B.E, V Semester, Electronics & Communication Engineering

Course Title	TECHNICAL MANAGEMENT, ENTREPRENEURSHIP & IPR	Semester	V
Course Code	MVJ20TMEC51	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3Hrs

Course objective is to:

- Study the concepts of management, planning, organizing and staffing.
- Acquire the knowledge required to become an entrepreneur.
- Understand and choose the appropriate institutional support to succeed as an entrepreneur.
- Study the requirements towards the small-scale industries and project preparation.
- Understand the general principles of IPR, Concept and Theories, Criticisms of Intellectual Property Rights.

Module-1	RBT Level L1, L2, L3	8Hrs.

Prerequisites: Basics of management system, roles and responsibilities.

Management: Introduction, Meaning, nature and characteristics of Management, Scope and Functional areas of management, Management as a science, art of profession, Management &Administration ,Roles of Management, Levels of Management, Managerial Skills, Management & Administration, Development of Management Thought early management approaches, Modern management approaches.

Planning: Nature, Importance, Types, Steps and Limitations of Planning, Decision Making: Meaning, Types and Steps in Decision Making

Laboratory session/Experiment:

1. Choose, Conduct & document a survey on the Management structure of an organization.

Applications: IT sectors and Institutional Research sectors.

Video link / Additional online information:

1. https://nptel.ac.in/courses/110/107/110107150/
2. https://nptel.ac.in/courses/110/105/110105146/

Module-2	RBT Level L1, L2, L3	8Hrs.

Organizing and Staffing: Nature and purpose of organization, Principles of organization, Span of Management, Types of organization, Departmentation Committees, Centralization Vs Decentralization of authority and responsibility, Span of control, MBO and MBE (Meaning Only) Nature and importance of staffing: Need and Importance, Recruitment and Selection Process.

Directing and Controlling: Meaning and nature of directing Leadership styles, Motivation Theories, Communication: Meaning and importance, Leadership: Meaning, Characteristics, Behavioral Approach of Leadership; Coordination: Meaning, importance and Techniques of Coordination. Meaning and steps in Controlling, Essentials of a sound control system and Methods of establishing control system.

Laboratory session/Experiment:

1. Document the job responsibilities of a manager level employee of an organization.

Applications: IT sectors, Banking sectors and Institutional Research sectors.

Video link / Additional online information:

1. https://nptel.ac.in/courses/110/107/110107151/

Module-3	RBT Level L3,L4	8Hrs.

Entrepreneur: Meaning of Entrepreneur, Evolution of the Concept, Functions of an Entrepreneur, Types of Entrepreneur, Entrepreneur - an emerging. Classification of Entrepreneurs, Concept of Entrepreneurship, Evolution of Entrepreneurship, Development of Entrepreneurship, Stages in entrepreneurial process, Role of Entrepreneurs in Economic Development, Entrepreneurship in India, Entrepreneurship-its Barriers.

Laboratory session/Experiment:

1. Find, Fill and Document the application forms which are all need to start an enterprise.

Applications: Core Industrial sectors, New Enterprises sectors.

Video link / Additional online information:

1. https://nptel.ac.in/courses/110/106/110106141/

Module-4	RBT Level L3,L4,L5	8Hrs.

Small Scale Industries: Definition, Characteristics, Need and rationale, Objectives, Scope, role of SSI in Economic Development. Advantages of SSI, Steps to start and SSI-Government policy, Different Policies of SSI, Government Support for SSI during 5year plans. Impact of Liberalization, Privatization, Globalization on SSI Effect of WTO/GATT, Sickness in SSI sector, Problems for Small Scale Industries, Supporting Agencies of Government for SSI, Meaning, Nature of support, Objectives, Functions, Types of Help, Ancillary Industry and Tiny Industry.

Laboratory session/Experiment:

1. Find, Fill and Document the application forms which are all need to start a small scale industry.

Applications: Industrial sectors, and Institutional Research sectors.

Video link / Additional online information:

1. https://www.youtube.com/watch?v=2I0XdF_uOuA
2. https://www.youtube.com/watch?v=jmx7SiCzay8

Module-5	RBT Level L1, L2, L3	8Hrs.

Intellectual Property Rights: Introduction to Intellectual Property Rights, Copyrights, Trademarks, Designs and Design Patents, Semiconductor Integrated Circuits and Layout Designs. Ideas and Intellectual Property Rights, Contents of a Patent, Patent Draft, Filing Patent Applications, IPR Strategy and IPR Policy

Laboratory session/Experiment:

1. Conduct a survey on Forms and Fees related to IPR. Document the application forms for the Grant of Patent. https://www.ipindia.gov.in/form-and-fees.htm

Applications: Research works copyrights, Paper Publication and Patent filing.

Video link / Additional online information:

1. https://www.youtube.com/watch?v=RLQivEQUgUc
2. https://www.youtube.com/watch?v=NFTBbfYGM6A

Course outcomes:	
CO1	Explain about the management and planning.
CO2	Apply the knowledge on organizing, staffing, directing and controlling.
CO3	Analyse the concept of Entrepreneurship.
CO4	Choose the requirements towards the small-scale industries and project preparation.
CO5	Understand the Concepts of Intellectual Property Rights

Text Books:	
1.	P.C.Tripathi, P.N.Reddy , "Principles of Management", Tata Mc Graw Hill, 5th edition, 2008.
2.	Poornima M Charantimath, "Entrepreneurship Development Small Business Enterprises", Pearson Education, 2008, ISBN 978-81-7758-260-4.
3.	Rachna Singh Puri & Arvind Viswanathan, "Practical Approach to Intellectual Property Rights", 1/e, I K International Publishing House Pvt. Ltd, 2009.
Reference Books:	
1.	Vasant Desai, "Dynamics of Entrepreneurial Development & Management", Himalaya Publishing House, 6th Edition, 2018.
2.	Stephen P Robbins, "Management", Pearson Education/PHI1, 7thEdition, 2003.
3.	Roberts Lusier Thomson, "Management Fundamentals - Concepts, Application, Skill Development", Fifth Edition, Thomson Publications, 2011.
CIE Assessment:	
CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests - Quizzes/mini tests (4 marks) - Mini Project / Case Studies (8 Marks) - Activities/Experimentations related to courses (8 Marks)	
SEE Assessment:	
i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.	

ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.

iii. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	3	3	-	-	1	-	3	3	2	2	1
CO2	-	3	3	-	-	1	-	3	3	2	2	1
CO3	-	3	3	-	-	1	-	3	3	2	2	1
CO4	-	3	3	-	-	1	-	3	3	2	2	1
CO5	-	3	3	-	-	1	-	3	3	2	2	1

High-3, Medium-2, Low-1

Course Title	ARM MICROCONTROLLER & EMBEDDED SYSTEM	Semester	V
Course Code	MVJ20EC52	CIE	50
Total No. of Contact Hours	50	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 3 : 2 : 0)	Total	100
Credits	4	Exam. Duration	3Hrs

Course objective is to:

- Provide students with the Knowledge of Microprocessors and its memory organization.
- Provide a strong foundation about the principles, programming of Microcontrollers.
- Programming and system design used in industrial and commercial applications.
- Make the students to understand the necessary Hardware components of embedded system.
- Emphasize the necessity of Real time operating system for embedded system Applications.

Module-1	RBT Level L1, L2, L3, L5	10Hrs.

Prerequisites: Basics of Digital Systems and Computer organization

Introduction to Microprocessor: Introduction to 8085 - 8085 Architecture –Signal Description of 8085, Timing Diagrams - Interrupts - Addressing Modes - Instruction Set and Assembly Language Programming of 8085 – Introduction to 8086.

Laboratory Sessions/ Experimental learning:

1. 8085 ALP Programming

Applications: Electronics appliances, Controlling devices, Computers.

Video link / Additional online information:

1. https://nptel.ac.in/courses/108/103/108103157/
2. https://www.youtube.com/watch?v=95uGOJ1Ud2c&list=PLJGA4olwzpArvcdWULcRuMn2495g0n8j

Module-2	RBT Level L1, L2, L3, L6	10Hrs.

Prerequisites: Basics of Microprocessor

Introduction to Microcontrollers: Overview of 8051 Microcontrollers, Architecture, I/O Ports, Memory Organization, Addressing Modes, Instruction Set of 8051 - Timer, Serial I/O, Parallel I/O, and Instruction set – Simple programs.

