S Y L L A B U S

MASTER OF TECHNOLOGY

TWO YEAR INTERGRATED COURSE

M. Tech. Examination, 2014 - 2016
Electronics & Communication- (Digital Communication)

JODHPUR NATIONAL UNIVERSITY JODHPUR

I SEMESTER

S. No.	Subject Code (New)	Subject	Hrs. / Week				Marks		
			L	T	P	Total	Theory Exam/Viva voce	Internal Assessment	Total
1	MEC101	Digital Signal Processing	4	1	-	6	100	50	150
2	MEC102	Digital and Data Communication	4	1	-	6	100	50	150
3	MEC103	Antenna & Radar Engineering	4	1	-	6	100	50	150
4	MEC104.1	Satellite Communication	4	1	-	6	100	50	150
	MEC104.2	Digital System Design	4	-	-	4			
	MEC104.3	Computer Networks	4	-	-	4			
5	MEC105	Antenna Lab	-		6	6	50	50	100
		Total	**24**		**6**	**38**	**450**	**250**	**700**

II SEMESTER

S. No.	Subject Code (New)	Subject	Hrs. / Week				Marks		
			L	T	P	Total	Theory Exam/Viva voce	Internal Assessment	Total
1	MEC201	Mobile Communication	4	1	-	6	100	50	150
2	MEC202	Advanced Optical Comm.	4	1	-	6	100	50	150
3	MEC203	Image Processing and Pattern Recognition	4	1	-	6	100	50	150
4	MEC204.1	Modern Telephone Switching Systems	4	-	-	4	100	50	150
	MEC204.2	MIMO Theory & Application		1					
	MEC204.3	Embedded System							
5	MEC205	Image Processing Lab	-	-	6	6	50	50	100
		Total	**16**	**4**	**6**	**28**	**450**	**250**	**700**

Jodhpur National University
Faculty of Engineering & Technology
M. Tech. Programme (Digital Communications)
Electronics & Communication
TEACHING/EXAMINATION SCHEME

III SEMESTER

S. No.	Subject Code (New)	Subject	Hrs. / Week				Marks		
			L	T	P	Total	Theory Exam/Viva voce	Internal Assessment	Total
1	MEC301.1 MEC301.2 MEC301.3	Microwave Comm. & Remote Sensing Operating Systems Micro-electro-mechanical-systems (MEMS)	4	2	-	6	100	50	150
2	MEC302.1 MEC302.2 MEC302.3	Neural Networks And Fuzzy Logic Biomedical Electronics DSP Structures for VLSI	4	2	-	6	100	50	150
3	MEC303	Seminar	-	-	6	6			100
		Total	**08**	**04**	**6**	**18**	**200**	**100**	**400**

IV SEMESTER

S. No.	Subject Code (New)	Subject	Hrs. / Week				Marks		
			L	T	P	Total	Theory Exam/Viva voce	Internal Assessment	Total
1	MEC401	Dissertation / Industrial Training/ Project work	-	-	-	-	200	-	200
		Total	**0**	**0**	**-**	**-**	**200**	**-**	**200**

Total Marks: 700 + 700 + 400 + 200 = 2000

I SEMESTER

MEC101 DIGITAL SIGNAL PROCESSING

4L+1T   3 Hours, 100 Mark

Representation of deterministic signals: Orthogonal representation of signals. Dimensionality of signal spaces.

Frequency domain analysis: DFT & its properties. Decimation in time and decimation in frequency FFT algorithms, discrete cosine transform.

Filter Design: IIR Filter design: Butterworth design, bilinear transformation. Low Pass, High Pass, Band Pass and Band Stop digital filters. Spectral transformation of IIR filters. FIR filter design: Symmetric and antisymmetric linear phase. FIR filter by rectangular, triangular and Blackman window functions. Finite word length effects in FIR and IIR digital filters: Quantization, round off errors and overflow errors.

Multi rate digital signal processing: Concepts, design of practical sampling rate converters, Decimators, interpolators. Polyphase decompositions.

