MAHARASHTRA INSTITUTE OF TECHNOLOGY, AURANGABD

An Autonomous Institute Affiliated to

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad, Maharashtra (India)

First & Second Year M.Tech. (Electronics & Tele Communication)

Syllabus 2021-22

FACULTY OF SCIENCE AND TECHNOLOGY

Syllabus Structure w.e.f. 2021-2022 (Choice Based Credit System)

M. Tech. (Electronics & Telecommunication)

Semester-I

Course Code	Course Name Tutorial	Teaching Scheme (Hours/Week)			Examination Scheme and Marks							Credits			
		Lectures	Tutorial	Practical	MSE-I	MSE-II	TA	ESE	TW	PR/OR	Total	LECT	TW/PR	TUT	Total
MTM101	Research Methodology and IPR	3	1	-	15	15	20	50	-	-	100	3	-	1	4
MTE 102	Advance Digital Signal Processing	3	-	-	15	15	20	50	-	-	100	3	-	-	3
MTE 103	Advance Digital Communication System	3	-	-	15	15	20	50	-	-	100	3	-	-	3
MTE 104	Wireless Sensor Network	3	-	-	15	15	20	50	-	-	100	3	-	-	3
MTE 121-126	Professional Elective-I	3	-	-	15	15	20	50	-	-	100	3	-	-	3
MTE 111	Lab –I Advance Digital Signal Processing	-	-	2	-	-	-	-	25	-	25	-	1	-	1
MTE 112	Lab –II Advance Digital Communication System	-	-	2	-	-	-	-	25	-	25	-	1	-	1
MTE 113	Lab-III Wireless Sensor Network	-	-	2	-	-	-	-	25	-	25	-	1	-	1
MTE 114	Seminar	-	-	4	-	-	-	-	-	50	50	-	2	-	2
	Total (Semester-I)	**15**	**1**	**10**	**75**	**75**	**100**	**250**	**75**	**50**	**625**	**15**	**5**	**1**	**21**

Semester-II

Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks							Credits			
		Lectures	Tutorial	Practical	MSE-I	MSE-II	TA	ESE	TW	PR/OR	Total	LECT	TW/PR	TUT	Total
MTE 141	Optimization Techniques	3	1	-	15	15	20	50	-	-	100	3	-	1	4
MTE 142	Digital Audio Processing	3	-	-	15	15	20	50	-	-	100	3	-	-	3
MTE 143	VLSI Design Verification & Testing	3	-	-	15	15	20	50	-	-	100	3	-	-	3
MTE 144	Image Processing and Computer Vision	3	-	-	15	15	20	50	-	-	100	3	-	-	3
MTE 161-166	Professional Elective-II	3	-	-	15	15	20	50	-	-	100	3	-	-	3
MTE 151	Lab –I VLSI Design Verification	-	-	2	-	-	-	-	25	-	25	-	1	-	1
MTE 152	Lab –II Image Processing & Computer Vision	-	-	2	-	-	-	-	25	-	25	-	1	-	1
MTE 153	Lab-III Optimization Techniques	-	-	2	-	-	-	-	25	-	25	-	1	-	1
MTE 154	Minor Project	-	-	4	-	-	-	-	-	50	50	-	2	-	2
	Total (Semester-II)	**15**	**1**	**10**	**75**	**75**	**100**	**250**	**75**	**50**	**625**	**15**	**5**	**1**	**21**

MSE- Mid Semester Exam, ESE- End Semester Exam, LECT -Lectures, OR- Oral, TA-Teacher Assessment, TW- Term Work, PR- Practical, TUT- Tutorial

M. Tech (First Year)

Grand Total				**150**	**150**	**200**	**500**	**150**	**100**	**1250**	**30**	**10**	**2**	**42**

Professional Elective Courses-I

Group A	Group B	Group C
MTE121-Internet of Things MTE122-System on Chip	MTE123- Antennas and Wave Propagation MTE124 -Satellite Communication	MTE125- Information Security MTE126 -Artificial Intelligence and Machine Learning

Professional Elective Courses-II

Group A	Group B	Group C
MTE 161-Industry 4.0 MTE 162-Automotive Embedded System	MTE163 -Remote Sensing MTE164-Voice & Data Network	MTE165 -Data Analytics MTE 166 -Block Chain

Semester-III															
Course Code	**Course Name**	**Teaching Scheme (Hours/Week)**			**Examination Scheme and Marks**							**Credits**			
		Lectures	**Tutorial**	**Practical**	**MSE-I**	**MSE-II**	**TA**	**ESE**	**TW**	**PR/OR**	**Total**	**LECT**	**TW/PR**	**TUT**	**Total**
MTE 201	MOOC Course	3	-	-	-	-	-	100	-	-	100	3	-	-	3
MTE 211	Dissertation-I	-	-	18	-	-	-		50	100	150	-	9	-	9
	Total (Semester-III)	**3**		**18**				**100**	**50**	**100**	**250**	**3**	**9**	**-**	**12**

Semester-IV															
Course Code	**Course Name**	**Teaching Scheme (Hours/Week)**			**Examination Scheme and Marks**							**Credits**			
		Lectures	**Tutorial**	**Practical**	**MSE-I**	**MSE-II**	**TA**	**ESE**	**TW**	**PR/OR**	**Total**	**LECT**	**TW/PR**	**TUT**	**Total**
MTE 251	Dissertation-II	-	-	24	-	-	-		100	100	200	-	12	-	12
	Total (Semester-IV)			**24**					**100**	**100**	**200**	**-**	**12**	**-**	**12**
M. Tech (Second Year)															
Grand Total								**100**	**150**	**200**	**450**	**3**	**21**	**-**	**24**

Grand Total (Electronics & Telecommunication)														
Grand Total M. Tech	**3**	**-**	**-**	**150**	**150**	**200**	**600**	**300 -**	**300**	**1700**	**33**	**31**	**2**	**66**

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(Faculty of Science & Technology)

Syllabus of M. Tech. (Electronics and Telecommunication) Semester-I

Course Code: MTM101 Course: Research Methodology & IPR Teaching Scheme: Lectures: 3 Hrs/week Tutorial: 1 Hr/week	Credits: 3-1-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02 Hrs

Unit-I	**Research Problems and Research Design** Meaning of research, types of research, steps in involved in research process, criteria of good research, importance of ethics in research, codes and policies for research ethics. Selection of research problem, steps involved in defining research problem, need for research design, types of research designs, basic principles of experimental design, formal and informal experimental design**.** **(05 Hrs.)**
Unit-II	**Sampling Design** Need for sampling, steps in sampling design, different types of sampling designs, sampling distributions, concept of central limit and standard error, sources of errors, population mean and proportion, sample size calculations, tests of measurements for validity, reliability and practicality (**05Hrs.)**
Unit-III	**Data collection, Processing and Analysis** Methods for collection of data, selection of data collection method, data processing operations, statistics in research, confidence level, measures of central tendency, dispersion, asymmetry and relationship. Spearman's and Pearson's coefficient of correlation, simple & multiple regression analysis, analysis of variance (ANOVA), factor analysis methods. (**08Hrs.)**
Unit-IV	**Hypothesis Test and Report Writing** Concept of research hypothesis, concept of testing of hypothesis, Parametric tests (z, t, F and chi-square tests), Hypothesis testing of means and correlation coefficient, Non parametric tests, significance of research report writing, types of reports, structure of the research report, steps in report writing, precautions and ethics in writing report. (**07Hrs.)**
Unit-V	**Introduction to IPR** Origin and evolution of IPR to its present form and use, Different Tools of IPR and what is the nature of these rights, Balancing Rights and Responsibilities, Societal implications of IPR (**05Hrs.)**
Unit-VI	**Patents** Concept of inventions/discoveries, patents protect; benchmarks for patentability of inventions; Exceptions to patentability; Patenting issues in BIOTechnology and computer based inventions, process to apply for patents in India and in other countries around the world, The steps to granting of a patent; Opposing grant of a patent; term of a patent; rights of a patent holder; challenging validity of a patent licensing of patent rights; using patent rights in the market place; compulsory license. (**06Hrs.)**

References	**Sr. No.**	**Title**	**Author**	**Publication**	**Edition**
	1.	Research Methodology: Methods and Techniques,	C. R. Kothari and G. Garg	New Age International, 2019	4th Edition
	2.	Research Methodology	R. Pannerselvam	PHI Learning, 2014	2nd Edition
	3.	Research Methodology- As Theoretical Approach	D. Napolean & B. Narayan	Laxmi Publications, 2014	
	4.	Research Methods and Statistics	Bernard C. Beins & Maureen A. McCarthy	Pearson Education Inc., 2012	
	5.	Research Methods Handbook, CLES	Stuart MacDonald & Nicola Headlam		
	6.	Intellectual Property Rights--Unleashing the Knowledge Economy	Ganguli Prabuddha	Tata McGrawHill, 2001	
	7.	Intellectual Property Rights	Neeraj Pandey and Khushdeep Dharni.	PHI Learning, 2014	1st Edition
	8.	Fundamentals of Intellectual Property Rights	Ramakrishna B	Notion Press, 2017	1st Edition
	9.	The Indian Patents Act 1970 (as amended in 2005)			

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(Faculty of Science & Technology)

Syllabus of F. Y. M. Tech. (Electronics and Telecommunication) Semester-I

Course Code: MTE102 Course: Advanced Digital Signal Processing Teaching Scheme: Lectures: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02 Hrs

