M.Tech.
in
Electrical Engineering
Tripura University
(A Central university)
Tripura, India

syllabus

(Course Structure (Electrical Engineering)

1st Semester: 700

Theoretical Courses	Subject Code	Subject Name	Marks	L	T	P	C	Core/Optional Elective
Paper-I	MEE -901 C	Modern Power System Operation and Control	100 *(70+30)	04	0	0	04	C
Paper-II	MEE -902 C	Modern Control Systems	100 *(70+30)	04	0	0	04	C
Paper-III	MEE - 903C	Nonconventional Energy Sources and Power Generation	100 *(70+30)	03	0	0	03	C
Paper-IV	MEE -904 E	Elective Papers :	100 *(70+30)	03	0	0	03	E
	MEE -904 E1	DSP and Communication Networking						E
	MEE -904 E2	Image Processing						E (Offered by Department of CSE)
	MEE -904 E3	Probability and Random Processes						
	MEE -904 E4	Introduction of Quantum Computing						E
	MEE -904 E5	Fuzzy Set Theory						E (Offered by Department of Mathematics)
	MEE -904 E5	Advance Mathematics						E
Compulsory Foundation Course	Computer Skill III	JAVA Software	100 *(70+30)	04	0	0	**04**	CFC (offered by IT or CSE)
Sessional Courses	**Subject Code**	**Subject Name**	**Marks**					
Sessional 1	MEE 905P	Power system Simulation Lab	100 *(70+30)	0	0	04	02	C
Sessional 2	MEE 906P	Control and Measurement Lab	100 *(70+30)	0	0	04	02	C
Total			700	18	0	08	22	

*70 (Theory) + 30 (Internal Assessment)

2nd Semester: 600

Theoretical Courses	Subject Code	Subject Name	Marks	L	T	P	C	Core/ Elective
Paper-V	MEE- 1001 C	Power Electronics Converters	100 *(70+30)	04	0	0	04	C
Paper-VI	MEE- 1002 C	Power System Protection and Switchgear	100 *(70+30)	04	0	0	04	C
Paper-VII	MEE- 1003 E	Elective Papers :	100 *(70+30)	03	0	0	03	E
	MEE- 1003 E 1	Optical Information Processing						E
	MEE- 1003 E 2	Advance Electrical Drives						E
	MEE- 1003 E3	Smart Grid						E
	MEE -1003 E4	Fuzzy Logic and Application						E (offered by Department of Mathematics)
	MEE -1003 E4	Network Security and Cryptography						E (Offered by Department of CSE)
Paper-VIII	MEE 1004 E	Elective Papers	100 *(70+30)	03			03	E
	MEE -1004 E 1	EMI/EMC						E
	MEE- 1004 E 2	Power Electronics Application in Power System						**E (Offered by Department of CSE)**
	MEE- 1004 E 3	VLSI						E
Sessional Courses	**Subject Code**	**Subject Name**	**Marks**					
Sessional 1	MEE -1005- P	Power Electronics Lab	100 *(70+30)	0	0	04	02	
Sessional 2	MEE -1006 -P	Design Project&Term Paper Leading to Thesis	100 *(70+30)	0	0	04	02	
Total			600	14	0	08	18	

*70 (Theory) + 30 (Internal Assessment)

3rd Semester: 500 Marks

Thesis Identification, Literature Survey and Plan of Work (Thesis: Phase-I)

Subject Code	Subject name	Marks	L	T	P	C	Core/ Elective
EE -1101 C	Thesis Report Interim	100	0	0	04	04	C
EE -1102 C	Thesis Seminar Interim (Presentation & VIVA-VOCE)	200	0	0	04	04	C
EE -1103 C	Technical Communication	100	0	0	04	02	C
EE -1104 C	Workshop and Seminars	100 *(70+30)	0	0	02	02	C
EE -1005 E	Elective Papers	100 *(70+30)	04	0	0	04	E
EE -1005 E1	Artificial Neural Network						E
EE -1005 E2	Fundamental of Business managements						E (offered by MBA Department)
EE -1005 E3	Wireless Communication and Mobile Computing						E (offered by CSE Department)
EE -1005 E4	Special Electrical Machine						E
EE-1005 E5	Advance Electromagnetic & Antenna Theory						E (offered by ECE Department)
Total		600	04	0	10	16	

