SEMESTER IV

Sl. No	Code	Title	L	T	P	C	Category
1	MA2002	Maths – IV	3	1	-	3	BS
2	EE2005	Circuits & Networks	3	-	-	3	PT
3	EE2006	Applied Electromagnetics	3	-	-	3	PT
4	EE2007	Electrical Machines – I	3	-	-	3	PT
5	EE2008	Analog Electronic Circuits & Systems	3	-	-	3	PT
6	ME2007	Mechanical Engineering	3	-	-	3	PT
7	EE2092	Electrical Measurements Lab	-	-	3	2	PT
8	EE2093	Electronics Lab II	-	-	3	2	PT
			18	**1**	**6**	**22**	

BRIEF SYLLABI

EE2005 CIRCUITS & NETWORKS

Pre-requisites: ZZ1001 Basic Electrical Sciences
EE1001 Introduction to Electrical Engineering

L	T	P	C
3	0	0	3

Generalization of time-domain analysis technique for higher order circuits- s-domain Analysis of Circuits - Nodal Admittance Matrix and Mesh Impedance Matrix in the s-domain - circuits with mutual inductance – Generalization of Circuit theorems – Input and transfer immittance functions - Transfer functions - Impulse response and Transfer function - Poles and Zeros - Pole Zero plots – Stability and poles- - frequency response function from s-domain transfer and immittance functions – frequency response of first and second order circuits Graphical evaluation of frequency response function from pole-zero plots, – frequency response specifications for second order functions – correlation between time-domain specs and freq-domain specs in the case of first order and second order circuits. - Bode plot approximation - Frequency response of an ideal and non-ideal two-winding transformer, tank circuits. - three-phase unbalanced sources – symmetrical transformation
Fourier Series -Steady State Solution of Circuits with non-sinusoidal periodic inputs - power and rms value of non-sinusoidal waveforms, Discrete Power Spectrum, THD measure for waveforms. Fourier Transforms - Parseval's theorem - Linear distortion in signal transmission context – Two Port Networks - Two port networks-characterization in terms of impedance, admittance, hybrid and transmission parameters - Symmetrical Two Port Networks - T and Π Equivalent of a two port network – characteristic impedance and propagation constant of a symmetrical two port network - properties of a symmetrical two port network. - Symmetrical Two Port Reactive Networks as Filters - Filter fundamentals-pass and stop bands-behaviour of iterative impedance-Constant-k low pass filter-Constant-k high pass filter- m-derived T and Π sections and their applications for infinite attenuation and filter terminations-constant-k band pass and band elimination filters.

Total Hours: 42 Hours

EE2006 APPLIED ELECTROMAGNETICS

Pre-requisites : Nil

L	T	P	C
3	0	0	3

The Co-ordinate Systems and revision of vector calculus- Electrostatics : Electric Flux and Flux Density; Gauss's law -Energy and Potential . - Capacitors and Capacitances- Method of Images. Steady Electric Currents: -The Equation of Continuity . Joules law- Magnetostatics : The Biot-Savart law. Amperes' Force Law - Magnetic Vector Potential .- Ampere's Circuital law. - Faraday's Law of Induction; Self and Mutual inductance . Maxwell's Equations from Ampere's and Gauss's Laws. Maxwell's Equations in Differential and Integral forms; Equation of Continuity. Concept of Displacement Current. Electromagnetic Boundary Conditions -Poynting's Theorem , Time – Harmonic EM Fields . -Plane wave Propagation : Helmholtz wave Equation-Plane wave solution.-Plane wave propagation in lossless and lossy dielectric medium and conducting medium . Polarization of EM wave - Linear, Circular and Elliptical polarization. Boundary Conditions-Transmission Lines. LCR ladder model for transmission lines. The transmission line equation. -Solution for lossless lines. Wave velocity and wave impedence. Reflection and Transmission coeffcients at junctions. VSWR. Introduction to electromagnetic interference and compatibility

Total Hours : 42 Hours

EE2007 ELECTRICAL MACHINES I

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Electromagnetic Machines - fundamental principles - classification - DC machines - construction - principle of operation - methods of excitation - commutation - armature reaction - generators - power flow diagram - circuit model - performance characteristics - parallel operation - applications - motors - power flow diagram - circuit model - performance characteristics - starting - speed control - testing - permanent magnet DC motor -

applications - transformers - types - construction - principal of operation - parallel operation - testing - different connections of three phase transformers - cooling methods.