Prerequisite	Signals and Systems Digital Signal Processing
Objectives	1. To Understand theory of different Filters and algorithms 2.To Learn and understand theory of MultiMate Signal Processing with Its Applications 3. To Understand theory of prediction and solution of normal equations
Unit-I	**Overview** Overview of DSP, Characterization in time and frequency, FFT Algorithms, Digital filter design and structures: Basic FIR/IIR filter design &structures, design techniques of linear phase FIR filters, IIR filters by impulse invariance, bilinear transformation, FIR/IIR Cascaded lattice structures, and Parallel all pass realization of IIR. **(06 Hrs.)**
Unit-II	**Multi rate DSP** Decimators and Interpolators, Sampling rate conversion, multistage decimator & interpolator, poly phase filters, QMF, digital filter banks, Applications in sub band coding. (**06Hrs.)**
Unit-III	**Linear filters** Linear prediction & optimum linear filters, stationary random process, forward-backward linear prediction filters, solution of normal equations, AR Lattice and ARMA Lattice-Ladder Filters, Wiener Filters for Filtering and Prediction. **(06 Hrs.)**
Unit-IV	**Adaptive Filters** Adaptive Filters Applications, Gradient Adaptive Lattice, Minimum mean square criterion, LMS algorithm, Recursive Least Square algorithm **(06 Hrs.)**
Unit-V	**Estimation** Estimation of Spectra from Finite-Duration Observations of Signals. Nonparametric Methods for Power Spectrum Estimation, Parametric Methods for Power Spectrum Estimation, Minimum Variance Spectral Estimation, Eigen analysis Algorithms for Spectrum Estimation. (**06Hrs.)**
Unit-VI	**Applications** Application of DSP & Multi rate DSP, Application to Radar, introduction to wavelets, application to image processing, design of phase shifters, DSP in speech processing & other applications **(06 Hrs.)**

	Sr. No.	Title	Author	Publication	Edition
References	1.	MultiMate Signal Processing : MultiMate Systems- Filter Banks- Wavelets	Monson H. Hayes	John Wiley And Sons	1999
	2.	Digital Signal Processing: Principles, Algorithm and Applications	John G. Proakis, D. G. Manolakis	Prentice Hall	2007
	3.	Adaptive Filter Theory	S. Haykin	Prentice Hall	2001
	4.	Digital Signal Processing – A Practical Approach	Emmanuel C. Ifeachor, Barrie W. Jervis	Addison Wesley	1993

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Syllabus of M. Tech. (Electronics and Telecommunication) Semester-I

Course Code: MTE 103 Course: Advance Digital Communication System Teaching Scheme: Lectures: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02 Hrs

Prerequisites	Basics of Communication
Objectives	1. To learn and understand the basic statistics of Digital Communication 2. To learn how to solve the limitations of digital communication for different channels.
Unit-I	**Introduction** Digital communication system (description of different modules of the block diagram), complex baseband representation of signals, gram Schmidt orthogonalization procedure. m-ary orthogonal signals, bi - orthogonal signals, simplex signal waveform. (**04 Hrs.)**
Unit-II	**Modulation** Pulse Amplitude Modulation (Binary and M - Ary, QAM), Pulse Position Modulation (Binary And M - Ary), Carrier Modulation (M - Ary ASK, PSK, FSK, DPSK), Continuous Phase Modulation (QPSK and Variants, MSK, GMSK). **(08Hrs.)**
Unit-III	**Receiver in Additive White Gaussian Noise Channels Coherent and No Coherent Demodulation** Matched Filter, Correlator Demodulator, Square- Law, And Envelope Detection; Detector: Optimum Rule for ML and MAP Detection Performance: Bit-Error- Rate, Symbol Error Rate for Coherent and No Coherent Schemes. (**08 Hrs.)**
Unit-IV	**Band Limited Channels** Pulse shape design for channels with ISI Nyquist pulse, partial response signalling (duo binary and modified duo binary pulses), demodulation; channel with distortion: design of transmitting and receiving filters for a known channel and for time varying channel (equalization), Performance: Symbol By Symbol Detection And BER, Symbol And Sequence Detection, Viterbi Algorithm. (1**0 Hrs.)**
Unit-V	**Synchronization** Different Synchronization Techniques (Early Late Gate, MMSE, ML and Spectral Line Methods). (**04 Hrs.)**
Unit-VI	**Communication Over Fading Channels** Characteristics of Fading Channels, Rayleigh and Rician channels, Receiver Performance- Average SNR, Outage Probability, Amount of Fading and Average Bit/Symbol Error Rate. **(06 Hrs.)**

	Sr. No.	**Title**	**Author**	**Publication**	**Edition**
	1.	Digital Communications	John G. Proakis and Masoud Salehi, “	Tata McGraw Hill,	5th Edition

References	2.	Digital Communication Fundamentals and Applications	Bernard Sklar and Pabitra Kumar Ray	Pearson Education Asia,	2nd Edition.
	3.	Digital Communication	John R. Barry, Edwa John R. Barry, Edward A. Lee and David G. Messerschmitt, rd A. Lee and David G. Messerschmitt,	Springer 2003	3rd Edition
	4.	CDMA: Principles of Spread Spectrum Communications	Andrew J. Viterbi,	Prentice Hall	2nd Edition

Course Code: MTE104 Course: Wireless Sensor Network Teaching Scheme: Lectures: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02Hrs

Prerequisite	Basics of Wireless Communication
Objectives	1. To provide in-depth understanding of design and implementation of WSN 2. To provide ability to formulate and solve problems creatively in the area of WSN 3. To provide in-depth understanding of various applications of WSN
Unit-I	**Introduction to WSN** Introduction and overview of sensor network architecture and its applications, sensor network comparison with Ad Hoc Networks, Sensor node architecture with hardware and software details. **(06Hrs.)**
Unit-II	**Hardware** Hardware: Examples like mica2, micaZ, telosB, cricket, Imote2, Tmote, btnode, and Sun SPOT, Software (Operating Systems): tinyOS, MANTIS, Contiki, and RTOS. **(06Hrs.)**
Unit-III	**Programming tools** Programming tools C, nesC. Performance comparison of wireless sensor networks simulation and experimental platforms like open source (ns-2) and commercial (QualNet,Opnet) **(06Hrs.)**
Unit-IV	**Overview of Sensor Network Protocols** Overview of Sensor network protocols (details of at least 2 important protocol per layer): Physical, MAC and routing/ Network layer protocols, node discovery protocols, multi-hop and cluster based protocols, Fundamentals of 802.15.4, Bluetooth, Bluetooth low energy UWB. **(06 Hrs.)**
Unit-V	**Data Processing** Data dissemination and processing; differences compared with other database management systems, data storage; query processing. **(06Hrs.)**
Unit-VI	**Specialized features** Energy preservation and efficiency; security challenges; fault- tolerance, Issues related to Localization, connectivity and topology, Sensor deployment mechanisms; coverage issues; sensor Web; sensor Grid, Open issues for future research, and Enabling technologies in wireless sensor network**.** **(06 Hrs.)**

References	**Sr. No**	**Title**	**Author**	**Publication**	**Edition**

	1.	Protocols and Architectures for Wireless Sensor Networks- -	Holger Karl, Andreas Willig	John Wiley & Sons, India, 2012	Ist Edition
	2.	Wireless Sensor Networks	C. S. Raghavendra, K. M. Sivalingam, and T. Znati, Editors,	Springer Verlag,	1st Indian reprint, 2010
	3.	Wireless Sensor Networks: An Information Processing Approach	F. Zhao and L. Guibas	Morgan Kaufmann	1stIndian reprint, 2013
	4.	Wireless sensor Network and Applications.	YingshuLi, MyT. Thai, Weili Wu,	Springer series on signals and Communication Technology, 2008	Ist Edition

Course Code: MTE121 Course: Professional Elective Course-I Internet of Things Teaching Scheme: Lectures: 3 Hrs/week	**Credits: 3-0-0** Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02Hrs

Prerequisite	Basic Electronics, Basic Programming Language
Objectives:	1. Introduce evolution of internet technology and need for IOT. 2. Discuss on IOT reference layer and various protocols and software. 3. Train the students to build IOT systems using sensors. 4. Make the students to apply IOT data for business solution in various domains in secured manner.
Unit-I	**Introduction to IOT** Origin of terminology, IOT LAN, IOT WAN, IOT node, IOT gateway, IPV4, IPV6 **(06 Hrs.)**
Unit-II	**IOT application and its Variants.** **Case studies:** IOT for smart cities, health care, agriculture, smart meters. M2M, Web of things, Industrial IOT, Industry 4.0. **(06 Hrs.)**
Unit-III	**IOT point to point communication technologies** IOT communication Pattern, IOT protocol Architecture, Selection of Wireless technologies (6LoWPAN, Zigbee, WIFI) **(06 Hrs.)**
Unit-IV	**IOT Networking** IOT network configurations, IOT components, IOT Service oriented architecture, Industrial IOT, Consumer IOT, MQTT, UDP, MQTT brokers, publish subscribe modes, HTTP, COAP, XMPP and gateway protocols **(06 Hrs.)**
Unit-V	**Microcontrollers for IOT** Features of ESP8266, Specification of ESP8266, Block diagram of ESP8266, Applications of ESP8266 , Features of ESP32, Specification of ESP32, Block diagram of ESP32, Applications of ESP32, Access point and station point mode **(06 Hrs.)**
Unit-VI	**Introduction to Cloud computation and Big Data Analytics** Evolution of Cloud Computation, Commercial clouds and their features, open source IOT platforms, cloud dashboards, Introduction to big data analytics and Hadoop. Interfacing and data logging with cloud: Thing speak, Blync platform. **(06 Hrs.)**
Reference books/ Text books	Alessandro Bassi, Martin Bauer, Martin Fiedler, Thorsten Kramp, Rob van Kranenburg, Sebastian Lange, Stefan Meissner, "Enabling things to talk – Designing IOT solutions with the IOT Architecture Reference Model", Springer Open, 2016 .

	Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis Karnouskos, Stefan Avesand, David Boyle, "From Machine to Machine to Internet of Things", Elsevier Publications, 2014. LuYan, Yan Zhang, Laurence T. Yang, Huansheng Ning, The Internet of Things: From RFID to the Next-Generation Pervasive Network, Aurbach publications, March, 2008. Vijay Madisetti , Arshdeep Bahga, Adrian McEwen (Author), Hakim Cassimally "Internet of Things A Hands-on-Approach" Arshdeep Bahga & Vijay Madisetti, 2014. Asoke K Talukder and Roopa R Yavagal, "Mobile Computing," Tata McGraw Hill, 2010. Barrie Sosinsky, "Cloud Computing Bible", Wiley-India, 2010 RonaldL. Krutz, Russell Dean Vines ,Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Wiley-India, 2010 Fadi Al-Turjman, Intelligence in IOT- enabled Smart Cities, 2019, 1st edition, CRC Press, ISBN-10: 1138316849 Giacomo Veneri, and Antonio Capasso, Hands-on Industrial Internet of Things: Create a powerful industrial IOT infrastructure using Industry 4.0, 2018, Packt Publishing. Subhas Chandra Mukhopadhyay, Smart Sensing Technology for Agriculture and Environmental Monitoring, 2012, Springer, ISBN-10: 3642276377

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Faculty of Science & Technology) Syllabus of M. Tech. (Electronics and Telecommunication) Semester-I	
Course Code: MTE122	Credits: 3-0-0
Course: Professional Elective Course-I	Mid Semester Examination-I: 15 Marks

System on Chip Teaching Scheme: Lectures: 3 Hrs/week	Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02 Hrs

Prerequisite	Digital Electronics VLSI Design fundamentals, ASIC, FPGA Basics of C Programming
Objectives	Provide an understanding of the concepts, issues, and process of System-on-Chip (SOC) design, i.e., hardware-software co-design & co-verification. Expose the student to the modelling and specification of an SOC at a high level of abstraction. Use co-simulation to validate system functionality.
Unit-I	**System on Chip** What is System-on-Chip SOC: More of a System not a Chip , software and interconnection structure for integration, SOC may consists of all or some of the following: Processor/CPU cores , On-chip interconnection (busses, network, etc.) , Analog circuits , Accelerators or application specific hardware modules , ASICs Logics ,Software – OS, Application, etc. , Firmware **(06 Hrs).**
Unit-II	**Modeling** Levels of Modeling Abstraction, Design Flow, Synthesizable RTL, hazards, Critical Path Timing Delay, Simple Microprocessor: Bus Connection and Internals, I/O Blocks, Common Interface Nets, RAM - on chip memory (Static RAM). GPIO - General Purpose Input/output Pins **(06 Hrs.)**
Unit-III	**SOC Examples** SOC Example Helium 210 case study, Using C Preprocessor to Adapt Firmware, Transactional Level Modeling (TLM), ABD - Assertion-Based Design and various aspects. **(06 Hrs.)**
Unit-IV	**Bus & Memory** Basic bus: Multiple Initiators (II), Network on Chip: Simple Ring, Dynamic RAM : DRAM Features of SOC, Applications, Advantages of SOC. **(06 Hrs.)**
Unit-V	**Tools** SOC Engineering and Associated Tools, Static Timing Analyzer Tool, RAM Macro cell Compiler Tool, Test Program Generator Tool **(06 Hrs.)**
Unit-VI	**Architectural Design** Architectural Design Exploration, H/W Design Partition, Chip Types and Classifications, SOC may consists of all or some of the following: • Processor/CPU cores • On-chip interconnection (busses, network, etc.) • Analog circuits • Accelerators or application specific hardware modules • ASICs Logics **(06 Hrs.)**

	Sr. No.	Title	Author	Publication	Edition
References	1.	System on Chip Design and Modeling	Dr. David J Greaves	University of Cambridge	First edition
	2.	A Practical Approach to VLSI System on Chip (SOC) Design A Comprehensive Guide: -- Chakravarthi, Veena	Chakravarthi, Veena	Springer	First edition
	3.	System-on-Chip Design with Arm Cortex-M Processors Reference Book"	Joseph Yiu, ,	Arm education media Springer 2003	First Edition

Course Code: MTE123 Course: Professional Elective Course-I Antennas and Wave Propagation Teaching Scheme: 3 Hrs/Week Lectures: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02 Hrs

Prerequisite	1. Concepts of orthogonal Co-ordinate Geometry (Cartesian, Cylindrical and Spherical), Differential length, surface and volume in coordinate system. 2. Vector Calculus and different vector operators 3. Concepts of Electromagnetic and Time varying EM fields, Maxwell's Equations, Transmission Lines
Course Objectives	1. To Understand the behavior of Uniform Plane waves and fundamentals of Antenna and its parameters. 2. To analyze mathematical modeling of electrically small wire antennas and their Arrays 3. To Understand the concepts of electrically large, broadband antennas and reflector antennas 4. To apply the mathematical transform on aperture antennas and various modes of propagation associated with it 5. To understand Planar antenna and its parameters. 6. To analyze and understand wave propagation in various media and Environments.
Unit-I	**Uniform plan waves and Fundamental Of Antennas** Maxwell's equation using phasor notations, Electromagnetic wave equations (Helmholtz equation), Relation between E and H, depth of penetration, concept of polarization, Introduction to Antenna, Isotropic Radiators, Radiation Pattern, Gain, Directive Gain, Directivity, Reciprocity Theorem & Its Applications, Effective Aperture, Radiation Resistance, Terminal Impedance, Noise Temperature, Elementary Ideas About Self & Mutual Impedance, Front-To-Back Ratio, Beam Width, Bandwidth, Beam Efficiency, Beam Area Or Beam Solid Angle, Polarization, Temperature. **(06 Hrs.)**
Unit-II	**Linear Wire Antennas And Arrays** Infinitesimal Dipole, Small Dipole, half Wave Dipole: Current Distribution, Radiated Field, Power Density And Radiation Resistance. Two Element Array, N-Element Array: Broadside And End Fire Array. Planar Array And Circular Array: Design Consideration, Array Factor. **(06 Hrs.)**
Unit-III	**Broadband, Frequency Independent Antennas And Reflector Antennas:** Helical Antenna, Yagi-Uda Array Of Linear Elements, Yagi-Uda Array Of Loops Electric Magnetic Dipole. Log Periodic Antennas. Corner Reflector, Plane Reflector, Parabolic Reflector With Feed System. **(06 Hrs.)**
Unit-IV	**Aperture Antennas:** Rectangular Apertures, Circular Apertures: Uniform Distribution On Infinite Plane, TE Mode Distribution, Beam Efficiency, Design Consideration, Babinets Principle, Fourier Transform, Aperture Antenna Theory, Spectral Domain And Radiation Fields.

	(06 Hrs.)
Unit-V	**Horn Antennas And Micro Strip Antennas:** E And H- Plane Spectral Horn, Pyramid Horn, Conical Horn, Corrugated Horn, Aperture Matched Horn, Multimode Horn And Their Aperture Fields, Radiated Fields And Phase Centre. Rectangular Patch, Circular Patch, Basic Characteristics, Feeding Method, TM Mode , Quality Factor, Bandwidth, Input Impedance, Coupling And Efficiency, Arrays And Feed Networks **(06 Hrs.)**
Unit-VI	**Wave Propagation:** Calculation Of Great Circle Distance Between Any Two Points On Earth, Ground Wave Propagation, Free-Space Propagation, Ground Reflection, Surface Waves, Diffraction, Wave Propagation In Complex Environments, Tropospheric Propagation, Tropospheric Scatter. Ionospheric Propagation: Structure Of Ionosphere, Sky Waves, Skip Distance, Virtual Height, Critical Frequency, MUF, Electrical Properties Of Ionosphere, Effects Of Earths Magnetic Fields, Faraday Rotation, Whistlers. **(06 Hrs.)**

Reference Books

Sr. No.	Title	Author	Publication	Edition
1.	Antenna Theory: Analysis And Design.	C. A. Balanis	Wiley India.	Fourth
2.	Antenna And Wave Propagation	G.S.N. Raju	Pearson Education.	---
3	Antennas For All Applications	J.D.Krauss	TMH	Third
4	Electromagnetic Wave & Radiating Systems	Jordan And Balmain	PHI	Second
5	Antenna & Wave Propagation	K.D. Prasad	Satyaprakash Publications	---
6	Antennas And Wave Propagation	A.R.Harish, M.Sachidanada	Oxford University Press	---
7	Antenna Analysis And Design	W.L Stutzman And G.A. Thiele	John Wiley	Third

Course Code: MTE124 Course: Professional Elective Course -I Satellite Communication Teaching Scheme: Lectures: 03 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration):02 Hrs

Prerequisite	Knowledge of Analog communication, Digital Communication
Objectives	1. Learn and understand the basics of satellite communication. 2. Understand various aspects related to satellite systems
Unit-I	**Architecture of Satellite Communication System:** Principles and architecture of satellite Communication, Brief history of Satellite systems, advantages, disadvantages, applications, and frequency bands used for satellite communication and their advantages/drawbacks. **(06 Hrs.)**
Unit-II	**Orbital Analysis**: Orbital equations, Kepler's laws of planetary motion, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity of a satellite, concepts of Solar day and Sidereal day. **(06 Hrs.)**
Unit-III	**Satellite sub-systems**: Architecture and Roles of various sub-systems of a satellite system such as Telemetry, tracking, command, and monitoring (TTC & M), Attitude and orbit control system (AOCS), Communication sub-system, power sub-systems, antenna sub-system **(06 Hrs.)**
Unit-IV	**Typical Phenomena in Satellite Communication:** Solar Eclipse on satellite, its effects, remedies for Eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift phenomena ,expression for Doppler shift **(06 Hrs.)**
Unit-V	**Satellite link budget:** Flux density and received signal power equations, Calculation of System noise temperature for satellite receiver, noise power calculation, Drafting of satellite link budget and C/N ratio calculations in clear air and rainy conditions, Case study of Personal Communication system (satellite telephony) using LEO **(06 Hrs.)**
Unit-VI	**Modulation and Multiple Access Schemes:** Types of modulation used in satellite communication, Typical case studies of VSAT, DBS-TV satellites and few recent communication satellites launched by NASA/ ISRO, GPS **(06 Hrs.)**

References

Sr. No.	Title	Author	Publication	Edition
1.	Satellite Communications	Timothy Pratt and Others	Wiley India	2nd Edition, 2010.

	2.	Fundamentals of Satellite Communication	S. K. Raman	Pearson Education Asia	2nd Edition
	3.	Satellite Communication	Dennis Roddy	McGraw Hill	4th Edition, 2008
	4.	Digital Satellite Communications	Tri T. Ha	Tata McGraw Hill	2009.