4th Semester: 400 Marks

Thesis Implementation (Thesis: Phase-II)

Subject Code	Subject name	Marks	L	T	P	C	Core/ Elective
MEE -1201	Thesis Report Final	200	0	0	08	04	C
MEE -1202	Thesis Seminar Final (Presentation &VIVA-VOCE)	200	0	0	08	04	C
MEE -1203	Workshop and Seminars	100 *(70+30)	0	0	02	01	C
MEE -1204 E	Elective Papers	100 *(70+30)	03	0	0	03	E
MEE -1204 E1	Advance Electronics						E (offered by Physics Department)
EE -1204 E2	Bioinformatics Sequence Analysis						E (offered by Molecular Biology & Bioinformatics Department)
EE-1204 E3	Sensor and System						E
Total		600	03	0	16	12	13

Total Credits: 68 Total Marks 2500

Program Outcomes

A post graduate in Electrical Engineering will be able to: -

1. Engineering knowledge:

Apply the knowledge of mathematics, science, electrical engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. Problem analysis:

Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. Design/development of solutions:

Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct investigations of complex problems:

Use research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern tool usage:

Demonstrate their technical ability to design and analyze Electrical Engineering circuits, computer based programs through Logic Controller, PSCAD, ETAP, MATLAB, Lab-VIEW, Open LCA, Arduino and IOT.

6. Environment and sustainability:

Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

7. Individual and team work:

Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

8. Communication:

Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

9. Self learning and entrepreneurship:

Graduate will be able to participate and succeed in campus placements and competitive examinations like Public sector, GATEetc. An understanding of the industry needs through direct exposure with the industries under the Entrepreneurship Development Cell.

10. Higher education and research:

An ability to take interest in higher education, research avenues through various trainings and research laboratory exposure.

Syllabus

1st Semester

MEE 901: Modern Power Systems Operation and Control **100 Marks**

Learning Outcome:

On successful completion of the course students will be able to:

- Know the optimal power flow condition in power system.
- Understand Load frequency Control and Automatic Generation Control and distributed generation.
- Understand the load flow in power system operation.
- Analyze Key Issues in Power System Stability problem and Stability Problems faced by modern Power Systems
- Understand the voltage stability and reliability of the power system under power system operation and control

Syllabus: Operation and control of modern power systems, Power system deregulation; Load flow and stability studies; optimal power flow, distributed generation, magneto hydrodynamic generation, power system reliability, voltage stability.

Books:

1. J.DuncanGlover,M.S.Sharma, T.J.Overbye, " Power System Analysis & Design", Cengage Learning

2. D.P.Kothari, I.J. Nagrath, " Modern Power System Analysis" , Mc Graw Hill, 2016

3. T.K. Nagsarkar, M.S. Sukhija," Power System Analysis", Oxford 2013

MEE 902: Modern Control Systems **100 Marks**

Learning Outcomes:
After successful completion of the course, student will be able to:

- Understand mathematical models of linear discrete-time control systems using transfer functions and state-space models
- Analyze steady state behaviors of discrete time control systems.
- Understand sampled system , Shannon's sampling theorem, Final and Initial value theorem
- Understand the role of Z transform, inverse z transform, and discrete equations, sampler, Holding device
- Student can able to analyze the stability of any discrete data control system
- Analyzes the considered MIMO discrete time system.(State space Model, Controllability , observability)
- Design state feedback controller of considered discrete time control system
- Design compensator and discrete controller for considered system

Syllabus: Sampled data control systems, sampling process, ideal sampler, Shannon's sampling theorem, sampling time selection, zero order hold (ZOH).The z-transform, inverse Z-Transform pulse transfer function of ZOH, system stability, z-plane stability, polar plot analysis, stability analysis using root locus diagrams, Z-plane steady state error analysis, State-space models of discrete time systems, Controllability and Observability, Eigen value assignment by state feedback , Kalman filtering, Lyapunov stability analysis, compensator design.

