REGULATION 2018

COURSE STRUCTURE

SYLLABUS

2 Years M.Tech Degree Programme

ELECTRONICS AND COMMUNICATION ENGINEERING

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

GIET MAIN CAMPUS AUTONOMOUS GUNUPUR – 765022

(Affiliated to Biju Patnaik University of Technology, Rourkela)

Accredited by NAAC with 'A' Grade with a CGPA of 3.28/4.00
Accredited by NBA

Regulation 2018

GIET MAIN CAMPUS AUTONOMOUS GUNUPUR 765022
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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
M.TECH ECE (R-2018)

I SEMESTER

Sl No	Course type	Course Code	Course Name	L	T	P	C
1	PC	MECPC1010	Advanced Communication Networks	3	0	0	3
2	PC	MECPC1020	Wireless and Mobile Communication	3	0	0	3
3	PE	MECPE1031	Wireless Sensor Networks	3	0	0	3
		MECPE1032	Optical Networks				
		MECPE1033	Statistical Information Processing				
4	PE	MECPE1041	Cognitive Radio	3	0	0	3
		MECPE1042	RF and Microwave Circuit Design				
		MECPE1043	DSP Architecture				
5	MC	MECPE1050	Research Methodology and IPR	2	0	0	2
6	AU	MECAU1061	English for Research Paper Writing	2	0	0	0
		MECAU1062	Disaster Management				
		MECAU1063	Sanskrit for Technical Knowledge				
		MECAU1064	Value Education				
7	LAB I	MECPC1170	Advanced Communication Networks Lab	0	0	4	2
8	LAB II	MECPC1180	Wireless and Mobile Communication Lab	0	0	4	2
Total				16	0	8	**18**

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II SEMESTER

Sl. No	Course type	Course Code	Course Name	L	T	P	C
1	PC	MECPC2010	Antennas and Radiating Systems	3	0	0	3
2	PC	MECPC2020	Advanced Digital Signal Processing	3	0	0	3
3	PE	MECPE2031	Satellite Communication	3	0	0	3
		MECPE2032	Internet of Things				
		MECPE2033	Voice and data networks				
4	PE	MECPE2041	Markov Chain and Queuing System	3	0	0	3
		MECPE2042	MIMO System				
		MECPE2043	Programmable Networks – SDN, NFV				
5	AC	MECAU2051	Constitution of India	2	0	0	0
		MECAU2052	Pedagogy Studies				
		MECAU2053	Stress Management by Yoga				
		MECAU2054	Personality Development through Life Enlightenment Skills				
6	Lab III	MECPC2160	Antennas and Radiating Systems lab	0	0	4	2
7	Lab IV	MECPC2170	Advanced Digital Signal Processing Lab	0	0	4	2
8	Mini Project	MECPC2180	Mini Project	0	0	4	2
Total				14	0	12	**18**

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III SEMESTER

Sl. No	Course type	Course Code	Course Name	L	T	P	C
1	PE	MECPE3011	High-performance Networks	3	0	0	3
		MECPE3012	Pattern Recognition and Machine learning				
		MECPE3013	Remote Sensing				
2	OE	MECOE3021	Business Analytics	3	0	0	3
		MECOE3022	Industrial Safety				
		MECOE3023	Operations Research				
		MECOE3024	Cost Management of Engineering Projects				
3	Project	MECES3130	Project – I	0	0	20	10
		Total		6	0	20	**16**

IV SEMESTER

Sl. No	Course type	Course Code	Course Name	L	T	P	C
1	Project	MECES4110	Project Phase – II	--	--	32	16
		Total		--	--	32	**16**

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SCHEME OF INSTRUCTION SUMMARY

SL. NO.	COURSE WORK - COURSES AREA	CREDITS / SEMESTER				TOTAL CREDITS	%
		I	II	III	IV		
1	Professional Core (PC)	6	6			12	18.18
2	Professional Electives (PE)	6	6	3		15	22.72
3	Open Electives (OE)			3		3	4.54
4	Thesis Work , Seminar and VIVA-VOICE	4	6	10	16	36	54.54
	TOTAL	**16**	**18**	**16**	**16**	**66**	**100**

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I SEMESTER

Sl No	Course type	Course Code	Course Name	L	T	P	C
1	PC	MECPC1010	Advanced Communication Networks	3	0	0	3
2	PC	MECPC1020	Wireless and Mobile Communication	3	0	0	3
3	PE	MECPE1031	Wireless Sensor Networks	3	0	0	3
		MECPE1032	Optical Networks				
		MECPE1033	Statistical Information Processing				
4	PE	MECPE1041	Cognitive Radio	3	0	0	3
		MECPE1042	RF and Microwave Circuit Design				
		MECPE1043	DSP Architecture				
5	MC	MECPE1050	Research Methodology and IPR	2	0	0	2
6	AU	MECAU1061	English for Research Paper Writing	2	0	0	0
		MECAU1062	Disaster Management				
		MECAU1063	Sanskrit for Technical Knowledge				
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7	LAB I	MECPC1170	Advanced Communication Networks Lab	0	0	4	2
8	LAB II	MECPC1180	Wireless and Mobile Communication Lab	0	0	4	2
Total				16	0	8	**18**

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Subject Code	Subject Name	L	T	P	C	QP
MECPC1010	**Advanced Communication Network**	3	0	0	3	A
	SYLLABUS					

Unit 1 : [8 Hours]

Overview of Internet-Concepts, challenges and history. Overview of -ATM. TCP/IP Congestion and Flow Control in Internet-Throughput analysis of TCP congestion control. TCP for high bandwidth delay networks. Fairness issues in TCP.

Unit 2 : [10 Hours]

Real Time Communications over Internet. Adaptive applications. Latency and throughput issues. Integrated Services Model (intServ). Resource reservation in Internet. RSVP, Characterization of Traffic by Linearly Bounded Arrival Processes (LBAP). Leaky bucket algorithm and its properties.

Unit 3 : [8Hours]

Packet Scheduling Algorithms-requirements and choices. Scheduling guaranteed service connections. GPS, WFQ and Rate proportional algorithms. High speed scheduler design. Theory of Latency Rate servers and delay bounds in packet switched networks for LBAP traffic,Active Queue Management - RED, WRED and Virtual clock. Control theoretic analysis of active queue management

Unit 4 : [10 Hours]

IP address lookup-challenges. Packet classification algorithms and Flow Identification- Grid of Tries, Cross producting and controlled prefix expansion algorithms.

Unit 5 : [10 Hours]

Admission control in Internet. Concept of Effective bandwidth. Measurement based admission control. Differentiated Services in Internet (DiffServ). DiffServ architecture and framework

Unit 6 : [8 Hours]

IPV4, IPV6, IP tunnelling, IPswitching and MPLS, Overview of IP over ATM and its evolution to IP switching. MPLS architecture and framework. MPLS Protocols. Traffic engineering

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M.TECH ECE (R-2018)

issues in MPLS.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:

- Jean Wairand and Pravin Varaiya, "High Performance Communications Networks", 2nd edition, 2000.
- Jean Le Boudec and Patrick Thiran, "Network Calculus A Theory of Deterministic Queueing Systems for the Internet", Springer Veriag, 2001.
- Zhang Wang, "Internet QoS", Morgan Kaufman, 2001.

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M.TECH ECE (R-2018)

Subject Code	Subject Name	L	T	P	C	QP
MECPC1020	**Wireless and Mobile Communication**	3	0	0	3	A
	SYLLABUS					

Unit 1: :   **[8 Hours]**

Cellular Communication Fundamentals:Cellular system design, Frequency reuse, cell splitting, handover concepts, Co channel and adjacent channel interference, interference reduction, techniques and methods to improve cell coverage, Frequency management and channel assignment.GSM architecture and interfaces, GSM architecture details, GSM subsystems, GSM Logical Channels, Data Encryption in GSM, Mobility Management, Call Flows in GSM.2.5 G Standards: High speed Circuit Switched Data (HSCSD), General Packet Radio Service (GPRS),2.75 G Standards: EDGE,

Unit 2: :   **[10 Hours]**

Spectral efficiency analysis based on calculations for Multiple access technologies:TDMA, FDMA and CDMA,Comparison of these technologies based on their signal separation techniques, advantages, disadvantages and application areas.Wireless network planning (Link budget and power spectrum calculations)

Unit 3: :   **[8 Hours]**

Mobile Radio Propagation:Large Scale Path Loss, Free Space Propagation Model, Reflection, Ground Reflection (Two-Ray) Model, Diffraction, Scattering, Practical Link Budget Design using Path Loss Models, Outdoor Propagation Models, Indoor Propagation Models, Signal Penetration into Buildings. Small Scale Fading and Multipath Propagation, Impulse Response Model, Multipath Measurements, Parameters of Multipath channels, Types of Small Scale Fading: Time Delay Spread; Flat, Frequency selective, Doppler Spread; Fast and Slow fading.