Laboratory Sessions/ Experimental learning:

1. 8051 ALP Programming

Applications: Security, Traffic control system, Surveillance

Video link / Additional online information:

1. https://nptel.ac.in/courses/117/104/117104072/
2. http://nptel.ac.in/downloads/106108100/

Module-3	RBT Level L1, L2, L3, L5	10Hrs.

Prerequisites: Basics of Microcontroller

Introduction to RISC processors: ARM features applications - ARM microcontrollers architecture – ARM Thumb architecture – ARM pipeline – Registers - Memory organization –Stack – Modes - Exceptions - ARM Cache – Virtual memory- Instruction set of ARM.

Laboratory Sessions/ Experimental learning:

1. ARM programming exercises

Applications: Industrial instrumentation devices, Process control devices.

Video link / Additional online information:

1. https://nptel.ac.in/courses/117/106/117106111/
2. https://nptel.ac.in/courses/106/105/106105193/

Module-4	RBT Level L1, L2, L3, L4	10Hrs.

Embedded System Components: Embedded Vs General computing systems, Classification of Embedded systems, Major application and purpose of ES, Elements of Embedded systems, RISC and CSIC, Sensor, Actuators, Optocouplers, Relay, Communication Interfaces (I2C,SPI,IrDA,Bluetooth,Wi-Fi,Zigbee)

Laboratory Sessions/ Experimental learning:

1. Develop an embedded system using sensors and relay for any real time application.

Applications: Vehicle control systems, Telecommunication, radio and satellite communications, Medical systems, Military, Systems with artificial intelligence and robotics.

Video link / Additional online information :

1. https://www.youtube.com/watch?v=gScYun0wzjA
2. http://www.nptelvideos.in/2012/11/embedded-systems.html
3. https://nptel.ac.in/courses/108/102/108102045/

Module-5	RBT Level L1, L2, L3	10Hrs.

RTOS and IDE for Embedded System Design: Basics of operating systems, Task, process and threads, Thread preemption, Preemptive Task scheduling techniques, Task Communication, Task synchronization issues – Racing and Deadlock, Semaphores, Embedded system Development Environment and debugging techniques.

Laboratory Sessions/ Experimental learning:

1. Develop a prototype for Voice based Speed control system.

Applications: Home appliance such as washing machine, microwave, Multimedia systems, Building control systems, Space operations, etc.,

Video link / Additional online information:

1. https://nptel.ac.in/courses/108/102/108102045/
2. https://nptel.ac.in/courses/106/105/106105193/
3. https://nptel.ac.in/courses/108/105/108105057/

Course outcomes:	
CO1	Acquire the basic knowledge of functionalities of 8085 architectures and Assembly language programming.
CO2	Describe the architecture and functional block of 8051 microcontroller.
CO3	Apply the knowledge gained for Programming ARM cortex M3 for different applications.

CO4	Understand the basic Hardware components of Embedded system and their selection Methods.
CO5	Apply the concepts of real time operating system for embedded system applications.

Text Books:	
1.	Ramesh Gaonkar, "Microprocessor Architecture, Programming and Applications with the 8085" 6/e, 2013.
2.	Kenneth J Ayala, "The 8051 Microcontroller Architecture Programming and Application", 2nd Edition, Penram International Publishers, 1996.
3.	Joseph Yiu, "The Definitive Guide to the ARM Cortex-M3", 2nd Edition, Newnes, (Elsevier), 2010.
4.	Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education Private Limited, 2nd Edition, 2009.
Reference Books:	
1.	Douglas V. Hall: "Microprocessors and Interfacing", Revised 2nd Edition, TMH, 2006.
2.	A.K Ray & K.M. Burchandi, "Advanced Microprocessor and peripherals Architectures, Programming and interfacing", 2nd edition, Tata McGraw-Hill, 2004.

CIE Assessment:
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- Quizzes/mini tests (4 marks)   - Mini Project / Case Studies (8 Marks)   - Activities/Experimentations related to courses (8 Marks)
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CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	1	1	-	-	1	-	2	1
CO2	3	3	3	2	1	1	-	-	1	-	2	1
CO3	3	3	3	2	1	1	-	-	1	-	2	1
CO4	3	3	3	2	1	1	-	-	1	-	2	1
CO5	3	3	3	2	1	1	-	-	1	-	2	1

High-3, Medium-2, Low-1

Course Title	DIGITAL SIGNAL PROCESSING	Semester	V
Course Code	MVJ20EC53	CIE	50
Total No. of Contact Hours	50	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 3 : 2 : 0)	Total	100
Credits	4	Exam. Duration	3Hrs

Course objective is to:

- Understand the frequency domain sampling and reconstruction of discrete time signals.

- Study the properties and the development of efficient algorithms for the computation of DFT.

- Learn the procedures to design IIR filters from the analog filters using impulse invariance and bilinear transformation.

- Study the different windows used in the design of FIR filters and design appropriate filters based on the specifications.

- Learn DSP Processor Architecture and study the real time applications of DSP

Module-1	RBT Level L1, L2, L3, L4, L5	10Hrs.

Prerequisites: DTFT and its properties.

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

Laboratory Sessions/ Experimental learning:

1.DFT computation of square pulse and Sinc function using MATLAB.

Applications: Spectral Analysis of Signals, Frequency Response of Systems, Convolution via the Frequency Domain.

Video link / Additional online information :

1. https://nptel.ac.in/courses/117/105/117105134/

2. https://youtu.be/gpv4h2fcKdA 3. https://youtu.be/BPa2Ysel834		
Module-2	RBT Level L1, L2, L3, L4, L5	10Hrs.

Linear filtering methods based on the DFT: Use of DFT in Linear Filtering, Filtering of Long

Data Sequences, overlap-save and overlap-add method.

Fast-Fourier-Transform (FFT) algorithms: Efficient Computation of the DFT: Radix-2 FFT algorithms for the computation of DFT and IDFT, decimation-in-time and decimation-in-frequency

Algorithms.

Laboratory Sessions/ Experimental learning:

1. Computation of FFT of a given image and to plot magnitude and phase spectrum using MATLAB.

Applications: Frequency domain filtering, video and audio signal processing.

Video link / Additional online information:

1. https://youtu.be/ADnSkJnprBY
2. https://youtu.be/gg2lgResMc0
3. https://youtu.be/3fVu__fCSg0

Module-3	RBT Level L1, L2, L3, L4, L6	10Hrs.

Prerequisites: L- Hospital rule, Sinc function

Design of FIR Filters: Symmetric and Antisymmetric FIR filters, Design of Linear-phase FIR filters using windows - Rectangular, Hamming, Hanning, Bartlett windows. Design of FIR filters using frequency sampling method.

Structure for FIR Systems: Direct form, Cascade form and Lattice structures.

Laboratory Sessions/ Experimental learning:

1. Design and implementation of Low pass FIR filter to meet the desired specifications (using different window techniques) and test the filter with an audio file. Plot the spectrum of audio signal before and after filtering.

Applications: Noise suppression, Enhancement of selected frequency ranges, Removal or attenuation of selected frequencies

Video link / Additional online information:		
1. https://nptel.ac.in/courses/117/102/117102060/ 2. https://nptel.ac.in/courses/108/105/108105055/ 3. https://www.youtube.com/watch?v=nsK7mmRSTDY		

Module-4	RBT Level L1, L2, L3, L4, L6	10Hrs.

Prerequisites: Types of filters

IIR filter design: Characteristics of commonly used analog filter − Butterworth and Chebyshev filters, analog to analog frequency transformations. Design of IIR Filters from analog filter using Butterworth filter: Impulse invariance, Bilinear transformation.

Laboratory Sessions/ Experimental learning:

1. Design and implementation of Low pass IIR filter to meet the desired specifications (using different window techniques) and test the filter with an audio file. Plot the spectrum of audio signal before and after filtering

Applications: Audio equalization, biomedical sensor signal processing, IoT/IIoT smart sensors and high-speed telecommunication/RF applications.

Video link / Additional online information :

1. https://nptel.ac.in/courses/117/102/117102060/
2. https://nptel.ac.in/courses/108/105/108105055/

Module-5	RBT Level L1, L2, L3	10Hrs.

