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.

V to VIII Semesters

Scheme and Syllabus

With effect from Academic Year 2021-2022

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 (Hrs/week)	Total Credits	Marks
1	20ECT51	Analog Communication	EC	3-2-0	4	100
2	20ECI52	Fundamentals of CMOS VLSI (IC)	EC	3-0-2	4	100
3	20ECT53	Information Theory and Coding	EC	2-2-0	3	100
4	20ECT54	Enterprise Management	ECH	3-0-0	3	100
5	20ECT55X	Professional Elective-I	EC	3-0-0	3	100
6	20ECT56X	Professional Elective-II	CS/IS	3-0-0	3	100
7	20ENV57	Environmental Studies	S&H	1-0-0	1	100
8	20ECL58	Analog Communication LAB	EC	1-0-2	2	100
9	20PES59	Employability Skills and Aptitude Development	PD	0-0-4	2	100
TOTAL				**19-4-8**	**25**	**900**

Professional Elective-I

Sl.No	Course Code	Course
1	20ECT551	Digital Switching Systems
2	20ECT552	Linear Integrated Circuits
3	20ECT553	Control Systems

Professional Elective-II

Sl.No	Course Code	Course
1	20ECT561	Object Oriented Programming using C++
2	20ECT562	Web Technology
3	20ECT563	JAVA Programming

Sixth Semester B.E.-Scheme

Sl. No	Course Code	Course	Teaching Dept	L-T-P (Hrs/week)	Total Credits	Marks
1	20ECT61	Digital Communication	EC	3-0-0	3	100
2	20ECT62	Digital Signal Processing	EC	4-0-0	4	100
3	20ECT63	Antennas and Wave Propagation	EC	4-0-0	4	100
4	20ECT64X	Professional Elective-III	EC	3-0-0	3	100
5	20ECT65X	Professional Elective-IV	EC	3-0-0	3	100
6	20HOE66X	Industrial Elective-I	EC	3-0-0	3	100
7	20ECL67	Digital Communication LAB	EC	1-0-2	2	100
8	20ECL68	Digital Signal Processing LAB	EC	1-0-2	2	100
9	20PET69	Employability Skills and Aptitude Development	PD	1-0-0	1	100
TOTAL				23-0-4	25	900

Professional Elective-III

Sl.No	Course Code	Course
1	20ECT641	ARM Processors
2	20ECT642	Internet Of Things Technology
3	20ECT643	Nano-electronics
4	20ECT644	CCNA routing and switching

Professional Elective-IV

Sl.No	Course Code	Course
1	20ECT651	Artificial Neural Networks
2	20ECT652	Image Processing
3	20ECT653	Pattern Recognition
4	20ECT654	Salesforce administrator/developer

Industrial Elective-I

Sl.No	Course Code	Course
1	20HOE661	LabVIEW – Level 1
2	20HOE662	Robotic Process Automation
3	20HOE663	Wireless and Mobile Communication

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGG

Seventh Semester B.E.-Scheme

Sl. No	Course Code	Course	Teaching Dept	L-T-P (Hrs/week)	Total Credits	Marks
1	20ECT71	Embedded Systems	EC	3-2-0	4	100
2	20ECI72	Data Communication (IC)	EC	3-0-2	4	100

3	20ECT73X	Professional Elective-V /PBL	EC	3-0-0	3	100
4	20ECT74X	Professional Elective-VI	CS/IS	3-0-0	3	100
5	20HOE75X	Industrial Elective-II	EC	3-0-0	3	100
6	20ECL76	Embedded Systems LAB	EC	1-0-2	2	100
7	20ECP77	Project Phase-1	EC	0-0-2	1	100
TOTAL				**16-2-6**	**20**	**700**

Professional Elective-V / PBL

Sl.No	Course Code	Course
1	20ECT731	Satellite Communication
2	20ECT732	Artificial Intelligence & Machine Learning (AI&ML)
3	20ECT733	Fiber Optics and Networks

Professional Elective-VI

Sl.No	Course Code	Course
1	20ECT741	Operations Research
2	20ECT742	Data Analytics
3	20ECT743	Cloud Computing with AWS

Industrial Elective-II

Sl.No	Course Code	Course
1	20HOE751	LabVIEW – Level 2
2	20HOE752	Cryptography and Network Security
3	20HOE753	Industrial IOT using TI Microcontroller
4	20HOE754	DevNet Associate

NAGARJUNA COLLEGE OF ENGINEERING & TECHNOLOGY
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Eighth Semester B.E.-Scheme

Sl. No	Course Code	Course	Teaching Dept	L-T-P (Hrs/week)	Total Credits	Marks
1	20ECP81	Project Phase II (Mid Term Evaluation)	EC	0-0-6	3	100
2	20ECP82	Project Phase III (Final Evaluation)	EC	0-0-8	4	100
3	20ECP83	Project Evaluation	EC	0-0-8	4	100
4	20ECP84	Technical Seminar	EC	0-0-2	1	100
5	20ECI85	Internship	EC	0-0-6	3	100
TOTAL				**0-0-30**	**15**	**500**

Analog Communication

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
20ECT51	3:2:0	4	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.
- Gain the knowledge of generation and demodulation of SSB.
- Apply the various methods for FM generation.
- Illustrate the concept of FM demodulation.
- Analyze and design of noise effect 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. **11 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 of SSB wave. Phase discrimination method for generating an SSB modulated wave, Demodulation of SSB waves, frequency translation, Application: AM Radio **11 Hours**

Module – III

Angle Modulation: Basic definitions, Frequency Modulation, Narrow Band FM(NBFM), Wide Band FM(WBFM), transmission bandwidth of FM waves, generation of FM waves: indirect FM and direct FM. frequency stabilization in FM receivers. **10 Hours**

Module – IV

FM Demodulation: 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. Applications of FM **10 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. **10 Hours**

Course Outcomes:

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

- Explain the generation and demodulation of AM and DSBSC systems.
- Apply the concept for generating and demodulating of SSB-SC wave.
- Analyze the direct and indirect method of generation of FM.
- Evaluate the generation and demodulation of FM wave.
- Design and analyze the noise performance of receivers.

Text Books:

1. Simon Haykins: "Communication Systems", John Willey India Pvt. Ltd., 5th Edition, 2010, ISBN: 10: 8126521511

2. B. P. Lathi: "Modern digital and analog Communication systems", 4th Edition, Oxford University Press, 2011, ISBN: 9780199476282, 9780199476282

Reference Books:

1. Simon Haykins: "An Introduction to Analog and Digital Communication", 2nd Edition, John Wiley India Pvt. Ltd., 2012, ISBN: 9788126536535, 9788126536535.

2. R. P. Singh, S. Sapre: "Communication Systems Analog and digital", 3rd edition, 2017,McGraw Hill Education, ISBN:10 : 1259004600

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. http://www.radio-electronics.com/info/rf-technology-design/fm-reception/fmdemodulation-detection-overview.php

Fundamentals of CMOS VLSI(IC)					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20ECI52	3:0:2	4	CIE:50SEE:50	3Hours	**FC**

Course Objectives:

This course will enable the students to

- Understand the concepts of fabrication process of MOS transistor.
- Gain the knowledge about characteristics of CMOS inverter.
- Understand the basic concepts of circuit and sequential MOS transistor Logic.
- Analyze the design of different CMOS Logic Circuits.
- Learn the design of different Digital circuits.

Syllabus

Module–I

Basic MOS technology: Integrated circuit's era. NMOS fabrication. CMOS Fabrication, pwell/ nwell /twin well process, BiCMOS technology.

Circuit design processes: MOS layers. Stick diagrams. Design rules and layout–lambda-based design and other rules. Examples. Layout diagrams.

0**8Hours**

Module–II

CMOS Inverter: DC Characteristics, Static Load MOS Inverters, the Differential Inverter, Tristate Inverter, Generalized AOI and OAI Logic Gates, Transmission Gate Circuits, Clocking and Dataflow Control.

0**8Hours**

Module–III

Basic circuit concepts: Sheet resistance. Area capacitances. Capacitance calculations. The delay unit. Inverter delays. Driving capacitive loads. Propagation delays. Wiring capacitances.

Examples of structured Design (Combinational Logic):A Parity Generator, Bus Arbitration Logic for n-line Bus, Multiplexers (Data Selectors), A Gray Code to Binary Code Converter.

0**8Hours**

Module–IV

CMOS Logic Structures: Mirror Circuits, Pass Transistor Logic, Pseudo NMOS logic, Tristate Circuits, Dynamic CMOS Logic, Charge sharing problems, remedies, Clocked CMOS Logic, CMOS Domino Logic.

0**8Hours**

Module–V

Subsystem Design: Data path Operators, Bit adder, Ripple Carry Adder, Carry Look ahead adder, Carry Skip adder, Carry select adder, Carry save adder, Multiplier.

0**8Hours**

List of Experiments:

1. Design an Inverter with given specifications, completing the design flow mentioned below:
a. Draw the schematic and verify the following
   i. DC Analysis
   ii. Transient Analysis
b. Draw the Layout and verify the DRC, ERC

2.Design an AND Gate and OR Gate with given specifications, completing the design flow mentioned below:
a. Draw the schematic and verify the following
   i. DC Analysis
   ii. Transient Analysis

3. Design an NAND Gate and NOR Gate with given specifications, completing the design flow mentioned below:
a. Draw the schematic and verify the following
   i. DC Analysis
   ii. Transient Analysis

4 . DesigntheCommonSourceAmplifiercircuitswithgivenspecifications,drawtheschematicandverifythefollowing
   i. DC Analysis
   ii. AC Analysis
   iii. Transient Analysis

5.Design the Common Drain Amplifier circuits with given specifications, Draw the schematic and verify the following
   i. DC Analysis
   ii. AC Analysis
   iii. Transient Analysis

5. Develop a Verilog Code for the following circuits and their Test Bench for verification, observe thewaveformandsynthesizethecodewithtechnologicallibrary.Dotheinitialtimingverification with gate level simulation.
   i. Inverter
   ii. Transmission gate
   iii. Basic/universal gates
   iv. Full adder
   v. Parallel Adder

Course Outcomes:

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

- Analyze the fabrication process of NMOS, CMOS, Stick diagram and Lay out of CMOS circuit.
- Illustrate DC characteristics of CMOS inverter ,tri state inverter
- Analyse and interpret basic Concepts of MOS transistor, SR Latch, clocked latch and flip flop circuits
- Design BI CMOS Logic, Pseudo NMOS LOGIC, Clocked CMOS Logic, dynamic logic CMOS circuits.
- Gain a complete overview of design of different Adder and Subtractor Circuit.

Text Books:

1. Douglas A. Pucknell & Kamran Eshraghian, “Basic VLSI Design” PHI 3rd Edition (original Edition–1994), 2005. ISBN-13:978-8120309869
2. Neil H. E. Weste and K. Eshragian, “Principles of CMOS VLSI Design”, A Systems Perspective, “Pearson Education (Asia) Pvt. Ltd, 2nd edition, 2000. ISBN:9789332542884
3. John P. Uyemura, “Introduction to VLSI Circuits and Systems”, JohnWiley, First edition, 2003. ISBN:0471127043

Reference Books:

1. Kang, Sung Mo, Yusuf Leblebici, and Chulwoo Kim. "CMOS digital integrated circuits: analysis and design."4th Edition (2015) , ISBN-13 ： 978-0073380629

2. Pucknell, Douglas A., Kamran Eshraghian, and Sholeh Esraghian. Essentials of VLSI Circuits and Systems. Prentice-Hall of India, 2011.ISBN:978-81-203-2772-6

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**

Information Theory and Coding

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
20ECT53	3:0:0	3	CIE:50 SEE:50	3 Hours	FC

Course Objectives:

This course will enable students to:

- Understand the concepts of the information content of symbols, mark off model and entropy.
- Gain the knowledgeabout various coding techniques using different Algorithms.
- Apply the linear block codes for error detection and correction.
- Analyze the cyclic codes for Error control coding.
- Design and develop the different types of Convolutional codes and tree diagram.

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

Error Control Coding: Introduction, Groups, Rings, Fields. Modular Arithmetic, 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: Introduction, Types of binary cyclic codes, Algebraic Structure of Cyclic codes, Encoding using an (n-k) bit shift register of cyclic codes, Syndrome Calculation circuit of cyclic codes, BCHcodes.

08 Hours

Module – V

Convolutional Codes: Introduction, Types of convolutional codes, Time domain approach, Transform domain approach, Tree diagram, RS Codes

08 Hours

Course Outcomes :

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

- Determine the average information, entropy and information rate of a source code.
- Evaluate the performance of source encoding techniques.
- Apply the error control coding method in linear block codes for encoder circuit and syndrome calculation circuit.
- Evaluate the cyclic codes for encoder circuit and syndrome calculation circuit.
- Design and develop convolutional codes in Time domain approach and Transform domain approach

Text Books:

1. K. Sam Shanmugam: "Digital and Analog Communication Systems", John WileyIndia Pvt. Ltd., 2012, ISBN-13 : 978-8126536801
2. Simon Haykin: "Digital Communications", John Wiley India Pvt. Ltd, Student Edition, 2013, ISBN-13 : 978-8126542314.