Books:

1. B.C. Kuo, Digital Control System,Oxford2014
2. K.M.Moudgalya, Digital Control, Wiley India2015
3. Gopal, Digital control and State Variable Methods , Mc Graw Hill,2014

MEE 903: Non-Conventional Energy Sources and Power Generation **100 marks**

Learning Outcomes

The Students will be able to:

- Calculate the amount of solar radiation and to understand the basic concept of solar cell.
- Understand the basic theory of electric power generation from wind energy.
- Know about the methodology and various components used in converting wind energy into electrical energy.
- Understand geothermal energy and its mechanism of production of energy.
- Understand how power is generated from tidal energy, wave energy and ocean thermal energy.

Syllabus: Solar Radiation, availability, measurement and estimation, Solar Thermal Conversion Devices and Storage, Applications. Wind resources and its characterization, stand alone, grid connected applications of WECS, wind farms, wind turbine, electrical generators and converters, Wind energy in India. Tidal Energy, Geothermal Energy, Solar Photovoltaic conversion, Ocean Energy Conversion, Wind Energy Conversion, Biomass Energy Conversion.

Books:

1. *D.P. Kothari, K.C. Singal, Rakesh Ranjan, "Renewable Energy Sources and Emerging Technologies" PHI learning Private Limited, 2016.*

2. *Rakosh Das Begamudre, "Energy Conversion Systems" New Age International (P) Limited, 2014.*

MEE-904 E Digital Signal Processing

Learning Outcomes
The Students will be able to:

- Demonstrate the analytical representation of discrete time signals.
- Apply techniques in time and frequency domain to the analysis and design of discrete time systems.
- Analyze discrete time systems in both time and frequency domain.
- Design and analysis of the frequency response of discrete-time signals and systems.
- Design, Analyze and Implement Digital IIR and FIR filters.

Syllabus: Short introduction- Discrete time systems & signals, z-transform, difference equation, filter design by transformation-impulse and step invariant, bi-linearz-transform, matched z-transform, discrete Fourier transform, state variable model. FIR filter design, frequency windowing technique, Chebyshev and Butterworth criterion. Filter performance and design in presence of noise, FIR filters banks-sub band decomposition. Inverse filtering, Deconvolution, signal reconstruction, time frequency analysis- STFT, WT, DSP hardware-design methodologies, popular architectures and overview of programming application notes. Filter implementation: topology, scalling, co-efficient quantization error, signal quantization, sensitivity analysis.

Books:

1. *Li Tan, "Digital Signal Processing", Elsevier, 2011.*

2. A.V. Oppenheim and Schafer, "Discrete Time Signal Processing", Prentice Hall, 1989.

MEE 904 E3 : Probability and Random Processes
Learning Outcomes:
After successful completion of the course students will be able to:

- Understand the concepts of random variables, probability distributions and independence of random variables.
- Understand the meaning of probability and probabilistic experiment
- Familiarize with the all approaches to probability theory and particularly, the axiomatic approach.
- Understanding the meaning of conditional probability.
- Distinguish between independent and uncorrelated random variables.
- Distinguish between discrete and continuous random variables and be able to represent them using probability mass, probability density, and cumulative distribution function.
- Identify important types of distributions such as exponential, Binomial, Poisson, Normal, and use them as suitable models in basic science and engineering problems.
- Understand the concept of statistical hypothesis and able to solve such type of real life problems.

Syllabus: Sample space and events, Probability axioms, conditional probability, independence of events, Bayes' rule.

1. Random variables - discrete and continuous. Expectations, Moments, Tchebyshev's inequality, Characteristic function. Functions of one random variable.
2. Discrete distributions: Binomial, Poisson, and continuous distributions: uniform, normal, exponential, gamma, Weibull etc.
3. Stochastic convergence and limit theorems.
4. Mean Square Estimation - linear regression.
5. General concepts of stochastic processes, Markov chains, Markov processes
6. Power spectrum, spectral representation, basic spectral estimation,
7. Entropy
8. Random walks, shot noise, deterministic signals in noise,
9. Queuing theory (M/M/1 and M/M/C).

