepts & properties of Electro-magnetism to obtain parameters of wave propagation.	1(H)	1(H)
CO3	Design different types of antenna arrays.	3(H)	1(H)
CO4	Analyse the antenna arrays on the basis of their properties and characteristics.	4(M)	1 (H)
CO5	Illustrate the characteristics of radio-wave and their propagation in the atmosphere.	2(H)	1(M)
CO6	Understand practically the knowledge of Antenna using Antenna design softwares.	5(M)	1(M)

Syllabus: **[Total Contact Hours: 39+13(T) =52]**

Unit1.Introduction **[4+2=6]**
Types of Antennas, Radiation Mechanism in single, two wire and dipole, Current Distribution on a Thin Wire Antenna.

Unit 2. Fundamental parameters of antennas **[7+3=10]**
Radiation Pattern, Radiation Power Density, Radiation intensity, Directivity, Gain, Antenna efficiency, Bandwidth, Polarisation, Antenna Input Impedance, Antenna Vector Effective length and equivalent areas, Maximum Directivity and Maximum Effective Area, Return Loss, Friis Transmission equation and Radar range Equation, Effective aperture, Antenna Temperature.

Unit3. Linear Wire Antennas **[6+2=8]**

Retarded potential, Infinitesimal dipole, Current distribution of short dipole and half wave dipole, Far-field, Radiating near-field and reactive near-field region, Monopole and Half wave dipole.

Unit 4. Antenna Arrays **[7+2=9]**

Array of two point sources, Array factor, n-element linear array with uniform amplitude and spacing, Analysis of Broadside array, Ordinary end-fire array, Hansen-woodyard end fire array, n-element linear array with non-uniform spacing, Analysis of Binomial and Dolph-Tschebyscheff array, Scanning Array, Superdirective array.

Unit 5. Aperture and Microstrip Antennas **[7+2=9]**

Field Equivalence principle, Rectangular and circular aperture antennas, Horn antenna, Babinet's Principle, Slot Antenna, Reflector antenna, microstrip antennas, rectangular patch, circular patch, arrays and feed networks for microstrip antennas, introduction to antenna design softwares.

Unit 6. Wave Propagation **[8+2=10]**

Free space equation, Reflection from earth's surface, Surface and Space wave propagation, Range of space wave propagation, Effective earth's radius, Duct propagation, Troposphere propagation. Structure of ionosphere, propagation of radio waves through ionosphere, Critical frequency, Maximum usable frequency, Optimum working frequency, lowest usable high frequency, virtual height, Skip Distance, Effect of earth's magnetic field.

Text Books:

1. Balanis C.A, "Antenna Theory", John Wiley & sons, 2005.
2. Krauss J.D, "Antenna Theory", McGraw Hill.

Reference Books:

1. Jordan E. C, "Electromagnetics and radiating systems", PHI, 2007.
2. Collins R. E., "Antenna and radio wave propagation", McGraw Hill.
3. Kennedy, G. " Electronic Communication Systems", TMH, Fourth Edition.

E books and online learning materials:

1. http://www.crectirupati.com/sites/default/files/lecture_notes/AWP%20Lecture%20Notes-final.pdf
2. https://khasimgriet.files.wordpress.com/2016/07/harish-a-r-_-sachidananda-m-antennas-and-wave-propagation-oxford-university-press-2007.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/108101092/4
2. http://nptel.ac.in/courses/108101092/14

COURSE NAME: ANALOG COMMUNICATION SYSTEMS
COURSE CODE: EC-17502

	L	T	P
Internal Marks: 40			
External Marks: 60	**3**	**1**	**-**

Numerical & Design Problems Content: 20% -30%

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes

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

CO	Definition	POs	PSOs
CO1	Develop basic understanding of different functional blocks in an analog communication system.	1(H),2(L)	1(L)
CO2	Discuss fundamental theory of modulation.	1(M),2(L),3(M)	1(L)
CO3	Analyze mathematically the different analog modulation techniques and solve related numerical problems.	1(L), 2(H),3(M)	1(H)
CO4	Apply analog communication techniques to generate and detect various analog modulation schemes.	4(M), 5(H)	1(H)
CO5	Construct a super-heterodyne AM receiver and define its significant performance metrics.	2(H), 3(H)	1(M)
CO6	Explain generation and detection methods for various pulse modulation techniques.	1(M),3(M)	1(M)

Syllabus: **[Total Contact Hours: 42+14=56]**

Unit 1. Analog Modulation Techniques **[6+3=9]**

Introduction, Elements of a Communication System, Modulation & Demodulation, Need of modulation, Types of analog modulations, theory of amplitude modulation, AM power calculations, AM current calculations, AM modulation with a complex wave, theory of frequency modulation, mathematical analysis of FM, spectra of FM signals, Narrowband FM, Wideband FM, theory of phase modulation, phase modulation obtained from frequency modulation, Comparison of AM & FM, Comparison of PM & FM.

Unit 2. AM Transmission and Reception [12+4=16]

Introduction, Low level and high level modulation, Basic principle of AM generation, AM generation using Square law modulation, Collector modulation of Class C transistor amplifiers, Balanced modulator and Ring modulator (Suppressed carrier AM generation), Product modulator; Receiver parameters: Selectivity, Sensitivity, Fidelity, Noise figure, Tuned radio frequency receiver, Super heterodyne receiver, Basic elements of AM super heterodyne receiver: RF amplifier circuit, Mixer/ Converter circuits: Self- excited mixer, Separately excited mixer, Diode mixer & Balanced diode mixer, Local oscillator Tracking, Choice of IF frequency, IF amplifier circuit, Image frequency & its rejection, AM detection: Envelope or diode detector, Principle of Simple AGC, AM detector with AGC, Distortion in diode detectors, Double hetero-dyne AM receivers, AM receiver using Phase locked loop.

Unit 3. FM Transmission and Reception [10+3=13]

FM allocation standards, generation of FM by direct methods: Varactor diode modulator, Reactance modulator, Phase locked loop direct FM transmitter; Indirect generation of FM: Armstrong method; Frequency stabilized reactance FM transmitter; Frequency demodulators: Balanced Slope detector, Foster Seeley discriminator, Ratio detector; FM detection using PLL, Pre-emphasis & De-emphasis, Limiter circuit, FM capture effect, FM Receiver.

Unit 4. SSB Transmission and Reception [8+2=10]

Introduction, Advantages of SSB transmission, Generation of SSB: Filter method, Phase shift method, Third Method, Pilot carrier SSB systems, Independent Sideband (ISB) Transmitter, Vestigial Sideband (VSB) transmission. SSB Product demodulator, Balanced modulator as SSB demodulator, Pilot carrier SSB Receiver, ISB Receiver.

Unit 5. Pulse Modulation Transmission and Reception [6+2=8]

Introduction, Sampling theorm, Pulse Amplitude Modulation(PAM), Natural PAM, Frequency spectra for PAM, Flat-top PAM, PAM Time Multiplexing, PAM modulator, PAM demodulator, Pulse Time Modulation:- Pulse Width Modulation (PWM) & demodulation, Pulse Position Modulation & demodulation.

Text Books:

1. G. Kennedy & B. Davis, Electronic Communication Systems, McGraw-Hill Electrical Engineering Series, 4th Edition, Glencoe Publishers,1993.
2. Wayne Tomasi, Electronic Communications Systems-Fundamental through Advanced, 5th Edition, Pearson Education,2001.

Reference Books/ Study Material:

1. Dennis Roddy & John Coolen, Electronic Communications, 4th edition, Pearson Education, 2009.

2. H. Taub & Donald L.Schilling, Principles of Communication Systems ,3rd Edition, Tata McGraw Hill Education, 2008.
3. L. W. Couch, Digital and Analog Communication Systems, 8th Edition, Pearson Education 2012.
4. K. Sam. Shanmugam, Digital and Analog Communication Systems, Student Edition, Wiley India Publications, 2006.

E books and online learning materials:

1. http://web.eecs.utk.edu/~roberts/ECE342/AnalogCommunicationSystems.pdf
2. http://www.ee.iitm.ac.in/~giri/pdfs/EE4140/textbook.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/117102059/6
2. http://nptel.ac.in/courses/117102059/7

COURSE NAME: DIGITAL SIGNAL PROCESSING
COURSE CODE: EC-17503

	L	T	P
Internal Marks: 40			
External Marks: 60	**3**	**1**	**-**

Numerical & Design Problems Content: 50%-60%

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes:

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

CO	Definition	POs	PSOs
CO1	Apply the knowledge of convolution sum method, difference equations, z-transforms and DFT to analyze digital signal processing systems.	1(H)	
CO2	Identity, formulate, and solve engineering problems in the area of digital signal processing.	2 (H) & 3 (H)	1 (H)
CO3	Apply appropriate methods to design and synthesize digital filters to meet the designed specifications within given constraints.	5 (M)	1 (H)
CO4	Identity and use the appropriate type of structure for the efficient development of DSP systems.	4 (M)	1 (H)
CO5	Apply the domain knowledge to demonstrate the applications of DSP in societal and environmental contexts.	3 (M) & 7 (M)	
CO6	Apply reasoning informed by the contextual knowledge to assess the architecture & characteristics of various digital signal processors.	3 (M)	3 (L)

Syllabus: **[Total Contact Hours: 40+13(T) =53]**

Unit 1. Introduction **[1+1=2]**

Basic elements of DSP system, Advantages and disadvantage of DSP over analog processing, Application of Digital signal processing.

Unit 2. Discrete-Time Signal and Systems **[8+2=10]**

Elementary discrete-time signals, Classification of discrete-time signals, Manipulation of discrete-time signals, Input-Output Description of Systems, Block diagram Representation of Discrete-time systems, Classification of discrete-time systems, Interconnection of discrete-time

systems, Analysis of Linear Time-invariant (LTI) systems using Convolution Sum method, Causal LTI systems, Stability of LTI systems, Analysis of LTI system using Difference equation. Cross-correlation and auto-correlation of Discrete-time signals.

Unit 3. z-Transforms [7+2=9]

Direct z-Transforms and Importance of ROC, Properties of Z-Transform, Rational Z-transforms, System function of LTI Systems, Inverse z-transform methods, One sided z-Transform, Analysis of LTI systems in z-domain.

Unit 4. Discrete Fourier Transform (DFT) [7+2=9]

Frequency domain sampling and reconstruction of discrete time signal, DFT, DFT as linear transformation, Relationship of DFT to other Transforms, Properties of DFT, Circular Convolution and DFT, Use of DFT in Linear Filtering, Fast Fourier Transform (FFT) Algorithms, Radix-2 Decimation in time FFT Algorithm, Radix-2 decimation in frequency FFT algorithm.

Unit 5. Implementation of Discrete-Time System [6+2=8]

Structures for Realization of Discrete-Time Systems, Direct Form, Cascade Form, and Lattice Form Structures for FIR Systems, Direct Form, Transposed Form, Cascade Form, Parallel Form and Lattice Form Structures for IIR Systems,

Unit 6. Design of Digital Filters [7+2=9]

Types of Filters, Steps of Filter Design, Linear-Phase Response Filter, Design of FIR Filter Using Window Method, Design of IIR Filter by Impulse Invariance, Bilinear Transformation and Matched z-Transform Technique, Analog and Digital Domain Frequency Transformation, Representation of Numbers and Finite Word Length Effects.

Unit 7. Digital Signal Processors [4+2=6]

Introduction, Computer Architecture for Signal Processing, Difference between General and Special-Purpose Digital Signal Processors, Selecting Digital Signal Processors, Overview of ADSP 2100 and TMS320C50 processors.

Text Books:

1. Digital Signal Processing: J.G. Proakis and D. G. Manolakis ; Pearson Education, New Delhi.

Reference books and other resources:

1. Digital Signal Processing-A.V. Oppenheim & R. W. Schafer, Pearson Education, New Delhi.
2. Digital Signal Processing : E. C. Ifeachor and B.W. Jervis, Pearson Education, New Delhi.
3. Digital Signal Processing : S. Salivahanan, A. Vallavaraj, and C. Gnanapriya; Tata Mc-Graw Hill, New Delhi.

E books and online learning materials:

1. https://users.dimi.uniud.it/~antonio.dangelo/MMS/materials/Guide_to_Digital_Signal_Process.pdf
2. https://www.cl.cam.ac.uk/teaching/0809/DSP/slides-2up.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/117102060/5
2. http://nptel.ac.in/courses/117102060/7

COURSE NAME: LINEAR INTEGRATED CIRCUITS
COURSE CODE: EC-17504

Internal Marks: 40	**L**	**T**	**P**
External Marks: 60	**3**	**1**	**-**

Numerical & Design Problems Content: 30%-40%

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes

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

CO	Definition	POs	PSOs
CO1	Comprehend various configurations of differential amplifiers along with their DC and AC analysis	1(M)	1(M)
CO2	Interpret data sheets, characteristics and performance parameters of an operational amplifier	4(M)	1(M)
CO3	Apply the knowledge of various performance parameters of an operational amplifier for designing different linear and non-linear applications	3(H)	1(M)
CO4	Design circuits like Integrator, Differentiator. Active filters satisfying desired needs within realistic constraints	3(H)	1(H)
CO5	Summarize the working principle of multivibrators using application specific IC555 and general purpose operational amplifier	1(L)	1(M)
CO6	Illustrate the function of application specific ICs such as voltage regulators, PLL and its applications in communication	1(M)	1(M)

Syllabus: **[Total Contact Hours: 39+13(T) =52]**

Unit 1. Differential and Cascade Amplifiers **[10+4=14]**

Introduction, Differential Amplifier, Differential Amplifier Circuit Configuration, Dual Input-Balanced output Differential Amplifier, Dual Input-Unbalanced output Differential Amplifier, Single Input-Balanced output Differential Amplifier, Single Input-unbalanced output Differential Amplifier with their DC and AC analysis, Differential Amplifier with swamping resistors, Constant current bias, Current Mirror, Cascaded differential Amplifier Stages, Level Translator, CE-CB configuration.

Unit 2. Introduction to Operational Amplifiers [10+4=14]

Block diagram of a typical Op-Amp, Schematic symbol, integrated circuits and their types, IC package types, Pin Identification and temperature range, Interpretation of data sheets, Overview of typical set of data sheets, Characteristics and performance parameters of an Op-Amp, Ideal Op-Amp, Equivalent circuit of an Op-Amp, Ideal voltage transfer curve, Open loop configurations : Differential, Inverting & Non Inverting. Practical Op-Amp: Input offset voltage, Input bias current, Input offset current, total output offset voltage, Thermal drift, Effect of variation in power supply voltages on offset voltage, Change in Input offset voltage and Input offset current with time, Temperature and supply voltage sensitive parameters, Noise, Common Mode configuration and common mode rejection Ratio.

Unit 3. Applications of Op-Amp [10+3=13]

Applications of Op-Amp as: DC and AC amplifiers, Peaking Amp, Summing, Scaling and Averaging Amplifier, Instrumentation Amplifier, V to I and I to V converter, Log and Antilog Amp, Integrator, Differentiator. Active filters: First order LP Butterworth filter, Second order LP Butterworth filter, First order HP Butterworth filter, Second order HP Butterworth filter, Higher order filters, Band pass filter, Band reject filters, All pass filter, Phase shift oscillator, Wein bridge oscillator, Quadrature oscillator, Square wave generator, Triangular wave generator, Sawtooth wave generator, Voltage controlled oscillator, Basic comparator, Zero crossing detector, Schmitt trigger, window detector, V to F and F to V converters, A to D and D to A converters, Peak Detector, Sample and Hold Circuit.

Unit 4. Specialized IC Applications [9+2=11]

IC 555 Timer: Pin configuration, Block diagram, application of IC 555 as Monostable and Astable Multivibrator., Phase Lock Loops: Operating principles & applications of IC 565, Voltage Regulators: Fixed voltage regulators, Adjustable voltage regulators, Switching Regulators.

Text Book:

1. R. Gayakwad, "Op-Amps & Linear Integrated circuits", Pearson Prentice Hall, 3rd Edition, 2006.

Reference Books and Other Resources:

1. R. F. Coughlin And F. F. Driscoll, "Operatinal Amplifiers & Linear Integrated circuits", Prentice Hall, 5th edition, 1998.
2. J. M. Fiore, "OP Amps and Linear Integrated Circuits: Concepts and Applications", Cengage Learning, 1st edition, 2010.

E books and online learning materials:

1. https://www2.mvcc.edu/users/faculty/jfiore/OpAmps/OperationalAmplifiersAndLinearICs_3E.pdf
2. https://www.scribd.com/document/356463964/Linear-Integrated-Circuit-2nd-Edition-D-Roy-Choudhary-pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/108106068/4
2. http://nptel.ac.in/courses/108106068/10

COURSE NAME: MICROPROCESSORS AND INTERFACING
COURSE CODE: EC-17505
Internal Marks: 40 **L T P**
External Marks: 60 **3 1 -**
Numerical & Design Problems Content: 30%-40%
Note: The Question paper shall have three sections:
Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes
On successful completion of this course, the students should be able to:

CO	Definition	POs	PSOs
C01	Analyze the architecture, features and functioning of microprocessors	2(H)	3(M)
C02	Apply the knowledge of instruction set for performing various operations on microprocessors.	1(M)	3(H)
CO3	Compare and contrast the role of different interrupts.	2(M)	3(L)
CO4	Utilize the peripheral devices in any of the applications.	1(M)	3(L)
CO5	Describe the interfacing of various devices with microprocessor.	3(L), 4(L)	1(L), 3(M)
CO6	Work in a team to demonstrate an application of microprocessors by engaging in self-learning	4(H), 9(H), 10(H)	1(M), 3(M)

Syllabus: **[Total Contact Hours: 39+13(T) =52]**

Unit 1. Basic Architecture **[7+3=10]**
8085 Architecture, Arithmetic and Logic Unit, Flags, Clock, buses, 8085 Pin configuration, Timing diagrams.

Unit 2. Instruction Set ` **[7+3=10]**
Introduction to Basic 8085 Instructions, Addressing modes, Data transfer instructions, Arithmetic instructions, Logic instructions, Branch instructions, Conditional call and return instructions, Assembly language programming, Stack, Subroutines.

Unit 3. Interrupts **[7+2=9]**

8085 interrupts, Basic interrupt processing, ISR, RST, RIM, SIM.

Unit 4. Peripheral Devices **[6+2=8]**

8255(PPI), 8279(Keyboard and display controller), 8259(PIC), 8237(DMA), RS-232.

Unit 5. Interfacing **[6+2=8]**

Memory interfacing, Interfacing of Keyboard and Seven Segment LED Display, Microprocessor Controlled Temperature System(MCTS), Study of Traffic Light System, Stepper Motor Controller.

Unit 6. 8086 Microprocessors **[6+1=7]**

Features, Architecture, Flags, Segment registers, Directives.

Text Books:

1. Ramesh S. Gaonkar, Microprocessor Architecture, Programming and application with 8085, 5th Edition, Penram International Publishing, New Delhi, 2007.
2. John Uffenbeck, The 80x86 Family, Design, Programming and Interfacing, Third Edition. Pearson Education, 2002.

