SEMESTER-III

Sl. No.	Course Code	Course Title	Hours Per Week			Total Credits	ESE	IA
			Lecture	Tutorial	Practical			
1.	103301	Electrical Circuit Analysis	3	1	0	4	70	30
2.	103302	Analog Electronics	3	1	0	4	70	30
3.	103303	Electrical Machine-I	3	1	0	4	70	30
4.	103304	Engineering Mathematics-III (PDE, Prob/stat)	3	1	0	4	70	30
5.	103305	Engineering Mechanics	3	1	0	4	70	30
6.	103306	Universal Human Values	3	0	0	3	70	30
7.	103307	Indian Knowledge System	3	0	0	0	-	-
8.	103301P	Electrical Circuit Analysis Lab	0	0	2	1	30	20
9.	103302P	Analog Electronics Lab	0	0	2	1	30	20
10.	103303P	Electrical Machine-I Lab	0	0	2	1	30	20
11.	103308	Internship – I	02 Weeks			2	30	20
					TOTAL	28	800	

Semester-III

Course Code-103301 Electrical Circuit Analysis 3 1 0 4

Unit-1.0: Introduction to Electrical Circuit Analysis 5 hrs

Circuit Elements, Linear and Non-Linear Devices, Active and Passive Devices, Unilateral and Bilateral Devices, Energy Sources (Voltage Source & Current Source), Source Transformation, Analysis with dependent current and voltage sources. Node and Mesh Analysis. Concept of duality and dual networks.

Unit-2.0: Network Theorems 8 hrs

Superposition theorem, Thevenin theorem, Norton theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation theorem, Millman's Theorem, Tellegen's Theorem, Substitution Theorem.

Unit-3.0: Solution of First and Second Order Networks 8 hrs

Solution of first and second order differential equations for Series and parallel R-L, R-C, R-L-C circuits, initial and final conditions in network elements, forced and free response, time constants, steady state and transient state response.

Unit-4.0: Electrical Circuit Analysis Using Laplace Transforms 8 hrs

Review of Laplace Transform, Analysis of electrical circuits using Laplace Transform for standard inputs, inverse Laplace transform, transformed network with initial conditions. Transfer function representation. Poles and Zeros. Series and parallel resonances

Unit-5.0: Two-Port Network 7 hrs

Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters, and hybrid parameters, interconnections of two port networks

Unit-6.0: Network Graph and Applications 6 hrs

Network Graph and their applications in Network Analysis.

Text/Reference:

1. M. E. Van Valkenburg, "Network Analysis", Prentice Hall, 2006.
2. D. Roy Choudhury, "Networks and Systems", New Age International Publications, 1998.
3. W. H. Hayt & J. E. Kemmerly, "Engineering Circuit Analysis", McGraw-Hill Education, 2013.
4. C. K. Alexander and M. N. O. Sadiku, "Electric Circuits", McGraw-Hill Education, 2004.
5. K. V. V. Murthy and M. S. Kamath, "Basic Circuit Analysis", Jaico Publishers, 1999
6. Kuo, Franklin. Network analysis and synthesis. John Wiley & Sons, 2006

Course Code-103302 **Analog Electronics** **3 1 0 4**

Unit-1.0: Diode circuits **6 hrs**

Introduction: Example of an electronic system, basic concept of signal, noise etc. P-N junction diode, I-V characteristics of a diode; review of half-wave and full-wave rectifiers, Zener diodes, clamping and clipping circuits.

Unit-2.0: BJT circuits **8 hrs**

Structure and I-V characteristics of a BJT; BJT as a switch. BJT as an amplifier: small-signal model, biasing circuits, Current mirror: Basic topology and its variants, V-I characteristics, output resistance and minimum sustainable voltage (VON), maximum usable load, generation of current source.; common- emitter, common-base and common collector amplifiers; Small signal equivalent circuits, high-frequency equivalent circuits, Miller's theorem.

Unit-3.0: MOSFET circuits **8 hrs**

MOSFET structure and I-V characteristics. MOSFET as a switch. MOSFET as an amplifier: small signal model and biasing circuits, common-source, common-gate and common-drain amplifiers; small signal equivalent circuits-gain, input and output impedances, trans-conductance, high frequency equivalent circuit.

Unit-4.0: Differential, multi-stage and operational amplifiers **6 hrs**

Voltage amplifier, current amplifier, trans-conductance amplifier and trans-resistance amplifier;Differential amplifier; power amplifier; direct coupled multi-stage amplifier; internal structure of an operational amplifier, ideal op-amp, non-idealities in an op-amp (Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product), Frequency Response of the amplifier.