Prerequisites: Binary number system, basics of computer architecture

Digital Signal Processors: DSP Architecture, DSP Hardware Units, Fixed point format, Floating point Format, IEEE Floating point formats, FIR and IIR filter implementations in Fixed point systems. **Application of DSP to real systems**: Voice Processing, Music processing, Image processing and Radar processing.

Laboratory Sessions/ Experimental learning:

1. Generation of sinusoid and Plotting with CCS (TMS320C6713)

Applications: Audio, Military, Video & Imaging, Wireless

Video link / Additional online information:

1. https://www.youtube.com/watch?v=I-ltsu9S_uA
2. https://www.youtube.com/watch?v=SKuywStjBLY

Course outcomes:	
CO1	Compute DFT of real and complex discrete time signals
CO2	Analyse the computational complexity of DFT and FFT algorithms
CO3	Solve problems on FIR filter design and realize using digital computations.
CO4	Design and realize IIR digital filters
CO5	Illustrate the DSP processor architecture and to apply knowledge to various real time cases.

Text Books:	
1.	Proakis & Monalakis, "Digital signal processing – Principles Algorithms & Applications", 4th Edition, Pearson education, New Delhi, 2007. ISBN: 81-317-1000-9.
2.	Dr.D.Ganesh Rao, "Digital Signal Processing", Pearson Education, 2nd edition, 2011.
Reference Books:	
1.	Li Tan, Jean Jiang, "Digital Signal processing – Fundamentals and Applications", Academic Press, 2nd Edition, 2013, ISBN: 978-0-12-415893.
2.	S. Salivahanan, C. Gnanpriya, "Digital Signal processing", McGraw Hill, 2nd edition, 2009.

CIE Assessment:

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   - Quizzes/mini tests (4 marks)
   - Mini Project / Case Studies (8 Marks)
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CO3	3	3	3	2	2	1	-	-	1	-	-	1
CO4	3	3	3	2	2	1	-	-	1	-	-	1
CO5	3	3	3	2	2	1	-	-	1	-	-	1

High-3, Medium-2, Low-1

Course Title	COMMUNICATION SYSTEMS	Semester	V
Course Code	MVJ20EC54	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3Hrs

Course objective is to:

- Understand the concepts of Analog Modulation schemes viz; AM, FM.
- Interpret the different types of noise in communication system.
- Learn the concepts of digitization of signals viz; sampling, quantizing and encoding.
- Analyze the Base Band data transmission system.
- Realize the basic concepts of coherent and Non-coherent digital modulation techniques and understand the basics of spread spectrum modulation.

Module-1	RBT Level L1, L2, L3	8Hrs.

Prerequisites: Modulation, Need for Modulation and types of Modulation.

Amplitude Modulation: Introduction to AM, Time-Domain description, Frequency-Domain description, Generation of AM wave: Switching modulator, Detection of AM waves: Envelop detector. **Double side band suppressed carrier modulation (DSBSC):** Time-Domain description, Frequency-Domain representation, Generation of DSBSC waves: Ring modulator. Coherent detection of DSBSC modulated waves. Costas loop.

Single Side-Band Modulation (SSB): Single side-band modulation, Time-Domain description, Frequency-Domain description of SSB wave, Phase discrimination method for generating an SSB modulated wave.

Vestigial Side-Band Modulation (VSB): Time - Domain description, Frequency – Domain description, Generation of VSB modulated wave, Applications: Radio broadcasting, AM radio.

Laboratory Sessions/ Experimental learning:

1. Generation of AM signal using MATLAB

2. Generation of DSBSC signal using transistor

Applications: Broadcast transmissions, Air band radio, Quadrature amplitude modulation

Video link / Additional online information :
1. https://nptel.ac.in/courses/117/105/117105143/
2. https://youtu.be/00ZbuhPruJw
3. https://youtu.be/rt08yTGv_z4
4. https://youtu.be/S8Jod9AtpN4
5. https://youtu.be/SxSPdjwXDQk

Module-2	RBT Level L1, L2, L3	8Hrs.

Frequency Modulation: Basic definitions, FM, narrow band FM, wide band FM, transmission bandwidth of FM waves, and generation of FM waves: indirect FM and direct FM.

Demodulation of FM waves: Phase-locked loop, Nonlinear model of the phase – locked loop, Linear model of the phase – locked loop, Nonlinear effects in FM systems.

Phase Modulation: Analog phase modulation, Digital phase modulation.

Noise: Introduction, Types of noise, Noise Figure, Equivalent noise temperature, Noise in AM receivers, Noise in FM receivers, Pre-emphasis and De-emphasis in FM.

Laboratory Sessions/ Experimental learning:
1. Generation of FM signal using MATLAB
2. Design of mixer

Applications: FM radio broadcasting, telemetry, radar, seismic prospecting, and monitoring new-borns for seizures via EEG, two-way radio systems, sound synthesis, magnetic tape-recording systems and some video-transmission systems.

Video link / Additional online information :
1. https://nptel.ac.in/courses/117/105/117105143/
2. https://youtu.be/gsUaHawPy-w
3. https://youtu.be/jqJpbPseX2c
4. https://youtu.be/PmuZnJfheK4
5. https://youtu.be/QEubAxBfqKU

Module-3	RBT Level L1, L2, L3	8Hrs.

Digital Communication: Introduction to Digital Communication, Sampling theory, Practical aspects of sampling and signal recovery, PAM, Quantization.

Waveform Coding techniques: PCM – Sampling, Quantization, Encoding, Regeneration. DPCM, Delta Modulation (DM), Adaptive Delta Modulation, Line codes.

Laboratory Sessions/ Experimental learning:

1. Delta modulation using Matlab

Applications: Speech recognition systems, pattern recognition systems, digital audio in computers, CDs, digital telephony, telephone and radio communications, television systems.

Video link / Additional online information :

1. https://nptel.ac.in/courses/117/105/117105077/
2. https://nptel.ac.in/courses/117/101/117101051/
3. https://youtu.be/s6vlXP3mYXk
4. https://youtu.be/HlGJ6xxbz8s

Module-4	RBT Level L1, L2, L3, L4	8Hrs.

Intersymbol Interference & Signal Space representation: Base band transmission: Discrete PAM Signals, Power spectra of Discrete PAM Signals, Inter Symbol Interference, Nyquist criterion for Distortion less Base band Binary Transmission, Eye diagram, Geometric representation of signals, Gram-Schmidt Orthogonalization procedure, Optimum receivers for coherent detection: Correlation Receivers and Matched Filter receiver.

Laboratory Sessions/ Experimental learning:

1. Eye diagram using Matlab

Applications: Ethernet, RFID marker localization signals, Radar Systems

Video link / Additional online information:

1. https://nptel.ac.in/courses/117/105/117105077/
2. https://nptel.ac.in/courses/117/101/117101051/

Module-5	RBT Level L1, L2, L3, L4	8Hrs.

Prerequisites: Probability & Random Process

Pass band transmission: Digital modulation techniques: Phase shift Keying techniques using Coherent detection: Generation, Detection and Error probabilities of BPSK and QPSK, M–ary PSK, M–ary QAM,Frequency shift keying techniques using Coherent detection: BFSK generation, detection and error probability.

Non-coherent orthogonal modulation techniques: BFSK, DPSK Symbol representation, Block diagrams of Transmitter and Receiver, Probability of error (without derivation of probability of error equation)

Principles of Spread Spectrum Communication Systems: Model of a Spread Spectrum Digital Communication System, Direct Sequence Spread Spectrum Systems (DSSS), Some applications of DS Spread Spectrum Signals, Generation of PN Sequences, Frequency Hopped Spread Spectrum (FHSS).

Laboratory Sessions/ Experimental learning:

1. Analyse constellation of 16-QAM Using MATLAB

Applications: CDMA, WiMAX (16d, 16e), telemetry, caller ID, garage door openers, wireless communication, mobile communication and Satellite Communication, LANs, Bluetooth, RFID, GPS, Wi-Fi, etc.,

Video link / Additional online information :

1. https://nptel.ac.in/courses/117/105/117105077/
2. https://nptel.ac.in/courses/117/101/117101051/
3. https://nptel.ac.in/courses/117/105/117105136/
4. https://youtu.be/Ojmv3I4kDn4

Course outcomes:	
CO1	Examine the concepts of analog modulation techniques such as amplitude, frequency and phase modulation.
CO2	Analyze and compute performance of AM and FM receivers in the presence of noise.