Course Code: MTE125 Course: Professional Elective Course-I Information Security Teaching Scheme: Lectures: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I:15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02Hrs

Prerequisite	Information Theory and Coding
Objectives	Acquire knowledge of various security issues Acquire knowledge of standard algorithms used for information security
Unit-I	**Introduction to information security** Components of Information Security, Security Policy, Security goals, Security mechanisms, Security Services, threats, Attacks. **(06 Hrs.)**
Unit-II	**Private-key Encryption** Block Ciphers, Stream Ciphers, Feistel Ciphers, Data Encryption Standard (DES), Triple DES, Modes of Operation, Advanced Encryption Standard (AES), RC5, International Data Encryption Algorithm (IDEA) **(06 Hrs.)**
Unit-III	**Public-key Encryption** RSA, Diffie—Hellman Key Exchange, Elliptic Curve Cryptography [ECC] **(06 Hrs.)**
Unit-IV	**Authentication** Authentication Using Symmetric Keys , Authentication Using Public Keys, Message-Digest algorithm 5, Secure Hash Algorithm, Message authentication code, RIPEMD-160, Digital signature: Digital Signature Algorithm (DSA), Digital Signature Standard (DSS). **(06 Hrs.)**
Unit-V	**Security Technology: Intrusion Detection and Prevention Systems** Types of IDPS,IDPS Detection Methods, Scanning and Analysis Tools, Port Scanners, Firewall Analysis Tools, Vulnerability Scanners ,Packet Sniffer. **(06 Hrs.)**
Unit-VI	**Cloud Security** SaaS security issues, PaaS security issues, LaaS security issues, Security Solutions, framework for security and Privacy in IOT. **(06 Hrs.)**

	Sr. No.	Title	Author	Publication	Edition
References	1.	Principles of Information Security	Michael Whitman	Cengage Learning	4th Edition
	2.	Information Security: Complete reference	Mark Rhodes-Ousley	Mc GrawHill	2nd Edition
	3.	Cryptography and Network Security	Behrouz Forouzan	MCGrawHill	3rd Edition
	4.	Information Security: Principles and Practices	Mark Stamp	Willy	2nd Edition

Course Code: MTE126 (Professional Elective Course-I) Course: Artificial Intelligence and Machine Learning Teaching Scheme: Lectures: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02 Hrs

Prerequisite	--
Objectives	Understanding Human learning aspects. Understanding primitives and methods in learning process by computer. Provide understanding of the techniques, mathematical concepts, and algorithm used in machines learning.
Unit-I	**Introduction to Intelligent Systems**, History, Foundations and Mathematical treatments, Problem solving with AI, AI models, Learning aspects in AI, Intelligent Agents, types of AI Agents. **(04 Hrs)**
Unit-II	**Automated Reasoning** Foundations of knowledge representation and reasoning, representing and reasoning about objects, relations, events, actions, time, and space; predicate logic, situation calculus, description logics, - Logic - Propositional and predicate logic - Syntax - Informal and formal semantics **(0 8Hrs)**
Unit-III	**Knowledge Representation:**Representation and mapping, Knowledge Based Agent, First Order Predicate Logic, Forward and Backward Chaining,. **AI Programming Language**: Introduction to AI Programming language, Concept and Programming**.** **(06 Hrs)**
Unit-IV	**Introduction of Machine Learning:** Basic Concept and Examples of Machine Learning with applications, Cross-Validation techniques. **(04 Hrs)**
Unit-V	**Concepts of Machine learning :** Supervised, unsupervised learning System **Supervised learning**: Linear Regression (with one variable and multiple variables), Gradient Descent, Classification (Logistic Regression, Over fitting, Artificial Neural Networks (Perceptrons Multilayer Networks) **(06 Hrs)**
Unit-VI	**Clustering and Classification:** Clustering methods- Iterative distance-based clustering; K-Means Constructing a hierarchical cluster , Bayes Classifier Model Assumptions, Probability estimation, Required data processing M-estimates and Feature selection. **. (08 Hrs)**

References	**Sr. No.**	**Title**	**Author**	**Publication**	**Edition**

	1	Artificial Intelligence A Modern Approach	Stuart J. Russell and Peter Norvig	Pearson Education	2nd Edition
	2	Artificial Intelligence and Machine Learning	Vinod Chandra S.S.Anand Hareendran S	McGraw-Hill,	2^{nd} Edition
	3	Machine Learning	Tom M. Mitchell	McGraw-Hill, 1997	2nd Edition
	4	Introduction to Machine learning	Ethem Alpaydin	The MIT Press, 2010	2^{nd} Edition The MIT Press,

Syllabus of F. Y. M. Tech. (Electronics and Telecommunication) Semester-I	
Course Code: MTE111 Course: Lab I - Advanced Digital Signal Processing Teaching Scheme: Practical : 2 Hrs/week	Credits: 0-0-1 Term Work: 25 Marks

Prerequisite	Signals and Systems Digital Signal Processing
Objectives	1.To Learn And Understand Different Signals 2.To Design And Implement Different Filter Techniques For Different Application
List of Practicals	1. Stability Using Hurwitz Routh Criteria 2. Sampling FFT Of Input Sequence 3. Butterworth Low pass And High pass Filter Design 4. Chebychev Type I,II Filter 5. State Space Matrix from Differential Equation 6. Normal Equation Using Levinson Durbin 7. Decimation And Interpolation Using Rationale Factors 8. Maximally Decimated Analysis DFT Filter 9. Cascade Digital IIR Filter Realization 10. Convolution And M Fold Decimation &PSD Estimator 11. Estimation Of PSD 12. Group Delay Calculation
List of Equipments /Instruments	1. Matlab Software

	Sr. No.	Title	Author	Publication	Edition
References	1	MultiMate Signal Processing : MultiMate Systems- Filter Banks- Wavelets	Monson H. Hayes	John Wiley And Sons	1999
	2	Digital Signal Processing: Principles, Algorithm and Applications	John G. Proakis, D. G. Manolakis	Prentice Hall	2007
	3	Adaptive Filter Theory	S. Haykin	Prentice Hall	2001
	4	Digital Signal Processing – A Practical Approach	Emmanuel C. Ifeachor, Barrie W. Jervis	Addison Wesley	1993

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Syllabus of MTech. (Electronics and Telecommunication) Semester-VI

Course Code: MTE112 Course: Lab II - Advanced Digital Communication System Teaching Scheme: Practical : 2 Hrs/week	Credits: 0-0-1 Term Work: 25 Marks

Course Objectives

Understand concepts in Digital Communication by simulating and computing numerically.
Use MATLAB or C/C++ tools to verify the concepts.

List of Practical	Study and Plot of Useful Distributions in Communication Numerical/Problems Based on Theory Covered Computation and Plot of Autocorrelation and Power Spectrum, Linear Filtering of Random Processes Error detection and correction coding Synchronization techniques Simulation Noise Effect on Different Constellations Monte Carlo Simulation of a Binary Communication System Match Filtering of Signal Waveforms Modulation techniques. Channel performance.
List of Reference Books	1. J.G. Proakis And M. Salehi, Fundamentals Of Communication Systems, Pearson Education, 2005. 2. S. Haykins, Communication Systems, 5th Ed., John Wiley, 2008.
List of Equipments /Instruments	Spectrum Analyzer, Digital communication trainer kit, Digital Storage Oscilloscope

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Course Code: MTE113 Course: Lab III – Wireless Sensor Network Teaching Scheme: Practical : 2 Hrs/week	Credits: 0-0-1 Term Work: 25 Marks

Pre requisties	Basics of Wireless Communication
Objectives	1. Realization of wireless environment for data transfer among nodes 2. Knowledge of Different Architectures
List of Practicals	1.Emerging application areas of sensor networks, describe any one in detail 2.NS-2 simulator study for wireless applications 3.Realization of wireless environment for data transfer among nodes using NS-2 simulator 4.Comparison of sensor nodes: Mica 2, MicaZ, telos B, cricket, imote, Sun spot LMote 5. Comparison of sensor networks operating systems: Tiny OS, Contiki, Lite OS 6.Details of wireless standard IEEE 802.15.4, features and applications 7.Difference in UWB and Bluetooth 8.Detail study of any 2 MAC layer protocols for sensor networks and their comparison 9.Detail description of any 2 Network layer protocols and their comparison 10. Observe the effect of parameter variation (like number of nodes, packet sent rate, energy model) on protocol behaviour for various performance parameters (throughput, energy consumption, network lifetime, delay etc.) 11.Virtual lab experimentation
List of Equipments /Instruments	1.NS2 Simulator

	Sr. No.	Title	Author	Publication	Edition
References	1.	Protocols and Architectures for Wireless Sensor Networks- -	Holger Karl, Andreas Willig	John Wiley & Sons, India, 2012.	Ist Edition
	2.	Wireless Sensor Networks	C. S. Raghavendra, K. M. Sivalingam, and T. Znati, Editors,	Springer Verlag,	1st Indian reprint, 2010
	3.	Wireless Sensor Networks: An Information Processing Approach	F. Zhao and L. Guibas	Morgan Kaufmann	1stIndian reprint, 2013
	4.	Wireless sensor Network and Applications.	YingshuLi, MyT. Thai, Weili Wu,	Springer series on signals and communication technology, 2008	Ist Edition

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Syllabus of M. Tech. (Electronics And Telecommunication.) Semester-I

Course Code: MTE114 Course: Seminar Teaching Scheme: Practical : 4 Hrs/week	Credits: 0-0-1 Term Work: --- Pr/Or: 50

Objectives

To create awareness amongst students for latest technological aspects.
To improve presentation and communication skill
To motivate students for research in respective area

Student should deliver Seminar of the topic in front of External Examiners and Internal Examiners, Staff and student colleagues. Prior to presentation student should carry the details of literature survey from standard references such as international journals and periodicals, recently published reference books etc. student should submit a report on same along with computer based presentation copy to the concerned examiner/guide at the end of seminar. the assessment shall be based on selection of topic its relevance to present context, report documentation and presentation skills

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Syllabus of **M. Tech. (Electronics & Telecommunication)**

Course Code: MTE141 Course: Optimization Techniques Teaching Scheme: Lectures: 3 Hrs/week Tutorial: 1Hr/Week	Credits: 3-1-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02 Hrs