Unit 4: :   **[10 Hours]**

Equalization, Diversity:Equalizers in a communications receiver, Algorithms for adaptive equalization, diversity techniques, space, polarization, frequency diversity, Interleaving.

Unit 5: :   **[10 Hours]**

Code Division Multiple Access: Introduction to CDMA technology, IS 95 system Architecture,

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Air Interface, Physical and logical channels of IS 95, Forward Link and Reverse link operation, Physical and Logical channels of IS 95 CDMA, IS 95 CDMA Call Processing, soft Handoff, Evolution of IS 95 (CDMA One) to CDMA 2000, CDMA 2000 layering structure and channels.

Unit 6: :   **[10 Hours]**

Higher Generation Cellular Standards:3G Standards: evolved EDGE, enhancements in 4G standard, Architecture and representative protocols, call flow for LTE, VoLTE, UMTS, introduction to 5G

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:

- V.K.Garg, J.E.Wilkes, "Principle and Application of GSM", Pearson Education, 5th edition, 2008.
- V.K.Garg, "IS-95 CDMA & CDMA 2000", Pearson Education, 4th edition, 2009.
- T.S.Rappaport, "Wireless Communications Principles and Practice", 2nd edition, PHI,2002.
- William C.Y.Lee, "Mobile Cellular Telecommunications Analog and Digital Systems", 2nd edition, TMH, 1995.
- Asha Mehrotra, "A GSM system Engineering" Artech House Publishers Bosten, London,1997.

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Subject Code	Subject Name	L	T	P	C	QP
MECPE1031	**Wireless Sensor Networks**	3	0	0	3	A
	SYLLABUS					

Unit 1: :   **[8 Hours]**

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.

Unit 2: :   **[8 Hours]**

Hardware: Examples like mica2, micaZ, telosB, cricket, Imote2, tmote, btnode, and Sun SPOT, Software (Operating Systems): tinyOS, MANTIS, Contiki, and RetOS.

Unit 3: :   **[10 Hours]**

Programming tools: C, nesC. Performance comparison of wireless sensor networks simulation and experimental platforms like open source (ns-2) and commercial (QualNet, Opnet)

Unit 4: :   **[8 Hours]**

Overview of sensor network protocols (details of atleast 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, BLE (Bluetooth low energy), UWB.

Unit 5: :   **[10 Hours]**

Data dissemination and processing; differences compared with other database management systems, data storage; query processing.

Unit 6: :   **[8 Hours]**

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.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

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Text Book:

- H. Karl and A. Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, India, 2012.
- C. S. Raghavendra, K. M. Sivalingam, and T. Znati, Editors, "Wireless Sensor Networks", Springer Verlag, 1st Indian reprint, 2010.
- F. Zhao and L. Guibas, "Wireless Sensor Networks: An Information Processing Approach", Morgan Kaufmann, 1st Indian reprint, 2013.

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M.TECH ECE (R-2018)

Subject Code	Subject Name	L	T	P	C	QP
MECPE1032	**Optical Networks**	3	0	0	3	A

SYLLABUS

Unit 1: :   **[10 Hours]**

SONET/SDH: optical transport network, IP, routing and forwarding, multiprotocol label switching.

Unit 2: :   **[8 Hours]**

WDM network elements: optical line terminals and amplifiers, optical add/drop multiplexers, OADM architectures, reconfigurable OADM, optical cross connects.

Unit 3: :   **[8 Hours]**

Control and management: network management functions, optical layer services and interfacing, performance and fault management, configuration management, optical safety.

Unit 4: :   **[10 Hours]**

Network Survivability: protection in SONET/SDH & client layer, optical layer protection schemes

Unit 5: :   **[10 Hours]**

WDM network design: LTD and RWA problems, dimensioning wavelength routing networks, statistical dimensioning models

Unit 6: :   **[8 Hours]**

Access networks: Optical time division multiplexing, synchronization, header processing, buffering, burst switching, test beds, Introduction to PON, GPON, AON.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:
- Rajiv Ramaswami, Sivarajan, Sasaki, "Optical Networks: A Practical Perspective", MK, Elsevier, 3 rd edition, 2010.
- C. Siva Ram Murthy and Mohan Gurusamy, "WDM Optical Networks: Concepts Design, and Algorithms", PHI, EEE, 2001

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Subject Code	Subject Name	L	T	P	C	QP
MECPE1033	**Statistical Information Processing**	3	0	0	3	A
	SYLLABUS					

Unit 1: :   **[10 Hours]**

Review of random variables: Probability Concepts, distribution and density functions, moments, independent, uncorrelated and orthogonal random variables; Vector-space representation of Random variables, Vector quantization, Tchebaychef inequality theorem, Central Limit theorem, Discrete &Continuous Random Variables.

Random process: Expectations, Moments,Ergodicity, Discrete-Time Random Processes Stationary process, autocorrelation and auto covariance functions, Spectral representation of random signals, Properties of power spectral density, Gaussian Process and White noise process.

Unit 2: :   **[8 Hours]**

Random signal modelling: MA(q), AR(p), ARMA(p,q) models, Hidden Markov Model & its applications ,Linear System with random input , Forward and Backward Predictions, Levinson Durbin Algorithm.

Unit 3: :   **[8 Hours]**

Statistical Decision Theory: Bayes' Criterion, Binary Hypothesis Testing, M-ary Hypothesis Testing, Minimax Criterion, Neyman-Pearson Criterion, Composite Hypothesis Testing. Parameter Estimation Theory: Maximum Likelihood Estimation, Generalized Likelihood Ratio Test ,Some Criteria for Good Estimators, Bayes' Estimation Minimum Mean-Square Error Estimate, Minimum, Mean Absolute Value of Error Estimate Maximum A Posteriori Estimate , Multiple Parameter Estimation   Best Linear Unbiased Estimator ,Least-Square Estimation Recursive Least-Square Estimator.

Unit 4: :   **[8 Hours]**

Spectral analysis: Estimated autocorrelation function, Periodogram, Averaging the periodogram (Bartlett Method), Welch modification, Parametric method, AR(p) spectral estimation and detection of Harmonic signals.

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Unit 5: :   **[8 Hours]**

Information Theory and Source Coding: Introduction, Uncertainty, Information and Entropy, Source coding theorem, Huffman, Shanon Fano , Arithmetic , Adaptive coding , RLE , LZW Data compaction, , LZ-77, LZ-78. Discrete Memory less channels, Mutual information, channel capacity, Channel coding theorem, Differential entropy and mutual information for continuous ensembles.

Unit 6: :   **[10 Hours]**

Application of Information Theory: Group, Ring & Field, Vector, GF addition, multiplication rules. Introduction to BCH codes, Primitive elements ,Minimal polynomials, Generator polynomials in terms of Minimal polynomials, Some examples of BCH codes,& Decoder, Reed- Solomon codes & Decoder, Implementation of Reed Solomon encoders and decoders.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:
- Papoulis and S.U. Pillai, "Probability, Random Variables and Stochastic Processes",4th Edition, McGraw-Hill, 2002.
- D.G. Manolakis, V.K. Ingle and S.M. Kogon, "Statistical and Adaptive Signal Processing", McGraw Hill, 2000.
- Mourad Barkat , "Signal Detection and Estimation", Artech House, 2nd Edition, 2005.
- R G. Gallager, "Information theory and reliable communication", Wiley, 1st edition, 1968.
- F. J. MacWilliams and N. J. A. Sloane, "The Theory of Error-Correcting Codes", New York, North-Holland, 1977.
- Rosen K.H, "Elementary Number Theory", Addison-Wesley, 6th edition, 2010.