Reference Books:

1. Dr.P.S.Satyanarayana, “Concepts of Information Theory & Coding”, Publication, Medtech, 2016, ISBN-13 :978-9384007980.
2. Bernard Sklar, Digital Communications Fundamentals and Applications, Prentice Hall International,2001,ISBN: 9780130847881
3. Shu Lin and Costello ,”Error Control coding : Fundamentals and Applications,” , New Jersey,1983, ISBN: 978-0130426727

E-Resources:

1. https://www.electronicshub.org/error-correction-and-detection-codes/
2. https://www.sciencedirect.com/topics/engineering/convolutional-coding
3. https://www.tutorialspoint.com/digital_communication/digital_communication_information_theory.htm

ENTERPRISE MANAGEMENT					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20ECT54	3:0:0	3	CIE:50 SEE:50	3 Hours	FC

Course Objectives:

This course will enable the students to

- Understand the principles of enterprise management
- Familiarize with the concepts and principals of management
- Study the functions of management
- Understand the leadership traits
- Develop decision making skills

Syllabus

Module – I

NATURE OF MANAGEMENT AND ITS PROCESS

Plan Meaning, Nature and Importance of Management, Management Functions, Principles of Management-Fayol's and Taylor's Principles; Managerial Skills; Tasks and Responsibilities of Professional Manager.

08 Hours

Module – II

PLANNING

Planning- Concept, Features, Importance, Limitations, Planning Process, Types of Plans, Objectives, Strategy, Policy, Procedures, Method, Rule, Budget.

08 Hours

Module – III

ORGANISATION

Concept, Features, B Importance, Limitations, Organizing process; Types of Organization, Centralized and Decentralized organization, Work from Home

08 Hours

Module – IV

DIRECTION & COORDINATION

Direction: Concept, Features, Importance, Limitations, Elements of Direction- Supervision, Motivation and theories of motivation, Leadership: Theories and Styles of Leadership, Coordination: Concept, Features, Importance.

08 Hours

Module – V

CONTROLLING:

Concept, Features, Importance, Limitations; Control Process, Essentials of good control system, Techniques of Control

08 Hours

Course Outcomes:

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

- Describe the process of planning in business
- Analyze the process of decision making
- Analyse the different types of organisation
- Evaluate different theories of motivation.
- Discuss different styles of leadership

- Explain the methods of establishing control in organization.

BOOKS FOR REFERENCE

1. Stephen P. Robbins,Management, Pearson
2. Koontz andO"Donnell, Management, McGraw Hill.
3. Griffin, Nelson, Manjunath, MGMT and ORGB, Cengage
4. L. M Prasad, Principles of management, Sultan Chand and Sons
5. V.S.P Rao/Bajaj. Management process and organization, Excel Books.
6. T. Ramaswamy: Principles of Management, HPH.
7. Tripathi& Reddy, Principles of Management. McGraw Hill
8. R.K. Sharma Shashi K Gupta Rahul Sharma: Principles of Management Kalyani Publishers

Digital Switching Systems					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20ECT551	3:0:0	3	CIE:50 SEE:50	3 Hours	PE

Course Objectives:

This course will enable the students to,

- Understand the network and hierarchical structure for telecommunication transmission.
- Explain the importance of switching over wired and wireless channels.
- Analyze the traffic management and grade of service of the switching systems.
- Evaluating the traffic in different systems and modeling software for the switching systems.
- Design the software and hardware for the maintenance of switching systems.

Syllabus

Module – I

Development of Telecommunications: Network structure, Network services, terminology, Regulation, Standards. Introduction to telecommunications transmission, Power levels, Four wire circuits, Digital transmission, FDM,TDM, PDH and SDH.

08 Hours

Module – II

Evolution of switching systems: Introduction, Message switching, Circuit switching, Functions of switching systems, Distribution systems, Basics of crossbar systems, Electronic switching.

Digital switching systems: Switching system hierarchy, Evolution of digital switching systems, Stored program control switching systems, Building blocks of a digital switching system, Basic call processing.

08 hours

Module – III

Telecommunications Standards: Introduction to communication traffic, Unit of traffic, Congestion, Traffic measurement, Mathematical model, lost call systems, Queuing systems.

Switching systems: Introduction, Single stage networks, Gradings, Link Systems, GOS of Linked systems.

08 Hours

Module – IV

Time Division Switching: Introduction, space and time switching, Time switching networks, Synchronization.

Switching system software: Introduction, Basic software architecture, Digital switching system software classification, Call models, Software linkages during call, Feature flow diagram.

08 Hours

Module – V

Maintenance of digital switching system: Introduction , Software maintenance, Interface of a typical digital switching system central office, System outage and its impact on digital switching system reliability, Impact of software patches on digital switching system maintainability,

A methodology for proper maintenance of digital switching system.

A generic digital switching system model: Introduction, Hardware architecture, Software architecture, Recovery strategy, Simple call through a digital switching system, common characteristics of digital switching system.

08 Hours

Course Outcomes:

On completion of this course the students should be able to

- Explain the telecommunication traffic and its measurements.
- Interpret the technologies associated with the data switching operations.
- Analyze the multiplexing technologies for efficient bandwidth operations.

- Applying multiplexing concept in digital switching systems.
- Design and Create required architecture for digital switching systems

Text Books:

1. Digital Telephony - John C Bellamy: Wiley India Pvt. Ltd, 3rd Ed, 2008. ISBN:978-0471345718
2. Telecommunication and Switching, Traffic and Networks - J E Flood: Pearson Education, 2002. ISBN:978-8131705025.

Reference Books:

1. Digital Switching Systems, Syed R. Ali, TMH Ed 2002. ISBN: 9780070483903.

Linear IC's and Applications

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
20ECT552	3:0:0	3	CIE:50 SEE:50	3 Hours	PE

Course Objectives:

This course will enable students to :

- Understand the use of op amp in DC and AC applications.
- Know the concepts of practical OP-AMP specifications, characteristics,Biasing of OP-AMPs.
- Describe the frequency response and bandwidth performance of practicalOP-AMP.
- Gain the knowledge of current amplifier, peak detectors, wave formGenerators.
- Design the 555 timer, PLL and its applications.

Syllabus

Module – I

Operational Amplifier Fundamentals: basics of BJT, JFET, MOSFET, Basic OP-AMP circuit, OP-AMP parameters: 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 for inverting amplifier.

08 Hours

Module – III

OP-Amp Applications: current amplifiers, instrumentation amplifier, precision rectifiers. Clamping circuits, Peak detectors, sample and hold circuits, Log and antilog amplifiers, Phase shift oscillator, Wien bridge oscillator, Triangular/rectangular wave generators.

08 Hours

Module – IV

More Applications: Active Filters: First order and second order active Low-pass and high pass filters, block diagram of Band pass Filter and Band stop Filter.

Voltage Regulators: Introduction, Series Op-amp regulator, IC voltage regulators. Block diagram of 723 general purpose regulators.

08Hours

Module – V

Other Linear IC applications:

555 timer: Basic timer circuit, 555 timer used as astable and Mono-stable multivibrator, Schmitt trigger; PLL: Operating principles, Phase detector / Comparator,VCO DAC using R-2R, ADC using Successive approximation.

08 Hours

Course Outcomes:

On completion of this course the students are able to

- Describe the practical OP-AMP specifications and characteristics.
- Explain OP-AMP as AC amplifiers.
- Analyzing stability condition of OP-AMP.
- Analyzing OP-AMP linear applications like crossing detectors, invertingSchmitt trigger circuits, Mono-stable and A-stable multivibrator, Active Filters.

- Design of 555 timers as astable and Mono-stable multivibrator, Schmitttrigger, PLL and their applications.

Text Books:

1. David A. Bell: "Operational Amplifiers and Linear IC's", 2nd Edition, PHI/Pearson, 2008, ISBN: 9788120323599.
2. D. Roy Choudhury and Shail B. Jain: "Linear Integrated Circuits", 4th Edition, New Age International, 2010, ISBN: 9788122430981

Reference Books:

1. Robert F. Coughlin and Fred F. Driscoll: "Operational Amplifiers and LinearIntegrated 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.linearsystems.com/
2.https://www.tutorialspoint.com/linear_integrated_circuits_applications/basics_of_linear_integrated_circuits_applications.htm

Control Systems					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20ECT553	3:0:0	3	CIE:50 SEE:50	3 Hours	PE

Course Objectives:

This course will enable the students to

- Understand the mathematical modeling, block diagram reduction techniques and signal flow graph.
- Explain the time response of first and second order systems for different test input signals.
- Analyze of stability of control systems and stability analysis using RH Criterion.
- Evaluate the stability of a given transfer functions using Root-Locus concepts.
- Compute the frequency responseassessment for relative stability using Bode plots.

Syllabus

Module – I

Modeling 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.

08 Hours

Module – III

Stability analysis: Concept of stability, Routh-Hurwitz criterion, Relative stability analysis, application of Routh stability criterion, Introduction to Nyquist plot, polar plots.

08 Hours

Module – IV

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

08 Hours

Module – V

Bode diagramsanalysis: Introduction, Bode diagrams, assessment of relative stability using Bode plots.

08 Hours

Course Outcomes:

On completion of this course the students should be able to

- Explain 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.
- Design 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 and M.Gopal “Control Systems Engineering”, New Age International (P) Limited, New Delhi, Sixth edition – 2018,ISBN-8122420087.

2) K. Ogata “Modern Control Engineering - Pearson PHI, 5th Edition- 2015,ISBN-9788120340107.

Reference Books:

1).Benjamin c. kuo – and FaridGolnaaghi “Automatic Control Systems”,Wiley student edition,8th edition-2016,ISBN-9788126513710.
2) A K Jairath “Problems and solutions of control systems with essential theory”,CBS, New Delhi, Reprint Fifth edition-2011,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/108103008/25
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

Object Oriented Programming using C++					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20ECT561	3:0:0	3	CIE:50 SEE:50	3 Hours	PE

Course Objectives:

This course will enable the students to

- Understand the features of Encapsulation, Inheritance and Polymorphism.
- Study the concept of constructor and destructor using classes and objects
- Apply the different types of inheritance using base class and derived class.
- Analyze the concept of function overloading, operator overloading and virtual functions.
- Develop the formatted and unformatted I/O operation using stream classes.

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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, recursive functions**.**

08 Hours

Module – II

Classes and Objects: Classes, structures and classes are related. Friend functions, inline functions, function over loading, 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 ,

08 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.

08 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 << and >> 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

Streams and Working with files: C++ streams and stream classes, formatted and unformatted I/O operations, Output with manipulators, Classes for file stream operations, opening and closing a file, EOF.

08 Hours

Course Outcomes:

On completion of this course the students will be able to

- Explain the features of Object Oriented Programming.
- Illustrate classes and objects using public and private members of the class.
- Analyze the different types of inheritance to solve complex problems.
- Implement mechanism of virtual function, polymorphism and operator overloading.
- Develop an I/O operations and file streams using opening and closing file.

Text Books:

1. Herbert Schildt: "The Complete Reference C++", 4th Edition, Tata McGraw Hill, 2003, ISBN 13: 9780070532465.

2. Object Oriented Programming with C++, E.Balaguruswamy, TMH, 6th Edition, 2013. ISBN-978-1-25-902993-6

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

Web Technology					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20ECT562	3:0:0	3	CIE:50 SEE:50	3 Hours	PE

Course Objectives:

This course will enable students to:

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

Syllabus

Module – I

Introduction to Web Technologies: JEE, PHP, ASP and .Net , 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: Request Dispatcher, Include / Forward / Redirect, Building sample application. **,**Creating & invalidating session, Different ways to handle session.

08 Hours

Module – III

Introduction to JSP: Need for JSP, JSP life cycle.

08 Hours

Module – IV

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

08 Hours

Course Outcomes :

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

- Understand the concepts of Web Technologies.
- Explain Web Servers and App Servers.
- Analyze Request and Response models.
- Implement 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 Books:

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

E-Resources:

1. https://www.rishabhsoft.com/blog/asp.net-core-features
2. http://servlet.techdazzler.com/2012/03/inter-servlet-communication.html
3. https://ericbooth.net/the-fundamentals-of-el-sistema/

JAVA Programming					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20ECT563	3:0:0	3	CIE:50 SEE:50	3 Hours	PE

Course Objectives:

This course will enable students to:

- Understand the basic concepts of object-oriented programming.
- Illustrate the basics of JAVA Programming using classes and objects.
- Gain the knowledge of Inheritance and packages.
- Implement the exceptions using exception handling methods.
- Develop the knowledge of multi-threaded programming in JAVA.

Syllabus

Module – I

Introduction to Object Oriented Concepts and java: Procedure–Oriented Programming system, Object Oriented Programming System, Comparison of Object Oriented Language with C.Java's magic, The Byte code, Java Development Kit (JDK), Java Buzzwords, Object- oriented programming, IO Streams, Data types, variables and arrays, reference variables, Operators, Control Statements. Simple Java programs.

08 Hours

Module – II

Classes: Classes fundamentals, Declaring objects, this keyword, garbage collection. Methods: Method Prototyping, Member functions and data members, Constructors, Objects and methods, Method Overloading, Objects and arrays, Access modifiers, Setters and getters, Nested classes, Console I/O.

08 Hours

Module – III

Packages and Inheritance: Inheritance basics, using super, creating multi-level hierarchy, method overriding, using Abstract classes, using final. Packages: Access Protection, Importing Packages.

08 Hours

Module – IV

Interfaces, **Exceptions, Applets:** Interfaces, Exception handling fundamentals, exception types, uncaught exceptions, using try and catch, using multiple catch clauses, nested try statements, throw, throws, finally, Exception handling in Java, Applets, Types of Applets, Applet basics and class, Applet Architecture.

08 Hours

Module – V

Multi-Threaded Programming: Threads, Java thread model, creating a thread, Extending thread, creating multiple threads, thread priorities, Synchronization, Interthread communication, Suspending, resuming and stopping threads

08 Hours

Course Outcomes :

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

- Compare the difference between Procedure and Object OrientedProgramming.
- Develop programs by using basics ofJAVA.
- Analyze Inheritance properties and packages in solving real worldproblems.
- Evaluate exception handling methodsefficiently.
- Develop specific applications by using multithreadedconcepts.

