NAGARJUNA

COLLEGE OF ENGINEERING & TECHNOLOGY

Outcome Based Education(OBE)/ Choice Based Credit System (CBCS) Curricula

2018-2019

Department of Electronics & Communication Engineering

NAGARJUNA COLLEGE OF ENGINEERING & TECHNOLOGY

Mudugurki Village, VenkatagiriKote Post,Devanahalli taluk,
Bangalore district - 562 164

PRINCIPAL
Nagarjuna College of Engineering & Technology
Devanahalli (Tq) Bengaluru (Dt.)-Pin: 562164

NAGARJUNA
COLLEGE OF ENGINEERING & TECHNOLOGY

An Autonomous College under VTU

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

VISION

To transform the students as leaders in Electronics & Communication Engineering to achieve professional excellence in the challenging future

MISSION

M1: To create an environment for the students to have strong academic fundamentals and enable them to be life-long learners.

M2: To provide modern tools to the students in the field of electronics and communication to meet the real-world challenges.

M3: To develop Communication skill, leadership qualities, team work and skills for continuing education among the students.

M4: To inculcate Ethics, Human values and skills for solving societal problems and environmental protection.

M5: Validate engineering knowledge through innovative research projects to enhance their employability and entrepreneurship skills.

III to VIII Semesters

Scheme and Syllabus

With effect from Academic Year 2018-19

Program Educational Objectives (PEOs)

PEO-1: Graduates of Electronics and Communication engineering will be using the basic academic knowledge of design and analysis required in the industry for sustainable societal growth.

PEO-2: Graduates of Electronics and Communication engineering will be able to design project based learning and team based learning.

PEO-3: Graduates in Electronics and Communication engineering will demonstrate good communication skills, dynamic leadership qualities with concern for environmental protection.

PEO-4: Electronics and Communication engineering graduates will be capable of pursuing higher studies, take up research and development work blended with ethics and human values.

PEO-5: Electronics and Communication engineering graduates will have the ability to get employed and become entrepreneurs thereby switching over from responsive engineering to creative engineering.

Program Outcomes and Program Specific Outcomes as defined by the Program

Program Outcome:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and electronics and communication engineering principles to the solution of complex problems in electronics and communication engineering.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex electronics and communication engineering problems reaching substantiated conclusions using first principles of mathematics, and engineering sciences.

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

PO4: Conduct Investigations of Complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions related to electronics and communication engineering problems.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex electronics and communication engineering activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities

relevant to the professional electronics and communication engineering practice.

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

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

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

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

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life Long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1. Graduate will be able to identify, analyze& solve the problems related to Electronics and Communication Engineering by applying the fundamental knowledge of Electronics and Communication.

PSO2. Graduate will demonstrate an ability to investigate, design and develop both software and hardware using significant knowledge of modern tools in Electronics and Communication Engineering.

PSO3. Graduate will be able to apply their knowledge to assess societal, environmental, health, safety issues with professional ethics and can also pursue higher studies, involve in research activities, be employable or entrepreneur.

NAGARJUNA COLLEGE OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGG

Third Semester B.E.-Scheme

Sl. No.	Course Code	Course	Teaching Dept.	L-T-P-S (Hrs/week)	Total Credits	Marks
1	17ECM31	Engineering Mathematics-III(IC)	Mathematics	3-0-2-0	4	100
2	17ECT32	Analog Electronic Circuits	EC	3-0-0-0	3	100
3	17ECT33	Logic Design	EC	3-0-0-0	3	100
4	17ECT34	Field Theory	EC	4-0-0-0	4	100
5	17ECI35	Network Analysis (IC)	EC	3-0-2-0	4	100
6	17ECI36X	Foundation Elective-I (IC)	EC	2-0-2-0	3	100
7	17ECL37	Analog Electronics Circuits Laboratory	EC	1-0-2-0	2	100
8	17ECL38	Logic Design Laboratory	EC	1-0-2-0	2	100
9	17ECH39	Integrated Rural Development– Part 1	EC	0-2-0-0	1	100
		TOTAL		**20-2-8-0**	**26**	**900**

Foundation Elective–I (IC)

SI. No.	Course Code	Course
1	17ECI361	Computer Communication and Networking
2	17ECI362	Creating Interactive and Responsive Web Pages
3	17ECI363	Electronic Instrumentation

NAGARJUNA COLLEGE OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGG

Fourth Semester B.E.-Scheme

Sl. No	Course Code	Course	Teaching Dept.	L-T-P-S (Hrs/week)	Total Credits	Marks
1	17ECM41	Engineering Mathematics-IV (IC)	Mathematics	3-0-2-0	4	100
2	17ECT42	Microprocessor	EC	4-0-0-0	4	100
3	17ECT43	Fundamentals of HDL	EC	3-0-0-0	3	100
4	17ECT44	Signals and Systems	EC	3-0-0-0	3	100
5	17ECI45X	Foundation Elective-II (IC)	EC	3-0-2-0	4	100
6	17ECT46X	Engineering Elective-III	EC	3-0-0-0	3	100
7	17ECL47	Microprocessors Laboratory	EC	1-0-2-0	2	100
8	17ECL48	HDL Laboratory	EC	1-0-2-0	2	100
9	17ECH49	Integrated Rural Develop-ment – Part 2	EC	0-2-0-0	1	100
TOTAL				**21-2-8-0**	**26**	**900**

Foundation Elective-II (IC)

SI. No	Course Code	Course
1	17ECI451	Linear Integrated Circuits
2	17ECI452	Fundamentals of VLSI
3	17ECI453	Introduction to Programming using Python

Engineering Elective-III

SI. No	Course Code	Course
1	17ECT461	Renewable Energy Resources
2	17ECT462	Object Oriented Programming using C++
3	17ECT463	Smart Materials
4	17ECT464	Management Information Systems

NAGARJUNA COLLEGE OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGG

Fifth Semester B.E.-Scheme

Sl. No.	Course Code	Course	Teaching Dept.	L-T-P-S (Hrs/week)	Total Credits	Marks
1	16ECT51	Communication Systems	EC	3-0-0-0	3	100
2	16ECT52	Microcontrollers	EC	3-0-0-0	3	100
3	16ECT53	Information Theory and Coding	EC	3-0-0-0	3	100
4	16ECI54X	Foundation Elective-IV (IC)	EC	3-0-2-0	4	100
5	16ECI55X	Foundation Elective-V (IC)	EC	3-0-2-0	4	100
6	16ECT56X	Engineering Elective-VI / PBL	EC/ME	3-0-0-0	3	100
7	16ECL57	Microcontroller Lab	EC	1-0-2-0	2	100
8	16ECL58	Communication System Lab	EC	1-0-2-0	2	100
9	16ECH59	General Aptitude	EC/BS&H	2-0-0-0	2	100
Total				**22-0-8-0**	**26**	**900**

Foundation Elective-IV (IC)

SI. No.	Course Code	Course
1	16ECI541	Control Systems
2	16ECI542	Low power VLSI Design
3	16ECI543	Microwave & Radar

Foundation Elective-V (IC)

SI. No.	Course Code	Course
1	16ECI551	Digital System Design using Verilog
2	16ECI552	Object Oriented Programming with JAVA
3	16ECI553	Online Certification course from IITs / IISc / SWAYAM / EDX

Engineering Elective-VI / PBL

SI. No.	Course Code	Course
1	16ECT561	Mechatronics
2	16ECT562	Energy Engineering and Management
3	16ECT563	Linear Algebra
4	16ECT564	Management Information Systems

NAGARJUNA COLLEGE OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGG

Sixth Semester B.E.-Scheme

Sl. No	Course Code	Course	Teaching Dept.	L-T-P-S (Hrs/week)	Total Credits	Marks
1	16ECT61	Digital Signal Processing	EC	4-0-0-0	4	100
2	16ECT62	Digital Communication	EC	4-0-0-0	4	100
3	16ECI63X	Foundation Elective-VII (IC)	EC	3-0-2-0	4	100
4	16ECT64X	Engineering Elective-VIII/PBL	EC	3-0-0-0	3	100
5	16ECL65	Digital Signal Processing Lab	EC	1-0-2-0	2	100
6	16HOE66X	Open Elective-IX	EC/BS&H	2-0-0-4	3	100
7	16ECL67	Digital Communication Lab	EC	1-0-2-0	2	100
8	16ECH68	Technical aptitude and GD	EC/BS&H	2-0-0-0	2	100
9	16ECP69	Mini Project and Seminar	EC	0-0-4-0	2	100
Total				**20-0-10-4**	**26**	**900**

Foundation Elective-VII (IC)

SI. No.	Course Code	Course
1	16ECI631	Antenna and Propagation
2	16ECI632	Database Concepts
3	16ECI633	Online certification courses from IITs / IISC / SWAYAM / EDX

Engineering Elective-VIII / PBL

SI. No.	Course Code	Course
1	16ECT641	Operations Research
2	16ECT642	Robotics
3	16ECT643	Internet of Things (IoT)

Open Elective–VIII

Sl. No.	Course Code	Course
1	16HOE661	LabVIEW – Level 1
2	16HOE662	Yoga and Meditation
3	16HOE663	Martial Arts
4	16HOE664	Music (Carnatic Vocal / Instrumental)
5	16HOE665	Dance
6	16HOE666	Sports
7	16HOE667	Online Certification Courses from IITs / IISc / SWAYAM / EDX

NAGARJUNA COLLEGE OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGG

Seventh Semester B.E. – Scheme

Sl. No.	Course Code	Course	Teaching Dept.	L-T-P-S (Hrs/week)	Total Credits	Marks
1	15ECT71	Power Electronics	EC	3-0-0-0	3	100
2	15ECT72	Data Communication	EC	3-0-0-0	3	100
3	15ECI73X	Foundation Elective-X (IC)	EC	3-0-2-0	4	100
4	15ECT74X	Engineering Elective-XI	EC/ME/CS	3-0-0-0	3	100
5	15HOE75X	Open Elective-XII	EC/BS&H	2-0-0-4	3	100
6	15HOE76X	Open Elective-XIII	EC/BS&H	2-0-0-4	3	100
7	15ECL77	Power Electronics Lab	EC	1-0-2-0	2	100
8	15ECL78	Data Communication Lab	EC	1-0-2-0	2	100
9	15ECP79	Project Phase-I and Seminar	EC	0-0-6-0	3	100
Total				**18-0-12-8**	**26**	**900**

Foundation Elective-X (IC)

SI. No.	Course Code	Course
1	15ECI731	Optical Fiber Communication
2	15ECI732	Web Technology
3	15ECI733	Online Certification courses from IITs / IISc / SWAYAM / EDX

Engineering Elective-XI / PBL

SI. No.	Course Code	Course
1	15ECT741	Wireless Communication
2	15ECT742	Artificial Intelligence
3	15ECT743	MEMS

Open Elective-XII

SI. No.	Course Code	Course
1	15HOE751	Tax Management
2	15HOE752	Assessment of Building Energy Performance (Of-fered by ASHRAE)
3	15HOE753	Crisis Management
4	15HOE754	Online certification courses from IITs / IISC /SWAYAM / EDX

Open Elective-XIII

SI. No.	Course Code	Course
1	15HOE761	Small & Medium Enterprise Management
2	15HOE762	Occupational Safety & Health Administration
3	15HOE763	Animation & Multimedia Engineering
4	15HOE774	Online certification courses from IITs / IISC /SWAYAM / EDX

NAGARJUNA COLLEGE OF ENGINEERING & TECHNOLOGY DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGG

Eigthth Semester B.E. – Scheme

SI. No.	Course Code	Course	Teaching Dept.	Total Credits	Marks
1	15ECP81	Project Phase-II and Seminar	EC	4	100
2	15ECP82	Project Phase-III and Seminar	EC	4	100
3	15ECP83	Evaluation and Viva voce (External)	EC	10	100
Total				**18**	**300**

Communication Systems

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16ECT51	3:0:0:0	3	CIE:50 SEE:50	3 hours	FC

Course Objectives:

This course will enable students to :

- Understand the concept of AM and DSBSC generation and demodulation.
- Analyze the generation and demodulation of SSB and VSB.
- Illustrate the concept of FM generation and demodulation.
- Analyze the effect of noise in CW modulation systems.

Syllabus

Module – I

Amplitude Modulation: Introduction to AM, Time-Domain description, Frequency – Domain description. Generation of AM wave, square law modulator, switching modulator. Detection of AM waves, square law detector, envelop detector. Double side band suppressed carrier modulation (DSBSC), Time-Domain description, Frequency-Domain representation, Generation of DSBSC waves, balanced modulator, ring modulator. Coherent detection of DSBSC modulated waves. **08 Hours**

Module – II

Single Side-Band Modulation (SSB) and Hilbert Transform: Properties of Hilbert transform, Pre-envelope. Single side-band modulation (SSB): Frequency-Domain description of SSB wave, Time-Domain description. Phase discrimination method for generating an SSB modulated wave, Demodulation of SSB waves.

Vestigial Side-Band Modulation (VSB): Frequency – Domain description, Generation of VSB modulated wave, Time – Domain description, Envelop detection of VSB wave plus carrier, Frequency translation, Application: AM radio. **08 Hours**

Module – III

Angle Modulation: Basic definitions, FM, narrow band FM, wide band FM, transmission bandwidth of FM waves, generation of FM waves: indirect FM and direct FM. frequency stabilization in FM receivers. **08 Hours**

Module – IV

Demodulation (FM): Demodulation of FM waves, Phase-locked loop (PLL), Linear model of the phase – locked loop, Nonlinear model of the phase – locked loop, Nonlinear effects in FM systems. **08 Hours**

Module – V

Noise In Continuous Wave Modulation Systems: Receiver model, Noise in DSB-SC receivers, Noise in SSB receivers, Noise in AM receivers, threshold effect, Noise in FM receivers, FM threshold effect, Pre-emphasis and De-emphasis in FM. **08 Hours**

Course Outcomes:

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

- Determine the generation and demodulation of AM and DSBSC systems.
- Understand the generation and demodulation of SSB, VSB and employ AM radio system.
- Describe the direct and indirect method of generation of FM.
- Evaluate the FM radio systems and its detection.
- Analyze the noise performance of receivers.

Text Books:

1. Simon Haykins: "Communication Systems", John Willey India Pvt. Ltd., 5th Edition, 2009, ISBN: 9971-51-170-3.
2. Simon Haykins: "An Introduction to Analog and Digital Communication", John Wiley India Pvt. Ltd., 2008, ISBN: 987-81-265-0932-4.

Reference Books:

1. B. P. Lathi: "Modern digital and analog Communication systems", 4th Edition, Oxford University Press, 2010, ISBN: 0-195-68622-5.
2. Singh, Sapre: "Communication Systems Analog and digital", 2nd Edition, TMH , 2007, ISBN: 100-07-063454-8.

E-Resources :

1. http://www.radio-electronics.com/info/rf-technology-design/am-amplitude-modulation/single-sideband-ssb-modulation.php
2. https://electronicspost.com/explain-the-generation-of-am-waves-using-square-law-modulator-and-switching-modulator/
3. https://www.tutorialspoint.com/principles_of_communication/principles_of_communication_vsb_modulation.htm
4. http://www.radio-electronics.com/info/rf-technology-design/fm-reception/fm-demodulation-detection-overview.php

ω ω ω ω ω

Microcontrollers

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16ECT52	3:0:0:0	3	CIE:50 SEE:50	3 Hours	FC

Course Objectives:

This course will enable students to :

- Understand the microcontroller systems and learn the assembly level programming language.
- Understand the architecture of 8051 and MSP430 microcontroller.
- Understand with the 8051 and MSP430 microcontroller instruction set, registers.
- Understand with 8051 microcontroller subsystems, such as timer modules.
- Understand the microcontrollers with common peripheral devices, such as switches, visual displays.
- Understand the interfacing of external devices connected to the microcontroller using a standard bus.

Syllabus

Module - I

Microprocessors and Microcontrollers: Introduction, Microprocessors and Microcontrollers, A microprocessors survey, RISC and CISC CPU architectures, Harvard and Von-Neumann CPU architectures.

The 8051 Architecture: Introduction, Architecture of 8051, Pin diagram of 8051, Memory organization, External Memory interfacing, stacks.

Addressing Modes: Introduction, Instruction syntax, Data types, Subroutines, Addressing modes: Immediate addressing, Register addressing, direct addressing, indirect addressing, relative addressing, absolute addressing, Long addressing, Indexed addressing, Bit inherent addressing, bit direct addressing. **08 Hours**

Module – II

Instruction set: Instruction timings.

8051 instructions: Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instruction.

8051 programming: Assembler directives, Assembly language programs and Time delay calculations, Assembly language programs. **08 Hours**

Module – III

8051 Interrupts and Timers/counters: Basics of interrupts, 8051 interrupt Structure

8051 Interfacing and Applications: Basics of I/O concepts, I/O Port Operation, Interfacing 8051 to LCD, Keyboard, parallel and serial ADC, DAC, Stepper motor interfacing and DC motor interfacing and programming. **08 Hours**

Module – IV

TTimers and Counters: 8051 timers/counters, programming 8051 timers in assembly and C. Time delay calculations (without using timers).

8051 Serial Communication: Data communication, Basics of Serial Data Communication, 8051 Serial Communication, connections to RS-232, Serial communication Programming in assembly and C.

8255A Programmable Peripheral Interface: Architecture of 8255A, I/O addressing, I/O devices interfacing with 8051 using 8255A. **08 Hours**

Module – V

Motivation for MSP430 microcontrollers: Low Power embedded systems, On-chip peripherals (analog and digital), low power RF capabilities, Target applications (Single-chip, low cost, low power, high performance system design).

MSP430 RISC CPU architecture: Compiler-friendly features, Instruction set, Clock system, Memory subsystem. Key differentiating factors between different MSP430 families.

Digital I/O-I/O ports: Programming using C and assembly, Understanding the muxing scheme of the MSP430 pins. Addressing modes and Instruction set of MSP430.

08 Hours

Course Outcomes:

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

- Solve basic binary math operations using the microcontroller.
- Demonstrate programming proficiency using the various addressing modes and data transfer instructions of the target Microcontroller.
- Analyze program using the capabilities of the stack, the program counter, and the status register and show how these are used to execute a machine code program.
- Apply knowledge of the microcontroller's internal registers and operations by use of a PC based microprocessor Simulator and write assemble assembly language programs.
- Design electrical circuitry to the microcontroller I/O ports in order to interface the processor to external devices.

Text Books:

1. Muhammad Ali Mazidi, Janice Gillespie Mazidi, Rollin D. McKinley: "The 8051 Microcontroller and Embedded Systems – using assembly and C", Pearson Publication, New Delhi, revised 2nd Edition, 2011, ISBN: 978-81-317-5899-1.
2. John Davies: "MSP430 Microcontroller Basics", Elsevier, 2008, ISBN: 978-0-7506-8276-X.

Reference Books:

1. Kenneth J.Ayala: "The 8051 Microcontroller Architecture, Programming & Applications", revised 3rd Edition, Thomson Learning, 2005, ISBN: 81-315-0200-7.
2. V.Udayashankar and Malikarjuna Swamy: "The 8051 Microcontroller", Tata McGraw-Hill Education, 2009, ISBN: 978-0-07-008681-4.

E-Resources:

1. https://www.elprocus.com/types-interfacing-devices-applications-with-microcontroller/
2. http://www.edsim51.com/8051Notes/8051/serial.html
3. https://www.tutorialspoint.com/microprocessor/microprocessor_intel_8255a_programmable_peripheral_interface.html
4. https://www.engineersgarage.com/tutorials/8051-assembly-programs
5. https://www.edgefx.in/8051-microcontroller-architecture/

Information Theory and Coding

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16ECT53	3:0:0:0	3	CIE:50 SEE:50	3 Hours	FC

Course Objectives:

This course will enable students to :

- Measure the information content of a Message.
- Understand the coding techniques using different Algorithms.
- Understand the different types of channels and its characteristics
- Understand the different types of Errors and introduce Error control coding.

Syllabus

Module – I

Information Theory: Introduction, Measure of information, Average information content of symbols in long independent sequences, Mark off statistical model for information source, Entropy and information rate of mark-off source. **08 Hours**

Module – II

Source Coding: Encoding of the source output, Shannon's encoding algorithm. Shannon Fano Encoding Algorithm, Huffman coding, Introduction to Communication Channels. **08 Hours**

Module – III

Introduction to Error Control Coding: Introduction, Types of errors, examples, Types of codes Linear Block Codes: Matrix description, Error detection and correction, Encoder for Linear block codes, Syndrome Calculation Circuit for Linear block codes. **08 Hours**

Module – IV

Binary Cyclic codes, Algebraic Structure of Cyclic codes, Encoding using an (n-k) bit shift register, Syndrome Calculation, BCH codes. **08 Hours**

Module – V

Convolution codes, Time domain approach, Transform domain approach, tree diagram, RS Codes. **08 Hours**

Course Outcomes:

On completion of this course, students will be able to :

- Compute entropy and information rate of a source.
- Encode the source output using encoding algorithms and coding techniques.
- Determine the channel capacity of different channels and also the mutual information.
- Implement the error control coding, methods of controlling errors and Error correction and detection.
- Encode using bit shift register, syndrome calculate and complete knowledge of BCH and burst error correcting codes.

Text Books:

1. K. Sam Shanmugam: "Digital and Analog Communication Systems", John Wiley India Pvt. Ltd., 2008, ISBN-10: 8126509147, ISBN-13: 9788126509140.
2. Simon Haykin: "Digital Communication", John Wiley India Pvt. Ltd., 2008. ISBN-10: 0471647357, ISBN-13: 978-0471647355.

Reference Books:

1. Dr. P. S. Satyanarayana: "Concepts of Information Theory & Coding", Publication, Dynaram, 2005, ISBN-13:1234567150966
2. Bernard Sklar, Digital Communications Fundamentals and Applications, Prentice Hall International, 2001, ISBN-10: 0130847887, ISBN-13: 978-0130847881.
3. Shu Lin, Costello ,"Error Control coding : Fundamentals and Applications", New Jersey, 1983, ISBN-10: 0130426725, ISBN-13: 978-0130426727.

E- Resources:

1. https://users.cs.cf.ac.uk/Dave.Marshall/Multimedia/node217.html
2. https://users.ece.cmu.edu/~koopman/des_s99/coding/
3. https://www.cs.cmu.edu/~guyb/realworld/reedsolomon/reed_solomon_codes.html
4. www.geeksforgeeks.org/greedy-algorithms-set-3-huffman-coding/
5. https://www.kernel.org/doc/htmldocs/librs/ch03s03.html

Control Systems (IC)

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16ECI541	3:0:2:0	4	CIE:50 SEE:50	3 Hours	FC

Course Objectives:

This course will enable students to :

- Understand the mathematical modelling of mechanical and electrical systems.
- Understand the concept of block diagram reduction techniques and signal flow graph to find the transfer function of a given system.
- Understand the time response of first and second order systems for different test input signals.
- Understand the concept of stability of control systems and stability analysis using RH.
- Understand the Criterion and Nyquist Criterion.
- Understand the concept of root locus in the construction of root loci in order to determine the stability of a given transfer functions.
- Understand the frequency response concepts for assessment of relative stability using Bode plots.

Syllabus

Module - I

Modelling of Systems: The control system, Mathematical models of Physical systems, Introduction, Differential equations of physical systems - Mechanical systems, Translational systems, Rotational systems, Electrical systems, Analogous systems.

Block diagrams and signal flow graphs: Transfer functions, Block diagram algebra and Signal Flow graphs. **08 Hours**

Module – II

Time response of feedback control systems: Standard test signals, Unit step response of First and second order systems, Time response specifications. Steady state error and error constants. Applications: Design and stability of second order system. **08 Hours**

Module – III

Stability analysis: Concept of stability, Routh-Hurwitz criterion, Relative stability analysis, application of Routh stability criterion, Nyquist plot: polar plots, Nyquist stability criterion, assessment of relative stability using Nyquist criterion. **08 Hours**

Module – IV

Root-Locus Techniques: Introduction, the root locus concepts, Construction of root loci, numerical examples. **08 Hours**

Module – V

Frequency response analysis: Introduction, Bode diagrams, assessment of relative stability using Bode plots.

Introduction to State variable analysis: Concepts of state, state variable and state models for electrical systems, Solution of state equations. **08 Hours**

List of Experiments:

1. Determine the transfer function for given closed loop system in block diagram representation.
2. Plot unit step response of given transfer function and find peak overshoot, peak time.
3. Plot unit step response and to find rise time and delay time.
4. Plot locus of given transfer function, locate closed loop poles for different values of k.
5. Plot root locus of given transfer function and to find out S, Wd, Wn at given root & to discuss stability.
6. Plot bode plot of given transfer function

Course Outcomes:

On completion of this course, students will be able to :

- Employ mathematical modelling techniques to determine the transfer function of a given system.
- Analyze the time response of first and second order systems for different test input signals.
- Apply the concept of RH criterion and Nyquist criterion to determine the stability of a given transfer functions.
- Interpret the concept of root locus to determine the stability of a given transfer function.
- Know the frequency domain specification fundamentals and sketch a Bode plot to analyze Stability of a given systems and able to write state model for the given system.

Text Books:

1. J. Nagarath, M.Gopal: "Control Systems Engineering", 5th Edition, New Age International (P) Limited, New Delhi, 2007, ISBN: 812242087.
2. K. Ogata: "Modern Control Engineering - Pearson PHI, 5th Edition- 2010, ISBN: 9788120340107.

Reference Books:

1. Benjamin C. Kuo, Farid Golnaaghi: "Automatic Control Systems", 8th Edition, Wiley student Edition, 2010, ISBN: 9788126513710.
2. A K Jairath: "Problems and solutions of control systems with essential theory", Reprint 5th Edition, CBS, New Delhi, 2009, ISBN: 978-81-239-1686-6.

E- Resources:

1. https://www.electrical4u.com/signal-flow-graph-of-control-system/
2. http://lpsa.swarthmore.edu/Bode/BodeReviewRules.html
3. http://nptel.ac.in/courses/10810308/25
4. https://www.electrical4u.com/root-locus-technique-in-control-system-root-locus-plot/
5. http://www.facstaff.bucknell.edu/mastascu/econtrolhtml/rootlocus/rlocus1a.html

Low Power VLSI Design (IC)

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16ECI542	3:0:2:0	4	CIE:50 SEE:50	3 Hours	FC

Course Objectives:

This course will enable students to :

- Understand the physics of power dissipation.
- Understand the basics sources of power dissipation in VLSI.
- Understand the basics of synthesis for low power.
- Understand the concept of leakage power in deep submicron transistors.
- Understand the basics of low energy computing.

Syllabus

Module - I

Introduction, Sources of power dissipation, designing for low power. Physics of power dissipation in MOSFET devices – MIS Structure, Long channel and sub-micron MOSFET. **08 Hours**

Module – II

Power dissipation in CMOS: Power dissipation in CMOS – Short circuit dissipation, dynamic dissipation, Load capacitance. Low power design limits - Principles of low power design, Hierarchy of limits, fundamental limits, Material, device, circuit and system limits. **08 Hours**

Module – III

Synthesis for low power: Behavioral, Logic and Circuit level approaches, Algorithm level transforms, FSM and Combinational logic, Transistor sizing. **08 Hours**

Module – IV

Design and test of low-voltage cmos circuits: Introduction, Design style, Leakage current in Deep sub-micron transistors, device design issues, Testing with elevated intrinsic leakage, multiple supply voltages. **08 Hours**

Module – V

Low energy computing: Energy dissipation in transistor channel, Energy recovery circuit design, designs with reversible and partially reversible logic, energy recovery in adiabatic logic and SRAM core.