Reference books and other resources:

1. A. K. Ray and K. M. Burchandi, Intel Microprocessors Architecture Programming and Interfacing, McGraw Hill International Edition, 2000
2. M. Rafi Quazzaman, Microprocessors Theory and Applications: Intel and Motorola prentice Hall of India, Pvt. Ltd., New Delhi, 2003.
3. D. V. Hall, "Microprocessor and Interfacing-Programming and Hardware", 2nd Ed., Tata McGraw-Hill Publishing Company Limited, 2008.
4. J. Stewart ,"Microprocessor Systems- Hardware, Software and Programming", Prentice Hall International Edition,1990
5. K. L. Short,"Microprocessors and Programmed Logic", 2nd Ed.,Pearson Education, 2008.

E books and online learning materials:

1. http://nptel.ac.in/courses/Webcoursecontents/IIScBANG/notused/Microprocessors%20and%20Microcontrollers/Learning%20Material%20%20Microprocessors%20and%20microcontrollers.pdf
2. https://www.tutorialspoint.com/microprocessor/microprocessor_tutorial.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/108107029/35
2. http://nptel.ac.in/courses/108107029/49

COURSE NAME: INTELLECTUAL PROPERTY RIGHTS
COURSE CODE: DEEC-17506

	L	T	P
Internal Marks: 40			
External Marks: 60	**3**	**1**	**-**

Numerical & Design Problems Content: 0%

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes

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

CO	Definition	POs	PSOs
C01	Understand the fundamental legal principles relating to to each of the areas of intellectual property.	7(H), 8(H),9(L)	1(M), 2(M), 3(M)
C02	Facilitate understanding about Cybercrimes, Ethical Hacking, cyber security and cyber laws	2(M),3(M),4(H),5(M), 6(H),7(M),8(H),9(M)	2(H)
CO3	Explain the basic concepts of patenting systems and applications.	4(L),6(M),7(M), 8(L),9(L)	2(L)
CO4	Analyze the issue related to protection of copyrights.	4(L),6(M),7(M), 8(L),9(L)	2(L)
CO5	Analyze the issue related to protection of design rights.	4(L),6(M),7(M), 8(L),9(L)	2(L)
CO6	Explain the basic function and selection of trademarks.	4(L),6(M),7(M), 8(L),9(L)	2(L)

Syllabus: **[Total Contact Hours: 39+13(T) =52]**

Unit 1. Introduction to Intellectual Property **[8+3=11]**

Introduction, Classification of intellectual property rights, International treaties & conventions, Acts on intellectual property rights, Domain name disputes and resolution, Cyber Crime offences and contraventions.

Unit 2. Patent System **[8+3=11]**

Introduction & objective of the patent system, Patent on genetic resources, patents on chemicals, Designs, patent based on software, Business methods, Internet patent, Obtaining the patent, Exclusive rights and obligations of a Patentee, Transfer of patent rights, Infringement of a patent.

Unit 3. Copyrights and Related Rights **[8+3=11]**

Nature & scope of protection, Protection of copyrights in the digital media, Defense of fair use, Moral rights of the author, Copyrights societies, Remedies for infringement of copyrights.

Unit 4. Design Rights **[8+2=10]**

Nature and scope of protection of design rights, Protection of layout designs (topographies) of integrated circuits, Protection of undisclosed information, Registration of designs.

Unit 5. Trade Marks **[7+2=9]**

Introduction to trademarks, Registration of trademarks, Infringement of trademarks, Passing off.

Text Books:

1. P. Narayana, "Intellectual Property Law", Eastern Law House, 2nd edition, 2001.

Reference Books and Other Resources:

1. W. Cornish, D. Llewelyn and T. Aplin, "Intellectual Property: Patents, Copyright, Trademarks and Allied Rights", Sweet and Maxwell, 2007.
2. R. Jacob and D. Alexander, "A Guide Book to Intellectual Property Patent trademarks, Copyrights and Designs", Sweet and Maxwell 4th edition, 1993.

E books and online learning materials:

1. http://www.wipo.int/edocs/pubdocs/en/intproperty/450/wipo_pub_450.pdf
2. http://www.bits-pilani.ac.in/uploads/Patent_ManualOct_25th_07.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/109105112/1
2. http://nptel.ac.in/courses/109105112/10

COURSE NAME: BUSINESS ANALYTICS
Course CODE: DEEC-17507
Internal Marks: 40 **L T P**
External Marks: 60 **3 - -**
Note: The Question paper shall have three sections:
Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes
On successful completion of this course, the students should be able to:

CO	Definition	POs	PSOs
CO1	Integrate information technologies with data science methods to extract value from data sets	1(M),2(L),4(H) 5(M)	_
CO2	Think critically about the business implications, meaningfulness and applicability of observed data patterns and analytical inferences	1(M),2(M),3(H),	_
CO3	Identify opportunities, needs and constraints for data analytics within organizational contexts	1(M),2(M),4(M)	_
CO4	Select appropriate analytic tools for specific managerial issues	1(M),4(M),5(H)	_
CO5	Compose data-analytic tools and concepts to create innovative data-analytic solutions	1(M),2(M),3(H), 4(H),5(H)	_
CO6	Demonstrate proficiency with several data-analytic tools	1(M),4(H),5(H)	_

Syllabus: **[Total Contact Hours: 39]**

Unit 1. Business Intelligence **[5]**
Introduction, Definition, History and Evolution, Business Intelligence Segments, Difference between Information and Intelligence, Defining Business Intelligence Value Chain, Factors of Business Intelligence System, Business Intelligence Applications, Types of Business Intelligence, Roles of Business Intelligence in Modern Business- Challenges of BI.

Unit 2. Architecting the Data **[4]**
Introduction, Types of Data, Enterprise Data Model, Enterprise Subject Area Model, Enterprise Conceptual Model, Enterprise Conceptual Entity Model, Granularity of the Data, Data Reporting and Query Tools, Data Partitioning, Metadata, Total Data Quality Management (TDQM).

Unit 3. Data Mining **[6]**

Introduction, Definition of Data Mining, Data mining parameters, How Data Mining works?, Types of relationships, Architecture of Data Mining, Kinds of Data which can be mined, Functionalities of Data Mining, Classification on Data Mining system, Various risks in Data Mining, Advantages and disadvantages of Data Mining, Ethical issues in Data Mining, Analysis of Ethical issues, Global issues. Data Mining techniques - Decision Tree-Illustrations, Neural Network, Neural Network versus Conventional Computers.

Unit 4. Data Warehousing **[6]**

Introduction, Data Warehousing, Advantages and Disadvantages of Data Warehousing, Data Warehouse, Data Mart, Aspects of Data Mart, Online Analytical Processing , Characteristics of OLAP, OLAP Tools, OLAP Data Modeling, OLAP Tools and the Internet, Difference between OLAP and OLTP, Multidimensional Data Model, Data Modeling using Star Schema and Snowflake Schema. Types of Business Models, B2B Business Intelligence Model, Electronic Data Interchange & E-Commerce Models, Advantages of E-Commerce for B2B Businesses, Systems for Improving B2B E-Commerce, B2C Business Intelligence Model, Need of B2C model in Data warehousing, Different types of B2B intelligence Models.

Unit 5. Knowledge Management **[4]**

Introduction, Characteristics of Knowledge Management, Knowledge assets, Generic Knowledge Management Process, Knowledge Management Technologies, Essentials of Knowledge Management Process.

Unit 6. Data Extraction **[3]**

Introduction to Data Extraction, Role of ETL process, Importance of source identification, Various data extraction techniques, Logical extraction methods, Physical extraction methods, Change data capture.

Unit 7. Business Intelligence Life Cycle **[7]**

Introduction, Business Intelligence Lifecycle, Enterprise Performance Life Cycle (EPLC) Framework Elements, Life Cycle Phases, Human Factors in BI Implementation, BI Strategy, Objectives and Deliverables, Transformation Roadmap, Building a transformation roadmap, BI Development Stages and Steps, Parallel Development Tracks, BI Framework.

Business Intelligence Opportunity Analysis Overview, Content Management System, End User Segmentation, Basic Reporting and Querying, Online Analytical Processing, OLAP Techniques, OLAP Applications, Applying the OLAP to Data Warehousing, Benefits of using OLAP, Dashboard, Advanced/Emerging BI Technologies, Future of Business Intelligence

Critical Challenges for Business Intelligence success, Cross-Organizational Partnership, Business Sponsors, Dedicated Business Representation, Availability of Skilled Team Members, Business Intelligence Application Development methodology, Planning the BI Projects, Business Analysis and Data Standardization, affect of Dirty Data on Business profitability, Importance of Meta-Data, Silver Bullet Syndrome, Customer Pain Points, Creating Cost Effective Enterprise friendly BI solution

Unit 8.Implementing Business Intelligence **[4]**

Introduction, Business Intelligence Platform, Business Intelligence Platform Capability Matrix, BI Target Databases, Data Mart, BI Products and Vendor, The Big Four Business Intelligence vendors.

Text Books:

1. Fundamentals of Business Analytics "RN Prasad, Seema Acharya"-John Wiley 2011
2. Business Analytics "James R Evans" – Pearson Education Ltd 2016.

Reference Books:

1."Business Analytics: Application to Consumer marketing" by Sandhya Kuruganti and Hindol Basu.
2. "Business Analytics: Data analysis and decision making" by S. Christian Albright and Wayne L. Winston

E books and online learning materials:

1. http://ptgmedia.pearsoncmg.com/images/9780133552188/samplepages/0133552187.pdf
2. http://www.iimb.ac.in/sites/default/files/u181/Business%20Analytics%20Batch%204%20_2_..pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/110106050/1
2. http://nptel.ac.in/courses/110106050/2

COURSE NAME: SOFTWARE PROJECT MANAGEMENT
COURSE CODE: DEEC-14508
Internal Marks: 40 **L T P**
External Marks: 60 **3 1 -**
Numerical & Design Problems Content: 10%-20%
Note: The Question paper shall have three sections:
Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes
On successful completion of this course, the students should be able to:

CO	Definition	POs	PSO's
CO1	Understand and apply the activities involved in the management of software projects	11(H)	-
CO2	Analyze the various software development environments and risk management.	11(H)	-
CO3	Develop and apply the key strategies to monitor, control and quality assurance of software projects.	11(H)	-
CO4	Select the appropriate planning and estimation models to better evaluate the software projects.	11(H)	-
CO5	Create a strong working knowledge of ethics and professional responsibility.	8(H)	-
CO6	Develop effective organizational, leadership and change skills for managing projects, teams and stakeholders.	9(H)	-

Syllabus: **[Toatal Contact Hours: 39+13(T)= 52]**

Unit 1. Project Evaluation and Planning **[7+2=9]**
Activities in Software project management, Project evaluation- Cost Benefit analysis, Cash flow forecasting, Cost-Benefit evaluation techniques, Risk evaluation. Project planning – Stepwise project planning, Software processes and process models. Project costing, COCOMO II, Staffing pattern, Effect of schedule compression, Putnam's equation, Capers Jones estimating rules of thumb.

Unit 2.Project Scheduling and Risk Management **[9+3=12]**
Project sequencing and scheduling activities, Scheduling resources, Critical path analysis, Network planning, Risk management- Nature and types of risks, Risk planning and control, Risk

assessment, Hazard identification, Hazard analysis, PERT and Monte Carlo simulation techniques.

Unit 3. Monitoring and Control **[8+3=11]**

Collecting data, Review techniques, Project termination review, Visualizing progress, Cost monitoring, Earned value analysis, Change control, Software Configuration Management (SCM), Managing contracts and acceptance.

Unit 4. People Management **[8+3=11]**

Introduction, Understanding behaviour, Organizational behaviour, Recruitment process, Motivation, The Oldman – Hackman Job Characteristics model, Stress, Health and safety. Working in teams, Decision making, Leadership, Organization and team structures.

Unit 5. Software Quality Management **[7+2=9]**

ISO Standards, Process capability models, Testing and software reliability, Quality plans, Test automation, Overview of project management tools.

Text Books:

1. Bob Hughes, Mike Cotterell, "Software Project Management", Tata McGraw Hill.
2. Royce, "Software Project Management", Pearson Education.
3. Robert K. Wysocki, "Effective Software Project Management", Wiley.
4. Ian Sommerville, "Software Engineering", Pearson Education.
5. R.S. Pressman, "Software Engineering: A Practitioner's Approach", Tata McGraw Hill.
6. Kassem, "Software Engineering", Cengage Learning.

Reference books and other resources:

1. http://www.cs.ox.ac.uk/people/michael.wooldridge/teaching/soft-eng/lect05.pdf
2. http://library.bec.ac.in/kbc/NOTES%20BEC/CSE/8%20SEM/Software%20Project%20Management.pdf

E books and online learning materials:

1. http://www.cs.ox.ac.uk/people/michael.wooldridge/teaching/soft-eng/lect05.pdf
2. http://library.bec.ac.in/kbc/NOTES%20BEC/CSE/8%20SEM/Software%20Project%20Management.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/106101061/29
2. http://nptel.ac.in/courses/106101061/15

COURSE NAME: TOTAL QUALITY MANAGEMENT
COURSE CODE: DEEC-17509

	L	T	P
Internal Marks: 40			
External Marks: 60	**3**	**-**	**-**

Numerical & Design Problems Content: 0-10%

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes

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

CO	Definition	POs	PSOs
C01	Develop an understanding on quality management philosophies and framework	11(H)	-
C02	Comprehend the role of leadership in Quality Management	9(H) 10(M)	-
CO3	Apply ethical principles to Quality Management	8(H)	-
CO4	Measure the cost of poor quality, process effectiveness and efficiency to identify areas for improvement.	11(H)	-
CO5	Apply benchmarking and business process reengineering to improve management processes	11(H)	-
CO6	Determine set of indicators to evaluate performance excellence of an Organization	11(H)	-

Syllabus: **[Total Contact Hours: 39]**

Unit 1: Introduction **[8]**

Definition of Quality, Dimensions of Quality, Definition of Total Quality Management, Barriers to TQM implementation, Benefits of TQM, Total Quality Principles: Deming Philosophy and Crosby Philosophy.

Unit 2: Leadership and Ethics **[8]**

Definition of a Leader, Characteristics of good quality leader, Definition of Ethics, Reasons for unethical behavior in an organization, Core values and concepts of a TQM Framework, Startegic Planning.

Unit 3: TQM Principles **[8]**

Customer Satisfaction: Customer perception of quality, Customer feedback, Customer Retention, Employee involvement: Motivation, Empowerment, Characteristics of Successful teams, Continuous Process Improvement: Juran Trilogy, PDSA Cycle, Kaizen, Performance Measures: Basic Concepts, Strategy, Performance Measure Representation.

Unit 4: TQM Tools **[8]**

Benchmarking: Definition, Reasons to benchmark, Benchmarking Process, Quality Function Deployment (QFD): Benefits, QFD Process, Taguchi Quality Loss Function, FMEA: Stages of FMEA.

Unit 5: Quality Systems **[7]**

Concept of Quality Systems Standard, Benefits of ISO Registration, Introduction to ISO 9000 Series of Standards, Implementation of a Quality Management System, Documentation, Auditing, Introduction to ISO 14000 Series Standards.

Text Books:

1. Dale H. Besterfield, "Total Quality Management" Pearson Education, 3rd Edition.
2. James R Evans, "Total Quality Management", Cengage Learning, 2005
3. Suresh Dalela, Saurabh, " ISO 9000 a Manual for Total Quality Management, S. Chand Co.

Reference books and other resources:

1. Narayana V. and Sreenivasan N.S. , "Quality Management- Concepts and Tasks", New Age International, Delhi, 1996
2. SubburajRamaswamy, " Total Quality Management", Tata McGraw Hill, 2005

E books and online learning materials:

1. https://www.wiley.com/college/sc/reid/chap5.pdf
2. http://www.mescenter.ru/images/abook_file/Total_Quality_Management_and_Six_Sigma.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/110104080/1
2. http://nptel.ac.in/courses/110104080/6

COURSE NAME: LAB LINEAR INTEGRATED CIRCUITS
COURSE CODE: EC-17510

	L	T	P
Internal Marks: 30			
External Marks: 20	**-**	**-**	**2**

NOTE: Do all Experiments. Evaluation of the lab work shall be done as per the approved Rubric.

Course Outcomes

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

CO	Definition	POs	PSOs
CO1	Implement circuits of various differential amplifier configurations	4(M), 10(H)	1(M)
CO2	Apply op-amp as inverting and non inverting amplifiers and analyze the frequency response of op-amp	4(H), 10(H)	1(M)
CO3	Design circuits like differentiator, integrator, oscillator and Butterworth filter using op-amp to meet specified needs	4(H), 10(H)	1(H), 3(M)
CO4	Demonstrate the use of op-amp as wave generators and Schmitt Trigger circuits	4(M), 10(H)	1(M)
CO5	To examine the operation of a PLL and to determine the free running frequency, the capture range and the lock in range of PLL	4(M), 10(H)	1(M)
CO6	Work in a team to demonstrate an application of linear integrated circuits by engaging in self learning	4(M), 9(H), 10(H)	1(L), 3(M)

Syllabus:

Experiment 1. To study differential amplifier configurations.
Experiment 2. To study op-amp as inverting and non inverting amplifier.
Experiment 3. To study frequency response of an op-amp.
Experiment 4. To use op-amp as summing, scaling & averaging amplifier.
Experiment 5. To use op-amp as instrumentation amplifier.
Experiment 6. To design differentiator and integrator using op-amp.
Experiment 7. To design low-pass, high-pass and band-pass 1st order Butterworth active filters using op-amp.
Experiment 8. To design Phase shift oscillator using op-amp.
Experiment 9. To study op-amp as Sawtooth wave generator.
Experiment 10. To study op-amp as Schmitt Trigger.
Experiment 11. To examine the operation of a PLL and to determine the free running frequency, the capture range and the lock in range of PLL.
Experiment 12. Introduction of SPICE software and its use for op-amp circuits.
Experiment 13. Verification of hardware results obtained using SPICE software.

Reference Books and Other Resources:

Lab manuals available in lab

MOOCS and Video Course:

1. http://nptel.ac.in/courses/108106068/2
2. http://nptel.ac.in/courses/108106068/5

COURSE NAME: LAB ANALOG COMMUNICATION SYSTEMS
COURSE CODE: EC-17511

	L	T	P
Internal Marks: 30			
External Marks: 20	**-**	**-**	**2**

NOTE: Do all Experiments. Evaluation of the lab work shall be done as per the approved Rubric.

Course Outcomes

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

CO1 Generate & detect DSB-FC AM & DSB-SC AM signals.
CO2 Generate & detect SSB AM signals.
CO3 Generate & detect FM signals by using different methods.
CO4 Comprehend the working of Super heterodyne receiver & be able to measure parameters such as sensitivity, selectivity & fidelity.
CO5 Generate & detect different pulse modulation techniques.
CO6 Sample & reconstruct the signal and understand the effect of change in its Duty cycle.