Unit-5.0: Linear applications of op-amp **8 hrs**

Idealized analysis of op-amp circuits. Inverting and non-inverting amplifier, differential amplifier, +instrumentation amplifier, integrator, active filter, P, PI and PID controllers and lead/lag compensator using an op-amp, voltage regulator, Feedback amplifiers and Oscillators design (Wein bridge and phase shift); multivibrators (astable, monostable & bistable); Analog to Digital Conversion.

Unit-6.0: Nonlinear applications of op-amp **6 hrs**

Hysteretic Comparator, Zero Crossing Detector, Square-wave and triangular-wave generators. Precision rectifier, peak detector. Monoshot; Design of two-stage amplifier, frequency compensation, generalized structure of multistage amplifier.

Text/ Reference:-

1. A. S. Sedra and K. C. Smith, "Microelectronic Circuits", New York, Oxford University Press, 1998.
2. J. V. Wait, L. P. Huelsman and G. A. Korn, "Introduction to Operational Amplifier theory and applications", McGraw Hill U. S., 1992.
3. J. Millman and A. Grabel, "Microelectronics", McGraw Hill Education, 1988.
4. P. Horowitz and W. Hill, "The Art of Electronics", Cambridge University Press,1989.
5. P.R. Gray, R.G. Meyer and S. Lewis, "Analysis and Design of Analog Integrated Circuits", John Wiley & Sons, 2001.
6. "Fundamentals of Microelectronics", B. Razavi, 2nd Edition.
7. "Microelectronic Circuits", A. S. Sedra and K. C. Smith, 7th Edition

Course Code-103303 **Electrical Machine-1** **3 1 0 4**

Unit-1.0: Basic Concept of Magnetic Circuits **4 hrs**

Concepts of MMF, Flux and reluctance, Electromagnetic induction phenomenon, Magnetic Circuit and application, Elementary machine working principle as motor and generator, Magnetic curves and core losses.

Unit-2.0: Single-Phase Transformers **8 hrs**

Constructional features of Ideal transformer and practical transformer, Principles of operation, Emf equation. Operation on load - magnetizing and core loss components phasor diagrams, equivalent circuit, and determination of its parameters from O.C and S.C tests; Per unit parameter values and their importance; Regulation, efficiency, and all-day efficiency expressions and calculations. Sumpner Test.

Unit-3.0: Three-Phase Transformers **8 hrs**

Constructional features as a single unit and a bank of three units. Vector groups for various connections: Scott connection –Open delta operation, Conversion from three-phase to one-phase, two-phase, and multi-phase, Per-phase analysis; tertiary winding. Parallel operation and load sharing

Types of Transformer: Auto Transformer (saving of copper –rating of autotransformers), Pulse Transformer, Isolation Transformer, Grounding Transformer, power transformer, distribution transformer

Unit-4.0: Basics of Electrical Rotating Machine **6 hrs**

Electromechanical energy conversion Principle: Field energy and co-energy, Torque and force in singly excited and multiple excited electromechanical systems and applications. Windings: Types of winding in DC and AC Machine, MMF in field and armature Winding of machines **Working Principle**: Elementary Machine, Torque generation in DC and AC Machine, types of Losses and efficiency in rotating machine

Unit-5.0: DC Machines- Construction and types **8 hrs**

Armature windings –simplex lap and wave windings, pole pitch, coil span, winding pitch, commutator pitch--equalizer ring connections-power flow diagram-numerical problems- dummy coils – methods of setting brushes in DC machines.

Basic construction of a DC machine, magnetic structure - stator yoke, stator poles, pole-faces or shoes, air gap, and armature core, Commutation; Type of Commutation. air gap flux density distribution, and armature MMF wave.

Type of DC generators and motors; Methods of excitation – separately excited, shunt, series and compound machines. Induced EMF: EMF equations- electromagnetic torque- numerical problems. Derivation of the back EMF equation and torque equation. Armature Reaction; demagnetizing and cross-magnetizing armature MMF; variation with brush position; compensating winding; interpoles-numerical problems

Unit-6.0: DC Machine – Operation & Performance **8 hrs**

Armature circuit equation for DC Motor and DC Generator; Types of field excitations, Open circuit characteristic of DC Generator, voltage build-up in a DC Generator, critical field resistance, and critical speed; V-I characteristics and torque-speed characteristics of DC Motors; DC Motor Speed Control. Testing of DC motors -Swinburne's test; Hopkinson's test and retardation test; Calculation of losses and efficiency; DC motor applications.

Parallel operation – parallel operation of shunt series and compound generations

Starting of DC motors- starters –2 point, 3point and 4 point starters; Speed control of DC motors - field control, armature control; Braking of DC motors- Power flow diagram – losses and efficiency.