Books:

1. Probability, Random Variables and Stochastic Processes - fourth Edition" by A. Papoulis and S. U. Pillai, McGraw Hill Education (India) Pvt. Ltd., New Delhi.

2. Probability & Statistics with Reliability, Queuing and Computer Science Applications. Kishore S. Trivedi. Eastern Economy Edition, PHI.

3. Stochastic Processes. J. Medhi. 3rd Edition, New Age. International, 2009.

4. Fundamentals *of* Mathematical Statistics*: A Modern Approach. S. C.*Gupta *(Prof.), Dr. V. K.* Kapoor*. Edition, 10. Publisher, Sultan Chand, 2000.*

MEE 904 E4: Introduction of Quantum Computing:

Learning Outcomes:

After successful completion of the course students will be able to:

- Speed: Quantum Computers will deliver enormous speed for specific problems. Researchers are working to build algorithms. To find out and solve the problems suitable for quantum speed-ups.
- Computation: The speed of quantum computers will improve many of our technologies. Especially, that need immense computation power**.** Like Machine Learning, 5G (and even faster internet speeds), bullet trains (and many other transport methods), and many more.

- Big Data: Quantum computing is important in the current age of Big Data. As we need efficient computers to process the huge amount of data we are producing daily.

- Power Reduction: Despite being computational, Quantum computers can reduce power consumption. From 100 to 1000 times they use Quantum tunneling.

Syllabus:

Mathematical foundations and quantum mechanical principles [8 lectures]

a. Finite dimensional inner product spaces, Hermitian and unitary operators, projection operators, commutators
b. Hilbert space as state space, Schrodinger equation and time evolution, measurement, Heisenberg uncertainty relation, Dirac notation, density operators, quantum entanglement

Qubits, quantum gates and quantum circuits [20 lectures]

c. Concept of qubit, representation of qubit in Bloch Sphere, Multi qubit quantum state representation

d. Single, Two and Multi-qubit quantum gates, Matrix representation of gates, universal gates for quantum computing
e. Quantum Circuit, Reversible Computation using quantum circuits, quantum parallelism, quantum circuit representation, quantum computing language (QCL) for quantum process description, Quantum Circuit description languages
f. Quantum Adder Circuits, Quantum Fourier transform Circuit, Quantum Multiplier, Quantum Shift register.
g. Quantum Physical Machine Description, Quantum Circuit Cost.
h. Synthesis techniques for quantum circuit

Quantum algorithms [12 lectures]

i. Elements of quantum automata and quantum complexity theory.
j. Deutsch's algorithm, Deutsch-Jozsa Algorithm and the Bernstein-Vazirani Algorithm, Simon's algorithm
k. Quantum Fourier transform, Shor's Algorithm and its applications.
l. Grover's algorithm for searching and its applications.

Books:
1. Quantum Computation and Quantum Information by Michael Nielsen and Isaac Chuang, Cambridge Univ. Press.
2. P. Kaye, R. Laflamme, and M. Mosca, "An introduction to Quantum Computing", Oxford University Press

Good lecture notes:

John Preskill's lecture notes-http://www.theory.caltech.edu/people/preskill/ph229/

David Mermin's lecture notes-http://people.ccmr.cornell.edu/mermin/qcomp/CS483.html

MEE 905P **Power System Simulation Lab** **100 Marks**

Learning Outcomes
On successful completion of The Students will be able to:

- Students can do the experiments on Ferranti effect, solar power system, wind farm system, Hydro-electric power plant etc. with the MATLAB simulink.
- $[Y]_{bus}$ formation , Load analysis , fault analysis , etc can also been done by this MATLAB simulink .