Syllabus:

Experiment 1. Generation of DSB-FC AM wave and determination of its Modulation Index & generation of DSB-SC AM signal using Balanced Modulator.
Experiment 2. Detection of DSB-FC AM signal using Diode detector.
Experiment 3. Generation of SSB AM signal.
Experiment 4. Detection of SSB signal using Product detector.
Experiment 5. Generation of FM signal using Varactor diode.
Experiment 6. Generation of FM signal using Reactance modulator.
Experiment 7. Detection of FM signal using PLL.
Experiment 8. Detection of FM signal using Foster- Seeley discriminator & Ratio detector.
Experiment 9. Study of Super heterodyne AM receiver and measurement of receiver parameters viz. sensitivity, selectivity & fidelity.
Experiment 10. Generation & detection of PAM, PWM and PPM.
Experiment 11. Sampling & Reconstruction of signal from its samples using Natural/ Flat-top sampling & Sample & Hold circuit and observe the effect of Duty cycle.
Experiment 12. Study of SIMULINK.
Experiment 13. Simulation of various modulation techniques (AM,FM,PM,DSB-SC AM, SSB)

Reference Books and Other Resources:

Lab manuals available in lab.

MOOCS and Video Course:

1. http://nptel.ac.in/courses/117102059/8
2. http://nptel.ac.in/courses/117102059/11

Mapping of Course contents with CO

Contents	CO1	CO2	CO3	CO4	CO5	CO6
Experiment 1	H	-	-	-	-	-
Experiment 2	H	-	-	-	-	-
Experiment 3		H	-	-	-	-
Experiment 4	-	H	-	-	-	-
Experiment 5	-	-	H	-	-	-
Experiment 6	-	-	H	-	-	-
Experiment 7	-	-	H	-	-	-
Experiment 8	-	-	H	-	-	-
Experiment 9	-	-	-	H	-	-
Experiment 10	-	-	-	-	H	-
Experiment 11	-	-	-	-	-	H
Experiment 12	M	M	M	M	M	M
Experiment 13	M	M	M	M	M	M

Mapping of CO with PO

CO	PO											
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**
CO1	H	-	-	-	L	-	-	-	-	-	H	-
CO2	H	-	-	-	L	-	-	-	-	-	H	-
CO3	H	-	-	-	L	-	-	-	-	-	H	-

CO4	H	H	-	-	L	-	-	-	-	-	H	-
CO5	H	-	-	-	L	-	-	-	-	-	H	-
CO6	H	L	-	-	-	-	-	-	-	-	H	-

COURSE NAME: LAB MICROPROCESSORS AND INTERFACING
COURSE CODE: EC-17512

	L	T	P
Internal Marks: 30			
External Marks: 20	**-**	**-**	**2**

NOTE: Do all Experiments. Evaluation of the lab work shall be done as per the approved Rubric.

Course Outcomes

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

CO	Definition	POs	PSOs
CO1	Identify and recall various components embedded on the 8085 and 8086 microprocessor kit.	2(H), 5(H), 9(H), 10(H)	3(H)
CO2	Apply the knowledge of instruction set to develop a code for arithmetic operations.	1(L), 4(M), 9(L)	1(L), 3(H)
CO3	Deduce the role and importance of interfacing modules and interfacing chips.	3(M), 9(H), 10(H)	3(H)
CO4	Illustrate the operation of motors.	1(L), 4(H), 10(H)	1(L), 3(L)
CO5	Conduct experiments using microprocessors to demonstrate the interfacing with various modules.	3(M), 4(H), 5(L), 10(H)	1(M),3(H)
CO6	Work in a team to demonstrate an application of microprocessors by engaging in self-learning	4(H), 9(H), 10(H), 12(H)	1(L), 3(M)

Syllabus:

Experiment 1. Introduction to the 8085 microprocessor kit.

Experiment 2. To perform of addition of two 8-bit numbers.

Experiment 3. To perform of subtraction of two 8-bit numbers.

Experiment 4. To perform of addition of two 16-bit numbers.

Experiment 5. To perform of subtraction of two 16-bit numbers.

Experiment 6. Write a program to multiply two 8 bit numbers by repetitive addition method using 8085.

Experiment 7. Write a program to sort series using bubble sort algorithm using 8085.

Experiment 8. Write a program to copy 12 bytes of data from source to destination using 8085.

Experiment 9. Write a program to find maximum and minimum from series using 8085.

Experiment 10. Study of interfacing modules and interfacing chips required for the same.
Experiment 11. Write a program to interface stepper motor with 8085 microprocessor.
Experiment 12. Write a program to interface DC motor with 8085 microprocessor.
Experiment 13. Write a program for Traffic Light System.
Experiment 14. Write a program to perform addition of two numbers using 8086.
Experiment 15. Write a program to perform subtraction of two numbers using 8086.
Experiment 16. Case Study: Microprocessor based projects.

Reference Books and Other Resources:

Lab manuals available in lab.

MOOCS and Video Course:

1. http://nptel.ac.in/courses/106108100/2
2. https://www.youtube.com/playlist?list=PL0E131A78ABFBFDD0

COURSE NAME: LAB DIGITAL SIGNAL PROCESSING
COURSE CODE: EC-17513

Internal Marks: 30	**L**	**T**	**P**
External Marks: 20	**-**	**-**	**2**

NOTE: Do all Experiments. Evaluation of the lab work shall be done as per the approved Rubric.

Course Outcomes

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

CO	Definition	POs	PSOs
CO1	Make use of MATLAB tool to implement various elementary discrete time functions.	1(L), 5(H)	1(L)
CO2	Develop code to process the given data in discrete time domain.	1(M)	1(L)
CO3	Develop code to calculate convolution using different transforms.	1(H), 5(M)	1(M)
CO4	Calculate and examine magnitude and phase response of LTI systems to estimate the behavior of systems.	1(H), 2(M), 4(M)	1(L)
CO5	Design IIR and FIR filters using window methods.	1(H), 2(M), 4(M)	1(L)
CO6	Construct a project in a team or individual for given problem using MATLAB features.	1(H), 3(M), 5(H), 9(M), 12(M)	1(H)

Syllabus:

Experiment 1. To develop elementary signal function modules (m-files) for unit sample, unit step, exponential and unit ramp sequences.

Experiment 2. To develop a program module to perform basic operations on sequences i.e. addition, multiplication, shifting, folding and scaling.

Experiment 3. To develop a program to find linear convolution and correlation of two discrete time sequences.

Experiment 4. To develop a program to find linear convolution using z-transforms.

Experiment 5. To develop program for computing inverse z- Transform.

Experiment 6. To develop a program module to perform DFT and IDFT operation on discrete time sequences.

Experiment 7. To develop a program to find circular convolution of two sequences using DFT and IDFT method.

Experiment 8. To develop program for finding magnitude and phase response of LTI system described by system function H(z).

Experiment 9. To develop a program to design IIR filter with given specifications using Impulse invariance method.

Experiment 10. To develop a program to design IIR filter with given specifications using bilinear transformation method.

Experiment 11. To develop a program to design FIR filter with given specifications using

- Rectangular Window
- Hanning Window.

Experiment 12. To develop a program to design FIR filter with given specifications using KAISER window.

Suggested Readings/ Books:

1. J. G. Proakis and V. K. Ingle, "A Self Study Guide for Digital Signal Processing", Pearson Education, 2004.
2. S. K. Mitra, "Digital Signal Processing", Tata Mc Graw Hill, 3rd edition, 2006.
3. Lab Manuals available in Lab.

MOOCS and Video Course:

1. http://www.nptelvideos.in/2012/12/digital-signal-processing.html
2. http://freevideolectures.com/Course/2317/Digital-Signal-Processing-IIT-Delhi

6th Semester

Course Code	Course Title	Load Allocation			Marks Distribution		Total Marks	Credits
		L	T	P	Internal	External		
EC-17601	Digital Communication System	3	1	-	40	60	100	4
EC-17602	Microwave & Radar Engineering	3	1	-	40	60	100	4
EC-17603	Wireless & Mobile Communication System	3	1	-	40	60	100	4
EC-17604	Microcontrollers and Embedded System	3	1	-	40	60	100	4
DEEC-176XX	Department Elective-II	3	1	-	40	60	100	4
OEXX-176XX	Open Elective	3	-	-	40	60	100	3
EC-17611	Microcontrollers and Embedded System Lab	-	-	2	30	20	50	1
EC-17612	Microwave Engineering Lab	-	-	2	30	20	50	1
EC-17613	Digital Communication System Lab	-	-	2	30	20	50	1
PREC-17601	Minor Project	-	-	1	60	40	100	1
GF-17601	**General Fitness**				100	NA	100	1
TOTAL	**18**	**5**	**7**		**490**	**460**	**950**	**28**

Department Elective-II

DEEC-17605 Micro Electronics
DEEC-17606 Digital System Design
DEEC-17607 Information Theory & Coding
DEEC-17608 Intelligent Robotics
DEEC-17609 Java Programming
DEEC-17610 Computer Networks

Open Elective (For other Branches)

OEEC-17601 Microprocessors and Microcontrollers
OEEC-17602 Neural Networks & Fuzzy logic

COURSE NAME: DIGITAL COMMUNICATION SYSTEM
COURSE CODE: EC-17601
Internal Marks: 40 **L T P**
External Marks: 60 **3 1 -**
Numerical & Design Problems Content: 20%-30%
Note: The Question paper shall have three sections:
Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes
On successful completion of this course, the students should be able to:

CO	Definition	POs	PSOs
C01	Comprehend the basic concept of signal processing sub-systems in digital communications.	1(M)	1(H)
C02	Apply the knowledge of working principles of various signal processing operations and coding techniques for effective connectivity in digital communication systems	1(H), 3(L)	1(H)
CO3	Analyze performance of different types of waveform coding and digital modulation techniques for a given set of parameters	1(M), 2(H)	1(H)
CO4	Select and utilize tools like eye pattern to analyze the performance of digital communication system.	1(M), 2(M), 5(H)	1(H)
C05	Demonstrate the basic concept of source coding theorem, sampling theorem, Nyquist's criterion and companding laws and applying them for the designing of digital communication system.	1(M), 3(M)	1(H)
C06	Engage in self-learning of advanced concepts and application of Digital Communication.	1(M), 2(M), 12(H)	1(H)

Syllabus: Total Contact Hours: **[39+13(T) = 42]**
Unit 1. Fundamentals of Digital Communication System **[10+4=14]**
Basic signal processing operations in digital communications, uncertainty, information and entropy, source coding theorem, Huffman coding, discrete memory less channels, mutual information, channel capacity, channel coding theorem, differential entropy, channel capacity theorem, sampling theorem, quardrature sampling of band-pass signals, reconstruction of a message process from its samples, signal distortion in sampling, practical aspects of sampling and signal recovery.

Unit 2. Waveform Coding Techniques [8+2=10]

Pulse code modulation, channel noise and error probability, quantization noise and signal-to-noise ratio, robust quantization, dynamic range, coding efficiency, A law and μ law companding, differential pulse code modulation, delta modulation, Adaptive delta modulation, coding speech at low bit rates

Unit 3. Baseband Shaping for Data Transmission [10+3=13]

Discrete PAM signal, power spectra of discrete PAM signals, Intersymbol interference, Nyquist's criterion for distortionless baseband binary transmission, correlative coding, eye pattern, adaptive equalization for data transmission, Basics of TDMA, FDMA and CDMA

Unit 4. Digital Modulation Techniques [11+4=15]

Introduction, Amplitude Shift Keying (ASK), ASK Spectrum, ASK Modulator, Coherent ASK Detector, Noncoherent ASK Detector, Frequency Shift Keying (FSK), FSK Bit Rate and Baud, FSK Transmitter, Non-coherent FSK Detector, Coherent FSK Detector, FSK Detection Using PLL, Binary Phase Shift Keying, Binary PSK Spectrum, BPSK Transmitter, Coherent PSK Detection, Quadrature Phase Shift Keying (QPSK), QPSK Demodulator, Offset QPSK, $\pi/4$ QPSK, Quadrature Amplitude Modulation (QAM); MQAM transmitters and receivers, Band Width efficiency, Carrier Recovery; Squaring Loop & Costas Loop, Differential PSK, DBPSK transmitter and receiver, Constant Envelop Modulation; Minimum Shift Keying (MSK) & Gaussian Minimum Shift Keying (GMSK), matched filter receivers

Text Books:

1. S. Haykin, "Digital Communications", Wiley publication, 2012.
2. W. Tomasi, "Advanced Electronic Communication System", PHI, 6th Edition, 2015.

Reference books and other resources:

1. G. M. Miller, "Modern Electronic Communication", Prentice-Hall, 6th edition, 1999.
2. F. G. Stremler, "Introduction to Communication Systems", Addison- Wesley, 1990.
3. E.A. Lee and D.G. Messerschmitt, "Digital Communication", Kluwer Academic Publishers,1994.
4. H. Meyr, M. Moeneclaey, and S.A. Fechtel, "Digital Communication Receivers", Wiley, 1998.
5. J. G. Proakis, "Digital communications", McGraw-Hill Education, 4th edition, 2001.

E books and online learning materials:

3. http://nptel.ac.in/courses/Webcoursecontents/IIScBANG/Data%20Communication/Learning%20Material%20%20DataCommunication.pdf
4. http://home.iitk.ac.in/~vasu/book0.pdf

MOOCS and Video Course:

3. http://nptel.ac.in/courses/117101051/3
4. http://nptel.ac.in/courses/117101051/6

COURSE NAME: MICROWAVE & RADAR ENGINEERING
COURSE CODE: EC-17602
Internal Marks: 40 **L T P**
External Marks: 60 **3 1 -**
Numerical & Design Problems Content: 20%-30%
Note: The Question paper shall have three sections:
Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes
On successful completion of this course, the students should be able to:

CO	Definition	POs	PSOs
CO1	Describe and analyze microwave components using S parameters	1(H), 3(H)	1(L)
CO2	Explain the various techniques of measurement at microwave frequencies	1(H),2(H)	1(H)
CO3	Describe the operation of different types of radar	1(H),2(H)	1(H)
CO4	Explain the basics of scanning and tracking techniques in radar	1(H), 2(H)	1(H)
CO5	Develop systems using microwave devices with concern to public health and safety	1(H), 3(H)	1(H)
CO6	Design and develop radar solutions to meet societal and environmental needs	1(H), 3(H)	1(H)

Syllabus: [39+13(T) =: 42]

Unit 1. Microwave Tubes [6+2]
Limitations of conventional tubes, Frequency allocations and frequency plans, Construction, operation and properties of Klystron Amplifier, Reflex Klystron, Magnetron, Travelling Wave Tube (TWT), Backward Wave Oscillator (BWO), Crossed field amplifiers.

Unit 2. Microwave Solid State Devices [6+2]
Limitation of conventional solid state devices at Microwaves, Transistors (Bipolar, FET), Diodes (Tunnel, Varactor, PIN), Transferred Electron Devices (Gunn diode), Avalanche transit time effect (IMPATT, TRAPATT, SBD), Microwave Amplification by Stimulated Emission of Radiation (MASER), Microwave integrated circuit and it's classification techniques.

Unit 3. Microwave passive devices & components [7+3]

Analysis of Microwave components using S-parameters, Junctions (E, H, Hybrid), Directional coupler, Bends and Corners, Microwave posts, Attenuators, Phase shifter, Ferrite devices (Isolator, Circulator, Gyrator),Cavity resonator, Matched termination.

Unit 4. Microwave Measurements [5+1]

Power measurements using calorimeters and bolometers, Measurement of Standing Wave Ratio (SWR), Frequency and wavelength, Microwave bridges.

Unit 5. Introduction to Radar Systems [5+1]

Basic Principle: Block diagram and operation of Radar, Radar range Equation, Pulse Repetition Frequency (PRF) and Range Ambiguities, Applications of Radar.

Unit 6. Doppler Radars [7+3]

Doppler determination of velocity, Continuous Wave (CW) radar and its limitations, Frequency Modulated Continuous Wave (FMCW) radar, Basic principle and operation of Moving Target Indicator (MTI)radar, Delay line cancellers, Blind speeds and staggered PRFs.

Unit 7. Scanning and Tracking Techniques [6+1]

Various scanning techniques (Horizontal, vertical, spiral, palmer, raster, nodding), Angle tracking systems (Lobe switching, conical scan, monopulse), Range tracking systems, Doppler (velocity) tracking systems.

Text Books:

3. S. Liao, "Microwave devices and circuits", 3rd edition,PHI.
4. M.I. Skolnik, "Introduction to radar systems",McGraw Hill .
5. R.E. Collin, "Foundation of Microwave Engg", 2nd edition McGraw Hill, 1992.

Reference books and other resources:

5. M.Kulkarni, "Microwave devices and Radar Engg", Umesh Publications.
6. K.C Gupta, "Microwave Engg", Tata McGraw-Hill, 7th Edition, 2007.
7. D.Pozar, "Microwave Engineering", John Wiley & Sons, New York, 1998.

E books and online learning materials:

1. https://www.tutorialspoint.com/microwave_engineering/microwave_engineering_tutorial.pdf
2. https://ecedmans.files.wordpress.com/2014/10/microwave-devices-and-circuits-samuel-liao.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/117105130/2
2. http://nptel.ac.in/courses/117105130/9

COURSE NAME: WIRELESS AND MOBILE COMMUNICATION SYSTEM
COURSE CODE: EC-17603

	L	T	P
Internal Marks: 40			
External Marks: 60	**3**	**1**	**-**

Numerical & Design Problems Content: 10%-20%

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes

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

CO	Definition	POs	PSOs
CO1	Demonstrate the basic theory, performance criteria, operation and components of cellular systems.	1(H)	1(M)
CO2	Comprehend different networks using 2G, 3G and beyond 3G systems.	1(M)	1(M)
CO3	Analyse the performance of mobile systems in terms of interference.	2(H)	1(H)
CO4	Design omnidirectional antenna for analysis of system.	3(H)	1(H)
CO5	Illustrate the concept of handoffs and dropped calls in wireless communication system.	2(M)	1(M)
CO6	Implement various intelligent networks for effective wireless communication.	5(H)	1(H)

Syllabus: **[Total Contact Hours: 39+13=53]**

Unit 1. Cellular Systems **[5+2]**

Basic cellular systems, performance criteria, uniqueness of mobile radio environment, operation of cellular systems, concept of frequency reuse channels, , handoff mechanism, cell splitting, cell sectoring, consideration of the components of cellular systems

Unit 2. 2G, 3G and Beyond 3G systems **[8+3]**

2G systems, GSM Architecture and channels, 3G systems, WCDMA-UMTS (UTRA-FDD) physical layer, WCDMA-ARIB physical layer, WCDMA-TDD physical layer UMTS network architecture, Evolution of UMTS-3GPP release 4 and beyond ,CDMA2000 physical layer, CDMA2000 network, CDMA2000 EV-DO and EV-DV

Unit 3. Interference in Mobile Systems [8+3]

Cochannel interference**,** ***cochannel interference reduction factor, desired C/I from a normal case in an omnidirectional antenna system***, exploring cochannel interference areas in a system, real-time cochannel interference measurement at mobile radio transceivers, design of an omnidirectional antenna system in the worst case, adjacent-channel interference, near-end–far-end interference.