CO3	Apply the concepts of sampling, quantization and encoding for digitization of signals.
CO4	Evaluate the performance of a baseband and pass band digital communication system in terms of error rate and spectral efficiency.
CO5	Analyze the digital communication system with spread spectrum modulation.

Text Books:	
1.	Simon Haykins, "Communication Systems", 3rd Edition, John Willey, 1996.
2.	Simon Haykin, "Digital Communication Systems", John Wiley & sons, 1st Edition, 2014, ISBN 978-0-471-64735-5.
Reference Books:	
1.	Simon Haykins, "An Introduction to Analog and Digital Communication", John Wiley, 2003.
2.	John G Proakis and Masoud Salehi, "Fundamentals of Communication Systems", 2014 Edition, Pearson Education, ISBN 978-8-131-70573-5.

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CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	1	1	-	-	-	-	-	1
CO2	3	3	3	2	1	1	-	-	-	-	-	1
CO3	3	3	3	2	1	1	-	-	-	-	-	1
CO4	3	3	3	2	1	1	-	-	-	-	-	1
CO5	3	3	3	2	1	1	-	-	-	-	-	1

High-3, Medium-2, Low-1

Course Title	INFORMATION THEORY & CODING	Semester	V
Course Code	MVJ20EC551	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3Hrs

Course objective is to:

• Understand the concept of Entropy, Rate of information and order of the source with reference to dependent and independent source.

• Study various source encoding algorithms.

• Model discrete & continuous communication channels.

• Study various error control coding algorithms.

• Emphasize encoding and error correction circuits for different coding algorithms

Module-1	RBT Level L1, L2, L3	8Hrs.

Prerequisites: Probability theory, Encoder, and decoder concept

Information Theory: Introduction, Measure of information, Information content of message, average information content of symbols in long independent sequences, average Information content of symbols in long dependent sequences, Markov Statistical Model of Information Sources, Entropy, and Information rate of Markoff Sources.

Laboratory session/Experiment:

1. Design a markoff model for calculating the steady state probabilities

Applications: Board games played with dice, Predicting the weather, Stock market.

Video link / Additional online information:

1. https://nptel.ac.in/courses/117/104/117104129/

	RBT Level	
2. https://nptel.ac.in/courses/108/102/108102117/		
3. https://nptel.ac.in/courses/117/101/117101053/		

Module-2	RBT Level L1, L2, L3	8Hrs.

Source Coding: Source coding theorem, Prefix Codes, Kraft McMillan Inequality property – KMI Encoding of the Source Output, Shannon's Encoding Algorithm, Shannon Fanon Encoding Algorithm, Huffman codes, Extended Huffman coding, Arithmetic Coding, Lempel – Ziv Algorithm.

Laboratory session/Experiment:

1.   Design a digital image compression and encoding using LZW algorithm

Application: Lossless compression

Video link / Additional online information:

1.   https://www.youtube.com/watch?v=aTHVz5pECog
2.   https://www.youtube.com/watch?v=yHw1ka-4g0s&t=358s
3.   https://nptel.ac.in/courses/117/104/117104129/

Module-3	RBT Level L1, L2, L3	8Hrs.

Information Channels: Communication Channels, Channel Models, Channel Matrix, Joint probability Matrix, Binary Symmetric Channel, System Entropies, Mutual Information, Channel Capacity, Channel Capacity of: Binary Symmetric Channel, Binary Erasure Channel, Muroga's Theorem, Continuous Channels, Fano's Inequality and the Converse to the Coding Theorem.

Laboratory session/Experiment:
1.   Compare the channel capacities of different channels
Applications: To model data networks, where packets either arrive correctly or are lost due to buffer overflows or excessive delays.
Video link / Additional online information:

1.   https://nptel.ac.in/courses/117/104/117104129/
2.   https://nptel.ac.in/courses/108/102/108102117/

3.	https://nptel.ac.in/courses/117/101/117101053/		
Module-4	RBT Level L1, L2, L3, L4		8Hrs.

Error Control Coding: Introduction, examples of Error control coding, methods of controlling Errors, Types of Errors, types of Codes, **Linear Block Codes**: matrix description of Linear Block Codes, Error Detection and Error Correction Capabilities of Linear Block Codes, Single Error Correcting Hamming Codes

Binary Cyclic Codes: Algebraic Structure of Cyclic Codes, Encoding using an (n-k) Bit Shift register, Syndrome Calculation, Error Detection and Correction.

Laboratory session/Experiment:

1.   Design encoding circuit for(6,3)linear code

Applications: Binary cyclic codes in stegnography

Video link / Additional online information:

1.   https://nptel.ac.in/courses/117/104/117104129/
2.   https://nptel.ac.in/courses/108/102/108102117/
3.   https://nptel.ac.in/courses/117/101/117101053/

Module-5	RBT Level L1, L2, L3, L4, L5		8Hrs.

Some Important Cyclic Codes: Golay Codes, BCH Codes, Reed-Solomon Codes.

Convolution Codes: Convolution Encoder, Time domain approach, Transform domain approach, Code Tree, Trellis and State Diagram, The Viterbi Algorithm.

Introduction to Cryptography: Symmetric key and Asymmetric key cryptography.

Laboratory session/Experiment:

1.   Write a MATLAB code for Reed-Solomon code

Applications: Satellite communications, Compact disc players, DVDs, disk drives, solid-state drives, quantum-resistant cryptography and two-dimensional bar codes.

Video link / Additional online information:

1.   https://nptel.ac.in/courses/117/104/117104129/
2.   https://nptel.ac.in/courses/108/102/108102117/

3. https://nptel.ac.in/courses/117/101/117101053/

Course outcomes:	
CO1	Acquire the knowledge of dependent & independent Source, measure of information, Entropy, Rate of Information and Order of a source
CO2	Represent the information using Shannon Encoding, Shannon Fano, Prefix and Huffman Encoding Algorithms
CO3	Model the continuous and discrete communication channels using input, output and joint probabilities
CO4	Determine a codeword comprising of the check bits computed using Linear Block codes, cyclic codes & convolutional codes
CO5	Design the encoding and decoding circuits for Linear Block codes, cyclic codes, convolutional codes, BCH and Golay codes.
Text Books:	
1.	K. Sam Shanmugam, "Digital and analog communication systems", John Wiley India Pvt. Ltd, 1996.
2.	K Giridhar, "Information Theory And Coding", 4th Edition, Pooja Publication, Bangalore, 2001.
3.	Simon Haykin, "Digital communication", John Wiley India Pvt. Ltd, Third Edition, 2010.
Reference Books:	
1.	Muralidhar Kulkarni, K.S. Shivaprakasha, "Information Theory and Coding", Wiley India Pvt. Ltd, 2015, ISBN:978-81-265-5305-1.
2.	Ranjan Bose, "ITC and Cryptography", TMH, II edition, 2007
3.	J. Das, S. K. Mullick, P. K. Chatterjee, "Principles of digital communication", Wiley, Second edition 1986 - Technology & Engineering.
4.	Bernard Sklar, "Digital Communications – Fundamentals and Applications", Second Edition, Pearson Education, 2016, ISBN: 9780134724058.
5.	K.N.Haribhat, D.Ganesh Rao, "Information Theory and Coding", Cengage Learning, Second Edition, 2017.

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CO3	3	3	3	2	-	1	-	-	1	-	2	2
CO4	3	3	3	2	-	1	-	-	1	-	2	2
CO5	3	3	3	2	-	1	-	-	1	-	2	2

High-3, Medium-2, Low-1

Course Title	OPERATING SYSTEM	Semester	V
Course Code	MVJ20EC552	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3Hrs

Course objective is to:

• Understand the services provided by an operating system.

• Learn how processes are synchronized and scheduled.

• Identify different approaches of memory management and virtual memory management.

• Study the structure and organization of the file system

• Understand interprocess communication and deadlock situations.

Module-1	RBT Level L1, L2	8Hrs.

Prerequisites: Computer Organization and Architecture

Introduction to Operating Systems: OS, Goals of an OS, Operation of an OS, Program's, Resource allocation techniques, Efficiency, System Performance and User Convenience, Classes of operating System, Batch processing, Multi programming, Time Sharing Systems, Real Time , distributed and modern Operating Systems.