MEE 906P **Control and Measurement Lab** **100 Marks**

Learning Outcomes
On successful completion of The Students will be able to:

- Learn the basics of a digital control system
- Understand sampling process and aliasing problem
- Learn how to convert from continuous-time to discrete-time system and use of discrete-time transfer function

- Measurement of level in a tank using capacitive type level probe
- Characterize the LVDT
- Characterize the strain gauge sensor

2nd Semester

MEE 1001: Power Electronics Converters **100 marks**

Learning Outcomes
On successful completion of The Students will be able to:

- Understand Theoretical knowledge on modern day semiconductor devices, their characteristics and control.
- Understand theoretical knowledge on modern day semiconductor devices, their characteristics and control.
- Understand operation and analysis of DC-DC,AC-DC and DC-AC converters and their designing.
- Identify the critical areas in application levels and select suitable power converters to control such applications

Syllabus:AC-DC Converters, DC-AC converters, buck, boost, buck-boost, cuk, fly back configuration, resonant converters, PWM inverters; active filters.

Book:
1. Mohan,Undeland,Riobbins, "Power Electronics". Wiley, 2014

MEE 1002: Power System Protection and Switchgear **100 Marks**

Learning Outcomes
On successful completion of The Students will be able to:

- Describe the protection schemes used for protection of generator, motor and transformer.
- Differentiate between different types of relays including distance, directional and differential relays.
- Explain the working principle of static relays.

- Knowledge of various types of existing
- Explain the design and constructional details of circuit breakers.
- Explain different types of numerical protection and microprocessor based digital protection.

Syllabus: Protection of generators: under frequency, loss of excitation, loss of prime mover, rotor earth fault, pole slipping, over speed, unbalanced loading; Protection of Transformer: generalized differential protection, protection due to switching surge, Earth fault, over current, over fluxing protection; overcurrent, directional, differential and distance protection, current transformer & potential transformer, Power swing conditions, Static Relays: current, voltage and impedance relays, Motor protection relay, Computer and microprocessor applications in protection schemes, Numerical relays, Advanced topics in Circuit Breaker.

Book:

1. *Bhavesh Bhalja, R.P. Maheshwari, Nilesh G. Chothani "Protection and Switchgear", Oxford University press, 2013.*
2. *Badri Ram, D.N. Vishwakarma "Power System Protection and Switchgear", McGraw Hill Education (India) Private Limited, 2014.*

MEE 1003E : Smart Grid **100 Marks**

Learning Outcomes
On successful completion of The Students will be able to:

- The definitive solution for managing the grids of the future.
- Energy savings through reducing consumption.
- Better customer service and more accurate bills.
- Fraud detection and technical losses.
- Reduced balancing cost.
- Levelling of the demand curve (Peak reduction)

Syllabus: The Smart Grid, Smart Grid Communication and Measurement Technology-Monitoring, PMU, Smart Meters, GIS and Google Mapping Tools, Multiagent Systems (MAS) Technology, Components of Smart Grid, Smart Grid Benefits and Challenges, Performance Analysis Tools for Smart Grid Design, Stability Analysis Tools for Smart Grid, Information Security for the Smart Grid.

Text Books:
(i) Smart Grid: Fundamentals of Design and Analysis; James Momoh; Edition: 2015; Publisher: Wiley India Pvt Ltd
(ii) The Advanced Smart Grid:Edge Power Driving Sustainability ; John Cooper; Edition: 2011; Publisher: Artech House Publishers
(iii) The Smart Grid; Clark W Gellings; Edition: 2009; Publisher: T&F
(iv) Smart Grid Technology and Applications; Janaka Ekanayake, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, Nick Jenkins; Edition: 2015; Publisher: Wiley India Pvt Ltd
(v) Smart Grids- Engineering and Management; Jean-Claude Sabonnadiere; Edition: 2011; Publisher: Wiley

EMI/EMC -1004 E 1: EMI/EMC (Electromagnetic Interference /Electromagnetic Coupling)

Learning Outcomes:
After successful completion of the course students will be able to:

- Understand EMC regulation and methods of eliminating interferences
- Explain about the Methods of grounding of cable shield

- Examine the phenomena of wave propagation in different media and its interfaces and in applications of microwave engineering.