Software design for low power: Introduction, sources of power dissipation, power estimation and optimization. **08 Hours**

List of Experiments:

1. Full adder
2. Ripple Carry Adder (RCA)
3. Carry Skip Adder (CSkA)
4. Conventional Multiplier
5. Booth multiplier
6. Wallace tree multiplier
7. Array multiplier
8. Sequential multiplier

Course Outcomes:

On completion of this course, students will be able to :

- Distinguish between different types of MOSFET devices.
- Analyze different principles of low power VLSI design
- Apply the concept of transistor sizing for synthesis of low power.
- Design and test of low-voltage CMOS circuits
- Estimate the power consumption of VLSI circuits & optimize it

Text Book:

1. Kaushik Roy, Sharat C Prasad: "Low-Power CMOS VLSI Circuit Design", Wiley, 2009, ISBN-10: 812652023X, ISBN-13: 978-8126520237.

Reference Book:

1. Weste, Harris: "CMOS VLSI Design: A circuits and systems perspective", 4th Edition, Pearson Education India, 2015, ISBN-10: 9332542880, ISBN-13: 978-9332542884.

E- Resources:

1. http://www.iue.tuwien.ac.at/phd/schrom/node89.html
2. https://www.cs.umd.edu/class/sum2003/cmsc311/Notes/Seq/fsm.html
3. http://ecomputernotes.com/mis/structure-and-classification/describe-the-mis-structure-based-on- the-physical-components
4. http://large.stanford.edu/courses/2010/ph240/iyer2/

Microwaves and RADAR (IC)

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16ECI543	3:0:2:0	4	CIE:50 SEE:50	3 Hours	FC

Course Objectives:

This course will enable students to :

- Understand the concepts of Transmission lines and its applications using Smith chart.
- Understand the rectangular waveguides and its modes of operation.
- Understand the Directional Couplers and have a basic idea about circulators and isolators.
- Understand the concept of GUNN diode and its modes of operation.
- Understand the concept of Strip lines and Microstrip lines
- Understand the origins of RADAR and its applications.

Syllabus

Module – I

Microwave Transmission Lines: Introduction, Transmission Lines, Equations and Solutions, Reflection and Transmission Coefficients, Standing Waves and SWR, Smith Chart, Impedance matching using Single Stubs, Microwave coaxial connectors and Adapters.

Microwave Waveguides and Components: Rectangular waveguides, Circular Waveguides, Directional Couplers, Circulators and Isolators, Reflex Klystrons.

08 Hours

Module – II

Microwave Diodes: Transfer electron devices: Introduction, GUNN effect diodes-GaAs diode, RWH theory, Modes of Operation, Avalanche transit time devices: READ diode, IMPATT diode, parametric amplifiers, and other diodes: PIN diodes. **08 Hours**

Module – III

Microwave Network Theory and Passive Devices: Symmetrical Z and Y parameters for reciprocal networks, S matrix representation of Multi port networks, Phase shifters, Attenuators, Waveguide Tees, Magic Tees. **08 Hours**

Module – IV

Strip Lines: Introduction, Micro strip lines, Parallel strip lines, coplanar strip lines, shielded strip lines. **07 Hours**

Module – V

An Introduction to Radar: Basic Radar, The simple form of the Radar equation, Radar block diagram, radar frequencies, applications and origins of Radar.

MTI and Pulse Doppler Radar: Introduction to Doppler and MTI Radar, Delay line Cancellers, digital MTI processing, Moving Target Detector, pulse Doppler Radar.

08 Hours

List of Experiments:

1. To conduct an experiment to obtain the mode curves of Reflex Klystron.
2. To conduct an experiment to find power division and isolation of a Magic Tee.
3. Measurement of Frequency, Wavelength, Power, VSWR and Attenuation in a microwave test bench using Klystron.
4. Determination of Coupling and Isolation characteristics of a Stripline-Directional Coupler.
5. To conduct an experiment to determine the V-I curve of a GUNN diode, measurement of a guide wavelength (λg), frequency and VSWR.
6. Measure of power division and isolation characteristics of a microstrip 3 dB power divider.

Course Outcomes:

On completion of this course, students will be able to :

- Define line parameters and analyze various transmission lines and resonators.
- Understand the basic concepts of diodes and its applications.
- Apply the concepts of S parameters to analyze waveguide Tees.
- Analyze the differences between various strip lines and its applications
- Apply the concepts of RADAR to find range of the target object and velocity of the target.

Text Books:

1. Samuel Y Liao: "Microwave Devices and Circuits", 3rd Edition, Pearson, 2011, ISBN-10: 0135832047, ISBN-13: 978-0135832042.
2. Merill I Skolnik: "Introduction to Radar systems", 3rd Edition, McGraw-Hill Education, 2002, ISBN-10: 0072881380, ISBN-13: 978-0072881387
3. Annapurna Das, Sisir K Das: "Microwave Engineering", TMH Publication, 3rd Edition, 2014, ISBN-10: 9332902879, ISBN-13: 978-9332902879

Reference Book:

1. David M Pozar: "Microwave Engineering", 4th Edition, Wiley, 2011, ISBN-10: 0470631554, ISBN-13: 978-0470631553

E- Resources:

1. https://www.maximintegrated.com/en/app-notes/index.mvp/id/742
2. https://www.elprocus.com/gunn-diode-working-characteristics-and-its-applications/
3. http://www.radartutorial.eu/11.coherent/co13.en.html
4. http://www.rfwireless-world.com/Articles/types-and-basics-of-microstrip-line.html
5. https://www.microwaves101.com/encyclopedias/magic-tees
6. http://www.radio-electronics.com/info/antennas/waveguide/waveguide-basics-tutorial.php

Digital System Design using Verilog (IC)

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16ECI552	3:0:2:0	4	CIE:50 SEE:50	3 Hours	FC

Course Objectives:

This course will enable students to :

- Understand the fundamental design methodologies in Verilog and combinational basics.
- Understand the concepts of number system basics and sequential basics.
- Understand the Computer organization, Instruction and Data.
- Understand the concept of I/O interfacing, accelerators and design methodologies.

Syllabus

Module – I

Introduction and Methodology: Digital Systems and Embedded Systems, Binary representation and Circuit Elements, Real-World Circuits, Models, Design Methodology.

Combinational Basics: Boolean Functions and Boolean Algebra, Binary Coding, Combinational Components and Circuits, Verification of Combinational Circuits.

08 Hours

Module – II

Number Basics: Unsigned and Signed Integers, Fixed and Floating-point Numbers.

Sequential Basics: Storage elements, Counters, Sequential Data paths and Control, Clocked Synchronous Timing Methodology. **08 Hours**

Module – III

Memories: Concepts, Memory Types, Error Detection and Correction. Implementation Fabrics: ICs, PLDs, Packaging and Circuit Boards, Interconnection and Signal Integrity.

Processor Basics: Embedded Computer Organization, Instruction and Data, Interfacing with memory. **08 Hours**

Module – IV

I/O interfacing: I/O devices, I/O controllers, Parallel Buses, Serial Transmission, I/O software. **08 Hours**

Module – V

Accelerators, Design Methodology: Accelerators: Concepts, case study, Verification of accelerators. Design Methodology: Design flow, Design optimization, Design for test. **08 Hours**

List of Experiments:

1. Write the hardware description of a 4-bit PRBS (pseudo-random Binary sequence) generator using a linear feedback shift register and test it
2. Write the hardware description of a 8-bit register with shift left and shift right modes of operation and test its operation
3. Write the hardware description of a 8-bit register with parallel load and shift left modes of operation and test its operation.
4. Write the hardware description of a 4-bit mod-13 counter and test it.
5. Write the hardware description of a 4-bit adder/subtractor and test it.
6. Write the hardware description of a carry look ahead, ripple carry adder and test it
7. Write the hardware description of booth multiplier and test it
8. Write the hardware description of Wallace tree multiplier and test it

Course Outcomes:

On completion of this module, students will be able to :

- Analyze and verify various combinational circuits.
- Discuss number basics and sequential basics in Verilog.
- Analyze the appropriate usage of instructions and data types.
- Analyze various I/O interfacings and software.
- Describe and verify accelerators and design methodologies.

Text Books:

1. Peter J Ashenden: “Digital Design: An embedded system approach using verilog”, 1st Edition, Elsevier, 2010, ISBN: 9780123695277.

Reference Books:

1. Samir Palnitkar: “Verilog HDL”, 2nd Edition, Pearson, New Delhi, 2003, ISBN: 978-0132599702.

E-Resources:

1. http://esd.cs.ucr.edu/labs/tutorial/
2. http://www.thomasnet.com/products/printed-circuit-board-pcb-packaging-55661177-1.html
3. https://learn.sparkfun.com/tutorials/serial-communication
4. http://www.people.vcu.edu/~rhklenke/tutorials/actel/design_flow.html

Object Oriented Programming with JAVA

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16ECI552	3:0:2:0	4	CIE:50 SEE:50	3 Hours	FE

Course Objectives:

This course will enable the students to :

- Understand the basic concepts of Java Technology and its features.
- Understand the OOPs concepts.
- Learn methods for solving programs in Java.
- Effectively use data structures like Collections, Lists, etc.
- Write defensive programming using Exception Handling.

Syllabus

Module – I

Introduction to Java: Why Java, Flavors of Java, Java Designing Goal and Features, JVM / JDK / JRE / History of JDK / JDM, Usage of IDE (Eclipse, NetBeans)

Language Fundamentals: Data Types - Variables, keywords, operators; Selection / Iterative / Decision making statements

Introduction to OOPs Concepts: Inheritance - Polymorphism - Abstraction – Encapsulation **10 Hours**

Module – II

Arrays and Strings: Defining of an Array, Initializing and accessing an Array, Multi-Dimensional Array, String / StringBuffer / StringBuilder

OOPs in Java: Inheritance, Abstract class and interface, Abstract class Vs Interface

Packages and Wrapper Classes: Defining Package, Organizing Classes and interfaces in Packages, Package as Access Protection, Import and Static Import, Naming Convention for packages, What is Wrapper Class, Why Wrapper, How to handle wrapper Classes. **10 Hours**

Module – III

Exception Handling: What is Exception, Types of Exception, Exception Hierarchy, Custom excpetions.

The Collection Framework: Collection of objects, Collection Interfaces and Hierarchy, List and Map, Types of List, Types of Map, Iterator, Generics. **08 Hours**

Module – IV

Threads: Understanding Threads, Needs of Multi-Threaded Programming, Thread Life-cycle, Synchronizing Threads. **02 Hours**

Module – V

Project Work: To create a Contact Book application using the Core Java concepts learnt with special emphasis on OOPs concepts, Exception Handling, and Collections Framework. **10 Hours**

Laboratory

1. Programs covering Data Types and OOPs Concepts.
2. Programs covering Arrays and Strings, OOPS concepts in Java, Packages and Wrapper Classes.
3. Programs covering Exception Handling, The Collection Framework and Threads.

Course Outcomes:

On completion of this course, students will be able to :

- Explain the basic concepts of Java Technology and its features.
- Explain the OOPs concepts.
- Write programs in Java.
- Analyze data structures like Collections, Lists, etc.
- Write defensive programming using Exception Handling.

Text Books:

1. Herbert Schildt: "Java: The Complete Reference", McGraw Hill Education, 9th Edition, ISBN-10: 9339212096.
2. Dr. R. Nageswara Rao: "Core Java: An Integrated Approach", 1st Edition, Dreamtech Press, 2016, ISBN-10: 9351199258.

Reference Books:

1. Joshua Bloch: "Effective Java", Pearson Education, 2nd Edition, ISBN-10: 933257653X.
2. Cay S. Horstmann: "Core Java - Vol. I - Fundamentals", 10th Edition, Pearson Education, ISBN-10: 9332582718.

Mechatronics

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16ECT561	3:0:0:0	3	CIE:50 SEE:50	3 Hours	EE

Course Objectives:

This course will enable students to :

- Mechanical, electronics, control, software, and computer engineering, and a solid command of the newest technologies.

Syllabus

Module – I

Introduction to mechatronics: Measurement and control systems. Their elements and functions, Microprocessor based controllers. Definition and classification of transducers. Definition and classification of sensors. Principle of working and applications of light sensors, proximity sensors and Hall effect sensors. **08 Hours**

Module – II

Electrical Actuation Systems: Electrical systems, Mechanical switches, solid-state switches, solenoids, DC & AC motors, Stepper motors and their merits and demerits **07 Hours**

Module – III

Signal Conditioning: Introduction to signal conditioning. The operational amplifier, Protection, Filtering, Wheatstone bridge, Digital signals Multiplexers, Data acquisition, Introduction to Digital system. Processing Pulse-modulation. **08 Hours**

Module – IV

Logic Function: Data word representation. Basic elements of control systems 8085A processor architecture terminology such as CPU, memory and address, ALU, assembler data registers, Fetch cycle, write cycle, state, bus, interrupts. Micro Controllers. Difference between microprocessor and micro controllers. Requirements for control and their implementation in micro controllers. Classification of micro controllers. **08 Hours**

Module – V

Programming of Microprocessors: Introduction to organization of INTEL 8085-Data and Address buses, Instruction set of 8085, programming the 8085, assembly language programming.

Organization and Programming of Microprocessors: Introduction to organization of INTEL 8085-Data and Address buses, Instruction set of 8085. **08 Hours**

Course Outcomes:

On completion of this course, students will be able to :

- Design and conduct experiments to evaluate the performance of a mechatronics system
- Design mechatronics component, system or process to meet desired needs
- Use the techniques, skills, and modern mechatronics engineering tools necessary for engineering practice.
- Identify and evaluate ethical ramifications and professional responsibilities in a variety of situations
- Discuss the impact of engineering on society, safety, and environment in relation to contemporary issues

Text Books:

1. W.Bolton: "Mechatronics", Pearson, 5th Edition, 2011, ISBN-10: 0273742868, ISBN-13: 978-0273742869.
2. R.S. Ganokar : "Microprocessor Architecture, Programming and Applications with 8085/8085A", Wiley Eastern, ISBN-10: 8187972882, ISBN-13: 978-8187972884.

Reference Books:

1. K.P.Ramchandran, G.K.Vijayraghavan, M.S.Balasundran: "Mechatronics and Micro processors", Wiley, 1st Edition, 2009.
2. Nitaigour, Premchand Mahilik: "Mechatronics - Principles, Concepts and applications", Tata McGraw Hill, 2003.
3. Godfrey C. Onwubolu: "Mechatronics Principles and applications", Elsevier.
4. David. G. Aliciatore, Michael. B. Bihistaned: "Introduction Mechatronics & Measurement systems", Tata McGraw Hill, 2000.

E-Resources:

1. https://lecturenotes.in/topic/2760/mechatronics/electrical-actuation-systems/?page=12
2. http://efxkits.com/blog/what-is-multiplexer-and-types/
3. http://www.electronics-tutorials.ws/electromagnetism/hall-effect.html

Energy Engineering and Management

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16ECT562	3:0:0:0	3	CIE:50 SEE:50	3 Hours	EE

Course Objectives:

This course will enable students to :

- The various types of Power plants and applications
- The concept of electrical and thermal energy management

Syllabus

Module – I

Steam Power Plant: Different Types of Fuels used for steam generation, Equipment for burning coal in lump form, strokers, different types, Oil burners, Advantages and Disadvantages of using pulverized fuel, Equipment for preparation and burning of pulverized coal, unit system and bin system. Pulverized fuel furnaces, cyclone furnace, Coal and ash handling, Generation of steam using forced circulation, high and supercritical pressures. **08 Hours**

Module – II

Diesel Engine Power Plant: Applications of Diesel Engines in Power field. Method of starting Diesel engines. Auxiliaries like cooling and lubrication system, filters, centrifuges, Oil heaters, intake and exhaust system, Layout of diesel power plant. **07 Hours**

Module – III

Energy and its various forms: Commercial and Non-commercial energy, primary energy resources, commercial energy production, Energy pricing, energy security, energy conservation and its importance, Electricity tariff, load management and maximum demand control, Thermal energy contents of fuel, heat capacity, sensible and latent heat, heat transfer, Stochiometric air-fuel ratio, Flue gas analysis.**08 Hours**

Module – IV

Electrical Energy Management: Reactive power management, Energy conservation in domestic and industrial sectors, Energy conservation in lighting, motors, pumps and fan systems. **08 Hours**

Module – V

Thermal Energy Management: Energy conservation in boilers and Furnaces, Waste heat recovery, Thermal insulation, Energy conservation in buildings, Building heating and cooling load management, Buildings code, solar passive and green building concepts. **08 Hours**

Course Outcomes:

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

- Describe the technology behind Steam Power plants and the types of fuels used.
- Understand and describe diesel engine power plants, and the auxiliaries used.
- Differentiate between the various types of Energy forms.
- Understand the management of electric energy.
- Describe the methods used in thermal energy management and energy conversation.

Text Book:

1. P.K.Nag: "Power plant engineering", 2nd Edition, Tata McGraw Hill, ,2001, ISBN-10: 9339204042, ISBN-13: 978-933920404.

Reference Book:

1. Domkundwar, Arora Domkundwar: "Power plant engineering", Dhanpat Rai & Co. (P) Limited, 2016, ISBN-10: 8177001957, ISBN-13: 978-8177001952.

E-Resources:

1. http://www.mechanicalbooster.com/2016/08/steam-power-plant.html
2. http://wgbis.ces.iisc.ernet.in/energy/paper/alternative/classification.html
3. http://www.maintenancetechnology.com/2006/01/energy-management-for-electrical-systems/
4. https://research.ncl.ac.uk/sustem/

Linear Algebra

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16ECT563	3:0:0:0	3	CIE:50 SEE:50	3 Hours	EE

Course Objectives:

This course will enable students to :

- The principles of linear algebra, calculus of variations, probability theory and random process
- The knowledge of linear algebra, calculus of variations, probability theory and random process in the applications of electronics and communication engineering sciences

Syllabus

Module – I

Linear Equations and Matrices: Introduction, Systems of Linear Equations, Matrices, Matrix Multiplication, Algebraic Properties of Matrix Operations, Elementary row operations, row echelon form, solving a system of linear equations, homogeneous systems. **08 Hours**

Module – II

Solving Linear Systems: Echelon Form of a Matrix Solving Linear Systems, Elementary Matrices, Matrices and Gaussian Elimination, Gauss Jordan method, Inverses, LU-factorization, LDU- factorization. **08 Hours**

Module – III

Determinants: Definition, Properties of Determinants, Cramer's rule to solve simultaneous equations, Co-factor Expansion, Inverse of a Matrix, Formulas for the Determinant, Applications of Determinant. **08 Hours**

Module – IV

Inner Product Spaces: Inner products, Projections onto Lines, inner product spaces, orthogonal sets and projections, Gram-Schmidt Orthogonalization, Least Squares Approximations, QR Decomposition. **08 Hours**

Module – V

Eigen values and Eigen vectors: Introduction, characteristic equation, Diagonalization of a Matrix, Difference Equations and the Powers Ak, Differential Equations and the Exponential eAt. **08 Hours**

Course Outcomes:

On completion of this course, students will be able to :

- Understand vector spaces, basis, linear transformations and the process of obtaining matrix of linear transformations arising in magnification and rotation of images.
- Apply the techniques of QR and singular value decomposition for data compression, least square approximation in solving inconsistent linear systems.
- Utilize the concepts of functional and their variations in the applications of communication systems, decision theory, synthesis and optimization of digital circuits.
- Learn the idea of random variables (discrete/continuous) and probability distributions in analyzing the probability models arising in control systems and system communications.
- Apply the idea of joint probability distributions and the role of parameter dependent random variables in random process.

Text Books:

1. David C. Lay: "Linear Algebra and its Applications," 3rd Edition, Pearson Education (Asia) Pvt. Ltd., 2005.
2. Gilbert Strang: "Linear Algebra and its Applications", 3rd Edition, Thomson Learning Asia, 2003.

Reference Books:

1. Kenneth Hoffman, Ray Kunze: "Linear Algebra," 2nd Edition, Pearson Education (Asia) Pvt. Ltd., Prentice Hall of India, 2004.

E References:

1. https://www.math.hmc.edu/calculus/tutorials/linearsystems/
2. http://nptel.ac.in/courses/122104018/node49.html
3. http://math.tutorvista.com/algebra/gauss-jordan-method.html
4. https://www.math.drexel.edu/~jwd25/LM_SPRING_07/lectures/lecture4B.html

Microcontroller Lab

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16ECL57	1:0:2:0	2	CIE:50 SEE:50	3 hours	FC

Course Objectives:

This course will enable students to :

- Understand the basics of 8051 programming like data transfer, arithmetic and logical instructions
- Understand the interfacing used in 8051 microcontroller, like stepper motors, DC motors.

List of Experiments:

1. Data Transfer - Block move, Exchange, Sorting, Finding largest element in an array.
2. Arithmetic Instructions - Addition/subtraction, multiplication and division, square, Cube
3. Counters.
4. Logical instruction (Bit and Byte manipulations).
5. Code conversion: BCD – ASCII; ASCII – Decimal; Decimal - ASCII; HEX - Decimal and Decimal - HEX.
6. Programs using serial port.
7. Generate different wave forms Sine, Square, Triangular, Ramp, etc using DAC interface to 8051.
8. Stepper and DC motor control interface to 8051.
9. Alphanumeric LCD panel and Hex keypad input interface to 8051.
10. External ADC and Temperature control interface to 8051.
11. Elevator interface to 8051.

Course outcomes :

On completion of this course, students will be able to:

- Understand data moving and exchange programs.
- Analyze and write delay programs.
- Interface Stepper motor, DC motor to the microcontroller.
- Discuss seven segment display and keyboard interface.
- Analyze different types of code conversion programs.

Text Books:

1. Muhammad Ali Mazidi, Janice Gillespie Mazidi and Rollin D. McKinley..“The 8051 Microcontroller and Embedded Systems – using assembly and C”-, Pearson Publication, New Delhi, revised second edition, 2011, ISBN-978-81-317-5899-1.
2. The 8051 Microcontroller Architecture, Programming & Applications”, Kenneth J.Ayala; revised third edition, 2005, Thomson Learning 2005, ISBN-81-315-0200-7.
3. “The 8051 Microcontroller”, V.Udayashankar and Malikarjuna Swamy, Tata McGraw –Hill Education, 2009, ISBN-978-0-07-008681-4.

ଓ ଓ ଓ ଓ ଓ

Communication System Lab

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16ECL58	1:0:2:0	2	CIE:50 SEE:50	3 Hours	FC

Course Objectives:

This course will enable students to :

- The practical perspective of various communication modules.
- The various analog modulation and demodulation techniques using discrete Components.

List of Experiments:

1. Design and construction of second order active low-pass filter and high-pass filter. Plot of frequency response and estimation of roll-off factor
2. Design and construction of active band-pass filter and band-stop filter. Plot of frequency response.
3. Amplitude modulation using transistor/FET (Generation and detection) and find the Modulation index.
4. Frequency modulation using IC 8038/2206.
5. Design and conduct an experiment on Half wave and Full wave rectifier
6. Design and conduct an experiment for Pre-emphasis and de-emphasis.
7. Design and conduct an experiment to generate Pulse amplitude modulation and demodulation.
8. Conduct an experiment to generate a PWM signal and demodulation.
9. Design and conduct an experiment to generate PPM signal.
10. Design and test an R-2R Ladder network and verify truth table.

Course Outcomes:

On completion of the course, students will be able to :

- Demonstrate second order active filters for various frequency bands
- Understand the design and implementation concept for modulation and demodulation circuit using amplitude modulation.
- Understand the design and implementation concept for modulation circuit using frequency modulation
- Analyze the circuit by conducting the precision rectifiers experiment

- Construct the circuit and demonstrate the characteristics of pre-emphasis and de-emphasis circuit.

Text Books:

1. Simon Haykins: "Communication Systems", John Willey, India Pvt. Ltd, 5th Edition, 2009. ISBN 9971-51-170-3.
2. B. P. Lathi: "Modern digital and analog Communication systems", Oxford University Press., 4th Edition, 2010, ISBN: 0-195-68622-5

ω ω ω ω ω

General Aptitude

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16ECH59	2:0:0:0	2	CIE:50 SEE:50	3 Hours	HSS

Course Objectives:

This course will enable students to :

- Understand different types of Numerical / Arithmetical problems.
- Understand the different Data interpretation problems.

Syllabus

Module – I

Numerical Ability-I: Numbers, HCF and LCM of numbers, Decimal Fractions, Average, Problems on Numbers, Problems on Ages. **06 Hours**

Module – II

Numerical Ability-II: Percentage, Profit and Loss, Ratio and Proportion, Partnership, Chain Rule, Time and Work. **05 Hours**

Module – III

Numerical Ability-III: Pipes and Cistern, Time and Distance, Problems on Trains, Alligation or Mixture, Simple Interest, Compound Interest. **05 Hours**

Module – IV

Numerical Ability-IV: Races and Games of Skill, Calender, Clocks, Permutations and Combinations, Probability, Odd man out and Series. **05 Hours**

Module-V

Data Interpretation: Tabulation, Bar Graphs, Pie Charts, Line Graphs. **05 Hours**

Course Outcomes:

On completion of this course, students will be able to :

- Solve and analyze different types of Numerical / Arithmetical problems.
- Solve and analyze different Data interpretation problems.

Text Books:

1. R S Aggarwal: "Quantitative Aptitude for competitive examinations", (Chapters 1-3,6-8,10-18,20-22,26-28,30,31,35-39), S. Chand Publishing, New Delhi, 2014, ISBN-13: 978-81-219-2498-6.

Sixth Semester B.E. – Syllabus

Digital Signal Processing

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16ECT61	4:0:0:0	4	CIE:50 SEE:50	3 Hours	FC

Course Objectives:

This course will enable students to :

- Understand the importance of Fourier Transform and its relation with other transform.
- Understand the filtering of long data sequence using various methods.
- Understand the concept of FFT algorithms to compute DFT.
- Understand the design of digital FIR filters using various window methods.
- Understand the basics of designing IIR filter using different methods.
- Understand the concept of Multi-rate signal processing and sample rate conversion.

Syllabus

Module – I

Discrete Fourier Transform: DFT as a linear transformation, its relationship with other transforms, Properties of DFT, Multiplication of two DFTs – circular convolution, DFT in linear filtering, Filtering long data sequences: overlap-save, Filtering long data sequences: overlap-add method. **10 Hours**

Module – II

FFT Algorithm: Introduction to Radix-2 Fast Fourier Transform(FFT), Decimation in Time FFT and Decimation in Frequency FFT. **10 Hours**

Module – III

FIR Filters: Symmetric and anti-symmetric FIR filters, Design of linear-phase FIR filters using windows and frequency sampling methods.

Structures for FIR Systems: Direct-Form Structures, Cascade-Form Structures and Lattice Structures. **10 Hours**

Module – IV

IIR Filters: Analog filter specifications, classification of analog filters: Butterworth and Chebyshev filters, frequency transformations, design of analog filters, Digital IIR filter design using impulse invariant, bilinear transformation, Matched Z-transform methods.

IIR Filter Structures: Direct form (I and II), Cascade, Parallel, and Transposed structures. **10 Hours**

Module – V

Multi-Rate Signal Processing Fundamentals: Basic sample rate alteration devices, Multi-Rate Structures for sampling rate Converters, Multistage design of decimator and Interpolator, Applications of Multirate Signal Processing. **10 Hours**

Course Outcomes:

On completion of this module, students will be able to :

- Implement DFT using linear filtering.
- Implement DFT using Fast Fourier Transforms.
- Design and analyze digital FIR filters and structure of FIR filters.
- Design and analyze digital IIR filters and structure of IIR filters.
- Explain the concept of Multi-rate signal processing and sample rate conversion.

Text Books:

1. J. G. Proakis, D. G. Manolakis: "Digital Signal Processing: Principles, Algorithms and Applications", 4th Edition, Pearson Education Asia/Prentice Hall of India, 2002, ISBN-10: 0131873741, ISBN-13: 978-0131873742.
2. Sanjit K. Mitra: "Digital Signal Processing", 4th Edition, Tata McGraw Hill, 2006, ISBN-10: 0073380490, ISBN-13: 978-0073380490.