Laboratory Sessions/ Experimental learning:

1. Case study: Basics of LINUX OS.

Applications:

• Controls the backing store and peripherals such as scanners and printers.

• Maintains security and access rights of users.

• Spooling (Simultaneous Peripheral Operation on Line)

Video link / Additional online information :

1. https://nptel.ac.in/courses/106/105/106105214/
2. https://www.youtube.com/watch?v=qJ_bXhrUOkc&t=12s
3. https://www.youtube.com/watch?v=29JPq5JuKj8

Module-2	RBT Level L1, L2	8Hrs.

Process Management: OS View of Processes, PCB, Process States and Transitions, Threads, Kernel and User level Threads, Non-preemptive scheduling- FCFS and SRN, Preemptive Scheduling- RR and LCN, Long term, medium term and short term scheduling in a time sharing system.

Laboratory Sessions/ Experimental learning:

1.   Case study on Processes and threads in Linux/ Windows/ UNIX Scheduling Algorithms

Applications:

•   Organizes the use of memory between programs.

•   Organizes processing time between programs and users.

•   Install Operating Systems - Ubuntu Linux.

Video link / Additional online information:

1.   https://www.youtube.com/watch?v=Lf3xYcIzgeQ

2.   https://www.youtube.com/watch?v=s1KsWNqezbY

3.   https://www.youtube.com/watch?v=Q6rniXYg1UM

Module-3	RBT Level L1, L2, L3	8Hrs.

Memory Management: Static and Dynamic memory allocation, Contiguous Memory allocation, Non-Contiguous Memory Allocation, Paging, Segmentation, Segmentation with paging, Virtual Memory Management, Demand Paging, Paging Hardware, VM handler, Page replacement policies - FIFO, LRU.

Laboratory Sessions/ Experimental learning:

1.   Case Study on Linux/ UNIX Memory Management.

Applications:

•   Memory Management deals with the transfer of programs in and out of memory.

•   Dynamically allocate portions of memory to programs at their request, and free it for reuse when no longer needed.

Video link / Additional online information:

1.   https://www.youtube.com/watch?v=MLbdsuxYAF4

2.   https://www.youtube.com/watch?v=WqnwrWODLKs

3.	https://www.youtube.com/watch?v=EbnaTJIf0ZE

Module-4	RBT Level L1, L2, L3, L4	8Hrs.

File Systems: File systems and IOCS, Files and File Operations, Fundamental File Organizations, Directory structures, File Protection, Interface between File system and IOCS, Allocation of diskspace, Implementing file access, and File sharing schematics.

Laboratory Sessions/ Experimental learning:

1.   Case Study on UNIX/ Windows/ Linux File System.

Applications:

•   Understand file handling operations (read, write, and append).

•   Basic understanding of how pointers are used

Video link / Additional online information :

1. https://www.youtube.com/watch?v=Fjz3PKJGe5s
2. https://www.youtube.com/watch?v=E3PshX16WEY

Module-5	RBT Level L1, L2,L3	8Hrs.

Message Passing and Deadlocks: Overview of Message Passing, Implementing message passing, Mailboxes, Deadlocks, Deadlocks in resource allocation, Handling Deadlocks, Deadlock detection algorithm, Deadlock Prevention, Deadlock avoidance-Bankers algorithm.

Laboratory Sessions/ Experimental learning:

1.   Simulate Bankers Algorithm for Dead Lock Avoidance.

Applications: Email management

Video link / Additional online information:

1. https://www.youtube.com/watch?v=rCHnS-ZX7PE
2. https://www.youtube.com/watch?v=vOfKOg0rFg4
3. https://www.youtube.com/watch?v=eJBoT0LbK2k

Course outcomes:	
CO1	Summarize the goals, structure, operation and types of operating systems.
CO2	Apply scheduling techniques to find performance factors.

CO3	Apply suitable techniques for contiguous and non-contiguous memory allocation.
CO4	Interpret the organization of file systems and IOCS.
CO5	Describe message passing, deadlock detection and prevention methods.

Text Books:	
1.	Dhamdare, "Operating Systems – A concept based approach", by TMH, 2nd edition, 2009.
2.	Silberschatz and Galvin, "Operating systems concepts", John Wiley India Pvt. Ltd,5th edition, 2001.
Reference Books:	
1.	William Stalling, "Operating system–internals and design system", Pearson Education, 4th ed, 2006.
2.	Tannanbhaum, "Design of operating systems", TMH, 2001.

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CO4	3	3	2	2	2	1	-	-	1	-	-	1
CO5	3	3	2	2	2	1	-	-	1	-	-	1

High-3, Medium-2, Low-1

Course Title	OOPS USING C++	Semester	V
Course Code	MVJ20EC553	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3Hrs

Course objective is to:

- Gain the basic knowledge on Object Oriented concepts.
- Study the operation of objects and classes and ability to develop applications using Object Oriented Programming Concepts.
- Analyse the problem statement and build programs using Inheritance in object oriented programming to solve real world problems.
- Study and implementation of C++ Constructors, Destructors and Polymorphism
- Analyse and implementation of exception handling and advance topics including templates, exceptions and Standard Template Library

Module-1	RBT Level L1, L2, L3, L6	8Hrs.

Prerequisites: knowledge of C programming

Introduction to Object Oriented Programming using C++: Traditional Versus Object Orientation Approach, Benefits and applications of OOPS, Characteristics of Object Oriented Programming Languages, Getting started with C++ syntax, data-type, variables, strings, functions, default values in functions, recursion, namespaces, operators, arrays and pointers, expressions, operator overloading and control structures in C++.

Laboratory Sessions/ Experimental learning:

1.   Develop a program to design a Calculator

2.   Develop a C++ program to find all roots of a quadratic equation ax2+bx+c=0.

Applications: Calculator Programming

Video link / Additional online information :

1.   https://nptel.ac.in/courses/106/105/106105151/

Module-2	RBT Level L1, L2, L3, L6	8Hrs.

Prerequisites: Expressions, Control structures, Functions in C

Program structure C++ Functions: Simple functions, Arguments passed by value and by reference Access specifiers : Private Public and Protected members , Specifying a class, C++ program with a class, Basics of object and class in C++, Programs on class and Object, Overloading of functions, Constructor Overloading-Inline functions, Friend function.

Laboratory Sessions/ Experimental learning:

1. Build a C++ Program to implement a sphere class with appropriate members and member function to find the surface area and the volume. (Surface = $4 \pi r2$ and Volume = $4/ 3 \pi r3$)

2. Develop a C++ program to implement Bank-SB-Account Class with member functions to deposit, withdraw and show the balance. assume appropriate data members

Applications: Universities and Academic Institutions, Railway booking

Video link / Additional online information:

1. https://www.digimat.in/nptel/courses/video/106101208/L01.html

2. https://www.youtube.com/playlist?list=PL0gIV7t6l2iIsR55zsSgeiOw9Bd_IUTbY

Module-3	RBT Level L1, L2, L3,L6	8Hrs.

Prerequisites: Knowledge of Classes and objects

Polymorphism: Static and Dynamic Binding , Operator Overloading, Overloading Unary Operators, Overloading Binary Operators, Constructors and their types, Destructor , Concept of Inheritance, Types of Inheritance: Single, Multiple, Multilevel, Hierarchical, Hybrid, Virtual Functions: Normal Member Functions Accessed with Pointers.

Laboratory Sessions/ Experimental learning:

1. Implement a program to enter salary and output income tax and net salary using multiple inheritance concept

2. Implement a program of maintaining banking account information system using multiple inheritance in C++ Programming. Here class savings derived from class account and class user. Use appropriate functions and variables

Applications: Banking software

Video link / Additional online information:

| | 1. | https://www.classcentral.com/course/swayam-programming-in-c-6704 |
| | 2. | http://www.infocobuild.com/education/audio-video-courses/computer-science/programming-in-cpp-iit-kharagpur.html |

Module-4	RBT Level L1, L2, L3, L6	8Hrs.

Prerequisites: Knowledge of Constructor and Destructors

Pointers, Streams & Working with Files: Virtual Member Functions Accessed with Pointers, Abstract Classes and Pure Virtual Functions, Virtual Destructors, Virtual Base Classes, THIS Pointer. C++Type casting streams and stream classes, formatted and unformatted I/O operations, Output with manipulators, Classes for file stream operations.