Total Hours : 42 Hours

EE2008 ANALOG ELECTRONIC CIRCUITS & SYSTEMS

Pre-requisites: EE2004 Basic Electronic Circuits

L	T	P	C
3	0	0	3

Feedback Amplifiers ,Stability and Oscillators - BJT and MOSFET Differential Amplifiers-Operational amplifier-ideal opamp properties-properties of practical opamps (LM741,LM324,LM358,LF351and OP07)-CMOS Operational Amplifiers – Analysis of opamp circuits using ideal opamp model-Basic linear applications-Series Voltage Regulators-Monolithic Regulators-Three terminal regulators-Regenerative Comparator Circuits -Square, Triangle and Ramp Generator Circuits unction - Principles of VCO circuits-Astable and Monostable Circuits, Sweep circuits, Staircase waveform generation, Timer ICs –Nonlinear Applications-Phase Locked Loops-Active Filtering-Butterworth Low Pass Filter Functions--Sallen and Key Second Order LP Section-Butterworth High Pass Filters-Second Order Wide Band and Narrow Band Bandpass Filters. Multiple Feedback Single OPAMP LPF,HPF & BPF.- Analog Switches-Sample and Hold Amplifier-Data Conversion Fundamentals-D/A Conversion-A/D conversion-

Total Hours : 42 Hours

ME2007 MECHANICAL ENGINEERING

L	T	P	C
3	0	0	3

Pre-requisite: nil

Laws of thermodynamics, Engineering Applications of Laws, Carnot cycle, Otto cycle, Diesel cycle, Rankine cycle, Brayton cycle, Principle of internal combustion engines, Refrigeration principles -- vapour compression and absorption refrigeration systems, Psychrometric processes – applications, Fluid flow, Continuity equation, Momentum equation, Energy equation – applications, Flow measurement, Friction in fluid flow, Fluid machines-turbines – pumps -- Cavitation in fluid machinery, Conversion technology of conventional and non-conventional energy sources, Steam power plant, Hydel power plants, Gas turbine power plant, Internal combustion engine power plant.

Number of Hours: 42

EE2092: ELECTRICAL MEASUREMENTS LABORATORY

Pre-requisites: EE2003 Electrical Measurements

L	T	P	C
0	0	3	2

Determination of B-H curve μ_r - H curve and μ_r - B curve of an iron ring specimen -Calibration of magnetic flux meter using standard solenoid, search coil and Hibbert’s magnetic standard -Measurement of resistances, capacitance,inducatnce, calibration of meters -Determination of hysteresis loop of an iron ring specimen using 6-point method and CRO -Measurement of branch and node voltage of a given R-L-C circuit using AC potentiometer.- Measurement of candle power of given light sources. Determine the illumination levels at different working planes and verify laws of illumination - Determination of MSCP of an Incandescent lamp/CFL - Determination of the polar curve of candle power distribution and hence find MHCP/MSCP of light sources.

Total Hours : 42 Hours

EE2093 ELECTRONICS LAB II

Pre-requisites : None

L	T	P	C
0	0	3	2

Opamp Linear and non-linear circuits – PLL Applications – Astable and Monostable Circuits – Combinational and Sequential Circuits

Total Hours : 42 Hours

DETAILED SYLLABI

EE2005 CIRCUITS & NETWORKS

Pre-requisites: ZZ1001 Basic Electrical Sciences
EE1001 Introduction to Electrical Engineering