Prerequisite	--
Objectives	Students will learn different problem formulation techniques with different algorithm. Students will learn and understand constrains of optimization in research operations
Unit-I	**Introduction** Optimal Problem Formulation, Engineering Optimization Problems, Optimization Algorithms**.** **(02Hrs.)**
Unit-II	**Single Variable Optimization Algorithms** Optimality Criteria, Bracketing Methods, Region Elimination Methods, Point Estimation Methods, Gradient Base, Root Finding Using Optimization Techniques. **(06 Hrs.)**
Unit-III	**Multivariable Optimization Algorithms** Optimality Criteria, Unidirectional Search, Direct Search Methods, Gradient Based Methods, Computer Programs On Above Methods. **(08Hrs.)**
Unit-IV	**Constrained Optimization Algorithms** Kuhn-Tucker Conditions, Transformation Methods, Sensitivity Analysis, Direct Search For Constrained Minimization, Liberalized Search Techniques, Feasible Direction Method, Generalized Reduced Gradient Method, Gradient Projection Method, Computer Programs On Above Methods. **(08Hrs.)**
Unit-V	**Special Optimization Algorithms** Integer Programming, Geometric Programming, Genetic Algorithms, Simulated Annealing, Global Optimization, Computer Programs On Above Methods. **(08Hrs.)**
Unit-VI	**Optimization In Operations Research** Linear Programming Problem, Simplex Method, Artificial Variable Techniques, Dual Phase Method, Sensitivity Analysis **(08Hrs.)**

	Sr. No.	Title	Author	Publication	Edition
References	**1.**	Engineering Optimization Theory and Practice	Singiresu Rao	Wiley	4 th Edition
	2.	Optimization for Machine Learning	Suvrit Sra Sebastian Nowozin Stephen J. Wright	The MIT Press Cambridge Massachusetts London, England	1st Edition
	3.	Optimization for Engineering Design Algorithms and Examples	Kalyanmoy Deb	Prentice Hall	1st Edition
	4.	Nature-Inspired Optimization Algorithms	Xin-She Yang	Elsevier ISBN: 978012416742	1st Edition

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Syllabus of F. Y. M. Tech. (Electronics and Telecommunication Engineering) Semester-II

Course Code: MTE142 Course: Digital Audio Processing Teaching Scheme: Lectures: 03 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15Marks Mid Semester Examination-II: 15Marks Teacher Assessment: 20Marks End Semester Examination: 50Marks End Semester Examination (Duration):2 Hrs

Prerequisite	Basics of signal, speech
Objectives	1. Understand different characteristics of Speech 2. Identify and analyze different speech analysis system
Unit-I	**Introduction** Principle Characteristics of Speech: Linguistic information, Speech and Hearing, Speech production mechanism, Acoustic characteristic of speech Statistical Characteristics of speech. Speech production models, Linear Separable equivalent circuit model, Vocal Tract and Vocal Cord Model. **(06 Hrs.)**
Unit-II	**Speech Analysis and Synthesis Systems**: Digitization, Sampling, Quantization and coding, Spectral Analysis, Spectral structure of speech, Autocorrelation and Short Time Fourier transform, Window function, Sound Spectrogram, Mel frequency Cepstral Coefficients, Filter bank and Zero Crossing Analysis, Analysis –by-Synthesis, Pitch Extraction **(06 Hrs.)**
Unit-III	**Linear Predictive Coding Analysis**: Principle of LPC analysis, Maximum likelihood spectral estimation, Source parameter estimation from residual signals, LPC Encoder and Decoder,PARCOR analysis and Synthesis, Line Spectral Pairs, LSP analysis and Synthesis **(06Hrs.)**
Unit-IV	**Speech Coding**: Reversible coding, Irreversible coding and Information rate distortion theory, coding in time domain: PCM, ADPCM, Adaptive Predictive coding, coding in Frequency domain: Sub band coding, Adaptive transform coding, Vector Quantization, Code Excited Linear6Predictive Coding (CEL **(06 Hrs.)**
Unit-V	**Speech Recognition**: Principles of speech recognition, Speech period detection, Spectral distance Measure, Structure of word recognition system, Dynamic Time Warping (DTW), Theory and implementation of Hidden Markov Model (HMM). **(06 Hrs.)**
Unit-VI	**Speaker recognition**: Human and Computer speaker recognition Principles Text dependent and Text Independent speaker recognition systems. Applications of speech Processing

					(06 Hrs.)
References	**Sr. No.**	**Title**	**Author**	**Publication**	**Edition**
	1.	"Digital Speech Processing, Synthesis and Recognition"	SadaokiFurui	Taylor & Francis, 2000.	2nd Edition
	2.	"Digital Processing of Speech Signals"	Rabiner and Schafer	Pearson Education, 1979	1st Edition

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Syllabus of F. Y. M. Tech. (Electronics and Telecommunication Engineering) Semester-II

Course Code: MTE143 Course: VLSI Design, Verification and Testing Teaching Scheme: Lectures: 3Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 60 Marks End Semester Examination (Duration): 2Hrs

Prerequisite	Digital System Design VLSI Design
Objectives	At the end of this course, students will be able to Familiarity of Front end design and verification techniques and create reusable test Environments. Verify increasingly complex designs more efficiently and effectively Use EDA tools like Cadence, Mentor Graphics1.
Unit-I	**Verification Guidelines** Verification Process, Basic Test bench functionality, directed testing, Methodology basics, Constrained-Random stimulus, Functional coverage, Test bench components, Layered test bench, Building layered test bench, Simulation environment phases, Maximum code reuse, Test bench performance. **(06Hrs.)**
Unit-II	**Data types** Built-in data types, Fixed-size arrays, Dynamic arrays, Queues, Associative arrays, Linked lists, Array methods, Choosing a storage type, Creating new types with typedef Creating user-defined structures, Type conversion, Enumerated types, Constants strings, Expression width. **(06Hrs.)**
Unit-III	**Procedural Statements and Routines** Procedural statements, tasks, functions and void functions, Routine arguments, Returning from a routine, Local data storage, Time values Connecting the test bench and design: Separating the test bench and design, Interface constructs, Stimulus timing, Interface driving and sampling, Connecting it all together, Top-level scope Program – Module interactions **(06 Hrs.)**
Unit-IV	**System Verilog Assertions** Basic OOP: Introduction, think of nouns, Not verbs, your first class, where to define a class, OOP terminology, Creating new objects, Object de-allocation, Using objects, Static variables vs. Global variables, Class methods, Defining methods outside of the class, Scoping rules, Using one class inside another, Understanding dynamic objects, Copying objects, Public vs. Local, Straying off course building a test bench **(06 Hrs.)**
Unit-V	**Randomization** Introduction, What to randomize, Randomization in System Verilog, Constraint details solution probabilities, Controlling multiple constraint blocks, Valid constraints, In-line constraints, The pre randomize and post randomize functions **(06 Hrs.)**

<table>
<tr><td>Unit-VI</td><td colspan="5">Random number functions
Constraints tips and techniques, Common randomization problems, Iterative and array constraints, Atomic stimulus generation vs. Scenario generation, Random control, Random number generators, Random device configuration. (06 Hrs.)</td></tr>
<tr><td rowspan="5">References</td><td>Sr. No.</td><td>Title</td><td>Author</td><td>Publication</td><td>Edition</td></tr>
<tr><td>1.</td><td>System Verilog for Verification</td><td>Chris Spears</td><td>Springer</td><td>2nd Edition</td></tr>
<tr><td>2.</td><td>Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits</td><td>• M. Bushnell and V. D. Agrawal</td><td>Kluwer Academic Publishers</td><td>1st Edition</td></tr>
<tr><td>3.</td><td colspan="3">IEEE 1800-2009 standard (IEEE Standard for System Verilog— Unified Hardware Design, Specification, and Verification Language)</td></tr>
<tr><td>4.</td><td colspan="3">www.systemverilog.org,
http://www.sunburstdesign.com/papers/CummingsSNUG2006Boston_SystemVerilog Events.pdf
General reuse information and resources www.design-reuse.com</td></tr>
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Syllabus of F. Y. M. Tech. (Electronics and Telecommunication) Semester-II

Course Code: MTE144 Course: Image Processing and Computer Vision Teaching Scheme: Lectures: 03Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02 Hrs

Prerequisite	Image Fundamentals, Linear algebra, vector calculus
Objectives	Study the image formation models and feature extraction for computer vision Identify the segmentation and motion detection and estimation techniques
Unit-I	**Introduction** Overview, computer imaging systems, lenses, Image formation and sensing, Image analysis, pre-processing and Binary image analysis **(04Hrs.)**
Unit-II	**Feature Extraction** Image representations (continuous and discrete) • Edge detection, Edge linking, corner detection, texture, binary shape analysis, boundary pattern analysis, circle and ellipse detection, Light at Surfaces; Phong Model; Reflectance Map; Albedo estimation; Photometric Stereo; Use of Surface Smoothness Constraint; Shape from Texture, color, motion and edges **(07 Hrs.)**
Unit-III	**Shape Representation and Segmentation** Deformable curves and surfaces, Snakes and active contours Level set representations, Fourier and wavelet descriptors ,Medial representations ,Multi-resolution analysis, Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation **(07 Hrs.)**
Unit-IV	**Motion Detection and Estimation** Motion estimation, Background Subtraction and Modeling, Optical Flow, KLT, Spatial-Temporal Analysis, Dynamic Stereo; Motion parameter estimation Structure from motion, Motion Tracking in Video. **(06Hrs.)**
Unit-V	**Object Recognition** Hough transforms and other simple object recognition methods , Shape correspondence and shape matching ,Principal component analysis , Shape priors for recognition **(06Hrs.)**
Unit-VI	**Applications of Computer Vision** Automated Visual Inspection, Inspection of Cereal Grains, Surveillance, In-Vehicle Vision Systems, CBIR, CBVR, Activity Recognition, computational photography, Biometrics, stitching and document processing **(06Hrs.)**

	Sr. No.	Title	Author	Publication	Edition
References	1.	Computer Vision - A modern approach	D. Forsyth and J. Ponce	Pearson Prentice Hall, 2012	2nd Edition
	2.	Digital Image Processing	Rafael C. Gonzalez and Richard E. Woods	Prentice Hall, 2008	3rd Edition,
	3.	Computer Vision: Algorithms and Applications	Szeliski, Richard	Springer Verlag London Limited, 2011	1st Edition
	4.	Robot Vision	B. K. P. Horn	McGraw-Hill, 1986	1st Edition