Unit 4. Handoffs and dropped calls [9+2]

Value of implementing handoffs, initiation of a hard handoff, delaying a handoff, forced handoffs, queuing of handoffs, power-difference handoffs, mobile assisted handoff (maho) and soft handoff, cell-site handoff only, intersystem handoff, introduction to dropped call rate, formula of dropped call rate

Unit 5. Intelligent Network for wireless communication [9+2]

Advanced intelligent network (AIN), SS7 network and ISDN for AIN, AIN for mobile communication, asynchronous transfer mode (ATM) technology, IP Network, future of IP networks, an intelligent system: future public land mobile telecommunication system (FPLMTS), Mesh Network/Ad Hoc Network, wireless information superhighway

Text Books:

1. W. C. Lee, "Wireless and Cellular Communications". 3rd Edition, McGraw Hill.

Reference books and other resources:

1. Jochen H. Schiller, "Mobile Communications", Second Edition, Pearson Education.
2. IEEE Communication Magazine

E books and online learning materials:

1. http://ee.sharif.edu/~pr.wireless.comm/references/Schwartz.pdf
2. http://www.egr.msu.edu/~tongli/Introduction-WCN.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/117102062/3
2. http://nptel.ac.in/courses/117102062/6

COURSE NAME: MICROCONTROLLERS AND EMBEDDED SYSTEM
COURSE CODE: EC-17604

Internal Marks: 40	**L**	**T**	**P**
External Marks: 60	**3**	**1**	**-**

Numerical & Design Problems Content: 20%-30%

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes

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

CO	Definition	POs	PSOs
CO1	Apply the knowledge of microcontrollers and embedded systems for advanced applications	1(H)	1(H)
CO2	Explain the internal architecture and interfacing of different peripheral devices with microcontroller	1(L)	1(L)
CO3	Demonstrate the ability to write the programs for microcontroller	3(M), 5(L)	1(L)
CO4	Develop the ability to understand the role of embedded system in industry	3(M)	1(M)
CO5	Extend and apply the acquired knowledge to the embedded application development platform	3(M)	1(L)
CO6	Explain the instruction set of microcontrollers	1(L)	1(L)

Syllabus: **[Total Contact Hours: 39+13(T)=53]**

Unit 1. Introduction to Embedded Systems **[7+3]**

Overview of Embedded systems, Embedded processors, Embedded hardware units and devices, Design parameters of an Embedded system, Present trends and applications of Embedded systems.**]**

Unit 2. The 8051 Microcontrollers **[14+4]**

Overview of 8051 family, Architecture and pin configuration of 8051, 8051 Assembly language programming: ROM space, data types and directives, PSW register, register banks and stack; Jump, loop and call instructions, I/O Port programming, Addressing modes, Programs using Arithmetic, Logic and Single bit instructions, Timer/counter programming, Serial

communication. Assembly/C language programs to interface LED, LCD and ADC with 8051 microcontroller.

Unit 3. ARM Processor Architecture and Programming [12+3]

The ARM design philosophy, ARM data flow architecture, Registers, Interrupts & vector table, ARM 32-bit instruction set: Data processing instructions and Load-store instructions. Assembly/C language programs to configure GPIO and interface stepper motor and relay modules with ARM7 microcontroller.

Unit 4. Embedded Application Development [6+3]

Introduction to Embedded application development platforms such as Arduino, Raspberry Pie, Tiva C Series and MSP430 based development kits.

Text Books:

1. M. A. Mazidi and J. A. Mazidi, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Prentice Hall, 2000.
2. N. Sloss, D. Symes and C. Wright, "ARM system developer's guide", Elsevier/ Morgan Kaufman, 1st Edition, 2004.

Reference books and other resources:

1. R. Kamal, "Embedded systems", McGraw-Hill Higher Education, 1st Edition, 2008.
2. UM10139 LPC214x User manual.
3. Technical documents related to MSP-EXP430G2 and Tiva C Series TM4C123G.

E books and online learning materials:

1. https://www.tutorialspoint.com/embedded_systems/embedded_systems_tutorial.pdf
2. http://people.bu.edu/bkia/PDF/01.%20Introduction%20to%20Embedded%20Systems.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/108102045/3
2. http://nptel.ac.in/courses/108102045/7

COURSE NAME: MICROELECTRONICS
COURSE CODE: DEEC-17605

	L	T	P
Internal Marks: 40			
External Marks: 60	**3**	**1**	**-**

Numerical & Design Problems Content: Nil

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes

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

CO	Definition	POs	PSOs
CO1	Comprehend the miniaturization of electronic systems and examine its influence on device characterization.	1(M)	1(L), 3(L)
CO2	Apply the knowledge of semiconductors in various steps of fabrication process.	1(H)	1(L), 3(L)
CO3	Analyze different techniques for crystal growth, epitaxy, lithography, oxidation, etching and diffusion process.	1(H), 2(H)	1(L),3(M)
CO4	Assess the consequences of external factors at various levels of fabrication and engage in life-long learning	1(H), 2(M), 12(H)	3(M)
CO5	Examine the defects and faults in the process under various operating conditions.	1(H)	3(M)
CO6	Distinguish between thin and thick film hybrid ICs.	1(H)	3(M)

Syllabus: **[Total Contact Hours: 39+13(T)=53]**

Unit 1. Miniaturization of Electronic Systems & its impact on characterization [4+2]

Introduction, Trends & Projections in microelectronics, Monolithic chips trends, Advantages, limitations & classification of ICs.

Unit 2. Crystal growth and Epitaxial Process in Fabrication [8+3]

Crystal growth: Electronics grade silicon production, Crystal growth techniques: float zone method, Czochralski method, Wafer Preparation & Crystal Defects.

Epitaxial Process: Vapour phase epitaxy-reactor design, selective epitaxy, epitaxial process induced defects, molecular beam epitaxy, recent trends in Epitaxy.

Unit 3. Oxidation and Lithography Process [8+2]

Oxidation: Types of oxidation techniques, dry & wet oxidation, oxidation induced faults, recent trends in oxidation.

Lithography: Lithography techniques, resists and mask preparation of respective lithographies, printing techniques, recent trends in lithography at nano regime.

Unit 4. Etching, Diffusion and Metallization [9+2]

Etching: Etching techniques-ion beam, sputter ion plasma etching and reactive ion etching (RIE), etching induced defects.

Diffusion and Ion Implantation: Diffusion mechanisms, parameters affecting diffusion profile. Ion Implantation-impurity distribution profile, low energy and high energy ion implantation.

Metallization: Metallization choices, metallization techniques–vacuum evaporation, sputtering.

Unit 5. Monolithic Components & their Isolation [5+2]

Resistors, Capacitors, Transistors, MOS and Various isolation techniques.

Unit 6. Thick Film and Thin Film Hybrid ICs [5+2]

Features of Hybrid IC technology, Thick film processing and design. Thin film technology and design.

Text Books:

1. J. Millman and A. Grabel, "Microelectronics", Tata McGraw-Hill, 2nd Edition, 2009.
2. G. Bose, "IC Fabrication Technology", McGraw Hill Education, 2014.
3. S.M. Sze, "VLSI Technology", McGraw-Hill, 2nd Edition, 2008.
4. J. D. Plummer, M. D. Deal and P. B. Griffin, "Silicon VLSI Technology", Pearson Education, 2009.

Reference books and other resources:

1. D. Nagchoudhuri, "Principles of Microelectronics Technology", Wheeler, 1998.
2. S.K. Gandhi, "VLSI Fabrication Principles", John Willey & Sons, 1994.
3. S.A. Campbell, "The Science and Engineering of Microelectronic Fabrication", Oxford University Press, 1996.

E books and online learning materials:

1. http://www2.elo.utfsm.cl/~lsb/elo102/datos/microelectronics.pdf
2. http://www2.units.it/carrato/didatt/doc/Fonstad_MicroelecDevCkt_2006EEd.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/103106075/2
2. http://nptel.ac.in/courses/103106075/12

COURSE NAME: DIGITAL SYSTEM DESIGN
COURSE CODE: DEEC-17606
Internal Marks: 40 **L T P**
External Marks: 60 **3 1 -**
Numerical & Design Problems Content: 40%-50%
Note: The Question paper shall have three sections:
Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes
On successful completion of this course, the students should be able to:

CO	Definition	POs	PSOs
C01	Design solutions for complex combinational and sequential circuits through standard design process.	1(M), 3(H), 5(L)	3(H)
C02	Apply the knowledge of working principle of standard combinational circuits and sequential machines in implementation of other digital circuits	1(H), 3(L)	3(H)
CO3	Analyze the complex synchronous and asynchronous sequential logic through standard analysis process.	1(M), 2(H)	3(H)
CO4	Select and utilize tools like state diagram, MDS diagram, ASM chart to model the complex synchronous and asynchronous sequential circuits	1(M), 3(M), 5(H)	3(H)
CO5	Demonstrate the basic concept of programmable devices and applying them for the designing of combinational and sequential circuits	1(M), 3(M)	3(H)
CO6	Comprehend the basic concept of memory, binary cell and hazards and apply for digital circuit design problems.	1(M), 3(M)	3(H)

Syllabus: **[Total Contact Hours: 39+13(T)=52]**

Unit 1. Combinational Logic **[8+3=11]**
Design of arithmetic circuits, comparators, multiplexers, code converters, multiplier, EXOR and AND-OR-INVERT gates

Unit 2. Synchronous Sequential logic **[8+3=11]**
Concept of memory, binary cell, fundamental difference between sequential machines, classification of sequential machines, capabilities and limitations of finite state machines, design

procedure of flip-flops, flip-flop conversion, state diagram, analysis of synchronous sequential circuits, design procedure of traditional synchronous sequential circuits, state reduction, minimizing the next decoder, output decoder design, modeling and simulation of Moore and Mealy machines, design of counters, shift register

Unit 3. Algorithmic State Machines [8+3=11]

ASM chart, Timing considerations, Control implementation, Control Design with multiplexers, PLAs, etc

Unit 4. Asynchronous Sequential Logic [8+2=10]

Analysis Procedure, Circuits with latches, Design procedure, Reduction of state and flow tables, Race-free state assignment, Hazards, Design examples

Unit5.Designing with Programmable Logic Devices and Programmable Gate Arrays [7+2=9]

Read only memories, Programmable logic arrays, Programmable array logic, designing with FPGAs, Xilinx series FPGAs

Text Books:

1. W. I. Fletcher, "An engineering approach to digital design", PHI, 2002.
2. G. K. Kharate, "Digital electronics", OXFORD university press, 2010.

Reference books and other resources:

1. S. Brown and Z. Vranesic, "Fundamentals of Digital Logic with VHDL design", TMH, 2009.
2. D. D. Givone, "Digital principles and design", TMH, 2002
3. J. P. Uyemura, "A first course in digital system design", Thomson, 2006
4. Grout, "Digital systems design with FPGAs and CPLDs", Newnes(Elsevier), 2011

E books and online learning materials:

1. http://nptel.ac.in/courses/106108099/Digital%20Systems.pdf
2. https://dvikan.no/ntnu-studentserver/kompendier/digital-systems-design.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/117105080/12
2. http://nptel.ac.in/courses/117105080/24

COURSE NAME: INFORMATION THEORY & CODING
COURSE CODE: DEEC-17607
Internal Marks: 40 **L T P**
External Marks: 60 **3 1 -**
Numerical & Design Problems Content: 60%-70%
Note: The Question paper shall have three sections:
Section A shall consist of one question with 10 sub-questions of two (02) marks each. Section B shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. Section C shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of Section C may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes
On successful completion of this course, the students should be able to:

CO	Definition	POs	PSOs
C01	Apply the knowledge of various channel coding techniques for effective communication in digital systems.	1(H)	1(H), 2(M)
C02	Construct the linear block codes for detecting error while transmission of data in digital communication system.	1(H)	1(H), 2(M)
CO3	Build the circuits for implementation of error codes.	4(H)	1(H), 2(M)
CO4	Construct advanced error control codes for error- free decoding on receiver side in digital communication system.	1 (H) , 3(L)	1(H), 2(M)
CO5	Develop advanced error coding techniques for given set of specifications in communication system.	1(H)	1(H), 2(M)
CO6	Compare various automatic repeat request strategies.	1(M)	1(H)

Syllabus: **[Total Contact Hours: 40+13(T)=53]**

Unit 1. Elements of Information Theory **[8+3=11]**
Introduction to Information theory, Uncertainty and information, information measures, entropy, Information rate, Shannon's Theorem, Mutual information; Channel capacity; BSC and other channels, Capacity of a Gaussian Channel, Bandwidth – S/N Trade-off , Information Capacity Theorem , Shannon Limit, Source Coding Theorem, Huffman coding, Lempel Ziv Coding, Run Length encoding.

Unit 2. Error Control Coding **[7+2=9]**
Linear Block Codes: Introduction, Basic Definition, Equivalent codes, parity – check matrix,

decoding of Linear Block codes, syndrome decoding, Perfect Codes, Hamming Codes, Optimal Linear codes, Maximum Distance Separable (MDS) codes.

Unit 3. Cyclic Codes [7+2=9]

Introduction to polynomials, The Division Algorithm, Method for generating cyclic codes, Burst Error correction, CRC Codes, Circuit implementation.

Unit 4. Bose Chaudhuri Hocquenghem (BCH) Codes [6+2=8]

Introduction, Primitive elements, minimum polynomial, Examples of BCH codes, Decoding of BCH codes.

Unit 5. Convolution Codes [6+2=8]

Introduction, Tree Codes and Trellis Codes, Polynomial description, The Generating Function, Matrix Description, Viterbi Decoding, Distance bounds.

Unit 6. Automatic Repeat Request Strategies: [6+2=8]

Stop and wait, Go back and selective repeat ARQ strategies, Hybrid ARQ Schemes.

Text Books:

1. Ranjan Bose, *Information Theory, Coding and Cryptography*, TMH Publication,2005.

Reference books and other resources:

1. Roberto Togneri, Christopher J.S. deSilva, *Fundamental of information theory and coding design*. CRC Press. ISBN: 978-1584883104
2. Cover, Thomas, and Joy Thomas. *Elements of Information Theory*. 2nd ed. New York, NY: Wiley-Interscience, 2006. ISBN: 9780471241959
3. Coding Theory, Algorithm, Architectures and Application. Andre Neubauer, Jurgen Freudenberger, Volker Kuhn. John Wiley & Sons, Ltd.

E books and online learning materials:

1. http://www-public.tem-tsp.eu/~uro/cours-pdf/poly.pdf
2. http://www.cl.cam.ac.uk/teaching/0910/InfoTheory/InfoTheoryLectures.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/117101053/5
2. http://nptel.ac.in/courses/117101053/12

COURSE NAME: INTELLIGENT ROBOTICS
COURSE CODE: DEEC-17608

Internal Marks: 40	**L**	**T**	**P**
External Marks: 60	**3**	**1**	**-**

Numerical & Design Problems Content: 20%-30%

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes

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

CO	Definition	POs	PSOs
CO1	Able to understand the general principles of intelligence and robotics	1(H)	1(H), 2(H)
CO2	Able to display the creativity and innovation in solving unfamiliar problems	2(H) 3(M)	2(H)
CO3	Ability to apply knowledge of computing appropriate to the discipline	4(H)	2(H)
CO4	Ability to design implement and evaluate a computer based system, process to meet desired needs	4(H)	3(H), 2(M)
CO5	Ability to function effectively on teams to accomplish a goal	5(H)	3(H), 2(H)
CO6	Identify appropriate AI methods to solve a given problem	5(M), 3(M)	3(M)

Syllabus: **[Total Contact Hours: 38+13(T)=51]**

Unit 1. Introduction **[7+3=10]**

Automation & Robotics, Drive System, Control System and dynamic performance precision of movement, Sensors.

Unit 2. Sensors & Machine Vision **[7+3=10]**

Common Sensors and their properties, Sensing & Digitizing functions in Machine Vision, Image Processing and analysis.

Unit 3. Planning approach to Robot Control **[8+3=11]**

Control system models and analysis, Robot manipulator kinematics, Robot Arm Kinematics & Dynamics, Transformations.

Unit 4. Control Theory [8+2=10]

Feedback, Feed-forward and open loop control, Linear first order lag processes, Limitations of Control theory.

Unit 5. Robot Programming &Artificial Intelligence [8+2=10]

Languages, A Robot Program as a Path in Science, Motion Interpolations, Introduction of AI, goals, Techniques, Role of AI in Robotics, Machine.

Text Books:

1. Mikell P Groover, M Weiss, "Industrial Robotics", Mc Graw Hill Education.
2. C.S.G. Lee, K.S. Fu, R.C. Gonzalez, "Robotics", Mc Graw Hill Education.

Reference books and other resources:

1. Arkin R.C. 1998, "Behaviour Based Robotics", MIT Press, Cambridge MA.
2. Negnewitsky, M, "Artificial intelligence: A guide to Intelligent Systems", Harlow: Addison-Wesley, 2002.

E books and online learning materials:

1. http://www.tmrfindia.org/ijcsa/v5i33.pdf
2. http://www.sciencemag.org/sites/default/files/custom-publishing/documents/Brain-inspired-robotics-supplement_final.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/108104049/1
2. http://nptel.ac.in/courses/108104049/3

COURSE NAME: JAVA PROGRAMMING
COURSE CODE: DEEC-17609
Internal Marks: 40 **L T P**
External Marks: 60 **3 1 -**
Numerical & Design Problems Content: 20%-30%
Note: The Question paper shall have three sections:
Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes
On successful completion of this course, the students should be able to:

CO	Definition	POs	PSOs
C01	Use the Java SDK environment to create and run simple Java programs.	1(M)	2(M)
C02	Understand fundamentals of programming such as variables, conditional and iterative execution, methods etc	1(H)	2(M)
CO3	Understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries etc	1(L)	2(L)
CO4	Understand the hierarchy of classes and their implementation in real world problems.	3(H),7(L)	2(H)
CO5	Implement, compile, test and run Java programs comprising more than one class, to address a particular software problem.	5(H)	2(H)
CO6	Use exception handling using tries, catch and throw.	1(L)	2(L)
CO7	Create Java applets and embed in a simple HTML document	1(L)	2(L)

Syllabus: **[Total Contact Hours: 39+13(T)=52]**

Unit 1. Introduction **[3+2=5]**
History of Java, Features and importance of Java to the internet, Differences between Java and C++, structure of Java Program, understanding class path.

Unit 2. Building blocks of Java **[6+2=8]**
Literals**,** Tokens, Keywords, constants, Variables and Data-types, Operators, Expressions,

Control statements, Arrays, Vectors, Type conversion, command line arguments, Parameter passing, Recursion, String handling.

Unit 3. Classes and Objects [7+2=9]

Concepts of classes and objects, static classes, abstract classes, Method Overloading and overriding, Constructors, Access control, this keyword, Garbage collection.

Unit 4. Inheritance [8+2=10]

Basics of inheritance, Types of inheritance, Member access rules, Using super, Using final with inheritance, Method overriding, Dynamic method dispatch, Using abstract classes.

Unit 5. Interfaces and Packages [3+2=5]

Interfaces and implementing interface, defining a package, Accessing a package, Importing packages.

Unit 6. Exception Handling [6+2=8]

Concepts of exception handling, Exception types, Using try, catch, throw, throws and finally, Java's built in exceptions, Creating own exception subclasses.

Unit 7. Applets [6+1=7]

Basics of applets, Differences between applets and applications, Life cycle of an applet, Types of applets, The HTML applet tag, Creating applets, Passing parameters to applets.