Reference Books:
1. Signals And Systems: Continuous And Discrete,RogerE Ziemer,
2. Digital Signal Processing,Sanjit K Mitra
3. Digital Signal Processing : Principals,Algorithms And Applications,John G.Proakis,Dimitris G Manolakis
4. Digital Signal Processing ,A.V. Oppenheim And R.W.Schaffer
5. Digital Signal Processing,Chi-Tsong Chen

MEC102 DIGITAL AND DATA COMMUNICATION

4L+1T   3 Hours, 100 Marks

Characterization of communication signals, signal space representation, equalisation, matched filtering, binary PSK, QPSK, FSK, QAM & M-Ary modulation techniques and their representation. Coherent & non-coherent detection, carrier & symbol synchronization, bits vs symbol error probability, bandwidth efficiency.

Spread spectrum modulation: Pseudo noise sequences, DS & FH spread spectrum.

Shannon's fundamental coding theorems, Differential entropy & mutual information for discrete & continuous ensembles, source coding, Channel coding & decoding: Run length limited codes, LBC, cyclic code, BCH code, convolutional code, Trellis coded modulation, Reed-Solomon code

Reference Books:
1. Data Communication Principles, R.D.Gitlin and others
2. Introduction to Spread Spectrum Communication R.L.Peterson
3. Digital Communication Techniques: Signal Design & Detection Marvin K.Simon
4. ITC & Cryptography, Ranjan Bose

MEC103 ANTENNA & RADAR ENGINEERING

4L+1T   3 Hours, 100 Marks

Antenna: Fundamental parameters of antennas, radiation integrals, potential functions, linear wire antennas, loop antennas. Arrays: linear, planar & circular. Matching techniques. Broad band antennas, Planner antennas, Aperture antennas & Horn antennas, Antenna measurement. Preliminary on antenna synthesis.

Radar Fundamentals, Radar System: Functions and Parameters, Radar Equation, Target and interfacing signals. Target Echo and information extraction, different types of radars, radar antennas, receivers and displays.

Radar signal processing : Introduction, Signal integration, spectrum analysis, windows and resolutions, MT fundamentals, DC-Staggering and processing, high, resolution radar, Special radar topics

Reference Books:
1. Antenna theory, analysis and design, CA balanis.
2. Antennas, JD Kraus.
3. Introduction to radar, MI Skolnik
4. Radar (Principles, Technology and Applications), Byron Edde
5. Antennas & Radio Propagation, RE Collin
6. Travelling wave antenna, CH Walter
7. Antenna & wave propagation, KD Prasad
8. Microstrip Antennas, PS Hall
9. Radar Hand book, MI Skolnik
10. Hand book of radar measurement, DK Barton and HR Ward
11. Radar system design and analysis, Hovanession.

MEC104.1 SATELLITE COMMUNICATION

4L+1T   3 Hours, 100 Marks

Origin of satellite communication current state of satellite communication orbital aspects of satellite communication system performance.

Earth Station Technology: Earth station design using antenna, tracking, small earth station antenna equipment for earth station, video receive only station and frequency co-ordination.

Satellite Link Design Basic Transmission Theory: System noise temp and G/T ratio, design of down links, domestic satellite system using small earth station, uplink design, design of satellite link for specified (C/N)

Multiple Access Techniques: FDMA, Time Division Multiple Access (TDMA) : Frame structure burst structure frame efficiency, super frame, frame acquisition, and synchronization, burst time plan.

Demand Assignment Multiple Access Techniques: Erlang call congestion formula, demand assignment control, DA-FDMA (spade) system, demand assignment TDMA, random access techniques, and miscellaneous access techniques frequency hopping satellite switched TDMA.

Role and Application of Satellite : Satellite application different areas, satellite television, telephone service via satellite, data communication, services, satellite for earth observation, satellite for weather forecast, satellite for scientific studies, satellite for military application.

Propagation on Satellite: Earth Path and its influence on the Design and Advanced Topics, Quantizing attenuation depolarization, interference effect, rain and ice effect, monitoring propagation effects. VSAT technology and mobile satellite Networks

Reference Books:
1. Satellite Comm.,Timothy Pratt
2. Satellite Comm., Dr. DC Aggarwal
3. Satellite Communications, Dennis Roddy

MEC104.2 DIGITAL SYSTEM DESIGN

4L+1T   3 Hours, 100 Marks

Fundamental & history of various hardware description language, Design flow of ASICs and standard logic circuits using software

COMBINATIONAL CIRCUIT BUILDING BLOCKS: Multiplexer, Decoders, encoders, Code Converters, VHDL Code for Combinational Circuits.