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Subject Code	Subject Name	L	T	P	C	QP
MECPE1041	**Cognitive Radio**	3	0	0	3	A
	SYLLABUS					

Unit 1: : [10 Hours]

Introduction to Cognitive Radios: Digital dividend, cognitive radio (CR) architecture, functions of cognitive radio, dynamic spectrum access (DSA), components of cognitive radio, spectrum sensing, spectrum analysis and decision, potential applications of cognitive radio.

Unit 2: : [8 Hours]

Spectrum Sensing: Spectrum sensing, detection of spectrum holes (TVWS), collaborative sensing, geo-location database and spectrum sharing business models (spectrum of commons, real time secondary spectrum market).

Unit 3: : [10 Hours]

Optimization Techniques of Dynamic Spectrum Allocation: Linear programming, convex programming, non-linear programming, integer programming, dynamic programming, stochastic programming.

Unit 4: : [8 Hours]

Dynamic Spectrum Access and Management: Spectrum broker, cognitive radio architectures, centralized dynamic spectrum access, distributed dynamic spectrum access, learning algorithms and protocols.

Unit 5: : [8 Hours]

Spectrum Trading: Introduction to spectrum trading, classification to spectrum trading, radio resource pricing, brief discussion on economics theories in DSA (utility, auction theory), classification of auctions (single auctions, double auctions, concurrent, sequential).

Unit 6: : [8 Hours]

Research Challenges in Cognitive Radio: Network layer and transport layer issues, cross- layer design for cognitive radio networks.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

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Text Book:

- Ekram Hossain, Dusit Niyato, Zhu Han, "Dynamic Spectrum Access and Management in Cognitive Radio Networks", Cambridge University Press, 2009.
- Kwang-Cheng Chen, Ramjee Prasad, "Cognitive radio networks", John Wiley & Sons Ltd., 2009.
- Bruce Fette, "Cognitive radio technology", Elsevier, 2nd edition, 2009.
- Huseyin Arslan, "Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems", Springer, 2007.

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Subject Code	Subject Name	L	T	P	C	QP
MECPE1042	**RF and Microwave Circuit Design**	3	0	0	3	A
	SYLLABUS					

Unit 1: :   **[10 Hours]**

Transmission Line Theory:Lumped element circuit model for transmission line, field analysis, Smith chart, quarter wave transformer, generator and load mismatch, impedance matching and tuning.

Unit 2: :   **[10 Hours]**

Microwave Network Analysis:Impedance and equivalent voltage and current, Impedance and admittance matrix, The scattering matrix, transmission matrix, Signal flow graph.

Unit 3: :   **[8 Hours]**

Microwave Components: Microwave resonators, Microwave filters, power dividers and directional couplers, Ferromagnetic devices and components.

Unit 4: :   **[8 Hours]**

Nonlinearity And Time VarianceInter-symbol interference, random process & noise, definition of sensitivity and dynamic range, conversion gain and distortion.

Unit 5: :   **[8 Hours]**

Microwave Semiconductor Devices And Modeling: PIN diode, Tunnel diodes, Varactor diode, Schottky diode, IMPATT and TRAPATT devices, transferred electron devices, Microwave BJTs, GaAs FETs, low noise and power GaAs FETs, MESFET, MOSFET, HEMT.

Unit 6: :   **[8 Hours]**

Amplifiers Design: Power gain equations, stability, impedance matching, constant gain and noise figure circles, small signal, low noise, high power and broadband amplifier, oscillators, Mixers design.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:
- Matthew M. Radmanesh, "Advanced RF & Microwave Circuit Design: The Ultimate Guide to Superior Design", AuthorHouse, 2009.
- D.M.Pozar, " Microwave engineering" ,Wiley, 4th edition, 2011.

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- R.Ludwig and P.Bretchko, "R. F. Circuit Design", Pearson Education Inc, 2009.
- D. Vendelin, A.M. Pavoi, U. L. Rohde, "Microwave Circuit Design Using Linear And Non Linear Techniques", John Wiley 1990.
- S.Y. Liao, "Microwave circuit Analysis and Amplifier Design", Prentice Hall 1987.
- Radmanesh, "RF and Microwave Electronics Illustrated" , Pearson Education, 2004.

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Subject Code	Subject Name	L	T	P	C	QP
MECPE1043	**DSP Architecture**	3	0	0	3	A
	SYLLABUS					

Syllabus Contents :

Unit 1 :   **[10 Hours]**

Programmable DSP Hardware: Processing Architectures (von Neumann, Harvard), DSP core algorithms (FIR, IIR, Convolution, Correlation, FFT), IEEE standard for Fixed and Floating Point Computations, Special Architectures Modules used in Digital Signal Processors (like MAC unit, Barrel shifters), On-Chip peripherals, DSP benchmarking.

Unit 2: :   **[8 Hours]**

Structural and Architectural Considerations: Parallelism in DSP processing, Texas Instruments TMS320 Digital Signal Processor Families, Fixed Point TI DSP Processors: TMS320C1X and TMS320C2X Family,TMS320C25 –Internal Architecture, Arithmetic and Logic Unit, Auxiliary Registers, Addressing Modes (Immediate, Direct and Indirect, Bit-reverse Addressing), Basics of TMS320C54x and C55x Families in respect of Architecture improvements and new applications fields, TMS320C5416 DSP Architecture, Memory Map, Interrupt System, Peripheral Devices, Illustrative Examples for assembly coding.

Unit 3:   **[8 Hours]**

VLIW Architecture: Current DSP Architectures, GPUs as an alternative to DSP Processors, TMS320C6X Family, Addressing Modes, Replacement of MAC unit by ILP, Detailed study of ISA, Assembly Language Programming, Code Composer Studio, Mixed Cand Assembly Language programming, On-chip peripherals, Simple applications developments as an embedded environment.

Unit 4:   **[8 Hours]**

Multi-core DSPs: Introduction to Multi-core computing and applicability for DSP hardware, Concept of threads, introduction to P-thread, mutex and similar concepts, heterogeneous and homogenous multi-core systems, Shared Memory parallel programming –OpenMP approach

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of parallel programming, PRAGMA directives, OpenMP Constructs for work sharing like for loop, sections, TI TMS320C6678 (Eight Core subsystem).

Unit 5:   **[8 Hours]**

FPGA based DSP Systems: Limitations of P-DSPs, Requirements of Signal processing for Cognitive Radio (SDR), FPGA based signal processing design-case study of a complete design of DSP processor.

Unit 6:   **[10 Hours]**

High Performance Computing using P-DSP: Preliminaries of HPC, MPI, OpenMP, multicore DSP as HPC infrastructure.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:
- M. Sasikumar, D. Shikhare, Ravi Prakash, "Introduction to Parallel Processing", 1st Edition, PHI, 2006.
- Fayez Gebali, "Algorithms and Parallel Computing",1st Edition, John Wiley & Sons, 2011
- Rohit Chandra, Ramesh Menon, Leo Dagum, David Kohr, DrorMaydan, Jeff McDonald,"Parallel Programming in OpenMP", 1st Edition, Morgan Kaufman,2000.
- Ann Melnichuk,Long Talk, "Multicore Embedded systems", 1st Edition, CRC Press,2010.
- Wayne Wolf, "High Performance Embedded Computing: Architectures, Applications and Methodologies", 1st Edition, Morgan Kaufman, 2006.
- E.S.Gopi, "Algorithmic Collections for Digital Signal Processing Applications Using MATLAB", 1st Edition, Springer Netherlands,2007.