Reference Book:

1. Oppenheim, Schafer: "Discrete Time Signal Processing", 3rd Edition, Pearson Education, 2003, ISBN-10: 0131988425, ISBN-13: 978-0131988422.

E- Resources:

1. www.cmlab.csie.ntu.edu.tw/cml/dsp/training/coding/transform/fft.html
2. www.tech-faq.com/iir-filter.html
3. www.labbookpages.co.uk/audio/firWindowing.html
4. www.multirate-digital-signal-processing-pdf.html

Digital Communication

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16ECT62	4:0:0:0	4	CIE:50 SEE:50	3 Hours	FC

Course Objectives:

This course will enable students to :

- Understand the Nyquist Sampling Theorem.
- Understand the different quantization techniques.
- Understand the need for DPCM, DM and ADM.
- Analyze the concept of Detection and Estimation.
- Understand the Coherent modulation techniques such as BPSK, ASK, DPSK and QPSK systems.

Syllabus

Module – I

Signal Sampling: Basic signal processing operations in digital communication, Sampling Principles, Sampling Theorem, Quadrature sampling of band-pass signals, PAM, TDM. **10 Hours**

Module – II

Waveform Coding Techniques: PCM block diagram, Different quantization techniques, SNR in PCM, robust quantization, DPCM, DM, Adaptive DM. **10 Hours**

Module – III

Base-Band Shaping for Data Transmission: Line Codes and their power spectra, ISI, Nyquist criterion for distortion less base-band binary transmission, adaptive equalization, eye pattern. **10 Hours**

Module – IV

Digital Modulation and Demodulation Techniques: Coherent binary modulation techniques, BPSK, FSK, ASK, DPSK, QPSK systems with signal space diagram, generation, demodulation and error probability concept, Comparison using Power Spectrum, Coherent demodulation techniques for ASK, FSK and BPSK**.** **10 Hours**

Module – V

Spread Spectrum Modulation: Pseudo noise sequences, notion of spread spectrum, direct sequence spread spectrum, coherent binary PSK, frequency hop spread spectrum, applications. **10 Hours**

Course Outcomes:

On completion of this module, students will be able to :

- Sample a signal and reconstruct it at receiver.
- Design a PCM, DPCM, DM and ADM systems.
- Design Base Band shaping for data transmission.
- Describe system level blocks for BPSK, ASK, DPSK and QPSK systems.
- Analyze coherent and no-coherent digital modulation systems and understand the basics of spread spectrum technology.

Text Books:

1. Simon Haykin: "Digital Communications", John Wiley, 2003.
2. J. Proakis: "Digital Communication", 4th Edition, McGraw Hill, 2000.

Reference Books:

1. K. Sam Shanmugam: "Digital and Analog Communication Systems", John Wiley, 1996.
2. Simon Haykin: "An Introduction to Analog and Digital Communication", John Wiley, 2003.
3. Bernard Sklar: "Digital Communications", Pearson Education, 2007.
4. K. Sam Shanmugam, A. M. Breipohl: "Random Signals: Detection, Estimation and Data Analysis", Wiley, 1988.

E-Resources:

1. https://www.tutorialspoint.com/signals_and_systems/signals_sampling_theorem.htm
2. http://www.electronicdesign.com/communications/understanding-modern-digital-modulation-techniques
3. https://ned.ipac.caltech.edu/level5/Sept04/Wright/Wright6_2.html
4. https://www.tutorialspoint.com/digital_communication/digital_communication_quantization.htm
5. http://nptel.ac.in/courses/117103018/44

Antenna and Propagation (IC)

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16ECI631	3:0:2:0	4	CIE:50 SEE:50	3 Hours	FE

Course Objectives:

This course will enable students to :

- Understand the fundamental concepts of antenna parameters and definitions.
- Understand the different types of antenna arrays.
- Understand the basic knowledge of different types of antenna like Slot antennas, Yagi-Uda antennas, etc.
- Understand the importance of radio wave propagation and its effects.

Syllabus

Module - I

Basics of Antennas: Definition of antenna parameters – Gain, Directivity, Effective aperture, Radiation Resistance, Band width, Beam width, Input Impedance. Matching, Antenna noise temperature, Radiation from oscillating dipole, Half wave dipole. Folded dipole. **08 Hours**

Module – II

Aperture and slot antennas: Radiation from rectangular apertures, Uniform and Tapered aperture, Horn antenna, Reflector antenna, Aperture blockage, Feeding structures, Slot antennas, Microstrip antennas – Radiation mechanism – Applications, Numerical tool for antenna analysis. **08 Hours**

Module – III

Point source and Antenna arrays: N element linear array, Pattern multiplication, Broadside and End fire array – Concept of Phased arrays, Adaptive array, Basic principle of antenna Synthesis-Binomial array . **08 Hours**

Module – IV

Special antennas: Principle of frequency independent antennas - Spiral antenna, Helical antenna, Log periodic. Modern antennas- Reconfigurable antenna, Active antenna, Dielectric antennas, Electronic band gap structure and applications, Antenna Measurements-Test Ranges, Measurement of Gain, Radiation pattern, Polarization, VSWR, measurement of power by two-wattmeter method. Determination of power factor using wattmeter readings. Illustrative examples. **08 Hours**

Module – V

Propagation of Radio waves: Modes of propagation, Structure of atmosphere, Ground wave propagation, Tropospheric propagation, Duct propagation, Troposcatter propagation, Flat earth and Curved earth concept Sky wave propagation – Virtual height, Critical frequency, Maximum usable frequency – Skip distance, Fading, Multi-Hop propagation. **08 Hours**

List of experiments:

1. Performance analysis of Half wave dipole antenna.
2. Study of Folded dipole antenna.
3. Analysis of Loop antenna.
4. Calculation of Directivity and other parameters for Yagi-Uda antenna.
5. Performance study of Helix antenna.
6. Calculation of radio wave propagation path loss.

Course Outcomes:

On completion of this course, students will be able to :

- Describe the basic parameters of antenna.
- Discuss the concepts of aperture and slot antenna.
- Analyze antenna arrays.
- Understand the concept and principle of special antennas.
- Understand the propagation of radio waves.

Text Books:

1. William H Hayt Jr., John A Buck: "Engineering Electromagnetics", 7th Edition, Tata McGraw-Hill, 2006.
2. A. R. Harish, M. Sachidananda: "Antenna and Wave Propagation", Oxford University Press India, 2007.

Reference Books:

1. John Krauss, Daniel A Fleisch: "Electromagnetics with Applications", 5th Edition, McGraw-Hill, 1999.
2. Edward C. Jordan, Keith G Balmain: "Electromagnetic Waves and Radiating Systems", 2nd Edition, Prentice Hall of India / Pearson Education, 1968.

E-Resources:

1. http://physics.usask.ca/~hirose/ep225/radiation.htm
2. http://www.radio-electronics.com/info/antennas/horn_antenna/horn_antenna.php
3. http://gmrt.ncra.tifr.res.in/gmrt_hpage/Users/doc/WEBLF/LFRA/node43.html
4. https://www.electronics-notes.com/articles/antennas-propagation/tropospheric/tropospheric-propagation.php

Database Concepts (IC)

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16ECI632	3:0:2:0	4	CIE:50 SEE:50	3 Hours	FE

Course Objectives:

This course will enable the students to :

- Understand the basic concepts of database and Database Management System.
- Understand the difference between relational systems and non-relational systems.
- Get a clear understanding of how to maintain data (CRUD operations) in a relational database.
- Understand the working of a non-relational database.
- Get a clear understanding of how to maintain data (CRUD operations) in a non-relational database.
- Understand how Java programs can access database management systems using JDBC.

Syllabus

Module – I

Introduction to Database: Relational Database, Schemaless Database.

Introduction to SQL: DDL, DML, DQL, TCL, DCL.

Constraints: Not null, Unique, Primary key, foreign key. **08 Hours**

Module – II

Operators and Functions: Operators and Functions.

Joins, Inner queries, Co-related queries: Joins, Inner queries, Co-related queries.

07 Hours

Module – III

JDBC: JDBC API, Statement / Prepared Statements / Callable Statments, Result Set, CRUD operations. **05 Hours**

Module – IV

MongoDB: Introduction and Installation, CRUD operations, Projections. **06 Hours**

Module – V

Project Work: To create a Banking application using the concepts of database management systems with special emphasis on Java, JDBC, and MySQL database.

14 Hours

Laboratory

1. Programs covering SQL, Constraints, Operators and Functions, Joins, Inner queries, Co-related queries.
2. Programs covering JDBC concepts.
3. Programs covering MongoDB concepts.

Course Outcomes

On completion of this course, students will be able to :

- Explain the basic concepts of database and Database Management System.
- Differentiate between relational systems and non-relational systems.
- Describe how to maintain data (CRUD operations) in relational and non-relational database.
- Manage Java programs to access database management systems using JDBC.
- Save and retrieve data in a safe and consistent manner.

Text Books:

1. Rajiv Chopra: "Database Management Systems (DBMS)", 5th Edition, S Chand Publishing, ISBN-10: 9385676342.
2. Kristina Chodorow, Shroff: "MongoDB: The Definitive Guide", 2nd Edition, ISBN-10: 9351102696.

Reference Books:

1. Raghu Ramakrishnan: "Database Management Systems (Asia Higher Education Engineering/Computer Science)", 3rd Edition, McGraw Hill Education, ISBN-10: 007123151X.
2. Kyle Banker, Peter Bakkum, Shaun Verch: "MongoDB in Action: Covers MongoDB Version 3.0", 2nd Edition, Dreamtech Press, ISBN-10: 9351199355.

Operations Research

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16ECT641	3:0:0:0	3	CIE:50 SEE:50	3 Hours	EE

Course Objectives:

This course will enable students to :

- Understand the how to use variables for formulating complex mathematical models in management science, industrial engineering and transportation science.
- Understand the use of basic methodology for the solution of linear programs and integer programs.

Syllabus

Module – I

Introduction: Linear programming, Definition, scope of Operations Research (O.R) approach and limitations of OR Models, Characteristics and phases of OR Mathematical formulation of L.P. Problems. **08 Hours**

Module – II

Linear Programming Problems: The simplex method - slack, surplus and artificial variables. Concept of duality, two phase method, dual simplex method, degeneracy, and procedure for resolving degenerate cases. **07 Hours**

Module – III

Transportation Problem: Formulation of transportation model, Basic feasible solution using different methods, Optimality Methods, Unbalanced transportation problem, Degeneracy in transportation problems, Applications of Transportation problems.

Assignment Problem: Formulation, unbalanced assignment problem. **08 Hours**

Module – IV

PERT-CPM Techniques: Network construction, determining critical path, floats, scheduling by network, project duration, variance under probabilistic models, prediction of date of completion, crashing of simple networks. **08 Hours**

Module – V

Integer Programming: Gommory's technique, branch and bound algorithm for integer programming problems, zero one algorithm. **08 Hours**

Course Outcomes:

On completion of this course, students will be able to :

- Describe some basics of Linear programming and solve problems on the same
- Analyze Linear programming problems
- Describe and Analyze Transportation problems
- Describe the various methods involved in CPM technique
- Understand the basics of Integer programming

Text Books:

1. Taha H. A.: "Operations Research and Introduction", Pearson Education.
2. S. D. Sharma: "Operations Research", Kedarnath Ramnath & Co., 2002.

Reference Book:

1. Harold Koontz, Heinz Weihrich: "Essentials of Management", 7th Edition.

E-Resources:

1. http://www.phpsimplex.com/en/simplex_method_example.htm
2. https://ocw.mit.edu/courses/sloan-school-of-management/15-053-optimization-methods-in-management-science-spring-2013/tutorials/
3. http://www.dspguide.com/ch10/2.htm

Robotics

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16ECT642	3:0:0:0	3	CIE:50 SEE:50	3 Hours	EE

Course Objectives:

This course will enable students to :

- Understand the automation and brief history of robot and applications.
- Understand the Robot end effectors and their design.
- Understand the Robot Programming methods & Languages of robot.
- Understand the Various Sensors and their applications in robots.

Syllabus

Module – I

Introduction: Introduction -- brief history, types, classification and usage, Science and Technology of robots. **07 Hours**

Module – II

Elements of robots – links, joints, actuators, and sensors: Position and orientation of a rigid body, Homogeneous transformations, Representation of joints, link representation using D-H parameters, Examples of D-H parameters and link transforms, different kinds of actuators – stepper, DC servo and brushless motors, model of a DC servo motor, Types of transmissions, Purpose of sensors, internal and external sensors, common sensors – encoders, tachometers, strain gauge based force-torque sensors, proximity and distance measuring sensors, and vision. **08 Hours**

Module – III

Kinematics of serial robots: Introduction, Direct and inverse kinematics problems, Examples of kinematics of common serial manipulators, workspace of a serial robot, Inverse kinematics of constrained and redundant robots, Tractrix based approach for fixed and free robots and multi-body systems, simulations and experiments, Solution procedures using theory of elimination, Inverse kinematics solution for the general 6R serial manipulator. **08 Hours**

Module – IV

Kinematics of parallel robots: Degrees-of- freedom of parallel mechanisms and manipulators, Active and passive joints, Constraint and loop-closure equations, Direct kinematics problem, Mobility of parallel manipulators, Closed-from and numerical solution, Inverse kinematics of parallel manipulators and mechanisms, Direct kinematics of Gough-Stewart platform. **08 Hours**

Module – V

Velocity and static analysis of robot manipulators: Linear and angular velocity of links, Velocity propagation, Manipulator Jacobians for serial and parallel manipulators, Velocity ellipse and ellipsoids, Singularity analysis for serial and parallel manipulators, Loss and gain of degree of freedom, Statics of serial and parallel manipulators, Statics and force transformation matrix of a Gough Stewart platform, Singularity analysis and statics. **08 Hours**

Course Outcomes:

On completion of this course, students will be able to :

- Understand the basics of automation and also brief history of robot and applications.
- Familiarize with the kinematic motions of robot.
- Have good knowledge about robot end effectors and their design concepts.
- Analyze with the Programming methods & various Languages of robots.
- Familiarize with the principles of various Sensors and their applications in robots.

Text Book:

1. Ghosal A.: "Robotics: Fundamental Concepts and Analysis", 2nd Edition, Oxford University Press, 2008, ISBN-10: 0195673913 , ISBN-13: 978-0195673913.

Reference Book:

1. Fu K., Gonzalez, R., Lee, C. S. G.: "Robotics: Control, Sensing, Vision and Intelligence", Tata McGraw Hill, 1987, ISBN-10: 0070226253, ISBN-13: 9780070226258.

E-Resources:

1. http://nptel.ac.in/courses/112108093/3
2. https://www.coursehero.com/file/p1kbmho/II-Elements-of-robots-joints-links-actuators-and-sensors-Position-and/
3. http://www8.tfe.umu.se/courses/elektro/RobotControl/
4. http://data.mecheng.adelaide.edu.au/avc/publications/thesis/

Internet of Things (IoT) (IC)

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16ECI643	3:0:2:0	4	CIE:50 SEE:50	3 Hours	EE

Course objectives:

This course will enable students to :

- Understand the Vision and Introduction to IoT.
- Understand IoT Market perspective.
- Understand the data and knowledge management and use of devices in IoT technology.
- Understand State of the Art – IoT Architecture.
- Understand the Real World IoT Design Constraints, Industrial Automation and Commercial Building Automation in IoT.

Syllabus

Module – I

IoT and Web Technology: The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics. **08 Hours**

Module – II

M2M to IoT – A Basic Perspective: Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. **06 Hours**

Module – III

M2M to IoT-An Architectural Overview: Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. **06 Hours**

Module – IV

IoT Architecture - State of the Art: Introduction, State of the art.

Architecture Reference Model: Introduction, Reference Model and architecture, IoT reference Model.

IoT Reference Architecture: Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. **10 Hours**

Module – V

IoT Applications for Value Creations: Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, eHealth. **10 Hours**

Laboratory

1. Sketch the architecture of IoT Toolkit and explain each entity in brief.
2. Demonstrate a smart object API gateway service reference implementation in IoT toolkit.
3. Write and explain working of an HTTP- to-CoAP semantic mapping proxy in IoT toolkit.
4. Explain application framework and embedded software agents for IoT toolkit.
5. Explain working of Raspberry Pi.
6. Connect Raspberry Pi with your existing system components.
7. Give overview of Zetta.

Design based Problems (DP) / Open Ended Problem:

1. How do you connect and display your Raspberry Pi on a Monitor Or TV?

2. Create any circuitry project using Arduino.

Major Equipment:

1. Raspberry pi, Arduino

Course Outcomes:

On completion of this course, students will be able to :

- Understand the vision of IoT from a global context.
- Determine the Market perspective of IoT.
- Use of Devices, Gateways and Data Management in IoT.
- Understand the building state of the art architecture in IoT.
- Application of IoT in Industrial and Commercial Building Automation and Real World Design Constraints.

Text Book:

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle: "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, (Chapters 1-4,8-10), Academic Press, 2014, ISBN: 978080994017.

Reference Books:

1. Vijay Madisetti and Arshdeep Bahga: "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014.
2. Francis daCosta: "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013.

E-Resources:

- https://github.com/connectIOT/iottoolkit
- https://www.arduino.cc/
- http://www.zettajs.org/
- Contiki (Open source IoT operating system)
- Arduino (open source IoT project)

Digital Signal Processing Lab

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16ECL65	1:0:2:0	2	CIE:50 SEE:50	3 Hours	FC

Course Objectives:

This course will enable students to :

- Understand Working knowledge of the design & implementation on various DSP operations using MATLAB.
- Understand Practical perspective of convolution and filtering operations using DSP processor.

List of Experiments:

1. Verification of sampling theorem.
2. Linear Convolution of given two sequences.
3. Impulse response of a given system.
4. Circular convolution of given two sequences.
5. Autocorrelation of a given sequence and verification of its properties.
6. Cross correlation of given two sequences and verification of its properties.
7. Solving a given difference equation.
8. Computation of N point DFT of a given sequence and to plot magnitude and phase spectrum.
9. Linear convolution of two sequences using DFT and IDFT.
10. Circular convolution of given two sequences using DFT and IDFT.
11. Design and implementation of FIR filter to meet given specifications.
12. Design and implementation of IIR filter to meet given specifications.

B. List of Experiments using DSP Processor

1. Linear convolution of given two sequences.
2. Circular convolution of given two sequences.
3. Computation of N- Point DFT of a given sequence
4. Realization of an FIR filter (any type) to meet given specifications. The input can be a signal from function generator / speech signal.

5. Audio applications such as to plot time and frequency (Spectrum) display of Microphone output plus a cosine using DSP. Read a wav file and match with their respective spectrograms.
6. Noise: Add noise above 3kHz and then remove; Interference suppression using 400 Hz tone.
7. Impulse response of first order and second order system.

Course Outcomes

On completion of this course, students will be able to :

- Implement circular and section convolution.
- Implement linear convolution and circular convolution using DFT and IDFT.
- Implement digital FIR filter to meet the given specifications.
- Implement digital IIR filters to meet the given specification.
- Implement convolution and filtering using DSP processor.

.

LabVIEW - Level I

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16HOE661	2:0:0:4	3	CIE:50 SEE:50	3 Hours	OE

Course Objectives:

This course will enable students to :

- Understand the fundamental of graphical coding system.
- Learn to develop basic level of LabVIEW coding.
- Study the different component of LabVIEW operating tools.
- Study and develop state machine for a specific problem.
- Develop integrated coding solution for analysis and presentation with MyRio hardware using accelerometer.

Syllabus

Module - I

LabVIEW programming concepts, environment and Software constructs: Data flow, Polymorphism, Front panel window, block diagram, and connector pane, Menus and palettes, Configuration options. Controls, indicators, IO controls, and refnums Terminals, constants, nodes, update modes, and legends of charts and graphs. Mechanical action of Boolean objects Property Nodes. Numeric, string, Boolean, and path data types. Array and cluster data types. Shift registers, Case, Sequence and Event structures. **10 Hours**

Module - II

Programming, Data communication and synchronization VIs and functions: Conversion, comparison, and manipulation, Timing and Timing functions related to Timed structures. Data storage and file I/O formats, Waveform and waveform file I/O, Dynamic and User events Local, global, and shared variables Data Socket TCP and UDP Notifiers Queues Semaphores Property Nodes, and Invoke Nodes. **08 Hours**

Module - III

Error handling VIs and functions: Error clusters Dialog and User Interface VIs Custom error codes.

Design patterns: Simple state machine, User interface event handler, Queued message handler, producer/consumer (data) and producer/consumer (events), Functional global variables. **06 Hours**

Module - IV

Sub VI design: SubVI creation methods, Connector panes and connection types, Polymorphic subVIs, Options related

Debugging tools and techniques: Debugging tools, Error list window, Execution highlighting, Breakpoints and single stepping, Generic and custom probes, Debugging practices and techniques for different situations. **08 Hours**

Module - V

VI design and documentation (style) practices: Refer to the LabVIEW Style Checklist topic of the LabVIEW Help for information on the following items

i. User interface design and block diagram layout

ii. Modular and hierarchical design

iii. SubVI icons and connector pane layout (standard)

iv. Properties

v. Documenting Vis

Memory, performance, and determination

a. Tools for identifying memory and performance issues

Profile memory and performance, Show buffer allocations and VI metrics

b. Programming practices

Enforcing dataflow, User interface updates and response to user interface controls, Data type selection, coercion, and buffer allocation, Array, string, and loop operations **08 Hours**

Course Outcomes:

On completion of this course, students will be able to :

- Formulate basic aspects of the graphical programming using LabVIEW 2016.
- Develop LabVIEW coding for a specific problem of datalogging, measurement and presentation.
- Handle the error function and errors in the LabVIEW coding.
- Develop coding for data handling and Analysis on the acquired data.
- Design a state machine LabVIEW coding for an applied problem.

Text Books:

1. "LabVIEW - Getting Started with LabVIEW", M/s National Instruments, 2013

373427J-01.

2. Jovitha Jerome: "Virtual instrumentation using labview", PHI Learning Pvt. Ltd., 2010.
3. Hans-Petter Halvorsen: "Introduction to LabVIEW," University College of Southeast, Norway.
4. S. Sumathi, P. Surekha: "LabVIEW based Advanced Instrumentation Systems", Springer.
5. Lab manual provided by Dept. of Civil Engg., NCET.

Reference Books:

1. Jeffrey Travis, Jim Kring: "Introduction to Graphical Programming with LabVIEW", Pearson, 2006.
2. Malan Shiralkar: "LabVIEW Graphical Programming Course Collection", National Instruments.

E-Resources:

1. http://cnx.org/content/col10241/1.4.

Yoga and Meditation

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16HOE662	2:0:0:4	3	CIE:50 SEE:50	3 Hours	OE

Course Objectives:

This course will enable students to :

- Introduce the main principles of Yoga.
- Generate knowledge and skills of students to use the tools and techniques for using Yoga in day to day life for better health and well being.
- Improve communication and increase concentration through Yoga and Meditation.
- Equip the individual to handle stressful situations and manage day to day activities.

Syllabus

Module – I

Definition and meaning of yoga: Meaning of Asanas, Types of Asanas: standing, sitting and supine asanas. Standing Asanas (Trikon asan, padhastasan, ardhachakrasan, veerbhadrasan), Sitting Asanas (Vajrasan, padmasan, suptavajrasan, Ardhamaschendrasan, vakrasan), Supine Asanas (Sarvangasan, Matsyasan, Natarajasan, Shavasan). **08 Hours**

Module – II

Patanjali's Yoga Sutra: Eight limbs of yoga, Importance of discipline in Yoga, Stillness of mind, Five Modulations (vritti) of the mind, Practice and Dispassion, Obstacles in the path of Yoga, Overcoming distractions of the mind through Yoga. **08 Hours**

Module – III

Understanding physiological implications of Yoga, Three types of Gunas (Satva, Rajas and Tamas) and their effects on body and mind, Food Habits, Meaning of Prana, Pranayama and its advantages, Different types of Pranayama. **08 Hours**

Module – IV

Ayurveda: The science of life, Three types of doshas (Vata, Pitta and Kapha), Balancing the different doshas for a healthy life, Ayurvedic principles of food and activity, Advanced Asanas: Mayurasana, Sirsasana, Gomukh Asana, Vrkshasana, Baddha Konasana. **08 Hours**

Module – V

Meditation: Meaning of meditation, Meditation vs Concentration, Advantages of Meditation, Effects of Meditation on body and mind, Effect on health and general well being, Reducing stress through meditation, Increasing concentration, Improving communication, Effect on Environment. **08 Hours**

Course Outcomes:

On completion of this course, students will be able to :

- Know the basic principles of Yoga.
- Know and practice the basic asanas and their benefits.
- Use Pranayama and Meditation for improving health and mental peace.
- Know the difference between meditation and concentration.
- Apply the principles of Ayurveda and implement them for one's benefit.

Text Books:

1. Yoga Sutras of Patanjali (ancient text).
2. B K S Iyengar: "Light on Yoga".

Reference Books:

1. A traditional touch to Yogasanas for beginners and Sadhakas, Swami Vivekananda Yoga Prakashana (SVYP).
2. Dr. Vasant Lad: "Ayurveda: The Science of Self-Healing: A Practical Guide".

ॐ ॐ ॐ ॐ ॐ

Martial Arts

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16HOE663	2:0:0:4	3	CIE:50 SEE:50	3 Hours	OE

The following types of Martial arts are offered,

1. Karate
2. Taekwondo
3. Judo
4. Kung-fu

Expert Trainers will be provided during the academic year through experts in Martial Arts. Students who enroll for this elective should attend the regular Training classes and maintain a minimum of 85% attendance.

At the end of the training programme the performance Evaluation will be made by team of experts. Students who secure at least a satisfactory grade will be issued a certificate and deemed to have been completed the above said 3 Credit course. However, the students who have shortage of attendance will be consider for the award of 3 credits provided they undergo training at any of the training centers in the above said Martial Arts, complete the certification programme and give a demo along with viva in the presence of experts in the campus.

ଓ ଓ ଓ ଓ ଓ

Music (Carnatic Vocal/Instrumental)

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16HOE664	2:0:0:4	3	CIE:50 SEE:50	3 Hours	OE

Course Objectives:

This course will enable students to :

- Get familiarized with the conceptual understanding of Carnatic music.
- Gain knowledge about the basics of Swaravalis.
- Understand the use of different Talas.
- Gain understanding about various Raagas.
- Gain understanding about intricacies of Swaras.

Syllabus

Module – I

Theoretical Aspects: Father of Carnatic music, Famous personalities in Carnatic music, Concept of Sapta Swara, Taala, Melody, Pitch, Rhythm, Janaka Raaga, Janya Raaga. **03 Hours**

Module – II

Sarale Varase (Any 5), Janti Varase (Any 5), Daatu Varase, Tara Stayi, Mandra Stayi. **08 Hours**

Module – III

Alankaras: Druva Taala, Matya Taala, Triputa Taala, Rupaka Taala, Jampe Taala, Atta Taala, Eka Taala. **08 Hours**

Module – IV

Geethagalu, Pillari Geethe (4), Sanchari Geethe (5), Lakshana Geethe (1). **10 Hours**

Module – V

Swarajatis (Any 2), Kalyani, Bilahari, Neelambari, Kamach.
Varna (Any 2), Shankarabarana, Kalyani, Hamsadwani , Mohana. **10 Hours**

Course Outcomes:

On completion of this course, students will be able to :

- Gain knowledge about the theoretical background of carnatic music
- Acquire practical knowledge on basics of Carnatic music.
- Practical demonstration of different Talas.
- Distinguish among various Raagas based on swara sthanas.
- To synchronize the Raaga and Taala.