L	T	P	C
3	0	0	3

Total Hours: 42 Hours

Module 1: – Circuit Analysis in Time-domain and *s*-domain (10 hours)
Time Domain Analysis of Circuits -
Solution of multi-mesh and multi-node circuits (containing RLCM and linear dependent sources) by differential equation method - Determination of initial conditions – Obtaining step response and ramp response of circuits from impulse response – Generalization of time-domain analysis technique for higher order circuits-
[*Review of Laplace Transforms* **-** Laplace Transform -Transform Pairs-Gate Functions-Shifting Theorem-Solution of Differential Equations by Laplace Transforms - Initial and Final Value Theorems-Laplace Transforms of periodic signals-Inversion of transforms by partial fractions-Convolution Theorem and Convolution Integral. *(Review to be done by students. No class hour will be spent for this review. Home assignments will be given.)*]
s-domain Analysis of Circuits **-** Transformed equivalent of inductance, capacitance and mutual inductance - Impedance and admittance in the transform domain – concept of the transformed circuit in *s*-domain –
Node Analysis and Mesh Analysis of the transformed circuit - Nodal Admittance Matrix and Mesh Impedance Matrix in the s-domain
Solution of transformed circuits with mutual inductance – step response of an ideal trnsformer – step response of a non-ideal transformer – flux expulsion by short circuited winding –instantaneous change in current in coupled coil systems.
Generalization of Circuit theorems –
Input and transfer immittance functions - Transfer functions - Impulse response and Transfer function - Poles and Zeros - Pole Zero plots – Stability and poles

Module 2: - Sinusoidal Steady-State Frequency Response (12 hours)
Concept of sinusoidal steady-state and frequency response function – frequency response function as a complex function of w as evaluated from phasor equivalent circuit - frequency response function from *s*-domain transfer and immittance functions - explanation for substituting $s = jw$ in *s*-domain transfer function to get frequency response function – frequency response of first order circuits – concept of cut-off frequencies and bandwidth – Series and parallel RC circuits as an averaging filter (for current signal and voltage signal), low-pass filter, high-pass filter, integrator, differentiator, signal coupling circuit, signal bypassing circuit etc. –
Graphical evaluation of frequency response function from pole-zero plots, introduction to filtering and illustration of graphical evaluation of frequency response function from pole-zero plots in the case of standard second order filter functions using Series RLC and Parallel RLC Circuits – frequency response specifications for second order functions – correlation between time-domain specs and freq-domain specs in the case of first order and second order circuits.
Frequency response and bandwidth of cascaded first order circuits with interaction between stages and without interaction between stages.
Bode plot approximation - Transfer function from frequency response data –
Frequency response of an ideal and non-ideal two-winding transformer, tank circuits.
Steady-state analysis of three-phase balanced loads excited by three-phase unbalanced sources – symmetrical transformation – sequence components – sequence impedances – sequence decoupling – power in sequence components.

Module 3: - Fourier Analysis of Circuits (10 hours)
Fourier Series representation of non-sinusoidal periodic waveforms
[*(revision)* - Fourier Coefficients-Determination of Coefficients-Waveform Symmetry-Exponential Fourier Series - Discrete Amplitude and Phase Spectra-*(Review to be done by students. No class hour will be spent for this review. Home assignments will be given.)*]
Steady State Solution of Circuits with non-sinusoidal periodic inputs by Fourier Series and frequency response function, power and rms value of non-sinusoidal waveforms, Discrete Power Spectrum, THD measure for waveforms. – Application of tuned series LC and parallel LC structures in Power Systems – Application of

parallel RLC circuit in Communication circuits – Application of LC circuits in power supply filtering – Application of RLC circuit in power supply decoupling.

Fourier Transforms

[*(revision)* - Aperiodic inputs – Fourier Transform from Fourier Series , properties of Fourier Transforms, Fourier Spectra*(Review to be done by students. No class hour will be spent for this review. Home assignments will be given.)*]

Energy spectral density of finite energy waveforms – Parseval's theorem - energy spectral density of output waveform of a circuit – Relation between impulse response and frequency response of a circuit - Frequency response of Ideal filter functions – why ideal filters can not be realised – time-limited waveforms and continuous nature of their Fourier transforms – band limited Fourier transforms and corresponding time-domain signals - bandwidth measures for Fourier transforms – uncertainty principle in Fourier transforms –

Linear distortion in signal transmission context – amplitude and phase distortion – conditions for distortion-free transmission – why such conditions can not be met in practice – Practical distortion criterion for pulse transmission in terms of energy content of output.