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Subject Code	Subject Name	L	T	P	C	QP
MECPE1050	**Research Methodology and IPR**	3	0	0	3	A

SYLLABUS

Unit 1:   **[10 Hours]**

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Unit 2:   **[8 Hours]**

Effective literature studies approaches, analysis Plagiarism, Research ethics,

Unit 3:   **[8 Hours]**

Effective technical writing, how to write report, Paper,Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

Unit 4:   **[8 Hours]**

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Unit 5:   **[8 Hours]**

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

Unit 6:   **[8 Hours]**

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:
* Stuart Melville and Wayne Goddard, "Research methodology: an introduction for

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science & engineering students'"
- Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
- Ranjit Kumar, 2 nd Edition , "Research Methodology: A Step by Step Guide for beginners"
- Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
- Mayall , "Industrial Design", McGraw Hill, 1992.
- Niebel , "Product Design", McGraw Hill, 1974.
- Asimov , "Introduction to Design", Prentice Hall, 1962.

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Course Code	Course Name	L	T	P	C	QP
MECAU1061	**English for Research Paper Writing**	**2**	**0**	**0**	**0**	A

SYLLABUS

Unit – I   **[8 Hours]**

- Planning and Preparation, Word Order, Breaking up long sentences,
- Structuring Paragraphs and Sentences, Being Concise and Removing
- Redundancy, Avoiding Ambiguity and Vagueness`
- Clarifying Who Did What, Highlighting Your Findings, Hedging and
- Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

Unit - II   **[4 Hours]**

- Review of the Literature, Methods, Results, Discussion, Conclusions, The
- Final Check

Unit – III   **[4 Hours]**

- key skills are needed when writing a Title, key skills are needed when
- writing an Abstract, key skills are needed when writing an Introduction,
- skills needed when writing a Review of the Literature,

Unit – IV   **[8 Hours]**

- skills are needed when writing the Methods, skills needed when writing the
- Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions
- useful phrases, how to ensure paper is as good as it could possibly be the
- first- time submission

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Book:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book .
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

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Course Code	Course Name	L	T	P	C	QP
MECAU1062	**Disaster Management**	**2**	**0**	**0**	**0**	A

SYLLABUS
Unit – I   **[8 Hours]** **Introduction** Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude. **Repercussions Of Disasters And Hazards**: Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.
Unit - II   **[4 Hours]** **Disaster Prone Areas In India** Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics
Unit – III   **[4 Hours]** **Disaster Preparedness And Management** Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness
Unit – IV   **[8 Hours]** **Risk Assessment** Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co- Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival. **Disaster Mitigation** Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.
Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS
Text Book: 1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "' New Royal book Company. 2. Sahni, Pardeep Et.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of

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India, New Delhi.
3. Goel S. L. , Disaster Administration And Management Text And Case Studies"
,Deep &Deep Publication Pvt. Ltd., New Delhi.

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Course Code	Course Name	L	T	P	C	QP
MECAU1063	**Sanskrit for Technical Knowledge**	**2**	**0**	**0**	**0**	A

SYLLABUS

Unit – I   [8Hours]
- Alphabets in Sanskrit,
- Past/Present/Future Tense,
- Simple Sentences

Unit - II   [8 Hours]
- Order
- Introduction of roots
- Technical information about Sanskrit Literature

Unit – III   [10 Hours]
- Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Book:
1. "Abhyaspustakam" - Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

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Course Code	Course Name	L	T	P	C	QP
MECAU1064	**Value Education**	**2**	**0**	**0**	**0**	A

SYLLABUS

Unit – I   **[4 Hours]**
- Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism.
- Moral and non- moral valuation. Standards and principles.
- Value judgements

Unit - II   **[6 Hours]**
- Importance of cultivation of values.
- Sense of duty. Devotion, Self-reliance. Confidence,
- Concentration. Truthfulness, Cleanliness.
- Honesty, Humanity. Power of faith, National Unity.
- Patriotism.Love for nature ,Discipline

Unit – III   **[8 Hours]**
- Personality and Behavior Development - Soul and Scientific
- attitude. Positive Thinking. Integrity and discipline
- Punctuality, Love and Kindness.
- Avoid fault Thinking.
- Free from anger, Dignity of labour.
- Universal brotherhood and religious tolerance.
- True friendship.
- Happiness Vs suffering, love for truth.
- Aware of self-destructive habits.
- Association and Cooperation.
- Doing best for saving nature

Unit – IV   **[8 Hours]**
- Character and Competence –Holy books vs Blind faith.
- Self-management and Good health.
- Science of reincarnation.
- Equality, Nonviolence, Humility, Role of Women.
- All religions and same message.
- Mind your Mind, Self-control.
- Honesty, Studying effectively

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Book:
1 Chakroborty, S.K. "Values and Ethics for organizations Theory and practice" , Oxford University Press, New Delhi

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Course Code	Course Name	L	T	P	C	QP
MECPC1170	**Advanced Communication Networks Laboratory**	0	0	4	2	A

LIST OF EXPERIMENTS

1. Study of Networking Commands (Ping, Tracert, TELNET, nslookup, netstat, ARP, RARP) and Network Configuration Files.

2. Linux Network Configuration.

    Configuring NIC's IP Address.

    b. Determining IP Address and MAC Address using if-config command.

    c. Changing IP Address using if-config.

    d. Static IP Address and Configuration by Editing.

    e. Determining IP Address using DHCP.

    f. Configuring Hostname in /etc/hosts file.

3. Design TCP iterative Client and Server application to reverse the given input sentence.

4. Design a TCP concurrent Server to convert a given text into upper case using multiplexing system call "select".

5. Design UDP Client Server to transfer a file.

6. Configure a DHCP Server to serve contiguous IP addresses to a pool of four IP devices with a default gateway and a default DNS address. Integrate the DHCP server with a BOOTP demon to automatically serve Windows and Linux OS Binaries based on client MAC address.

    a. Configure DNS: Make a caching DNS client, and a DNS Proxy; implement reverse DNS and forward DNS, using TCP dump/Wireshark characterise traffic when the DNS server is up and when it is down.

7. Configure a mail server for IMAP/POP protocols and write a simple SMTP client in C/C++/Java client to send and receive mails.

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8. Configure FTP Server on a Linux/Windows machine using a FTP client/SFTP client characterise file transfer rate for a cluster of small files 100k each and a video file of 700mb.Use a TFTP client and repeat the experiment.

9. Signaling and QoS of labeled paths using RSVP in MPLS.

10. Find shortest paths through provider network for RSVP and BGP.

11. Understand configuration, forwarding tables, and debugging of MPLS.

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Course Code	Course Name	L	T	P	C	QP
MECPC1180	**Wireless and Mobile Communication Laboratory**	0	0	4	2	A

LIST OF EXPERIMENTS

1. Understanding Cellular Fundamentals like Frequency Reuse, Interference, cell splitting, multi path environment, Coverage and Capacity issues using communication software.

2. Knowing GSM and CDMA architecture, network concepts, call management, call setup, call release,Security and Power Control, Handoff Process and types, Rake Receiver etc.

3. Study of GSM handset for various signalling and fault insertion techniques (Major GSM handset sections: clock, SIM card, charging, LCD module, Keyboard, User interface).

4. To study transmitters and receiver section in mobile handset and measure frequency band signal and GMSK modulating signal.

5. To study various GSM AT Commands their use and developing new application using it.Understating of 3G Communication System with features like; transmission of voice and videocalls, SMS, MMS, TCP/IP, HTTP, GPS and File system by AT Commands in 3G network.

6. Study of DSSS technique for CDMA, observe effect of variation of types of PN codes,

7. To learn and develop concepts of Software Radio in real time environment by studying the building blocks like Base band and RF section, convolution encoder, Interleaver and De- Interleaver.

8.To study and analyze different modulation techniques in time and frequency domain using SDR kit.

