SYLLABUS

MASTER OF TECHNOLOGY

ELECTRICAL ENGINEERING

SEMESTER SCHEME

Two Year Degree Course

M.Tech. , First Year Examination, 2014-2015

M.Tech. , Second Year Examination, 2015-2016

JODHPUR NATIONAL UNIVERSITY
JODHPUR

JODHPUR NATIONAL UNIVERSITY
(Faculty of Engineering & Technology)
Department of Electrical Engineering
M.Tech. (Control & Instrumentation)

I Semester Scheme

S.No.	Subject Code	Subject	Lectures	Tutorials	Practicals	Exam. H.	Theory		Practicals & Sessionals		Total
							Internal	External	Internal	External	
1	MEE111	Strategic Management	4	2	-	3	50	100	_		150
2	MEE112	Modern Control System	4	2	-	3	50	100			150
3	MEE113	Instrumentation	4	2	-	3	50	100			150
4	MEE114	Fuzzy Logics & Neural Networks	4	2	-	3	50	100			150
5	MEE115	Simulation & Control Lab.	-	-	6	3			50	50	100
Total			16	8	6	15	**200**	**400**			**700**

II Semester Examination Scheme

S.NO.	Subject Code	Subject	Lectures	Tutorials	Practicals	Exam. H.	Theory		Practicals & Sessionals		Total
A. Theory Papers							Internal	External	Internal	External	
1	MEE211	Digital Control System	4	2	-	3	50	100			150
2	MEE212	Non-liner control system	4	2	-	3	50	100			150
3	MEE213	Transducer Technologies	4	2		3	50	100			150
4	MEE214	Elective – 1	4	2		3	50	100			150
5	MEE215	Simulation & Control Lab. - 2	-	-	6	3			50	50	100
		Total	16	8	6	15	200	400			**700**

Note:- List of Elective subject may be amended by Dean, Faculty E&T

	List of Elective Subject 1
	Select Any One
MEE214.1	Instrumentation System
MEE214.2	Telemetry
MEE214.3	Biomedical Instrumentation
MEE214.4	Nuclor Instrumentation & Reactor Control

III Semester Examination Scheme

S.No.	Subject Code	Subject	Lectures	Tutorials	Practicals	Exam. H.	Theory		Practicals & Sessionals		Total
A. Written Papers							**Internal**	**External**	**Internal**	**External**	
1	MEE311	Elective - 1	4	2	-	3	50	100			**150**
2	MEE312	Elective – 2	4	2		3	50	100			**150**
List of Elective Subject 1 Select any one											
	MEE311.1	Remote Sensing & Control System									
	MEE311.2	Optimal Control									
	MEE311.3	Electric Drives & Their Control									
	MEE311.4	Stochastic Control									
List of Elective Subject 2 Select any one											
	MEE312.1	Optical & laser Instrumentation									
	MEE312.2	Space Science Instrumentation									
	MEE312.3	Digital Signal Processing									
	MEE312.4	Real Time Instrumentation Technique									
		Total (A)	8	4	0	6	100	200			**300**
B. Practicals and Sessionals											
3	MEE313	Seminar (Literature Survey & Presentation)	-	-	6	3	50	50			**100**
		Total (B)									
		Grand Total (A+B)									**400**

Note:- List of Elective subject may be amended by Dean, Faculty E&T

IV Semester Scheme

S.No.	Subject Code	Subject	Lectures	Tutorials	Practicals	Exam. H.	Theory		Practicals & Sessionals		Total
							Internal	**External**	**Internal**	**External**	
B. Practicals and Sessionals											
1	MEE411	Dissertation	-	-			100	100			200
		Grand Total					100	100			**200**

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

1st Sem

MEE111 Strategic Management

Teaching Hrs. **Exam. Hrs. : 3 Hrs.**
L-4, T-2, P-0 **Exam Marks: 150 {Internal (50) & University (100)}**

Basics of Management: Scientific management: Fredrick Winslow Taylor; Henry foyal's administrative Management; Managerial Roles; Managerial skills.

a. **Managing Change**: Need for change; Paradigm shifts; Organization inertia; Leadership committed to change; Strategy of managing change; case studies highlighting steps needed for managing change successfully.

b. **Crisis Management**: Contingencies; contingency planning; Visualizing possible majors problems for the organization in the foreseeable future; Preparing an organization and its staff to deal with such problems; case studies.