Syllabus:
Module-A:

Introduction To EMC - Concepts of EMC, EMC units.
EMC requirements for electronic systems - World regulatory bodies- FCC, CISPR etc. Class-A devices, class-B devices.
Regulations of the bodies on EMC issues. 3 lectures

Module-B:

Different Mitigation Techniques for preventing EMI.
Grounding: Fundamental grounding concepts, Floating ground, Single-point & Multi-point ground, advantages & disadvantages of different grounding processes.
4 lectures

Module-C:

Shielding: Basic concepts of shielding, Different types of shielding, Shielding effectiveness(S.E), S.E of a conducting barrier to a normal incident plane wave, multiple reflection within a shield, mechanism of attenuation provided by shield,
shielding against magnetic field & Electric field, S.E for Electronic & Magnetic material, Skin-depth, S.E for far-field sources, shield seams.
8 lectures

Module-D:

Non-ideal behavior of different electronic components.
Ferrites.
EMI/EMC materials and components.
3 lectures

Module-E:

Characteristics of antennas, fields due to short electric dipole & small magnetic pole, near field & Far-field sources & their characteristics 4 Lectures

Module-F:

EMC measurement set, Power losses in cable, calculation of signal source output for a mismatched load.
3 lectures

Module-G:
Measuring & Test systems, Test facilities, measurements of radiated emission in open test range & in Anechoic chamber, Conducted emission testing by Line Impedance Stabilization network (LISN).
4 lectures

Module-H:

EMP & ESD 4 lectures

Module-I:

PCB wire line with skin depth, grounding multi-point& single point, SMT & through hole.
3 lectures

Total 37 lectures

May be added:

*Transient suppression systems 2 lectures

*Case studies 3 lectures

* EMI filters 3 lectures

*Gaskets 1 lecture

*Sources of conducted & radiated noise. Nature & treatment 3 lectures

*Coupling 1 lecture

MEE- 1004 E 2 :Power Electronics Applications in Power Systems 100 marks

Learning Outcomes

On successful completion of The Students will be able to:

- Understand the classification of FACTS controllers depending upon different parameters.
- Learn the benefits of using FACTS controllers.
- Understand the basic principle some FACTS device such as SVC, STATCOM, TCSC, SSSC and UPFC.

Syllabus: Steady state and dynamic problems in AC systems, Flexible AC transmission systems (FACTS). series and shunt compensation, Static Var compensators (SVC), Thyristor Controlled series compensators (TCSC), Static phase shifters (SPS), Static compensator (STATCOM), Static synchronous series compensator (SSSC) and Unified power flow controller (UPFC), Modelling and Analysis of FACTS controllers. Control strategies to improve system stability.; Power Quality problems in distribution systems, harmonics, harmonics creating loads, modeling, harmonic propagation, Series and parallel resonances, harmonic power flow, Mitigation of harmonics, filters, passive filters, Active filters, shunt, series hybrid filters, voltage sags & swells, voltage flicker, Mitigation of power quality problems using power electronic conditioners.

Book:

1. K.R. Padiyar*"FACTS Controllers in Power Transmission and Distribution", New Age International Publishers, 2007.*

MEE- 1004 E 3: VLSI 100 Marks

Learning Outcomes:

After successful completion of the course, student will be able to:

- Explain the basic theory of crystal growth, wafer fabrication and IC fabrication technology.
- Explain the different VLSI design styles, overview of ICs and fabrication steps of MOS, CMOS and BJT.
- Design and analyse the output characteristics of different MOS inverters.
- Design combinational and sequential circuit.

Syllabus: Introduction to VLSI Design, Design Styles and parameters, popular technologies. Logic implementation with nMOS, CMOS. DCVS and PLAs. Pass vs.transistorlogic,transit time, clocking, scaling, PLA minimization and folding, SIMPLIFY, ESPRESSO. Testability Issues. Physical Design algorithms: Partitioning, Floor planning and placement, Routing, compaction, gate arrays, FPGAs, MCMs. Data structures for layout desing -MAGIC. Design Rule checking, Expert systems, symbolic layout, complexity of layout algorithms.