Module 4: Two-port Networks and Passive Filters (10 hours)

Two Port Networks **-** Two port networks-characterization in terms of impedance, admittance, hybrid and transmission parameters - inter relationships among parameter sets - Reciprocity Theorem-Interconnection of Two port networks: Series, Parallel and Cascade - Input impedance, output impedance and gain of terminated two-ports in terms of two-port parameters and termination impedance – Application of *y, z, g* and *h* parameters in the analysis of negative feedback systems – Application of *ABCD* parameters in the power frequency analysis of transmission lines – T and Π models for a line.

Symmetrical Two Port Networks **-** T and Π Equivalent of a two port network – T and Π equivalents for Ladder networks, transmission lines, amplifiers etc., iterative impedance and image transfer constant, image impedance – determination of image parameters from open circuit and short circuit impedance measurements - characteristic impedance and propagation constant of a symmetrical two port network - properties of a symmetrical two port network.

Symmetrical Two Port Reactive Networks as Filters **-** Filter fundamentals-pass and stop bands-behaviour of iterative impedance-Constant-k low pass filter-Constant-k high pass filter- m-derived T and Π sections and their applications for infinite attenuation and filter terminations-constant-k band pass and band elimination filters.

Text/Reference Books :

1. K.S. Suresh Kumar, '*Electric Circuits and Networks*' , Pearson Education, New Delhi, 2009
2. M.E. Van Valkenburg, '*Network Analysis'*, Prentice-Hall India, 3rd Edn, 2010
3. William H. Hayt, Jack E. Kemmerly, '*Engineering Circuit Analysis'*, McGraw-Hill,6th Edn
4. John D. Ryder, '*Networks, Lines and Fields*' , 2nd Edn, Prentice-Hall India, 1989
5. K. V. V. Murthy, M.S. Kamath, '*Basic Circuit Anaysis*',Tata McGraw-Hill, 1989
6. Charles A. Desoer, Ernest S. Kuh, '*Basic Circuit Theory*', McGraw-Hill, New York, 1969

EE2006 APPLIED ELECTROMAGNETICS

Pre-requisites : Nil

L	T	P	C
3	0	0	3

Total Hours : 42 Hours

Module 1: **(12 Hrs)**
The Co-ordinate Systems; Rectangular, Cylindrical, and Spherical Co-ordinate System. Co-ordinate transformation. Gradient of a Scalar field, Divergence of a Vector field and Curl of a Vector field. Their Physical interpretation. The Laplacian. Divergence Theorem, Stokes' Theorem. Useful Vector identifies
Electrostatics : The experimental law of Coulomb, Electric field intensity. Field due to a line charge, Sheet Charge and Continuous Volume Charge distribution. Electric Flux and Flux Density; Gauss's law.
Application of Gauss's law. Energy and Potential . The Potential Gradient. The Electric dipole. The Equipotential surfaces. Energy stored in an electrostatic field. Boundary Conditions. Capacitors and Capacitances. Poisson's and Laplace's equations. Solutions of Simple Boundary value problems. Method of Images.

Module 2: **(10 Hrs)**
Steady Electric Currents: Current densities , Resistance of a Conductor; The Equation of Continuity . Joules law. Boundary Conditions for Current densities. The EMF. Magnetostatics : The Biot-Savart law. Amperes' Force Law . Torque exerted on a current carrying loop by a magnetic field. Gauss's law for magnetic fields. Magnetic Vector Potential . Magnetic Field Intensity and Ampere's Circuital law. Boundary conditions. Magnetic Materials . Energy in magnetic field . Magnetic circuits. Application to cathode Ray Oscilloscope.