c. **Innovation and Creativity**: Encouraging creativity at all levels; Innovation; key for future leadership; Innovation for product; process or the organization itself; Increment improvement v/s quantum jump.

d. **Entrepreneurship**: Need of the hour: Entrepreneurship; Developing qualities for entrepreneurship; Calculated Risk; Entrepreneurship within an organization.

e. **Work study and Re-engineering: Productivity**; Methods of improving productivity by changes in the manufacturing process as well as by better utilization of assts; Re-engineering the product process as well as the organizational set up.

f. **Managing Intangibles**: Management at different levels in an organization; Organizational culture; Leadership effective leadership for overall success; Motivation; Developing a diverse workforce; Negotiations within the organization; Attitudes and Behavior.

g. **Communication Skills**: Communication Basic: Written and Verbal communication, Presentation skill, Meetings and their effective; organization; Dealing / Interacting with customers.

h. **Quality and Customer Care**: Quality Management; Reliability of product; Defect and Defect Analysis; Total Quality; Economics of Quality; Quality Standards and ISO-9000; Customer care and important outcome of quality and quality relationship.

i. **Safety and Ergonomics**: Safety its practice at all levels; Safety training; Importance of safety; Cost of neglecting safety; Environment and need to maintain a clean and healthy environment; Ergonomics-a new term combining nature and its inhabitants.

MEE112 MODERN CONTROL SYSTEM

Teaching Hrs. **Exam. Hrs. : 3 Hrs.**
L-4, T-2, P-0 **Exam Marks: 150 {Internal (50) & University (100)}**

Review of matrices and linear vector spaces and their applications. System representation and state functions of Lagrange, Lagrange's equation and Newton's law; Generalized co-ordinates and constraints; choice of state variables.

Introduction to state variable representation of non-linear and time varying systems, linearization of state equations, solutions of state equations of linear time invariant and time varying systems. Control ability and observability of dynamical system. Minimal realization of linear systems.

Liapunov's stability theory for linear dynamical systems

Design of control systems using pole placement method.

Theory of observers, Luenberer observer and its application for control.

MEE113 INSTRUMENTATION

Teaching Hrs. **Exam. Hrs. : 3 Hrs.**
L-4, T-2, P-0 **Exam Marks: 150 {Internal (50) & University (100)}**

1. GENERALIZED APPROACH TO A MEASURING SYSTEM:

Functional description, Input Output configuration, Methods of correction for Interfering and -modifying inputs, predominance characteristic of instruments Error analysis.

2. SYSTEM PERFORMANCE MEASUREMENT:

System inputs; system linearing and distortion, sine wave testing, pulse testing, random signal testing, Pseudo random binary sequences and their applications..

3. FEEDBACK MESURING SYSTEM AND INVERSE TRANSDUCERS:

Feedback for control and measurement, Force and torque balance, current balance, Heat flow balance, voltage balance, temperature balance, Inverse transduces.

4. DATA TRANSMISSION AND TELEMETRY:

Modulation and encoding methods, transmission media, Bandwidth and noise restriction. Statistical measurements, multiplexing.

5. DATA PROCESSING, DISPLAY AND RECORDING:

Data display, Data recording, Data logging, Data acquisition and Data processing.

MEE114 Fuzzy Logics & Neural Networks

Teaching Hrs. **Exam. Hrs. : 3 Hrs.**
L-4, T-2, P-0 **Exam Marks: 150 {Internal (50) & University (100)}**

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, Koheneri'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. .

2nd Sem.

MEE211 Digital Control System

Teaching Hrs. **Exam. Hrs.: 3 Hrs.**
L-4, T-2, P-0 **Exam Marks: 150 {Internal (50) & University (100)}**

Analysis of sampling process, sampling theorem, reconstruction of sampled signals, Z-transform and theorems. Inverse Z-transform, modified Z-transform, pulse transfer function, State variable description of digital systems, state transition matrix, state transition equation, state diagrams, Response of digital system to step, ramp and sinusoidal inputs, Time domain analysis, frequency domain analysis, Effect of poles and zeros in Z-plane, Root locus method.
Stability : Stability tests, Controllability and observability of time invariant and time varying systems, principle of duality.

Design of digital control systems : Dead beat Control, Digital Controllers and their design using linear transformation. Digital PID controller, Design of a controller by pole placement techniques using state feed back and output feedback, Design of Digital state observers.