Text books:

1. Dr. Sachidevi: “Karnataka Sangeetha Darpana”, Sreenivasa Prakashana, Bengaluru, 2014.
2. Junior Carnatic Music – C Shiva Musicals, Malleshwaram, Bengaluru, 2013.

Dance (Bharatanatya)

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16HOE665	2:0:0:4	3	CIE:50 SEE:50	3 Hours	OE

Course Objectives:

This course will enable students to :

- Gain theoretical knowledge about various types of Indian dances.
- Understand about various musical instruments used in Bharatanatya.
- Learn Practical demonstrations of Bharatanatya steps on Prarthane Namaskara and Shlokas.
- Learn the movements of head, neck, eyes, hands according to Bharatanatya steps.
- Learn the brisk movements in Bharatanatya with the help of ADAVUS.

Syllabus

Module – I

Indian Classical dance, It's history and Significance, Types of Classical Dance, Bharatanatya, Kathakali, Mohini Attam, Koochipudi, Katahak, Odissi, Manipuri.

04 Hours

Module – II

Musical Instuments used in Bharatanatya: Tabala, Mrudanga, Kamsale, Kolata, Taala vadya. Famous personalities in Bharatanatya, Composers of Natya Grantas.

03 Hours

Module – III

Practical exercises on Prarthane, Namaskara and Shloka, Vyayama Kriye for Bharatanatya (Two Shlokas and Two Prarthanes). **10 Hours**

Module – IV

Abhinaya Steps (Chaturvidha) ShiroBedha, Drushti Bedha, Greeva Bedha, Brubedha, Hasta Bedha (Samyuta and Asamyuta). **10 Hours**

Module – V

Adavugalu (DashaVidha) Tattu adavu, Mettu Adavu, Nat Adavu, Egaru Tattu Adavu, Egaru Mettu adavu, Jaaru Adavu, Mandi adavu, TattuMettu Adavu, Rangakarma Adavu, Teermana Adavu. **12 Hours**

Course Outcomes:

On completion of this course, students will be able to :

- Get an insight into various types of Indian dances.
- Gain knowledge of different instruments used to perform dance.
- Perform exercises on prarthane, Namaskara according to Bharatanatya style.
- Perform basic steps in Abhinaya.
- Recognise and perform different Adavus.

Reference Book:

1. "Bharatanatya shastra", Department of Public Instruction, Karnataka State Government**.**

Sports

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16HOE666	2:0:0:4	3	CIE:50 SEE:50	3 Hours	OE

Students who are selected by the University to represent the VTU teams and for participating at State level / National level Sports in the following sports are exempted from taking open elective (Code:16HOE666) and will be awarded 3 credits.

Outdoor games	Indoor games
Cricket	Carrom
Foot ball	Chess
Hockey	Shuttle Badminton
Basket Ball	Squash
Kabbadi	Table – Tennis
Kho – Kho	Gymnastics
Hand – Ball	
Athletics	
Swimming	
Lawn Tennis	

The achievement in Sports as said above should have been made during the academic year during which the said open elective is offered.

After representing at VTU / State / National level in any of the above said sports, the students should produce the certificates from the competent authorities. Based on the certificates the institution will issue another certificate related to the achievement and awarding of three credits.

ଓ ଓ ଓ ଓ ଓ

Digital Communication Lab

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16ECL67	1:0:2:0	2	CIE:50 SEE:50	3 Hours	FC

Course Objectives:

This course will enable students to :

- A practical knowledge of different digital modulation techniques.
- The implementation of design concepts with software.

List of Experiments:

Hardware

1. TDM of two band limited signals.
2. ASK generation and detection.
3. FSKgeneration and detection.
4. PSK generation and detection.
5. QPSK generation.
6. Analog and Digital (with TDM) communication link using optical fiber.
7. Verification of sampling theorem using Flat-top sampling.

Software

1. ASK modulation and demodulation.
2. FSK modulation and demodulation.
3. PSK modulation and demodulation.
4. QPSK modulation and demodulation.

Course Outcomes:

On completion of this course, students will be able to :

- Implement ASK, PSK and FSK.
- Implement TDM using optical fiber.
- Demonstrate the QPSK generation.
- Realize the design theory concept using software.
- Analyze and understand the outputs by changing the important parameters.

Technical Aptitude and GD

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
15CSH68	2:0:0:0	2	CIE:50 SEE:50	3 Hours	HSS

The respective branches shall conduct training programmes related to important and latest programming languages and other emerging technologies, such as Solar and Electric power based gadgets, IoT, ROBOT's, Environmental friendly and cost effective construction techniques, UAV's and technologies pertaining to the respective department.

Seventh Semester B.E. – Syllabus

Power Electronics

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16ECT71	3:0:0:0	3	CIE:50 SEE:50	3 Hours	FC

Course Objectives:

This course will enable students to :

- Understand the meaning and importance of power electronics.
- Understand the main switching topologies used in power electronics circuits and how they operate, how they are controlled, driven and protected.
- Understand the principle of operation of a thyristor.
- Understand the different configurations of control rectifiers.
- Understand the categorize different commutation techniques.
- Understand the categorize AC voltage controllers.
- Understand the conceptualize DC-DC converters.
- Understand the principles of inverters.

Syllabus

Module – I

Power Devices: Application of power electronics, Power BJT's, Switching characteristics, Switching units, Base drive control, Power MOSFETs, Switching characteristics, Gate drives, IGBTs, Isolation of gate and base drive, Construction of thyristor, Principle of operation, Different states/Modes of operation, Static anode VI characteristics, Two transistor model, Triggering/Turn-on mechanism, Dynamic (Turn-on and Turn-off), Characteristics, Gate characteristics, Gate triggering, di/dt and dv/dt protection, Thyristor firing circuits. **08 Hours**

Module – II

Control Rectifier: Introduction, Principle of phase controlled converter operation, Single phase half controlled converter, Single phase fully controlled converter, Dual converter, Three phase half controlled converter, Three phase fully controlled converter. **08 Hours**

Module – III

Commutation Techniques: Introduction to commutation, Different types of commutations, Natural commutation and forced commutation, Self-commutation, Complementary commutation, Auxiliary thyristor commutation. **08 Hours**

Module – IV

AC Voltage Controllers and Choppers: Introduction to choppers, Principles of step down and step up choppers, Step down chopper with RL load, Classification of chopper, Analysis of impulse commutated thyristor chopper, Introduction to AC voltage controllers, Principle of ON-OfF control, Principle of phase control, Single-phase AC controllers with R load and RL load. **08 Hours**

Module – V

Inverters: Introduction, Principle of operation, Performance parameters, Single-phase bridge inverter, Voltage control of single-phase inverters, Current source inverters. **08 Hours**

Course Outcomes:

On completion of this module, students will be able to :

- Design drive controls for power semiconductor devices.
- Analyze the operation of single phase and three phase rectifiers with various loads.
- Design commutation circuits.
- Design AC-voltage controllers for different configurations.
- Analyze the operation of choppers and inverters.

Text Books:

1. M. H. Rashid: "Power Electronics Circuits, Devices and Applications", 3rd Edition, Pearson India, New Delhi, 2014, ISBN: 978-9332518445
2. G. K. Dubey, S. R. Doradla, A. Joshi, R. M. K. Sinha: "Thyristorized Power Controllers", 6th Edition, New Age International Pvt. Ltd., 1986, ISBN: 9788122434224.

Reference Book:

1. P. S. Bhimbra: "Power Electronics", Khanna Publication, 1995, ISBN: 9788174092 -793.

E-Resources:

1. https://www.electrical4u.com/power-mosfet/
2. http://www.completepowerelectronics.com/power-mosfet/
3. http://www.electronics-tutorial.net/dc-dc-converter-chopper/step-down-chopper/
4. http://www.electronics-tutorial.net/dc-to-ac-inverter/single-phase-full-bridge-inverter/
5. http://www.electricalidea.com/2016/05/21/single-phase-inverter/

Data Communication

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16ECT72	3:0:0:0	3	CIE:50 SEE:50	3 Hours	FC

Course Objectives:

This course will enable students to :

- Understand the fundamental of layered task and OSI model and its functions.
- Understand the concepts of Data link control and its protocols.
- Understand the concepts of Wired LAN and Ethernet standards.
- Understand the concepts of Virtual LANs and connecting devices.
- Understand the application of Network layer.

Syllabus

Module – I

Layered tasks, OSI Model, Layers in OSI model, TCP?IP Suite, Addressing, Telephone and cable networks for data transmission, Telephone networks, Dial up modem, DSL, Cable TV for data transmission. **08 Hours**

Module – II

Data Link Control: Framing, Flow and error control, Protocols,Noiseless channels and noisy channels, HDLC. **08 Hours**

Module – III

Wired LAN, Ethernet, IEEE standards, Standard Ethernet, changes in the standards, Fast Ethernet, Gigabit Ethernet. **08 Hours**

Module – IV

Connecting LANs, Backbone and Virtual LANs, Connecting devices, Back bone Networks, Virtual LANs. **07 Hours**

Module – V

Network Layer, Logical addressing, Ipv4 addresses, Ipv6 addresses, Ipv4 and Ipv6 Transition from Ipv4 to Ipv6 **08 Hours**

Course Outcomes:

On completion of this module, students will be able to :

- Describe layers of OSI model and its functions.
- Discuss the different protocols of Noiseless and Noisy channels.
- Analyze different types of Ethernet.
- Distinguish below Virtual and Connecting LANs.
- Describe the functions of network layer, Transition from Ipv4 to Ipv6.

Text Book:

1. B Forouzan: "Data Communication and Networking", 4th Edition, TMH, 2006.

Reference Books:

1. , James F. Kurose, Keith W. Ross: "Computer Networks", Pearson education, 2nd Edition, 2003.
2. Wayne Tomasi: "Introduction to Data communication and Networking", Pearson Education, 2007.

E-Resources:

1. http://www.webopedia.com/quick_ref/OSI_Layers.asp
2. https://gradeup.co/flow-and-error-control-techniques-i-28750a29-ba8d-11e5-b537-dcac2f2dd7d1
3. http://www.cse.wustl.edu/~jain/cis788-97/ftp/virtual_lans/
4. http://www.studytonight.com/computer-networks/osi-model-network-layer
5. https://www.tutorialspoint.com/data_communication_computer_network/network_layer_introduction.htm

Optical Fiber Communication (IC)

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16ECI731	3:0:2:0	4	CIE:50 SEE:50	3 Hours	FE

Course Objectives:

ThisThis course will enable students to :

- Understand the fundamental concepts in Optical Fiber Communication.
- Understand the types and function of various sources and detectors used OfC.
- Understand the basic knowledge of Fiber Couplers, Fiber Connectors and Optical Receivers.
- Understand the characteristics of Analog and Digital links.
- Understand the concept of WDM and Optical Networks.

Syllabus

Module – I

Overview of optical fiber communication: Introduction, Historical development, general system, advantages, disadvantages, and applications of optical fiber communication, optical fiber waveguides, Ray theory, cylindrical fiber, single mode fiber, cutoff wave length, mode filed diameter. Optical Fibers: fiber materials, photonic crystal, fiber optic cables specialty fibers. **08 Hours**

Module – II

Transmission Characteristics of Optical Fibers: Introduction, Attenuation, absorption, scattering losses, bending loss, dispersion, Intra model dispersion, Inter model dispersion.

Optical Sources and Detectors: Introduction, LED's, LASER diodes, Photo detectors, Photo detector noise, Response time, double heterojunction structure, Photo diodes, comparison of photo detectors. **08 Hours**

Module – III

Fiber couplers and connectors: Introduction, fiber alignment and joint loss, single mode fiber joints, fiber splices, fiber connectors and fiber couplers.

Optical receiver: Introduction, Optical Receiver Operation, receiver sensitivity, quantum limit, eye diagrams, coherent detection, burst mode receiver, operation, Analog receivers. **08 Hours**

Module – IV

Analog and digital links: Analog links – Introduction, overview of analog links, CNR, multichannel transmission techniques, RF over fiber, key link parameters, Radio over fiber links, microwave photonics.

Digital links – Introduction, point–to–point links, System considerations, link power budget, resistive budget, short wave length band, transmission distance for single mode fibers, Power penalties, nodal noise and chirping. **08 Hours**

Module – V

WDM concepts and components: WDM concepts, overview of WDM operation principles, WDM standards, multiplexer, Isolators and circulators, direct thin film filters, active optical components, MEMS technology, variable optical attenuators, tunable optical fibers, polarization controllers, chromatic dispersion compensators, tunable light sources.

Optical Amplifiers and Networks – optical amplifiers, basic applications and types, semiconductor optical amplifiers, EDFA.

Optical Networks: Introduction, SONET / SDH, Optical Interfaces, SONET/SDH rings, High – speed light – waveguides. **08 Hours**

List of Experiments:

1. Demonstration and study of different types of Optical Fibers and connectors.
2. To establish and Study of a 650nm fiber optic analog link.
3. To establish and Study of a 650nm fiber optic digital link.
4. Study of Intensity Modulation Technique using Analog input signal. To obtain intensity modulation of the analog signal, transmit it over a fiber optic cable and demodulate the same at the receiver and to get back the original signal.
5. Study of Intensity Modulation Technique using digital Input signal. The objective of this experiment is to obtain intensity modulation of digital signal, transmit it over fiber optic cable and demodulate the same at the receiver end to get back the original signal.
6. To measure propagation or attenuation loss in optical fiber.
7. To measure propagation loss in optical fiber using optical power meter.
8. To measurement of the Numerical Aperture (NA) of the fibre.

Course Outcomes:

On completion of this course, students will be able to :

- Know the fundamental concepts of OfC.
- Analyze the characteristics of Optical Fiber and functions of various Sources and Detectors.
- Describe various Fiber couplers, connectors and analyse Optical receivers.
- Distinguish Analog and Digital Links.
- Discuss concept of WDM, Optical Amplifiers and Optical networks.

Text Books:

1. Gerd Keiser: ”Optical Fiber Communication”, MGH, 4th Edition, 2008.
2. John M. Senior: “Optical Fiber Communications”, Pearson Education, 3rd Impres -sion, 2007.

Reference Book:

1. Joseph C Palais: “Fiber Optic Communication”, 4th Edition, Pearson Education.

E-Resources:

1. vlab.ambita.edu/index.php
2. http://nptel.ac.in/syllabus/syllabus.php?subjectId=108105053
3. http://nptel.ac.in/syllabus/syllabus.php?subjectId=108108076
4. http://nptel.ac.in/courses/108108076/

Web Technologies – Servlet, JSP (IC)

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16ECI732	3:0:2:0	4	CIE:50 SEE:50	n/a	FE

Course Objectives:

This course will enable students to :

- Understand the concepts of Web Technologies.
- Understand what are Web Servers and App Servers, and their differences.
- Understand Request and Response models.
- Understand how to build e-commerce applications using Servlets and JSP.
- Understand what EL and EL Tags are, and their usage in developing dynamic web pages.

Syllabus

Module – I

Introduction to Web Technologies: JEE, PHP, ASP and .Net

Introduction Web Dev environment: App Server, Web Server, 2-Tier and 3 -Tier Architecture.

Introduction to Servlet: Introduction to JEE containers, Application directory structure, Servlet Interface / Generic Servlet / HttpServlet, Servlet life cycle, Request and Response objects, Building sample application. **08 Hours**

Module – II

Inter Servlet Communication: RequestDispatcher, Include / Forword / Redirect, Building sample application.

Session Management: Creating & invalidating session, Different ways to handle session, Session time out configuration. **08 Hours**

Module – III

Introduction to JSP: Need for JSP, JSP life cycle. **06 Hours**

Module – IV

Introduction to EL: Need for EL and its advantages, Fundametals of EL.

EL Tags: Core Tags, Introduction to MVC, Building sample application. **08 Hours**

Module – V

Project Work: Create an e-commerce application using the client-side languages, such as Bootstrap3, HTML5, CSS3, JavaScript and jQuery, along with the server-side Java language - Servlets and JSP. **10 Hours**

Laboratory

1. Programs covering Web Technologies, Web Dev environment, Servlet.
2. Programs covering Inter Servlet Communication, Session Management.
3. Programs covering JSP, Introduction to EL, EL Tags.

Course Outcomes:

On completion of this course, the students are able to :

- Analyze the concepts of Web Technologies.
- Compare Web Servers and App Servers.
- Implement Request and Response models.
- Demonstrate how to build e-commerce applications using Servlets and JSP.
- Design dynamic web pages using EL Tags.

Text Books:

1. Basham, Bryan, Sierra Kathy, Bates, Bert: "Head First Servlets and JSP", 2nd Edition, Shroff, ISBN-10: 8184044976.
2. Santosh Kumar K: "JDBC 4.2, Servlet 3.1, and JSP 2.3 includes JSF 2.2 and Design Patterns, Black Book", 2nd Edition, Dreamtech Press, ISBN-10: 9351199088.

Reference Book:

1. Budi Kurniawan: "Servlet & JSP: A Tutorial", 2nd Edition, Brainy Software, ISBN-10: 1771970278.

Wireless Communication

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16ECT741	3:0:0:0	3	CIE:50 SEE:50	3 Hours	EE

Course Objectives:

This course will enable students to :

- The basic concepts behind wireless communication system
- The concept of path losses in radio wave propagation
- The different types of modulation techniques used in radio communication

Syllabus

Module – I

Introduction to wireless communication systems: Evolution of mobile radio commutation, mobile radio telephonic, Mobile radio systems around the world, Examples of wireless communication systems, paging systems, cordless telephone systems, cellular telephone systems, comparisons of common wireless communication systems, trends in cellular radio and personal communication systems. **08 Hours**

Module – II

The cellular concept –System Design Fundamentals: Introduction, Frequency Reuse, Channel Assignment strategies, Handoff strategies, Interference and system capacity, Trunkingand Grade of service, improving coverage and capacity in cellular systems. **08 Hours**

Module – III

Mobile radio propagation, Large scale path loss: Introduction to radio wave propagation, free space propagation model, Relating power to electric field, The Three basic propagation mechanism, reflection, ground reflection (Two-Ray) Model, Diffraction, Scattering, Practical link budget design using path loss models, outdoor propagation models, indoor propagation models , signals penetration into building s, ray tracing and site specific modeling. **08 Hours**

Module – IV

Modulation Techniques for mobile radio: Digital modulation- an overview, line coding pulse shaping techniques, geometric representation of modulation techniques, liner modulation technique, constant envelope modulation, combined linear and constant envelope modulation techniques. **08 Hours**

Module – V

Multiple-Accesses (MA) schemes: Introduction, FDMA, TDMA, SDMA, packet radio, capacity of cellular system. **08 Hours**

Course Outcomes:

On completion of this course, students will be able to :

- Describe basics of wireless communication techniques.
- Analyze and describe the fundamentals of cellular concepts.
- Describe mobile radio communication in depth.
- Distinguish between different types of modulation techniques for mobile radio communication.
- Differentiate the types of Multiple Access schemes.

Text Books:

1. Theodore S. Rappaport: "Wireless communications - Principles and Practices", 2nd Edition, Prentice Hall, 2001, ISBN-10: 0130422320, ISBN-13: 978-0130422323.

Reference Books:

1. Dr. Kamilo Feher: "Wireless digital communication", Prentice Hall, Har/Dskt, 1995, ISBN-10: 0130986178, ISBN-13: 978-0130986177.
2. William C. Y. Lee: "Mobile Communication Engineering -Theory and applications", Tata McGraw Hill, 1995, ISBN-10: 0070370397, ISBN-13: 978-0070370395.

E-Resources:

1. http://nptel.ac.in/courses/117102062/8
2. http://nptel.ac.in/courses/117102062/21
3. http://www.radio-electronics.com/info/cellulartelecomms/cellular_concepts/multiple_access_schemes.php
4. https://www.elprocus.com/types-of-wireless-communication-applications/

Artificial Intelligence

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16ECT742	3:0:0:0	3	CIE:50 SEE:50	3 Hours	EE

Course Objectives:

This course will enable students to

- Apply a given AI technique to a given concrete problem
- Implement non-trivial AI techniques to handle complex problem
- Understand uncertainty and Problem-solving techniques.
- Understand various symbolic knowledge representation to specify domains and reasoning tasks of a situated software agent.
- Understand different logical systems for inference over formal domain

Syllabus

Module – I

Introduction: What is AI? Intelligent Agents: Agents and environment; Rationality; the nature of environment; the structure of agents. Problem solving: Problem-solving agents; Example problems; Searching for solution; Uninformed search strategies.

09 Hours

Module – II

Informed Search, Exploration, Constraint Satisfaction, Adversial Search: Informed search strategies; Heuristic functions; On-line search agents and unknown environment. Constraint satisfaction problems; Backtracking search for CSPs. Adversial search: Games; Optimal decisions in games; Alpha-Beta pruning.

08 Hours

Module – III

Logical Agents: Knowledge-based agents; The wumpus world as an example world; Logic; propositional logic Reasoning patterns in propositional logic; Effective propositional inference; Agents based on propositional logic. **07 Hours**

Module – IV

First-Order Logic, Inference in First-Order Logic-1: Representation revisited; Syntax and semantics of first-order logic; Using first-order logic; Knowledge engineering in first-order logic. Propositional versus first-order inference; Unification and lifting

08 Hours

Module – V

Inference in First-Order Logic-2: Forward chaining; Backward chaining; Resolution.

08 Hours

Course Outcomes:

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

- Design intelligent agents for solving simple gaming by using artificial intelligence.
- Apply non-trivial AI techniques to handle complex problems.
- Apply various symbolic knowledge representation to specific problems.
- Design Knowledge-based agents.
- Understand syntax and semantics of first-order logic.
- Understand inference in first order logic.

Text Book:

1. Stuart Russel, Peter Norvig: Artificial Intelligence A Modern Approach, 2nd Edition, Pearson Education, 2003. (Chapters 1.1, 2, 3.1 - 3.4, 4.1, 4.2, 4.5, 5.1, 5.2, 6.1-6.3, 7, 8, 9, 10, 11.1, 11.2, 11.4, 11.5, 13.1, 13.4, 13.5, 13.6,) ISBN 0-13-103805-2.

Reference Books:

1. Elaine Rich, Kevin Knight: "Artificial Intelligence", 3rd Edition, Tata McGraw Hill, 2009, ISBN-10: 007087709.
2. Nils J. Nilsson: "Principles of Artificial Intelligence", Elsevier, 1980, ISBN: 978-3-540-11340-9.

E-Resources:

1. http://stpk.cs.rtu.lv/sites/all/files/stpk/materiali/MI/Artificial%20Intelligence%20A%20Modern%20Approach.pdf.
2. http://www.getfreeebooks.com/16-sites-with-free-artificial-intelligence-ebooks

Micro-Electro-Mechanical Systems (MEMS)

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16ECT743	3:0:0:0	3	CIE:50 SEE:50	3 Hours	EE

Course Objectives:

This course will enable students to :

- Understand the standard micro fabrication techniques and the issues surrounding them.
- Understand the major classes, components, and applications of MEMS devices/systems.
- Understand the unique requirements, environments, and applications of MEMS.

Syllabus

Module – I

Overview of MEMS and Microsystems: MEMS & Microsystems, Typical MEMS and Micro system products — features of MEMS, The multidisciplinary nature of Microsystems design and manufacture, Applications of Microsystems in automotive industry, health care industry, aerospace industry, industrial products, consumer products and telecommunications. **08 Hours**

Module – II

Scaling Laws in Miniaturization: Introduction to scaling, scaling in geometry, scaling in rigid body dynamics, scaling electrostatic forces, electromagnetic forces, electricity, scaling in fluid mechanics & heat transfer.

Transduction Principles in MEMS and Microsystems: Introduction, Micro sensors — thermal, radiation, mechanical, magnetic and bio-sensors, Micro actuation, MEMS with micro actuators. **08 Hours**

Module – III

Microsystems Fabrication Process: Introduction, Photolithography, Ion-implantation, diffusion, oxidation, CVD, PVD, etching and materials used for MEMS, Some MEMS fabrication processes: surface micro-machining, bulk micromachining, LIGA process, LASER micro machining, MUMPS, FAB-less fabrication **08 Hours**

Module – IV

Micro System Design and Modeling: Introduction, Design considerations: Process design, Mechanical design, Modeling using CAD tools: ANSYS / Multiphysics or Intellisuite or MEMS CAD, Features and Design considerations of RF MEMS, Design considerations of Optical MEMS (MOEMS), Design and Modeling: Case studies: i) Cantilever beam ii) Micro switches iii) MEMS based SMART antenna in

mobile applications for maximum reception of signal in changing communication conditions and iv) MEMS based micro mirror array for control and switching in optical communications. **08 Hours**

Module – V

Micro system packaging: Over view of mechanical packaging of micro electronics micro system packaging, Interfaces in micro system packaging, Packaging technologies. **08 Hours**

Course Outcomes:

On completion of this course, students will be able to :

- Describe new applications and directions of modern engineering.
- Describe the techniques for building microdevices in silicon, polymer, metal and other materials.
- Describe the physical, chemical, biological, and engineering principles involved in the design and operation of current and future microdevices.
- Analyze microsystems technology for technical feasibility as well as practicality.
- Describe the limitations and current challenges in microsystems technology.

Text Books:

1. Tai Ran Hsu: "MEMS and Micro Systems: Design and Manufacture", Tata McGraw Hill, 2002.
2. Boca Raton: "MEMS and NEMS: Systems, Devices and Structures", CRC Press, 2002.

Reference Books:

1. J. W. Gardner, V. K. Vardan: "Micro Sensors MEMS and SMART Devices", John Wiley, 2002.
2. N. Maluf: "Introduction to Micro Mechanical Systems Engineering, Artech House", Norwood, MA, 2000.

E-Resources:

1. http://nptel.ac.in/courses/117105082/
2. http://www.ece.ubc.ca/course/elec-465
3. https://www.mems-exchange.org/MEMS/fabrication.html
4. https://www.elprocus.com/understanding-fabrication-mems/

Tax Management

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16HOE751	2:0:0:4	3	CIE:50 SEE:50	3 Hours	OE

Course Objectives:

This course will enable students to :

- Familiarise the students with the significance of taxation system.
- Understand the structure of Indian Taxation system.
- Gain knowledge about the practical aspects of Indian taxation.
- Understand the system of computation of tax from Salaries.
- Sketch the recent trends in Indian taxation system.

Syllabus

Module – I

Introduction to taxation system, Objectives of taxation, Factors to be considered for tax planning Canons of taxation, Types of taxation, Direct tax, Indirect tax (Broad perspective only). **07 Hours**

Module – II

Taxation system in India, Types of taxes levied in India, Various heads of income tax (Broad outline only} Basic concepts in taxation, Assessment year, Financial year, assessee, Residential status, Tax liability **08 Hours**

Module – III

Income tax authorities in India, Constitution, Powers, Functions specimen of Form 16, Filing of returns, tax evasion, Penalties for contravening the provisions of income tax. **08 Hours**

Module – IV

System of computation of tax from salaries, Taxable income, Permissible deductions from 80C to 80U Fringe benefits exempted from tax, exempted income under section 10 of Income tax act. **10 Hours**

Module – V

Trends in Indian taxation system, Self assessment, PAN card, Budgetary provisions of the financial year 2017-18 on taxation, GST, Advantages, Problems in implementing GST, Measures to overcome the limitations of GST. **06 Hours**

Course Outcomes:

On completion of this course, students will be able to :

- Gain knowledge about the system of taxation prevailing in the country.
- Compute tax under different heads.
- Gain practical knowledge on filing returns.
- Calculate the payable tax for salaried individuals.
- Gain insight into recent practices on taxation.

Reference Books:

1. Dr. Vinod K. Singhania: “Direct taxes-Law and Practice”, Taxmann Publication.
2. Dr. Mehrotra, Dr. Goyal: “Direct taxes- Law and Practice”, Sahitya Bhavan Publication.
3. “7 lectures-Income tax-I “, VBH.
4. Swaminathan: “Income Tax”, KPH.
5. T.N.Manoharan: “Income tax including VAT”.
6. R.G.Saha, Ushadevi: “Taxation”, HPH.