Text Books:

1. Herbert Schildt , "The Complete Reference Java 2" , Tata McGraw-Hill.

Reference Books and other Resources:

1. Joyce Farrell, "Java for Beginners", Cengage Learning.
2. J. Nino and F.A. Hosch, "An Introduction to programming and OO design using Java", John Wiley & Sons.
3. Y. Daniel Liang, "Introduction to Java programming", Pearson education.

E books and online learning materials:

1. http://www.tutorialspoint.com/java/java_tutorial.pdf
2. http://www.iitk.ac.in/esc101/share/downloads/javanotes5.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/106106147/2
2. http://nptel.ac.in/courses/106106147/4

COURSE NAME: COMPUTER NETWORKS
COURSE CODE: DEEC-17610
Internal Marks: 40 **L T P**
External Marks: 60 **3 1 -**
Numerical & Design Problems Content: NIL
Note: The Question paper shall have three sections:
Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes
On successful completion of this course, the students should be able to:

CO	Definition	POs	PSOs
CO1	Explain the concepts of networking and classify the different networks and their topologies.	1(M)	2(M)
CO2	Outline the advantages and usage of various network connecting devices.	1(M), 5(M)	2(M)
CO3	Review the network protocols and apply this knowledge to make efficient networks.	1(H)	2(M)
CO4	Demonstrate and analyze the impact of congestion in the network and apply appropriate techniques for congestion avoidance.	2(M), 3(H)	2(H)
CO5	Design solutions for routing issues in the network.	3(H)	1(M), 2(H)
CO6	Assess the security issues in the network and apply ethical principles to address them.	8(H)	2(M)

Syllabus: **[Total Contact Hours: 40+13(T)=53]**

Unit 1. Introduction **[7+3=10]**

Introductory networking concepts , Network topologies, Categories of networks (Wired networks Vs wireless networks, LAN, MAN, WAN), Internet, Intranet & Extranet, Connection-Oriented and Connectionless Services, Need of Protocols, OSI and TCP/IP reference Model, Comparison of OSI & TCP/IP, Network connecting devices (Repeaters, Bridges, Hubs, Routers and Switches), Virtual LANs.

Unit 2. Network Protocols **[7+3=10]]**

Multiple Access Protocols (ALOHA, Carrier Sense Multiple Access Protocols), ARP, RARP, Framing and its methods, Sliding window protocols (One-Bit Sliding Window Protocol, Protocol Using Go Back n, Protocol Using Selective Repeat), High-Level Data Link Control (HDLC).

Unit 3. Congestion Control in Data Networks [9+3=12]

Causes of congestion, Effects of Congestion, Congestion Prevention Policies, Congestion Control in Virtual-Circuit Subnets, Congestion Control in Datagram Subnets, Load Shedding, Jitter Control, Tunneling, Congestion Control in Packet-Switching Networks.

Unit 4. Routing Algorithms [9+2=11]

The optimality principle, Sink tree formation, Shortest path routing and solution of network problems using Dijkstra's Algorithm, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast Routing, Multicast Routing, Routing for Mobile Hosts, Routing in Ad Hoc Networks, Node lookup in peer- to- peer networks.

Unit 5. Internetwork Protocols [8+2=10]

Internet Protocol & IP Addresses, Principles of Internetworking, Structure of IP, IPv4, IPv6, Virtual Private Networks, Security Issues and IP Security (Digital Signatures, Intrusion Detection Systems).

Text Books:

1. B. A. Forouzan, "Data Communications and Networking", Tata Mcgraw-Hill, 3rd edition, 2004.
2. A.S. Tanenbaum, "Computer Networks", Pearson Education, 4th edition, 2011.

Reference books and other resources:

1. W.Stallings, "Data and Computer Communication", Prentice Hall, 6th edition, 2002.
2. D. P. Bertsekas, "Data Networks", Prentice Hall, 2nd edition, 1992.
3. K. C. Mansfield and J. L. Antonakos , "An Introduction to Computer Networking", PHI.

E books and online learning materials:

1. http://cnp3book.info.ucl.ac.be/2nd/cnp3bis.pdf
2. https://www.tutorialspoint.com/data_communication_computer_network/data_communication_computer_network_tutorial.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/106105081/2
2. http://nptel.ac.in/courses/106105081/14

COURSE NAME: MICROPROCESSORS and MICROCONTROLLERS
COURSE CODE: OEEC-176XX

	L	T	P
Internal Marks: 40			
External Marks: 60	**3**	**1**	**-**

Numerical & Design Problems Content: 20%-30%

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes

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

CO	Definition	POs	PSOs
C01	Analyze and differentiate between the architecture, features and functioning of microprocessor and microcontroller.	2(H)	3(M)
C02	Apply the knowledge of instruction set for performing various operations on microprocessor and microcontroller.	1(M)	3(H)
CO3	Compare and contrast the role of different interrupts.	2(M)	3(L)
CO4	Utilize the timer/counters in any of the applications.	1(M)	3(L)
CO5	Describe the interfacing of various devices with microcontroller.	3(L), 4(L)	1(L), 3(M)
CO6	Work in a team to demonstrate an application of microprocessor and microcontroller by engaging in self-learning	4(H), 9(H), 10(H),12(H)	1(M), 3(M)

Syllabus: **[Total Contact Hours: 39+13(T)=52]**

Unit 1. Basic Architecture **[6+2=8]]**

8085 Architecture, Arithmetic and Logic Unit, Flags, Clock, Buses, 8085 Pin configuration, Timing diagrams.

Unit 2. Instruction Set [10+3=13]

Introduction to Basic 8085 Instructions, Addressing modes, Data transfer instructions, Arithmetic instructions, Logic instructions, Branch instructions, Conditional call and return instructions, Assembly language programming, Stack, Subroutines.

Unit 3. Interrupts [3+2=5]

8085 interrupts, Basic interrupt processing, ISR, RST, RIM, SIM.

Unit 4. 8051 Microcontroller [5+2=7]

Comparison of microprocessor and microcontroller, architecture and pin configuration of 8051, flag bits and PSW register, Register banks and stacks, Timer/Counter.

Unit 5. 8051 Assembly Language programming [9+2=11]

Introduction to 8051 assembly language programming, Arithmetic instructions, Logic instructions, Single bit instructions, Jump, loop and call instructions, I/O port programming, timer/counter programming, Addressing modes, Directives.

Unit 6. Interfacing [6+2=8]

8051 connection to RS 232, interfacing of 8051 microcontroller: LCD, ADC, DAC, Stepper motor.

Text Books:

3. Ramesh S Gaonkar, Microprocessor Architecture, Programming and application with 8085, 5th Edition, Penram International Publishing, New Delhi, 2007.
4. Muhammed Ali Mazidi, Rolin McKinlay, Janice Gillispe "The 8051 Microcontroller and Embedded Systems", Pearson Education, 2007
5. K. J. Ayala, "The 8051 Microcontroller", Cengage Learning, 2004.

Reference books and other resources:

6. A.K. Ray and K.M.Burchandi, "Intel Microprocessors Architecture Programming and Interfacing", McGraw Hill International Edition, 2000
7. M. Rafi Quazzaman, "Microprocessors Theory and Applications: Intel and Motorola", Prentice Hall of India, Pvt. Ltd., New Delhi, 2003.
8. D.V. Hall, "Microprocessor and Interfacing-Programming and Hardware", 2nd Ed., Tata McGraw-Hill Publishing Company Limited, 2008.
9. J. Stewart ,"Microprocessor Systems- Hardware, Software and Programming", Prentice Hall International Edition,1990
10. K. L. Short, "Microprocessors and Programmed Logic", 2nd Ed.,Pearson Education, 2008.
11. Davies J H, "Microcontroller Basics", Elsevier, 2011.

12. Subrata Ghoshal, “Microcontroller: Internals, Instructions, Programming and Interfacing”, Pearson Education, 2010

E books and online learning materials:

1.http://nptel.ac.in/courses/Webcoursecontents/IIScBANG/notused/Microprocessors%20and%20Microcontrollers/Learning%20Material%20%20Microprocessors%20and%20microcontrollers.pdf
2. https://courses.cs.washington.edu/courses/cse466/15au/pdfs/lectures/02-Microprocessors-Microcontrollers.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/108107029/1
2. http://nptel.ac.in/courses/108107029/10

COURSE NAME: NEURAL NETWORKS & FUZZY LOGIC
COURSE CODE: OEEC-176XX

Internal Marks: 40	**L**	**T**	**P**
External Marks: 60	**3**	**-**	**-**

Numerical & Design Problems Content: 20%-30%

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes

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

CO	Definition	POs	PSOs
CO1	Analyze the fundamental concepts of biological neural networks and understand the evolution of artificial neural networks	1(H)	1(M)
CO2	Summarize different types of artificial neural network learning	1(H)	1(M)
CO3	Demonstrate adequate knowledge about feedback networks	1(H)	1(H)
CO4	Apply neural networks concepts to model and solve complicated practical problems	1(M), 3(M)	1(M)
CO5	Comprehend the rules of fuzzy logic for fuzzy logic control	1(M)	3(H)
CO6	Apply the knowledge of application of fuzzy logic control to real time systems and design systems that meet desired needs within realistic constraints	1(M), 3(M)	3(H)

Syllabus: **[Total Contact Hours: 39]**

Unit 1. Introduction **[10]**

Biological neural networks, history of development in neural networks principles, artificial neural net terminology, models of neuron, activation functions, topology, learning, types of learning: supervised, unsupervised, re-enforcements learning, learning rules/methods.

Unit 2. Artificial Neural Networks **[10]**

Introduction to feedforward and feedback neural networks, back-propagation learning algorithm, architecture of back propagation networks, selection of various parameters in back propagation networks, Hopfield model, Kohonen's self-organizing networks.

Unit 3. Applications of neural networks **[10]**

Applications of neural nets such as pattern recognition, optimization, associative memories,

speech and decision-making. VLSI implementation of neural networks.

Unit 4. Fuzzy Logic **[9]**

Crisp & fuzzy sets; properties, operations, arithmetic and relations, membership functions, fuzzification, fuzzy rule based systems, fuzzy-inference systems, defuzzication techniques, applications/ case-studies.

Text Books:

1. Y. Narayanan, " Artificial Neural Networks", Wiley India, 2nd edition, 2009
2. T. J. Ross., "Fuzzy Logic with Engineering Applications", John Wiley & Sons, 2009.
3. G. J. Klir, "Fuzzy sets and fuzzy logic: Theory and Applications", PHI Learning, 2009.

Reference books and other resources:

1. S. K. Valluru and T. N. Rao, "Introduction to Neural Networks, Fuzzy Logic & Genetic Algorithms", Jaico, 1st edition, 2010.
2. S. Rajasekaran and G. A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic, and Genetic Algorithms: Synthesis and Applications", PHI, 2010.
3. Related IEEE/IEE/ Science Direct publications.

E books and online learning materials:

1. http://users.monash.edu/~app/CSE5301/Lnts/LaD.pdf
2. http://www.site.uottawa.ca/~petriu/ELG5196-SoftComputing-NN_FL.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/108104049/1
2. http://nptel.ac.in/courses/108104049/4

COURSE NAME: LAB MICROCONTROLLERS AND EMBEDDED SYSTEM
COURSE CODE: EC-17611

	L	T	P
Internal Marks: 30			
External Marks: 20	**-**	**-**	**2**

NOTE:

1) Do all Experiments. Evaluation of the lab work shall be done as per the approved Rubric.
2) All students shall design and implement a small project related to lab.

Course Outcomes

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

CO	Definition	POs	PSOs
CO1	Develop programs for microcontroller for performing mathematical operations	1(M), 4(M), 10(H)	3(M)
CO2	Comprehend the working of microcontroller based development boards	1(L), 4(M), 10((H)	3(L)
CO3	Illustrate programming concepts to interface peripheral devices with the microcontroller	1(L), 4(H), 10(H)	3(M)
CO4	Develop source codes for interfacing of peripherals	4(H), 10(H)	3(M)
CO5	Design high end applications using microcontrollers	3(M), 4(H), 10(H)	3(H)
CO6	Work in a team to demonstrate an application of microcontroller and embedded system by engaging in self	9(H), 10(H)	3(M)

Syllabus:

Experiment 15. Study 8051 microcontroller kits and write programs to add and multiply two numbers lying at two memory locations.

Experiment 16. Write a Program to arrange 10 numbers stored in memory in ascending and descending order.

Experiment 17. Write a program to flash LED using 8051 microcontroller.

Experiment 18. Write a program to interface LCD display with 8051 microcontroller.

Experiment 19. Write a program to interface ADC/DAC with 8051 microcontroller.

Experiment 20. Study ARM microcontroller kits and write a program to blink multiple LEDs connected to the microcontroller.

Experiment 21. Write a program to control the speed and direction of a stepper motor using ARM7 microcontroller.

Experiment 22. Write a program to interface a relay with ARM7 microcontroller.

Experiment 23. Write a program to interface RFID module with ARM7 microcontroller.

Experiment 24. Write a program to interface a color LCD display with ARM Cortex microcontroller.

Experiment 25. Write a program to demonstrate the use of Real Time Clock using ARM Cortex microcontroller.

Experiment 26. Write a program to configure GPIO ports for MSP430 microcontroller.

Experiment 27. Study of Tiva C series TM4C123G development kit.

Reference Books and Other Resources:

Lab manuals available in lab.

MOOCS and Video Course:

3. http://nptel.ac.in/courses/117104072/38
4. http://nptel.ac.in/courses/117104072/39

COURSE NAME: MICROWAVE ENGINEERING LAB
COURSE CODE: EC-17612

	L	T	P
Internal Marks: 30			
External Marks: 20	**-**	**-**	**2**

Note: The evaluation of the Lab work shall be done as per the approved Rubrics.

Course Outcomes

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

CO	Definition	POs	PSOs
CO1	Conduct experiments using microwave devices to investigate characteristics.	4(M), 5(H)	1(M)
CO2	Demonstrate the measurement and interpretation of radiation parameters of antenna using network analyzer.	1(L), 4(M)	1(H)
CO3	Identify and formulate microwave components and their characteristics	2(H)	1(H)
CO4	Develop communication systems using horn antennas	3(H), 4(H)	1(H)
CO5	Apply the knowledge of S-parameters to solve complex engineering systems	1(H)	1(H)
CO6	Use knowledge of microwave components and devices to develop systems for societal needs	3(H), 4(H)	1(H)

Syllabus:

Experiment 1. Study of microwave components and instruments.

Experiment 2. Measurement of crystal characteristics and proof of the square law characteristics of the diode.

Experiment 3. Measurement of klystron characteristics.

Experiment 4. Measurement of VSWR and standing wave ratio.

Experiment 5. Measurement of Dielectric constants.

Experiment 6. Measurement of Directivity and coupling coefficient of a directional coupler.

Experiment 7. Measurement of Q of a cavity.

Experiment 8. Calibration of the attenuation constant of an attenuator.

Experiment 9. Determination of the radiation characteristics and gain of Horn antenna.

Experiment 10. Determination of the phase-shift of a phase shifter.

Experiment 11. Measurement of return loss of patch antenna using Vector Network Analyzer.

Reference Books and Other Resources:

Lab manuals available in lab.

MOOCS and Video Course:

1. http://nptel.ac.in/courses/117101119/6
2. http://nptel.ac.in/courses/117101119/16

COURSE NAME: LAB-DIGITAL COMMUNICATION SYSTEM
COURSE CODE: EC-17613

	L	T	P
Internal Marks: 30			
External Marks: 20	**-**	**-**	**2**

NOTE:

1) Do all Experiments. Evaluation of the lab work shall be done as per the approved Rubric.
2) All students shall design and implement a small project related to lab.

Course Outcomes

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

CO	Definition	POs	PSOs
CO1	Comprehend the concept of Time division multiplexing using communication system modules	1(L), 4(H) 10(H)	1(H)
CO2	Demonstrate the various pulse coding and decoding techniques	1(L), 4(H) 10(H)	1(H)
CO3	Illustrate the modulation and demodulation process for amplitude shift keying, frequency shift keying and phase shift keying.	1(L),4(H),10(H)	1(H)
CO4	Conduct experiments using system modules to demonstrate the operation of PCM and DM and analyze their performances.	2(L), 4(H), 10(H)	1(H)
CO5	Apply hamming codes and demonstrate its use in detection and correction of errors.	1(L),4(H), 10(H)	1(H)
CO6	Select and utilize tools like SIMULINK to model delta modulation and binary phase shift keying	4(H), 5(H), 10(H)	1(H)

Syllabus:

Experiment 1. To demonstrate time division multiplexing system.
Experiment 2. To demonstrate pulse code modulation and demodulation.
Experiment 3. To demonstrate adaptive delta modulation and demodulation.
Experiment 4. To study pulse data coding and decoding techniques for various formats.
Experiment 5. To study of amplitude shift keying modulator and demodulator.
Experiment 6. To study of frequency shift keying modulator and demodulator.
Experiment 7. To study of quadrature phase shift keying modulator and demodulator.
Experiment 8. To demonstrate error detection & correction using Hamming Code.
Experiment 9. To simulate delta modulation and demodulation using MATLAB (SIMULINK).
Experiment 10. To simulate binary phase shift keying using MATLAB (SIMULINK).

Reference Books and Other Resources:

Lab manuals available in lab.

MOOCS and Video Course:

1. http://nptel.ac.in/courses/117101051/30
2. http://nptel.ac.in/courses/117101051/31

COURSE NAME: MINOR PROJECT
COURSE CODE: PREC-17601

	L	T	P
Internal Marks: 60			
External Marks: 40	**-**	**-**	**2**

Course Outcomes

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

CO	Definition	POs	PSOs
C01	To apply knowledge of electronics and communication field to identify, collect relevant literature and analyze the information to formulate the problem definition for project.	1(H), 2(H), 4(M)	1(H), 2(H), 3(H)
C02	Demonstrate ethical principles in project planning, execution and documentation.	8(H), 11(M)	1(H), 2(H), 3(H)
CO3	Select and utilize appropriate **tools** to implement and demonstrate the proposed project.	5(H)	1(H), 2(H), 3(H)
CO4	Design and develop sustainable solution/system for the improvement of environment conditions and betterment of the society.	3(H), 6(H), 7(H)	1(H), 2(H), 3(H)
CO5	Communicate effectively on developed solution/system with engineering community as individual or team through effective presentation and report writing.	9(H),10(H), 11(M)	1(H), 2(H), 3(H)
CO6	Develop sustainable system with scope for enhancement and continue life-long learning	12(H)	1(H), 2(H), 3(H)

Syllabus:

Students may choose a project based on any subject of Electronics and Communication Engineering. The student will submit a synopsis at the beginning of the semester for approval from the departmental committee in a specified format. The student will have to present the progress of the work through seminars and progress reports. Evaluation of the project work shall be done as per the approved Rubrics.

Reference Books and Other Resources:

Various projects based magazines available in the college/department library.