SEQUENCIAL CIRCUITS: VHDL code for Flip-Flops, shift registers, counters.

SYNCHRONOUS/ ASYNCHRONOUS SEQUENCIAL CIRCUITS :Mealy & Moore tye FSMs, VHDL Code for Mealy & Moore Machines, VHDL Codes for Serial Adder, Vending Machine.

DIGITAL SYSTEM DESIGN: Building Block circuits, Memory organization, SRAM, Design examples of divider, Multiplier, Shifting & Sorting Operations, Clock Synchronization, CPU organization and design concepts.

Reference Books:
1. Digital Logic Design with VHDL Programming, Brown, Vranesic
2. A VHDL Primer, J.Bhaskar,
3. VHDL Programming by example, Doglous Pery,

MEC104.3 COMPUTER NETWORK

4L+1T   Hours, 100 Marks

Basic elements of a computer network. Computing Models. Network topologies and their features. Characteristics of Peer-to-peer, Server-based, Broadcast, and Point-to-point networks. Characteristic features of LAN, MAN, and WAN.

Network Architecture: Layered network architecture. The OSI reference model. Concepts of layer entities, layer interfaces, service access points, connection oriented/connectionless services, reliable/unreliable services, and service primitives. TCP/IP reference model. ATM reference model.

Physical Layer: Overview of data, signals and channel characteristics. Characteristics and application of various transmission media: Coaxial cable, Twisted pair, Optical fiber and wireless.

Data Link Layer:Design issues for data link layer. Framing, character and bit stuffing. Polynomial code (CRC) for error Detection. Flow-control protocols: Stop-and-wait and Sliding-window. Link protocols: HDLC and SLIP and PPP protocols.

Local Area Networks: Medium Access Control protocols: ALOHA, CSMA.   ,.

Features of IEEE LAN standards: 802.2 (Logical Link Control), 802.3 (CSMA/CO), 802.5 (Token Ring), FDDI. 802.12 (100VG-ANYLAN), 802.11(Wireless LAN), ATM LAN, and Fiber channel. Structure and operation of Hubs, Bridges, Switches, Routers and Gateways.

Operating System: Functions and types of operating systems. Services provided. Structure of an OS. Concepts of Scheduling, and Memory management. Features of network and distributed operating systems. Remote login, Remote file transfer, Data migration, Computation migration, Process migration, Remote services.

Reference Books:
1. Tanenbaum, A.S. Computer Networks, 3rd Ed, PHI
2. Stallings, William Data and Compter Communications, 5th ED, PHI
3. Forouzan Data Communication and Networks, 2nd Ed, Tata Mcgraws Hill
4. Sheldon, Tom Encyclopedia of Networking, TMH

Silberschatz and Galvin Operating System Concepts, 5th Ed, Addision-Wesley

II SEMESTER

MEC201 MOBILE COMMUNICATION

4L+1T   3 Hours, 100 Marks

An overview of wireless communication systems. First generation analog cellular systems, second generation digital cellular systems, third generation systems standards for wireless communications systems. GSM, IMT-2000, UMTS. Mobile Satellite Communication – GEO, LEO, MEO, Terrestrial mobile system.

Cellular communication fundamentals. Cellular systems. Geometry of a Hexagonal Cell. Cochannel interference ratio. Cellular system design in worst case with an omnidirectional antenna, cochannel interference reduction with use of directional antenna. Cell splitting. Frequency and spectrum management and handoffs Access Techniques.

GSM architecture and interfaces. GSM frequency bands, GSM PLMN, GSM PLMN Services, GSM interfaces. The Radio interface MS to BTS. Abis interface (BTS to MSC). Interface BSC to MSC. Data services in GSM. GSM GPRS. Privacy and security in GSM

Radio Propagation and cellular engineering concept. Propagation characteristics. Multipath faded radio signals. Radio link design. Receiver sensitivity and link budget.

Basics of CDMA. Properties and generation of PN sequences. Applications of CDMA to cellular communication systems. Second and third generation CDMA systems/ standards. Multicarrier CDMA. Synchronization and demodulation. Diversity techniques and rake receiver. General study of 4-G and 5-G mobile communication system.