Assessment of Building Energy Performance

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16HOE752	2:0:0:4	3	CIE:50 SEE:50	3 Hours	OE

Course Objectives:

This course will enable students to :

- Provide a foundation for performing a building energy audit
- Perform assessment tasks on building energy performance
- Submit a Building EQ rating
- Understand the methods and processes to be performed in the field
- Know the process of certifying professionals in energy assessment

Syllabus

Module – I

Introduction, global energy consumption characteristics and the role of commercial and residential buildings, building energy end use consumption characteristics, impact of time variations in building energy consumption, Building mechanical, electrical, and lighting systems. **08 Hours**

Module – II

Anatomy of typical HVAC systems in commercial buildings , typical primary and secondary HVAC equipment and their role in meeting system requirements , basics of electrical distribution systems and their equipment in commercial buildings, basics of lighting system in buildings, including performance terminology, lighting technologies, energy performance, and the role of day lighting. **08 Hours**

Module – III

Introduction to building energy benchmarking and assessment , differences between benchmarking, labeling programs, and energy and environmental auditing, role of building type and climate zone on energy use, key aspects of ENERGY STAR® Portfolio Manager and other tools for benchmarking, ASHRAE Building EQ As Designed and In Operation ratings, differences between Building EQ and Portfolio Manager, Preliminary Energy Use Analysis (PEA). **08 Hours**

Module – IV

Measuring and monitoring building performance, instrumentation for measuring indoor environmental quality and building energy flows, Perform measurements of indoor environmental quality and building energy flows, accuracy of building measurements, Identify the components of an ASHRAE Level 1 walk through survey and the differences between Level 1, 2, and 3 surveys, Indoor Environment Quality.

08 Hours

Module – V

Energy Efficiency Measures – Building Envelope and Lighting, role of building envelope characteristics on energy use, energy conservation and energy efficiency measures related to envelope and lighting characteristics, Energy Efficiency Measures – HVAC Systems, energy conservation and energy efficiency measures related to HVAC systems, financial analysis of expected improvements to HVAC systems. **08 Hours**

Course Outcomes:

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

- Produce an ASHRAE Building EQ In Operation rating for the buildings provided in the class
- Produce a listing of potential Energy Efficiency Measures (EEM) including financial payback analysis
- Perform measurements of indoor environmental quality and HVAC system performance
- Identify different building types and determine the impact of climate on energy use.
- Analyze raw energy consumption data from measured-meter readings

Text Books:

1. ASHRAE Building Energy Quotient Program website.
2. ASHRAE BEAP certification study guide.
3. ASHRAE Standard 105-2014 Standard Methods of Determining, Expressing, and Comparing Building Energy Performance and Greenhouse Gas Emission.

Reference Books:

1. ASHRAE Performance Measurement Protocols for Commercial Buildings: Best Practices Guide.
2. ENERGY STAR® Portfolio Manager website.

Natural Disaster Mitigation and Management

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16HOE753	2:0:0:4	3	CIE:50 SEE:50	3 Hours	OE

Course Objectives:

This course will enable students to :

- Understand the types of natural and environmental disasters.
- Develop skills in various stages of disaster preparedness, mitigation and management.
- Understand the methodologies for disaster risk assessment.

Syllabus

Module – I

Natural Disasters – Overview: Introduction- Natural Disasters around the world- Natural Disaster Risk Assessment- Earth and its characteristics Human Dimensions of Global environment Change – Disaster mitigation, preparedness, response and recovery comprehensive emergency management Early warning systems and Disaster Preparedness– Rehabilitation, Vulnerable Populations - Logistics and Services, Food, Nutrition and Shelter -Role of UN Red cross and NGOs. **08 Hours**

Module – II

Natural Hazards: Introduction and Review - Natural Disasters -Principles, Elements, and Systems - Geological-Geomorphological aspects, - Earthquake-Geology, Seismology, Characteristics and dimensions– Landslides- Human impact on the mountainous terrain and its relationship with Rainfall, liquefaction etc- Tsunami - Nature and characteristics. **08 Hours**

Module – III

Climate system aspects and Processes: Oceanic, Atmospheric and Hydrologic cycles - Severe Weather & Tornadoes , Cyclones, Floods and Droughts - Global Patterns - Mitigation & Preparation – Drought – Famine- nature and dimensions – Drought Assessment and Monitoring. **08 Hours**

Module – IV

Natural Disaster Communication: Mapping - Modeling, risk analysis and loss estimation – Natural disaster risk analysis - prevention and mitigation - Applications of Space Technology (Satellite Communications, GPS, GIS and Remote Sensing and Information / Communication Technologies (ICT) in Early warning Systems - Disaster Monitoring and Support Centre– Information Dissemination, mobile communication – etc. **08 Hours**

Module – V

Administrative mechanisms: Community and Social organizations – Education and Training – Establishment of capacity building among various stake holders – Government - Educational institutions – Use of Multi-media knowledge products for self education. **08 Hours**

Course Outcomes:

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

- Learn about the types of natural and environmental disasters and its causes.
- Learn about organizational and Administrative strategies for managing disasters.
- Learn about the early warning systems, monitoring of disasters effect and necessity of rehabilitation.
- Learn about the engineering and non-engineering controls of mitigating various natural disasters.
- Understand the key roles of capacity building to face disaster among government bodies, institutions, NGO's, etc.
- Learn methodologies for disaster risk assessment with the help of latest tools like GPS, GIS, Remote sensing, information technologies, etc.

Text Books:

1. Kovach, Robert L :"Earth's Fury: An Introduction to Natural Hazards and Disasters", Englewood Cliffs, N.J., Prentice Hall, 1995.
2. Siddhartha Gautam, K Leelakrishna Rao: "Natural disaster Management", 3rd Edition, 2012, ISBN: 9381604320.

Reference Books:

1. Arul Jothi, D L Balaji: "Safety And Disaster Management Education in Schools", 1st Edition, Anmol Publications, 2009, ISBN: 9380252609.

E-Resources:

1. https://www.publicsafety.gc.ca/cnt/mrgnc-mngmnt/dsstr/bt-dsstr-mtgtn-en.aspx
2. www.nrdms.gov.in/natural_disaster.asp
3. https://www.ncbi.nlm.nih.gov › NCBI › Literature › Bookshelf

Small and Medium Enterprise Management

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16HOE761	2:0:0:4	3	CIE:50 SEE:50	3 Hours	OE

Course Objectives:

This course will enable students to :

- Understand the various concepts of Entrepreneurship and familiarize them with the understanding of contemporary environment of MSMEs.
- Understand the business Environment to MSMEs.
- Understand the process of Enterprise Creation.
- Understand the effective Business Plan and Institutional Support Mechanism.
- Understand the concepts of marketing management in the MSMEs.

Syllabus

Module – I

Basic Aspects: Concept, nature of Entrepreneur and Entrepreneurship, Distinction between Entrepreneur and Manager, Entrepreneurship, Medium, Small and Tiny Business : Definition, Role in the economy and significance, Changing scenario of MSMEs in the era of Liberalization and Globalization, Competitiveness. **08 Hours**

Module-II

Environment assessment: Political, Legal, Economic, Social, Technological, Global environment, Assessment of business opportunities, Government initiatives and private sector opportunity. **08 Hours**

Module-III

Enterprise Creation: Starting a small industry, Entrepreneurial function or process of starting a new venture based on personal competencies, requirements to start a business venture, Feasibility of the project, Business incubators . **08 Hours**

Module-IV

Business Plan: Developing effective business plan-meaning, benefits of business plan, Timing of the business plan, Length of the business plan, composition of the business plan or detailed project report. Institutional Support Mechanism: District Industries Centre, State Directorate of Industries, SIDBI, NSIC, SISI, KSFC, KIADB, TECSOK. **08 Hours**

Module-V

Small Business Marketing: Concept of Marketing, Scope of Marketing, Marketing Mix, Product Mix, Channels of Distribution, Market Segmentation, Role of Middlemen, Distribution Strategies, Sales Promotion, Advertising and Publicity, Packaging Strategies, Branding Strategies. **08 Hours**

Course Outcomes:

On completion of this course, students will be able to :

- Visualize the various concepts of Entrepreneurship and understand of current environment of MSMEs.
- Know the Business Environment with respect to MSMEs.
- Know the Process of Enterprise Creation.
- Prepare Business Plan and Understand the Institutional Support Mechanism.
- Know the marketing management with reference to MSMEs.

Text Books:

1. Shukla. M.B: "Entrepreneurship and Small Business Management", Kitab Mahal, Allahabad, 2011.
2. Sahay A., V. Sharma: "Entrepreneurship and New Venture Creation", Excel Books, New Delhi, 2008.
3. Lall, Sahai: "Entrepreneurship", Excel Books, New Delhi, 2006.
4. S. Anil Kumar: "Small Business and Entrepreneurship", I.K.International Publishing House Pvt. Ltd., 2008.
5. Kotler, Keller, Koshy, Jha: "Marketing Management", 13th Edition, Pearson Education.

Reference Book:

1. Wickham, Phillip A: "Strategic Entrepreneurship", Pitman, UK, 1998.

Occupational Safety and Health Administration

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16HOE762	2:0:0:4	3	CIE:50 SEE:50	3hours	OE

Course Objectives:

This course will enable students to :

- Understand the occupational health and safety and sector specific occupational health and safety issues.
- Understand the socio-economic aspects of occupational health and safety.
- Understand the health screening measures.
- Understand the legal Provisions on Occupational Health and Safety.
- Understand the participatory Research and Occupational Health.

Syllabus

Module – I

Introduction to Occupational Health and Safety: Definition and Context of OHS, Objectives and Principles of OHS, Workplace and Health Occupational Health, Hygiene and Ergonomics.

Sector Specific Occupational Health and Safety Issues: Health and Safety Risks in Mining, Health Hazards in Electronic Industry, Health Hazards in Food Processing Industry, Health Hazards in Other Industries. **07 Hours**

Module – II

Socio-Economic aspects of Occupational Health and Safety: Women's occupational and health safety, Child labour issues in occupational health and safety, Health issues in the unorganized sector.

Basics of Preventive Techniques: Definition of Accident, Accident Analysis, Monitoring of Hazards, Reporting and Investigation of Accidents. **08 Hours**

Module – III

Health Screening Measures: Stages of Medical Examination, Occupational History, Pulmonary Function Test (PFT), Noise Induced Hearing Loss (NIHL). **07 Hours**

Module – IV

Legal Provisions on Occupational Health and Safety: Overview of existing OHS Legislations in India, The Factories Act, The Mines Act, The Workmen's Compensation Act, The Employee's State Insurance Act. **07 Hours**

Module-V

Participatory Research and Occupational Health: Philosophy of Participatory Research (PR) Analysis based on PR Methodologies Conducting Participatory Research for OHS. **07 Hours**

Course Outcomes:

On completion of this course, students will be able to :

- Develop the ability to know the occupational health and safety.
- Have the knowledge of the socio-economic aspects of occupational health and safety.
- Demonstrate purpose of health screening measures.
- Know the legal Provisions on Occupational Health and Safety.
- Participate in Research and Occupational Health.

References:

1. International Labour Organinization. Mining: a hazardous work [Internet]. ; 2015 ([cited 2015 Feb 2]. Available from: http://www.ilo.org/safework/areasofwork/hazardous-work/WCMS_124598/lang--en/index.htm
2. Gyekye, S.A. Workers' perceptions of workplace safety: an African perspective. Int J Occup Saf Ergon. 2006;12:31–42.Crossref | PubMed| Scopus (4)
3. Amponsah-Tawiah, K., Jain, A., Leka, S., Hollis, D., Cox, T. Examining psychosocial and physical hazards in the Ghanaian mining industry and their implications for employees' safety experience. J Safety Res. 2013;45:75–84.Crossref PubMed| Scopus (5)
4. Owiredu D. Annual chamber of mines presidential review. 83rd Annual General Meeting of the Ghana Chamber of Mines [Internet]. 2011 [cited 2014 Mar 1]. Available from:http://www.ghanachamberofmines.org.
5. Helliwell, J.F., Putnam, R.D. The social context of wellbeing. Philos Trans R Soc Lond B Biol Sci. 2004;35:1435–1446.Crossref| Scopus (550)
6. Bhagawati, B. Basics of occupational safety and health. IOSR J Environ Sci Toxicol Food Technol. 2015;9:91–94.
7. Amponsah-Tawiah, K., Dartey-Baah, K. Occupational health and safety: key issues and concerns in Ghana. Int J Bus Soc Sci. 2011;14:120–126.

   National Safety Council. Injury facts. NSC, Itasca (IL); 2004.

Animation and Multimedia Engineering

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16HOE763	2:0:0:4	3	CIE:50 SEE:50	3 Hours	OE

Course Objectives:

This course will enable students to:

- Understand the basics of Animation.
- Understand computer animation using characters.
- Learn how to create quality animation characters.
- Learn about volume construction and action made from face, gestures.
- Understand Acting and Sketching techniques.

Syllabus

Module – I

Introduction to Animation: History of Animation, The Origins of Animation, Types of Animation, Terms used in Animation, Basic Principles of Animation.

Introduction to equipment required for Animation: Animator's Drawing Tools, Rapid Sketching and Drawing, Developing Animation Character. **07 Hours**

Module – II

Developing the characters with computer animation: Anatomy and Body Language, 2-D virtual drawing for animation.

Motion studies: : Thumbnails, sequential movement drawing, drawing for motion.

08 Hours

Module – III

Essentials and qualities of good animation characters: Three dimensional drawings of characters.

Skills and Basic proportions: Visual and creative development of an artist, how to draw gestures, Heads, Rotation in Arcs, Key Lines, Perspective. **08 Hours**

Module – IV

Volume Construction: Balance, Muscles, Light and shade.

Shape and Action: Hands and Legs, Foreshortening, Facial expressions. **08 Hours**

Module – V

Acting and Sketching techniques: Introduction to Acting, Modeling, Sketching from Acting, Sketching from live models, Introduction to Rapid Sketching Techniques, Sketching from Memory, live action. **09 Hours**

Course Outcomes:

On completion of this course, students will be able to :

- Recognize the basics of animation along the tools.
- Develop characters with computer animation.
- Develop 3D drawings of characters and acquire skills regarding basic level of sketching.
- Explain Foreshortening, Facial expressions.
- Develop small animation characters by using acting and sketching techniques.

Text Book:

1. Chris Patmore: "The Complete Animation course: The Principles, Practice and Techniques of Successful Animation", (Chapters 1-10), Barons Educational Series New York, 2003, ISBN-13: 978-0764123993.

Reference Books:

1. Frank Thomas, Ollie Johnston: "The Illusion of Life by Walt Disney", Abbeville Press, 1981.
2. Daniel Carter, Michael Courtney: "Anatomy for the Artist: A Comprehensive Guide to Drawing the Human Body, A Complete Guide", 2011.

E-Resources:

1. http:// www.animationmentor.com/
2. https://www.bloopanimation.com/animation-for-beginners/
3. https://robots.thoughtbot.com/css-animation-for-beginners

Power Electronics Lab

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16ECL77	1:0:2:0	2	CIE:50 SEE:50	3 Hours	FC

Course Objectives:

This course will enable students to :

- Understand the working knowledge of different triggering circuits, DIAC and TRIAC.
- Understand the operation and characteristics of Stepper motor and Inverter.

List of Experiments:

1. SCR Characteristics
2. TRIAC Characteristics
3. MOSFET Characteristics
4. IGBT Characteristics
5. RC Triggering circuit – HWR & FWR
6. UJT Triggering of SCR
7. Oscillation Chopper circuit
8. UJT Triggering circuit – HWR & FWR
9. Digital Firing circuit
10. AC Voltage control by using TRIAC and DIAC
11. Single Phase FWR
12. Impulse Commuted Chopper
13. Speed control of a Stepper motor
14. Series Inverter
15. Parallel Inverter

Course Outcomes:

On completion of this course, students will be able to :

- Understand the fundamental concepts of MOSFET, IGBT and SCR.
- Understand the basics of UJT HWR and FWR.
- Discuss UJT triggering of SCR.
- Understand Stepper motor concepts.
- Describe various types of inverters.

Data Communication Lab

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16ECL78	1:0:2:0	2	CIE:50 SEE:50	3 Hours	FC

Course Objectives:

This course will enable students to :

- Understand the practical aspects of techniques used in data communication
- Understand the Serial communication techniques for data communication

List of Experiments:

1. Simulate bit stuffing and destuffing
2. Character stuffing
3. Encryption and decryption
4. Cyclic Redundancy check
5. Simulate short path
6. Minimum spanning tree
7. Serial Communication using RS-232 (Synchronous and Asynchonous)
8. Serial Communication using telephone cable
9. Telnet
10. Remote host access

Course Outcomes:

On completion of this course, students will be able to :

- Understand different data stuffing techniques used in communication.
- Analyze basic encryption techniques.
- Discuss spanning tree.
- Understand serial communication techniques.
- Describe telnet basics and remote access.

Project Phase-I and Seminar

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
16ECP79	0-0-6-0	3	100	3 Hours	FC

Phase	Activity	Credits
I	Batch formation, project identification, literature survey, finalization of problem statement with objectives and outcomes, Synopsis submission, Preliminary seminar for the approval of selected topic and objectives	3

Eighth Semester B.E. – Syllabus

Phase	Activity	Credits
II	Design, Theoretical/experimental investigation and Mid-term seminar to review the progress of the work and documentation (Mid term report).	4
III	Completion of the project work, participation in the project exhibition, Submission of project report Final Internal seminar and demonstration, Publications.	4
	Evaluation and Viva-voce	5 +5

Program Educational Objectives (PEOs)

Electronics & Communication Engineering graduates are expected to fulfill the following PEOs after few years of their graduation.

PEO1	Graduates of Electronics and Communication engineering will be using the basic academic knowledge of design and analysis required in the industry for sustainable societal growth.
PEO2	Graduates of Electronics and Communication engineering will demonstrate the technical competence based on modern tools.
PEO3	Graduates in Electronics and Communication engineering will demonstrate good communication skills, dynamic leadership qualities with concern for environmental protection.
PEO4	Electronics and Communication engineering graduates will be capable of pursuing higher studies, take up research and development work blended with ethics and human values.
PEO5	Electronics and Communication engineering graduates will have the ability to become employable and entrepreneurs thereby switching over from responsive engineering to creative engineering.

Program Outcomes (POs)

PO1	**Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and electronics and communication engineering principles to the solution of complex problems in electronics and communication engineering.
PO2	**Problem Analysis:** Identify, formulate, research literature, and analyze complex electronics and communication engineering problems reaching substantiated conclusions using first principles of mathematics, and engineering sciences.
PO3	**Design/ Development of solutions:** Design solutions for complex electronics and communication engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4	**Conduct Investigations of Complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions related to electronics and communication engineering problems.
PO5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex electronics and communication engineering activities with an understanding of the limitations.
PO6	**The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional electronics and communication engineering practice.
PO7	**Environment and Sustainability:** Understand the impact of the professional electronics and communication engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the electronics and communication engineering practice.
PO9	**Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex electronics and communication engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-Long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

NAGARJUNA

COLLEGE OF ENGINEERING & TECHNOLOGY

An Autonomous College under VTU

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

VISION

To transform the students as leaders in Electronics & Communication Engineering to achieve professional excellence in the challenging future

MISSION

M1: To create an environment for the students to have strong academic fundamentals and enable them to be life-long learners.

M2: To provide modern tools to the students in the field of electronics and communication to meet the real-world challenges.

M3: To develop Communication skill, leadership qualities, team work and skills for continuing education among the students.

M4: To inculcate Ethics, Human values and skills for solving societal problems and environmental protection.

M5: Validate engineering knowledge through innovative research projects to enhance their employability and entrepreneurship skills.

III & IV Semesters

Scheme and Syllabus
With effect from Academic Year 2018-19

Third Semester B.E.– Scheme

Sl. No.	Course Code	Course	Teaching Dept.	L-T-P-S (Hrs/week)	Total Credits	Marks
1	17ECM31	Engineering Mathematics-III(IC)	Mathematics	3-0-2-0	4	100
2	17ECT32	Analog Electronic Circuits	EC	3-0-0-0	3	100
3	17ECT33	Logic Design	EC	3-0-0-0	3	100
4	17ECT34	Field Theory	EC	4-0-0-0	4	100
5	17ECI35	Network Analysis (IC)	EC	3-0-2-0	4	100
6	17ECI36X	Foundation Elective-I (IC)	EC	2-0-2-0	3	100
7	17ECL37	Analog Electronics Circuits Laboratory	EC	1-0-2-0	2	100
8	17ECL38	Logic Design Laboratory	EC	1-0-2-0	2	100
9	17ECH39	Integrated Rural Development – Part 1	EC	0-2-0-0	1	100
		TOTAL		**20-2-8-0**	**26**	**900**

Foundation Elective–I (IC)

Sl. No.	Course Code	Course
1	17ECI361	Computer Communication and Networking
2	17ECI362	Creating Interactive and Responsive Web Pages
3	17ECI363	Electronic Instrumentation

Fourth Semester B.E. – Scheme

Sl. No.	Course Code	Course	Teaching Dept.	L-T-P-S (Hrs/week)	Total Credits	Marks
1	17ECM41	Engineering Mathematics -IV (IC)	Mathematics	3-0-2-0	4	100
2	17ECT42	Microprocessor	EC	4-0-0-0	4	100
3	17ECT43	Fundamentals of HDL	EC	3-0-0-0	3	100
4	17ECT44	Signals and Systems	EC	3-0-0-0	3	100
5	17ECI45X	Foundation Elective-II (IC)	EC	3-0-2-0	4	100
6	17ECT46X	Engineering Elective-III	EC	3-0-0-0	3	100
7	17ECL47	Microprocessors Laboratory	EC	1-0-2-0	2	100
8	17ECL48	HDL Laboratory	EC	1-0-2-0	2	100
9	17ECH49	Integrated Rural Development – Part 2	EC	0-2-0-0	1	100
		TOTAL		**21-2-8-0**	**26**	**900**

Foundation Elective-II (IC)

Sl. No.	Course Code	Course
1	17ECI451	Linear Integrated Circuits
2	17ECI452	Fundamentals of VLSI
3	17ECI453	Introduction to Programming using Python

Engineering Elective-III

Sl. No.	Course Code	Course
1	17ECT461	Renewable Energy Resources
2	17ECT462	Object Oriented Programming using C++
3	17ECT463	Smart Materials
4	17ECT464	Management Information Systems

IC – Integrated Course **L – Lecture** **T-Tutorials**
P-Practical **S – Self Study**

Engineering Mathematics-III (IC)

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
17ECM31	3:0:2:0	4	CIE:50 SEE:50	3 Hours	BS

Course Objectives:

This course will enable students to :

- Develop the application of mathematical skills in solving the engineering problems using computers.
- Learn to use the partial differential equations in engineering applications.
- Use of Transforms in the engineering problems.
- Find the approximated solutions to engineering problems numerically.

Syllabus

Module - I

Partial Differential Equations: Formation of PDE –Eliminating the Arbitrary constants and arbitrary functions, solutions of non homogenous PDE by direct integration., Method of separation of variables. Applications to PDE –Derivation of one dimensional of wave equation and solution by separation of variables-with specified boundary conditions. Derivation of one dimensional of Heat equation and solution by separation of variables-with specified boundary conditions. **08 Hours**

Module - II

Fourier Series: Periodic functions, Dirchlet's conditions, Euler's Formulae-Fourier series of periodic functions of period 2l and 2π, Half range Fourier series, Practical harmonic analysis. **08 Hours**

Module - III

Fourier Transform: Infinite Fourier Transform, Fourier Sine and Cosine Transform and their inverse transforms-Problems.

Z-Transforms: Definition, Standard functions, statements of Linearity property, Damping and shifting rules-problems. Inverse Z-Transforms by partial fraction method. Difference equations– solutions by Z-transform. **08 Hours**

Module - IV

Numerical Methods: Numerical solutions of Algebraic and transcendental equations-Regula Falsi Method and Newton Raphson Method. Finite Differences-Forward, Backward and Central differences, Newton's Forward, Newton's Backward and Sterling's interpolation formulae. Lagrange's Interpolation formula (without proof). Numerical Differentiation using Newton's Forward and Backward formulae. **08 Hours**

Module - V

Introduction to SCILAB, and its family, Menus and toolbars, Types of windows and types of files, SCILAB Help system, Basic calculations in SCILAB, Basic variables, Functions-Elementary Mathematical, Builtin and User defined functions. Array operations, Matrix operations, Loops: for and while loops, condition statements- if-then and if-then-else statements, plotting of graphs, working with scripts and files.

08 Hours

List of SCILAB Experiments

Sl. No.	Name of the Experiment
1	SCILAB Environment
2	Basic operations in SCILAB
3	Basic Matrix operations
4	SCILAB programming environment
5	Use of Functions
6	Plotting of 2D and 3D Curves
7	Polynomial Evaluation and Determination of Roots of a Polynomial
8	Statistics Using SCILAB
9	Differentiation and Integration using SCILAB
10	Numerical Methods using SCILAB

Course Outcomes:

On completion of this course, the students are able to :

- Form a partial differential equations and their solutions.
- Expressing the given functions as infinite series of sine and cosine.
- Apply Fourier and Z-Transform to different problems
- Find approximated solutions by numerical methods.
- Use the SCILAB to solve the various types engineering problems.

Text Books:

1. Dr. B.S. Grewal:"Higher Engineering Mathematics", (Chapters 10, 17, 18, 22, 23, 28-30), Khanna Publishers, New Delhi, 42nd Edition, 2012, ISBN:9788174 091956.

2. N.P. Bali and Dr. Manish Goyal: "A Text Book of Engineering Mathematics", (Chapters 10, 16, 17, 20, 22, 23), Laxmi Publications (P) Ltd., New Delhi, 9thEdition, 2014, ISBN: 9788131808320.
3. SCILAB Group:"Introduction to SCILAB, A Users Guide".

Reference Books:

1. Erwin Kreyszig: "Advanced Engineering Mathematics", (Chapters 11, 12, 19), Wiley Pvt. Ltd. India, New Delhi, 9th Edition, 2011, ISBN 13: 9788126531356.
2. B.V. Ramana: "Higher Engineering Mathematics", (Chapters 17-21, 32), Tata Mc Graw – Hill Publishing company Limited, New Delhi, 2nd Reprint, 2007, ISBN 13: 978-0-07063417-0.
3. S.S. Sastry: "Introductory methods of Numerical analysis", (Chapters 2,3,6), PHI Learning Private, Delhi, 5th Edition, 2013, ISBN 13: 978-81-203-4592-8.
4. Stormy Attaway: "A practical introduction to programming and problem solving", Elsevier, Boston, 2nd Edition.

E-Resources:

1. http://bookboon.com/en/essential-engineering-mathematics-ebook
2. https://www.free-ebooks.net/ebook/essential-engineering-mathematics
3. https://www.scilab.org/resources/documentation/books
4. https://archive.org/details/AdvancedEngineeringMathematics10thEdition
5. https://mars.uta.edu/mae3183/simulation/introscilab_baudin.pdf

Analog Electronics Circuits

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
17ECT32	3:0:0:0	3	CIE:50 SEE:50	3 Hours	FC

Course Objectives:

This course will enable students to :

- Understand the principles, operation of the analog building blocks like diodes, BJT for performing various functions.
- Understand the concepts of rectifiers, clipping and clamping circuits.
- Understand the functionality of circuit models, equations and illustrate the concepts involved.
- Understand an overview and designing of amplifiers, feedback amplifiers and oscillators.