Module 3: **(10 Hrs)**
Faraday's Law of Induction; Self and Mutual inductance . Maxwell's Equations from Ampere's and Gauss's Laws. Maxwell's Equations in Differential and Integral forms; Equation of Continuity. Concept of Displacement Current, Electromagnetic Boundary Conditions.
Poynting's Theorem , Time – Harmonic EM Fields . Application to Transformer. Plane wave Propagation : Helmholtz wave Equation. Plane wave solution. Plane wave propagation in lossless and lossy dielectric medium and conducting medium . Plane wave in good conductor, surface resistance , depth of penetration. Polarization of EM wave - Linear, Circular and Elliptical polarization. Normal and Oblique incidence of linearly Polarized wave at the plane boundary of a perfect conductor, Dielectric – Dielectric Interface . Reflection and Transmission Co-efficient for parallel and perpendicular polarizations , Brewstr angle.

Module 4: **(10Hrs)**
The TEM wave and the transmission line limit - Transmission Lines: The high-frequency circuit. Time domain reflectometry. LCR ladder model for transmission lines. The transmission line equation. Analogy with wave equation. Solution for lossless lines. Wave velocity and wave impedence. Reflection and Transmission coeffcients at junctions. VSWR. Introduction to electromagnetic interference and compatibility

Text/Reference Books:

1. Nannapaneni Narayana Rao, "Elements of Engineering Electromagnetics", Prentice Hall of India.
2. Elements of Electromagnetic by Mathew N. O. Sadiku, Publisher Oxford University Press.
3. Fields and Wave Electromagnetics, By David K. Cheng, 2nd Edition , Publisher : Pearson Education.
4. Electromagnetics By John D Kraus , (Mcgraw-Hill)

EE2007 ELECTRICAL MACHINES I

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total Hours : 42 Hours

Module 1: Electromagnetic Machines (8 hours)

Fundamental principles - classification - generators, motors and transformers - elements of electromagnetic machines - armature windings - commutator winding - lap winding and wave winding - phase winding - single phase winding and three phase winding - single layer winding and double layer winding - MMF of a winding - space harmonics - torque developed in a winding - EMF developed in a winding - distribution factor - chording factor.

Module 2: DC Machines (7 hours)

Construction - principle of operation - magnetic circuit - flux distribution curve in the air-gap - EMF equation - armature reaction - demagnetizing and cross magnetizing ampere turns - commutation - methods of excitation - generators and motors.

Module 3: DC Generators and Motors (12 hours)

DC Generators: Power flow diagram -circuit model - magnetization characteristics - process of voltage build up - terminal characteristics - control of terminal voltage - parallel operation - applications.
DC Motors: Power flow diagram - circuit model - back EMF - torque and speed equations performance characteristics - applications - starting methods - design of starters - methods of speed control - testing - Swinburne's test - Hopkinton’s test - separation of losses - retardation test - permanent magnet DC motor.

Module 4: Transformers (15 hours)

Types and construction - principle of operation - magnetizing current - harmonics - ideal and real transformer - dot convention - current and voltage ratio - equivalent circuit - phasor diagram - per unit impedance - losses - efficiency and regulation - all day efficiency - OC and SC tests - Sumpner's test - parallel operation - tap changing - switching transients - auto transformers - voltage and current relationships - saving of copper - different connections of three phase transformers - notations - Scott connection - cooling methods.

Text/Reference Books:

1. Clayton & Hancock, Performance & Design Of DC Machines, CBS, 3rd edition, 2001
2. Langsdorf A.S., Principles of DC Machines, McGraw Hill.6th edition, 1959.
3. Say M. G, Performance & Design of AC Machines, Pitman, ELBS.3rd edition, 1983.
4. Langsdorf A.S., Theory of AC Machinery, McGraw Hill., 2nd edition, 2002.
5. Toro V.D, Electrical Machines & Power Systems, Prentice Hall, 2nd edition, 2003.
6. Chapman S.J, Electric Machinery Fundamentals, McGraw Hill, 2nd edition, 1991.
7. Nagarath I.J. & Kothari D.P, Electric Machines, Tata McGraw Hill, 3rd edition, 2004.