MOOCS and Video Course:

1. http://nptel.ac.in/courses/117106111/
2. http://nptel.ac.in/courses/117103063/

7th /8th Semester

Course Code	Course Title	Course Component	Internal Marks	External Marks	Total Marks	Credits
TREC-17701	Industrial Training-II (Six months Industrial Training)	Industrial Training - II	450	350	800	13
TREC-17702		Industry Oriented Training	200	-	200	2
Total			650	350	**1000**	**15**

7th/8th Semester

Course Code	Course Title	Load Allocation			Marks Distribution		Total Marks	Credits
		L	T	P	Internal	External		
EC-17701	VLSI Design	3	1	-	40	60	100	4
EC-17702	Optical Communication	3	1	-	40	60	100	4
EC-17703	Engineering Management	3	1	-	40	60	100	4
DEEC-177XX	Department Elective-III	3	1	-	40	60	100	4
DEEC-177YY	Department Elective-IV	3	1	-	40	60	100	4
EC-17715	Lab Optical Communication	-	-	2	30	20	50	1
EC-17716	Lab VLSI Design	-	-	2	30	20	50	1
PREC-17701	Major Project	-	-	3	120	80	200	3
GF-17701	General Fitness	-	-	1	100	NA	100	1
TOTAL		**15**	**5**	**8**	**480**	**420**	**900**	**26**

Departmental Elective –III (Common Code XX)

DEEC-17704	CMOS based Design
DEEC-17705	Biomedical Electronics
DEEC-17706	Satellite Communication
DEEC-17707	Speech & Image Processing
DEEC-17708	Human Resource Management
DEEC-17709	Computer Organization and Architecture

Departmental Elective – IV (Common Code YY)

DEEC-17710	CAD for VLSI Design
DEEC-17711	Wireless Sensor Networks
DEEC-17712	Operation Research
DEEC-17713	Mobile Computing
DEEC-17714	Numerical Methods in Engineering

COURSE NAME: VLSI DESIGN
COURSE CODE: EC-17701

	L	T	P
Internal Marks: 40			
External Marks: 60	**3**	**1**	**-**

Numerical & Design Problems Content: 30%-40%

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes

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

CO	Definition	POs	PSOs
CO1	Apply the knowledge of basic MOS structure in CMOS technology.	1(H)	1(L), 3(L)
CO2	Comprehend the electrical characteristics of MOS circuits using mathematical equations.	1(H)	1(L)
CO3	Assess the effect of scaling on the performance of MOS circuits.	1(H), 2(H), 4(M)	1(M), 3(M)
CO4	Make use of hardware description language VHDL to represent digital circuit.	5(H)	3(L)
CO5	Design combinational and sequential circuits for given specifications using VHDL features.	1(H), 3(H), 5(H)	3(M)
CO6	Work in a team to construct code and design component for given application and engage in life-long learning.	1(H), 3(H), 5(H), 9(M), 12(H)	3(M)

Syllabus: **[Total Contact Hours: 42+14(T) = 56]**

Unit 1. Review of MOS Devices **[4+2=6]**

MOS Structure, NMOS, PMOS and CMOS fabrication, Enhancement & Depletion Transistor.

Unit 2.Basic Electrical Properties and Circuit Concepts **[8+3=11]**

MOS device design equations: drain current-voltage, threshold voltage, transconductance. NMOS Inverter and Transfer characteristics, pull up and pull down ratios of NMOS, alternative forms of pull up, CMOS Inverter and transfer characteristics, Latch-up in CMOS circuits.

Unit 3. Scaling of MOS Circuits [4+2=6]

Scaling Models, Scaling factors for device parameters, Limitations of Scaling.

Unit 4. Introduction to VHDL [8+3=11]

Introduction to VLSI design cycle, Computer-aided design tools for digital systems, Hardware description language: VHDL, features, Data objects, Classes and data types, Operators, Sub-programs, Overloading.

Unit 5. Architecture Modeling Styles [10+2=12]

Behavioral, structural, data flow style of modeling: Assignment statements, Sequential Statements and Process, Conditional Statements, Case Statements, Loops, Resolution Functions, Packages & Libraries, Concurrent Statements.

Unit 6. Applications of VHDL [8+2=10]

Combinational Circuit Design such as such as Multiplexers, Encoders, Decoders, Code Converters, Comparators, and Implementation of Boolean functions etc., Sequential Circuit Design such as Shift registers, Counters, Flip-flops etc.

Text Books:

1. J. Bhasker, "A VHDL Primmer", Prentice Hall PTR, 1999.
2. D. A. Pucknell and K. Eshraghian, "Basic VLSI Design", Prentice Hall India, 3rd Edition, 2003.
3. Neil H. E. Weste and K. Eshraghian, "Principle of CMOS VLSI Design: A Systems Perspective" Addison Wesley, 2000.
4. D. L. Perry, "VHDL: Programming by Example", Tata McGraw-Hill, 2002.

Reference books and other resources:

1. S. Brown and Z. Vranesic, "Fundamentals of Digital Logic with VHDL Design" McGraw-Hill Education, 2008.
2. S.- M. Kang, Y. Leblebici, "CMOS digital integrated circuits: Analysis & design", Tata McGraw-Hill, 3rd Edition, 2003.

E books and online learning materials:

5. https://www.tutorialspoint.com/vlsi_design/vlsi_design_tutorial.pdf
6. https://web.ewu.edu/groups/technology/Claudio/ee430/Lectures/L1-print.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/117106093/1
2. http://nptel.ac.in/courses/117106093/3

COURSE NAME: OPTICAL COMMUNICATION
COURSE CODE: EC-17702

Internal Marks: 40	**L**	**T**	**P**
External Marks: 60	**3**	**1**	**-**

Numerical & Design Problems Content: 20%-30%

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes

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

CO	Definition	POs	PSOs
C01	Apply the knowledge of engineeringfundamentalsfor the concept of optical fiber communication.	1(H)	1(H)
C02	Demonstrate the basic concept of degradation, fabrication and measurement techniques. employed in fibers	1(M)	1(M)
CO3	Design system components of optical sources and detectors and derive the expression for their efficiency.	3(H)	1(M), 2(H)
CO4	Select electronic components to describe the concept of Optical link design.	5(H)	3(M)
CO5	Analyze the performance of different optical amplifiers and integrated optical devices.	2(H)	1(H)
CO6	Use research-based knowledge to describe the concepts of nonlinear optical effects in optical communication system.	4(H)	1(M)

Syllabus: **[Total Contact Hours: 42+14(T)=56]**

Unit 1. Introduction **[7+2=9]**

Elements of an optical fiber transmission link, introduction to vector nature of light, propagation of light, propagation of light in a cylindrical dielectric rod, Ray model, wave model.

Unit 2. Optical Fibers **[9+4=13]**

Different types of optical fibers, Modal analysis of a step index fiber. Signal degradation in optical waveguides due to dispersion and attenuation, pulse broadening in graded-index waveguides, mode coupling, fiber fabrication: vapor-phase axial deposition, plasma-activated chemical deposition and double-crucible method. Measurement techniques: optical spectrum analyzers, optical time domain reflectometer (OTDR).

Unit 3. Optical Sources and Detectors **[8+3=11]**

Optical sources - LEDs and Lasers, Photo-detectors - pin-detectors, Avalanche photodiode, detector responsivity, noise, optical receivers. Optical link design - BER calculation, quantum limit, power penalties.

Unit 4. Optical Amplification and Integrated Optics **[8+2=10]**

Optical amplifiers – semiconductor optical amplifier, EDFA, Raman amplifier, Integrated optical devices: directional couplers, electro-optic switches, modulator, polarization transformer, frequency translators.

Unit 5. Nonlinear Optical Effects **[10+2=12]**

Nonlinear effects in fiber optic links. Concept of stimulated light scattering, self-phase modulation, four wave mixing, group velocity dispersion and solition based communication.

Text Books:

1. G. Keiser, "Optical Fiber communications", McGraw Hill Education, 3rd Edition, 2000.
2. J. M. Senior, "Optical Fiber Communications, Principles and Practices", Pearson Education, 3rd Edition, 2010.

Reference books and other resources:

1. J.E. Midwinter, "Optical Fibers for Transmission", John Wiley, 1979.
2. J. Gowar, "Optical Communication Systems", Prentice Hall India, 1987.
3. G. Agrawal, "Nonlinear Fibre Optics", Academic Press, 2nd Edition 1994.
4. G. Agrawal, "Fiber Optic Communication Systems", John Wiley and Sons, New York, 1992

Research Papers

1. **"**A comprehensive study of linear and non-linear optical properties of novel charge transfer molecular systems**"** B.A SriyankaMendis, K.M Nalin de Silva**, J**ournal of Molecular Structure: THEOCHEM, Volume 678, Issues 1–3, June 2004, Pages 31-38**.**
2. "Non-linear optical materials and applications", Y. Fainman, J. Ma, S.H. Lee, Research article Materials Science Reports, Volume 9, Issues 2–3, January 1993, Pages 53-139.

E books and online learning materials:

1. https://eceagmr.files.wordpress.com/2014/09/optical-fiber-communications-principles-and-pr.pdf
2. https://www.utdallas.edu/~torlak/courses/ee4367/lectures/FIBEROPTICS.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/117101002/34
2. http://nptel.ac.in/courses/117101002/38

COURSE NAME: ENGINEERING MANAGEMENT
COURSE CODE: EC-17703
Internal Marks: 40 **L T P**
External Marks: 60 **3 1 -**
Numerical & Design Problems Content: 10%-20%
Note: The Question paper shall have three sections:
Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes
On successful completion of this course, the students should be able to:

CO	Definition	POs	PSOs
C01	Developability to analyze and solve problems methodically as well as manage individual and team projects with appropriate consideration of engineering and financial aspects.	11(H)	
C02	Apply knowledge of economics for the analysis of engineering and management issues.	11(H)	
CO3	Develop an understanding of professional, ethical and social responsibilities as professional Engineer and manager.	8(H)	
CO4	Analyze the relationship between performance management and organizational effectiveness.	11(M)	
CO5	Explain the importance of risk management and quality management	11(H)	
CO6	Function effectively in groups and teams as a member / leader.	9(H)	

Syllabus: **[Total Contact Hours: 42+14(T)=56]**

Unit 1. Project Management **[5+1=6]**
Project and Project Management, Project life cycle, Organizational structures (functional, matrix and projectized), Importance of organizational structures.

Unit 2. Engineering Economics **[7+2=9]**
Introduction to engineering economics- Importance, Time value of money, Interest and Interest Rate, Cost analysis- Breakeven analysis, Two and three alternatives, Breakeven charts, effects of changes in fixed and variable cost, Economic life of a project, Economic analysis- Decision making in selection of alternative by Rate of Return method and Uniform Annual Cost method.

Unit 3. Leadership and Management [6+2=8]

Introduction to Leadership and Leadership Effectiveness, Qualities of a Leader, Effects of a Leader on Management performance, Team and Team Development, Evaluation of performance of a team, Relationship between a leader and its team.

Unit 4. Ethical Management [4+2=6]

Ethical responsibility towards organization, Effect of ethics on management, Corporate social Responsibility (CSR).

Unit 5. Human resource management [5+1=6]

Role of Human Resources, Strategic Planning in HRM, Recruitment Process, Training and Development, Employee Assessment.

Unit 6. Motivation of employees [6+2=8]

Need, Effects on management, Motivational Techniques, Motivational Theories (Maslow's hierarchy of needs, Herzberg's two-factor theory, Vroom's expectancy theory and Locke's goal theory).

Unit 7. Risk and Risk Management [4+2=6]

Types of risks, Effects of risk on management, Risk management strategies, Risk reduction strategies.

Unit 8. Quality Management [5+2=7]

Scope, Benefits of standardization, Quality Planning, Quality Assurance, Configuration Management.

Text Books:

1. K.R. Singhal and R. Singhal, "Engineering Economics and Industrial Management", Kataria and Sons, 1st Edition, 2014.
2. G. Dessler, "Human Resource Management" Pearson Publications, 13th edition, 2011
3. K. Nagarajan, "Project Management", New Age International Publishers, New Delhi, 3rd edition, 2007.

Reference books and other resources:

1. B. Patnayak, "Human Resource Management", PHI, 3rd Edition, 2010.
2. K. Schwalbe, "An Introduction to Project Management", Paperback, 5th Edition, 2015.
3. G.J. Thuesen, W.J. Fabrycky, "Engineering Economy" Prentice Hall, 2001.
4. C. E. Bullinger, "Engineering Economic Analysis" Tata McGraw Hill, 1950.
5. "Engineering Economic Analysis" Available (online) [http://www.nptel.ac.in/courses/112107209]

E books and online learning materials:

1. https://www.robertfreund.de/blog/wp-content/uploads/2014/05/anisic-freund-susic-2013.pdf
2. https://www.researchgate.net/profile/Osama_Suleiman_Khayal/publication/305709980_project_management/links/591c18dda6fdcc701fd2bcbe/project-management.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/110102058/4
2. http://nptel.ac.in/courses/110102058/22

COURSE NAME: CMOS BASED DESIGN
COURSE CODE: DEEC-17704
Internal Marks: 40 **L T P**
External Marks: 60 **3 1 -**
Numerical & Design Problems Content: 20%-30%
Note: The Question paper shall have three sections:
Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes
On successful completion of this course, the students should be able to:

CO	Definition	POs	PSOs
CO1	Comprehend the basic knowledge of MOS structures, MOS models, MOS scaling and its effects.	1(H)	1(M)
CO2	Demonstrate the process steps and issues related to CMOS fabrication and manufacturing process.	4(M)	1(M)
CO3	Apply the concept of stick diagrams and layout design rules for formation of CMOS based circuits.	5(M)	2(H)
CO4	Analyze MOS circuit characteristics, performance parameters, various interconnect parasitic elements and scaling factors.	2(H)	2(M)
CO5	Design solutions for different logic circuits using pass transistor logic, static and dynamic CMOS circuits.	5(H)	3(H)
CO6	Implement efficient techniques at circuit level for improving power and speed of combinational and sequential circuits.	2(H)	3(M)

Syllabus: **[Total Contact Hours: 39+13(T)=52]**

Unit 1. Introduction to MOS device **[9+3=12]**
Introduction to IC Technology, Basic MOS Transistor (enhancement and depletion mode), NMOS process, CMOS process (P-well, N-well and twin-tub). MOS models, MOS structure capacitance, Non ideal I-V effects, Mobility degradation and velocity saturation, channel length modulation, threshold voltage effects, Leakage, temperature and geometry dependence, Resistive operation, saturation region, body effect, DC transfer characteristics, Tristate inverters, Hotcarrier effect, drain current v/s voltage charts, sub threshold conduction.

Unit 2. CMOS Processing **[9+2=11]**

CMOS technologies, wafer formation photolithography channel formation, isolation, gate oxide, gate source, drain formation, contacts and metallization, layout design rules, design rule checking. CMOS process enhancement, fabrication and manufacturing issues, CMOS layout and stick diagrams.

Unit 3. Circuit Characterization & Performance Estimation [9+3=12]

Delay estimation , delay models, inverter design using delay constraints, sources of power dissipation, estimation of interconnect parasitic, calculation of interconnect delay, reliability, variability, transistor sizing, Scaling models, scaling factor for device parameters, Advantages and Limitations of scaling.

Unit 4. Design of Combinational & Sequential Circuits [12+5=17]

Static CMOS design, complementary CMOS, static properties, complementary CMOS design, Power consumption in CMOS logic gates, dynamic or glitching transitions, Design to reduce switching activity, Radioed logic, DC VSL, pass transistor logic, Differential pass transistor logic, sizing of level restorer, sizing in pass transistor, Dynamic CMOS design, Domino logic, optimization of Domino logic, NPCMOS, Implement efficient techniques at circuit level for improving power and speed of combinational and sequential circuits, Designing logic for reduced supply voltages, Pitfalls and Fallacies, sequencing static circuits and circuit design of latches and flip flops.

Text Books:

1. Weste& Harris, CMOS VLSI Design: A Circuits and Systems Perspective, 3rd ed, Addison Wesley, 2005.
2. Nail H.E. Weste, David Harris, Ayan Banerjee, ―CMOS VLSI DESIGN‖ , Pearson Education.

Reference books and other resources:

1. Jan M Rabaey, Digital Integrated Circuits, 2nd Edition, Pearson Education, 2003.
2. Patterson& Hennessy, Computer Organization & Design, 2nd ed, Morgan Kaufmann, 1998.
3. Sung-Mo Kang, CMOS Digital Integrated Circuits, 3rd Edition, McGraw-Hill, 2003.
4. Kang and Leblebici ―CMOS Digital integrated circuits‖, TMH 2003.
5. Wayne Wolf, ―Modern VLSI Design ", 2nd Edition, Prentice Hall, 1998.

E books and online learning materials:

1. https://www.ucursos.cl/usuario/9553d43f5ccbf1cca06cc02562b4005e/mi_blog/r/CMOS_Circuit_Design__Layout__and_Simulation__3rd_Edition.pdf
2. http://www.rnbs.hiroshima-u.ac.jp/RCNS/lecture/pdf/HJM_H20/OHP_CMOS_5(H20-5-9).pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/117101105/1
2. http://nptel.ac.in/courses/117101105/3

COURSE NAME: BIOMEDICAL ELECTRONICS
COURSE CODE: DEEC-17705

	L	T	P
Internal Marks: 40			
External Marks: 60	**3**	**1**	**-**

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes

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

CO	Definition	POs	PSOs
C01	Apply the knowledge of signals in determining the output.	1(H)	1(M)
C02	Demonstrate the methods for recording and measuring various bio potentials	1(M)	1(M)
CO3	Comprehend the basic concept of imaging system and apply in biomedical domain.	1(M)	1(L)
CO4	Select and utilize electronic equipments for solving electronics circuit problems.	5(H)	1(M)
CO5	Analyze performance of different types of therapeutic equipments.	2(H)	1(H)
CO6	Design an application by working in a team comprising of medical experts.	3(M), 9(H)	1(M)

Syllabus: **[Total Contact Hours: 39+13= 52]**

Unit 1. Measuring, Recording and Monitoring Instruments [8+3=11]

MEMS, Bioelectric signals, electrodes, biosensors, ECG, EEG, Oximeters, Biotelemetry, Clinical data Interchange Standards, Cyber Medicine, Spirometry, Pulmonary Function Analyzers, Blood cell counters.

Unit 2. Modern Imaging Systems [11+4=15]

Basics of Diagnostic Radiology, X-ray machine, Visualization of X-rays, Physical parameters for X-ray Detectors, Principle of NMR Imaging system, Image reconstruction techniques, Basic NMR components, Biological effect of NMR imaging, Advantages of NMR imaging system.

Unit 3. Ultrasonic Systems [9+3=12]

Basics of diagnostic radiology, Diagnostic Ultrasound, Physics of Ultrasonic waves, Medical ultrasound, Three-dimensional ultrasound imaging systems, Portable ultrasound systems

Unit 4. Therapeutic Equipment [11+3=14]

Need for Cardiac pacemakers, Implantable pacemakers, DC Cardiac defibrillators, Surgical Diathermy, Physiotherapy equipment, Electrotherapy equipment, Capnography, Radiotherapy equipment, Laser applications in Biomedical field.

Text Book:

1. R. S. Khandpur, "Magnetic Resonance Imaging System", in Handbook of Biomedical Instrumentation, Third Edition, New Delhi, India: McGraw Hill Education, 2014.