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II SEMESTER

Sl. No	Course type	Course Code	Course Name	L	T	P	C
1	PC	MECPC2010	Antennas and Radiating Systems	3	0	0	3
2	PC	MECPC2020	Advanced Digital Signal Processing	3	0	0	3
3	PE	MECPE2031	Satellite Communication	3	0	0	3
		MECPE2032	Internet of Things				
		MECPE2033	Voice and data networks				
4	PE	MECPE2041	Markov Chain and Queuing System	3	0	0	3
		MECPE2042	MIMO System				
		MECPE2043	Programmable Networks – SDN, NFV				
5	AC	MECAU2051	Constitution of India	2	0	0	0
		MECAU2052	Pedagogy Studies				
		MECAU2053	Stress Management by Yoga				
		MECAU2054	Personality Development through Life Enlightenment Skills				
6	Lab III	MECPC2160	Antennas and Radiating Systems lab	0	0	4	2
7	Lab IV	MECPC2170	Advanced Digital Signal Processing Lab	0	0	4	2
8	Mini Project	MECPC2180	Mini Project	0	0	4	2
Total				14	0	12	**18**

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Subject Code	Subject Name	L	T	P	C	QP
MECPC2010	**Antennas and Radiating Systems**	3	0	0	3	A
	SYLLABUS					

Unit 1: :   **[8 Hours]**

Types of Antennas: Wire antennas, Aperture antennas, Micro strip antennas, Array antennas Reflector antennas, Lens antennas, Radiation Mechanism, Current distribution on thin wire antenna.Fundamental Parameters of Antennas: Radiation Pattern, Radiation Power Density, Radiation Intensity, Directivity, Gain, Antenna efficiency, Beam efficiency, Bandwidth, Polarization, Input Impedance, radiation efficiency, Antenna Vector effective length, Friis Transmission equation, Antenna Temperature.

Unit 2: :   **[4 Hours]**

Linear Wire Antennas: Infinitesimal dipole, Small dipole, Region separation, Finite length dipole, half wave dipole, Ground effects.

Loop Antennas: Small Circular loop, Circular Loop of constant current, Circular loop with non uniform current.

Unit 3: :   **[10 Hours]**

LinearArrays: Two element array, N Element array: Uniform Amplitude and spacing, Broadside and End fire array, Super directivity, Planar array, Design consideration.

Unit 4: :   **[8 Hours]**

Aperture Antennas: Huygen's Field Equivalence principle, radiation equations, Rectangular Aperture, Circular Aperture.Horn Antennas: E-Plane, H-plane Sectoral horns, Pyramidal and Conical horns.

Unit 5: :   **[4 Hours]**

Micro strip Antennas: Basic Characteristics, Feeding mechanisms, Method of analysis, Rectangular Patch, Circular Patch.

Unit 6: :   **[8 Hours]**

Reflector Antennas: Plane reflector, parabolic reflector, Cassegrain reflectors, Introduction to MIMO

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

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Text Book:
- Constantine A. Balanis, "Antenna Theory Analysis and Design", John Wiley & Sons, 4th edition, 2016.
- John D Kraus, Ronald J Marhefka, Ahmad S Khan, "Antennas for All Applications", TataMcGraw-Hill, 2002.
- R.C.Johnson and H.Jasik, "Antenna Engineering hand book", Mc-Graw Hill, 1984.
- I.J.Bhal and P.Bhartia, "Micro-strip antennas", Artech house, 1980.

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Subject Code	Subject Name	L	T	P	C	QP
MECPC2020	**Advanced Digital Signal Processing**	3	0	0	3	A
	SYLLABUS					

Unit 1: :   **[8 Hours]**

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, parallel realization of IIR.

Unit 2:   **[10 Hours]**

Multi rate DSP, Decimators and Interpolators, Sampling rate conversion, multistage decimator & interpolator, poly phase filters, QMF, digital filter banks, Applications in subband coding.

Unit 3: :   **[8 Hours]**

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.

Unit 4: :   **[6 Hours]**
Adaptive Filters, Applications, Gradient Adaptive Lattice, Minimum mean square criterion, LMS algorithm, Recursive Least Square algorithm

Unit 5: :   **[8 Hours]**

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.

Unit6 : :   **[4 Hours]**

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

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Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:
- J.G.Proakis and D.G.Manolakis"Digital signal processing: Principles, Algorithm and Applications", 4th Edition, Prentice Hall, 2007.
- N. J. Fliege, "Multirate Digital Signal Processing: Multirate Systems -Filter Banks – Wavelets", 1st Edition, John Wiley and Sons Ltd, 1999.
- Bruce W. Suter, "Multirate and Wavelet Signal Processing",1st Edition, Academic Press 1997.
- M. H. Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley & Sons Inc., 2002.
- S.Haykin, "Adaptive Filter Theory", 4th Edition, Prentice Hall, 2001.

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Subject Code	Subject Name	L	T	P	C	QP
MECPE2031	**Satellite Communication**	3	0	0	3	A
	SYLLABUS					

Unit 1: :   **[8 Hours]**

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.

Unit 2: :   **[6 Hours]**

Orbital Analysis: Orbital equations, Kepler's laws of planetary motion, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity etc of a satellite, concepts of Solar day and Sidereal day.

Unit 3: :   **[4 Hours]**

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.

Unit 4: :   **[8 Hours]**

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 and expression for Doppler shift.

Unit 5: :   **[10 Hours]**

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.

Unit 6: :   **[8 Hours]**

Modulation and Multiple Access Schemes used in satellite communication.Typical case studies of VSAT, DBS-TV satellites and few recent communication satellites launched by

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M.TECH ECE (R-2018)

NASA/ ISRO. GPS.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:
- Timothy Pratt and Others, "Satellite Communications", Wiley India, 2nd edition,2010
- S. K. Raman, "Fundamentals of Satellite Communication", PearsonEducation India, 2011
- Tri T. Ha, "Digital Satellite Communications", Tata McGraw Hill, 2009.
- Dennis Roddy, "Satellite Communication", McGraw Hill, 4th Edition, 2008

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
M.TECH ECE (R-2018)

Subject Code	Subject Name	L	T	P	C	QP
MECPE2032	**Internet of Things**	3	0	0	3	A
	SYLLABUS					

Unit 1: :   **[8 Hours]**

Smart cities and IoT revolution, Fractal cities, From IT to IoT, M2M and peer networking concepts, Ipv4 and IPV6.

Unit 2: :   **[6 Hours]**

Software Defined Networks SDN, From Cloud to Fog and MIST networking for IoT communications, Principles of Edge/P2P networking, Protocols to support IoT communications, modular design and abstraction, security and privacy in fog.

Unit 3: :   **[10 Hours]**

Wireless sensor networks: introduction, IOT networks (PAN, LAN and WAN), Edge resource pooling and caching, client side control and configuration.

Unit 4: :   **[4 Hours]**

Smart objects as building blocks for IoT, Open source hardware and Embedded systems platforms for IoT, Edge/gateway, IO drivers, C Programming, multithreading concepts.

Unit 5: :   **[8 Hours]**

Operating systems requirement of IoT environment, study of mbed, RIoT, andContiki operating systems, Introductory concepts of big data for IoT applications.

Unit 6: :   **[8 Hours]**

Applications of IoT, Connected cars IoT Transportation, Smart Grid and Healthcare sectors using IoT, Security and legal considerations, IT Act 2000 and scope for IoT legislation.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:
- A Bahaga, V. Madisetti, "Internet of Things- Hands on approach", VPT publisher, 2014.
- McEwen, H. Cassimally, "Designing the Internet of Things", Wiley, 2013.
- CunoPfister, "Getting started with Internet of Things", Maker Media, 1st edition, 2011.
- Samuel Greenguard, "Internet of things", MIT Press, 2015.

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M.TECH ECE (R-2018)

Subject Code	Subject Name	L	T	P	C	QP
MECPE2033	**Voice and Data Networks**	3	0	0	3	A
	SYLLABUS					

Unit 1: :   **[8 Hours]**

Network Design Issues, Network Performance Issues, Network Terminology, centralized and distributed approaches for networks design, Issues in design of voice and data networks.

Unit 2: :   **[10 Hours]**

Layered and Layer less Communication, Cross layer design of Networks, Voice Networks (wired and wireless) and Switching, Circuit Switching and Packet Switching, Statistical Multiplexing.

Unit 3: :   **[6 Hours]**

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.