Reference Books:
1. Principles of Mobile Communication Systems, G. Stuber
2. Wireless Information Networks, K. Pahlavan and A. Levesque
3. Principles & applications of GSM, Vijay K. Garg, and J.E.
4. Principal of Mobile Communications, Rappapart

MEC202 ADVANCED OPTICAL COMMUNICATION

4L+1T   3 Hours, 100 Marks

Optical fibers: Review of fundamentals, signal distortion and attenuation, intermodal and intramodal dispersion, dispersion flattened and dispersion compensated fibers, profile dispersion, study of PMD.Laser diode and photodiode. Photodetector, noise analysis.

Optical Amplification and integrated optics: Optical amplifiers, semiconductor laser amplifiers, theory, performance characteristics, fiber amplifiers, rare earth doped fiber amplifiers, raman and brillouin fiber amplifier, integrated optics, planar waveguides, some integrated optical devices, beam splitters, directional couplers and switches, modulators.

Optical couplers: passive optical couplers, Mach-Zehnder interferometer multiplexer, optical add/drop multiplexers, isolators, circulators, optical filters, tunable sources and tunable filters, arrayed waveguide grating, diffraction grating

Optical networks: Network concepts, network topologies, SONET & SDH, high-speed lightwave links, optical add/drop multiplexing, optical switching, WDM network, DWDM examples, mitigation of transmission impairments.

Performance measurement and monitoring: Measurement standards, basic test equipment, optical power measurements,   optical timedomain reflectometer OTDR, Optical switching, WDM networks, optical performance monitoring.

Classification of optical sensors: Intensity modulated, phase modulated and spectrally modulated sensors.

Reference Books:
1. Optical Fiber communication by Senior JM
2. Optical Fiber communication by Gerd Keiser
3. Introduction to Optical Fiber by Allien H. Chairin
4. Optical communication by RM Gagliardi & S. Karp

MEC203 IMAGE PROCESSING AND PATTERN RECOGNITION

4L+1T   3 Hours, 100 Marks

Imaging in ultraviolet and visible band. Fundamental steps in image processing. Components in image processing. Image perception in eye, light and electromagnetic spectrum, Image sensing and acquisition using sensor array.

Image sampling and quantization, Representing digital images, Basic Relationship Between Pixels, Zooming and Shrinking digital images,

Basic Intensity transformation functions, Histogram processing, Fundamental of Spatial Filtering. Smoothning, Sharpening Spetial filters.

Image restoration model, Noise Models, Spatial and frequency properties of noise, noise probability density functions, Restoration in presence of noise - only spatial filter, Mean filter, order Statistic filter and Adaptive filter, Frequency domain filters - Band reject filter, Band pass filter and Notch filter.

Compression Fundamentals - Coding Redundancy, Interpixel redundancy, Psycho visual redundancy and Fidelity criteria. Image Compression models, Source encoder and decoder, Channel encoder and decoder, Lossy compression and compression standards.

Fundamentals, point , edge and line detection., THresholding, Region based segmentation., Region based segmentation, Region Growing & Splitting & merging.

Use of computers in problem solving, information representation, searching, theorem proving, and pattern matching with substitution. Methods for knowledge representation, searching, spatial, temporal and common sense reasoning, and logic and probabilistic inference. Applications in expert systems and robotics.

Reference Books:
1. Digital Image Processing, Gonzalez & Wood
2. Digital Image Processing, A.K Jain,

MEC204.1 MODERN TELEPHONE SWITCHING SYSTEMS

4L+1T   3 Hours, 100 Marks

Electronic space Division switching :- Stored program control (SPC), switching matrices, multistage switching, enhance services photonic switching.

Time Division switching: - Time division space, and time switching, multiplexed switching, combination switching, T-S, T-S-T, switching n-stage combination switching, PBX switching, PBX networking, digital PBX.

Traffic Engg. : - Traffic load , Grade of service, Erlang's formulas, blocking modeling switching systems, Blocking model.

Subscriber Loop, Dialing Systems :- Switching hierarchy & routing, Transmission plan, numbering plan, charging plan, signaling technique.