Syllabus

Module - I

Diode Circuits: Diode Resistance, Diode equivalent circuits, Transition and diffusion capacitance, Reverse recovery time, Load line analysis, Rectifiers, Clippers and clampers. **08 Hours**

Module - II

Transistor Biasing: Operating point, Fixed bias circuits, Emitter stabilized biased circuits, and Voltage divider biased, DC bias with voltage feedback, miscellaneous bias configurations, Bias stabilization- General expression, Fixed Bias, Emitter Bias and Voltage Divider type Bias. **08 Hours**

Module - III

Transistor at Low Frequencies: BJT transistor modeling, CE Fixed bias configuration, Voltage divider bias, Emitter follower, CB configuration, Collector feedback configuration, Analysis of circuits re model. Hybrid π Model (CE configuration). **Transistor Frequency Response:** General Frequency considerations, Low frequency response, Miller effect capacitance. **08 Hours**

Module - IV

Darlington Emitter Follower, Feedback concept, Feedback connections type.

Power Amplifiers: Definitions and amplifier types, series fed class A amplifier, Transformer coupled Class A amplifiers, Class B amplifier operations, Class B amplifier circuits. **08 Hours**

Module - V

Oscillators: Oscillator operation, Phase shift Oscillator, Wien bridge Oscillator, Tuned Oscillator circuits, Crystal Oscillator. (BJT Version Only), Simple design methods of Oscillators. **08 Hours**

Course Outcomes

On completion of this course, the students are able to :

- Design Rectifiers, Clipping and Clamping circuits.
- Analyze different ways of biasing transistors.
- Evaluate transistor frequency response.
- Design of simple amplifier and power amplifiers circuits.
- Analyze different type's oscillator circuits for particular frequencies.

Text Book:

1. Robert L. Boylestad and Louis Nashelsky: "Electronic Devices and Circuit Theory", (Chapters 1-5), 10th Edition, PHI/Pearson Education, 2012, ISBN: 978-81-317-6459-6.

Reference Books:

1. Jacob Millman and Christos C. Halkias: "Integrated Electronics", 2nd Edition, Tata - McGraw Hill, 2010, ISBN-978-007-015142-0.
2. David A. Bell: "Electronic Devices and Circuits", 5th Edition, PHI, 2008, ISBN: 978-0-19-569340-9.
3. U.B.Mahadevaswamy: "Analog Electronics Circuits: A Simplified Approach", 1st Edition, Pearson/Saguine, 2010, ISBN: 978-81-317-3234-2.

E-Resources:

1. http://www.allaboutcircuits.com/textbook/semiconductors/chpt-3/introduc-tion-to-diodes-and-rectifiers/
2. http://fourier.eng.hmc.edu/e84/lectures/ch2/node4.html
3. http://www.allaboutcircuits.com/video-lectures/transistor-biasing/

Logic Design

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
17ECT33	3:0:0:0	3	CIE:50 SEE:50	3 Hours	FC

Course Objectives:

This course will enable students to :

- Understand the concepts of Boolean algebra and Boolean expression minimization techniques.
- Understand the operations of combinational logic circuits like adder, subtractor, Multiplexers, Decoders, Encoders and Comparator.
- Understand the operation of different types of Flip-Flops.
- Understand the functioning of different types of counters and Shift registers.
- Understand the construction of state diagrams, state table and state equations.

Syllabus

Module - I

Simplification of Boolean functions: Definition of combinational logic, Canonical forms, Generation of switching equations from truth tables, Karnaugh maps-three, four, five variables, Incompletely specified functions (Don't Care terms), Simplifying Max term equations, Quine Mc-Clusky minimization technique, Map Entered Variable. **08 Hours**

Module - II

Combinational Logic Circuits: Binary adders and subtractors, parallel adder and subtractor, carry look ahead adder, Comparators, Decoders, Encoders and Multiplexers. **08 Hours**

Module - III

Flip-Flops and Simple Flip –Flops Applications: Basic Bi-stable Element, Latches, SR Latch, Application of SR Latch, A Switch Debouncer, The SR Latch, The gated SR Latch, The gated D Latch, The Master Slave Flip-Flops (Pulse-Triggered Flip-Flops): The Master-Slave SR Flip-Flops, The Master-Slave JK Flip-Flop, Edge Triggered Flip-Flop: The Positive Edge-Triggered D Flip-Flop, Negative-Edge Triggered D Flip-Flop. **08 Hours**

Module - IV

Sequential Circuits: Characteristic Equations, Registers, Counters - Binary Ripple Counters, Synchronous Binary counters, Counters based on Shift Registers, Design

of a Synchronous counters, Design of a Synchronous mod-6 Counter using clocked JK Flip-Flops Design of a Synchronous mod-6 Counter using clocked D, T, or SR Flip-Flops. **08 Hours**

Module - V

Sequential Design: Introduction, Mealy and Moore Models, State Machine Notation, Synchronous Sequential Circuit Analysis, construction of state diagrams. **08 Hours**

Course Outcomes

On completion of this course, the students are able to :

- Design an optimal solution for a given digital problem using K – Maps.
- Design combinational digital circuits for the given specifications.
- Describe the different types of Flip-Flop.
- Design sequential digital circuits for the given specifications.
- Develop the appropriate Mealy FSM or Moore FSM.

Text Books:

1. John M Yarbrough: "Digital Logic Applications and Design", 1st Edition, Cengage Learning, New Delhi, Reprint, 2012, ISBN-13: 978-81-315-0058-3, ISBN-10: 81-315-0058-6.
2. Donald D Givone: "Digital Principles and Design", 1st Edition, Tata McGraw Hill, New Delhi, Reprint, 2005, ISBN: 0-07-052906-X.

Reference Books:

1. Charles H Roth: "Fundamentals of logic design", 5th Edition, Thomson, New Delhi, Reprint, 2007, ISBN: 81-315-0043-8.
2. M. Morris Mano and Charles R. Kime: "Logic and computer design Fundamentals", 2nd Edition, Pearson, Reprint, 2005, ISBN: 81-7808-334-5.

E-Resources:

1. http://nptel.ac.in/courses/117106086/
2. http://www.asic-world.com/digital/tutorial.html
3. https://www.wiziq.com/tutorials/digital-electronics

Field Theory

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
17ECT34	4:0:0:0	4	CIE:50 SEE:50	3 Hours	FC

Course Objectives:

This course will enable students to :

- Understand the fundamental concepts and techniques in Fields and waves.
- Understand the basic concepts of Energy, Potential and Boundary conditions.
- Understand the importance of Poisson's and Laplace theorems and their applications.
- Understand the basic principles of Maxwell's equations and Uniform Plane wave.

Syllabus

Module - I

Vector Analysis: Vector Algebra, the Cartesian coordinate system, vector field, circular coordinate system, cylindrical coordinate system, spherical coordinate system. **Electrostatics:** Introduction, Coulomb's Law and field intensity, Electric flux density, Gauss's Law, Applications of Gauss's Law, Divergence theorem, Electric potential, Gradient of a scalar quantity, Relationship between Electric field and potential, Electric dipole and flux. **10 Hours**

Module - II

Energy and potential: Energy and potential in a moving point charge in an Electric Field, the Line Integral, definition of potential difference and potential, the potential field of a point charge and system of charges, Potential gradient, Energy density in an electrostatic field.

Conductors, dielectrics and capacitance: Current and current density, Continuity of current, metallic conductors, Conductor properties and boundary conditions, the method of images, Semiconductors, Nature of Dielectric materials, Boundary conditions for perfect dielectric materials, Capacitance, several capacitance examples, capacitance of a two wire line. **10 Hours**

Module - III

Poisson's and Laplace's Equations: Derivations of Poisson's and Laplace's Equations, Uniqueness theorem, Examples of the solutions of Laplace's and Poisson's equations. **10 Hours**

Module - IV

The Steady Magnetic Field: Biot-Savart Law, Ampere's Circuital Law, Curl, Stokes Theorem, Magnetic Flux and Magnetic Flux density, The Scalar and Vector magnetic potentials, Derivation of steady magnetic field Laws.

Magnetic Forces: Force on a moving charge, Force on a Differential current element, Force between differential Current elements, Force and Torque on a closed circuit.

11 Hours

Module - V

Time varying fields and Maxwell's equations: Faraday's law, displacement current, Maxwell's equation in point and Integral form, the retarded potentials. Uniform plane wave: Wave propagation in free space and dielectrics, The Poynting vector and power considerations, Poynting's theorem and wave power, propagation in good conductors. **11 Hours**

Course Outcomes:

On completion of this course, the students are able to :

- Describe the basics of Vectors, Coordinate systems and Electrostatics.
- Discuss the concepts of Energy and potential for the boundary conditions.
- Analyze basic theory of Poisson's and Laplace's equations.
- Apply the laws and theorems governing magnetic field.
- Apply the Maxwell's equations and relationship between Maxwell's equations and Uniform Plane wave.

Text Book:

1. William H Hayt Jr. and John A Buck: "Engineering Electromagnetic", 8th Edition, Tata McGraw-Hill, 2006, ISBN-13: 978-0071244497, ISBN-10: 0071244492.

Reference Books:

1. John Kraus: "Electromagnetics with Applications", 5th Edition, Tata Mc-Graw Hill, 1999, ISBN-13: 978-0072899696, ISBN-10: 0072899697.
2. Edward C. Jordan and Keith G Balmain: "Electromagnetic Waves and Radiating Systems", 2nd Edition, PHI, New Delhi, 1968, ISBN: 9780132499958.

E-Resources:

1. http://hyperphysics.phy-astr.gsu.edu/hbase/electric/maxeq.html
2. http://www.maxwells-equations.com/
3. http://mathworld.wolfram.com/CoordinateSystem.html
4. http://edndoc.esri.com/arcsde/9.1/general_topics/what_coord_sys.html

Network Analysis (IC)

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
17ECI35	3:0:2:0	4	CIE:50 SEE:50	3 Hours	FC

Course Objectives:

This course will enable students to :

- Understand the fundamental concepts and techniques in network analysis.
- Understand the functioning of DC and AC sources for the graph theory.
- Understand to design Resonant Circuit modules considering Frequency response of series and parallel Circuits.
- Understand the importance of Network Theorems and their applications.
- Understand the basic concepts of synthesis for designing filters.

Syllabus

Module - I

Basic Concepts: Practical sources, Source transformations, Network reduction using Star – Delta transformation, Loop and node analysis with linearly dependent and independent sources for DC and AC networks, Concepts of super node and super mesh. **08 Hours**

Module - II

Network Topology: Graph of a network, Concept of tree and co-tree, incidence matrix, tie-set, tie-set and cut-set schedules, Formulation of equilibrium equations in matrix form, Solution of resistive networks, Principle of duality. **08 Hours**

Module - III

Network Theorems I: Superposition, Reciprocity and Millman's theorems.

Network Theorems II: Thevinin's and Norton's theorems and Maximum Power transfer theorem. **08 Hours**

Module - IV

Resonant Circuits: Series and parallel resonance, frequency- response of series and parallel circuits, Q –factor, Bandwidth.

Transient behavior and initial conditions: Behavior of circuit elements under switching condition and their Representation, evaluation of initial and final conditions in RL, RC and RLC circuits for AC and DC excitations. **08 Hours**

Module - V

Two port network parameters: Definition of z, y, h and transmission parameters, modeling with these parameters, relationship between parameters sets. **08 Hours**

List of Experiments

1. Verification of Thevinin's Theorem.
2. Maximum Power Transfer theorem for DC Circuits.
3. Characteristics of Series and Parallel resonant circuits.
4. Verification of Norton's Theorem.
5. Verification of superposition Theorem for DC circuits.
6. Analyze the Z-transforms for the resistive two port network.

Course Outcomes:

On completion of this course, the students are able to :

- Analyze the concepts of loop and nodal analysis to various electrical circuits.
- Evaluate circuits using network topology.
- Design various network theorems to simplify circuits.
- Design resonant circuit modules and analyze the transient behavior of RLC circuits.
- Analyze the circuits using two-port parameters.

Text Books:

1. M. E. Van Valkenburg: "Network Analysis", (Chapters 1-5), 3rd Edition, Pearson Prentice Hall, New Delhi, 1974. ISBN: 978-81-203-0156-6.
2. W. H. Hyatt Jr., and J. E. Kemmerly, S. M. Durbin: "Engineering Circuit Analysis", 7th Edition, Tata McGraw Hill, New Delhi, 2011, ISBN: 978-0-07-015385-1.

Reference Books:

1. M. Nahvi, J. A. Edminister: "Electric Circuits", 10th Edition, Tata-McGraw Hill, New Delhi, 2007, ISBN 0-07-463591-3.
2. C.K. Alexander, M. N O Sadiku: "Fundamentals of Electric Circuits", 3rd Edition, Tata McGraw Hill, New Delhi, 2007, ISBN: 978-0-07-064803-6.

E–Resources:

1. http://www.allaboutcircuits.com/textbook/
2. http://fourier.eng.hmc.edu/e84/lectures/ch2/node3.html
3. http://tutorial.math.lamar.edu/Classes/DE/LaplaceIntro.aspx
4. http://fourier.eng.hmc.edu/e84/lectures/ch2/node4.html

Computer Communication and Networking (IC)

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
17ECI361	2:0:2:0	3	CIE:50 SEE:50	3 Hours	FE

Course Objectives:

This course will enable students to :

- Understand the basics of data communication system and network models.
- Identify the need and techniques for digital and analog transmissions.
- Get exposed to different error detection and correction methods.

Syllabus

Module - I

Introduction to Communications: Data Communications, Networks - Physical structure, Categories of Networks, Network Models –The OSI Model, TCP/IP Protocol Suite. **06 Hours**

Module - II

Digital Transmission: Digital to Digital Conversion – Line coding, Line coding schemes (Unipolar, Polar, Bipolar only),Analog to Digital Conversion – PCM Encoder and Decoder, Transmission Modes. **05 Hours**

Module - III

Analog Transmission: Digital to Analog conversion - Introduction, ASK, PSK, FSK, Analog to Analog conversion – Introduction, AM, PM, FM. **05 Hours**

Module - IV

Multiplexing and Spectrum Spreading: Multiplexing - Introduction, FDM, Synchronous TDM, Statistical TDM, , Spread Spectrum – Introduction, FHSS, DSSS. **05 Hours**

Module - V

Error Detection and Correction: Introduction, Block Coding, Cyclic Codes – CRC, Polynomials, Cyclic code encoder using Polynomials, Advantages of cyclic codes. Checksum. **05 Hours**

Laboratory

1. Write a program to convert digital to analog data transmission.
2. Write a program to convert analog to digital data transmission.
3. Write a program for error detecting code using CRC-CCITT (16 bits).
4. Using TCP/IP sockets write a client server program to make the client send the file name and to make the server send back the contents of the request-ed file if present.

Course Outcomes:

On completion of this course, the students are able to :

- Describe the basics of data communication system and network models.
- Distinguish between different techniques of digital transmissions.
- Compare different methods of analog transmissions.
- Explain various types of multiplexing and spread spectrum mechanisms.
- Solve problems of error detection and correction using Block coding and CRC mechanisms.

Text Book:

1. Behrouz A. Forouzan: "Data Communication and Networking", (Chapters 1,2, 4-6,10), McGraw Hill Education, New Delhi, India, 5th Edition, Copyright: 2013. Publication Date: February 17, 2012, ISBN: 9781259064753.

Reference Books:

1. William Stallings: "Data and Computer Communication", Pearson Education, Delhi, 8th Edition, 2007, ISBN: 9788131715369.
2. Craig Zacker: "The Complete Reference Networking", McGraw-Hill Education, New Delhi, India, 1st Edition, 2002, ISBN: 13: 978-0070474161.
3. Wayne Tomasi: "Introduction to Data Communications and Networking", Pearson Education, Delhi, 1st Edition, ISBN 13: 978-8131709306.

E-Resources:

1. http://www.mhhe.com/engcs/compsci/forouzan/frontmatter.pdf.
2. http://ebookinga.com/data-communication-and-networking-tata-mcgraw-hil.
3. https://www.goodreads.com/book/show/209441.Introduction_to_Data_Communications_and_Networking.

Creating Interactive and Responsive Web Pages (IC)

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
17ECI362	2:0:2:0	3	CIE:50 SEE:50	3 Hours	FE

Course Objectives:

This course will enable students to:

- Learn the evolution of the World Wide Web and its relevance in today's world.
- Get a clear understanding of the technologies involved in developing a website.
- Learn web technology with a focus on creating interactive and responsive web pages.

Syllabus

Module - I

HTML 5 and CSS: Introduction to Hyper Text Markup Language, Key components of HTML document, HTML elements, Headers, Linking, Images, Unordered Lists, and Nested and ordered Lists.

Tables, Divs and forms: HTML Tables and Formatting, HTML Forms, Internal Linking,

Creating and Using Images, Maps, Div and span tags. CSS: Introduction, CSS selector, positioning, layouts, debugging. **06 Hours**

Module - II

JavaScript: Browser and Document object, scripts and HTML Document, variables, expressions, Data type conversions, decisions and loops, control structure, windows Document object, forms and form handling elements, scripting, event handling.

05 Hours

Module- III

jQuery: Using selectors with jQuery, Manipulating page elements with jQuery, jQuery event model, jQuery and Ajax, jQuery animation and advanced effects, jQuery plugins.

05 Hours

Module- IV

Bootstrap: Bootstrap Scaffolding, Bootstrap CSS, Bootstrap Layout Components, Bootstrap JavaScript Plugins, Using Bootstrap. **05 Hours**

Module - V

XML: What is XML? What are the differences between HTML and XML, what is the purpose of XML?

AJAX: AJAX Introduction, AJAX XML Http, AJAX Request, AJAX Response, AJAX with Server side. **05 Hours**

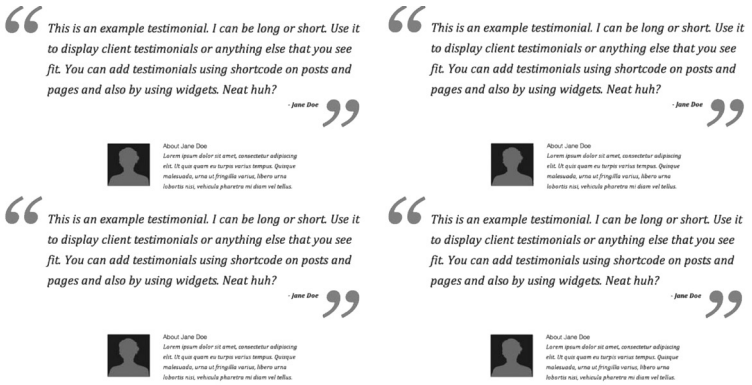
Hands on

1. HTML and CSS -

a. Create a HTML page to display the following content <Ensure the format is same as shwn below>; Use HTML Tables UnorderList and OrderList (UL and OL):

1. Development Environment • Eclipse (SpringSource Tool Suite distribution) • Apache Tomcat/VMware® vFabric™ tc Server • Spring Insight • Testing tools	**2. Spring Overview** • Introduction to Spring configuration • Bean life cycle • Simplifying configuration • Integration testing with Spring
3. Getting Started with Spring Web MVC • Spring model-view-controller (MVC) overview • DispatcherServlet • Controller programming model overview • Spring MVC views • Simplifying configuration	**4. Spring MVC Configuration Options** • Spring MVC infrastructure Beans • URL mappings • Handler interceptors and handler adapters • Exception resolvers • Message source

b. Create a HTML page to display testimonials received from customers along with their picture and Name as shown below:



2. Java Script and jQuery

a. jQuery form validations:

Front-End: Develop below form using HTML to create new user:

Field Details:

1. Name <String, Length(16), Mandatory, Validations: Minimum Length: 3, Can accept special characters>
2. Email <String, Length(60), Mandatory, Validations: Should be a valid email id>
3. Password <String, Length(16), Mandatory, Validations: Minimum Length: 5, Can accept special characters>

   - Create Buttons - “Create an account” and “Cancel”

   - Form should be Scrollable

   - For field validations, use jQuery

   - Ensure all validations pertaining to Name, Email and Password are taken care. If the use enters incorrect values appropriate error message should be displayed and should allow the user to enter correct data

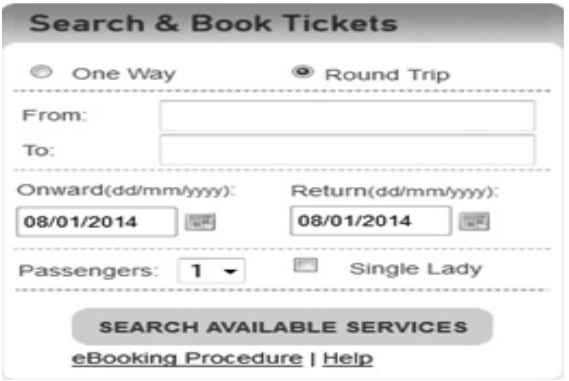
   b. jQuery image slider:

In an HTML page, insert a minimum of 5 images; Ensure inserted images are scrollable.

Hint: To make images scrollable use jQuery image slider or use javascript.

Sample screen shot :

3. Develop below form using HTML to Search and Book Tickets:

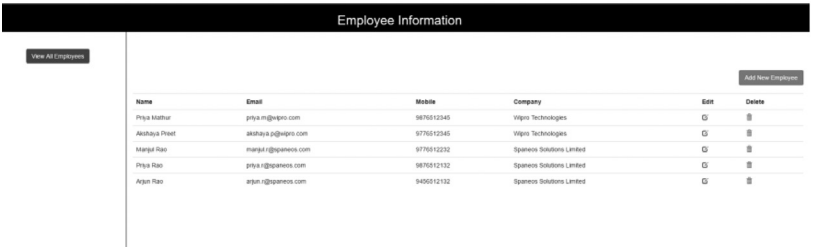


Validations :

1. All fields are Mandatory except “Single Lady” Field
2. Onwards date must be less than Return date

4. Bootstrap, AJAX and jQuery:

a. Create a Bootstrap Page that helps maintain Employee Information in an organization.



b. When clicked on the “Add New Employee” button, load a dialog box as shown below

Validations:

1. All fields are Mandatory.
2. On successful submission of the form, the new employee details has to be appended as a last row in the table.
3. When clicked on the Edit icon, a similar pop-up as the "Add new Employee" form has to be displayed with the input fields populated with appropriate values. When the form is submitted in the Edit flow, ensure all the validations are in place. The name of the button in the Edit flow has to be "Update" instead of "Add".
4. When clicked on the Delete icon, a confirmation dialog box has to be displayed with a message "Are you sure, you want to delete this entry?" If the user clicks "Yes", the corresponding row has to be deleted from the table. If the user clicks "No" the table has to remain unaffected.

Course Outcomes:

On completion of this course, the students are able to :

- Develop web layouts with style sheets and web screens in a presentable form.
- Write interactive web pages through form validations and other methods. Use the same in UI development.
- Use the Java Script libraries to accelerate UI development.
- Design and develop responsive and mobile first web pages.
- Develop applications by using synchronous and asynchronous communication over web.

Text Book:

1. Jon Duckett: "Web Design with HTML, CSS, JavaScript and jQuery Set", Wiley, 1st Edition, 2014, ISBN 13: 978-1118907443.

Reference Books:

1. Jake Spurlock: "Bootstrap, Shroff", O'Reilly Media, United States of America, 1st Edition, 2013, ISBN: 978 -1 -4493-4391-0.
2. Bear Bibeault, Yehuda Katz and Aurelio De Rosa: "jQuery in Action", Dreamtech Press, New Delhi, India, 3rd Edition, 2015, ISBN: 978-1617292071.

E-Resources:

1. http://www.w3schools.com/
2. https://learn.jquery.com/
3. https://developer.mozilla.org/en-US/Learn/Getting_started_with_the_web/JavaScript_basics

Electronic Instrumentation (IC)

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
17ECI363	2:0:2:0	3	CIE:50 SEE:50	3 Hours	FE

Course Objectives:

This course will enable students to :

- Understand the concepts oferrors and characteristics of the measurement systems.
- Understand the importance of various technologies available to measure R, L, C using Voltmeters and Multimeters.
- Understand the basic working principle of DVM, DMM, CRO, DFM.
- Understand the fundamental concepts and working of CRT.
- Understand the functioning of different Signal Generators and Bridge Circuits.
- Understand the principle of Different types of Transducers

Syllabus

Module - I

Introduction

Measurement Errors: Gross errors and systematic errors, Absolute and relative errors, accuracy, Precision, Resolution and Significant figures.

Voltmeters and Multimeters: Introduction, Multirange voltmeter, Extending voltmeter ranges, Loading, AC voltmeter using Rectifiers – Half wave and Full wave, Peak responding and True RMS voltmeters. **06 Hours**

Module - II

Digital Instruments: Digital Voltmeters – Introduction, DVM's based on V – T, V – F and Successive approximation principles, Resolution and sensitivity, General specifications, Digital Multi-meters, Digital frequency meters, Digital measurement of time. **05 Hours**

Module - III

Oscilloscopes: Introduction, Basic principles, CRT features, Block diagram and working of each block, Typical CRT connections, Dual beam and dual trace CROs, Electronic switch. **06 Hours**

Module - IV

Signal Generators: Introduction, Fixed and variable AF oscillator, Standard signal generator, Laboratory type signal generator, AF sine and Square wave generator, Function generator, Square and Pulse generator, Sweep frequency generator, Frequency synthesizer.

Measurement of resistance, inductance and capacitance: Wheatstone's bridge, Kelvin bridge, AC bridges, Capacitance Comparison bridge, Maxwell's bridge, Wein's bridge, Wagner's earth connection. **06 Hours**

Module - V

Transducers-I: Introduction, Electrical transducers, Selecting a transducer, Resistive transducer, Resistive position transducer, Strain gauges, Resistance thermometer, Thermistor, Inductive transducer, Differential output transducers and LVDT.

Transducers–II: Piezoelectric transducer, photoelectric transducer, Photovoltaic transducer, Semiconductor photo devices, Temperature transducers-RTD, Thermocouple. **05 Hours**

List of Experiments

1. Study blockwise construction of a analog oscilloscope & function generator.
2. Study blockwise construction of a multimeter & frequency counter.
3. Study measurement of different components and parameters like q of a coil using lcr q – meter.
4. Study distortion factor meter and determination of the % distortion of the given oscillator.
5. Study characteristics of temperature transducer like thermocouple, thermistor and rtd with implementation of a small project using signal conditioning circuits like instrumentation amplifier.
6. Measurement of strain using strain gauge.
7. Study differential pressure transducer & signal conditioning of output signal.
8. Measurement of level using capacitive transducer.

Course Outcomes:

On completion of this course, the students are able to :

- Analyze characteristics of various measuring instruments and different types of errors.
- Describe the different current and voltage meters.
- Use the CRO and able to measure different parameters.
- Use Signal generators and function generator.
- Describe the working of different types of Transducers.

Text Books:

1. H. S. Kalsi: "Electronic Instrumentation", 3rd Edition, TMH, New Delhi, 2010, ISBN: 978-0-07-070206-6.
2. David A Bell: "Electronic Instrumentation and Measurements", 3rd Edition, PHI, New Delhi, 2006, ISBN: 9788120323605.

Reference Book:

1. Cooper D and A D Helfrick: "Modern electronic instrumentation and measuring techniques", PHI, New Delhi, 1990, ISBN: 978-81-203-0752-0.