Unit 4: :   **[6 Hours]**

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,

Unit 5: :   **[8 Hours]**

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,

Unit 6: :   **[6 Hours]**

Congestion avoidance, RED TCP Throughput Analysis, Quality of Service in Packet Networks. Network Calculus, Packet Scheduling Algorithms

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

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Text Book:

- D. Bertsekas and R. Gallager, "Data Networks", 2nd Edition, Prentice Hall, 1992.
- L. Peterson and B. S. Davie, "Computer Networks: A Systems Approach",5th Edition, Morgan Kaufman, 2011.
- Kumar, D. Manjunath and J. Kuri, "Communication Networking: An analytical approach",1st Edition, Morgan Kaufman, 2004.
- Walrand, "Communications Network: A First Course", 2nd Edition, McGraw Hill, 2002.
- Leonard Kleinrock, "Queueing Systems, Volume I: Theory", 1st Edition, John Wiley and Sons, 1975.
- Aaron Kershenbaum, "Telecommunication Network Design Algorithms", McGraw Hill,1993.
- Vijay Ahuja, "Design and Analysis of Computer Communication Networks", McGraw Hill, 1987

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M.TECH ECE (R-2018)

Subject Code	Subject Name	L	T	P	C	QP
MECPE2041	**Markov Chains and Queueing Systems**	3	0	0	3	A

SYLLABUS

Unit 1: :   **[8 Hours]**

Introduction: Review of basic probability, properties of nonnegative random variables, laws of large numbers and the Central Limit Theorem.

Unit 2: :   **[6 Hours]**

Renewal Processes: Basic definitions, recurrence times, rewards and renewal reward theorem, point processes, Poisson process, Walds equation, Blackwell's theorem.

Unit 3: :   **[10 Hours]**

Discrete time Markov chains: definitions and properties, matrix representation, Perron-Frobenius theory.

Unit 4: :   **[8 Hours]**

Continuous time Markov chains: basic definitions, Q-matrix, birth-death processes, quasi birth death processes.;Embedded Markov processes, semi Markov processes, reversible Markov chains, Random walks.

Unit 5: :   **[6 Hours]**

Fundamental queuing results: Little's theorem, invariance of the mean delay, Conservation law.

Markovian queues: Jackson and BCMP networks, numerical Algorithms. M/G/1 & G/M/1 queues and G/G/1 queues.

Unit 6: :   **[8 Hours]**

Advanced queuing models: priority, vacation and retrials in queues.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:
- Cliffs, "Stochastic Modelling and the Theory Queues", Prentice Hall, 1989.
- P.Bremaud, "Markov Chains", Springer-Verlag, 1999.

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M.TECH ECE (R-2018)

- E.Seneta, "Non Negative Matrices and Markov Chains", Springer Series in Statistics, Springer,1981.
- R.Gallager, "Discrete Stochastic Processes", Kluwer Academic Press, 1996.
- L.Kleinrock, "Queuing Systems", vols I and II, John Wiley and Sons 1976.

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Subject Code	Subject Name	L	T	P	C	QP
MECPE2042	**MIMO Systems**	3	0	0	3	A
	SYLLABUS					

Unit 1: :   **[10 Hours]**

Introduction to Multi-antenna Systems, Motivation, Types of multi-antenna systems, MIMO vs. multi-antenna systems.

Unit 2: :   **[8 Hours]**

Diversity, Exploiting multipath diversity, Transmit diversity, Space-time codes, The Alamouti scheme, Delay diversity, Cyclic delay diversity, Space-frequency codes, Receive diversity, The rake receiver, Combining techniques, Spatial Multiplexing, Spectral efficiency and capacity, Transmitting independent streams in parallel, Mathematical notation

Unit 3: :   **[6 Hours]**

The generic MIMO problem, Singular Value Decomposition, Eigenvalues and eigenvectors, Equalising MIMO systems, Disadvantages of equalising MIMO systems, Pre- distortion in MIMO systems, Disadvantages of pre-distortion in MIMO systems, Pre-coding and combining in MIMO systems, Advantages of pre-coding and combining, Disadvantages of pre- coding and combining, Channel state information.

Unit 4:   **[8 Hours]**

Codebooks for MIMO, Beamforming, Beamforming principles, Increased spectrum efficiency, Interference cancellation, Switched beamformer, Adaptive beamformer, Narrowband beamformer, Wideband beamformer

Unit 5: :   **[6 Hours]**

Case study: MIMO in LTE, Codewords to layers mapping, Pre-coding for spatial multiplexing, Pre-coding for transmit diversity, Beamforming in LTE, Cyclic delay diversity based pre-coding, Pre-coding codebooks, Propagation Channels, Time & frequency channel dispersion, AWGN and multipath propagation channels, Delay spread values and time variations, Fast and slow fading environments, Complex baseband multipath channels, Narrowband and wideband channels, MIMO channel models

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Unit 6: : [6 Hours]
Channel Estimation, Channel estimation techniques, Estimation and tracking, Training based channel estimation, Blind channel estimation, Channel estimation architectures, Iterative channel estimation, MMSE channel estimation, Correlative channel sounding, Channel estimation in single carrier systems, Channel estimation for CDMA, Channel estimation for OFDM.
Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//
Text Book: - Claude Oestges, Bruno Clerckx, "MIMO Wireless Communications : From Real-world Propagation to Space-time Code Design",Academic Press, 1st edition, 2010.   - Mohinder Janakiraman, "Space - Time Codes and MIMO Systems", Artech House Publishers, 2004.

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Subject Code	Subject Name	L	T	P	C	QP
MECPE2043	**Programmable Networks - SDN, NFV**	3	0	0	3	A
	SYLLABUS					

Unit 1 : :   **[10 Hours]**

Introduction to Programmable Networks, History and Evolution of Software Defined Networking (SDN), Fundamental Characteristics of SDN, Separation of Control Plane and Data Plane, Active Networking.

Unit 2 : :   **[8 Hours]**

Control and Data Plane Separation: Concepts, Advantages and Disadvantages, the basics of OpenFlow protocol.

Unit 3 : :   **[8 Hours]**

Network   Virtualization: Concepts,   Applications,   Existing   Network   Virtualization Framework, Mininet A simulation environment for SDN.

Unit 4 : :   **[6 Hours]**

Control   Plane: Overview,   Existing   SDN   Controllers   including   Floodlight   and OpenDaylight projects. Customization of Control Plane: Switching and Firewall Implementation using SDN Concepts. Data Plane: Software-based and Hadrware-based; Programmable Network Hardware.

Unit 5 : :   **[6 Hours]**

Programming SDNs: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs. Network Functions Virtualization (NFV) and Software Defined Networks: Concepts, Implementation and Applications.

Unit 6 : :   **[6 Hours]**

Data Center Networks: Packet, Optical and Wireless Architectures, Network Topologies. Use Cases of SDNs: Data Centers, Internet Exchange Points, Backbone Networks, Home Networks, Traffic Engineering.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

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Text Book:
- Thomas D. Nadeau, Ken Gray, "SDN: Software Defined Networks, An Authoritative Review of Network Programmability Technologies", O'Reilly Media, August 2013.
- Paul Goransson, Chuck Black, Timothy Culver. "Software Defined Networks: A Comprehensive Approach", Morgan Kaufmann Publishers, 2016.
- Fei Hu, "Network Innovation through OpenFlow and SDN: Principles and Design", CRC Press, 2014.
- Vivek Tiwari, "SDN and OpenFlow for Beginners", Amazon Digital Services, Inc., ASIN: , 2013.
- Nick Feamster, Jennifer Rexford and Ellen Zegura, "The Road to SDN: An Intellectual History of Programmable Networks" ACM CCR April 2014.

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M.TECH ECE (R-2018)

Course Code	Course Name	L	T	P	C	QP
MECAU2051	Constitution of India	2	0	0	0	A
SYLLABUS						

Unit – I [10 Hours]
- History of Making of the Indian Constitution:History`Drafting Committee, (Composition & Working)
- Philosophy of the Indian Constitution: Preamble Salient Features

Unit - II [6 Hours]
- **Contours of Constitutional Rights & Duties:**
- Fundamental Rights
- Right to Equality
- Right to Freedom
- Right against Exploitation
- Right to Freedom of Religion
- Cultural and Educational Rights
- Right to Constitutional Remedies
- Directive Principles of State Policy
- Fundamental Duties.