MEE212 NON-LINEAR CONTROL SYSTEMS

Teaching Hrs. **Exam. Hrs. : 3 Hrs.**
L-4, T-2, P-0 **Exam Marks: 150 {Internal (50) & University (100)}**

Characteristics of non linear systems. types of non linearities. Linearizing approximations. Analytical methods of analysis. Basic concepts of functional analysis. Describing function techniques, derivation of describing function for common non linearities, of the describing functions to determine system stability. Phase Plane methods, construction and interpretation of the phase portrait, evaluation of time from phase trajectory, singular points. Relay Switching errors on the performance of optimized relay servos, Dual mode operation. Stability analysis by methods of Poincare, Liapunov and Popov.

MEE213 Transducer Technologies

Teaching Hrs. **Exam. Hrs. : 3 Hrs.**
L-4, T-2, P-0 **Exam Marks: 150 {Internal (50) & University (100)}**

Theory of operation and performance analysis in time and frequency domains of the following of the following transducers :

Resistive inductive, capactive, magneto-strictive, piezo electric, photoemissive, photo resistive, photo-valtaic, LVDT, electro dynamic, Hall effect, thermo-electric, Optimal design and performance index-realisation. Methods of mounting the transducers, Testing of transducers.

MEE214.1 Instrumentation System

Teaching Hrs. **Exam. Hrs. : 3 Hrs.**
L-4, T-2, P-0 **Exam Marks: 150 {Internal (50) & University (100)}**

Selection of transducers, signal conditioners, data transmitters and receivers, data display and recorders for the instrumentation of the following system :

Nuclear power stations, electric power grid, steel plants, cement factory, textile industry, food processing plants, paper industry, traffic control, biomedical.

MEE214.2 Telemetry

Teaching Hrs. **Exam. Hrs. : 3 Hrs.**
L-4, T-2, P-0 **Exam Marks: 150 {Internal (50) & University (100)}**

Principles of data transmission, Types of telemetry systems, D.C. and A.C. telemetry systems, Voltage and current telemetering.Systems modulation : Amplitude, frequency and phase modulation, Pulse telemetry systems; Pulse amplitude modulation, Pulse frequency pulse duration, pulse position modulation systems. Digital telemetry, Pulse code modulation.Transmission channels and media. Wire line, radio, microwave and power line carrier channels, Multiplexing, Time sharing systems

MEE214.3 Biomedical Instrumentation

Teaching Hrs. **Exam. Hrs. : 3 Hrs.**
L-4, T-2, P-0 **Exam Marks: 150 {Internal (50) & University (100)}**

Basic physiological systems of the human body, Problems encountered in measuring a living system. Generation, propagation and distribution of bioelectrical potentials. Theory of polarizable, and non-polarizable, recording electrodes. Silver silverchloride electrode, impedance considertations. Tissue response to electrode contacts, Different types of electrodes, their equivalent circuits, Saltbridge electrodes. Fluid and metal microelectrodes, Micropipette electrodes.Desirable characteristics of amplifiers for different electro-physiological measurement : Single ended versus differential amplifier. Detailed theory of differential amplifier for bioelectric measurement. Limitation of differential amplifier. Various chopperamplifiers and their advantages and Limitations. Aplifiers for use with high impedance electrodes electrometer and PET circuits. Input capacitance compesation. Principle of driven shield. Vibrating reed electrometer. Characteristics of oscillographs and recorders for biochemical measurements.Discussions of different configurations and circuits used with the methods of recording electrocardiograms, electronic phalograms and electromyograms. Interpretation of these wave forms. Use of wave and spectrum analysis. Electronic methods of the measurement and monitor of blood pressure, blood flow, skin and systematic body temperatures and pulse rate. Patient monitoring systems coronary eare monitoring, operating or recoveryro omnt ensiver -monitoringand prenatal intensive care units. Different types of electronic pace markers and defibrillators. Use of simulators selection of current wave forms.Sources of stimulus artifacts and minimization. Recordings of baseal skin resistance and galvanic skin response. High frequency cauterization. Heat therapy Elements of radiography, fluoroscopy and plethsmography. Simple lase applications in bio-medical instruments, Electrical safety considerations of patients.