Text Books:

1. Herbert Schildt, Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007ISBN 10: 007063677X

Reference Books:

1. Herbert Schildt, The Complete Reference C++, 4th Edition, Tata McGraw Hill,2003. ISBN-10: 007053246X
2. E Balagurusamy, Programming with Java-A primer, Tata McGraw Hillcompanies.ISBN-13: 978-0070617131.

E-Resources:

1. https://www.programiz.com/java-programming
2. https://www.w3schools.com/java/java_intro.asp
3. https://www.tutorialspoint.com/java/index.htm

Environmental Studies					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20ENV57	1:0:0	1	CIE:50 SEE:50	2 Hours	HSS

Course Objectives:

This course will enable the students to

- To identify the major challenges in environmental issues and evaluate possible solutions.
- Develop analytical skills, critical thinking and demonstrate socio-economic skills for sustainable development.
- To analyze an overall impact of specific issues and develop environmental management plan.
- To Understand various factors for Pollution
- To Understand the concepts of GIS and Remote Sensing.

Syllabus

Module – I

Introduction**:**Environment – Components of Environment Ecosystem: Types & Structure of Ecosystem, Balanced ecosystem Human Activities – Food, Shelter, And Economic & Social Security. Impacts of Agriculture & Housing Impacts of Industry, Mining & Transportation Environmental Impact Assessment, Sustainable Development

03 Hours

Module – II

Natural Resources, Water resources – Availability & Quality aspects, Water borne diseases & water induced diseases, Fluoride problem in drinking water Mineral resources, Forest Wealth Material Cycles – Carbon Cycle, Nitrogen Cycle & Sulphur Cycle. Energy – Different types of energy, Conventional sources & Non-Conventional sources of energy Solar energy, Hydro electric energy, Wind Energy, Nuclear energy, Biomass & Biogas Fossil Fuels, Hydrogen as an alternative energy.

03 Hours

Module – III

Environmental Pollution – Water Pollution, Noise pollution, Land Pollution, Public Health Aspects. Global Environmental Issues: Population Growth, Urbanization, Land Management, Water & Waste Water Management.

02 Hours

Module – IV

Air Pollution & Automobile Pollution: Definition, Effects – Global Warming, Acid rain & Ozone layer depletion, controlling measures. Solid Waste Management, E – Waste Management & Biomedical Waste Management – Sources, Characteristics & Disposal methods.

03 Hours

Module – V

Introduction to GIS & Remote sensing, Applications of GIS & Remote Sensing in Environmental Engineering Practices. Environmental Acts & Regulations, Role of government, Legal aspects, Role of Non-governmental Organizations (NGOs) , Environmental Education & Women Education.

02 Hours

Course Outcomes:

On completion of this course the students are able to

- Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale,
- Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment,

- Demonstrate ecology knowledge of a complex relationship between biotic and abiotic components
- Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues.
- To get a knowledge of Pollution and Remote Sensing Concepts.

Text Books:

1. Benny Joseph (2005), "Environmental Studies", Tata McGraw – Hill Publishing Company Limited.
2. R.J.Ranjit Daniels and Jagadish Krishnaswamy, (2009), "Environmental Studies", Wiley India Private Ltd., New Delhi.
3. R Rajagopalan, "Environmental Studies – From Crisis to Cure", Oxford University Press, 2005,
4. Aloka Debi, "Environmental Science and Engineering", Universities Press (India) Pvt. Ltd. 2012.

Reference Books:

1. Raman Sivakumar, "Principals of Environmental Science and Engineering", Second Edition, Cengage learning Singapore, 2005
2. P. Meenakshi, "Elements of Environmental Science and Engineering", Prentice Hall of India Private Limited, New Delhi, 2006
3. S.M. Prakash, "Environmental Studies", Elite Publishers Mangalore, 2007
4. Erach Bharucha, "Text Book of Environmental Studies", for UGC, University press, 2005
5. G.Tyler Miller Jr., "Environmental Science – working with the Earth", Tenth Edition, Thomson Brooks /Cole, 2004

E-Resources:

1. https://en.wikipedia.org/wiki/Environmental_social_science
2. https://www.environmentalscience.org/

Analog Communication Laboratory					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
20ECL58	1:0:2	2	CIE:50 SEE:50	3 Hours	FC

Course Objectives:

This course will enable students to :

- Gain the basic knowledge and Practical insights of Analog communication.
- Understand the application of filters in communication systems.
- Design various types of Analog communication blocks.
- Construct the different types of circuits for communication experiments.
- Demonstrate the analog modulation and demodulation techniques using discrete Components.

List of Experiments

1. Design and construction of second order active low-pass filter and Plot the frequency response and Estimation of roll-off factor.
2. Design and construction of second order active high-pass filter and Plot the frequency response and estimation of roll-off factor
3. Design and construction of active band-pass filter and Plot the frequency response.
4. Design and construction of active band-stop filter and Plot the frequency response.
5. Amplitude modulation-Generation and detection also find the Modulation index.
6. Frequency modulation- Generation.
7. Design and conduct an experiment for Pre-emphasis and de-emphasis.
8. Design and conduct an experiment to generate Pulse amplitude modulation and demodulation.
9. Design and test an R-2R Ladder network and verify truth table.

Course Outcomes:

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

- Design the second order active filters for various frequency bands.
- Analyze the design and implementation concept for modulation and demodulation circuit using amplitude modulation.
- Design and evaluate the concept for modulation circuit using frequency modulation.
- Analyze the circuit by conducting the R-2R- Digital to analog converter experiment.
- Design and evaluate 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", 4th Edition, Oxford University Press, 2010, ISBN: 0-195-68622-5.

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. http://www.radio-electronics.com/info/rf-technology-design/fm-reception/fmdemodulation-Detection-overview.php.

Employability Skills and Aptitude Development-I					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20PES59	0:0:4	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 in AMCAT Framework.
- To enhance interpersonal and soft skills for professional development.
- Enables students to develop their ability to reason by introducing them to elements of formal reasoning.
- To develop Problem Solving, confidence building, organizational, team working skills.

Syllabus

Module – I

Quantitative Aptitude I: Number System, Ratio Proportion and Partnership, Average.

06 Hours

Module – II

Quantitative Aptitude II: Percentage, Profit and Loss, Time and Work

06 Hours

Module – III

Logical Reasoning I: Number Series**,** Letter Series**,** Blood Relations

04 Hours

Module – IV

Logical Reasoning II: Analogy**,** Seating Arrangement**,** Data Arrangement

04 Hours

Module – V

Verbal Ability: Comprehension**,** Sentence Correction**,** Sentence Completion**.**

05 Hours

Course Outcomes:

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

- Solve and analyze different types of Numerical / Arithmetical problems.
- Identify logical relations among statements; and analyze logically complex statements into their truth-functional or quantificational components.
- Develop enhanced productivity, efficiency and effectiveness.
- Be equipped with a set of transferable team-building skills and general employability skills.
- Gain ease in switching jobs in the same or different sectors.
- Ability to crack the puzzles on their own
- Helps to improvise the logical thinking and ability to understand the fundamental concepts and its application of the same.

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.

Reference Books:

1. R.S. Aggarwal "A Modern Approach to Verbal & Non-Verbal Reasoning (Old Edition)" 2001.
2. R.S. Aggarwal "A Modern Approach to Logical Reasoning (Old Edition)" 1999.

E-Resources:

1. https://employabilityskills.org/development/
2. https://anivda.com/personal-development-for-employability/

Digital Communication

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
20ECT61	3:0:0	3	CIE:50 SEE:50	3 Hours	FC

Course Objectives:

This course will enable students to:

- Understand the concept of Sampling Theorem.
- Interpret the different quantization techniques, DPCM, DM and ADM.
- Illustrate the base band shaping techniques in Digital modulation.
- Gain the concept of digital modulation and demodulation.
- Design and analyze the Spread Spectrum modulation techniques.

Syllabus

Module – I

Signal Sampling: Basic signal processing operations in digital communication, Sampling Principles, Sampling Theorem, Quadrature sampling of band-pass signals, TDM. **08 Hours**

Module – II

Waveform Coding Techniques: PCM block diagram, Different quantization techniques, SNR in PCM, robust quantization, DPCM, DM, Adaptive DM. **08 Hours**

Module – III

Base-Band Shaping for Data Transmission: Line Codes and their power spectra, ISI, adaptive equalization, eye pattern. **08 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-ASK-BPSK, Coherent demodulation techniques for ASK, FSK and BPSK, Introductionto Minimum Shift Keying (MSK) and Gaussian Minimum Shift Keying (GMSK).

08 Hours

Module – V

Spread Spectrum Modulation: Pseudo noise sequences, direct sequence spread spectrum, coherent binary PSK, frequency hop spread spectrum, applications**.** **08 Hours**

Course Outcomes :

On completion of this course students should be able to:

- Explain the Sampling concept and reconstruction of signal.
- Apply the concept for generating PCM, DPCM, DM and ADM systems.
- Analyze the Base Band shaping Technique for data transmission.
- Evaluate the generation of digital modulation and demodulation concepts.
- Design and analyze the generation of spread spectrum modulation Techniques.

Text Books:

1. Simon Haykin: "Digital Communications", John Wiley India Pvt. Ltd, Student Edition, 2013, ISBN-13 : 978-8126542314

2. J. Proakis: "Digital Communication", 4th Edition, McGraw Hill, 2014,ISBN-10 : 9789339204792

Reference Books:

1. K. Sam Shanmugam: "Digital and Analog Communication Systems", John Wiley India Pvt.Ltd, 2012, ISBN-10:9788126536801

2. Simon Haykin: “An Introduction to Analog and Digital Communication”, Wiley, Secondedition, January 2012, ISBN-10:9788126536535.

3. Bernard Sklar, “ Digital Communications Fundamentals and Applications”, Prentice Hall ternational,2001, ISBN-10:0130847887.

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://www.tutorialspoint.com/digital_communication/digital_communication _quantization.htm
4. https://nptel.ac.in/courses/117101051.

Digital Signal Processing

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
20ECT62	4:0:0	4	CIE:50 SEE:50	3 Hours	FC

Course Objectives:

This course will enable the students to

- Understand the basics of Fourier Transform and its relation with other transforms.
- Explain the Properties of Discrete Fourier Transform.
- Apply the concept of FFT algorithms to compute DFT and linear filtering.
- Analyze the performance of IIR filters.
- Design and develop FIR filter using window technique..

Syllabus

Module – I

Discrete Fourier Transforms: Frequency domain sampling and reconstruction of discrete time signals (DFT/IDFT), DFT as a linear transformation, DFT in relationship with other transforms, Properties of DFT.

10 Hours

Module – II

Additional Properties of DFT and Linear Filtering: The circular convolution,Use of DFT in linear filtering, Overlap-save and add methods, Direct computation of DFT.

10 Hours

Module – III

FFT Algorithms: Need for efficient computation of the DFT (FFT algorithms), Radix-2 FFT algorithm for the computation of DFT and IDFT, Decimation-in-time FFT algorithm, Decimation-in-frequency FFT algorithm, Goertzel algorithm and chirp-Z transform.

10 Hours

Module – IV

Design of IIR Filters: Structure for IIR Systems(Direct form, Cascade form, Parallel form structures), Characteristics of commonly used analog filter – Butterworth and Chebyshev filters, analog to analog frequency transformations, design of IIR Filters from analog filter using Impulse invariance and Bilinear transformation.

11 Hours

Module – V

Design of FIR Filters: Introduction to FIR filters,Structure for FIR Systems (Direct form, Linear Phase, Frequency sampling structure,Lattice structure). Design of FIR filters using Rectangular, Hamming windows.

11 Hours

Course Outcomes:

On completion of this course the students are able to

- Understand the use of Discrete Fourier Transform in signal processing.
- Apply DFT techniques in linear filtering and spectral analysis.
- Evaluate convolution using FFT algorithms.
- Analyze digital IIR filters and structure of IIR filters.
- Design and analyze digital FIR filters and structure of FIR filters.

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 Books:

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

E-Resources:

1. http://indico.ictp.it/event/a08187/session/81/contribution/50/material/0/2.pdf
2. https://engineering.purdue.edu/~ee538/DFTbasedLinearFiltering.pdf.
3. https://web.eecs.umich.edu/~fessler/course/451/l/pdf/c6.pdf
4. https://www.mathworks.com/help/signal/ug/iir-filter-design.html
5. https://www.vyssotski.ch/BasicsOfInstrumentation/SpikeSorting/Design_of_FIR_Filters.pdf

Antennas and Wave Propagation					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20ECT63	4:0:0	4	CIE:50 SEE:50	3 Hours	FC

Course Objectives:

This course will enable the students to

- Understand the fundamental concepts of antenna parameters.
- Learn the basic principles of antenna arrays.
- Illustrate the characteristics of different types of antennas.
- Gain the knowledge on radiation mechanism of special antennas and antenna measurements.
- Interpret the importance of radio wave propagation.

Syllabus

Module – I

Antennas Basics: Introduction, Antenna parameters, Radiation Resistance, Patterns, Beam area, Radiation Intensity, Beam efficiency, Directivity and Gain, Antenna aperture, Effective height, Radio Communication link, Fields from oscillating dipole, Antenna field zones, wave polarization, Antenna Temperature, illustrative examples.

10 **Hours**

Module – II

Point source: Introduction, Power theorem, Radiation Intensity, **Source with unidirectional Cosine and Cosine squared power pattern, Source with Bidirectional Cosine power pattern, Source with Sine (Doughnut) power pattern, Source with Sine (Doughnut) squared power pattern.**

Antenna arrays: Introduction, Array of Two Isotropic Point Sources, Pattern Multiplication, Linear array of *n* Isotropic Point Sources of equal amplitude and spacing, Broadside array, End fire array, Phased arrays, Adaptive array and Binomial array.