Unit – III [8 Hours]
- **Organs of Governance:**
- Parliament
- Composition
- Qualifications and Disqualifications
- Powers and Functions
- Executive
- President
- Governor
- Council of Ministers
- Judiciary, Appointment and Transfer of Judges, Qualifications
- Powers and Functions

Unit – IV [10 Hours]
- **Local Administration:**
- District's Administration head: Role and Importance,
- Municipalities: Introduction, Mayor and role of Elected Representative,
- CEO of Municipal Corporation.
- Pachayati raj: Introduction, PRI: Zila Pachayat.
- Elected officials and their roles, CEO Zila Pachayat: Position and role.

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• Block level: Organizational Hierarchy (Different departments), • Village level: Role of Elected and Appointed officials, • Importance of grass root democracy • Election Commission: Role and Functioning. • Chief Election Commissioner and Election Commissioners. • State Election Commission: Role and Functioning. • Institute and Bodies for the welfare of SC/ST/OBC and women
Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS
Text Book: 1. The Constitution of India, 1950 (Bare Act), Government Publication. 2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015. 3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014. 4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

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M.TECH ECE (R-2018)

Course Code	Course Name	L	T	P	C	QP
MECAU2052	Pedagogy Studies	2	0	0	0	A

SYLLABUS

Unit – I   **[8 Hours]**

Introduction and Methodology:
- Aims and rationale, Policy background, Conceptual framework and terminology
- Theories of learning, Curriculum, Teacher education.
- Conceptual framework, Research questions.
- Overview of methodology and Searching.
- Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries.
- Curriculum, Teacher education.

Unit - II   **[6 Hours]**
- Evidence on the effectiveness of pedagogical practices
- Methodology for the in depth stage: quality assessment of included studies.
- How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?
- Theory of change.
- Strength and nature of the body of evidence for effective pedagogical practices.
- Pedagogic theory and pedagogical approaches.
- Teachers' attitudes and beliefs and Pedagogic strategies.

Unit – III   **[6 Hours]**
- Professional development: alignment with classroom practices and followup
- support
- Peer support
- Support from the head teacher and the community.
- Curriculum and assessment
- Barriers to learning: limited resources and large class sizes

Unit – IV   **[4 Hours]**
- **Research gaps and future directions**
- Research design
- Contexts
- Pedagogy
- Teacher education
- Curriculum and assessment
- Dissemination and research impact

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Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Book:

1.   Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2):245-261.

2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.

3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.

4.   Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal

5. Educational Development, 33 (3): 272–282.

6. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education.Oxford and Boston: Blackwell.

7. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.

8.   www.pratham.org/images/resource%20working%20paper%202.pdf.

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Course Code	Course Name	L	T	P	C	QP
MECAU2053	Stress Management by Yoga	**2**	**0**	**0**	**0**	A

SYLLABUS

Unit – I   **[8 Hours]**
- Definitions of Eight parts of yog. (Ashtanga)
- Yam and Niyam.
- Do`s and Don't's in life.
- Ahinsa, satya, astheya, bramhacharya and aparigraha
- Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

Unit - II   **[6 Hours]**
- Asan and Pranayam
- Various yog poses and their benefits for mind & body
- Regularization of breathing techniques and its effects-Types of
- pranayam

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Book:
1. 'Yogic Asanas for Group Tarining-Part-I' : Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

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Course Code	Course Name	L	T	P	C	QP
MECAU2054	Personality Development through Life Enlightenment Skills	2	0	0	0	A

SYLLABUS

Unit – I [8 Hours]

Neetisatakam-Holistic development of personality
- Verses- 19, 20, 21, 22 (wisdom)
- Verses- 29, 31, 32 (pride & heroism)
- Verses- 26, 28, 63, 65 (virtue)
- Verses- 52, 53, 59 (dont's)
- Verses- 71, 73, 75, 78 (do's)

Unit - II [6 Hours]

Approach to day to day work and duties.
- Shrimad Bhagwad Geeta : Chapter 2-Verses 41, 47, 48,
- Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5, 13, 17,
- 23, 35,
- Chapter 18-Verses 45, 46, 48.

Unit – III [8 Hours]

Statements of basic knowledge.
- Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68
- Chapter 12 –Verses 13, 14, 15, 16, 17, 18
- Personality of Role model. Shrimad Bhagwad Geeta:
- Chapter2-Verses 17, Chapter 3-Verses 36, 37, 42,
- Chapter 4-Verses 18, 38, 39
- Chapter18 - Verses 37, 38, 63

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Book:

1. "Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit
Sansthanam, New Delhi.

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Course Code	Course Name	L	T	P	C	QP
MECPC2160	**Antennas and Radiating Systems Laboratory**	**0**	**0**	**4**	**2**	A
LIST OF EXPERIMENTS						

1. Simulation of half wave dipole antenna.

2. Simulation of change of the radius and length of dipole wire on frequency of resonance of antenna.

3. Simulation of quarter wave, full wave antenna and comparison of their parameters.

4. Simulation of monopole antenna with and without ground plane.

5. Study the effect of the height of the monopole antenna on the radiation characteristics of the antenna.

6. Simulation of a half wave dipole antenna array.

7. Study the effect of change in distance between elements of array on radiation pattern of dipole array.

8. Study the effect of the variation of phase difference 'beta' between the elements of the array on the radiation pattern of the dipole array.

9. Case study.

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Course Code	Course Name	L	T	P	C	QP
MECPC2170	**Advanced Digital Signal Processing lab**	**0**	**0**	**4**	**2**	A

LIST OF EXPERIMENTS

1. Basic Signal Representation

2. Correlation Auto And Cross

3. Stability Using Hurwitz Routh Criteria

4. Sampling FFT Of Input Sequence

5. Butterworth Lowpass And Highpass Filter Design

6. Chebychev Type I,II Filter

7. State Space Matrix from Differential Equation

8. Normal Equation Using Levinson Durbin

9. Decimation And Interpolation Using Rationale Factors

10. Maximally Decimated Analysis DFT Filter

11. Cascade Digital IIR Filter Realization

12. Convolution And M Fold Decimation &PSD Estimator

13. Estimation Of PSD

14. Inverse Z Transform

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III SEMESTER

Sl. No	Course type	Course Code	Course Name	L	T	P	C
1	PE	MECPE3011	High-performance Networks	3	0	0	3
		MECPE3012	Pattern Recognition and Machine learning				
		MECPE3013	Remote Sensing				
2	OE	MECOE3021	Business Analytics	3	0	0	3
		MECOE3022	Industrial Safety				
		MECOE3023	Operations Research				
		MECOE3024	Cost Management of Engineering Projects				
		MECOE3025	Composite Materials				
		MECOE3026	Waste to Energy				
3	Project	MECES3130	Project – I	0	0	20	10
Total				6	0	20	**16**

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Subject Code	Subject Name	L	T	P	C	QP
MECPE3011	**High Performance Networks**	3	0	0	3	A
	SYLLABUS					

Unit 1:   **[8 Hours]**

Types of Networks, Network design issues, Data in support of network design. Network design tools, protocols and architecture. Streaming stored Audio and Video, Best effort service, protocols for real time interactive applications, Beyond best effort, scheduling and policing mechanism, integrated services, and RSVP-differentiated services.

Unit 2:   **[10 Hours]**

VoIP system architecture, protocol hierarchy, Structure of a voice endpoint, Protocols for the transport of voice media over IP networks. Providing IP quality of service for voice, signalling protocols for VoIP, PSTN gateways, VoIP applications.

Unit 3:   **[4 Hours]**

VPN-Remote-Access VPN, site-to-site VPN, Tunneling to PPP, Security in VPN. MPLSoperation, Routing, Tunneling and use of FEC, Traffic Engineering, MPLS based VPN, overlay networks-P2P connections.

Unit 4:   **[8 Hours]**

Traffic Modeling: Little's theorem, Need for modeling, Poisson modeling, Non-poisson models, Network performance evaluation.

Unit 5:   **[4 Hours]**

Network Security and Management: Principles of cryptography, Authentication, integrity, key distribution and certification, Access control and fire walls, attacks and counter measures, security in many layers.