Reference books and other resources:

1. Joseph J. Carr and John M. Brown, "Introduction to Biomedical EquipmentTechnology", John Wiley and Sons, New York, 2004.
2. Leislie Cromwell, "Biomedical Instrumentation and Measurement", Prentice Hall ofIndia, New Delhi, 2007.

E books and online learning materials:

1. http://www.home-machine-shop.com/Intro_Medical_Electronics_Applications.pdf
2. http://www.robots.ox.ac.uk/~gari/teaching/b18/lecture_slides/B18_LectureA.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/117108037/11
2. http://nptel.ac.in/courses/117108037/15

COURSE NAME: SATELLITE COMMUNICATION
COURSE CODE: DEEC-17706

	L	T	P
Internal Marks: 40			
External Marks: 60	**3**	**1**	**-**

Numerical & Design Problems Content: 20%-30%

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes

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

CO	Definition	POs	PSOs
C01	Comprehend the basic concept of Satellite Systems and apply in different domains.	1(H)	1(L)
C02	Develop an understanding of Kepler's laws, satellite orbital elements and the Space segment.	2(M)	1(M)
CO3	Comprehend the basic concept of propagation impairments. in Satellite Systems	1(M)	1(L)
CO4	Design and analyze Satellite System Link budget.	5(H)	1(H)
CO5	Analyze performance of different types of Multiple Access systems	2(H)	1(M)
CO6	Explain the importance of various Satellite applications & Specialized services.	1(H)	1(M)

Syllabus: **[Total Contact Hours: 39+13=52]**

Unit-1. Introduction to Satellite Communication **[5+1=6]**

Historical evolution of Satellite Communication, Frequency allocation of Satellite Services, INTELSAT, Applications, Future trends in Satellite Communication.

Unit-2. Orbital Mechanism and Space Segment **[8+4=12]**

Kepler's laws of planetary motion, terms used for earth orbiting satellites, orbital elements, Geostationary orbit and non-Geostationary orbits, Angle of azimuth & Angle of elevation, Satellite Attitude Control, Satellite Station Keeping ; Telemetry, Tracking, Command & Monitoring (TTC&M); Transponder.

Unit-3. Propagation impairments [5+3=8]

Propagation impairments**:** Atmospheric loss, Ionospheric effects, Rain attenuation, Depolarization, Tropospheric scintillation, Cloud attenuation and other impairments.

Unit-4. Satellite Link design [8+2=10]

Basic transmission theory, System Noise Temperature, C/N and G/T ratios, Satellite Downlink design- link budget, Uplink design, System design examples.

Unit-5. Satellite Access [7+2=9]

Multiple access schemes**:** FDMA **:** Fixed assigned FDMA, Demand Assigned FDMA-SPADE System, TDMA **:** Frame Structure, Reference Burst structure, Traffic burst structure, Frame acquisition & synchronization, Fixed assigned TDMA, Demand assigned TDMA, Introduction to CDMA.

Unit-6. Satellite Services [6+1=7]

INSAT, VSAT, Mobile satellite services-GPS, Satellite Navigation system, Direct Broadcast satellite(DBS)-television **,** Digital Audio Broadcast (DAB).

Text Books:

6. T. Pratt, C. Bostian& J. Allnutt, 'Satellite Communications', 2nd Ed., Wiley India, New Delhi, 2008
7. D. Roddy, 'Satellite Communications',4th Ed., Tata Mc-Graw-Hill, New Delhi, 2009.

Reference books:

8. A. K. Maini and V. Agrawal, 'Satellite Communications',1st Ed., Wiley India Pvt. Ltd., New Delhi, 2010
9. Tri T.Ha, 'Digital Satellite Communications',2nd Ed., Tata McGraw-Hill, New Delhi, 2009
10. Dr. D. C. Agarwal, ' Satellite Communications', 6th Ed., Khanna Publishers,2008

E books and online learning materials:

1. http://archive.mu.ac.in/myweb_test/Satelight%20Comm..pdf
2. https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-851-satellite-engineering-fall-2003/lecture-notes/l21satelitecomm2_done.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/106105082/4
2. http://nptel.ac.in/courses/106105082/15

COURSE NAME: SPEECH & IMAGE PROCESSING
COURSE CODE: DEEC-17707
Internal Marks: 40 **L T P**
External Marks: 60 **3 1 -**
Numerical & Design Problems Content: 20%-30%
Note: The Question paper shall have three sections:
Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes
On successful completion of this course, the students should be able to:

CO	Definition	POs	PSOs
CO1	Apply the basics of digital image processing	1(H), 3(H)	1(L)
CO2	Analyze image transforms and enhancement techniques in time and frequency domains	1(H),2(H)	1(H)
CO3	Analyze and interpret the color and multispectral aspects of three dimensional images	1(H),4(H)	1(H),2(L)
CO4	Use artificial intelligence techniques for processing speech	4(H)	1(H),2(L)
CO5	Develop solutions for speech processing systems with concern to societal needs	3(H)	1(H)
CO6	Interpret and synthesize speech signals to develop speech processing systems	4(H)	1(H)

Syllabus: **[Total Contact Hours: 40+13(T)=53]**

Unit 1. Digital Image Fundamentals **[6+2=8]**
Origin of digital image processing, fundamental steps & components of digital image processing, Elements of visual perception, light electromagnetic spectrum, image sensing &acquistion, image sampling & quantization, Connectivity and Relations between Pixels.

Unit 2. Image transforms and enhancement **[9+4=13]**
Image Transforms: 2D Orthogonal and Unitary Transforms: Properties and Examples,2D DFT,FFT, DCT, Hadamard Transform, Haar Transform, Slant Transform, KL Transform: Properties and Examples.

Image Enhancement:Histogram modeling, equalization and modification, Image smoothing, Image crispening.

Unit 3. Color and multispectral image processing [8+3=11]

Color Image Processing Fundamentals, RGB Models, HSI Models, Relationship Between Different Models. Multispectral Image Analysis , Color Image Processing Three Dimensional Image Processing, Computerized Axial Tomography, Stereometry, Stereoscopic Image Display, Shaded Surface Display.

Unit 4. Representation of speech and speech production [9+2=11]

Models of Speech production:Human speech production mechanism, acoustic theory of speech production, digital models for speech production, Perception of Loudness, Critical bands, Pitch perception, Auditory masking.

Unit 5. Automatic speech recognition (ASR) [8+2=10]

The Decision processes in ASR, Representative recognition performance, Principle Component Analysis, Singular Value Decomposition, Usage of Artificial Intelligence and Linear algebra in Speech processing.

Text Books:

1. Rafael C. Gonzalez and Richard E. Woods: Digital Image Processing, Addison-Wesley, 1992
2. T.F. Quatieri: Discrete-time Speech Signal Processing, Prentice-Hall, PTR, 2001.

Reference books:

1. Anil K. Jain: Fundamentals of Digital Image Processing, Prentice Hall, 1989.
2. William K. Pratt: Digital Image Processing, 4th Edition, John Wiley & Sons Inc., 2007.
3. Kenneth R. Castleman: Digital Image Processing, Prentice Hall, 1996.
4. Lawrence R. Rabiner and Ronald. W. Schafer: Introduction to Digital speechprocessing, now publishers USA, 2007.

E books and online learning materials:

1. https://www-i6.informatik.rwthaachen.de/web/Teaching/Lectures/WS06_07/Signal/skript.pdf
2. http://cpsc.yale.edu/sites/default/files/files/tr474.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/117105145/1
2. http://nptel.ac.in/courses/117105079/17

COURSE NAME: HUMAN RESOURCE MANAGEMENT
COURSE CODE: DEEC-17708

Internal Marks: 40	**L**	**T**	**P**
External Marks: 60	**3**	**1**	**-**

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course outcomes:

On completion of syllabus students will be able to:

CO	Definition	POs	PSOs
CO1	Interpret planned keys of human resources to function within organization.	7(H)	1(L)
CO2	Discover current issue, trends, processes and practices in HRM.	8(M)	1(L)
CO3	Develop &Extend employability skills to work as an individual and as a group for all workspaces.	9(H)	1(L)
CO4	Combine employee's performance management and organizational effectiveness.	11(H)	1(L)
CO5	Apply contextual knowledge to assess social and legal issues in an organization.	6(H)	1(L)
CO6	Utilize oral and written skills to communicate effectively on engineering activities in organization.	10(H)	1(L)

Syllabus: **[Total Contact Hours: 40+13=53]**

Unit 1. Introduction to Human Resource **[6+2=8]**

Definition, Role and Functions of Human Resource Management, Concept and Significance of HR, Role of HR managers, HR functions and Global Environment.

Unit 2. Human Resources Planning **[9+3=12]**

Need and Process for Human Resource Planning, Methods of Recruitment, The Process of Human Resource Planning, Difficulties in human resource planning, Recruitment and selection processes, Sources of Recruitment, Restructuring strategies, Placement and Induction, Retention of Employees, , Employment Exchanges.

Unit 3. Training and Development [9+3=12]

Principles of Training, Employee Development, Need for skill up gradation, Assessment of training needs, Retraining and Redeployment methods and techniques of training employees and executives, performance and potential appraisal systems, 360 degree appraisal and feedback, Career Development & Planning.

Unit 4. Job analysis, Design and Satisfaction [9+3=12]

Job Analysis & Job Description, Job Specification, Job Specification versus Job Description, Job satisfaction, Motivation, Factors affecting motivation, Theories of Motivation, Quality of work life.

Unit 5. Industrial Relations [7+2=9]

Factors influencing industrial relations, State Interventions and Legal Framework, Role of Trade unions, Structure of Trade Unions, Collective Bargaining, Worker's participation in management.

Text Books:

1. Gary Dessler, Human Resource Management (8th ed.), Pearson Education, Delhi
2. A Minappa and M. S. Saiyada - Personnel Management (Tata Mc. Graw-Hill)

Reference Books:

1. T.N.Chhabra- Human Resource Management (DhanpatRai& Co.).
2. BiswajeetPatanayak, Human Resource Management, PHI, New Delhi

E books and online learning materials:

1. http://archive.mu.ac.in/myweb_test/M.Com.%20Study%20Material/Human%20Res.%20Management%20-%20M.%20Com%20-%20I.pdf
2. https://openaccess.leidenuniv.nl/bitstream/handle/1887/22381/ASC-075287668-3030-01.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/122105020/1
2. http://nptel.ac.in/courses/122105020/7

COURSE NAME: COMPUTER ORGANIZATION AND ARCHITECTURE
COURSE CODE: DEEC-17709
Internal Marks: 40 **L T P**
External Marks: 60 **3 1 -**
Numerical & Design Problems Content: 20%-30%
Note: The Question paper shall have three sections:
Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes
On successful completion of this course, the students should be able to:

CO	Definition	POs	PSOs
CO1	Able to describe the structure and functioning of a digital computer, operating system and digital components.	1(H),2(H)	2(H)
CO2	Able to explain the generic principles that underlie the building of digital computer, digital logic and processor programming.	2(H),4(H),5 (M)	2(H),3(H)
CO3	Comprehend the architecture and organization of computers	1(M),5(M)	3(H)
CO4	Describe the memory organizations in a computer system	1(M),5(L)	2(H),3(M)
CO5	Explain the concept of sequencing and memory management in an operating system.	1(M),5(L)	2(M)
CO6	Discuss the hardware and software performance issues in a multi-core organization	1(M),5(L),6 (M),11(M)	3(M)

Syllabus: **[Total Contact Hours:38+13(T)=51]**

Unit 1. Introduction **[10+3=13]**
Organization and Architecture, Structure and Function, Brief history of Computers, Designing for performance, Performance metrics: MIPS, MFLOPS, Computer Components and Functions, Interconnection Structures, Bus Interconnection, Point-to-Point Interconnect, PCI Express, Flynn's classification of Computers (SISD, MISD, MIMD), Error Detection and Correction.

Unit 2. Internal and Cache Memory **[9+3=12]**
Computer Memory System Overview, Cache Memory Principles, Elements of Cache Design, Pentium 4 Cache Organization, Semiconductor Main Memory, Advanced Drum Organization

Unit 3. Basic non Pipeline CPU Architecture and Operating System [10+4=14]

CPU Architecture, types(accumulator, register, stack, memory/register) detailed data path of a typical register based CPU, Fetch-Decode-Execute cycle (typically 3-5 stage), microinstruction sequencing, implementation of control unit, Enhancing performance with pipelining, Operating system overview, Scheduling, Memory Management, Pentium Memory Management, RISC v/s CISC.

Unit 4. Parallel Processing and Multi-Core computer [9+3=12]

Multiple Processor Organizations, Symmetric Multiprocessors, Cache Coherence and the MESI protocol, Multithreading and Chip Multiprocessors, Clusters, Non-Uniform Memory Access, Vector Computation, Multi-Core Computers, Hardware and Software Performance Issues, Multi-Core Organization, Intelx86 Multi-Core Organization

Text Books:

1. William Stallings, Computer Organization and Architecture, 9/E Pearson, Delhi.

Reference Books:

1. Computer Architecture and Organization, 3rd Edition, John P. Hayes, 1998, TMH.

E books and online learning materials:

1. http://www.cse.iitm.ac.in/~vplab/courses/comp_org/LEC_INTRO.pdf
2. http://nptel.ac.in/courses/106103068/pdf/coa.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/106103068/1
2. http://nptel.ac.in/courses/106103068/5

COURSE NAME: CAD FOR VLSI DESIGN
COURSE CODE: DEEC-17710

	L	T	P
Internal Marks: 40			
External Marks: 60	**3**	**1**	**-**

Numerical & Design Problems Content: 5%-10%

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes

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

CO	Definition	POs	PSOs
C01	Comprehend the VLSI design cycle, various design styles and basic concept of data structures & algorithms.	1(H)	1(H)
C02	Demonstrate the MOS fabrication process and different layout design rules.	1(M)	1(M)
CO3	Implement different Partitioning, Placement and constraints Graph algorithms.	3(M)	2(H)
CO4	Design solutions for problems related to flooplanning and routing algorithms	3(H)	3(M)
CO5	Apply the fundamental concepts of verilog language &various modeling and simulationin digital design system.	5(H)	2(M)
CO6	Analyze the various synthesis and scheduling algorithm in CAD VLSI.	2(H)	3(M)

Syllabus: **[Total Contact Hours: 39+13(T)=52]**

Unit 1.Introduction **[8+3=11]**

Introduction to design methodologies, VLSI Design Cycle, Design styles: full-custom, standard-cell, gate-array and FPGA. Review of Data structures and algorithms, Review of VLSI Design automation tools, Algorithmic Graph Theory and Computational Complexity, Tractable and Intractable problems, general purpose methods for combinatorial optimization.

Unit 2.Design Rules, Partitioning & Placement **[8+3=11]**

Review of MOS/CMOS Fabrication Technology, Layout Compaction, Design rules, problem formulation, algorithms for constraint graph compaction, placement and partitioning: Circuit

representation and problem formulation, Placement algorithms, Partitioning algorithms; Kernighan Lin (K-L) and FiducciaMattheyses (FM).

Unit 3. Floor Planning & Routing [8+3=11]

Floor planning concepts, shape functions and floor plan sizing, Types of local routing problems , Area routing, channel routing, global routing, overview of clock and power routing, algorithms for global routing.

Unit 4. Simulation [7+2=9]

Simulation, Gate-level modeling and simulation, Switch-level modeling and simulation, an overview of Verilog language.

Unit 5.Modelling and Synthesis [8+2=10]

Logic synthesis and verification, High level Synthesis, Hardware models, internal representation, Allocation, assignment and scheduling, Simple scheduling algorithm, Assignment problem, High level transformations.

Text Books:

1. S.H. Gerez, "Algorithms for VLSI Design Automation", John Wiley & Sons, 2002.
2. N.A. Sherwani, "Algorithms for VLSI Physical Design Automation", Third Edition,Springer, 2013.
3. J. Bhasker, "Verilog VHDL synthesis: a practical primer", Star Galaxy publishing 1998.

Reference books and other resources:

1. Drechsler, Rolf, "Evolutionary Algorithms for VLSI CAD" Springer Science & Business Media, 1998.
2. Trimberger, Stephen M., "An Introduction to CAD for VLSI", Springer Science & Business Media, 1987.
3. Sadiq M. Sait and H. Youssef, "VLSI Physical Design Automation: Theory and Practice", World Scientific, 1999
4. Cormen, Thomas H., Charles E. Leiserson, and Ronald L. Rivest. "Introduction to Algorithms." The MIT Press, 3rd edition, 2009.
5. Steven M.Rubin, "Computer Aids for VLSI Design", Addison Wesley Publishing 1987.
6. D.D. Gajski, N.D. Dutt, A.C. Wu and A.Y. Yin, "High-level synthesis: introduction to chip and system design", Kluwer Academic Publishers, 1992.
7. M. Sarrafzadeh and C.K. Wong, "An introduction to physical design", McGraw Hill, 1996.
8. M. Sarrafzadeh and C.K. Wong, Introduction to VLSI Physical Design, Fourth Edition, McGraw-Hill., 1996.
9. Charles J. Alpert, Dinesh P. Mehta, Sachin S. Sapatnekar, Handbook of Algorithms foR Physical Design Automation, Auerbach Publications (CRC Press), 2008.
10. S.K. Lim, Practical Problems in VLSI Physical Design Automation, Springer, 2008.

11. Palnitkar, Samir, “Verilog HDL”, Prentice Hall PTR, 2nd edition, 2003

E books and online learning materials:

1. http://nptel.ac.in/courses/IIT-MADRAS/CAD_for_VLSI_Design_I/pdf/nptel-cad1-01.pdf
2. http://www.serc.iisc.ernet.in/~viren/Courses/2010/E0285/Lecture2.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/106106088/1
2. http://nptel.ac.in/courses/106106088/6

COURSE NAME: WIRELESS SENSOR NETWORKS
COURSE CODE: DEEC-17711
Internal Marks: 40 **L T P**
External Marks: 60 **3 1 -**
Numerical & Design Problems Content: 10%-20%
Note: The Question paper shall have three sections:
Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes
On successful completion of this course, the students should be able to:

CO	Definition	POs	PSOs
C01	Apply the knowledge of working principle of wireless sensor networks for utilization in different applications.	1(H)	1(M)
C02	Demonstrate the basic concept of wireless sensor network's architecture along with Constraints and Challenges of wireless sensor networks for utilization in different applications.	1(M)	1(M)
CO3	Select and utilize the best topology control system for wireless sensor networks in different applications.	1(M)	1(L), 3(M)
CO4	Demonstrate various Wireless Sensor Network platforms and tools.	3(H)	3(M)
CO5	Design transceiver and protocol for Wireless Sensor Network.	5(H)	1(M)
CO6	Describe the concept of VANET (Vehicular Adhoc Networks).	2(H)	1(H)

Syllabus: **[Total Contact Hours: 39+13(T)= 52]**

Unit 1. Introduction to Wireless Sensor Networks **[9+3=12]**
Constraints and Challenges of sensor networks, Emerging technologies for wireless sensor networks, Node architecture, Hardware components overview, Energy consumption of Sensor nodes, Dynamic energy and power management on System level, some examples of Sensor nodes, Optimization goals and figures of merit, QOS, Energy Efficiency, scalability, robustness. Advantages of sensor networks, Sensor network applications.