E-Resources:

1. http://www.testandmeasurementtips.com/oscilloscopes/different-types-of-oscilloscopes
2. http://www.myklassroom.com/Engineering-branches/21/Electronics-and-Instrumentation-Engg.- (EIE)
3. http://www.radio-electronics.com/info/t_and_m/generators/signal-generator-types.php
4. http://www.delabs-circuits.com/cirdir/analog/analog2.html

Analog Electronics Circuits Laboratory

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
17ECL37	1:0:2:0	2	CIE:50 SEE:50	3 Hours	FC

Course Objectives:

This course will enable students to :

- Understand the basic operation of semiconductor devices.
- Understand the analog components used in electronics.
- Understand the design of operational circuits using analog devices.
- Understand the use of appropriate test equipment to analyze circuit operation

List of Experiments

1. Design of Clamping circuits: positive clamping / negative clamping.
2. Design and testing of Diode clipping (Single/Double ended) circuits for peak clipping, peak detection.
3. Design and testing of Half wave Rectifier with and without Capacitor filter. Determination of ripple factor and efficiency.
4. Design and testing of Full wave Rectifier with and without Capacitor filter. Determination of ripple factor and efficiency.
5. Design and testing of Bridge Rectifier with and without Capacitor filter. Determination of ripple factor and efficiency.
6. Design of RC coupled Single stage BJT amplifier and determination of the gain-frequency response.
7. Design of BJT Darlington Emitter follower and determination of the gain-frequency response.(Single circuit) (One Experiment).
8. Design and testing for the performance of BJT-RC Phase shift Oscillator for $f_0 \leq$ 10 KHz.
9. Design and testing for the performance of BJT – Hartley and Colpitts Oscillators for RF range $f_0 \geq 50$ KHz.
10. Design and testing for the performance of BJT -Crystal Oscillator for $f_0 > 100$ KHz.
11. Design and Testing of a transformer less Class – B push pull power amplifier and determination of its conversion efficiency.

Course Outcomes:

On completion of this course, the students are able to :

- Design various types of clipping and clamping circuits.
- Analyze and design different rectifiers.
- Design BJT amplifier and power amplifier.
- Design and evaluate Darlington emitter follower.
- Design and evaluate the performance of various types of oscillators.

E-Resouces:

1. http://www.allaboutcircuits.com/textbook/semiconductors/chpt-3/introduction-to-diodes-and-rectifiers/
2. http://fourier.eng.hmc.edu/e84/lectures/ch2/node4.html
3. http://www.allaboutcircuits.com/video-lectures/transistor-biasing/

Logic Design Laboratory

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
17ECL38	1:0:2:0	2	CIE:50 SEE:50	3 Hours	FC

Course Objectives:

This course will enable students to :

- Understand the practical aspects of the Digital Electronic Circuits.
- Understand the designing of different types of the Combinational Circuits.
- Understand the designing of various Sequential Circuits.

List of Experiments

1. Simplification, Realization of Boolean Expression using Logic/Universal gates.
2. Realization of Half/Full Adder and Half/Full Subtractor using Logic Gates,
   a) Realization of Parallel Adder/Subtractor using 7483 Chip.
   b) BCD to Excess-3 Conversion.
3. Realization of Binary to Gray code conversion and vice versa.
4. MUX / DEMUX – use of 74153, 74139 for arithmetic circuits and Code converter.
5. Realization of 1/2 bit Comparator and study of 7485.
6. Use of a) Decoder chip to drive LED displays b) Priority Encoder.
7. Truth Table verification of Flip-Flop's, a) JK Master Slave b) T and D.
8. Realizations of 3 bit counter as sequential circuit and Mod N counter design (IC 7476).
9. Shift Left, Shift Right, SISO, SIPO, PISO, PIPO operations using IC7495.
10. Implementation of Ring/ Johnson Counter.
11. Implementation of Sequence Generator.

Course Outcomes:

On completion of this course, the students are able to :

- Design and analyze simple Boolean expression using basic gates.
- Design and verification of various Combinational Circuits.
- Analyze practical application of decoder chip and priority encoder.
- Evaluate the various Sequential Circuits.
- Design and analyze various types of registers and counters.

E-Resources:

1. http://nptel.ac.in/courses/117106086/
2. http://www.asic-world.com/digital/tutorial.html
3. https://www.wiziq.com/tutorials/digital-electronics

Integrated Rural Development – Part 1

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
17ECH39	0:2:0:0	1	CIE:50 SEE:50	2 Hours	HSS

Course Objectives:

This course will enable students to:

- Gain an awareness of the existing challenges in rural areas of India
- Develop the ability to communicate and interact with rural sections of our society
- Use and apply their academic knowledge to facilitate rural development and uplift via targeted initiatives and activities.

Syllabus

Module - I

Introduction: Introduction to the course and its objectives; overview of typical challenges faced in villages; importance of integrating villages in mainstream society; relevance of course to nation building; division of students into groups; allotment of villages to student groups; assignment of mentors to student groups. **03 Hours**

Module - II

Project Definition: Visit of student groups to respective villages with assigned mentors; interacting with villagers and ice-breaking activities; identifying possible project topics with the help of mentor and supervisor; student group discussion to finalize the project definition; review of project definition with mentor and supervisor. **06 Hours**

Module - III

Project Conceptualization and Planning: Creation of plan to realize the project; review of plan with mentor and supervisor; assigning action items to students within the group; planning for needed logistics and infrastructure. **06 Hours**

Module - IV

Project Realization: Execution of the project plan (for example by conducting workshops); aggregation of project deliverables like survey reports, collected data, interviews, and questionnaires; recording of impact of the project on the village; periodical review of the project execution status as well as the project deliverables (like aggregated data and survey reports) with mentor and supervisor. **10 Hours**

Module - V

Project Reporting: Creation of project report by the student groups detailing the motivation for the project, the approach, the work packages along with student assignments, the execution of the project, impact of the project, and lessons learned by the students during the project; creation of a slide-set to present the project report during the final exam; review by mentor and supervisor. **03 Hours**

Course Outcomes:

On completion of this course, students will be able to:

- Develop the ability to interact and communicate with different sections of society, thus improving their communication skills.
- Understand the existing problems and needs of a village, thus developing an awareness of the challenges facing rural India.
- Conceptualize, plan, and realize measures to address these problems, thus improving their practical problem-solving and leadership skills.
- Make an impact to rural section of society, thus building their self-confidence.

Text Books:

1. Bhagawan Sri Sathya Sai Baba: “Service to Village is Service to God”, Sri Sathya Sai Publications.

Reference Books:

1. Bhagawan Sri Sathya Sai Baba: “Man Management: A Value-Based Management Perspective”, Sri Sathya Sai Publications.
2. Lt. Gen. M.L.Chibber:“Sai Baba’s Mahavakya on Leadership : Book for Youth, Parents and Teachers.”

E-Resources:

1. http://rural.nic.in/netrural/rural/index.aspx
2. www.annapoorna.org.in

ॐ ॐ ॐ ॐ ॐ

Engineering Mathematics-IV (IC)

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
17ECM41	3:0:2:0	4	CIE:50 SEE:50	3 Hours	BS

Course Objectives:

This course will enable students to :

- Develop the application of mathematical skills in solving statistics and probability problems using computers.
- Find differentiation, integration and solutions of differential equations using numerical methods.
- Analyze of complex variable functions, Introduction of Statistical Software's.

Syllabus

Module - I

Numerical Methods-I: Numerical Integration-Trapezoidal rule, Simpson's $1/3^{rd}$ and $3/8^{th}$ rule. Numerical solutions of ordinary differential equations of first order and first degree- Picard's method, Taylor's Series method, Modified Euler's Method, Runge-Kutta Method of 4^{th} order and Milne's Predictor Corrector Method. **08 Hours**

Module - II

Numerical Methods-II: Numerical solutions of simultaneous first order ordinary

differential equations: Picard's method and Runge- Kutta method of fourth order. Numerical solutions of second order ordinary differential equations: Picard's method and Runge-Kutta method of fourth order. Numerical solutions of partial differential equations:1-dimensional heat equation, 1-dimensional wave equation**.** **08 Hours**

Module - III

Complex variables: Functions of a complex variable, derivative of complex functions. **Analytic functions:** Cauchy's-Riemann equations in Cartesian and polar forms (No problems by using limits), Harmonic functions, construction of analytic functions by using Milne-Thomson method. Cauchy Theorem, Cauchy's integral formula problems. **08 Hours**

Module - IV

Probability and Statistics: Probability distributions: Poisson distribution, Poisson distribution is the limiting case of binomial distribution. Constants of Poisson distribution (no proof), Continuous random variable, Continuous probability distribution, Normal distribution (no proof)-problems.

Sampling and Inference: Sampling distribution, testing of hypothesis, level of significance, confidence limits. Test of significance of large samples, sampling of variables, central limit theorem, confidence limits for unknown means, students t-distribution. **08 Hours**

Module - V

Introduction to R, Basic Data types, vector operations, matrix construction, lists, data frames, Elementary statistics with R-Qualitative and Quantitative data, Numerical measures, probability distribution, interval estimation and simple linear regression.

08 Hours

List of R-Lab Experiments

1. Introduction to R Software and basic commands
2. Demonstration and operations of Vectors
3. Operations of Matrices
4. Demonstration of Lists
5. Demonstration of Data Frames
6. Qualitative Data Analysis
7. Quantitative Data Analysis
8. Numerical Measures of Data
9. Probability Distribution
10. Linear Regressions

Course Outcomes:

On completion of this course, the students are able to :

- Determine the Differentiation, Integration using numerical methods.
- Solve Differential equations using numerical methods.
- Find the differentiation and integrals of complex functions.
- Find the probability using different distributions and analysis by using samplings.
- Use the statistical software's.

Text Books:

1. Dr. B.S. Grewal: "Higher Engineering Mathematics", (Chapters 20,26,27,30,32,33), Khanna Publishers, New Delhi, 42nd Edition, 2012, ISBN: 9788174091956.

2. N.P. Bali and Dr. Manish Goyal, "A Text Book of Engineering Mathematics", (Chapters : 19,21,22,24,25), Laxmi Publications (P) Ltd., New Delhi, 9th Edition, 2014, ISBN: 9788131808320.

3. W.N.Venables, D.M.Smith: "An introduction to R".

Reference Books:

1. Erwin Kreyszig: "Advanced Engineering Mathematics", (Chapters 13, 14,19,21,24,25), Wiley Pvt. Ltd., India, New Delhi, 9th Edition, 2011, ISBN 13: 9788126531356.

2. B.V. Ramana: "Higher Engineering Mathematics", (Chapters 22,23,27-29,32,33), Tata McGraw – Hill Publishing Company Limited, New Delhi, 2nd Reprint, 2007, ISBN 13: 978-0-07063417-0.

3. S.S.Sastry: "Introductory methods of numerical analysis", (Chapters 6,8,9), PHI

4. Learning Private Ltd., Delhi, 5th Edition, 2013, ISBN: 978-81-203-4592-8.

5. John Verzani: "Using R for introductory Statistics", Champan and Hall/ CRC, New York, Washington D.C., ISBN: 978-1-59327-384-2.

E-Resources:

1. http://www.zums.ac.ir/ebooks/mathematics/essential-engineering-mathematic.

2. https://archive.org/details/AdvancedEngineeringMathematics10thEdition

3. https://www.r-project.org/

Microprocessor

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
17ECT42	4:0:0:0	4	CIE:50 SEE:50	3 Hours	FC

Course Objectives:

This course will enable students to :

- Understand the concept of evolution and structure of microprocessors.
- Understand the instruction set of 8086 microprocessor.
- Understand the hardware architecture of microprocessor.
- Understand the concept of Multi programming the microprocessor for performing various tasks.

Syllabus

Module - I

8086 Processors: Historical background, The microprocessor-based personal computer system, 8086 CPU Architecture, registers and segments, operation of stack, pin diagram of 8086.

Instruction Set of 8086: Assembler instruction format, data transfer and arithmetic, branch and loop type, NOP and HALT. **10 Hours**

Module - II

Flag and Logical instructions: Flag manipulation, logical and shift and rotate instructions. Illustration of these instructions with example programs, Directives and operators.

Byte and String Manipulation: String instructions, REP Prefix, Table translation, Number format conversions, Procedures, Macros. **10 Hours**

Module - III

8086 Interrupts: 8086 Interrupts and interrupt responses, Hardware interrupt applications, Software interrupt applications, Interrupt examples.

8086 Interfacing: 8255 block diagram and architecture, Interfacing microprocessor to keyboard, Interfacing a microprocessor to a stepper motor. **10 Hours**

Module - IV

8086 based Multiprocessing Systems: Coprocessor configurations, The 8087 numeric data processor: data types, processor architecture, instruction set and examples. **System Bus Structure**: Basic 8086 configurations: minimum mode, maximum mode, **Bus Interface:** Peripheral Component Interconnect (PCI) bus, the Universal Serial Bus (USB). **11 Hours**

Module - V

80386 Processor: Introduction to the 80386 microprocessor, architecture, special 80386 registers.

80486 Processor: Introduction to the 80486 microprocessor, Introduction to the Pentium microprocessor. **11 Hours**

Course Outcomes:

On completion of this course, the students are able to :

- Describe the architecture of 8086.
- Analyze the appropriate usage of instructions in programming.
- Develop the interfacing programs with various interfaces.
- Analyze the appropriate algorithms for solving problems in math coprocessor.
- Distinguish various advanced processors.

Text books:

1. Y.C. Liu and G.A. Gibson: "Microcomputer Systems - The 8086 / 8088 Family", 2nd Edition, (Chapter 1), Prentice Hall of India, New Delhi, 2003, ISBN: 81-203-0409-8.
2. Barry B. Brey: "The Intel Microprocessor, Architecture, Programming and Interfacing", (Chapters 2-5), 8th Edition, Pearson Education, New Delhi, 2009, ISBN: 9780135026458, ISBN: 978-81-317-2622-8.

Reference Books:

1. Douglas Hall: "Microprocessor and Interfacing - Programming and Hardware", 3rd Edition, TMH, New Delhi, 2012, ISBN-9781259006159.
2. A.K. Ray and K.M. Bhurchandi: "Advanced Microprocessors and Peripherals", 3rd Edition, TMH, New Delhi, 2013, ISBN-9781259006135.

E-Resources:

1. http://nptel.ac.in/courses/Webcoursecontents/IIScBANG/Microprocessors%20and%20Microcontrollers/pdf/Teacher_Slides/mod1/M1L3.pdf
2. http://www.nptel.ac.in/courses/Webcoursecontents/IIScBANG/Microprocessors%20and%20Microcontrollers/pdf/Lecture_Notes/LNm2.pdf
3. http://www.feis.unesp.br/Home/departamentos/engenhariaeletrica/cap_2_extra_8087.pdf

Fundamentals of HDL

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
17ECT43	3:0:0:0	3	CIE:50 SEE:50	3 Hours	FC

Course Objectives:

This course will enable students to :

- Understand the basic concept of HDL, comparison between Verilog and VHDL.
- Understand the fundamentals of data flow and behavioral designs.
- Understand the concept of structural and mixed language descriptions.
- Understand the concepts task, functions and file processing in HDL.
- Understand the concept of map Register Transfer Logic code to hardware domain.

Syllabus

Module - I

ntroduction: Why HDL? , A Brief History of HDL, Structure of HDL Module, Operators, Data types, Types of Descriptions, simulation and synthesis, brief comparison of VHDL and Verilog. **08 Hours**

Module - II

Data-Flow Descriptions: Highlights of Data-Flow Descriptions, Structure of Data-Flow Description, Data Type – Vectors.

Behavioural Descriptions: Behavioral Description highlights, Structure of HDL behavioral Description, The VHDL variable: Assignment Statement, Sequential statements. **08 Hours**

Module - III

Structural Description: Highlights of structural description, organization of structural description.

Mixed-Language Descriptions: Highlights of Mixed-Language Description, How to invoke one language from the other, Mixed Language Description examples, and Limitations of Mixed-Language Description. **08 Hours**

Module - IV

Procedures and Functions: Procedures, Tasks, and Functions: Highlights of Procedures, tasks, and Functions, Procedures and tasks, Functions. Advanced HDL Descriptions: File Processing, Examples of File Processing. **08 Hours**

Module - V

Synthesis Basics: Highlights of Synthesis, Synthesis information from Entity and Module, Mapping Process and always in the Hardware Domain. **08 Hours**

Course Outcomes:

On completion of this course, the students are able to :

- Describe the various descriptions in VHDL and Verilog.
- Develop program using data flow and behavioural descriptions.
- Develop program using structural and mixed language description.
- Develop programs using procedure, task, and function.
- Analyze and synthesis VHDL and VERILOG codes for digital circuits.

Text Book:

1. Nazeih M. Botros: " HDL Programming (VHDL and Verilog)", (Chapters 1-5), Dreamtech Press Publishers, New Delhi, 2008, ISBN-13: 9788177226973.

Reference Books:

1. J. Bhaskar: "A Verilog HDL Primer", 2nd Edition, BS Publications, Hyderabad, 2001, ISBN: 8178000121.
2. Volnei A. Pedroni: 'Circuit Design with VHDL", 1st Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2004, ISBN: 8120326830.

E-Resources:

1. http://www.xilinx.com/video/hardware/basic-hdl-coding-techniques.html
2. http://www.academia.edu/1492361/VHDL_BASICS_WITH_EXAMPLES
3. http://ece-research.unm.edu/jimp/vlsi/slides/vhdl.html
4. http://www.asic-world.com/systemverilog/basic1.html
5. http://www.referencedesigner.com/tutorials/verilog/verilog_01.php
6. http://vhdlguru.blogspot.in/p/example-codes.html

Signals and Systems

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
17ECT44	3:0:0:0	3	CIE:50 SEE:50	3 Hours	FC

Course Objectives:

This course will enable students to :

- Understand the basic types of continuous-time and discrete-time signals and system properties.
- Understand the convolution operation on continuous and discrete LTI system.
- Understand the concept of differential and difference equations in describing an LTI systems and express the system in block diagram representations.
- Understand the fourier Transform representation, various properties of continuous and discrete Fourier transform.
- Understand the properties of Z-Transforms and role of ROC for evaluating causality, stability of the given signal.

Syllabus

Module - I

Introduction to signals and systems: Classification of continuous and discrete time signals, basic operations on independent variables, elementary signals: Exponential, sinusoidal signals, unit impulse, unit step and unit ramp signals, systems viewed as interconnection of operations, CT and DT systems, properties of systems. **08 Hours**

Module - II

Time-domain representations for LTI systems: Impulse response representation, convolution sum, convolution integral, Properties of impulse response representation, step response. Differential and difference equation representation of an LTI System, Solutions for Differential and difference equation, Block diagram representation-direct form I and direct form II through differential and difference equations.

08 Hours

Module - III

Fourier Transform: Continuous Fourier transforms and Discrete Fourier transform and their properties. Application of Fourier transform-solving difference and differential equation, frequency response, impulse response, Comment on stability and causality analysis. **08 Hours**

Module - IV

Z-Transforms-1: Introduction, definition of Z-transform, properties of ROC. Properties of Z transform, inverse Z-transforms using partial fraction and long division method.

08 Hours

Module - V

Z-Transforms-2: Transform analysis of LTI Systems using Z-transform, system function, causality, stability, Unilateral Z-Transform and its application to solve difference Equation. **08 Hours**

Course Outcomes:

On completion of this course, the students are able to :

- Discriminate various elementary signals and identify the properties of systems.
- Compute convolution operation on continuous and discrete time signals and express difference and differential equations as block diagram.
- Express the signals using Fourier transform and apply their properties for solving differential and difference equation.
- Analyze Z transforms and inverse Z transforms using various methods.
- Analyze LTI systems using Z transforms.

Text Books:

1. Simon Haykin: "Signals and Systems", 4th Edition, John Wiley India Pvt. Ltd., Re-print, 2004, ISBN: 978-81-265-1265-2.
2. Michael J Roberts: "Fundamentals of Signals and Systems", 2nd Edition, Tata Mc Graw-Hill, 2010, ISBN: 978-0-07-070221-9.

Reference Books:

1. Alan V Oppenheim, Alan S, Willsky and Hamid Nawab: "Signals and Systems", 2nd Edition, Pearson Education Asia / PHI, Indian Reprint, 2002, ISBN: 81-203-1246-5.
2. H.P Hsu, R. Ranjan, "Signals and Systems", Scham's Outlines, TMH, 1995, ISBN-13: 978-0-07-060171-0.

E-Resources:

1. http://link.springer.com/chapter/10.1007/978-1-4020-6272-8_4#page-1
2. http://www.thefouriertransform.com/
3. http://lpsa.swarthmore.edu/LaplaceZTable/LaplaceZFuncTable.html

Linear IC's and Applications (IC)

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
17ECI451	3:0:2:0	4	CIE:50 SEE:50	3 Hours	FE

Course Objectives:

This course will enable students to :

- Understand the use of op amp in DC and AC applications.
- Understand the concepts of practical OP-AMP specifications, characteristics, biasing of OP-AMPs.
- Understand the frequency response and bandwidth performance of practical OP-AMP.
- Understand the concept of 555 timer, PLL and its applications.

Syllabus

Module - I

Operational Amplifier Fundamentals: Basic OP-AMP circuit, OP-AMP parameters: Input and Output voltage, CMRR and PSRR, Offset voltages and currents, Input and Output impedances, Slew rate and Frequency limitations.

OP-AMPs as DC Amplifiers: Biasing OP-AMPs, Direct coupled -Voltage Followers, Non-inverting Amplifiers, Inverting amplifiers, Summing amplifiers, Difference amplifier. **08 Hours**

Module - II

OP-AMPs as AC Amplifiers: Capacitor coupled Voltage Follower, High input impedance-Capacitor coupled Voltage Follower, Capacitor coupled Non-inverting Amplifiers, High input impedance - Capacitor coupled Non-inverting Amplifiers, Capacitor coupled Inverting amplifiers, setting the upper cut-off frequency, Capacitor coupled Difference amplifier, Use of a single polarity power supply. **08 Hours**

Module - III

OP-AMPs frequency response and compensation: Circuit stability, Frequency and phase Response, Frequency compensating methods, Band width, Slew rate effects, Zin Mod compensation, and circuit stability precautions. **08 Hours**

Module - IV

OP-AMP Application: Current amplifiers, precision rectifiers, Clamping circuits, Peak detectors, sample and hold circuits, Log and antilog amplifiers, Multiplier and divider, Triangular / rectangular wave generators.

Non-linear circuit applications of OP-AMP: Crossing detectors, inverting Schmitt trigger circuits, Mono-stable and A-stable multivibrator, Active Filters: First and Second order Low pass and High pass filters. **08 Hours**

Module - V

Other Linear IC applications: 555 timer: Basic timer circuit, 555 timer used as a stable and Mono-stable multivibrator, Schmitt trigger; PLL: Operating principles, Phase detector / Comparator, VC; D/A and A/ D converters: Basic DAC Techniques, AD converters, IC 723 general purpose Regulator. **08 Hours**

List of Experiments

1. Design a Second order active LPF.
2. Design a Second order active HPF.
3. Design a Second order active BPF.
4. Design and test a Schmitt trigger circuit for the given values of UTP and LTP.
5. Design and test R-2R DAC using OP-AMP.
6. Design and test the circuits Astable multivibrator for given frequency and duty cycle using IC 555.
7. Design and test the circuits Monostable multivibrator for given pulse width W using IC555.

Course Outcomes:

On completion of this course, the students are able to :

- Describe the practical OP-AMP specifications and characteristics.
- Determine OP-AMP as AC amplifiers.
- Analyzing stability condition of OP-AMP.
- Analyzing OP-AMP linear and non linear applications.
- Analyzing of 555 timers, PLL and their applications.

Text Books:

1. David A. Bell: "Operational Amplifiers and Linear IC's", 2nd Edition, (Chapters 1-4), PHI/Pearson, 2008, ISBN: 9788120323599.
2. D. Roy Choudhury and Shail B. Jain: "Linear Integrated Circuits", 4th Edition, (Chapter 5), New Age International, 2010, ISBN: 9788122430981.

Reference Books:

1. Robert F. Coughlin and Fred F. Driscoll: "Operational Amplifiers and Linear Integrated Circuits", 6th Edition, PHI/Pearson, 2001, ISBN: 8120320964.
2. Ramakant A. Gayakwad: "OP-AMPs and Linear Integrated Circuits", 4th Edition, PHI/Pearson, 2000, ISBN: 8120320581.

E-Resources:

1. http://www.electronics-tutorials.ws/opamp/opamp_1.html
2. http://www.radio-electronics.com/info/circuits/opamp_basics/operational-amplifier-basics-tutorial.php
3. http://www.chem.uoa.gr/applets/appletopamps/appl_opamps2.html
4. http://www.allaboutcircuits.com/textbook/semiconductors/chpt-8/introduction-operational-amplifiers/

Fundamentals of VLSI (IC)

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
17ECI452	3:0:2:0	4	CIE:50 SEE:50	3 Hours	FE

Course Objectives:

This course will enable students to :

- Understand the fundamental concepts of fabrication process and VLSI design flow.
- Understand the ideal, non-ideal V-I and C-V characteristics.
- Design of CMOS combinational logic circuits.
- Understand the basic concepts of testing and dynamic logic circuits.
- Understand the fundamental concepts of low power VLSI Design.

Syllabus

Module - I

Introduction: A brief History**,** MOS Transistors, CMOS logic, CMOS fabrication and Layout, VLSI Design flow, Fabrication, Packaging and Testing.

CMOS Processing Technology: CMOS technologies Layout Design Rules, CMOS Process Enhancements. **08 Hours**

Module - II

MOS Transistor Theory: Introduction, Ideal I-V characteristics, Non ideal I-V effects, DC transfer Characteristics, C-V characteristics **08 Hours**

Module - III

Combinational MOS Logic circuits: MOS Logic circuits with Depletion NMOS load, CMOS logic circuits complex logic circuits, CMOS Transmission gates.

Sequential MOS Logic circuits: SR Latch, clocked latch and flip flop circuits, CMOS D Latch and edge triggered flip flop. **08 Hours**

Module - IV

Dynamic logic circuits: Basic principles of Pass Transistor circuits, Dynamic CMOS circuit techniques**:** CMOS TG logic, Dynamic CMOS logic, High performance Dynamic circuits, charge sharing problems, remedies.

Design for testability: Fault type and models, Controllability, Observability, Ad hoc testing, Scan based techniques, BIST, Current monitoring I_{DDQ} Test. **08 Hours**

Module - V

Low power CMOS Logic circuits: Introduction, Overview of power consumption, Low power design through voltage scaling, Estimation and Optimization of switching activity, Reduction of switched capacitance, Adiabatic logic circuits. **08 Hours**

List of Experiments

1. Simulation of basic gates.
2. Simulation of universal gates.
3. Simulation of Transmission Gate.
4. Simulation of Combinational Logic Circuits.
5. Layout of basic gates.
6. Layout of universal gates.
7. Layout of Transmission Gate.

Course Outcomes:

On completion of this course, the students are able to :

- Describe the fabrication process and VLSI design flow.
- Discuss V-I and C-V characteristics of MOSFETS.
- Analyze sequential and combinational logic circuits using CMOS.
- Discuss the concepts of testing and dynamic CMOS circuits.
- Describe the concepts of low power VLSI design.

Text Books:

1. Niel H.E Weste, David Harris: "CMOS VLSI Design-A Circuits and Systems Perspective", 3rd Edition, Pearson Education, 2006, ISBN: 9788131764671.
2. Sung Mo Kang, Yusuf Leblebici: "CMOS digital integrated circuits-Analysis and Design", 3rd Edition, Tata McGraw Hill, 2003, ISBN 10: 0070530777, ISBN13: 9780070530775.

Reference Book:

1. John P. Uyemura: "Introduction to VLSI Circuits and Systems", 1st Edition, John Wiley, 2003, ISBN: 0471127043.

E- Resources:

1. http://ece-research.unm.edu/jimp/vlsi/slides/chap3_1.html
2. http://www.slideshare.net/kalyankumarkalita/dynamic-logic-circuits
3. http://www.slideshare.net/jainatush/vlsi-test-principles-and-architectures-design-for-testability
4. http://www.eeherald.com/section/design-guide/Low-Power-VLSI-Design.html

Introduction to Programming using Python (IC)

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
17ECI453	3:0:2:0	4	CIE:50 SEE:50	3 Hours	FE

Course Objectives:

This course will enable students to :

- Understand programming concepts, and various programming paradigms.
- Get a clear understanding of Object Oriented Programming.
- Learn Python with a focus on regular expressions, exception handling, file handling, creating modules, interacting with database.