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Syllabus of F. Y. M. Tech. (Electronics and Telecommunication) Semester-II

Course Code:MTE161 Course: Professional Elective-II Industry 4.0 Teaching Scheme: Lectures: 03 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02 Hrs

Prerequisite	Nil. No prior technical background is required
Objectives	This course is designed to offer learners an introduction to Industry 4.0 , its applications in the business world. Learners will gain deep insights into how smartness is being harnessed from data and appreciate what needs to be done in order to overcome some of the challenges.
Unit-I	**Introduction to Industry 4.0** The Various Industrial Revolutions ,Digitalization and the Networked Economy Drivers, Enablers, Compelling Forces and Challenges for Industry 4.0, The Journey so far: Developments in USA, Europe, China and other countries,Comparison of Industry 4.0 Factory and Today's Factory, Trends of Industrial Big Data and Predictive Analytics for Smart Business Transformation **(06 Hrs.)**
Unit-II	**Road to Industry 4.0** Basic principles and Technologies of a Smart Factory, Internet of Things (IOT) & Industrial Internet of Things (IIOT) & Internet of Services, Big Data, Cyber-Physical Systems, Value chains in manufacturing companies, Customization of products, Digital Twins, Cloud Computing / Cloud Manufacturing, Security issues within Industry 4.0 networks **(06 Hrs.)**
Unit-III	**Related Disciplines, System, Technologies for enabling Industry 4.0** Cyber physical Systems, Robotic Automation and Collaborative Robots, Support System for Industry 4.0, Mobile Computing, Related Disciplines, Cyber Security **(06 Hrs.)**
Unit-IV	**Role of data, information, knowledge and collaboration in future organizations** Resource-based view of a firm, Data as a new resource for organizations, Harnessing and sharing knowledge in organizations, Cloud Computing Basics, Cloud Computing and Industry 4.0 **(06 Hrs.)**
Unit-V	**Human-Robot Collaboration** Human-Robot Collaboration in Industry, Example video Airplane Assembly and others,

	Collaborative Robots, tasks, Collaborative Robots, examples (Yumi, IIWA, UR, Panda, …),Types of Human-Robot Collaboration, Safety of Human-Robot Collaboration (Standards and Norms in the EU),Applications with Collaborative Robots (examples of existing or future applications in the field of manufacturing) **(06 Hrs.)**				
Unit-VI	**Interoperability: Communication systems and standards for Industry 4.0 and cloud applications** Industrial communication ,Industrial Internet of Things (IIOT), The Industry 4.0 Reference Architecture Model RAMI4.0 ,Basics on Service oriented Architecture ,OPC-UA as future standard in Industry 4.0 ,Machine to machine interaction in practice (examples of existing or future applications in the field of manufacturing) **(06 Hrs.)**				
References	**Sr. No.**	**Title**	**Author**	**Publication**	**Edition**
	1.	Industry 4.0: The Industrial Internet of Things	Alasdair Gilchrist	Apress	**2017**
	2.	Future Tense (Industry 4.0)	Dr. Bhushan Kelkar	Rurda Publishing House	**2019**
	3.	Industry 4.0: Managing The Digital Transformation	Alp Ustundag & Emre Cevikcan	Springer Series in Advanced Manufacturing	**2017**
	4.	The Fourth Industrial Revolution	Klaus Schwab	U Read-Store	2017

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Syllabus of M. Tech. (Electronics And Telecommunication) Semester-II

Course Code : MTE162 Course: Professional Elective-II Automotive Embedded System Teaching Scheme: Lectures: 03 Hrs/week Tutorial: 0 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02 Hrs

Objectives	• To Understand Automotive Embedded System. • To Understand Concepts Of Electronics Used in Automotive. • Automotive Sensor Concepts
Unit-I	**Introduction:** Introduction To Embedded System, Automotive Embedded System Controllers, Fuel Injection System, Alternator, Applications. **(06 Hrs.)**
Unit-II	**Body Electronics:** Instrument Panel Design Using HCS12 CPU Core, System Basis Chip MC33904, Remote Key, Keyless Entry, Door, Window Anti-Pinch System, Lighting, Air Bag, Seat Belt.
Unit-III	**Chassis And Safety:** Breaking And Stability Control, Pre-Crash Safety, Parking Assistance, Lane Keeping Assistance, Electronic Power Steering. **(06 Hrs.)**
Unit-IV	**Power train:** Engine, Automatic Transmission, Hybrid Control, Steering, Brake, Suspension. Engine Management System, Drive By Wire System. **(06 Hrs.)**
Unit-V	**Diagnosis And Sensors:** OBD-2, Sensors: Crankshaft Position Sensor, MAP Sensor, Manifold Absolute Pressure, Mass Flow Sensor, Or Mass Airflow (MAF) Sensor, Oxygen Sensor, Throttle Position Sensor (TPS), Variable Reluctance Sensor. **(06 Hrs.)**
Unit-VI	**Vehicle Network:** CAN, Flex ray, Local Interconnect Network, Power Line Communication. Noise Sources And Protections. **(06 Hrs.)**
	Web Resources: 1. http://www.ti.com/ 2. http://www.freescale.com 3. http://www.atmel.com

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Syllabus of F. Y. M. Tech. (Electronics and Telecommunication) Semester-II

Course Code : MTE163	Credits: 3-0-0
Course: Professional Elective-II Remote Sensing	Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks
Teaching Scheme: Lectures: 03 Hrs/week	Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs

Prerequisite	Concepts of Image Processing Techniques
Objectives	1. Identify specific data and methodologies for effective Remote Sensing 2. Understanding Remote Sensing concepts for various applications
Unit-I	**Basics of Remote Sensing** Principles of Remote sensing, Source of Energy, Electromagnetic Radiation and Electromagnetic Spectrum, Reflectance, Transmission, Absorption, thermal Emission of Radiation, Radiation Principles (Plank's Law, Stephen Boltezman law), Interaction of EMR with the Earth Surface (Wien's Displacement law, Kirchoffs Law). Spectral signature, Reflectance characteristics of Earths cover types, Remote sensing systems. **(05 Hrs.)**
Unit-II	**Platforms and Sensors** Platforms, Types of sensors, resolutions sensor, Passive and Active Sensors, Optical sensors, Selection of Sensor Parameter, key terms- Spatial Resolution, Spectral Resolution, Radiometric Resolution, and Temporal Resolution, FOV,IFOV, PSF;. Characteristics of different types of platforms. Satellite missions: Landsat series SPOT series, IRS. **(06 Hrs.)**
Unit-III	**Data Analysis** Data Products and Their Characteristics, Data Pre-processing – Atmospheric correction, Radiometric correction, Geometric Corrections. Basic Principles of Visual Interpretation, Equipment for Visual Interpretation, Ground Truth, Ground Truth Equipment. **(05 Hrs.**)
Unit-IV	**Microwave Remote Sensing** Active and Passive Systems, Advantages, Platforms and Sensors, Microwave Radiation and Simulation, Principles of Radar – Resolution, Range, Angular Measurements, Microwave Scattering, Imagery – characteristics and Interpretation. **(05 Hrs.**).
Unit-V	**Remote Sensing and GIS** GIS Introduction, Need for GIS, Data Model, Data Entry, Data Analysis, GPS, and Remote Sensing as input for GIS, Integration of Satellite Images and GIS. **(05 Hrs.)**
Unit-VI	**Study of various GIS Tools.** Applications: Forest Analysis, Disaster Management, Water Resources, Land use Land Cover, Soil Analysis, etc**.** **(04 Hrs.)**

	Sr. No.	Title	Author	Publication	Edition
References	1.	Remote Sensing and Image Interpretation	T. M. Lillesand, R. W. Kiefer, J. W. Chipman	Willey	1st Edition
	2.	Remote Sensing and Geographical Information System	A. M. Chandra and S. K. Ghosh	Narosa Publishing House	1st Edition
	3.	Remote Sensing: The quantitative approach,	P.H. Swain and S.M. Davis	McGraw Hill.	1st Edition
	4.	Introduction to Remote Sensing,	Campbell James,	Taylor & Francis London.	1st Edition

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad

(Faculty of Science & Technology)

Syllabus of F. Y. M. Tech. (Electronics and Telecommunication) Semester-II

Course Code : MTE163 Course: Professional Elective-II Remote Sensing Teaching Scheme: Lectures: 03 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs

Prerequisite	Concepts of Image Processing Techniques
Objectives	3. Identify specific data and methodologies for effective Remote Sensing 4. Understanding Remote Sensing concepts for various applications
Unit-I	**Basics of Remote Sensing** Principles of Remote sensing, Source of Energy, Electromagnetic Radiation and Electromagnetic Spectrum, Reflectance, Transmission, Absorption, thermal Emission of Radiation, Radiation Principles (Plank's Law, Stephen Boltezman law), Interaction of EMR with the Earth Surface (Wien's Displacement law, Kirchoffs Law). Spectral signature, Reflectance characteristics of Earths cover types, Remote sensing systems. **(05 Hrs.)**
Unit-II	**Platforms and Sensors** Platforms, Types of sensors, resolutions sensor, Passive and Active Sensors, Optical sensors, Selection of Sensor Parameter, key terms- Spatial Resolution, Spectral Resolution, Radiometric Resolution, and Temporal Resolution, FOV,IFOV, PSF;. Characteristics of different types of platforms. Satellite missions: Landsat series SPOT series, IRS. **(06 Hrs.)**
Unit-III	**Data Analysis** Data Products and Their Characteristics, Data Pre-processing – Atmospheric correction, Radiometric correction, Geometric Corrections. Basic Principles of Visual Interpretation, Equipment for Visual Interpretation, Ground Truth, Ground Truth Equipment. **(05 Hrs.**)
Unit-IV	**Microwave Remote Sensing** Active and Passive Systems, Advantages, Platforms and Sensors, Microwave Radiation and Simulation, Principles of Radar – Resolution, Range, Angular Measurements, Microwave Scattering, Imagery – characteristics and Interpretation. **(05 Hrs**).
Unit-V	**Remote Sensing and GIS** GIS Introduction, Need for GIS, Data Model, Data Entry, Data Analysis, GPS, and Remote Sensing as input for GIS, Integration of Satellite Images and GIS. **(05 Hrs.)**
Unit-VI	**Study of various GIS Tools.** Applications: Forest Analysis, Disaster Management, Water Resources, Land use Land Cover, Soil Analysis, etc**.** **(04 Hrs.)**