MEE214.4 Nuclor Instrumentation & Reactor Control

Teaching Hrs. **Exam. Hrs. : 3 Hrs.**
L-4, T-2, P-0 **Exam Marks: 150 {Internal (50) & University (100)}**

Characteristics of interaction of nuclear radiation with matter. Classification of radiation-detection methods. Theory of integrating and non-integrating ionintegrating chambers. Measuring instruments for mean-level and pulse type ionization chambers.Ionization chambers for dose measurements, neutron detection and reactor-control; Fission PCT, differential compensated chambers, Cuite-Pie monitor.Principles of gas amplification. Theory, construction and application of proportional and G.M. counters. Quenching techniques. Dead, resolving and recovery-times of the ounters, Special characteristics of G.M. counters for B particles, Y and x rays. Proportional counters neutron detection. Simple neutron recoil of counters. Scintillation detector systems, Theory of organic and inorganic scintillators. Photo multipliers. Scientilation counters, Study of electronic circuits used with the various nuclear detectors. Methods of pulse shapping, pulse amplifier circuits and characteristics. Log amplifiers, Effects of S/N ratio on the counter-systems.

Amplitude and phase discriminations. Linear and lognount rate meters. Coincidence circuits. Statistical fluctuations in mean-level and counting detection system. Accuracy of counters and counting effect of finite resolving time. Statistics of coincidence measurement. Meaning ofsource counter, period and power range with regard to nuclear power reactor control. Linear pulse and longs channel reactor instrumentation systems. Basic control diagrams for start up operation and shut down system. Control rod motion system. Reactor safety circuits.

3rd Sem.

MEE311.1 Remote sensing control

Teaching Hrs. **Exam. Hrs. : 3 Hrs.**
L-4, T-2, P-0 **Exam Marks: 150 {Internal (50) & University (100)}**

Nature of electromagnetic radiation – spectral , spatial & temporal characteristics of objects – atmospheric interaction sensors – photographic , thermal , multi-spectral, passive microwave & active microwave sensors – ground data acquisition – photo – interpretation – image processing techniques , remote sensing applications Techniques of remote control ; remote control in industry including oil pipelines, rocket motion & satellite movement

MEE311.2 Optimal Control

Teaching Hrs. **Exam. Hrs. : 3 Hrs.**
L-4, T-2, P-0 **Exam Marks: 150 {Internal (50) & University (100)}**

Interoduction : Formulation of the Optimal Control problem; Performance titerion; Calculus of Variations Approach; Euler's equation, Lagrangian multipliers and contraint equations; Fixed and Varibale end point problems, Transversality conditions, Generalised boundary conditions, Hamiltonian Approach.Bounded input problem, Pontryagin's principle, Deiscrete maximum
principle,Switchingcontrol and switching curves. Closed loop control problem, Hamilton Jacobi equation; Concept of LQ problem, Matrix Ticcatti equation, Second method of Liapunov, Kalman filter approach, Numerical determination of optimal Trajectories, dynamic Programming, Principle of optimality and Bellmann's equation, Application to continuous time and discrete data systems; Minimisation by steepest descent and gradient projection. Computer implementation.

MEE311.3Electric Drives & Their Control

Teaching Hrs. **Exam. Hrs. : 3 Hrs.**
L-4, T-2, P-0 **Exam Marks: 150 {Internal (50) & University (100)}**

Units	Topics	Details of Coverage
I	**Characteristics of Electric Motors**	Characteristics of DC motors, 3-Phase induction motors and synchronous motors, Starting and braking of electric motors
II	**Dynamics of Electric Drives**	Mechanical system, Fundamental torque equations, components of load torques, Dynamic conditions of a drive system, Energy loss in transient operations, Steady State Stability, Load equalization.
III	**DC Motor Drives**	Starting, Braking and Speed Control, Transient analysis of separately excited motor with armature and field control, Energy losses during transient operation, Phase controlled converter fed DC drives, Dual-converter control of DC drive, Supply harmonics, Power factor and ripple in motor current, Chopper Control DC drives, Source current harmonic in Choppers
IV	**Induction Motor Drives**	Starting, Braking and transient analysis, Calculation of energy losses, Speed control, Stator voltage control, Variable frequency control from voltage and current sources, Slip power recovery-Static Scherbius and Cramer drives
V	**Synchronous Motor Drives**	Starting, Pull in and braking of synchronous motors, Speed control – variable frequency control, Cyclo converters control. Brushless DC Motor, Linear Induction Motor, Stepper Motor and Switched Reduction Motor Drives: Important features and applications.
VI	**Energy Conservation in Electrical Drives**	Losses in electrical drive system, Measures for energy conservation in electric drives, Use of efficient motor, Energy efficient operation of drives, Improvement of power factor and quality of supply.