MEE -1005- P **Power Electronics Lab** **100 Marks**

After successful completion of the course, student will be able to:

- Understand the basics of Power Electronics
- Learn the details of power semiconductor switches (Construction, Characteristics and operation). Understand the working of various types of converters.
- Learn how to analyse the converters and design the components of them, under various load types.
  Llearn about the control of various converters.

MEE -1006 -P **Design Project & Term PaperLeading to Thesis** **100 Marks**

Learning Outcomes:

After successful completion of the course, student will be able to:

- Identify the project of their expertise domain and interest.
- Explain the recent trend of research and its recent developments through literaturesurvey
- Make an in-depth study of a specific topic within suitable engineering design and specifications.

3rd Semester

MEE 1105 E4: Special Electrical Machines **100 Marks**

Learning Outcomes:

After successful completion of the course, student will be able to:

- Develop various types of models used for synchronous machines like, hydro, steam turbine, governors & excitation systems.
- Understand the construction, connections, principle of operation of three-phase &single phase induction motor.
- Understand equivalent circuits representation of three phase &single phase induction motor. Understand calculation of the performance characteristics (current/speed and torque/speed) of the three-phase &single phase induction motor.
- Understand the starting and speed control methods of three-phase induction motor.
- Understand the construction, connections, principle of operation of single-phase induction and special purpose motors.
- Perform tests on synchronous and induction machines.

Syllabus: Linear motors: Basic principle of operation and types, End effects & transverse edge effects, Field analysis & Propulsion force, equivalent circuit. Induction generators: self excitation requirements,

steady state analysis, voltage regulation, different methods of voltage control, application to mini and micro hydel systems. Doubly fed induction machines: control via static converter, power flow, voltage/frequency control (generation mode), application to grid connected wind and mini/micro hydel systems. Brushless DC Machines: construction operation, performance, control and applications. Switched reluctance motor (SRM): Construction, importance of stator & rotor arc angles, position sensor & indirect rotor position sensing, torque expression, steady state and dynamic performance. Permanent magnet, Hysteresis & reluctance motors, Recent developments in electrical machines.

MEE 1105 E5: Advanced Electromagnetic& Antenna Theory 100 Marks

Learning Outcomes:
After successful completion of the course, student will be able to:

- Recall electromagnetic plane waves. Apply principles of electromagnetic to explain antenna radiation. Explain various antenna parameters.
- Explain antenna as a point source. Design antenna patterns for different cases.
- Explain dipole antennas. Establish mathematical equations for various parameters of thin linear antenna.
- Explain loop, slot, patch and horn antennas. Derive expressions for the parameters of loop and slot antennas.

Syllabus:
Electromagnetics:
Vector analysis, The static electric field, Energy, potential and capacitance, The static electric field in dielectrics, The steady electric current, The steady magnetic field, Time varying fields and Maxwell's equations, Electromagnetic waves.

Microwave & Wireless antenna Theory:
Printed Antennas : Microstrip Antennas: Basic configuration and advantages; Radiation mechanism; Analysis and CAD; Basic characteristics; Feeding techniques; Broad banding techniques; Phased arrays; Printed antennas for mobile and portable wireless equipment; Reconfigurable antennas, wearable antenna, antennas for RFID systems.

Dielectric Resonator Antennas (DRA): Dielectric Resonators, modes, radiation mechanisms, feeding mechanisms, characteristics, design and applications; materials for DRA, integration with active devices, challenges in RFIC designs.

Ultra wideband (UWB) Antennas: Monopole antennas, UWB Slot antennas, Loop antennas, Tapered slot antennas, Impulse Radiating antennas, Conical antennas, Frequency independent antennas, basic principles and characteristics, Radiation mechanisms.

Antennas for special applications: Antennas for on-board systems, antennas for medical applications, antennas for radiometry and remote sensing.

Antenna Measurements: Basic principles, antenna radiation measurements using anechoic chamber and compact range techniques, measurements of antenna patterns, gain, and efficiency, measurement circularly polarized antennas.