Laboratory Sessions/ Experimental learning:

1.   Implement a C++ program to implement flight class with data member as flight no., source, destination and fare. Write a member function to display the flight information using this pointer

Applications: Games, Advanced Computations and Graphics, Flight bookings

Video link / Additional online information :

1.   https://nptel.ac.in/courses/106/104/106104128/

2.   https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs17/

Module-5	RBT Level L1, L2, L3, L6	8Hrs.

Prerequisites: Knowledge of strings and its use

Exception handling: Try, throw, and catch, exceptions and derived classes, function exception declaration, unexpected exceptions, exception when handling exceptions. Template: template classes, template functions. Standard Template Library, Fundamental idea about string, iterators, hashes, iostreams and other types.

Laboratory Sessions/ Experimental learning:

1.   List out the real time applications of Exception Handling.

2.   Create two classes Employee and Department. Make Department class, a friend class of Employee class. In order to access the private and protected members of Employee class into Department class explicitly pass an object of Department class to the member functions of Employee class. Display the net salary of employee using proper formatting.

Applications: Database Connectivity exception handling, Web form for users using exception handling
Video link / Additional online information:
1.   https://nptel.ac.in/courses/106/106/106106127/

Course outcomes:	
CO1	Summarize the basics of object oriented programming concepts
CO2	Illustrate the concepts of polymorphism in programs using overloading methods
CO3	Apply the Inheritance and ability to implement features of object oriented programming to solve real world problems by reducing the length of the code.
CO4	Utilize the concepts of Polymorphism by using virtual function and abstract class in programs
CO5	Apply the basics of exception handling and templates, exceptions and Standard Template Library

Text Books:	
1.	Robert Lafore, "Object -Oriented Programming in C++", Sams Publication, 4th edition, 2002.
2.	E. Balagurusamy, "Object Oriented Programming with C++", 5th edition, Tata McGraw Education Hill , 2011.
Reference Books:	
1.	Ashok N. Kamthane, "Object oriented Programming with ANSI & Turbo C++", First Edition, Pearson India,2003.
2.	Reema Thareja ,"OOP WITH C++" , REVISED 1ST ED ,Paperback – 1, January 2018
3.	D Ravichandran, "Programming with C++", Second edition, Tata McGraw- Hill, 2003.
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CO5	3	3	3	2	2	2	-	-	1	-	-	1

High-3, Medium-2, Low-1

Course Title	FUZZY LOGIC SYSTEMS AND NEURAL NETWORKS	Semester	V
Course Code	MVJ20EC554	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3Hrs

Course objectives is to:

• Make the students to understand about the concept of fuzzy set theory and fuzzy systems.

• Analyse the fuzzy system-based rules and fuzzy logic decision making.

• Understand the basics of Neural Networks and its architecture.

• Know about the single and multilayer feed forward networks.

• Provide the adequate knowledge about the Associative memory.

Module-1	RBT Level L1, L2, L3	8Hrs.

Fuzzy Set Theory: Fuzzy versus Crisp, Crisp sets, Fuzzy Sets, Crisp Relations, Fuzzy Relations.

Fuzzy Systems: Crisp Logic, Predicate Logic, Fuzzy Logic, Fuzzy Quantifiers, Fuzzy Interference, Fuzzy rule-based system, Defuzzification methods, Applications.

Laboratory Sessions/ Experimental learning:

1. Implementation of Fuzzy operations.

2. Implementation of Fuzzy relations.

Applications: Facial Pattern recognition, air conditioners, washing machines, vacuum cleaners, antiskid breaking systems.

Video link / Additional online information:

1. https://nptel.ac.in/courses/108/104/108104157/

Module-2	RBT Level L1, L2, L3	8Hrs.

Fuzzy Rule- Based Systems: Natural Language, Linguistic Hedges, Rule-Based Systems, Canonical Rule Forms, Decomposition of Compound Rules, Likelihood and Truth Qualification, Aggregation of Fuzzy Rules, Graphical Techniques of Inference.

Fuzzy Decision Making : Fuzzy Synthetic Evaluation, Fuzzy Ordering, Preference and consensus, Multi-objective Decision Making, Fuzzy Bayesian Decision Method, Decision Making under Fuzzy States and Fuzzy Actions.

Laboratory Sessions/ Experimental learning:

1. Development of fuzzy membership functions and Fuzzy set properties
2. Implementation of Air Conditioning system using Fuzzy Logic Algorithm.
3. Implementation of Facial Pattern Recognition using Fuzzy Logic Algorithm.

Applications: Facial Pattern recognition, air conditioners, washing machines, vacuum cleaners, antiskid breaking systems.

Video link / Additional online information:

1. https://www.digimat.in/nptel/courses/video/117105084/L01.html
2. https://www.digimat.in/nptel/courses/video/127105006/L01.html

Module-3	RBT Level L1, L2, L3	8Hrs.

Prerequisites: Fundamentals of computing, Analysation, Mathematical calculations.

Introduction to Neural Networks: Basic concepts of Neural networks, Human Brain, Model of an Artificial Neuron, Artificial Neural network architectures, Characteristics of Artificial Neural Networks, Learning methods, Taxonomy of Neural Network Architectures, Early Neural Network Architectures, Rosenblatt's perceptron, ADALINE and MADALINE networks.

Laboratory Sessions/ Experimental learning:

1. Implementation of Simple Neural Network in pattern recognition/matching.

Applications: Speech recognition, character recognition, human face recognition

Video link / Additional online information:

1. https://nptel.ac.in/courses/117/105/117105084/

Module-4	RBT Level L1, L2, L3	8Hrs.

Back Propagation Networks: Architecture: The perceptron model, the solution, Single Layer Artificial Neural Network, Model of multilayer Perceptron. **Back propagation Learning:** Input layer, Hidden layer, Output layer Computations, Error calculation, Training of neural network, Steepest Descent, Effect of learning rate, Adding of Momentum term, Back propagation algorithm.

Laboratory Sessions/ Experimental learning:

1. Implementation of Perceptron Learning Algorithm for AND gate

2. Application of Back Propagation technique in financial data.

Applications: Voice Recognition, Financial forecasting

Video link / Additional online information:

1. https://nptel.ac.in/courses/106/106/106106184/

2. https://nptel.ac.in/courses/108/108/108108148/

Module-5	RBT Level L1, L2, L3	8Hrs.

Associative Memory: Auto correlators, Hetero correlators, Wang et al's Multiple Encoding Strategy, Exponential BAM (Bidirectional Associative Memory), Associative memory for Real coded pattern pairs, Applications.

Laboratory Sessions/ Experimental learning:

1. Development of auto associative network using outer product rule

Applications: Used for parallel searches, speedup databases, page tables used by virtual memory in neural networks

Video link / Additional online information:

1. http://www.nptelvideos.in/2012/12/neural-networks-and-applications.html

2. https://nptel.ac.in/courses/117/105/117105084/

Course outcomes:	
CO1	Acquire the comprehensive knowledge of fuzzy set theory and fuzzy logic systems.
CO2	Apply the concepts of Fuzzy rule-based system and fuzzy decision making in real time applications.
CO3	Analyze the organization of the Brain, Biological and Artificial Neuron Models.

CO4	Design Perceptron Model, Single layer Artificial Neural Network, Back propagation network architecture, Model for Multilayer Perceptron.
CO5	Illustrate the concepts of associative memory in neural networks.

Text Books:	
1.	Rajasekharan and Rai, "Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications" by – PHI Publication.
2.	Timothy. J. Ross, "Fuzzy logic with engineering applications", McGraw Hill International Edition, 1997.
Reference Books:	
1.	James A Freeman and Davis Skapura, "Neural Networks", Pearson Education, 2002.
2.	Simon Hakins, "Neural Networks", Pearson Education, 3rd Edition, 2009.
3.	John Yen, Rena Langari, "Fuzzy Logic, Intelligence, Control, and Information", Pearson Education, 2005.