MEE311.4 Stochastic Control

Teaching Hrs. **Exam. Hrs. : 3 Hrs.**
L-4, T-2, P-0 **Exam Marks: 150 {Internal (50) & University (100)}**

Stochastic Signals : Stochastic processes, characterization of stochastic signals : Probability density functions. Ensembles, Ergodic Properties, Gaussian and Poisson distributions, Properties of Autocorrelation and cross-correlation function, Power density spectrum. Analytical determination of correlation functions and power density spectrum.Linear Stochastic system : Input-output relations in terms of correlation functions in time and frequency domains, systems identification by cross-correlation, effect of noise, state space representation.Optimum Linear Systems : Minimization of the mean square error functional, Wiener-Hopf Equation and its solution; Kalman filter.

MEE312.1Optical & laser Instrumentation

Teaching Hrs. **Exam. Hrs. : 3 Hrs.**
L-4, T-2, P-0 **Exam Marks: 150 {Internal (50) & University (100)}**

Deterministic and Stochastic signals, Fourier series analysis. Fast Fourier transform, use of non-sinusoidal (walsh and haar) transform, spectal analysis, correlation analysis, use of correlation for the recovery of signal, Digital filtering, FIR and IIR digital filters. Applications of digital signal processing.

MEE312.2 Space Science Instrumentation

Teaching Hrs. **Exam. Hrs. : 3 Hrs.**
L-4, T-2, P-0 **Exam Marks: 150 {Internal (50) & University (100)}**

Telescope, theory of optics, fundamental design issues, aberrations, standards of measure, realworld examples –Pros and cons of differing approaches and designs Imaging and detectors, fundamentals of semiconductors operations, fundamentals of imaging design and theory, Introduction to CCDs – Nomenclature, noise properties, quantum efficiency,CCD manufacturing and operation, types of CCD's, CCD coatings, analog to digital converters.Characterization of charge-coupled devices: Quantum efficiency, Charge diffusion, Chargetransfer efficiency, Readout noise, Dark current, CCD pixel size, pixel binning, full well capacity,

and windowing, Overscan and bias, CCD gain and dynamic range. Practical observing: filter choice and design, calculations related to CCD, CCD imaging, Image orplate scale, Flat fielding, calculation of read noise and gain, signal to noise ratio, basic CCD data

reduction. Photometry and astrometry: Stellar photometry from digital images, Image centering,Estimation of background, Two-dimensional profile fitting, Difference image photometry,Aperture photometry, Absolute versus differential photometry, High speed photometry,Astrometry. Spectroscopy with CCDs: Review of spectrographs, CCD spectrographs, CCD spectroscopy, Signal-to-noise calculations for spectroscopy, Data reduction for CCD spectroscopy, extendedobject spectroscopy.

MEE312.3 DIGITAL SIGNAL PROCESSING

Teaching Hrs. **Exam. Hrs. : 3 Hrs.**
L-4, T-2, P-0 **Exam Marks: 150 {Internal (50) & University (100)}**

Deterministic and Stochastic signals, Fourier series analysis. Fast Fourier transform, use of non-sinusoidal (walsh and haar) transform, spectal analysis, correlation analysis, use of correlation for the recovery of signal, Digital filtering, FIR and IIR digital filters. Applications of digital signal processing.

MEE312.4 REAL-TIME INSTRUMENTATION TECHNIQUES

Teaching Hrs. **Exam. Hrs. : 3 Hrs.**
L-4, T-2, P-0 **Exam Marks: 150 {Internal (50) & University (100)}**

Online & real time applications of Digital Instruments and Measurement Techniques, Digital voltmeters ramp type, Dual slope type, integrating type, Successive approximation type, Digital counters and timers, Basic elements of a Digital counter, Real time applications to the measurement of pulse counter, Frequency, Frequency ratio, time period, average time interval etc. Real time measurement techniques for measuring power at audio & radio frequencies, Measurement of power at audio & radio frequencies by Electronic wattmeter, three-ammeter, output meter, calorimetric and biometric methods. Real time measurement techniques for measuring the Audio & Radio frequencies and phase angle, Measurement of audio & radio frequencies by CRO method, Wein bridge, monostable multivibrator based direct reading frequency meter, heterodyne method, wave meters and digital frequency counter method, measurement of phase angle, at radio & audio frequencies by CRO method, direct reading phase angle meter and delay time method. Real time application in the Industries, Biomedical engineering etc.