	Sr. No.	Title	Author	Publication	Edition
References	1.	Remote Sensing and Image Interpretation	T. M. Lillesand, R. W. Kiefer, J. W. Chipman	Willey	1st Edition
	2.	Remote Sensing and Geographical Information System	A. M. Chandra and S. K. Ghosh	Narosa Publishing House	1st Edition
	3.	Remote Sensing: The quantitative approach,	P.H. Swain and S.M. Davis	McGraw Hill.	1st Edition
	4.	Introduction to Remote Sensing,	Campbell James,	Taylor & Francis London.	1st Edition

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Faculty of Science & Technology) Syllabus of F. Y. M. Tech. (Electronics and Telecommunication) Semester-II	
Course Code : MTE164 Course: Professional Elective-II Voice and Data Network Teaching Scheme: Lectures: 03 Hrs/week Tutorial: 0 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I:15 Marks Mid Semestexamination-II:15 Marks Teacher Assessment: 20Marks End Semester Examination: 50 Marks End Semester Examination (Duration):02 Hrs

Prerequisite	Basics of Wireless Communication
Objectives	1. In-depth knowledge on computer networks and provides a good background for advanced studies in communication networks. 2. Design different networks based on different Internet protocols and also able to work for different OSI layers.
Unit-I	**Network Design** Network Design Issues, Network Performance Issues, Network Terminology, centralized and distributed approaches for networks design, Issues in design of voice and data networks. **(06 Hrs)**
Unit-II	**Layered and Layer less Communication** Layered and Layer less Communication, Cross layer design of Networks, Voice Networks (wired and wireless) and Switching, Circuit Switching and Packet Switching, Statistical Multiplexing. **(06Hrs**)
Unit-III	**Data Networks and their Design** Data Networks and their Design, Link layer design- Link adaptation, Link Layer Protocols, Retransmission. Mechanisms (ARQ), Hybrid ARQ (HARQ), Go Back N, Selective Repeat protocols and their analysis. **(06 Hrs)**
Unit-IV	**Queuing Models** Queuing Models of Networks , Traffic Models , Little's Theorem, Markov chains, M/M/1 and other Markov systems, Multiple Access Protocols , Aloha System , Carrier Sensing , Examples of Local area networks**.** **0(06Hrs)**
Unit-V	**Inter-Networking** Inter-networking, Bridging, Global Internet, IP protocol and addressing, Sub netting Classless Inter domain Routing (CIDR) , IP address lookup , Routing in Internet. End to End Protocols, TCP and UDP. Congestion Control , Additive Increase/Multiplicative Decrease , Slow Start, Fast Retransmit/ Fast Recovery. **(06Hrs)**
Unit-VI	**Congestion Avoidance**

	Congestion avoidance, RED TCP Throughput Analysis, Quality of Service in Packet Networks. Network Calculus, Packet Scheduling Algorithms **(06Hrs)**				
References	**Sr. No.**	**Title**	**Author**	**Publication**	**Edition**
	1.	Data Networks	D. Bertsekas and R. Gallager	Prentice Hall, 1992	2nd Edition
	2.	Computer Networks A Systems Approach	L. Peterson and B. S. Davie	Morgan Kaufman, 2011	5th Edition
	3.	Communication Networking: An analytical approach	Kumar, D. Manjunath and J. Kuri	Morgan Kaufman, 2004	1st Edition
	4.	Communications Network A First Course	Walrand	McGraw Hill, 2002.	2nd Edition
	5.	Queuing Systems, Volume I: Theory	Leonard Kleinrock	John Wiley and Sons, 1975	1st Edition
	6.	Telecommunication Network Design Algorithms	Aaron Kershenbaum	McGraw Hill, 1993	1st Edition
	7.	Design and Analysis of Computer Communication Netwrk	Vijay Ahuja	McGraw Hill,1987	1st Edition

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Faculty of Science & Technology) Syllabus of F. Y. M. Tech. (Electronics and Telecommunication) Semester-II	
Course Code : MTE165 Course: Professional Elective-II Data Sciences Teaching Scheme: Lectures: 03 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15Marks Mid Semester Examination-II: 15Marks Teacher Assessment: 20 Marks End Semester Examination: 50Marks End Semester Examination (Duration): 02 Hrs
Prerequisite	Basics of Linear algebra, Probability & Statistics
Objectives	1. Explain the significance of exploratory data analysis in data science 2. Apply basic machine learning algorithm. 3. Create effective visualization of given data
Unit-I	**Introduction:** Introduction to data, big data, data sciences, big data and data science hype, datafication, current landscape of perspective of data sciences, types of data and its measure. **(06Hrs)**
Unit-II	**Statistics and Probability** Introduction to Statistics, Populations and samples, statistical modeling ,Descriptive Statistics, Summary Statistics Basic probability theory, Statistical Concepts (univariate and bivariate sampling, distributions, resampling, statistical Inference, prediction error) **(06Hrs)**
Unit-III	**Machine Learning** Introduction to machine learning, Supervised, Semi Supervised, Unsupervised Learning and reinforced learning, Uses of Machine learning Clustering, K means, Hierarchical Clustering, Decision Trees, Oblique tree. **(06Hrs)**
Unit-IV	**Feature Generation and Selection:** Feature generation's algorithms, feature selection algorithms: filters, wrappers, random forest. Algorithmic ingredients of a recommendation engine, dimensionality reduction, singular value decomposition, principal component analysis. **(06Hrs)**
Unit-V	**Social Network Graphs:** Social Networks as graphs, clustering of graphs, direct discoveries of communities in graphs, portioning of graphs, neighborhood properties of graphs. **(06Hrs)**
Unit-VI	**Data visualization**

	Basic principles, ideas and tools for data visualization, creation of visualization for complex data set. Case study. Data and models for Business analytics, problem solving, Visualizing and Exploring Data, **(06Hrs)**				
References	**Sr. No.**	**Title**	**Author**	**Publication**	**Edition**
	1.	Mining of Massive Datasets.	Jure Leskovek, Anand Rajaraman and Jeffrey Ullman	Cambridge University Press. 2014	Version2.1
	2.	Machine Learning	Tom Mitchell	McGraw-Hill, 1997	1st Edition
	3.	Applied Numerical Linear Algebra	J. Demmel	SIAM, 1997	1st Edition

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Faculty of Science & Technology) Syllabus of F. Y. M. Tech. (Electronics and Telecommunication) Semester-II	
Course Code : MTE165 Course: Professional Elective-II Data Sciences Teaching Scheme: Lectures: 03 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15Marks Mid Semester Examination-II: 15Marks Teacher Assessment: 20 Marks End Semester Examination: 50Marks End Semester Examination (Duration): 02 Hrs
Prerequisite	Basics of Linear algebra, Probability & Statistics
Objectives	4. Explain the significance of exploratory data analysis in data science 5. Apply basic machine learning algorithm. 6. Create effective visualization of given data
Unit-I	**Introduction:** Introduction to data, big data, data sciences, big data and data science hype, datafication, current landscape of perspective of data sciences, types of data and its measure. **(06Hrs)**
Unit-II	**Statistics and Probability** Introduction to Statistics, Populations and samples, statistical modeling ,Descriptive Statistics, Summary Statistics Basic probability theory, Statistical Concepts (univariate and bivariate sampling, distributions, resampling, statistical Inference, prediction error) **(06 Hrs.)**
Unit-III	**Machine Learning** Introduction to machine learning, Supervised, Semi Supervised, Unsupervised Learning and reinforced learning, Uses of Machine learning Clustering, K means, Hierarchical Clustering, Decision Trees, Oblique tree. **(06 Hrs.)**
Unit-IV	**Feature Generation and Selection:** Feature generation's algorithms, feature selection algorithms: filters, wrappers, random forest. Algorithmic ingredients of a recommendation engine, dimensionality reduction, singular value decomposition, principal component analysis. **(06 Hrs.)**
Unit-V	**Social Network Graphs:** Social Networks as graphs, clustering of graphs, direct discoveries of communities in graphs, portioning of graphs, neighborhood properties of graphs. **(06 Hrs.)**
Unit-VI	**Data visualization**

	Basic principles, ideas and tools for data visualization, creation of visualization for complex data set. Case study. Data and models for Business analytics, problem solving, Visualizing and Exploring Data, **(06 Hrs.)**				
References	**Sr. No.**	**Title**	**Author**	**Publication**	**Edition**
	1.	Mining of Massive Datasets.	Jure Leskovek, Anand Rajaraman and Jeffrey Ullman	Cambridge University Press. 2014	Version2.1
	2.	Machine Learning	Tom Mitchell	McGraw-Hill, 1997	1st Edition
	3.	Applied Numerical Linear Algebra	J. Demmel	SIAM, 1997	1st Edition

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Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Faculty of Science & Technology) Syllabus of F. Y. M. Tech. (Electronics and Telecommunication Semester-II	
Course Code:MTE166 Course: Professional Elective-II- Block Chain Teaching Scheme: Lectures: 03 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02 Hrs
Prerequisite	Expertise in programming, basic knowledge of computer security, cryptography, networking, concurrent or parallel programming would help a student to understand the topics.
Objectives	To understand what Block chain is and why it is used To be able to explain the different components involved within Block chain To know when and why you may want to use Block chain within your environment
Unit-I	**Introduction and Basic Distributed Computing** Need for Distributed Record Keeping ,Modeling faults and adversaries Byzantine Generals problem, Consensus algorithms and their scalability problems Why Nakamoto Came up with Block chain based crypto currency? Technologies Borrowed in Block chain – hash pointers, consensus, byzantine fault-tolerant distributed computing, digital cash etc. Atomic Broadcast, Consensus, Byzantine Models of fault tolerance **(06 Hrs.)**
Unit-II	**Basic Crypto primitive** Hash functions, Puzzle friendly Hash, Collison resistant hash, digital signatures, public key crypto, verifiable random functions, Zero-knowledge system **(06 Hrs.)**
Unit-III	**Block chain 1.0** Bit coin block chain, the challenges, and solutions, proof of work, Proof of stake, alternatives to Bit coin consensus, Bit coin scripting language and their use **(06 Hrs.)**
Unit-IV	**Block chain 2.0** Ethereum and Smart Contracts, The Turing Completeness of Smart Contract Languages and verification challenges, Using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts **(06 Hrs.)**
Unit-V	**Block chain 3.0** Hyper ledger fabric, the plug and play platform and mechanisms in permission block chain **(06 Hrs)**