12 **Hours**

Module – III

Loop, Slot, Patch and Horn antennas: Introduction, small loop, comparison of far fields of small loop and short dipole, loop antenna General case far field patterns of circular loop with uniform current, the small loop as special case, radiation resistance, directivity of circular loop with uniform current, slot antenna, Babinet's Principle and complementary antennas, Patch or Microstrip antennas,horn antenna, rectangular horn antenna, Parabolic reflectors.

10 **Hours**

Module – IV

Special antennas and Antenna measurements: Yagi-Uda antenna, Turnstile antenna, Helical antenna, Log periodic antenna, Spiral antenna, Embedded antenna, plasma antenna and smart antenna.

Antenna Measurements:Radiation pattern, Gain & Direct measurement.

10 **Hours**

Module – V

Radio wave propagation: Modes of propagation, Structure of atmosphere,Ground wave propagation, Tropospheric propagation, Duct propagation, Troposcatterpropagation, Flat earth and curved earth concept, Sky wave propagation – Virtualheight, Critical frequency,Maximum usable frequency – Skip distance, Fading, MultiHop propagation.

10 **Hours**

Course Outcomes:

On completion of this course the students should be able to

- List and explainthe various antenna parameters.

- Illustrate the different types ofantenna arrays and their radiation pattern.
- Analyze the various antenna designing techniques.
- Design the antenna for a given antenna parameters.
- Explain the concept of radio wave propagation.

Text Books:

1. John. Krauss: "Antenna for all Applications", Tata McGraw Hill, 3rd Edition, 2008, ISBN: 10: 0070601852
2. A. R. Harish, M. Sachidananda: "Antenna and Wave Propagation", Oxford University Press India, 2007, ISBN-13: 978-0-19-568666-1

Reference Books:

1. C.A Balanis: "Antenna Theory-Analysis and Design", Third Edition, John Wiley & Sons,2010, ISBN:0-471-66782-X

E-Resources:

1. https://nptel.ac.in/courses/117107035/
2. https://www.smartzworld.com/notes/antenna-and-wave-propagation-notes-pdf-awp/
3. https://www.virtulearn.in/course/antenna-and-wave-propagation-online-classes

ARM Processors					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20ECT641	3:0:0	3	CIE:50SEE:50	3Hours	PE

Course Objectives:

This course will enable students to:

- Understand the operation of ARM and its importance
- Gain the knowledge of pipeline and bus interface.
- Analyze programming of ARM cortex M3 using assembly and c.
- Evaluate the different ARM instructions for Memory Faults.
- Interpret the memory interface of ARM processor.

Syllabus

Module–I

ARM-32bitMicrocontroller: Thumb-2technologyandapplicationsofARM,ArchitectureofARMCortex M3,VariousUnitsinthearchitecture,GeneralPurposeRegisters,SpecialRegisters,exceptions,interrupts,stackoperation,reset sequence **08Hours**

Module–II

InstructionSets: Assembly basics, Instructionlistanddescription,useful instructions,Memory Systems,Memorymaps,CortexM3implementationoverview,pipelineand businterface. **08Hours**

Module–III

Exceptions: NestedVectorinterruptcontrollerdesign,SystickTimer,Cortex-M3ProgrammingusingassemblyandClanguage,CMSIS **08Hours**

Module–IV

Branching: BranchandBranchwithLink(B,BL)andexchange(BX,BLX),ARMinstructions,Software Interrupt (SWI), Unused instruction space, Thumb Instruction Set Support for System Development Memoryfaults.

08Hours

Module–V

TheARMmemoryinterface:TheAdvancedMicrocontrollerBusArchitecture(AMBA),TheJTAGboundaryscantarchitecture,TheARM debugarchitecture,Signalprocessingsupport. **08Hours**

CourseOutcomes:

Oncompletionofthis course,students shouldbeableto:

- RecognizethearchitectureofARMcortexM3.
- Describetheworkingofvariousinstructions.
- Solvetheexceptionsandits programming
- Evaluatethumb instructionsetanddetermineunusedinstructionspace.
- ImplementtheARMmemoryinterfaceanditsdebuggingcapabilities.

TextBooks:

1. **Joseph Yiu,** "The Definitive Guide to the ARM Cortex-M3", 2nd edn, Newnes, (Elsevier), 2010. ISBN978-1-85617-963-8

ReferenceBooks:

8.James K. Peckol, "Embedded systems- A contemporary design tool", John Wiley, 2008. ISBN-13: 978-8126524563

2.Andrew N. Sloss, Donimic Symes, Chris Wright, ARM System Developer's Guide. ISBN 978-1-55860-874-0

E-Resources:

1. https://www.arm.com/resources/education/books
2. http://techspeaker.weebly.com/uploads/8/4/7/6/8476668/armch02.pdf
3. https://community.arm.com/developer/ip-products/processors/b/processors-ip-blog/posts/arm-fundamentals-

Internet of Things (IoT)					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20ECT642	3:0:0	3	CIE:50 SEE:50	3 Hours	PE

Course Objectives:

This course will enable the students to:

- Understand the concepts and characteristics of IoT devices.
- Interpret the use of different IoT devices and their prototyping.
- Apply the IoT Architecture, protocols and reference model.
- Analyze the diverse methods of designing IOT Applications.
- Develop web based IoT application using Web services.

Syllabus

Module – I

Introduction To Internet Of Things: Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates. Overview of Microprocessor and Microcontroller, Basics of Sensors and actuators.

08 Hours

Module – II

Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria- Bluetooth, Wi-Fi, Ethernet, ZigBee, RFID and NFC.

08 Hours

Module – III

IoT Architecture, Protocols and Architecture Reference Model: Introduction, Reference Model and architecture, IoT reference Model. Protocols- 6LowPAN, RPL, CoAP, MQTT.

08 Hours

Module – IV

Prototyping and Designing Software for IoT Applications: Introduction, Prototyping Embedded device software, Programming Embedded Device Arduino Platform using IDE, Reading data from sensors and devices, Devices, Gateways, Internet and Web/Cloud services software development.

08 Hours

Module – V

Cloud Services For IoT: Introduction to Cloud Storage models and communication APIs Webserver – Web server for IoT, Cloud for IoT, Python web application framework designing a RESTful web API, Amazon Web services for IoT.

08 Hours

Course Outcomes:

After studying this course, students will be able to

- Explain the IoT architectural protocols and components.
- Evaluate the smart objects and their technologies to connect IoT to network.
- Apply the IoT architecture, protocols and reference model.
- Illustrate the Sensor and Actuator interface to Arduino Microcontroller.
- Design and develop Web based IoT applications.

Text Books:

1. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education, 2017. ISBN: 9789352605224.
2. Srinivasa K G, "Internet of Things", CENGAGE Leaning India, 2017 ISBN:9789386858955

3. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, 1st Edition, Pearson Education,2016ISBN: 978- 9386873743

Reference Books:

1. Vijay Madisetti and ArshdeepBahga, “Internet of Things (A Hands-on-Approach)”, 1st Edition, VPT, 2014. (ISBN: 9788173719547)
2. Raj Kamal, “Internet of Things: Architecture and Design Principles”, 1st Edition, McGraw Hill Education, 2017. (ISBN: 9789352605224).
3. Olivier Hersent, David Boswarthick, Omar Elloumi “TheInternet of Things – Key applications and Protocols” Wiley, 2012. ISBN: 9781119994350

E-resources

1. www.coursera.org/specializations/iot
2. https://nptel.ac.in/courses/106/105/106105166/
3. www.futurelearn.com/courses/internet-of-things
4. https://onlinecourses.nptel.ac.in/noc19_cs65/preview
5. https://nptel.ac.in/courses/106/105/106105167/

Nano Electronics					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20ECT643	3:0:0	3	CIE:50 SEE:50	3 Hours	PE

Course Objectives:

This course will enable students to:

- Understand the basics of top-down and bottom-up fabrication process, devices and Systems
- Enhance basic engineering science and technical knowledge of nano electronics.
- Describe technologies involved in modern day electronic devices.
- Know various nanostructures of carbon and the nature of the carbon bond itself.
- Learn the photo physical properties of sensor used in generating a signal.

Syllabus

Module – I

Introduction to nanotechnology: Impacts, Limitations of conventional microelectronics, Trends in microelectronics and optoelectronics, mosfet basics and operation characteristic lengths in mesoscopic systems, Classification of Nano structures, Low dimensional structures Quantum wells, wires and dots, Density of states and dimensionality Basic properties of two dimensional semiconductor nanostructures,square quantum wells of finite depth, parabolic and triangular quantum wells Quantum wires and quantum dots, carbon nano tube, graphene

08 Hours

Module – II

Fabrication of nano-layers: Different approaches, physical vapour deposition, chemical vapour deposition Molecular Beam Epitaxy, Ion Implantation, Formation of Silicon Dioxide- dry and wet oxidation methods Fabrication of nano particle- grinding with iron balls, laser ablation , reduction methods, sol gel, self assembly, precipitation of quantum dots.

08 Hours

Module – III

Characterization of nanostructures: Tools used for of nano materials characterization, microscope-optical, electron, and electron microscope.Principle of operation of Scanning Tunnelling Microscope, Atomic Force Microscope, Scanning Electron microscope, Specimen interaction. Transmission Electron Microscope X-Ray Diffraction analysis, PL & UV Spectroscopy, Particle size analyzer.

08 Hours

Module – IV

Carbon Nanostructures: Carbon molecules, Carbon Clusters, Carbon Nanotubes, application of Carbon Nanotubes**.**

08 Hours

Module – V

Nano electronic devices: MODFETS, hetero junction bipolar transistors Resonant tunnel effect, RTD, RTT, Hot electron transistors Coulomb blockade effect and single electron transistor, CNT transistors Hetero structure semiconductor laser Quantum well laser, quantum dot LED, quantum dot laser
Quantum well optical modulator, quantum well sub band photo detectors, principle of NEMS.

08 Hours

Course Outcomes :

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

- Illustrate the principles behind Nano science engineering and Nano electronics.
- Explain the effect of particles size on mechanical, thermal, optical and electrical properties of nano materials.
- Describe the properties of carbon and carbon nanotubes and its applications..
- Apply the knowledge to prepare and characterize nano materials.
- Analyze the process flow required to fabricate state-of-the-art transistor technology.

Text Books:

1. J.M. Martinez-Duart, R.J. Martin Palma, F. Agulle Rueda Nanotechnology for Microelectronics and optoelectronics, Elsevier, 2006, ISBN 9780080445533.
2. W.R. Fahrner, Nanotechnology and Nanoelctronics, Springer, 2005, ISBN 9783540266211.

Reference Books:

3. Chattopadhyay, Banerjee, Introduction to Nano science & Technology, PHI, 2012, ISBN-13: 978-8120336087.
4. George W. Hanson, Fundamentals of Nano electronics, Pearson Education, 2009, ISBN-13: 9780.1B.
5. K. Goser, P. Glosekotter, J. Dienstuhl, Nano electronics and nano systems, Springer 2004, ISBN 978-3-662-05421-5.

E-Resources:

1. https://www.sciencedirect.com/topics/materials-science/nanoelectronics
2. https://www.circuitstoday.com/nanoelectronics

Artificial Neural Networks					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20ECT651	3:0:0	3	CIE:50 SEE:50	3 Hours	PE

Course Objectives:

This course will enable the students to:

- Understand the basics of ANN and comparison with Human brain.
- Explain reinforcement learning using neural networks.
- Compare the architecture, learning algorithm and issues of various feed forward and feedback neural networks.
- Build knowledge on generalization and function approximation of various ANN architectures.
- Apply knowledge of unsupervised learning using neural networks.

Syllabus

Module – I

Introduction: Biological Neuron – Artificial Neural Model - Types of activation functions –
Architecture: Feedforward and Feedback, Convex Sets, Convex Hull and Linear Separability, Non-Linear Separable Problem. XOR Problem, Multilayer Networks.
Learning: Learning Algorithms, Error correction and Gradient Descent Rules, Learning objective of TLNs, Perceptron Learning Algorithm, Perceptron Convergence Theorem.

08 Hours

Module – II

Supervised Learning: Perceptron learning and Non Separable sets, α-Least Mean Square Learning, MSE Error surface, Steepest Descent Search, μ-LMS approximate to gradient descent, Application of LMS to Noise Cancelling, Multi-layered Network Architecture, Back propagation Learning Algorithm, Practical consideration of BP algorithm.

08 Hours

Module – III

Support Vector Machines and Radial Basis Function: Learning from Examples, StatisticalLearning Theory, Support Vector Machines, SVM application to Image Classification, RadialBasis Function Regularization theory, Generalized RBF Networks, Learning in RBFNs, RBFapplication to face recognition.

08 Hours

Module – IV

Attractor Neural Networks: Associative Learning Attractor Associative Memory, Linear Associative memory, Hopfield Network, application of Hopfield Network, Brain State in a Box neural Network, Simulated Annealing, Boltzmann Machine, Bidirectional Associative Memory.

08 Hours

Module – V

Self-organization Feature Map: Maximal Eigenvector Filtering, Extracting Principal Components, Generalized Learning Laws, Vector Quantization, Self-organization Feature Maps, Application of SOM, Growing Neural Gas.

08 Hours

Course Outcomes:

On completion of this course the students are able to:

- Understand the role of neural networks in engineering, artificial intelligence, and cognitive modeling.

- Explain how simple ANNs can be designed and trained.
- Develop the concepts and techniques of neural networks through the study of the most important neural network models.
- Apply neural networks to particular application, and to know what steps to take to improve performance.
- Evaluate whether neural networks are appropriate to a particular application.