EE2008 ANALOG ELECTRONIC CIRCUITS & SYSTEMS

Pre-requisites: EE2004 Basic Electronic Circuits

L	T	P	C
3	0	0	3

Total Hours : 42 Hours

Module 1: **(11 Hours)**

Feedback Amplifiers ,Stability and Oscillators (s-domain approach is envisaged)

Concept of Feedback-Negative and Positive Feedback-Loop Gain-Closed Loop Gain-Voltage Series Feedback on a single time constant voltage to voltage amplifier-Advantages of negative feedback in a single time constant voltage to voltage amplifier-gain, input and output resistances, rise time, bandwidth, nonlinearity etc- stability and positive feedback in the above amplifier-Voltage Shunt,Current series and Current Shunt topologies and properties.
Voltage Series feedback on a second order amplifier-Closed Loop poles and loop gain-Transient Response of Closed Loop Amplifier vs Loop Gain-Voltage Series Amplifier with third order open loop amplifier-pole migration to right half of s-plane – Bode Plots of Loop Gain-Barkhausen's criterion for stability of feedback amplifiers-Gain Margin and Phase Margin-Introduction to amplifier compensation-dominant pole compensation-Oscillators- Transistor Phase Shift Oscillator-Wein's Bridge Oscillator

Module 2: **(11 Hours)**

Linear Opamp Circuits

BJT and MOSFET Differential Amplifiers-Common Mode and Differential Mode gains-CMRR-Current Source Biasing-Offset behaviour.
Current Sources for biasing inside an IC.
Operational Amplifier-ideal opamp properties-properties of practical opamps (LM741,LM324,LM358,LF351and OP07)-different stages in an opamp-internally compensated and externally compensated opamps-slew rate -offsets.
CMOS Operational Amplifiers – basic two-stage CMOS Opamp – Folded Cascode Opamp
Analysis of opamp circuits using ideal opamp model-concept of virtual short and its relation to negative feedback-offset model of a practical opamp-
Non inverting Amplifier-Gain bandwidth product-Voltage Follower-Inverting Amplifier-Summing Amplifier-Offset analysis of Non inverting and inverting amplifiers-Subtracting Circuit-Instrumentation Amplifier-Voltage to Current Converter for floating and grounded loads-Opamp Integrator-Opamp Differentiator.
Series Voltage Regulators-Monolithic Regulators-Three terminal regulators.

Module 3: **(10 Hours)**

Nonlinear IC Applications

Regenerative Comparator Circuits using Opamps-Comparator IC LM311 and its applications-Square, Triangle and Ramp Generator Circuits using Opamps and Comparator ICs-Effect of Slew Rate on waveform generation-Study of Function Generator IC ICL8038- Principles of VCO circuits-
Opamp based Astable and Monostable Circuits, Sweep circuits, Staircase waveform generation, Timer ICs – 555 Applications
Precision half wave and full wave rectification using opamps-
Log and antilog amps and applications.
Phase Locked Loops-Principles-Lock and Capture Ranges-Capture Process-Loop Filter-PLL dynamics under locked condition-study of NE564 and CD 4046-Applications of PLL in signal reconstruction, noise rejection, frequency multiplication, frequency synthesis, FSK demodulation, FM demodulation, line synchronization etc.

Module 4: **(10 Hours)**

Signal Conditioning and Signal Conversion

Active Filtering-Butterworth Low Pass Filter Functions-Low Pass Filter Specifications-order and cut off frequency of Butterworth Function from Low Pass Specifications-Sallen and Key Second Order LP Section-Gain Adjustment in Butterworth LP filters-Butterworth High Pass Filters-Second Order Wide Band and Narrow Band Bandpass Filters. Multiple Feedback Single OPAMP LPF,HPF & BPF.
Analog Switches-Sample and Hold Amplifier-Data Conversion Fundamentals-D/A Conversion-Weighted Resistor DAC- R/2R Ladder DAC-Current Switching DAC-Multiplying DAC-Bipolar DACs-A/D conversion-Quantiser Characteristics-Single Slope and Dual Slope ADCs-Counter Ramp ADC-Tracking ADC - Successive Approximation ADC-Simultaneous ADC.