CIE Assessment:
CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests   - Quizzes/mini tests (4 marks)   - Mini Project / Case Studies (8 Marks)   - Activities/Experimentations related to courses (8 Marks)
SEE Assessment:
i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus. ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions. iii. One question must be set from each unit. The duration of examination is 3 hours.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	1	1	1	-	-	1	-	-	1
CO2	3	3	3	1	1	1	-	-	1	-	-	1
CO3	3	3	3	1	1	1	-	-	1	-	-	1
CO4	3	3	3	1	1	1	-	-	1	-	-	1
CO5	3	3	3	1	1	1	-	-	1	-	-	1

CO-PO Mapping

High-3, Medium-2, Low-1

Course Title	EMBEDDED CONTROLLER LAB	Semester	V
Course Code	MVJ20ECL56	CIE	50
Total No. of Contact Hours	30	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 0: 2 : 2)	Total	100
Credits	2	Exam. Duration	3Hrs

Course objective is to:

- Make the students to understand the basics of microcontroller and its applications.
- Provide in depth-knowledge of 8051 Assembly language programming.
- Familiarize with Keil u Vision tool/compiler required for microcontroller programming.
- Develop C language programs and library functions for embedded system application.
- Learn Interfacing of external devices and I/O with ARM cortex M3.

Laboratory Sessions

Sl No	Experiment Name	RBT Level	Hours
Programming using 8051			
1	Data transfer, Sorting, Finding largest element in an array	L3	3
2	Arithmetic Instructions-Addition/subtraction, multiplication and division, square (16 bits Arithmetic operations-bit addressable).	L3	3
3	Generate Fibonacci series.	L4	3
4	Code conversion: BCD-ASCII, ASCII-Decimal, Decimal-ASCII.	L3	3
5	Programs to generate delay, Programs using serial port and on-Chip timer/counter.	L3	3
Interfacing using ARM Cortex M3			
6	Demonstrate the use of external interrupt to toggle an LED On/Off.	L3	2
7	Interface a simple switch and display its status through Relay, Buzzer and LED.	L5	3

8	Interface a 4x4 keyboard and display the key code on an LCD.	L4	2
9	Interface a stepper motor and rotate it in clockwise and anti-clockwise direction.	L5	3
10	Interface a DAC and generate Triangular and Square waveforms.	L3	2
11	Interface and control DC Motor.	L3	3

Course outcomes:	
CO1	Enhance programming skills using Assembly language and C
CO2	Apply the knowledge gained from programming 8051 for different applications.
CO3	Interface and control external I/O devices with ARM cortex M3
CO4	Analyze the functions of various peripherals, peripheral registers of ARM cortex M3
CO5	Develop applications based on ARM cortex M3 Microcontrollers

Scheme of Evaluation	
Regular Lab work and Writing Lab records	(20+15) = 35 marks
Lab test and Viva-voce at the end of the semester	(10+5) = 15 marks
Total	50 marks

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	2	-	-	2	-	-	1
CO2	3	3	3	2	2	2	-	-	2	-	-	1
CO3	3	3	3	2	2	2	-	-	2	-	-	1
CO4	3	3	3	2	2	2	-	-	2	-	-	1
CO5	3	3	3	2	2	2	-	-	2	-	-	1

High-3, Medium-2, Low-1

Course Title	DIGITAL SIGNAL PROCESSING LAB	Semester	V
Course Code	MVJ20ECL57	CIE	50
Total No. of Contact Hours	30	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 0 : 2 : 2)	Total	100
Credits	2	Exam. Duration	3Hrs

Course objective is to:

● Simulate discrete time signals and verification of sampling theorem

● Compute the DFT for a discrete signal and verification of its properties using MATLAB.

● Demonstrate convolution and correlation along with the verification of properties

● Compute and display the filtering operations and compare with the theoretical values

● Implement the DSP computations on DSP hardware and verify the result.

Laboratory Sessions			
Sl No	Experiment Name	RBT Level	Hours
Programming using Matlab			
1	Verification of sampling theorem.	L3	3
2	Linear and circular convolution of two given sequences, Commutative, distributive and associative property of convolution.	L3	3
3	Auto and cross correlation of two sequences and verification of their properties Solving a given difference equation.	L3	3
4	Computation of N point DFT of a given sequence and to plot magnitude and phase spectrum (using DFT equation and verify it by built-in routine).	L3	3
5	Verification of DFT properties (like Linearity and Parseval's theorem, etc.).	L4	3
6	Design and Implementation of FIR filter to meet given specifications (using different window techniques).	L3	3

7	Design and implementation of IIR filter to meet given specifications.	L4	2

Implementation using DSP Kit

8	Linear convolution of two sequences.	L3	2
9	Circular convolution of two sequences.	L3	2
10	N Point DFT of a given sequence.	L3	3
11	Impulse response of first order and second order system.	L3	3

Course outcomes:

CO1	Apply the concepts of analog to digital conversion of signals and frequency domain sampling of signals.
CO2	Analyze the properties of Linear and Circular convolution.
CO3	Model discrete time signals and systems and verification of its properties and results.
CO4	Examine discrete computations using DSP processor and verify the results.
CO5	Realize the digital filters using a simulation tool and verify the frequency and phase response.

Scheme of Evaluation	
Regular Lab work and Writing Lab records	(20+15) = 35 marks
Lab test and Viva-voce at the end of the semester	(10+5) = 15 marks
Total	50 marks

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	3	-	-	-	2	-	-	2
CO2	3	3	3	3	3	-	-	-	2	-	-	2
CO3	3	3	3	2	3	-	-	-	2	-	-	2
CO4	3	3	3	3	3	-	-	-	2	-	-	2
CO5	3	3	3	3	3	-	-	-	2	-	-	2

High-3, Medium-2, Low-1

Course Title	COMMUNICATION SYSTEMS LAB	Semester	V
Course Code	MVJ20ECL58	CIE	50
Total No. of Contact Hours	30	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 0: 2 : 2)	Total	100
Credits	2	Exam. Duration	3Hrs

Course objective is to:

● Practice the basic theories of analog communication systems viz., Amplitude and Frequency modulation.

● Design various pulse modulation techniques.

● Understand and analyze the concepts of digitization of signals.

● Learn the basic theories of digital modulation techniques in practical.

● Simulate the digital communication concepts and compute and display various parameters along with plots/figures.

Laboratory Sessions

Sl No	Experiment Name	RBT Level	Hours
Hardware Experiments			
1	Amplitude Modulation and Demodulation using transistor.	L3	3
2	Demonstrate Pulse sampling, flat top sampling and reconstruction.	L3	3
3	Pulse Amplitude Modulation and Detection.	L3	2
4	Pulse Width Modulation and Pulse Position Modulation.	L3	2
5	Frequency modulation using IC 8038/2206.	L3	3
6	Pre-emphasis & de-emphasis.	L3	2
7	TDM of two band limited signals.	L4	3
8	ASK generation & detection and FSK generation & detection.	L4	3
9	PSK generation and detection.	L3	3

	Simulation Experiments using SCILAB/MATLAB/Simulink/LabVIEW		
10	Simulate NRZ, RZ and generate eye diagram for binary polar signalling.	L3	2
11	Pulse code modulation and demodulation system.	L3	2
12	Digital Modulation Schemes i) DPSK Transmitter and receiver, ii) QPSK Transmitter and Receiver.	L3	2

Course outcomes:	
CO1	Design and test the analog and digital modulation circuits.
CO2	Demonstrate various pulse modulation techniques such as PAM, PPM & PWM.
CO3	Design the circuit to sample an analog signal. Also design pre-emphasis & de-emphasis to improve the SNR.
CO4	Analyze the concept of TDM.
CO5	Simulate the digital modulation schemes with the display of waveforms.

Scheme of Evaluation	
Regular Lab work and Writing Lab records	(20+15) = 35 marks
Lab test and Viva-voce at the end of the semester	(10+5) = 15 marks
Total	50 marks

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	1	-	-	2	-	-	1
CO2	3	3	3	2	2	1	-	-	2	-	-	1
CO3	3	3	3	2	2	1	-	-	2	-	-	1
CO4	3	3	3	2	2	1	-	-	2	-	-	1
CO5	3	3	3	2	2	1	-	-	2	-	-	1

High-3, Medium-2, Low-1

Course Title	ENVIRONMENTAL STUDIES	Semester	V
Course Code	MVJ20ENV59	CIE	50
Total No. of Contact Hours	20	SEE	50
No. of Contact Hours/week	1 (L : T : P :: 1 : 0 : 0)	Total	100
Credits	1	Exam. Duration	2 Hrs

Course objective is to: This course will enable the students to

- Relate to interdisciplinary approach to complex environmental problems using basic tools of the natural and social sciences including geo-systems, biology, chemistry, economics, political science and international processes; Study drinking water quality standards and to illustrate qualitative analysis of water.
- Critically evaluate the science and policy ramifications of diverse energy portfolios on air and water quality, climate, weapons proliferation and societal stability.