Text Book:

1. Satish Kumar, Neural Networks A Classroom Approach–McGraw Hill Education (India) Pvt. Ltd, 2004, Second Edition. ISBN 0070482926, 9780070482920

Reference Books:

1. Simon Haykin, "Neural Networks- A comprehensive foundation", Pearson Education, 2003.ISBN-13: 978-0132733502 ISBN-10: 0132733501
2. Laurene Fausett, "Fundamentals of Neural Networks" , Pearson Education, 2004.ISBN-13: 978-0133341867 ISBN-10: 0133341860

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

Image Processing					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20ECT652	3:0:0	3	CIE:50 SEE:50	3 Hours	**PE**

Course Objectives:

This course will enable the students to

- Understand the fundamentals of digital image processing.
- Study the concepts of image enhancement using transformation techniques.
- Illustrate image analysis techniques in the form of image segmentation and to evaluate the methodologies for segmentation.
- Analyze the image restoration techniques and methods used in digital image processing.
- Design Morphological operations used in digital image processing.

Syllabus

Module – I

Digital Image Fundamentals: Introduction, Brief history, Image Representation, Components in Image Processing, Fundamental Steps in Image Processing, Applications of Image Processing , Image sensing and Acquisition, Image sampling and quantization,Basic Relationship between pixels, Mathematical tools used in digital image processing.

08 Hours

Module – II

Spatial Domain: Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters.

Frequency Domain: Preliminary Concepts, Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters, Selective Filter.

08 Hours

Module – III

Image Segmentation: Point, Line, and Edge Detection, Thresholding, Region Based Segmentation, Segmentation using Morphological Watersheds, Representation, Boundary descriptors**.**

08 Hours

Module – IV

Image Restoration: Reasons for image degradation, Model of image degradation/ restoration process, Noise probability density functions, Image restoration using spatial filtering (Mean filters), Inverse Filtering, MMSE (Wiener) Filtering.

08 Hours

Module – V

Morphological Image Processing: Preliminaries, Dilation and erosion, opening and closing, Hit-or-Miss transformation, Basic morphological operations: Boundary extraction, Region filling, extraction of connected components, convex hull, thinning, thickening.

Color Image Processing: Color Fundamentals, Color Models, Pseudocolor Image Processing.

08 Hours

Course Outcomes:

On completion of this course the students are able to

3. Describe the historical background, concepts of image processing and its application.
4. Apply image processing techniques in both the spatial and frequency (Fourier) domains.
5. Design image analysis techniques in the form of image segmentation and to evaluate the Methodologies for segmentation
6. Analyze the image restoration technique to remove degradation from given image.

7. Design Morphological operation dilation and erosion on a given image.

Text Books:

1. Digital Image Processing, Rafael C. Gonzalez, Richard Eugene Woods, Pearson Education India, 3rd-Edition,2016, ISBN: 8131726959, 9788131726952

Reference Books:

1. S Jayaraman, S Esakkirajan, T Veerakumar: "Digital Image Processing", Tata McGraw Hill Publication.
2. S Sridhar: "Digital Image Processing", Oxford University Press, ISBN-10: 0199459355, ISBN-13: 9780199459353.
3. Milan Sonka and Roger Boile "Image Processing analysis and Machine vision with Mind Tap ", Cengage Publications, 2018.

E-Resources:

1. https://www.abebooks.com/9789332518469/Digital-Image-Processing-3rd-Edition-9
2. www.synergy.ac.in/intranet/classnotes/introduction.pdf

Pattern Recognition					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20ECT653	3:0:0	3	CIE:50 SEE:50	3 Hours	PE

Course Objectives:

This course will enable students to:

- Understand the basic principles of pattern recognition.
- Illustrate the significance of data representation in pattern recognition.
- Interpret the different classifiers.
- Gain the knowledge of principles of Decision Tree for pattern recognition application.
- Design and analyze the clustering algorithm.

Syllabus

Module – I

Introduction: Definition of PR, Applications, Datasets for PR, Different paradigms for PR, Introduction to probability, events, random variables, Joint distributions and densities, moments. Estimation minimum risk estimators, problems. **08 Hours**

Module – II

Representation: Data structures for PR, Representation of clusters, proximity measures, size of patterns, Abstraction of Data set, Feature extraction, Feature selection, Evaluation.

08 Hours

Module – III

Nearest Neighbor based classifiers & Bayes classifier: Nearest neighbor algorithm, variants of NN algorithms, use of NN for transaction databases, efficient algorithms, Data reduction, prototype selection, Bayes theorem, minimum error rate classifier, estimation of probabilities, estimation of probabilities, comparison with NNC, Naive Bayes classifier, Basyessian belief network.

08 Hours

Module – IV

Decision Trees: Introduction, DT for PR, Construction of DT, Splitting at the nodes, Over-fitting & Pruning, Examples.

08 Hours

Module – V

Clustering: Hierarchical (Agglomerative,single/complete/average linkage, wards, Partitional (Forgy's, k-means, Isodata), clustering large data sets, examples.

08 Hours

Course Outcomes :

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

- Explain the mathematical preliminaries for pattern recognition.
- Apply the data representation for pattern recognition applications.
- Interpret the Nearest Neighbor based classifier and Bayes classifier.
- Evaluate decision tree algorithms for real time applications.
- Design Hierarchical clustering and various clustering algorithms.

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Text Books:

1. V Susheela Devi, M Narsimha Murthy, Pattern Recognition (An Introduction), Universities Press, ISBN 978-81-7371-725-3,2011.
2. Earl Gose, Richard Johnsonburg, Steve Joust, Pattern Recognition & Image Analysis, PHI, ISBN- 81-203-1484-0, 1996.

Reference Book:

1. Duda R. O., P.E. Hart, D.G. Stork., Pattern Classification, John Wiley and sons, 2000.ISBN:786-31-8765-4356

E-Resources:

1. https://www.geeksforgeeks.org/pattern-recognition-introduction/
2. https://www.journals.elsevier.com/pattern-recognition-letters/call-for-papers/advances-in-human-action-activity-and-gesture-recognition

LabVIEW Level - 1					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20HOE661	3:0:0	3	CIE:50 SEE:50	3 Hours	IE

Course Objectives:

This course will enable students to:

- Understand the fundamental of graphical coding system.
- Understand the basic level of LabVIEW coding.
- Apply the different concepts of LabVIEW operating tools.
- Analyze the programming concepts in LabVIEW.
- Create and develop different Structures for a specific problem.

Syllabus

Module – I

Introduction of LabVIEW : Advantages OF LabVIEW, Software Environment- Front panel, Block Diagram, Connector Pane,Palletes –Tool, Block Diagram and Connector, Terminals, Nodes, Functions, SubVIs,Datatypes,Data Flow Program.

08Hours

Module – II

LabVIEW programming concepts: Modular Programming in LabVIEW, Building a VI Front Panel, Block Diagram and Connector Pane, Creating, Editing and Displaying SubVIs,

Programming Execution with Structures: For Loop -The While Loop - Placing Objects inside Objects - Counting the Loops - Shift Registers – Case registers – Dialogs – The Sequence Structures – Timing – Timed Structures – Formula Node – Expression Node.

08 Hours

Module – III

Arrays and Clusters: Arrays in LabVIEW, Creating 1D, 2D and multidimensional Arrays, Array Initialization Matrix Operations with Arrays, Polymorphism.

Clusters Introduction , Creating Cluster Controls and Indicators, Assembling and Dis assembling Clusters, Error Handling and Error Cluster, Numerical and string functions, Designing of Boolean operations, Comparator applications, Exercises in basic programming.

08 Hours

Module – IV

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

Structures:. Introduction, Case Structures, Sequence Structures, Timed Structures , Formula Node, Event Structures, Event Structure, LabVIEW Math Script

08 Hours

Module – V

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

08 Hours

Course Outcomes :

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

- Explain the LabVIEW programming and its Advantages.
- Apply the basic aspects of the graphical programming using LabVIEW.
- Analyze the error function and components in the LabVIEW coding.
- Evaluate the LabVIEW coding for a specific problem of datalogging, measurement and presentation.

- Formulate and Design coding for data handling and Analysis on the acquired data.

Text Books:

1. LabVIEW - Getting Started with LabVIEW", M/s National Instruments., 2013 , *ISBN* 10: 0-13-609429-5.
2. Jovitha Jerome: "Virtual instrumentation using labview", PHI Learning Pvt. Ltd., 2010. ISBN 10: 8120340302 / ISBN 13: 9788120340305
3. Hans-Petter Halvorsen: "Introduction to LabVIEW," University College of Southeast, Norway. ISBN :978-82-691106-3-0.
4. S. Sumathi, P. Surekha: "LabVIEW based Advanced Instrumentation Systems", Springer. ISBN - 13:978-3540485001

Reference Books:

1. Jeffrey Travis, Jim Kring: "Introduction to Graphical Programming with LabVIEW", Pearson, 2006. ISBN – 10:0-13-185672-3.

E-Resources:

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

ROBOTIC PROCESS AUTOMATION					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20HOE662	3:0:0	3	CIE:50 SEE:50	3 Hours	IE

Course Objectives:

This course will enable students to:

- Gain foundational knowledge of RPA and Blue Prism platform.
- Understanding of process studio.
- Understanding of object studio.
- Understanding of Exception Handling & Exception Management.
- Understanding of Control room, Release management.

Syllabus

Module– I

RPA : Benefits, Tools, Uses, Lifecycle, Types. Automation: Introduction to Blue Prism: Accessing the Blue Prism Training Environment and Learning Edition, Set-up, Quick Start, Glossary & Expression Writing guides.

08 Hours

Module– II

Process Studio: An introduction to Process Studio, Using Decision Stages, Using Calculation Stages, Using Data Items, Process Validation, Using Circular Paths, Controlling Play, Using Collections, Using Loops,LayersofLogic,CreatingInput&OutputParameters,Stepping,Pages.

08 Hours

Module– III

Business Objects: An introduction to Business Objects & Object Studio, What are Business Objects?, UsingActionStages,UsingObjectStudio,UsingNavigationStages,UsingWaitStages,UsingThrottles,UnconditionalWaits,CreatingUniqueAttributes,UsingWriteStages,UsingReadStages,CreatingActions,ActionInputs&Outputs.

08 Hours

Module– IV

Exception Handling & Exception Management: An introduction to Exception Handling, Recovery Mode,Throwingan Exception, ExceptionBubbling, PreservingthecurrentException, UsingBlocks.

08 Hours

Module– V

Work Queues: Introduction to Work Queues, Working Items, Queue Items, Work Queue Configuration,DeferringItems,andExceptionItemsretries.AdditionalFeatures:Release Manager.

08 Hours

08Hours

Course Outcomes :

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

- Understand Robotic Process Automation technology with blue prism.
- Apply through blue prism tool to process input/output configurations.
- Explore the business objects studio to interact with external applications.
- Design a programmed robot that includes exception management.
- Explore Release Management and Deploy bots with Control room .

Text Books:

1. Blueprism Software Robots-The Virtual Work force Foundation Course Training Guide Version: 5.0.2
2. Alok Mani Tripathi, Learning Robotic Process Automation, Publisher: OReilly Publishing, 2018, ISBN:9781788470940 2.
3. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant, Amazon Asia-Pacific Holdings Private Limited, 2018
4. Srikanth Merianda, Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation, 1st Edition, Consulting Opportunity Holdings LLC, 2018

E-Resources:

1.https://www.tutorialspoint.com/blue_prism/blue_prism_introduction_to_rpa.htm
2.https://www.guru99.com/blue-prism-tutorial.html

Wireless and Mobile communication					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20HOE663	3:0:0	3	CIE:50 SEE:50	3 Hours	IE

Course Objectives:

This course will enable students to:

- Understand the application of multiuser access in a cellular communication scenario.
- Illustrate the propagation mechanisms in an urban mobile communications using statistical and empirical models.
- Apply the different models for mobile radio technique using path loss propagation model..
- Analyze system architecture, call processing protocols and services of GSM, GPRS.
- Design system architecture, call processing protocols and services of CDMA based systems IS95 and CDMA2000.

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 buildings, ray tracing and site specific modeling.

08 Hours

Module – IV

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

08Hours

Module – V

Wireless technologies: Introduction to Wi-Fi, WiMAX, ZigBee networks, Software defined radio,UBW Radio,Wireless adhoc Network and mobile portability, GSM.

08 Hours

Course Outcomes:

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

- Gain the basics of wireless communication techniques.
- Apply the statistical characterization of urban mobile channels to compute the performance for simple modulation schemes.
- Test and validate voice and data call handling for various scenarios in GSM and CDMA systems.
- Analyze the call process procedure between a calling number and called number for all scenarios in GSM or CDMA based systems.
- Illustrate the limitations of GSM, GPRS and CDMA to meet high data rate requirements and limited improvements that are needed.

Text Books:

1. Theodore S. Rappaport: "Wireless communications - Principles and Practices", 2nd Edition, Prentice Hall, 2001, ISBN-10: 0130422320, ISBN-13: 978-0130422323.
2. Gary J Mullet, Introduction To Wireless Telecommunications Systems and Networks", Cengage Learning, ISBN 1401886590,9781401886592.

Reference Books:

1. Dr. KamiloFeher: "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/

Digital Communication Lab					
Course Code	**L:T:P**	**Credits**	**ExamMarks**	**Exam Duration**	**CourseType**
20ECL67	1:0:2	2	CIE:50 SEE:50	3 Hours	FC

Course Objectives:

This course will enable students to :

- Gain the practical knowledge of different digital modulation techniques.
- Understand the design concept used in digital modulation.
- Design a discrete component level concept for digital communication.
- Construct various modulation and demodulation circuits.
- Implement the digital modulations design concepts with open source software

Syllabus

List of Experiments

Digital Communication Experiments using discrete components.