Unit 6:   **[8 Hours]**

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Infrastructure for network management, The internet standard management framework - SMI, MIB, SNMP, Security and administration, ASN.1.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:
- Kershenbaum A., "Telecommunications Network Design Algorithms", Tata McGraw Hill, 1993.
- Larry Peterson & Bruce David, "Computer Networks: A System Approach", Morgan Kaufmann, 2003.
- Douskalis B., "IP Telephony: The Integration of Robust VoIP Services", Pearson Ed. Asia, 2000.
- Warland J., Varaiya P., "High-Performance Communication Networks", Morgan Kaufmann, 1996.
- Stallings W., "High-Speed Networks: TCP/IP and ATM Design Principles", Prentice Hall 1998.
- Leon Garcia, Widjaja, "Communication networks", TMH 7threprint 2002.
- William Stalling, "Network security, essentials", Pearson education Asia publication, 4th Edition, 2011.

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Subject Code	Subject Name	L	T	P	C	QP
MECPE3012	**Pattern Recognition and Machine Learning**	3	0	0	3	A
	SYLLABUS					

Unit 1:   **[10 Hours]**

Introduction to Pattern Recognition: Problems, applications, design cycle, learning and adaptation, examples, Probability Distributions, Parametric Learning - Maximum likelihood and Bayesian Decision Theory- Bayes rule, discriminant functions, loss functions and Bayesian error analysis

Unit 2:   **[8 Hours]**

Linear models: Linear Models for Regression, linear regression, logistic regression Linear Models for Classification

Unit 3:   **[6 Hours]**

Neural Network: perceptron, multi-layer perceptron, backpropagation algorithm, error surfaces, practical techniques for improving backpropagation, additional networks and training methods, Adaboost, Deep Learning

Unit 4:   **[4 Hours]**

Linear discriminant functions - decision surfaces, two-category, multi-category, minimum-squared error procedures, the Ho-Kashyap procedures, linear programming algorithms, Support vector machine

Unit 5:   **[6 Hours]**

Algorithm independent machine learning – lack of inherent superiority of any classifier, bias and variance, re-sampling for classifier design, combining classifiers

Unit 6:   **[8 Hours]**

Unsupervised learning and clustering – k-means clustering, fuzzy k-means clustering, hierarchical clustering

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:
- Richard O. Duda, Peter E. Hart, David G. Stork, "Pattern Classification", 2nd Edition

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John Wiley & Sons, 2001.

- Trevor Hastie, Robert Tibshirani, Jerome H. Friedman, "The Elements of Statistical Learning", 2nd Edition, Springer, 2009.

- C. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006

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M.TECH ECE (R-2018)

Subject Code	Subject Name	L	T	P	C	QP
MECPE3013	**Remote Sensing**	3	0	0	3	A
	SYLLABUS					

Unit 1: [10 Hours]

Physics Of Remote Sensing: Electro Magnetic Spectrum, Physics of Remote Sensing-Effects of Atmosphere-Scattering–Different types–Absorption-Atmospheric window-Energy interaction with surface features –Spectral reflectance of vegetation, soil and water atmospheric influence on spectral response patterns-multi concept in Remote sensing.

Unit 2: [8 Hours]

Data Acquisition: Types of Platforms–different types of aircrafts-Manned and Unmanned spacecrafts–sun synchronous and geo synchronous satellites –Types and characteristics of different platforms –LANDSAT,SPOT,IRS,INSAT,IKONOS,QUICKBIRD etc

Unit 3: [6 Hours]

Photographic products, B/W, color, color IR film and their characteristics –resolving power of lens and film -Opto mechanical electro optical sensors –across track and along track scanners-multispectral scanners and thermal scanners–geometric characteristics of scanner imagery - calibration of thermal scanners.

Unit 4: [8 Hours]

Scattering System: Microwave scatterometry, types of RADAR –SLAR –resolution – range and azimuth –real aperture and synthetic aperture RADAR. Characteristics of Microwave images topographic effect-different types of Remote Sensing platforms –airborne and space borne sensors -ERS, JERS, RADARSAT, RISAT -Scatterometer, Altimeter-LiDAR remote sensing, principles, applications.

Unit 5: [10 Hours]

Thermal And Hyper Spectral Remote Sensing: Sensors characteristics-principle of spectroscopy-imaging spectroscopy–field conditions, compound spectral curve, Spectral library, radiative models, processing procedures, derivative spectrometry, thermal remote sensing – thermal sensors, principles, thermal data processing, applications.

Unit 6: [4 Hours]

Data Analysis: Resolution–Spatial, Spectral, Radiometric and temporal resolution-signal to noise ratio-data products and their characteristics-visual and digital interpretation–Basic

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principles of data processing –Radiometric correction–Image enhancement–Image classification– Principles of LiDAR, Aerial Laser Terrain Mapping.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:
- Lillesand T.M., and Kiefer,R.W. Remote Sensing and Image interpretation, John Wiley & Sons-2000, 6thEdition

- John R. Jensen, Introductory Digital Image Processing: A Remote Sensing Perspective, 2nd Edition, 1995.

- John A.Richards, Springer –Verlag, Remote Sensing Digital Image Analysis,1999.

- Paul Curran P.J. Principles of Remote Sensing, ELBS; 1995.

- Charles Elachi and Jakob J. van Zyl , Introduction To The Physics and Techniques of Remote Sensing , Wiley Series in Remote Sensing and Image Processing, 2006.

- Sabins, F.F.Jr, Remote Sensing Principles and Image interpretation, W.H.Freeman& Co, 1978

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Subject Code	Subject Name	L	T	P	C	QP
MECOE3021	**Business Analytics**	3	0	0	3	A
	SYLLABUS					

Unit 1: [10 Hours]

Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

Unit 2: [8 Hours]

Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

Unit 3: [6 Hours]

Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling,

Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

Unit 4: [6 Hours]

Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models.

Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

Unit 5: [4 Hours]

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.

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Unit 6:	**[6 Hours]**
Recent Trends in : Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.	

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:
- Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.
- Business Analytics by James Evans, persons Education.

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Subject Code	Subject Name	L	T	P	C	QP
MECOE3022	**Industrial Safety**	3	0	0	3	A
	SYLLABUS					

Unit-I: **[10 Hours]**

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

Unit-II: **[6 Hours]**

Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

Unit-III: **[8 Hours]**

 Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Unit-IV: **[10 Hours]**

 Fault tracing: Fault tracing-concept and importance, decision treeconcept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic,automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

Unit-V: **[6 Hours]**

 Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and

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Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:
- Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
- Maintenance Engineering, H. P. Garg, S. Chand and Company.
- Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
- Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London

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Subject Code	Subject Name	L	T	P	C	QP
MECOE3023	**Operations Research**	3	0	0	3	A
	SYLLABUS					

Unit 1:   **[10 Hours]**

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

Unit 2 :   **[6 Hours]**

Formulation of a LPP - Graphical solution revised simplex method - duality theory – dual simplex method - sensitivity analysis - parametric programming

Unit 3:   **[8 Hours]**

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

Unit 4:   **[10 Hours]**

Scheduling and sequencing - single server and multiple server models – deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

Unit 5:   **[4 Hours]**

Competitive Models,Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:
- H.A. Taha, Operations Research, An Introduction, PHI, 2008
- H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
- J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
- Hitler Libermann Operations Research: McGraw Hill Pub. 2009
- Pannerselvam, Operations Research: Prentice Hall of India 2010

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Course Code	Course Name	L	T	P	C	QP
MECOE3024	**COST MANAGEMENT OF ENGINEERING PROJECTS**	**3**	**0**	**0**	**3**	A

SYLLABUS

Unit – I   **[12 Hours]**
- Introduction and Overview of the Strategic Cost Management Process Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunitycost.
- Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making

Unit - II   **[6 Hours]**
- Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

Unit – III   **[10 Hours]**
- Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

Unit – IV   **[8 Hours]**
- Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Book:
1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting

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4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

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IV SEMESTER

Sl. No	Course type	Course Code	Course Name	L	T	P	C
1	Project	MECES4110	Project Phase – II	--	--	32	16
			Total	--	--	32	**16**