Unit 2. Topology Control **[8+2=10]**
Location driven, Geographic Adaptive Fidelity (GAF), Geographic Random Forwarding

(GeRaF),GEAR, Connectivity driven, SPAN, ASCENT.

Unit 3 WSN Sensors [9+4=12]

Physical Layer Design, Transceiver Design, MAC Protocols for WSN, Low Duty Cycle Protocols & Wakeup Concepts, S-MAC, Mediation Device Protocol, Wakeup Radio Concepts, Address &Name Management, Assignment of MAC Addresses, Routing Protocols, Energy Efficient Routing, Geographic Routing.

Unit 4 WSN Platforms & Tools [8+2=10]

Sensor Node Hardware, Berkeley Motes, Programming Challenges, Node-level software platforms, Node level Simulators, State-centric programming.

Unit 5 VANET (Vehicular Adhoc Networks) [5+2=7]

Introduction and Motivation, V2X Communication Scenarios and Requirement, Architecture of ITS station, Regional Regulations.

Text Books:

1. Holger Karl & Andreas Willig, " Protocol and Architecture for wireless sensor networks, John Wiley 2005.
2. Feng Zhao & Leonidas J. Guibas, "Wireless sensor Networks-An Information Processing Approach", Elesevier,2007.
3. Riccardo Scopigno, AntonellaMolinaro, Claudia Campolo, "Vehicular ad hoc Networks: Standards, Solutions, and Research", Springer, 2015.

Reference Books:

1. WaltenegusDargie and Christian Poellabauer, "Fundamentals of Wireless Sensor Networks Theory and Practice", John Wiley and Sons,first edition,2010.
2. Holger Karl & Andreas Willig, "Protocol and Architecture for wireless sensor networks, John Wiley 2007.

E books and online learning materials:

1. http://cdn.intechopen.com/pdfs/38793/InTechOverview_of_wireless_sensor_network.pdf
2. http://image.sciencenet.cn/olddata/kexue.com.cn/bbs/upload/12615WSN-2007.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/106105160/21
2. http://nptel.ac.in/courses/106105160/24

COURSE NAME: OPERATION RESEARCH
COURSE CODE: DEEC-17712

	L	T	P
Internal Marks: 40			
External Marks: 60	**3**	**1**	**-**

Numerical & Design Problems Content: 80%-85%

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. Section B shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. Section C shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of Section C may be sub–divided (if required) into two parts of five (05) marks each**.**

Course Outcomes

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

CO	Definition	POs	PSOs
C01	Be able to illustrate characteristics of different types of decision making environments and appropriate decision making approaches and tools to be used in each type	1(M)	2(M)
C02	Solve linear programming problems using graphical method and simplex method	1(H), 3(L), 4(M) 12(L)	2(M)
CO3	Construct solution for solving transportation problem using transportation model.	1(M), 3(M)	2(M)
CO4	Apply Hungarian method to solve assignment problem.	1(M), 3(M), 5(L)	2(M)
CO5	Solve sequencing problems using Johnson's algorithm.	1(M), 3(M), 5(L)	2(M)
CO6	Apply dynamic programming for various problem solving fields.	1(M), 3(M)	2(M)
CO7	Implement games theory, which is mathematical theory for decision making.	1(M), 3(M)	2(M)

Syllabus: **[Total Contact Hours: 40+13(T)= 53]**

Unit 1. Introduction to Operation research **[5+2=7]**

Introduction, Historical Background, Scope of Operations Research , Features of Operations Research, Phases of Operations Research, Types of Operations Research Models, Operations Research Methodology, Operations Research Techniques and Tools , Structure of the Mathematical Model, Limitations of Operations Research

Unit 2. Linear Programming **[9+3=12]**

Introduction, Linear Programming Problem, Requirements of LPP, Mathematical Formulation of LPP, Graphical Methods to Solve Linear Programming Problems, Applications, Advantages, Limitations Some Exceptional Cases, Standard Form of LPP, Fundamental theorem of LPP, Solution of LPP – Simplex Method, The Simplex Algorithm, Penalty Cost Method or Big M-method, Two Phase Method, Solved Problems on Minimisation, degeneracy and unbound solutions, procedure for resolving degenerate cases. Concept of duality, Importance of Duality Concepts, Formulation of Dual Problem, Economic Interpretation of Duality,

Unit 3. Transportation Problem **[8+2=10]**

Formulation of transportation model, Optimality Methods, Unbalanced transportation problem, Basic feasible solution, Northwest corner rule, least cost method, Vogel's approximation method, MODI method. Applications of Transportation problems, Assignment Problem, Formulation, Hungarian method, unbalanced assignment problem, Travelling salesman problem.

Unit 4. Sequencing Model **[6+2=8]**

Johnsons algorithm, Processing n Jobs through 2 Machines, Processing n Jobs through 3 Machines, Processing 2 Jobs through m machines, Processing n Jobs through m Machines, Graphical solutions priority rules.

Unit 5. Dynamic Programming **[6+2=8]**

Characteristics of dynamic programming, Dynamic programming approach for Priority Management employment smoothening, capital budgeting, Stage Coach/Shortest Path, cargo loading and Reliability problems.

Unit 6. Games Theory **[6+2=8]**

Competitive games, rectangular game, saddle point, minimax (maximin) method of optimal strategies, value of the game. Solution of games with saddle points, dominance principle. Rectangular games without saddle point – mixed strategy for 2 × 2 games.

Text Books:

1. Hamdy A. Taha, "Operations Research – An introduction", Prentice Hall, 8th Edition, 2007.
2. J K Sharma., "Operations Research Theory &Applications , Macmillan India Ltd , 3rd edition, , 2007**.**

Reference books and other resources:

1. A.M. Natarajan, P. Balasubramani, A. Tamilarasi, "Operations Research", Pearson Education, 2005.
2. P. K. Gupta and D. S. Hira, "Operations Research", S. Chand & co., 2007

E books and online learning materials:

1. http://164.100.133.129:81/econtent/Uploads/Operations_Research.pdf
2. http://public.tepper.cmu.edu/jnh/tutorialLSE.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/112106134/1
2. http://nptel.ac.in/courses/112106134/3

COURSE NAME: MOBILE COMPUTING
COURSE CODE: DEEC-17713

	L	T	P
Internal Marks: 40			
External Marks: 60	**3**	**1**	**-**

Numerical & Design Problems Content: 20%-30%

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes

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

CO	Definition	POs	PSOs
C01	Define overview of wireless telephony and issues in mobile computing.	1(M)	2(M)
C02	Develop channel structure, air interfaces and architecture of GSM.	3(M)	2(M)
CO3	Explain the mobile networks and protocols related to transport layer.	1(M)	2(M)
CO4	Define the wireless application protocol and overview of wireless LAN.	1(M)	2(L)
CO5	Describe the various algorithms related to mobile Adhoc networks	1(M)	2(M)
CO6	Explain various properties and architecture of Mobile Adhoc Networks	1(M)	2(M)

Syllabus: **[Total Contact Hours:38+13(T)=51]**

Unit 1. Introduction **[9+3=12]**

Introduction, issues in mobile computing, overview of wirelesstelephony: cellular concept, frequency reuse, hand off strategies, channel assignment, channel interferences, GSM: services and features, GSM system architecture, GSM channel structure, air interfaces.

Unit 2. Mobile Network & Transport Layer **[10+3=13]**

Mobile IP Goals, assumptions, entities andterminology, IP packet delivery, agent advertisement and discovery, registration, tunneling and encapsulation, Dynamic Host Configuration Protocol (DHCP), Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission /time-out freezing, Selective retransmission, Transaction oriented TCP.

Unit 3. Wireless Networking [10+2=12]

Wireless LAN Overview: MAC issues, IEEE 802.11, BlueTooth, Wireless multiple access protocols, TCP over wireless, Wireless applications, data broadcasting, Mobile IP, WAP:Architecture, protocol stack, application environment, applications.

Unit 4. Mobile Ad hoc Networks [9+2=11]

Mobile Agents computing, security and fault tolerance,transaction processing in mobile computing environment, Mobile Ad hoc Networks (MANETs): Overview, architecture of MANET, Properties of a MANET, application of MANET, various routing algorithms, security in MANETs.

Text Books:

1. J. Schiller, Mobile Communications, Addison-Wesley, second edition, 2004.
2. Theodore S Rappaport , wireless communications : principles & practice, second edition, Pearson publications.

Reference Books:

1. Raj Pandya, Mobile & Personal Communication Systems and Service, PHI.
2. Asoke k Talukder ,Roopa R Yavagal, Mobile Computing , Technology, Application &Service Creation. Tata McGraw HillStojmenovic and Cacute, ―Handbook of Wireless Networks and Mobile Computing‖, Wiley, 2002.

E books and online learning materials:

1. https://disco.ethz.ch/courses/ss04/mobicomp/lecture/1/Chapter1Introduction4Slides.pdf
2. https://www.cse.iitk.ac.in/users/rkg/Talks/mobile_main.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/106106147/6
2. http://nptel.ac.in/courses/106106147/9

COURSE NAME: NUMERICAL METHODS IN ENGINEERING
COURSE CODE: DEEC-17714

	L	T	P
Internal Marks: 40			
External Marks: 60	**3**	**1**	**-**

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes

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

CO1 Analyze absolute, relative and percentage error.
CO2 Solve the system of linear equations.
CO3 Solve the system ofnon linear equations.
CO4 Solvethe stability and fracture problems with the help of lowest eigen value.
CO5 Describe the process of interpolation.
CO6 Solve the equations which have no solution using numerical integration.
CO7 Solve first and second order ordinary differential equation.

Syllabus: **[Total Contact Hours: 42+14(T)= 56]**

Unit 1. Error Analysis **[5+2=7]**

Exact and Approximate numbers, rounding of numbers, Significant digits, correct digits, various types of errors encountered in computations, Propagation of errors.

Unit 2. Solution of system of linear equations **[6+2=8]**

(I) Direct/Indirect Methods: Gauss elimination method without pivoting and with pivoting, LU-decomposition method
(II) Iterative methods, Jacobi and Gauss- Seidal methods.

Unit 3. Roots of Non linear equations **[6+2=8]**

Bisection method, Regulafalasi method, Newton Raphson method, direct iterative method with convergence criteria, Newton Raphson method for solution of a pair of non linear equation.

Unit 4. Eigen Values and Eigen Vectors **[5+1=6]**

Dominant and Smallest values/Eigen vectors by power method.

Unit 5. Interpolation **[6+2=8]**

Finite Difference operator and their relationships, Difference tables, Newton, Bessel and Stirling interpolation formulae, Divided Differences, Lagranges Interpolation and Newton's divided interpolation.

Unit 6.First and second order derivative by various interpolation formulae. **[4+1]**

Unit 7.Numerical Integration **[6+2=8]**

Trapezoidal, Simpson's 1/3 and 3/8 rule with errors and their combination, Boole's and Weddle Rule.

Unit 8.Solution of first and second order ordinary differential equation **[5+2=7]**

Picard's method, Taylor's series method, Eulers Method, Modified Euler's method-K method and Mile's Predictor-corrector method.

Text Books:

1. Jain M.K, Iyengar, S.R.K and Jain RK Numerical Methods for Scientific and Engg. Computation, New Age Pvt. Pub New Delhi.
2. Krishnamurthy, E.V and Sen, S.K., Applied Numerical Analysis East west Publication.
3. Rao V,Dukkipati, New Age International Publishers.

Reference books:

1. Gerald.C.F and Wheatly,P.O, Applied Numerical Analysis WESLEY
2. Conte,S.D and DeBoor,C., Elementary numerical Analysis,McGraw Hill Publisher.

E books and online learning materials:

1. http://nptel.ac.in/courses/101108047/module6/Lecture%2015.pdf
2. http://nptel.ac.in/courses/104101002/downloads/lecture-notes/module1/chapter4.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/122102009/1
2. http://nptel.ac.in/courses/122102009/2

Mapping of course contents with CO

Contents	CO1	CO2	CO3	CO4	CO5	CO6	CO7
UNIT 1	H	-	-	-	-	-	-
UNIT 2	-	H	-	-	-	-	-
UNIT 3	-	-	H	-	-	-	-
UNIT 4	-	-	-	H		-	-
UNIT 5	-	-	-	-	H	-	-
UNIT 6	-	-	-	-	H	-	-
UNIT 7	-	-	-	-	-	H	-
UNIT 8	-	-	-	-	-	-	H

Mapping of CO with PO

CO	PO											
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**
CO1	H	-	-	-	-	-	-	-	-	-	-	-
CO2	H	-	-	-	H	-	-	-	-	-	-	-
CO3	H	-	-	-	H	-	-	-	-	-	-	-
CO4	H	-	-	-	H	-	-	-	-	-	-	-
CO5	H	M	H	-	H	-	-	-	-	-	H	-
CO6	H	-	H	-	H	-	-	-	-	-	H	-
CO7	H	-	H	-	H		-	-	-	-	H	-

COURSE NAME: LAB OPTICAL COMMUNICATION
COURSE CODE: EC-17715

	L	T	P
Internal Marks: 30			
External Marks: 20	**-**	**-**	**2**

NOTE: Do all Experiments. Evaluation of the lab work shall be done as per the approved Rubric.

Course Outcomes

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

CO	Definition	POs	PSOs
CO1	Demonstrate the working of optical fiber communication system and analyze the propagation and bending loss of fiber.	4(M), 5(H), 9(H), 10(H)	1(M)
CO2	Measure the numerical aperture, sensitivity and BER in optical fibers	2(H), 4(H), 10(H)	1(L)
CO3	Demonstrate and measurement of sensitivity of the fiber optic link	1(L),4(H),10(H)	1(L)
CO4	Comprehend the voice Transmission through optical fiber using PWM.	1(L), 4(M) 10(H)	1(L)
CO5	Understand the V-I characteristics of LED and photo detector.	2(H), 4(H), 10(H)	1(L)
CO6	Work in a team to demonstrate transmission of WDM signal through optical fiber using Optisystem.	4(H), 9(H), 12(H)	1(M), 2(M)

Syllabus:

Experiment 1. To demonstrate fiber optic analog and digital link.
Experiment 2. To Study and measurement of propagation loss in optical fiber.
Experiment 3. To demonstrate and measurement of bending loss in optical fiber.
Experiment 4. To demonstrate and measurement of numerical aperture of optical fiber.
Experiment 5. To Measure the optical power using optical power meter.
Experiment 6. To demonstrate Voice Transmission through optical fiber using PWM.
Experiment 7. To measure the sensitivity of the fiber optic link.
Experiment 8. To demonstrate V-I characteristics of fiber optic LEDs.
Experiment 9. To demonstrate V-I characteristics of photo detector.
Experiment 10. To demonstrate transmission of WDM signal through optical fiber using Optisystem.

Reference Books and Other Resources:

Lab manuals available in lab.

MOOCS and Video Course:

3. http://nptel.ac.in/courses/117101002/2
4. http://nptel.ac.in/courses/117101002/12

COURSE NAME: LAB VLSI DESIGN
COURSE CODE: EC-17716

	L	T	P
Internal Marks: 30			
External Marks: 20	**-**	**-**	**2**

NOTE: Do all Experiments. Evaluation of the lab work shall be done as per the approved Rubric.

Course Outcomes

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

CO	Definition	POs	PSOs
CO1	Apply knowledge of VHDL for modeling and functional verification of digital circuits.	1(H), 5(H)	3(H)
CO2	Develop VHDL codes for combinational and sequential circuits under given specifications.	1(H)	3(M)
CO3	Examine the simulated waveforms for different inputs to digital circuits.	1(H), 2(M)	3(L)
CO4	Design digital circuits for given specifications using VHDL tool.	1(H), 3(H), 5(H)	3(H)
CO5	Demonstrate the operation of digital circuits on FPGA/CPLD kits.	1(H), 5(H)	3(H)
CO6	Work in a team to construct program for given engineering problem and test it on kits for enhanced learning.	1(H), 2(H), 4(H), 5(H), 9(M), 12(H)	3(H)

Syllabus:

Perform the following experiments using VHDL:

Experiment 28. Design of gates: AND, OR, NOT, NAND and NOR.
Experiment 29. Design of Half-Adder and Full Adder.
Experiment 30. Design of Half Subtractor and Full Subtractor.
Experiment 31. Design of 4:1 MUX.
Experiment 32. Design of 1:8 DEMUX.
Experiment 33. Design of 3:8 Decoder.
Experiment 34. Design of 8:3 Priority Encoder.
Experiment 35. Design of 4 Bit Binary to Grey code Converter.
Experiment 36. Design of 4 Bit Binary to BCD Converter using sequential statement.
Experiment 37. Design of 4-Bit Binary to Excess-3 converter using sequential statement.
Experiment 38. Design of 9-Bit parity generator using structural style.
Experiment 39. Design of 4-bit comparator.

Experiment 40. Design of all type of Flip-Flops using sequential statements.
Experiment 41. Design of 8-Bit Shift Register.
Experiment 42. Design of Synchronous 8-bit Johnson Counter.
Experiment 43. Design of Synchronous 8-Bit universal shift register.
Experiment 44. Design of counters: MOD 5, MOD 16.
Experiment 45. Design of a decimal up/down counter that counts up from 00 to 99 or down from 99 to 00.
Experiment 46. Study of FPGA/CPLD universal kits.
Experiment 47. Implementation of 1:4 DEMUX on FPGA kit.

Reference Books and Other Resources:

Lab manuals available in lab.

MOOCS and Video Course:

1. http://nptel.ac.in/courses/117101058/2
2. http://nptel.ac.in/courses/117101058/12

COURSE NAME: MAJOR PROJECT
COURSE CODE: PREC-17701

	L	T	P
Internal Marks: 120			
External Marks: 80	**-**	**-**	**3**

Course Outcomes

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

CO	Definition	POs	PSOs
C01	To apply knowledge of electronics and communication field to identify, collect relevant literature and analyze the information to formulate the problem definition for project.	1(H), 2(H), 4(M)	1(H), 2(H), 3(H)
C02	Demonstrate ethical principles in project planning, execution and documentation.	8(H), 11(M)	1(H), 2(H), 3(H)
CO3	Select and utilize appropriate **tools** to implement and demonstrate the proposed project.	5(H)	1(H), 2(H), 3(H)
CO4	Design and develop sustainable solution/system for the improvement of environment conditions and betterment of the society.	3(H), 6(H), 7(H)	1(H), 2(H), 3(H)
CO5	Communicate effectively on developed solution/system with engineering community as individual or team through effective presentation and report writing.	9(H),10(H), 11(M)	1(H), 2(H), 3(H)
CO6	Develop sustainable system with scope for enhancement and continue life-long learning	12(H)	1(H), 2(H), 3(H)

Syllabus:

Students may choose a project based on any subject of Electronics and Communication Engineering. The student will submit a synopsis at the beginning of the semester for approval from the departmental committee in a specified format. The student will have to present the progress of the work through seminars and progress reports. Evaluation of the project work shall be done as per the approved Rubrics.

Reference Books and Other Resources:

Various projects based magazines available in the college/department library.

MOOCS and Video Course:

1. http://nptel.ac.in/courses/117101105/
2. http://nptel.ac.in/courses/117101002/