1. Construct an experiment for TDM of two band limited signals.
2. Design and testing of an ASK generation and detection.
3. Conduct an experiment for FSK generation and detection.
4. Design and testing of PSK generation and detection.
5. Verification of sampling theorem using Flat-top sampling

Digital Communication Experiments using open source software

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

Course Outcomes:

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

- Understand the basic knowledge necessary for transmitting and receiving information.
- Analyze the TDM for two band limited signal.
- Design and Implement the ASK, FSK and PSK generation and detection.
- Analyze the outputs by changing the important parameters at the input.
- Realize the design theory and implementation concept using open source software.

E-Resources:

1. http://vlab.amrita.edu/index.php?sub=59&brch=163
2. https://scilab.in/lab_migration/completed_labs

Digital Signal Processing LAB					
Course Code	**L:T:P**	**Credits**	**ExamMarks**	**Exam Duration**	**CourseType**
20ECL68	1:0:2	2	CIE:50 SEE:50	3 Hours	FC

Course Objectives:

This course will enable students to :

- Understand basics of MATLab software Tool boxes and how to use it for the implementation of basic signal processing.
- Understand Practical perspective of convolution and filtering operations using MATLab.
- Understand Practical perspective of convolution and filtering operations using DSP processor.
- Gain knowledge about plotting and analysing power spectrum of a signal.
- Understand how a practical long data sequence can be filtered using FFTs.

Syllabus

List of Experiments

A. MATLab Experiments.

1. Computation of N point DFT of a given sequence using direct method.
2. Circular convolution of two given sequences using Direct and DFT /IDFT methods.
3. Linear convolution of two sequences using Direct and DFT /IDFT methods.
4. Computation of N point DFT of a given sequence using FFT technique.
5. Determination and plotting of magnitude and phase spectrum of a signal using FFT technique.
6. Overlap-save and overlap-add method for linear filtering of long data sequence.
7. Solving a given difference equation.
8. Design and implementation of FIR Filters (LP & HP) using window techniques.
9. Design and implementation of analog and digital IIR filters (Butterworth and Chebyshev).

B. Experiments using DSP Processor

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

Course Outcomes:

On completion of this course, students will able to:

- Implement linear and circular convolution using MATLab and DSP hardware..
- Implement Spectral analysis using MATLab.
- Implement digital FIR filter to meet the given specifications.
- Implement digital IIR filters to meet the given specification.
- Implement efficient filtering of long data sequences.

E-Resources:

1.http://indico.ictp.it/event/a08187/session/81/contribution/50/material/0/2.pdf
2. https://engineering.purdue.edu/~ee538/DFTbasedLinearFiltering.pdf.
3. https://web.eecs.umich.edu/~fessler/course/451/l/pdf/c6.pdf

Employability Skills and Aptitude Development-II					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20PET69	1:0:0	1	CIE:50 SEE:50	3 Hours	HSS

Course Objectives:

This course will enable students to:

- Understand different types of Numerical / Arithmetical problems.
- Improves analytical abilities to think on a particular given topic
- Anticipate interview questions according to job requirement.
- Articulate the importance of self-presentation.
- To learn adaptability and become more approachable in the work environment.

Syllabus

Module – I

Quantitative Aptitude : Time Speed and Distance, Permutation and Combination, Probability, Data Interpretation, Ages, Simple and Compound Interest, Alligation and Mixture.

03 Hours

Module – II

Logical Reasoning : Coding and Decoding, Syllogisms, Direction Sense Test, Clocks, Calendars, Data Sufficiency.

Verbal Ability: Change of Speech, Change of Voice, Ordering of Sentences.

03 Hours

Module – III

Group Discussions: GD introduction and basics, What actually happens in a GD?, Initiation, Body of the GD, Summarization GD etiquettes – Do's &Don'ts, Group Discussions – FAQs, GD Practice Sessions.

03 Hours

Module – IV

Interview skills: Personal Interview – introduction & basics, guidance in all types of interviews – technical, behavioral, resume, stress and telephonic, Dressing for the interview, Typical interview questions, Do's & Don'ts in an interview .

03 Hours

Module – V

Resume Building : Resume design & formatting for paper, email and uploads on job portals, Step-by-step creation of the most powerful sections of the resume, Best practices in resume writing, Developing resumes that are grammatically correct and written in business English**.**

03 Hours

Course Outcomes :

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

- Identify logical relations among statements; and analyze logically complex statements into their truth- functional or quantificational components.
- Enhances the leadership and communication skills.
- Understand the purpose and Identify the different types of professional interviews
- Students demonstrate an ability to target the resume to the presenting purpose.
- Gain expertise in time management and negotiation.

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.

Reference Books:

1. R.S. Aggarwal “A Modern Approach to Verbal & Non-Verbal Reasoning (Old Edition)” 2001.
2. R.S. Aggarwal “A Modern Approach to Logical Reasoning (Old Edition)” 1999.

E Resources:

https://resumebuild.com/resume-builder/
https://www.myperfectresume.com/resume/builder

EMBEDDED SYSTEM					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20ECT71	3:2:0	4	CIE:50 SEE:50	3 Hours	FC

Course Objectives:

This course will enable students to:

- Understand the concepts of embedded systems, applications.
- Interpret the significance of hardware software Co design and debugging tool.
- Apply the concepts of real time systems and scheduling schemes.
- Analyze the concepts of Firmware and Software application components.
- Develop the various inter process communication mechanism.

Syllabus

Module – I

Embedded System: Embedded vs General computing system, classification, application and purpose of ES. Core of an Embedded System, Memory, Sensors, Actuators, LED, Opto coupler, Communication Interface, Reset circuits, RTC, WDT, Characteristics and Quality Attributes of Embedded Systems

08 Hours

Module – II

Hardware Software Co-Design: embedded firmware design approaches, computational models, embedded firmware development languages, Integration and testing of Embedded Hardware and firmware, Components in embedded system development environment (IDE), Files generated during compilation, simulators, emulators and debugging

08 Hours

Module – III

Real-Time Systems and Resources: Brief history of Real Time Systems, A brief history of Embedded Systems. System Resources, Resource Analysis, Real-Time Service Utility, Scheduler concepts, Real-Time OS, State transition diagram and tables, Thread Safe Reentrant Functions.

08 Hours

Module – IV

Firmware Components: The firmware components, RTOS system software mechanisms, Software application components. Debugging Components, Exceptions, assert, Checking return codes, Single step debugging, Test access ports, Trace Ports.

08 Hours

Module – V

Process and Threads: Process and thread creations, Programs related to semaphores, message queue, shared buffer applications involving inter task/thread communication.

08 Hours

Course Outcomes :

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

- Explain the concepts of Embedded systems, applications and different input output components.
- Illustrate the concepts of Hardware software co design and debugging tool.
- Apply real time systems and scheduling schemes for the real time application.
- Evaluate various Firmware components and Software application components.
- Design and develop task, process and thread for embedded application.

Text Books:

1. Sam Siewert, “Real-Time Embedded Systems and Components”, Cengage Learning India Edition, 2007. ISBN :1584504684
2. Dr. K.V.K.K Prasad, Embedded/Real Time Systems, Concepts, Design and Programming, Black Book, Dream Tech Press, New edition, 2010.ISBN: 9788177224610
3. K. V. Shibu, "Introduction to embedded systems", TMH education Pvt. Ltd. 2009.ISBN : 9780070145894

Reference Books:

1. James K. Peckol, "Embedded systems- A contemporary design tool", 2nd Edition, John Wiley, 2019, ISBN: 9781119457558.
2. Andrew N. Sloss, Donimic Symes, Chris Wright, ARM System Developer’s Guide., Morgan Kaufmann, 2014, ISBN: 9781558608740

E-Resources:

1. https://www.arm.com/resources/education/books
2. http://techspeaker.weebly.com/uploads/8/4/7/6/8476668/armch02.pdf
3. https://community.arm.com/developer/ip-products/processors/b/processors-ip-blog/posts/arm-fundamentals-introduction-to-understanding-arm-processors

Data Communication (IC)

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
20ECI72	3:0:2	4	CIE:50 SEE:50	3 Hours	FC

Course Objectives:

This course will enable the students to:

- Understand the fundamental of layered task and OSI model and its functions.
- Learn the concepts of Data link control and its protocols.
- Interpret the concepts of Wired LAN and Ethernet standards.
- Illustrate the concepts of Virtual LANs and connecting devices.
- Gain the knowledge on applications of Network layer.

Syllabus

Module – I

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

0**8 Hours**

Module – II

Data Link Control: Framing, Flow and error control, Protocols, Noiseless channels and noisy channels, HDLC, Types of 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.

08 Hours

Module – V

Network Layer: Logical addressing, Ipv4 addresses, Ipv6 addresses, Ipv4 and Ipv6 Transition from Ipv4 to Ipv6.

08 Hours

List of Experiments

PART-A: Implement the following in C/C++

1. Write and execute a program for bit stuffing for a HLDC frame.
2. Write and execute a program for bit de-stuffing for a HLDC frame.
3. Write and execute a program for character stuffing for a HLDC frame.
4. Write and execute a program for error detecting code using CRC-CCITT (16- bits).

PART-B: Simulation experiments using NS2/ NS3/ OPNET/ NCTUNS/ NetSim/ QualNet or any other equivalent tool

INTRODUCTION to NCTUNS Simulator

5. Simulate a three node point to point network with a duplex link between them. Set the queue size and vary the bandwidth and find the number of packets dropped.

6. Simulate a four node point to point network and connect the link as follows Apply a TCP agent between n0 to n3 and apply a UDP agent between n1 and n3.Apply relevant applications over TCP and UDP agents changing the parameters and determine the number of packets sent by two agents.
7. Simulate the transmission of ping messages over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.

26

Hours

Course Outcomes:

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

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

Text Books:

1. B Forouzan "Data Communication and Networking", 4th Edition, TMH, 2006, ISBN: 978 0070634145

Reference Books:

1. James F. Kurose, Keith W. Ross: "Computer Networks", Pearson education, 2nd Edition, 2003, ISBN 9780132856201
2. Wayne Tomasi "Introduction to Data communication and Networking", Pearson Education, 2007, ISBN 9788131709306

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

Satellite Communication					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20ECT731	3:0:0	3	CIE:50 SEE:50	3 Hours	PE

Course Objectives:

This course will enable students to:

- Understand the basic principle of satellite orbits and trajectories.
- Gain the knowledge of electronic systems associated with a satellite and the earth station.
- Illustrate the various technologies associated with the satellite communication.
- Learn the concept of different communication satellite.
- Identify various remote sensing satellite and its applications .

Syllabus

Module – I

Satellite Orbits and Trajectories: Definition, Basic Principles, Orbital parameters, Injection velocity and satellite trajectory, Types of Satellite orbits, Orbital perturbations, Satellite stabilization, Orbital effects on satellite‘s performance, Eclipses.

08 Hours

Module – II

Satellite subsystem: Power supply subsystem, Attitude and Orbit control, Tracking, Telemetry and command subsystem, Payload.

Earth Station: Types of earth station, Architecture, Satellite tracking.

08 Hours

Module – III

Multiple Access Techniques: Introduction, FDMA (No derivation), SCPC Systems, MCPC Systems, TDMA, CDMA, SDMA..

08 Hours

Module – IV

Communication Satellites: Introduction, Related Applications, Frequency Bands, Payloads, Satellite Vs. Terrestrial Networks, Satellite Telephony, Satellite Television, Satellite radio, Regional satellite Systems, National Satellite Systems.

08 Hours

Module – V

Remote Sensing Satellites: Classification of remote sensing systems, orbits, Payloads, Types of images: Image Classification, Interpretation, Applications.

08 Hours

Course Outcomes :

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

- Understand the concept of satellite orbits and its trajectories.
- Explain the concept of satellite sub system and earth station design.
- Analyze the various multiple access techniques used in satellite system.
- Interpret the different types of communication satellites and its applications.
- Design the working of remote sensing satellites and its applications.

Text Books:

1. Anil K. Maini, Varsha Agrawal, Satellite Communications, Wiley India Pvt. Ltd., 2015, ISBN: 97-81-265-2071-8.

Reference Books:

1. Dennis Roddy, Satellite Communications, 4th Edition, McGraw- Hill International edition, 2006

2. Timothy Pratt, Charles Bostian, Jeremy Allnutt, Satellite Communications, 2nd Edition, Wiley India Pvt. Ltd , 2017, ISBN: 978-81-265-0833-4

E-Resources:

1. https://earthobservatory.nasa.gov/features/OrbitsCatalog
2. https://gracefo.jpl.nasa.gov/attitude-and-orbit-control-system/
3. https://www.sciencedirect.com/topics/engineering/terrestrial-network
4. https://oceanservice.noaa.gov/facts/remotesensing.html

Artificial Intelligence and Machine Learning (AI & ML)					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**CourseType**
20ECT732	3:0:0	3	CIE:50 SEE:50	3 Hours	PE

Course Objectives:

This course will enable students to

- Understand the importance of AI and ML technique to a given concrete problem.
- Interpret the non-trivial AI techniques to handle complex problem.
- Apply the propositional logic for-solving the problem related to Artificial Intelligence.
- Analyze the decision tree and classification algorithms.
- Develop the Artificial Neural Networks model and Baysian algorithms for real time applications.

Syllabus

Module – I

Introduction: Introduction to AI & MI. Real Time Applications of Machine Learning, Importance of Machine Learning, Intelligent Agents: Agents and environment; Rationality; the nature of environment; the structure of agents. Problem solving: Problem-solving agents; Example problems**.**

08 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.