Local Access Techniques :- Digital subscriber lines, DSL, ADSL etc, WLL, FIL, wireless for local telephone services.

Integrated services digital network: the concept of ISDN, ISDN interfaces and End-user applications, ISDN architecture.

Reference Books:
1. Switching systems & networks, T. Vishwanathan
2. 3.   Telecomm. & the Computers, James Martin
4. The Essential Guide to Telecomm , Annabelz Dodd

MEC204.2 MIMO THEORY & APPLICATION

4L+1T   3 Hours, 100 Marks

Overview of fundamentals of Digital Communications, the wireless channel, detection, diversity and channel uncertainty, capacity of wireless channels, spatial multiplexing and channel modeling, capacity and multiplexing architectures, diversity-multiplexing tradeoff and universal space time codes, multi-user communication.

Reference Books:
1. Fundamentals of Wireless Communications, David Tse, Pramod Viswanath
2. Coding for Wireless Channels, E. Biglieri
3. MIMO Wireless Communication, E. Biglieri

MEC204.3 EMBEDED SYSTEMS

4L +1T   3 Hours, 100 Marks

Introduction, The 8051 microcontroller hardware, I/O pins, Port, External memory, Counters and Timers, Serial data. Interrupts.
Addressing modes, External data moves, push and pop opcodes, Logical operations, Byte level and bit level logical operations. Arithmetic operations, Jump and call instructions, Interrupts & returns.
Interrupts, Multiple sources of interrupts, Non maskable sources of interrupts, Interrupt structure in 8051,Timers,Free running counter & Real Time control .
Serial I/O interface, Parallel I/O ports interface, Digital and Analog interfacing methods, LED array, keyboard, Printer, Flash memory interfacing.
 Application of Microcontrollers in interfacing, Robotics, MCU based measuring instruments. Real Time Operating System for System Design, Multitasking System, Task Definition in a Multitasking System, Round Robin Scheduling, Full Pre-emptive Scheduling, Basic study and Features of Commercial RTOS : WINCE and Embedded Linux.

Reference Books:
1 Microcontroller and Embedded Systems, M. Mazidi
2. Microcontroller. Architecture, Programming, and Applications. Kenneth J. Ayala.

III SEMESTER

MEC301.1 MICROWAVE COMM. & REMOTE SENSING

4L+1T   3 Hours, 100 Marks

Line of sight & troposcatter systems. Communications. Channel characterization, propagation studies, performance requirement, impairments and evolutions of digital and analog communications using Los & troposcatter systems. Design of Los communication systems, link calculation. Characterization of sub systems of line of sight communication system. Theory and system design of troposcatter communication system. Introduction to microwave remote sensing. Theory and principle of microwave remote sensing. Microwave sensors both passive and active microwave, receivers, radionmeters, real aperture radar, synthetic aperture radar, scatterometers, altimeters, antenna system for microwave sensors, characterization of microwave sensors. Data processing of microwave, data applications of passive and active microwave sensors for ocean land and atmosphere from tower aircraft and apace craft.

Reference Books:
1 Introduction to Microwave Remote Sensing, Iain H. Woodhouse
2. Microwave Remote Sensing, F.T. Ulaby, Richard K. Moore, Adrian K. Fung,

MEC301.2 OPERATING SYSTEMS

4L+1T   3 Hours, 100 Marks

Introduction to Operating Systems, Operating system services, multiprogramming, time-sharing system, storage structures, system calls, multiprocessor system. Basic concepts of CPU scheduling, Scheduling criteria, Scheduling algorithms, algorithm evaluation, multiple processor scheduling, real time scheduling I/0 devices organization, I/0 devices organization, I/0 devices organization, I/0 buffering.

Process concept, process scheduling, operations on processes, threads, inter-process communication, precedence graphs, critical section problem, semaphores, classical problems of synchronization. Deadlock problem, deadlock characterization, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock, Methods for deadlock handling.

Concepts of memory management, logical and physical address space, swapping, contiguous and non-contiguous allocation, paging, segmentation, and paging combined with segmentation.

Concepts of virtual memory, demand paging, page replacement algorithms, allocation of frames, thrashing, demand segmentation. Security threads protection intruders-Viruses-trusted system.