Text Books
1. Elements of Electromagnetics; Mathew N.O. Sadiku, Oxford University Press, 5th Edition(2010)
2. Electromagnetic Waves & Radiating Systems, EC Jordan & K.G. Balmain; Pearson Education, 2nd Edition (2009)
3. Microstrip Antenna Design Handbook- Ramesh Garg; Artech House (2001)
4. Antenna (for all application), John D. Kraus and Ronald J. Marhcfka; Tata- MacGraw Hill, 3rd Edition

5. Antenna & Wave Propagation, K.D Prasad; Satya Prakashan, New Delhi, 3rd Edition
6. Antenna Theory: Analysis & Design, Constantine A. Balanis; Willey, 3rd Edition

MEE 1101C Thesis Report Interim 100 Marks

Course outcomes:

- Understand that how to write thesis with good readability
- Learn to write section wise.
- Understand the skills needed while writing a thesis
- Ensure the quality of thesis report

MEE 1102C Thesis Seminar Interim(Presentation & Viva Voce) 200 Marks

- Synthesize knowledge and skills previously gained and applied to an in-depth study and execution of new technical problem.
- Identify from different methodologies, methods and forms of analysis to produce a suitable research design, and justify their design.
- Demonstrate the findings of their technical solution in a written report.
- Present the work in International/ National conference or reputed journals.

MEE 1103C Technical Communication 100

Course outcomes:

- Understand that how to improve your writing skills and level of readability
- Learn about what to write in each section
- Understand the skills needed when writing a Title
- Ensure the good quality of paper at very first-time submission

MEE 1104C Workshop andSeminars 100Marks

Course outcomes:

- Follow discussions, oral arguments, and presentations, noting main points or evidence and tracking threads through different comments
- Prepare appropriately to participate effectively and offer substantive repliesto others' arguments, comments, and questions, while remaining sensitive to the original speaker and the classroom audience
- Speak and debate with an appreciation for complex social and technical sensibilities
- Offer compelling, articulate oral arguments, showing an understanding of the unique demands of oral presentation as opposed to writing

4th Semester

MEE 1204 E3 Sensors and Systems **100 Marks**

Learning Outcomes:
After successful completion of the course, student will be able to:

- Classify and explain with example of sensors, transducers and actuators.
- Predict the expected performances of various sensors
- Locate different type of sensors used in real life
- understand of sensor interfacing with microcontroller
- Explain working Principles of different types of sensors.

Syllabus: Sensor characteristics; R, L and C sensors: Hall Effect sensors; piezoelectric sensors; Micro-sensors. Sensors for displacement, pressure, temperature, flow etc Optical sensors, chemical and bio-sensors, Sensor applications in non-destructive testing, Interfacing sensors with microprocessors and micro controllers.

Texts/References
1. Jon S. Wilson, Sensor Technology Handbook, ELSEVIER
2. Subhas Chandra Mukhopadhyay, Aimé Lay-Ekuakille, and Anton Fuchs, New Developments and Applications in Sensing Technology,Springer.

MEE 1201C **Thesis Report Final** **200 Marks**

Course outcomes:

- Understand that how to write thesis with good readability
- Learn to write section wise.
- Understand the skills needed while writing a thesis
- Ensure the quality of thesis report

MEE 1202C **Thesis Seminar Final(Presentation and Viva Voce)** 200Marks

Course Outcome:

- Synthesize knowledge and skills previously gained and applied to an in-depth study and execution of new technical problem.
- Identify from different methodologies, methods and forms of analysis to produce a suitable research design, and justify their design.
- Demonstrate the findings of their technical solution in a written report.
- Present the work in International/ National conference or reputed journals.

MEE 1203C **Workshop andSeminars** **100Marks**

Course outcomes:

- Follow discussions, oral arguments, and presentations, noting main points or evidence and tracking threads through different comments

- Prepare appropriately to participate effectively and offer substantive repliesto others' arguments, comments, and questions, while remaining sensitive to the original speaker and the classroom audience
- Speak and debate with an appreciation for complex social and technical sensibilities
- Offer compelling, articulate oral arguments, showing an understanding of the unique demands of oral presentation as opposed to writing