Syllabus

Module - I

Introduction and overview Introduction, What is Python, Origin, Comparison, Comments, Operators, Variables and Assignment, Numbers, Strings, Lists and Tuples, Dictionaries, if Statement, while Loop, for Loop and the range() Built-in Function, Files and the open() Built-in Function, Errors and Exceptions, Functions, Classes, Modules. **Syntax and Style:** Statements and Syntax, Variable Assignment, Identifiers, Basic Style Guidelines, Memory Management, Python Application Examples. **08 Hours**

Module - II

Python Objects, Standard Types, Other Built-in Types, Internal Types, Standard Type Operators, Standard Type Built-in Functions, Categorizing the Standard Types, Un-supported Types. Numbers and Strings, Introduction to Numbers, Integers, Floating Point Real Numbers, Complex Numbers, Operators, Built-in Functions. Sequences: Strings, Lists, and Tuples, Sequences, Strings, Strings and Operators, String-only Op-erators, Built-in Functions, String Built-in Methods, Special Features of Strings. **08 Hours**

Module-III

Lists Operators, Built-in Functions, List Type Built-in Methods, Special Features of Lists, Tuples, Tuple Operators and Built-in Functions, Special Features of Tuples. Con-ditionals and Loops: if statement, else statement, else-if statement, while statement, for statement, break statement, continue statement, pass statement, else statement. **08 Hours**

Module - IV

Files and Input/Output File Objects, File Built-in Function, File Built-in Methods, File Built-in Attributes, Standard Files, Command-line Arguments, File System, File Execu-tion, Persistent Storage Modules.

Exception handling: The dir Function, Errors, Runtime Errors, The Exception Model, Exception Hierarchy, Handling Multiple Exceptions, raise, assert. **08 Hours**

Module-V

Regular Expressions: Introduction/Motivation, Special Symbols and Characters for REs, REs and Python. Programming Exercise: Check for data error in CSV files: Nu-meric Check, Alphanumeric Check, Email Check, Date Check

Database Interactions: Database Connection, creating database tables, insert data into table, reading, updating data. **08 Hours**

List of Experiments:

1. Create a new program called hello world.py. You will use this file to write your very first 'Hello world!' program.
2. Write a program using print that, when run, prints out a tic-tac-toe board.
3. Using a for loop, write a program that prints out the decimal equivalents of 1/2, 1/3,1/4... 1/10.
4. Write a program using a for loop that calculates exponentials. Your program should ask the user for a base base and an exponent exp, and calculate baseexp.
5. Write a method fact that takes a number from the user and prints its factorial.
6. Write a function roots that computes the roots of a quadratic equation. Check for complex roots and print an error message saying that the roots are complex.

Course Outcomes:

On completion of this course, the students are able to :

- Apply the concepts of Object Oriented principles used in Python.
- Apply Types, Type Operators and Built-in functions and use the same in developing specific programs.
- Apply the usage of built-in libraries, creation of customized libraries and efficient ways to store and retrieve data.
- Use file handling and exception handling mechanisms and apply the same in solving specific problems.
- Apply techniques using regular expressions and apply the same in solving specific problems.

Text Book:

1. Mark Lutz: "Learning Python", 5th Edition, O'REILLY, 2013, ISBN: 978-1-4493-5573-9.

Reference Books:

1. Barry, Paul: "Head First Python", 2nd Edition, O'REILLY, 2010, ISBN: 978-1-4493-8267-4.
2. David M. Beazley: "Python Essential Reference", 4th Edition, Developer's Library, 2010, ISBN: 0672329786.

E-Resources:

1. http://www.tutorialspoint.com/python/
2. https://www.youtube.com/playlist?list=PL9FAE4422FA13FDE4
3. https://www.codementor.io/learn-python-online

Renewable Energy Resources

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
17ECT461	3:0:0:0	3	CIE:50 SEE:50	3 Hours	EE

Course Objectives:

This course will enable students to:

- Provide detailed information of the present energy scenario and the avail-able Renewable Energy Resources.
- Get detailed insight knowledge in basics of solar radiation geometry and various measurement techniques.
- Understand the solar energy through solar thermal devices, PV conversion and their performance analysis.
- Gain the conceptual knowledge about the various energy conversion methods such as Wind, Tidal, OTEC and Geothermal.
- Give introduction to energy from Biomass, Hydrogen energy and their impact on environment and sustainability.

Syllabus

Module - I

Introduction: Energy source, India's production and reserves of commercial energy sources, need for non-conventional energy sources.

Solar Radiation: Extra-Terrestrial radiation, spectral distribution of extraterrestrial radiation, solar constant, solar radiation at the earth's surface, beam, diffuse and global radiation, solar radiation data.

Measurement of Solar Radiation: Pyrometer, shading ring pyrheliometer, sunshine recorder, schematic diagrams and principle of working. **09 Hours**

Module - II

Solar Radiation Geometry: Flux on a plane surface, latitude, declination angle, surface azimuth angle, hour angle, zenith angle, solar altitude angle expression for the angle between the incident beam and the normal to a plane surface (No derivation), local apparent time. Apparent motion of sun, day length, numerical examples.

Radiation Flux on a Tilted Surface: Beam, diffuse and reflected radiation, expression for flux on a tilted surface (no derivations), numerical examples.

Solar Thermal Conversion: Collection and storage, thermal collection devices, liquid flat plate collectors, solar air heaters concentrating collectors (cylindrical, parabolic, paraboloid) (Quantitative analysis). **09 Hours**

Module - III

Performance Analysis of Liquid Flat Plate Collectors: General description, collector geometry, selective surface (qualitative discussion) basic energy-balance equation, stagnation temperature, transmissivity of the cover system, transmissivity-absorptivity product, numerical examples. The overall loss coefficient, correlation for the top loss coefficient, bottom and side loss coefficient, problems (all correlations to be provided). Temperature distribution between the collector tubes, collector heat removal factor, collector efficiency factor and collector flow factor, mean plate temperature, instantaneous efficiency (all expressions to be provided). Effect of various parameters on the collector performance; collector orientation, selective surface, fluid inlet temperature, number covers, dust. **09 Hours**

Module - IV

Photovoltaic Conversion: Description, principle of working and characteristics, applications.

Wind Energy: Properties of wind, availability of wind energy in India, wind velocity and power from wind; major problems associated with wind power, Wind machines: Types of wind machines and their characteristics, horizontal and vertical axis wind mills.

Tidal Power: Tides and waves as energy suppliers and their mechanics, fundamental characteristics of tidal power, harnessing tidal energy, limitations.

Ocean Thermal Energy Conversion : Principle of working, Rankine cycle.

Geothermal Energy Conversion: Principle of working, Types of geothermal station with schematic diagram. **08 Hours**

Module - V

Energy from Bio Mass: Photosynthesis, photosynthetic oxygen production, energy plantation, bio gas production from organic wastes by anaerobic fermentation, description of bio-gas plants, transportation of bio-gas, problems involved with bio-gas production, application of bio-gas, application of bio-gas in engines, advantages.

Hydrogen Energy : Properties of Hydrogen with respected to its utilization as a renewable form of energy, sources of hydrogen, production of hydrogen, electrolysis of water, thermal decomposition of water, thermo chemical production bio-chemical production.

07 Hours

Course Outcomes:

On completion of this course, the students are able to :

- Explain the present energy scenario and the available Renewable Energy Re-sources.
- Describe the basics of solar radiation geometry and various measurement techniques.
- Analyze the knowledge gained in tapping the solar energy through solar ther-

mal devices, pv conversion and their performance analysis.

- Demonstrate the various energy conversion methods such as Wind, Tidal, OTEC and Geothermal.
- Apply knowledge of Biomass and Hydrogen energy and their impact on environment and sustainability.

Text Books:

1. G D Rai: "Non-Conventional Energy Sources", (Chapters 1-3,6-9,11), 5th Edition,
2. Khanna Publishers, 2011, ISBN-13: 9788174090737.
3. John Twidell and Tony Weir: "Renewable Energy Resources", (Chapters 2,5-7,9-
4. 14), 3rd Edition, Routledge Publisher, 2015, ISBN-13: 978041558437.
5. N K Bansal: "Non-Conventional Energy Resources", (Chapters 1-3,9,10,12,13), 1st
6. Edition, Vikas Publishing, 2014, ISBN-13: 978935978577.

Reference Books:

1. B H Khan: "Non-Conventional Energy Resources", (Chapters 4-10), 2nd Edition, Tata McGraw-Hill Pub., 2006, ISBN-13: 9780070142763.
2. S P Sukhatme, J K Nayak, "Solar Energy", (Chapters 3,4), 3rd Edition, Tata McGraw-Hill Pub., 2008, ISBN-13: 9780070260641.

E-Resources:

1. http://www.pyrometer.com
2. https://www.eia.gov/energyexplained

Object Oriented Programming with C++

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
17ECT462	3:0:0:0	3	CIE:50 SEE:50	3 Hours	EE

Course Objectives:

This course will enable students to :

- Understand the features of object oriented Programming concepts.
- Understand the inline functions, default arguments, classes and objects.
- Understand the constructor, Types of constructor and destructor and their order of execution.
- Understand the operator overloading and its necessity.
- Understand the virtual function, polymorphism, exception handling.

Syllabus

Module - I

Introduction: Origin of C++, features of OOP, Sample C++ program, Different data types, operators, expressions, implicit conversion, Type cast operator and statements, arrays and strings, pointers and user defined types, reference variable, memory management operator, name space, control structure, Function, default argument, inline functions, function overloading, recursive functions. **09 Hours**

Module - II

Classes and Objects: Classes, structures and classes are related. Friend functions, inline functions, Constructors, Different types of constructor, Destructors, Static data members, when constructor and destructors are executed, scope resolution operator. Nested classes, local classes, passing objects to functions, returning objects, this pointer. **09 Hours**

Module - III

Inheritance: Base Class, Inheritance, Types of inheritance and protected members, protected base class inheritance, inheriting multiple base classes, Constructors, Destructors and inheritance, Passing parameters to base class constructors, Granting access, Virtual base classes. **09 Hours**

Module - IV

Virtual functions, Polymorphism and Operator overloading: Operator over loading basics, creating a member operator function, Operator overloading using friend functions such as +, - , pre-increment, post-increment, etc., overloading <<, >>. Virtual function, calling a Virtual function through a base class reference, Virtual attribute is inherited; Virtual functions are hierarchical, pure virtual functions, Abstract classes, Using virtual functions, Early and late binding. **08 Hours**

Module - V

Generic function, Exception handling C++ File I/O: Generic function, a function with two generic types, Generic sort. Exception handling fundamentals, catching class types, using multiple catch, catching all exception.<stream>, and the file classes ,opening and closing file, reading and writing text files, put(), get(), read(), write(), geline(), eof(), seekg(), seekp(), tellp(), tellg(). **07 Hours**

Course Outcomes:

On completion of this course, the students are able to :

- Apply the concepts of Object Oriented Programming.
- Implement the concepts of classes and objects.
- Apply the concepts of inheritance to solve complex problems.
- Implement mechanism of virtual function and polymorphism.
- Develop generic function to perform different operations on different data types and implement exception handling.

Text Book:

1. Herbert Schildt: "The Complete Reference C++", 4th Edition, Tata McGraw Hill, 2003, ISBN 13: 9780070532465.

Reference Books:

1. Stanley B. Lippmann, Josee Lajore: "C++ Primer", 4th Edition, Pearson Education, 2005, ISBN-10: 0-321-71411-3.
2. Paul J Deitel, Harvey M Deitel: "C++ for Programmers", Pearson Education, 2009, ISBN-10: 0137059663.

E-Resources:

1. http://www.tutorialspoint.com/cplusplus/cpp_tutorial.pdf
2. http://www.ddegjust.ac.in/studymaterial/mca-3/ms-17.pdf

Smart Materials

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
17ECT463	3:0:0:0	3	CIE:50 SEE:50	3 Hours	EE

Course Objectives:

This course will enable students to:

- Understand the characteristics of composites and smart materials in the product design process.
- Know the types of sensing and actuation devices.
- Gain the knowledge of optics and electromagnetic technology.
- Study the importance of different control systems.
- Realize and understand the principles of vibration and modal analysis.

Syllabus

Module - I

Introduction: Characteristics of composites and ceramics materials, Dynamics and controls, concepts, Electro-magnetic materials and shape memory alloys-processing and characteristics.

Control Design: Design of shape memory alloys, Types of MR fluids, Characteristics and application, principles of MR fluid value designs, Magnetic circuit design, MR Dampers, Design issues. **09 Hours**

Module - II

Sensing and Actuation: Principles of electromagnetic, acoustics, chemical and mechanical sensing and actuation, Types of sensors and their applications, their compatibility writer, conventional and advanced materials, signal processing, principles and characterization. **09 Hours**

Module - III

Structures: Principles of drag and turbulence control through smart skins, applications in environment such as aerospace and transportation vehicles, manufacturing, repair and maintainability aspects.

Optics and Electromagnetic: Principles of optical fiber technology, characteristics of active and adaptive optical system and components, design and manufacturing principles. **09 Hours**

Module - IV

Controls: Principles of structural acoustic control, distributed, analog and digital feedback controls, Dimensional implications for structural control. **08 Hours**

Module - V

Principles of Vibration And Modal Analysis: PZT Actuators, MEMS, Magnetic shape Memory Alloys, characteristics and Applications.

Information Processing: Neural Network, Data Processing, Data Visualization and Reliability: Principles and Application domains. **07 Hours**

Course Outcomes:

On completion of this course, the students are able to :

- Explain the characteristics of composites and smart materials in the product design process.
- Identify various types of sensing and actuation devices.
- Analyze the optics and design structures using smart materials.
- Demonstrate the working principles of different control systems.
- Describe the principles of vibration and modal analysis.

Text Books:

1. A V Srinivasan, D Michael Mcfarland: "Smart Structures:Analysis and Design", (Chapters 2-5,7,8), 1st Edition, Cambridge University Press, 2001, ISBN-13: 9780521659772.
2. M V Gandhi, B S Thomson: "Smart Materials and Structures", (Chapters 13-75), 1st Edition, Chapman and Hall Pub., 1992, ISBN-13: 9780412370106.

Reference Books:

1. Eric Udd: "Fiber Optic Sensors: An introduction for Engineers and Scientists", (Chapters 1-16), 2nd Edition, John Wiley and Sons Pub., 2011, ISBN-13: 9780470126844.
2. G P Gibss: "Adaptive Structures", John Wiles and Sons, New York, 1998.
3. Banks HT, RC Smith, Y Wang, Massow S A, "Smart Materials and Structures", Par-is, 1996.

E-Resources:

1. http://www. ceramtec.com/applications
2. http://www.predictiveengineering.com

Management Information Systems

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
17ECT464	3:0:0:0	3	CIE:50 SEE:50	3 Hours	EE

Course Objectives:

This course will enable students to:

- Effectively use and administrate information systems in different business applications.
- Understand problem solving techniques to model information system solutions for business problems.
- Understand the business and professional responsibilities related to the use of information system in organizations.

Syllabus

Module - I

Foundations of information systems in business: Introduction to Information Systems in Business: Why study Information Systems?, What you need to know, A global Information society, Success and Failure with IT, Why Businesses need Information Technology. Fundamentals of Information Systems: Fundamental Information System concepts: System concepts, Components of an Information System, Information System Resources, Information System activities, Overview of Information Systems: The expanding Role of Information Systems, Operations support Systems, Management support Systems, Other classifications of Information Systems. **08 Hours**

Module - II

Solving Business Problems with Information Systems: A Systems Approach to problem Solving: The Systems approach, Defining problems and opportunities, Developing alternative solutions, Evaluating Alternative solutions, Selecting the best solution, Using the Systems approach. Developing Information System Solutions: The system development cycle, Starting the Systems Development process, Systems Analysis, Systems Design, Prototyping, Implementing a new Information System, Maintenance of Information System, Computer Aided Systems Engineering, End user development.

Business applications –I

The Internet, Electronic Commerce and Business: Introduction, Business use of the Internet, Interactive marketing, Business value of the Internet, Customer value and the Internet. Fundamentals of Electronic Commerce: Introduction, Foundations and applications of e-commerce, Business to Consumer and Business to Business commerce, Electronic payments and security. **08 Hours**

Module - III

Intranets, Extranets, and Enterprise Collaboration: Intranets and Extranets in Business: Business Value, Applications and Technologies for Intranets, Role of Extranets, Enterprise Collaboration Systems: Enterprise Collaboration, Group Ware, Electronic communication and Conferencing tools, collaborative work management tools. Information Systems for Business Operations: Business Information Systems: Cross Functional Marketing, Manufacturing, Human Resources, Accounting and Financial Information Systems. **08 Hours**

Module - IV

Transaction Processing Systems: Transaction Processing, Data entry, Batch and Real-time processing, Database maintenance, Document and Report generation, Inquiry processing.

Business applications -II

Information Systems for Strategic Advantage: Introduction, Competitive strategy, Strategic Roles for Information System, Breaking Business Barriers, Value chain and strategic Information System, Strategic Applications and Issues in information Technology, Re-engineering Business process, Improving Business quality, Becoming an agile competitor. Creating a virtual Company, Building the knowledge-creating company, Using the Internet Strategically. **08 Hours**

Module - V

Managing information technology: Enterprise and global Management: Managing Information Resources and Technologies: Information Technology Architecture, Managers and Information Technology, Organizations and Information Technology, Information Resource Management, Strategic Management Operational Management, Resource Management, Technology Management, Global Information Technology Management: The International Dimension, Global IT Management, Cultural, Political and Geo-Economic challenges, The global company, Global Business and IT strategies, Global Business and IT applications, Global IT Platforms, Global data Issue, Global Systems development, You and Global IT Management, Planning.

Implementing change: Planning for Business change with IT: Organizational planning, Information System planning Methodologies, The scenario approach, planning for competitive advantage, Critical success factors, Business Systems Planning, Computer Aided Planning tools, implementing business change. **08 Hours**

Course Outcomes:

On completion of this course, the students are able to :

- Describe the roles and functionalities of information system.
- Analyze types of solutions for business and its applications.

- Analyze the usage of Intranet and Extranet in business applications.
- Describe database management and competitive strategic approach of information systems in business applications.
- Describe various approaches in managing information technology.

Text Books:

1. James O'brien, George Marakas: "Management Information System", 10th Edition, Mcgraw Hill Education, 2010, ISBN-13: 978-0-07-337681-3, ISBN: 0-07-337681-7.
2. M V Gandhi, B S Thomson: "Smart Materials and Structures", (Chapters 13-75), 1st Edition, Chapman and Hall Pub., 1992, ISBN-13: 9780412370106.

Reference Books:

1. Kenneth C. Laudon and Jane P. Laudon: "Management Information System, Man-aging the Digital Firm", 11th Edition, Pearson Education, 2006.
2. Steven Alter: "Information Systems-The Foundation of E-Business", 4th Edition, Pearson Education, 2002.

E-Resources:

1. https://books.google.co.in/books/about/Management_Information_System.html.
2. http://www.pearsoned.co.uk/bookshop.

Microprocessors Laboratory

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
17ECL47	1:0:2:0	2	CIE:50 SEE:50	3 Hours	FC

Course Objectives:

This course will enable students to :

- Understand the concept of assembly language programming.
- Understand the appropriate algorithm for the given problem in assembly language pro-gram.
- Understand the various interfacing components and its usage.

Syllabus

List of Experiments

1) Data transfer instructions like:
   i. Byte and word data transfer in different addressing modes.
   ii. Block move (with and without overlap).
   iii. Block interchange.
2) Arithmetic and logical operations like:
   i. Addition and Subtraction of multi precision no.s.
   ii. Multiplication and Division of signed and unsigned.
   iii. ASCII adjustment instructions.
   iv. Code conversions.
3) Arithmetic programs to find square cube, LCM, GCD, factorial,
   i. Bit manipulation instructions like checking.
   ii. Whether given data is positive or negative.
   iii. Whether given data is odd or even.
   iv. Logical 1's and 0's in a given data.
   v. 2 out 5 code.
   vi. Bit wise palindrome.
4) Branch/Loop instructions like:

   Arrays: addition/subtraction of N no.s. Finding largest and smallest nos. Ascending and Descending order.
5) Programs on String manipulation like string transfer, string reversing, searching for a string, etc.
6) Programs involving Software interrupts:

I) Programs to use DOS interrupt INT 21h Function calls for Reading a Chara cter from Keyboard, Buffered Keyboard input, Display of character.

II) Experiments on interfacing 8086 with the following interfacing modules through DIO (Digital Input/Output-PCI bus compatible) card,

a) Logical controller interface.

b) Stepper motor interface.

Course Outcomes:

On completion of this course, the students are able to :

- Develop the program for data transfer.
- Develop arithmetic logical and bit manipulation Assembly level programs.
- Develop programs to understand branch and looping instruction.
- Analyze the usage of appropriate interrupts in programming and interfacing.
- Analyze and interface the peripherals using assembly level language.

Text Books:

1. Y.C. Liu and G. A. Gibson: "Microcomputer systems - The 8086/8088 Family", 2nd Edition, (Chapter 1), Prentice Hall of India, New Delhi ,1996, ISBN: 81-203-0409-8.
2. A.K. Ray and K.M. Bhurchandi: "Advanced Microprocessors and Peripherals", 3rd Edition TMH, New Delhi, 2013, ISBN: 9781259006135.

E-Resources:

1. http://nptel.ac.in/courses/Webcourse-contents/IISc-BANG/Microprocessors%20and%20Microcontrollers/pdf/Teacher_Slides/mod1/M1L3.pdf
2. http://www.nptel.ac.in/courses/Webcourse-contents/IISc-BANG/Microprocessors%20and%20Microcontrollers/pdf/Lecture_Notes/LNm2.pdf
3. http://www.feis.unesp.br/Home/departamentos/engenhariaeletrica/cap_2_extra_8087.pdf

HDL Laboratory

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
17ECL48	1:0:2:0	2	CIE:50 SEE:50	3 Hours	FC

Course Objectives:

This course will enable students to :

- Understand the concept of HDL programming for Logic gates.
- Understand the hardware description programs for combinational and sequential circuits.
- Understand the different types of interfacing components.

Syllabus

List of Experiments

1. Write HDL code to realize all the logic gates.
2. Write a HDL program for the following combinational designs,
    i. Decoder.
    ii. Encoder.
    iii. Multiplexer and de-multiplexer.
    iv. Comparator.
3. Write a HDL code to describe the functions of a Full Adder Using three modeling styles.
4. Develop the HDL code for the following Flip-Flops, SR, D, JK, T.
5. Design 4 bit binary, BCD counters (Synchronous reset and Asynchronous reset).

Interfacing:

1. Write HDL code to control speed and direction of Stepper motor.
2. Write HDL code to generate different waveforms (Square, Triangle, Ramp etc.,) using DAC Change the frequency and amplitude.
3. Write HDL code to control speed of DC motor.

Course Outcomes:

On completion of this course, the students are able to :

- Develop HDL programs for Logic gates.
- Develop HDL programs for combinational designs.

- Develop HDL programs for sequential designs.
- Develop HDL programs for various counters.
- Analyze and Interface with various electrical components.

E- Resources:

1. http://www.xilinx.com/video/hardware/basic-hdl-coding-techniques.html
2. http://www.academia.edu/1492361/VHDL_BASICS_WITH_EXAMPLES
3. http://ece-research.unm.edu/jimp/vlsi/slides/vhdl.html
4. http://www.asic-world.com/systemverilog/basic1.html
5. http://www.referencedesigner.com/tutorials/verilog/verilog_01.php
6. http://vhdlguru.blogspot.in/p/example-codes.html

Integrated Rural Development – Part 2

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
17ECH49	0:2:0:0	1	CIE:50 SEE:50	2 Hours	HSS

Course Objectives:

Course Objectives:

This course is an extension of the Integrated Rural Development course which was introduced in Semester 3. This course will extend the previous semester's work and will enable the students to:

- Continue working on the problems and challenges identified in the village.
- Apply their academic knowledge, talents, and abilities to come up with innovative and practical solutions to the challenges in the village.
- Foster a sense of entrepreneurship towards addressing the problems in the village.

Syllabus

Module - I

Overview: Overview of the course; summary of the experiences from previous semester with assigned mentors and supervisors; discussion of the challenges faced in the village identified previously. **03 Hours**

Module - II

Project Backlog Revision: Revisiting the challenges already identified in the previous semester and identifying possible project topics with the help of mentor and supervisor (this can be either continuation of the previous semester's project with a larger scope or a new project); student group discussion to finalize the new project definition; review of project definition with mentor and supervisor. **06 Hours**

Module - III

Project Plan Finalization: Modification of the previous semester's project plan to accommodate the new objectives; review of new proposaland plan with mentor and supervisor to finalize plan of work; distribution of workand needed resources and logistics within the group. **06 Hours**

Module - IV

Project Execution: Execution of the project as per the plan;conducting surveys to evaluate the impact of the project execution; collection ofproject deliverables; periodical review of the project execution status and collected artifacts (like aggregated data and survey reports) with mentor and supervisor. **10 Hours**

Module - V

Project Presentation: Creation of a final project report and a high-quality project presentation; both the project report and presentation should clearly articulate the motivation, how the project was conceptualized and executed, impact of the project, futuredirections in the project, and lessons learned by the students during the project; final review and evaluation by mentor and supervisor. **03 Hours**

Course Outcomes:

On completion of this course, students will be able to:

- Further develop their social and communication skills by interacting with residents of the village and within their team.
- Conceptualize long term solution to challenges in villages, thus developing a sense of entrepreneurship.
- Make an impact to rural sections of society, thus building their self-confidence.

Text Books:

1. Bhagawan Sri Sathya Sai Baba: "Service to Village is Service to God", Sri Sathya Sai Publications.

Reference Books:

1. Bhagawan Sri Sathya Sai Baba: "Man Management: A Value-Based Management Perspective", Sri Sathya Sai Publications.
2. Lt. Gen. M.L.Chibber: "Sai Baba's Mahavakya on Leadership : Book for Youth, Parents and Teachers."

E-Resources:

1. http://rural.nic.in/netrural/rural/index.aspx
2. www.annapoorna.org.in

Program Educational Objectives (PEOs)

Civil engineering graduates are expected to fulfill the following PEOs after few years of their graduation.

PEO1	Graduates of Electronics and Communication engineering will be using the basic academic knowledge of design and analysis required in the industry for sustainable societal growth.
PEO2	Graduates of Electronics and Communication engineering will demonstrate the technical competence based on modern tools.
PEO3	Graduates in Electronics and Communication engineering will demonstrate good communication skills, dynamic leadership qualities with concern for environmental protection.
PEO4	Electronics and Communication engineering graduates will be capable of pursuing higher studies, take up research and development work blended with ethics and human values.
PEO5	Electronics and Communication engineering graduates will have the ability to become employable and entrepreneurs thereby switching over from responsive engineering to creative engineering.

Program Outcomes (POs)

PO1	**Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and electronics and communication engineering principles to the solution of complex problems in electronics and communication engineering.
PO2	**Problem Analysis:** Identify, formulate, research literature, and analyze complex electronics and communication engineering problems reaching substantiated conclusions using first principles of mathematics, and engineering sciences.
PO3	**Design/ Development of solutions:** Design solutions for complex electronics and communication engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct Investigations of Complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions related to electronics and communication engineering problems.

PO5	**Modern Tool Usage:** reate, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex electronics and communication engineering activities with an understanding of the limitations.
PO6	**The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional electronics and communication engineering practice.
PO7	**Environment and Sustainability:** Understand the impact of the professional electronics and communication engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the electronics and communication engineering practice.
PO9	**Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex electronics and communication engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-Long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.