Disk scheduling, file concepts, file access methods, allocation methods, directory systems, file protection, introduction to distributed systems and parallel processing case study.

MEC301.3 MICRO-ELECTRO-MECHANICAL-SYSTEMS (MEMS)

4L+1T   3 Hours, 100 Marks

Micro electro mechanical system (MEMS) origins. MEMS impetus/ motivation. Material for MEMS. The toolbox: processes for micro machining. MEMS fabrication technologies. Fundamentals MEMS device physics: Actuation. Fundamental MEMS devices: The cantilever beam.
Microwave MEMS applications: MEM switch design considerations. The micro-machined transmission line. MEMS-based microwave circuit and system.

MEC302.1 NEURAL NETWORKS AND FUZZY LOGIC

4L+1T   3 Hours, 100 Marks

Neural Networks Characteristics. Characteristics of neural networks, Historical development of neural networks principles, Artificial neural networks Terminology, Models of neuron, Topology, Basic learning laws.
Learning Rules: The Perceptron, Linear seperability, Hebbs rule, delta rule, widrow & Hoff LMS rule, Correlation learning rule, instar and outstar learning rules. Unsupervised learning, competitive learning, K-means clustering algorithm, Kohenen's feature maps
Different Neural Network: Basic Learning law in RBF nets, Back propagation method, feed forward network, ART network.
Application of Neural Nets: Pattern recognition, application of BPN, optimization, associative memories, vector quantization, applications in speech & decision making
Fuzzy Logic: Basic concept, fuzzy v/s crisp logic set, variables, membership function, operation's inference, techniques, defuzzification, basic inference algorithm. Application of Fuzzy Logic, Fuzzy system design & implementation.

Reference Books:
1. Neural Computing Theory and Practice, Philip D. Wasserman,.
2. Fundamentals of Artificial Neural Networks Mohamad H. Hassun,
3. Zurada - Artificial Neural Networks
4. Artificial neural networks, Yegna Naryanan
5. Neural networks & Fuzzy Logic, Bart Kosko
6. Neural Network Simon Haykin
7. Satish Kumar , Neural Network
8. Fundamental of Neural Network , Laurent Fauset
9. Fuzzy Logic with Engineering Applications, Timothy J Ross

MEC302.2 BIOMEDICAL ELECTRONICS

4L+1T   3 Hours, 100 Marks

Brief introduction to human physiology. Biomedical transducers: displacement, velocity, force, acceleration, flow, temperature, potential, dissolved ions and gases. Bioelectrodes and biopotential amplifiers for ECG, EMG, EEG, etc. Measurement of blood temperature, pressure and flow. Impedance plethysmography. Ultrsonic and nuclear imaging.

Prostheses and aids: pacemakers, defibrillators, heart-lung machine, artificial kidney, aids for the handicapped. Safety aspects. Telemetry – Transmission of the original through wire & wireless. Imaging techniques – Ultrasound, CAT, X-Rays, PET, NMR, Nuclear. Physiological effect of electric current, safety.

Cardiological Signal Processing: Basic Electrocardiography, ECG data acquisition, ECG lead system, ECG parameters & their estimation, the use of multi scale analysis for parameters estimation of ECG waveforms, Arrhythmia analysis, monitoring, long form continuous ECG recording. ECG data reduction technique, Direct data compression techniques, Direct ECG data compression techniques. Transformation compression techniques. Other data compression techniques. Data compression techniques, comparison.

MEC302.3 DSP Structures for VLSI

4L+1T   3 Hours, 100 Marks

VLSI Architectures for DSP algorithms – Data flow representations, pipelining and parallel processing, retiming, unfolding, register minimization techniques, systolic architectures, algorithms for fast implementation of convolution, FIR, IIR and adaptive filters, DCT, analysis of finite word length effects, Low power design strategies; Architecture, programming and applications of general purpose digital signal processors (Emphasis on TI & AD processors); Application case studies: Speech coding, image and video compression, Viterbi decoding, wireless communication.

Reference Books:

1. VLSI Digital signal processing systems: Design and implementation, K.K. Parhi,
2. DSP Integrated Circuits, Lars Wanhammar,
3. Real-Time Digital Signal Processing: Implementations, S.M. Kuo, B.H.Lee