08 **Hours**

Module – IV

Decision Tree Learning : Introduction, Decision Tree representation, Problems and examples for decision learning, The basic decision tree algorithm, Hypothesis space search in decision tree algorithms, Inductive bias in decision tree learning, Issues in decision tree learning

08 Hours

Module – V

Artificial Neural Networks: Introduction, Neural network representation, Problems for neural network learning **Baysian Learning** : Motivation, Estimating hypothesis accuracy, Basics of sampling theory, Bayes theorem and concept learning, Bayes optimal classifier, Gibbs algorithm, Naïve Bayes classifier

08 Hours

Course Outcomes:

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

- Explain the concepts of intelligent agents for solving problems using artificial intelligence.
- Illustrate the concepts of non-trivial AI techniques to handle complex problems.
- Apply the various symbolic knowledge representation to specific problems.
- Evaluate the characteristics of decision tree and solve the problems.
- Design and develop Artificial neural networks model and Bayesian techniques for appropriate applications

TEXT BOOKS:

1. Stuart Russel, Peter Norvig: Artificial Intelligence A Modern Approach, 2nd Edition, Pearson Education, 2003. ISBN 0131038052.
2. Tom M. Mitchell, Machine Learning, Tata McGraw-Hill, 2013, ISBN : 1259096955

REFERENCES :

1. Elaine Rich, Kevin Knight: Artificial Intelligence, 3rd Edition, Tata McGraw Hill, 2009. ISBN: 0070087709
2. Nils J. Nilsson: Principles of Artificial Intelligence, Elsevier, 1980 ISBN 9783540113409.

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/

Fiber optics and Networks					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20ECT733	3:0:0	3	CIE:50 SEE:50	3 Hours	PE

Course Objectives:

This course will enable students to:

- Gain the knowledge of fundamental concepts of optical fiber communication, fiber modes configurations and types of fiber materials.
- Illustrate the various losses in optical fiber and signal distortion in optical fiber.
- Analyze the types of optical sources, detectors and its characteristics.
- Evaluate the optical digital link based on budgets and discuss the concepts of WDM using fiber optics.
- Design the concepts of Optical Networks in various applications.

Syllabus

Module – I

Overview of optical fiber communication: Introduction, Historical development, general system, advantages of optical fiber communication, optical fiber waveguides: Ray theory, cylindrical fiber, single mode fiber, cutoff wave length, mode filed diameter. Optical Fibers: fiber materials,fiber optic cables.

08 Hours

Module – II

Transmission Characteristics of Optical Fibers: Introduction, Attenuation, absorption, scattering losses, bending loss, dispersion, chromatic dispersion, Intermodal dispersion.

08 Hours

Module – III

Optical Sources and Detectors: Optical emission from semiconductors, semiconductor injection LASER, LED power and efficiency, optical detection principles, absorption, quantum efficiency, responsivity, semiconductor photo diodes with and without internal gain**.**

08 Hours

Module – IV

Digital link and WDM Network Elements: Point–to–Point links, System considerations, link power budget, rise time budget, Optical line terminals, Optical line amplifiers, Optical add/ Drop Multiplexers, Optical cross connectors.

08 Hours

Module – V

Optical Networks: SONET/SDH:Multiplexing, SONET/SDH Layers, SONET Frame structure, SONET/SDH Physical Layer, Optical Transport Network, Ethernet, IP.

08 Hours

Course Outcomes :

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

- Explain the light propagation concepts in an optical fiber waveguides.
- Interpret the transmission characteristics of optical Fiber.
- Illustrate the construction and characteristics of optical sources and detectors.
- Evaluate the digitallink in the power budget estimation and concepts of WDM network.
- Analyze concepts of opticalnetworks in fiber optic communication.

Text Books:

1. John M. Senior, “Optical Fiber Communication: Principles and Practice”, 3rd Edition, PHI, 2010, ISBN 13: 9780130326812.
2. Rajiv Ramaswami, Kumar N. Sivarajan, Galen H. Sasaki, “Optical networks”, 3rd Edition, Morgan Kaufmann Publishers, 2010, ISBN: 9780123740922.
3. Gerd Keiser, “Optical Fiber Communications”, 5th Edition, McGraw Hill, 2015,ISBN 13: 9781259006876.

Reference Books:

1. Govind P. Agrawal, “Fiber Optic Communication System”, 3rd Edition, John Wiley and Sons, 2010,ISBN: 9788126513864.
2. Djafark Mynbaev and Lowell L. Scheiner, “Fiber Optic Communication Technology”, Pearson Education 2006,**ISBN** 13: 9780139620690.

E-Resources:

1.https://www.academia.edu/40453620/Optical_Fiber_Communications_Principles_and_Practice_Third_Edition_-John_M._Senior
2.http://www.cesarkallas.net/arquivos/faculdade-pos/TP319-redes-opticas/Optical-Networks-3nd.pdf

Operations Research

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
20ECT741	3:0:0	3	CIE:50 SEE:50	3 Hours	PE

Course Objectives:

This course will enable students to:

- Understandthe mathematical, engineering and modeling skills for effective decision-making, model formulation and applications to solve real world problems.
- Learn the various techniques and applications of OR, relationship between a linear program and its dual.
- Illustrate the different types of transportation and assignment models for optimization.
- Evaluate techniques that are used to plan, schedule and monitor large projects
- Gain the knowledge on decision making techniques under conflicting situations where there are one or more opponents.

Syllabus

Module – I

Introduction: Linear programming, Definition, scope of operations research (OR) approach and limitations of OR models, characteristics and phases of OR mathematical formulation ofL.P. Problems. Graphical solution methods.

Linear Programming Problems: Introduction, Definitions, simplex method - computational procedure.

08Hours

Module – II

Artificial Variable Technique: Two phase method. Big-M-method (Charne's penalty method). Degeneracy-Methods to resolve degeneracy. Special cases- Alternative, unbounded & non-existing solution, Concept of duality, primal &dual correspondence, Dual simplex method.

08 Hours

Module – III

Transportation Problem: Mathematical Formulation; Matrix form, Definitions, Initial basic feasible solution using different methods. Optimality methods. Minimization problem, unbalanced transportation problem, degeneracy in transportation problems.

Assignment Problem: Mathematical Formulation, Hungarian method, Minimal, Maximal & unbalanced assignment problem, traveling salesman (Routing) problem.

08 Hours

Module – IV

PERT-CPM Techniques: Definitions, difference between CPM & PERT. Applications. Network construction, labeling using Fulkerson's '1-J' Rule. Time Estimates and Critical path - Forward & Backward pass computation. Determination of Floats, Slack times & critical path. PERT-critical path, scheduling by project duration, variance under probabilistic models, prediction of date of completion, crashing of simple networks- Optimum duration & Minimum duration cost.

08 Hours

Module – V

Game Theory: Formulations of games, two person-zero sum game, games with and without saddle point, graphical solution (2 x n, m x 2 game), dominance property.

08Hours

Course Outcomes :

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

- Develop Linear Programming models and to infer the solutions to the real-world problems.
- Solve the Linear problems by applying different techniques of Operations research.
- Analyze the Transportation models and Assignment models.
- Design new simple models like CPM to improve decision making and to use critical path analysis,programming evaluation and review techniques for timely project scheduling and completion.

- Compare the characteristics of different types of decision making environments and theappropriate decision making approaches and tools to be used in each type.

Text Books:

1. Frederick S. Hillier and Gerald J. Lieberman: Introduction to Operations Research: Concepts and Cases, 8th Edition, Tata McGraw Hill, 2005, ISBN:9780070600928.

Reference Books:

1. , S. D. Sharma "Operation Research" – KedarnathRamnath and Co, 2007,ISBN:5551234001596.
2. Hamdy A Taha: Operations Research: An Introduction, 8th Edition, Pearson Education, 2007, ISBN:81-203-2235-53.

E-Resources:

1.www.nptelvideos.in/2012/12/fundamentals-of-operations-research.html2.
2. www.freevideos.com/courses/2678/advanced-operations-research

Data analytics					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20ECT742	3:0:0	3	CIE:50 SEE:50	3 Hours	PE

Course Objectives:

This course will enable students to:

- Understand big data, types, benefits, industry examples for business intelligence.
- Gain the knowledge of Nosql data models.
- Illustrate Nosql data with multiple databases.
- Analyze Hadoop, map-reduce architecture and Fundamentals.
- Evaluate HBase, Cassandra, Cassandra Query language, data replication

Syllabus

Module – I

Overview of Big Data: Defining Big Data, Big Data Types, Analytics, Industry Examples of Big Data, Benefits of Big Data, Crowd Sourcing Analytics, Indian Big Data companies.

08Hours

Module – II

NoSQL Data Management-1: Introduction to NoSQL, aggregate data models, aggregates, key, value and document data models, relationships, graph databases, schema less databases, materialized views, distribution models, sharding, version, Map reduce, partitioning and combining, composing map-reduce calculations.

08 Hours

Module – III

NoSQL Data Management-2: Key Value Databases, Document Databases, Column Family Stores, Graph Databases**.**

08 Hours

Module – IV

Basics of Hadoop: Understanding Hadoop features, Learning the HDFS and MapReduce architecture, Introducing Hadoop MapReduce, Understanding the Hadoop MapReduce fundamentals.

08 Hours

Module – V

Hbase and Cassandra: Introduction to HBase, Row-Oriented vs Column-Oriented data stores, HBase Architecture, Understanding HBase Data Model, Casandra: Introduction, Features of Cassandra, Data Replication in Cassandra, Cassandra Query language(CQL), Cassandra Data Model.

08Hours

Course Outcomes :

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

- Describe big data, types, and benefits and used cases from selected business domains.
- Explain NoSQL big data using data models.
- Analyze various databases like Key value, documents, etc.
- Apply Hadoop, perform map-reduce analytics using Hadoop.
- Evaluate Hadoop related tools such as HBase, Cassandra..

Text Books:

1. 1. V K Jain, “BIG DATA and HADOOP”, 2017 edition, Khanna Book Publishing. ISBN:978-93-82609-13-1.
2. Pramod J. Sadalage, Martin Fowler, “NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence”, Addison-Wesley. ISBN:9780133036121.
3. VigneshPrajapati, “Big data analytics with R and Hadoop”, 2013, SPD. ISBN 13: 978-93-5110-410-0.

Reference Books:

1. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
2. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.

E-Resources:

1. http://www.tutorialspoint.com/hadoop
2. http://www.sas.com/en_us/insights/big-data/what-is-big-data.html

Cloud Computing with AWS					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20ECT743	3:0:0	3	CIE:50 SEE:50	3 Hours	PE

Course Objectives:

This course will enable students to:

- Learn the basic concepts of Cloud Computing, AWS and AWS Economics and Billing System.
- Understanding of Global Infrastructure and Cloud Security.
- Understanding of Networking, Content Delivery and Compute Services.
- Understanding of Storage and Databases.
- Acquire knowledge of Cloud Architecture, Auto Scaling and Monitoring.

Syllabus

Module – I

Cloud Concepts overview: Introduction to cloud computing, Advantages of cloud computing, Introduction to Amazon Web Services (AWS), AWS Cloud Adoption Framework (AWS CAF). Cloud Economics and Billing: Fundamentals of Pricing, Total Cost of Ownership, AWS Organizations, AWS Billing and Cost Management, Technical Support

08 Hours

Module – II

AWS Global Infrastructure Overview: AWS Global Infrastructure, AWS service and service category overview. **AWS Cloud Security:** AWS shared responsibility model, AWS Identity and Access Management (IAM), Securing a new AWS account, Securing accounts, Securing data on AWS, Working to ensure compliance, Additional security services and resources.

08 Hours

Module – III

Networking and Content Delivery: Networking basics, Amazon Virtual Private Cloud (Amazon VPC), VPC networking, VPC security, Amazon Route 53, Amazon CloudFront. Compute: Compute services overview, Amazon EC2, Amazon EC2 cost optimization, Container services, Introduction to AWS Lambda, Introduction to AWS Elastic Beanstalk.

08 Hours

Module – IV

Storage: Amazon Elastic Block Store (Amazon EBS), Amazon Simple Storage Service (Amazon S3), Amazon Elastic File System (Amazon EFS), Amazon Simple Storage Service Glacier. Databases: Amazon Relational Database Service (Amazon RDS), Amazon DynamoDB, Amazon Redshift, Amazon Aurora.

08Hours

Module – V

Cloud Architecture: Amazon Relational Database Service (Amazon RDS), Amazon DynamoDB, Amazon Redshift, Amazon Aurora. **Auto Scaling and Monitoring**: Amazon Relational Database Service (Amazon RDS), Amazon DynamoDB, Amazon Redshift, Amazon Aurora.

08 Hours

Course Outcomes :

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

- Identify the architecture and infrastructure of Cloud computing.
- Analyze the core issues of cloud computing such as security, privacy, and interoperability.
- Articulate the main concepts, key technologies, strengths, and limitations of cloud computing.
- Adapt the appropriate technologies, algorithms, and approaches for the related issues.
- Create new ideas and innovations in cloud computing.

Text Books:

1. Buyya, Rajkumar, James Broberg, and Andrzej M. Goscinski, eds. Cloud computing: Principles and paradigms. Vol. 87. John Wiley & Sons, 2011, ISBN: 978-0-470-88799-8.
2. Velte T, Velte A, Elsenpeter R. Cloud computing, a practical approach. McGraw-Hill, Inc.; Sep 22. 2009, ISBN: 9780070683518.

Reference Books:

1. Thomas Erl: "Cloud Computing", Pearson Education, 1st Edition, 2014, ISBN-13: 978-9332535923.
2. Judith Hurwitz, Marcia Kaufman, Fern Halper: "Cloud Computing for dummies", Wiley, 1st Edition, 2009, ISBN: 9780470484708.
3. Velte, Anthony T., Toby J. Velte, and Robert Elsenpeter. "Cloud Computing: A Practical Approach." (2009), ISBN: 9780071626941

E-Resources:

1. http://www.buyya.com/MasteringClouds/ToC-Preface-TMH.pdf

LabVIEW Level-2					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20HOE751	3:0:0	3	CIE:50 SEE:50	3 Hours	IE

Course Objectives:

This course will enable students to:

- Remember the fundamentals of Graphical coding system.
- Understand how to employ string and file operations of LabVIEW coding.
- Apply the different concepts of Error Functions in LabVIEW.
- Evaluate the Memory performance concepts in LabVIEW.
- Create and develop Interface Designs for a specific problem.