Unit-VI	**Privacy, Security issues in Block chain** Pseudo-anonymity vs. anonymity, Zcash and Zk-SNARKS for anonymity preservation, attacks on Block chains – such as Sybil attacks, selfish mining, 51% attacks - -advent of algorand, and Sharding based consensus algorithms to prevent these **(06 Hrs.)**

	Sr. No.	**Title**	**Author**	**Publication**	**Edition**
References	1.	Block chain Revolution: How the Technology Behind Bit coin Is Changing Money, Business, and the World	Don Tapscott, Alex Tapscott	Google Books	2016
	2.	Block chain Basics	Daniel Drescher	Google Books	14 March 2017
	3.	Block chain: Blueprint for a New Economy	Melanie Swan	ACM	2015
	4.	Distributed Ledger Technology (block chain)	Roger Wattenhofer	Google Books	2016

ADDITIONAL Resources

1. Joseph Bonneau et al, SoK: Research perspectives and challenges for Bitcoin and cryptocurrency, IEEE Symposium on security and Privacy, 2015 (article available for free download) { curtain raiser kind of generic article, written by seasoned experts and pioneers}.
2. J.A.Garay et al, The bitcoin backbone protocol - analysis and applications EUROCRYPT 2015 LNCS VOl 9057, (VOLII), pp 281-310. (Also available at eprint.iacr.org/2016/1048) . (serious beginning of discussions related to formal models for bitcoin protocols).
3. R.Pass et al, Analysis of Blockchain protocol in Asynchronous networks , EUROCRYPT 2017,

   (eprint.iacr.org/2016/454) . A significant progress and consolidation of several principles).
4. R.Pass et al, Fruitchain, a fair blockchain, PODC 2017 (eprint. iacr .org/2016/916).

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad

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Syllabus of F. Y. M. Tech. (Electronics and Telecommunication) Semester-II

Course Code: MTE151 Course: Lab I VLSI Design, Verification and Testing Teaching Scheme: Lectures: 2 Hrs/week	Credits: 0-0-1 Term Work: 25 Marks

Prerequisite	1.Digital System Design 2.VLSI Design
Objectives	At the end of the laboratory work, students will be able to: • Verify increasingly complex designs more efficiently and effectively. • Use EDA tools like Cadence, Mentor Graphics.
List of Practical's	**List of Assignments:** 1. Sparse memory 2. Semaphore 3. Mail box 4. Classes 5. Polymorphism 6. Coverage 7. Assertions
List of Equipments /Instruments	EDA Tools 1 Cadence 2. Mentor Graphics

References

Sr. No.	Title	Author	Publication	Edition
1.	System Verilog for Verification	Chris Spears	Springer	2nd Edition
2.	Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits	• M. Bushnell and V. D. Agrawal	Kluwer Academic Publishers	1st Edition
3.	IEEE 1800-2009 standard (IEEE Standard for SystemVerilog— Unified Hardware Design, Specification, and Verification Language)			
4.	www.systemverilog.org, http://www.sunburstdesign.com/papers/CummingsSNUG2006Boston_SystemVerilog Events.pdf General reuse information and resources www.design-reuse.com			

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad

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Syllabus of F. Y. M. Tech. (Electronics and Telecommunication) Semester- II

Course Code: MTE152 Course: Lab II Image Processing and Computer Vision Teaching Scheme: Practical: 02Hr/week	Credits: 0-0-1 Term Work: 25Marks

Prerequisite	Image Fundamentals, Linear algebra, vector calculus
Objectives	1. Develop small applications and detect the objects in various applications 2. Detect an object in an image/video
List of Practicals	1. Perform basic operations on images like addition, subtraction, logical etc. 2. Plot the histogram of an image and perform histogram equalization 3.. Perform video enhancement 4. Perform video segmentation 5. Perform image restoration 6. Convert a colour model into another 7. Calculate boundary features of an image 8. Calculate regional features of an image 9. Detect an object in an image/video using template matching/Bayes classifier
List of Equipments /Instruments	1. Matlab software 2. Python open source software

References

Sr. No.	Title	Author	Publication	Edition
1.	Computer Vision - A modern approach	D. Forsyth and J. Ponce	Pearson Prentice Hall, 2012	2nd Edition
2.	Digital Image Processing	Rafael C. Gonzalez and Richard E. Woods	Prentice Hall, 2008	3rd Edition,
3.	Computer Vision: Algorithms and Applicationn	Szeliski, Richard	Springer Verlag London Limited, 2011	1st Edition
4.	Robot Vision	B. K. P. Horn	McGraw-Hill, 1986	1st Edition

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Syllabus of F.Y. M.. Tech. (Electronics and Telecommunication) Semester-II

Course Code: MTE153 Course: Lab III Optimization Techniques Teaching Scheme: Practical:02 Hrs/week	Credits: 0-0-1 Term Work: 25Marks

Prerequisite	Basics of linear algebra, probability and statistics
Course Objectives:	1. Student will learn different software techniques to solve optimization problems. 2. Students will learn to solve the optimization problems with different algorithm.
Course Outcomes:	**After the completion of the course students should be able to :** **COs are not defined**
List of Practical's	1. Introduction to MATLAB/Python. 2. Study of classical optimization techniques. 3. Study and computer implementation of one-dimensional elimination methods to compute optimal solution. 4. Study and computer implementation of one-dimensional interpolation methods to compute optimal solution. 5. Study of one-dimensional interpolation methods to compute optimal solution. 6. Study of solution based approaches for the optimization problems having equality constraints. 7. Study of solution based approaches for the optimization problems having inequality constraints. 8. Study of solution based approaches for the optimization problems based on bisection method 9. Study of solution based approaches for the optimization problems based on Gradient Base method 10. Study of solution based approaches for the optimization problems based on study of integer programming method 11. Study of solution based approaches for the optimization problems based on study of exhaustive search method
List of Software Required	Matlab/Python

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Faculty of Science & Technology) Syllabus of F.Y.M.. Tech. (Electronics and Telecommunication) Semester-II	
Course Code: MTE154 Course: Minor Project Teaching Scheme: Practical:04 Hrs/week	Credits: 0-0-2 PR Exam /Oral Exam : 50 Marks
Prerequisite	Basics of Electronics, Communication
Course Objectives:	To create awareness amongst students for latest technological aspects. To improve presentation and communication skill To motivate students for research in respective area.
Course Outcomes:	Student Should Deliver Seminar on the Minor Project Topic of Recent Technology in front of the External Examiners and Internal Examiners, Staff and Student Colleagues. Prior to Presentation student should carry the details of Literature Survey Standard References such as International Journals and Periodicals, Recently Published Reference Books etc. Student should submit a report on the same along with Computer based presentation copy to the Concerned Examiner/Guide At The end of Minor Project along with demo of the Project. The Assessment shall be based on selection of topic, its relevance to present context, Report documentation and Presentation Skills.

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Syllabus of S.Y.M. Tech. (Electronics And Telecommunication Engg.) Semester-III

Course Code: MTE201 Course: MOOC Teaching Scheme: Online Course (Minimum 12 Weeks)	Credits: 3-0-0 End Semester Exam : 100 Marks

Objectives:

To motivate students for research in respective area.

Apply filed knowledge to design and develop system for industry or society

It is mandatory for the student to complete one MOOC course related to the program of study.

Student will have to complete the MOOC course which will be available on the SWAYAM portal (Free online education portal). Registered MOOC courses should not have similar or overlapping content to that of the regular courses in the curriculum of the program. The credits can be given to the students after successful completion of the MOOC course of 12 weeks or more. The credits will be transferred by evaluation in terms of assignments or examinations or viva-voce. Incase the student is unable to clear MOOC Course examination, the student will have to appear for an Institute-level examination for the respective MOOC course.

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Syllabus of S.Y.M. Tech. (Electronics And Telecommunication) Semester-III

Course Code: MTE211 Course: Dissertation Part I Teaching Scheme: Practical:18 Hrs/week	Credits: 0-0-9 Term Work: 50 Marks PR Exam /Oral Exam : 100 Marks

Objectives :

To motivate students for research in respective area.

Apply filed knowledge to design and develop system for industry or society

The Dissertation Seminar will consist of a typed written Report of Dissertation Part I covering the problem selected for final Dissertation. This should include the problem definition, literature survey, objective, its limitations, technical details and related data required for the proposed Dissertation work. The candidate shall deliver the Dissertation Seminar on the topic or the problem selected for final dissertation which will be judged by two examiners (one external and one internal guide). the assessment shall be based on selection of topic its relevance to present context, report documentation and presentation skills, utility of the Dissertation work & publications based on the same.

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Syllabus Of M. Tech. (Electronics And Telecommunication) Semester-IV

Course Code: MTE251 Course: Dissertation Part II Teaching Scheme: Practical: 24 Hours/Week	Credits: 0-0-12 Term Work : 100 Marks Pr/Oral: 100 Marks

Objectives:

Apply their knowledge in problem solving and in Project Implementation.

To correlate theory and practical knowledge ,actual practices in the industries and societies

The student shall be allowed to submit the Dissertation-II Report only after the completion of Dissertation-I. Student should deliver Viva-Voce presentation on topic of Dissertation-II in front of the External Examiners and Internal Examiners, Staff and Student colleagues' .The assessment shall be based on design and implementation aspects, report documentation and presentation skills, utility of the dissertation work & publications based on the same.