Text/Reference Books:

1. A.S Sedra and K.C Smith, .'*Microelectronic Circuits*', Oxford University Press, 5th Edn,2009
2. Millman J, '*Microelectronic'*, 2nd edition, McGraw-Hill, New Delhi,2005.
3. Schilling & Belove, '*Electronic Circuits – Discrete and Integrated*', 3rd edition , McGraw-Hill, New Delhi,2006
4. D.H. Sheingold, .Nonlinear Circuits Handbook., Analog Devices Inc. 1976
5. Sergio Franco, '*Design with Operational Amplifiers and Analog Integrated Circuits*', Tata McGraw-Hill, New Delhi, 2005
6. M.E Van Valkenburg, '*Analog Filter Design'*, Oxford University Press 2001
7. National Semiconductor, '*Linear Applications Handbook'*, 1994
8. Anvekar D.K. & Sonde B.S, '*Electronic Data Converters'*, Tata McGraw Hill,1994
9. Gayakwad R.A, '*OPAMPS & Linear Integrated Circuits'*, 3rd edition, Prentice Hall of India,1995.
10. Clayton G.B,'*Operational Amplifiers'*, 5th edition, Oxford ,2004
11. Frederiksen T.M, '*Intuitive Operational Amplifiers'*, McGraw Hill,1996.

ME2007 MECHANICAL ENGINEERING

Pre-requisite: nil

L	T	P	C
3	0	0	3

Number of Hours: 42

Module 1 **(10 hours)**

Thermodynamics: Thermodynamic systems, Properties, Processes, Heat and work, Zeroth law of thermodynamics, First law of thermodynamics -- concept of internal energy and enthalpy -- steady flow energy equation -- applications, Second law of thermodynamics -- concept of entropy -- absolute zero -- heat engine -- refrigerator -- heat pump.

Module 2 **(10 hours)**

Engineering applications of thermodynamics: Carnot cycle, Otto cycle, Diesel cycle – applications, Principle of operation of two stroke and four stroke engines, Spark ignition and compression ignition engines – applications, Rankine cycle, Brayton cycle -- their applications.

Refrigeration -- methods of producing cold, Refrigeration cycle -- vapour compression system – vapour absorption system – applications, Psychrometric properties, Psychrometric processes.

Module 3 **(12 hours)**

Fluid mechanics and fluid machinery: Fluid properties – viscosity -- surface tension -- fluid pressure -- measurement of viscosity and pressure, Centre of pressure, Buoyancy, Classifications of flow, Continuity equation, Bernoulli's equation, Momentum equation – applications, Friction in flow passages, Flow measuring instruments.

Fluid machinery: Air compressors -- working principles – loads -- characteristics and electric power requirement.

Hydraulic turbines – classifications -- performance characteristics – governing -- cavitation,

Hydraulic pumps – classification -- performance characteristics – cavitation -- electric power requirements.

Module 4 **(10 hours)**

Power plant Engineering: Conversion technology of conventional and non-conventional energy sources.

Steam power plant: Layout -- steam generators -- types of boilers for power station.

Hydel power plants: Layout -- classifications and study of various components -- operation

Gas turbine power plant and Internal Combustion engine power plants. Layout -- schemes -- study of various components – operation.

Text/Reference books:

1. Cengel, Y.A., and Boles, M.A, *Thermodynamics- An Engineering approach*, 6th edition, McGraw Hill, 2008.
2. Cengel, Y.A., and Cimbala, J.M., *Fluid mechanics*, 2nd ed., McGraw Hill, 2010.
3. Zemansky, M.W., Basic *Engineering Thermodynamics*, 2nd ed., McGraw hill, 2002.
4. Spalding, D.B., and Cole, B.H., *Thermodynamics*, 3rd ed., Arnold, 1987.
5. Gill, P.W., and Smith J.H., *Internal combustion engines*, 4th ed., United States Naval Institute, 2010.
6. Joseph Heitner, *Automotive systems*, 2nd ed., D. Van Nostrand company Inc, 1984
7. Streeter, V.L., *Fluid Mechanics*, 8th ed., McGraw Hill 1985.
8. Krivchenko, G.I., *Hydraulic Machinery*, 2nd ed., Lewis Publishers, 1994.
9. Skrotsky, B., Vopat, H., *Power Plant Engineering*, 2nd ed., McGraw hill, 1985.
10. Gredrick, T. Morse, *Power Plant Engineering,* 3rd ed., Van Nostrand Company,1994
11. El-Wakil, M.M., *Power Plant Engineering*, 1st ed., McGraw Hill, New York, 1985.
12. Stoecker, W.F. and Jones, *Refrigeration & Air conditioning*,2nd edition, McGraw Hill, New York,1987
13. Nag, P.K., *Engineering thermodynamics*, 4th ed., McGraw Hill, 2008.
14. Jagdish Lal , *Hydraulics and fluid mechanics,* 9th ed., Metropolitan, 1987.