Syllabus

Module – I

Review of Level– 1: LabVIEW Environment, Front panel designing and working environment , Explanations of Controls Palette .Block Diagram and its working, About For loops , Shift registers , SubVIs, Exercises in basic programming , Working models in structures.Exercises in basic programming.

08 Hours

Module – II

Strings and File I/O : Introduction, Creating String Controls and Indicators, String Functions, Editing , Formatting and Parsing Strings, Formatting Strings, Configuring String Controls and Indicators. Basics of File Input/ Output, Choosing a File Format, File I/OVIs Functions**.**

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

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 – IV

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

08 Hours

Module – V

Memory, performance, and determination: a. Tools for identifying memory and performance issues **,**Profile memory and performance, Show buffer allocations and VI metrics **,** Programming practices

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

08 Hours

Course Outcomes :

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

- Explain the concepts of LabVIEW programming.
- Apply the various concepts of string and file functions.
- Analyze the basic aspects of the graphical programming using LabVIEW.
- Formulate coding for data handling and Analysis on the acquired data.
- Create LabVIEW coding for a specific problem of datalogging, measurement and presentation.

Text Books:

1. LabVIEW-Getting Started with LabVIEW",M/s National Instruments 2013,ISBN 10: 0-13-609429-5.
2. Jovitha Jerome: "Virtual instrumentation using labview", PHI Learning Pvt. Ltd.,2010. ISBN 10: 8120340302 / ISBN 13: 9788120340305
3. Hans-PetterHalvorsen: "Introduction to LabVIEW," University College of Southeast, Norway. ISBN:978-82-691106-3-0
4. S. Sumathi, P. Surekha: "LabVIEW based Advanced Instrumentation Systems", Springer.ISBN-13:978-3540485001

Reference Books:

1. Jeffrey Travis, Jim Kring: "Introduction to Graphical Programming with LabVIEW", Pearson, 2006. ISBN-10:0-13-185672-3..

E-Resources:

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

Cryptography and Network Security

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
20HOE752	3:0:0	3	CIE:50 SEE:50	3 Hours	IE

Course Objectives:

This course will enable students to:

- Understand the basic concepts of network security and classical encryption systems.
- Gain the knowledge of stream ciphers and block ciphers cryptographic algorithms.
- Apply the concept of classical encryption techniques to stream ciphers and block
- Analyze the stream ciphers and block ciphers and their applications in network security
- Design and develop the stream ciphers and block ciphers for applications in network security

Syllabus

Module 1

Introduction: Services, mechanisms and attacks, OSI security architecture, Model for network security.
Symmetric ciphers: Introduction**,** Symmetric Cipher Model, Substitution Techniques: Caesar Cipher, Mono Alphabetic Cipher, Playfair Cipher, Hill Cipher, poly alphabetic Cipher and One-Time Pad (OTP). Transposition Techniques, Rotor Machines, Steganography.

08 Hours

Module 2

Finite Fields: Groups, Rings, Fields. Modular Arithmetic: Divisors, properties of modulo operator, modular arithmetic operations and properties. Euclid's Algorithm, Greatest Common Divisor (GCD), finding GCD. Finite Fields of the form GF (p): Finite fields of order p, finding multiplicative inverse in GF (p). Polynomial Arithmetic: Ordinary polynomial Arithmetic, polynomial Arithmetic with coefficients in Zp. Finding GCD. Finite fields of the form GF(2^n).

08 Hours

Module3

Block Ciphers: Simplified DES, Block Cipher Principles, Data encryption standard (DES), Strength of DES, Block Cipher Design Principles and Block Cipher Modes of Operation, Evaluation Criteria for Advanced Encryption Standard, The AES Cipher.

08 Hours

Module4

Block Ciphers: Principles of Public-Key Cryptosystems, The RSA algorithm. Key Management, Diffie - Hellman Key Exchange,Overview of Elliptic curve Cryptography.
Authentication functions and Hash Functions: Authentication functions, message authentication codes, hash functions

08 Hours

Module 5

Web Security: Web Security Consideration, Security socket layer (SSL) and Transport layer Security (TLS), Secure Electronic Transaction (SET). Intruders, Intrusion Detection.

07 Hours

Course Outcomes :

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

- Explain the basic concepts of classical encryption used for network security
- Illustrate the structure of cryptographic algorithms and their applications
- Apply the concept of classical encryption techniques to existing standard algorithms
- Evaluate the significance of cryptographic algorithms and their applications in network security
- Design and develop the private key and public key, authentication functions for applications in network security.

Text Books:

1. **W**illiam Stallings "Cryptography and Network Security: Principles and Practice", Fifth Edition, Pearson education,2011.ISBN : 9780136097044

Reference Books:

1. Behrouz Forouzan" Cryptography and Network Security" Tata McGraw-Hill, 2007, ISBN : 9780070702080
2. **A**lfred J. Menezes, Paul C. Van Oorschot and Scott A. Vanston" Handbook of Applied Cryptography" CRC Press, reprint 2001, ISBN:9780849385230
3. Bruce Scheiner, " Applied Cryptography: Protoclos, Algorithms, and source code in C", 2nd Edition, Wiley India,2008. ISBN: 9780471117094
4. Atul Kahate," Cryptography And network Security", 2nd Edition, Tata McGraw-Hill, 2006, ISBN : 9781259029882

E-Resources:

1. http://www.nptel.ac.in/courses/106105031
2. http://faculty.mu.edu.sa/public/uploads/1360993259.0858Cryptography%20and%20Network%20Security%20Principles%20and%20Practice,%205th%20Edition.pdf

Industrial IOT using TI Microcontroller					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**CourseType**
20HOE753	3:0:0	3	CIE:50 SEE:50	3 Hours	IE

Course Objectives:

This course will enable students to:

- Understand the Concepts Next generation sensor and requirements of Industry 4.0.
- Gain the knowledge of Architecture of MSP 430, instruction set and Low power mode of operation
- Apply the concepts of Business Model and reference architecture IIoT
- Evaluate the concepts of data analytics, Machine Learning and Data Science for IIOT application
- Design and develop Security and Fog Computing models in IOT

Syllabus

Module – I

INDUSTRY 4.0: Introduction Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artifical Intelligence, Big Data and Advanced Analysis

0**8 Hours**

Module – II

MSP430 microcontroller: Introduction, Architecture, address space, on-chip peripherals (analog and digital), and Register sets. Instruction set, instruction formats, and various addressing modes of MSP430 devices; System clocks. Low Power aspects of MSP430: low power modes

08 Hours

Module – III

INDUSTRIAL IoT: IIoT-Introduction, Industrial IoT: Business Model and Reference Architecture: IIoT-Business Models, Industrial IoT- Layers: IIoT Sensing, IIoT Processing, IIoT Communication, IIoT Networking.

08 Hours

Module – IV

IIoT ANALYTICS: Big Data Analytics and Software Defined Networks, Machine Learning and Data Science, Julia Programming, Data Management with Hadoop**.**

08 Hours

Module – V

IoT SECURITY: Industrial IoT: Security and Fog Computing - Cloud Computing in IIoT, Fog Computing in IIoT, Security in IIoT.

08 Hours

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

- Explain the Industry 4.0 standards and its requirements for practical application.
- Illustrate the Architecture of MSP 430 for IOT application
- Apply the reference architecture for Industrial IoT application.
- Evaluate the concepts of Machine Learning and Data analytics for Industrial IOT application
- Develop the Security and Fog Computing architecture for IOT applications

TEXT BOOKS:

1. Alasdair Gilchrist , “Industry 4.0: The Industrial Internet of Things”, Apress, New York, 2016. ISBN 9781484220467.
2. Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat “Industrial Internet of Things: Cyber manufacturing Systems” Springer Series in Wireless Technology. ISBN

9783319425597**W**illiam Stallings “Cryptography and Network Security: Principles and Practice”, Fifth Edition, Pearson education,2011.ISBN : 9780136097044

Reference Books:

1. Veneri, Antonio Capasso, Packt, Hands-On Industrial Internet of Things: Create a powerful Industrial IoT, Packt Publishing; First edition, 2018. ISBN: 9781789537222

E-Resources:

1. http://www.nptel.ac.in/courses/106105031
2. http://faculty.mu.edu.sa/public/uploads/1360993259.0858Cryptography%20and%20Network%20Security%20Principles%20and%20Practice,%205th%20Edition.pdf

DevNet Associate					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**CourseType**
20HOE754	3:0:0	3	CIE:50 SEE:50	3 Hours	IE

Course Objectives:

This course will enable students to:

- Understand the Python programming and DevNet overview.
- Obtain the knowledge of Software development patterns and API's.
- Gain the knowledge of Network fundamentals and different network layers.
- Analyze the sample applications and the network security of the applications.
- Demonstrate the Infrastructure and Automation of different models and to manage the Cisco development platforms.

Syllabus

Module – I

Introduction: Installation of virtual lab environment, Manage the Linux file system and permissions, basic Python programming.

Developer Environment: DevNet Overview, DevNet Resources, DevNet Exchanges.

08 Hours

Module – II

Software Development and Design: Software development lifecycle, Design Patterns**,** software version control using GIT**,** Coding Basics , Code Review and Testing, Data Formats**.**

Introducing APIs:API Design Styles, Architecture Styles, REST APIs, Authenticating a REST API, Troubleshooting API Calls**.**

08 Hours

Module – III

Introduction to Network Fundamentals: Network Interface Layer, Internetwork Layer, Network Devices, Networking Protocols, Troubleshooting Application Connectivity Issues.

08 Hours

Module – IV

Introduction to Application Development and Security: Understanding Deployment Choices with Different Models, Creating and Deploying a Sample Application, Continuous Integration/Continuous Deployment (CI/CD), Networks for Application Development and Security, Securing Applications.

08 Hours

Module – V

Introduction to Automating, Developing, and Deploying Applications: Automating Infrastructure with Cisco, DevOps and SRE, Basic Automation Scripting, Automation Tools, Infrastructure as Code, Automating Testing, Network Simulation.

Introduction to Cisco Platforms and Development: Cisco SDKs, Understanding Network Programmability and Device Models, Cisco Network Management, Cisco Compute Management, Cisco Security Platforms.

08 Hours

Course Outcomes:

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

- Analyze the Python Programming.
- Apply the concepts Software development patterns and API's using Python Programming.
- Demonstrate different network layers and network interface in Packet Tracer.
- Design the sample applications and the network security of the applications.
- Develop the Infrastructure and Automation of different models and to manage the Cisco

development platforms.

Text Books:

1. Chris Jackson,Jason Gooley, Adrian Iliesiu, Ashutosh Malegankar"**Cisco Certified DevNet Associate**".

E-Resources:

1. https://learningnetwork.cisco.com/s/article/study-material-for-devnet-associate-devasc-200-901-x
2. https://www.ciscolive.com/c/dam/r/ciscolive/emea/docs/2020/pdf/DEVNET-2864.pdf
3. https://cdn.ttgtmedia.com/rms/pdf/9780136677383_DevNet_Ch18.pdf
4. https://www.cisco.com/c/dam/en_us/training-events/le31/le46/cln/marketing/exam-topics/200-901-DEVASC.pdf

Embedded System LAB					
Course Code	**L:T:P**	**Credits**	**ExamMarks**	**Exam Duration**	**CourseType**
20ECL76	1:0:2	2	CIE:50 SEE:50	3 Hours	FC

Course Objectives:

This course will enable students to :

- Understandthe concepts of linux based programming for complex algorithms .
- Illustrate the concepts of real time embedded systems .
- Develop a program for inter process communication.
- Develop a program for locking a Mutex.
- Design and develop the appropriate testing hardware to analyze the programs.

Syllabus

List of Experiments

Programming to be done using Linux based platform.

1. Inter process communication using Message Queues
2. Inter process communication using SHARED MEMORY
3. Inter process communication using PIPES
4. Inter process communication using SEMAPHORES
5. Inter process communication using SIGNALS.
6. client server program using Message queues.
7. Develop an C /Assembly Language Program for locking a Mutex.
8. Develop a SVC handler in C. Use the wrapper code to extract the correct stack frame starting location. The C handler can then use this to extract the stacked PC location and the stacked register values.

Course Outcomes:

On completion of this course, students will able to:

- Understand C program for complex algorithms.
- Apply the concepts of threads handling for real time embedded systems .
- Illustrate the Exception handling concepts.
- Developthe program for locking a Mutex.
- Design the appropriate testing hardware to analyze the programs.

E-Resources:

1. https://www.geeksforgeeks.org/mutex-lock-for-linux-thread-synchronization/
2. https://www3.ntu.edu.sg/home/ehchua/programming/cpp/gcc_make.html

Project Phase-1					
Course Code	**L:T:P**	**Credits**	**ExamMarks**	**Exam Duration**	**CourseType**
20ECP77	0:0:2	1	100	3 Hours	FC

Phase	Activity	Credits
1	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	1

Eighth Semester B.E. – Syllabus

Course	Activity	Credits
Project Phase II	Design, Theoretical/experimental investigation and Midterm seminar to review the progress of the work and documentation (Mid term report).	3
Project Phase III	Completion of the project work, participation in the project exhibition, Submission of project report Final Internal seminar and demonstration, Publications. (Final Evaluation)	4
Project Evaluation	Evaluation and viva voce	4
Technical Seminar	Presentation on a technical topic along with report of the Technical Seminar.	1
Internship	Presentation of work carried out by students along with report of the internship carried out during semester breaks at the industry / institution/ through valued add courses provided by the industry/institution attended for a duration of 4-6 weeks.	3