Module-1	RBT Level L1, L2	6Hrs.

Introduction to environmental studies, Multidisciplinary nature of environmental studies; Scope and importance; Concept of sustainability and sustainable development.

Ecosystems (Structure and Function): Forest, Desert, Rivers, Ocean

Biodiversity: Types, Hot spots; Threats and Conservation of biodiversity, Deforestation.

Video link / Additional online information:

1. https://nptel.ac.in/courses/120108004/

Module-2	RBT Level L1, L2, L3	6Hrs.

Advances in Energy Systems (Merits, Demerits, Global Status and Applications): Hydrogen, Solar, OTEC, Tidal and Wind.

Natural Resource Management (Concept and case-studies): Disaster Management, Sustainable Mining, Cloud Seeding, and Carbon Trading.

Video link / Additional online information:

1.	https://nptel.ac.in/courses/120108004/		
Module-3		RBT Level L1, L2	6Hrs.

Environmental Pollution (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts, Case-studies): Surface and Ground Water Pollution; Noise pollution; Soil Pollution and Air Pollution.

Waste Management & Public Health Aspects: Bio-medical Waste; Solid waste; Hazardous waste; E-waste.

Video link:

1. https://nptel.ac.in/courses/122/106/122106030/
2. https://nptel.ac.in/courses/105/103/105103205/

Module-4		RBT Level L1, L2	6Hrs.

Global Environmental Concerns (Concept, policies, and case-studies): Global Warming

Climate Change; Acid Rain; Ozone Depletion; Fluoride problem in drinking water.

Video link:

1. https://nptel.ac.in/courses/122/106/122106030/

Module-5		RBT Level L1, L2, L3	6Hrs.

Latest Developments in Environmental Pollution Mitigation Tools (Concept and Applications): G.I.S. & Remote Sensing, Environment Impact Assessment, Environmental Management Systems, ISO 14001.

Video link:

1. https://nptel.ac.in/courses/105/102/105102015/
2. https://nptel.ac.in/courses/120/108/120108004/

Course outcomes:	
CO1	Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale.

CO2	Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.
CO3	Demonstrate ecology knowledge of a complex relationship between biotic and a biotic components.
CO4	Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues.

Text Books:	
1.	Benny Joseph, "Environmental Studies", Tata Mc Graw – Hill. 2nd Edition, 2012.
2.	S M Prakash, "Environmental Studies", Pristine Publishing House, Mangalore 3rd Edition, 2018.
Reference Books:	
1.	Raman Siva Kumar, "Principals of Environmental Science and Engineering", Cengage learning, Singapur. 2nd Edition, 2005
2.	G.Tyler Miller Jr., "Environmental Science – working with the Earth", Thomson Brooks /Cole, 11th Edition, 2006.
3.	Pratiba Sing, Anoop Singh & Piyush Malaviya , "Text Book of Environmental and Ecology", Acme Learning Pvt. Ltd., New Delhi., 1st Edition.

CIE Assessment:
CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests   - Quizzes/mini tests (4 marks)   - Mini Project / Case Studies (8 Marks)   - Activities/Experimentations related to courses (8 Marks)
SEE Assessment:
i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.

iii. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	1	–	2	2	1	1	–	2	1
CO2	3	3	2	1	–	1	2	–	1	1	2	1
CO3	3	3	2	1	–	2	2	–	1	1	2	1
CO4	3	3	2	2	–	2	2	–	1	1	2	1

High-3, Medium-2, Low-1

Course Title	UNIVERSAL HUMAN VALUES - II	Semester	V
Course Code	MVJ20UHV510	CIE	50
Total No. of Contact Hours	20	SEE	50
No. of Contact Hours/week	2 (L: T : P : 2 : 0 :0)	Total	100
Credits	2	Exam. Duration	2 Hrs.

Course objective is to: This course will enable the students to

- Appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- Facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- Highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

Prerequisites: *Universal Human Values I*

Module-1	RBT Level L1,L2	4Hrs

Review on Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Self-exploration as the Process for Value Education, Happiness and Prosperity – Current Scenario,

Value Education: Understanding Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, , Method to Fulfill the Basic Human Aspirations,

Practical Sessions: Sharing about Oneself (Tutorial 1), Exploring Human Consciousness (Tutorial 2), Exploring Natural Acceptance (Tutorial 3)

Video link:

1. https://www.youtube.com/watch?v=85XCw8SU084
2. https://www.youtube.com/watch?v=E1STJoXCXUU&list=PLWDeKF97v9SP_Kt6jqzA3pZ3yA7g_OAQz
3. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw

Module-2	RBT Level L1,L2	4Hrs

Review on Understanding Human being as the Co-existence of the Self and the Body, The Body as an Instrument of the Self, Harmony of the Self with the Body.

Harmony in the Human Being: Distinguishing between the Needs of the Self and the Body, Understanding Harmony in the Self, Programme to ensure self-regulation and Health.

Practical Sessions: Exploring the difference of Needs of Self and Body (Tutorial 4), Exploring Sources of Imagination in the Self (Tutorial 5), Exploring Harmony of Self with the Body (Tutorial 6).

Video link:

1. https://www.youtube.com/watch?v=GpuZo495F24
2. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw

Module-3	RBT Level L1,L2	4Hrs

Review on Harmony in the Family – the Basic Unit of Human Interaction, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society.

Harmony in the Family and Society: Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Vision for the Universal Human Order,

Practical Sessions: Exploring the Feeling of Trust (Tutorial 7), Exploring the Feeling of Respect (Tutorial 8), Exploring Systems to fulfill Human Goal (Tutorial 9).

Video link:		
1. https://www.youtube.com/watch?v=F2KVW4WNnS8		
2. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw		

Module-4	RBT Level L1,L2	4Hrs

Harmony in the Nature/Existence: Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence.

Practical Sessions: Exploring the Four Orders of Nature (Tutorial 10), Exploring Co-existence in Existence (Tutorial 11).

Video link:

1. https://www.youtube.com/watch?v=1HR-QB2mCF0
2. https://www.youtube.com/watch?v=lfN8q0xUSpw
3. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw

Module-5	RBT Level L1,L2	4Hrs

Review on Natural Acceptance of Human Values, Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Holistic Technologies, Production Systems and Management Models-Typical Case Studies.

Implications of the Holistic Understanding – a Look at Professional Ethics: Definitiveness of (Ethical) Human Conduct, Competence in Professional Ethics, Strategies for Transition towards Value-based Life and Profession

Practical Sessions: Exploring Ethical Human Conduct (Tutorial 12), Exploring Humanistic Models in Education (Tutorial 13), Exploring Steps of Transition towards Universal Human Order (Tutorial 14).

Video link:

1. https://www.youtube.com/watch?v=BikdYub6RY0
2. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw

Course outcomes: On completion of the course, students would be able to	
CO1	Explore themselves, get comfortable with each other and with the teacher
CO2	Enlist their desires and the desires are not vague.
CO3	Restate that the natural acceptance (intention) is always for living in harmony, only competence is lacking
CO4	Differentiate between the characteristics and activities of different orders and study the mutual fulfillment among them
CO5	Present sustainable solutions to the problems in society and nature

Scheme of Evaluation

Details		Marks
Assessment by Faculty mentor (Class Room Evaluation)	CIE(50)	10
Self-Assessment + Assessment by peers		20
Activities / Experimentations related to courses/Assignment		10
Mini Projects / Case Studies		10
Semester End Examination	SEE (50)	50
	Total	100

Text Books:	
1.	AICTE SIP UHV-I Teaching Material, https://fdp-si.aicte india.org/ AicteSipUHV_download.php

2.	A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
3.	Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books:	
1.	Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010
2.	Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
3.	Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
4.	The Story of Stuff (Book).
5.	The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi

CO-PO Mapping												
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CO1	-	1	-	-	-	2	2	3	2	1	2	1
CO2	-	1	-	-	-	2	2	3	2	1	2	1
CO3	-	1	-	-	-	2	2	3	2	1	2	1
CO4	-	1	-	-	-	2	2	3	2	1	2	1
CO5	-	1	-	-	-	2	2	3	2	1	2	1

High-3, Medium-2, Low-1