EE2092: ELECTRICAL MEASUREMENTS LABORATORY

Pre-requisites: EE2003 Electrical Measurements

L	T	P	C
0	0	3	2

Total Hours : 42 Hours

LIST OF EXPERIMENTS:

1. Determination of B-H curve μ_r - H curve and μ_r - B curve of an iron ring specimen.
2. Calibration of magnetic flux meter using standard solenoid, search coil and Hibbert's magnetic standard.
3. a) Measurement of low/medium resistance using Kelvin's double bridge and wheat stone's bridge.

   b) Measurement of various cable resistance as per ISI specifications.
4. a) Measurement of Capacitance and Inductance using AC bridges.

   b) Measurement of Inductive and capacitive reactance at HF, VHF and UHF ranges.
5. Calibration of dynamometer type wattmeter using slide wire potentiometer.
6. Extension of range of ammeter/voltmeter using shunt/series resistance and calibration of the extended meter using standard ammeter/voltmeter.
7. Extension of range of a dynamometer type wattmeter using CT/PT and calibration of the extended meter using a standard wattmeter.
8. Calibration of single – phase energy meter by direct loading and phantom loading at various power factors.
9. Calibration of 3-phase energy meter using standard wattmeter.
10. Determination of hysteresis loop of an iron ring specimen using 6- point method and CRO.
11. Measurement of branch and node voltage of a given R-L-C circuit using AC potentiometer.
12. a)Measurement of candle power of given light sources. Determine the illumination levels at different working planes and verify laws of illumination.

   . b) Determination of MSCP of an Incandescent lamp/CFL.

   c) Determination of the polar curve of candle power distribution and hence find MHCP/MSCP of light sources.

Text/Reference Books

1. Golding E.W, Electrical Measurements & Measuring Instruments, 5e reem publications, 2009.
2. Cotton.H,. Advanced Electrical Technology,
3. Suresh Kumar K.S Electric Circuit and Networks, Pearson education.
4. Cooper W.D, Modern Electronics Instrumentation , Prentice Hall of India, 1986

EE2093 ELECTRONICS LAB II

Pre-requisites : None

L	T	P	C
0	0	3	2

Total Hours : 42 Hours

List of experiments

1. OPAMP circuits - design and set up of inverter - scale changer - adder - non-inverting amplifier - integrator and differentiator
2. OPAMP comparator - design and set up of Schmitt trigger - window comparator
3. Phase shift and Wein's bridge oscillator with amplitude stabilization using OPAMPs
4. Waveform generation - square, triangular and saw tooth wave form generation using OPAMPs
5. Precision rectification - absolute value and averaging circuit using OPAMPs
6. Second order LP and BP filters using single OPAMP
7. Using CD 4046 (PLL), study the dynamics of set up (a) Frequency multiplier (b) FSK MOD/DEMOD using PLL
8. Set up analog to digital converter (a) successive approximation method (b) dual slope method
9. Using UP DOWN COUNTER and a DAC Ics, generate triangular waveform

a) Using Cd 40447 IC, design and set up gated/ungated astable and monostable multivibrators

b) Using Cd 4093 Schmitt NAND IC, design and set up astable and monostable multivibraors

10. Design of Half adder and half subtractor circuits with NAND gates using mode control

a) Design and realization of ripple counter using JK flip-flop

b) Cascading of ripple counters

11. Design and realization of Johnson & Ring counter using (a) JK flip flop (b) shift register
12. Synchronous UP/DOWN counter design and realization
13. IC 555 applications

Text/Reference Books:

1. A.S Sedra and K.C Smith, .'*Microelectronic Circuits*', Oxford University Press, 5th Edn,2009