Text /Reference:

1. Principles of Electric Machines and Power Electronics, P.C. Sen, 2nd Edition, 2007, Wiley Publication
2. Electrical Machinery, A. E. Fitzgerald, C. Kingsley, S. D. Umans; 6th Edition, 2003, Tata McGraw-Hill
3. AC Machines: Puchstein, Lloyd &Hunte
4. Electrical Machinery, P. S. Bimbhra, Khanna Publishers
5. Electric Machines, I. J. Nagrath& D. P. Kothari, Tata McGraw-Hill Publication

Course Code- 103304 Engineering Mathematics-III (PDE, Prob/stat) **3 1 0 4**

Unit 1.0 **7 hrs**

Definition of Partial Differential Equations, First order partial differential equations, solutions of first order linear PDEs; Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method.

Unit 2.0 **8 hrs**

Second-order linear equations and their classification, Initial and boundary conditions, D'Alembert's solution of the wave equation; Duhamel's principle for one dimensional wave equation. Heat diffusion and vibration problems, Separation of variables method to simple problems in Cartesian coordinates. The Laplacian in plane, cylindrical and spherical polar coordinates, solutions with Bessel functions and Legendre functions. One dimensional diffusion equation and its solution by separation of variables

Unit 3.0 **8 hrs**

Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.

Unit 4.0 **5 hrs**

Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities.Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.

Unit 5.0 - **7hrs**

Basic Statistics, Measures of Central tendency: Moments, skewness and Kurtosis – Probability distributions: Binomial, Poisson and Normal – evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation. Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves.

Unit 6.0- **7 hrs**

Test of significance: Large sample test for single proportion, difference of proportions, Tests for single mean, difference of means, and difference of standard deviations. Test for ratio of variances – Chi- square test for goodness of fit and independence of attributes.

Text/ Reference:-

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9thEdition, John Wiley & Sons, 2006.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications.
3. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall.
4. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India,2002.

Course Code-103305 Engineering Mechanics 3 1 0 4

Unit- 1.0: Fundamentals of Mechanics 7hrs

Overview of engineering mechanics. Vector and scalar quantities. Units of physical quantities. Dimensions of physical quantities. Units and Dimensions. Dimensional analysis.

Unit- 2.0: Force Systems and Equilibrium 7hrs

Force Systems Basic Concepts, Particle Equilibrium in 2-D & 3-D, Rigid Body Equilibrium, System of Forces: oplanar Concurrent Forces, Components in Space, Resultant and Moment of Forces and its Application, Couples and Resultant of Force System, Free Body Diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems.

Unit- 3.0: Friction and Structural Analysis 7hrs

Types of Friction: Limiting, Static, and Dynamic, Laws of Friction, Motion of Bodies and Wedge Friction, Equilibrium in Three Dimensions, Method of Sections and Method of Joints, Tension and Compression in Members, Simple Trusses, Zero Force Members, Beams, Types of Beams, Frames and Machines.

Unit- 4.0: Centroid, Centre of Gravity, and Moment of Inertia 7hrs

Centroid of Simple Figures from First Principle, Centroid of Composite Sections, Centre of Gravity and Its Implications, Area Moment of Inertia: Definition and Theorems Moment of Inertia of Plane Sections, Standard Sections, and Composite Sections, Mass Moment Inertia of Circular Plate, Cylinder, Cone, Sphere, Hook.

Unit- 5.0: Virtual Work, Energy Method, and Particle Dynamics 7hrs

Virtual Displacements and Principle of Virtual Work, Degrees of Freedom and Active Force Diagram, Conservative Forces and Potential Energy, Energy Equation for Equilibrium, Applications of Energy Method for Equilibrium, Stability of Equilibrium, Review of Particle Dynamics: Rectilinear and Plane Curvilinear Motion, Relative and Constrained Motion, Newton's 2nd Law Work-Kinetic Energy, Power, Potential Energy Impulse-Momentum and Impact.

Unit- 6.0: Kinetics of Rigid Bodies 7hrs

Introduction to Kinetics of Rigid Bodies Basic Terms and General Principles in Dynamics Types of Motion and Instantaneous Centre of Rotation in Plane Motion Simple Problems D'Alembert's Principle and Its Applications in Plane Motion and Connected Bodies Work-Energy Principle and Its Application in Plane Motion of Connected Bodies Kinetics of Rigid Body Rotation.

Text/ Reference:-

1. Engineering Mechanics statics and dynamics R. C. Hibbeler Pearson Publication, 12th Edition. ISBN-10: 0-13-814929-1 ISBN-13:978-0-13-814929-1
2. Engineering Mechanics statics and dynamics, J. L. Meriam and L. G. Craige, John Willey and Son's publication. 9th Edition. ISBN: 978-1-119-39098-5
3. Engineering Mechanics, S. P. Timoshenko, D. H. Young, J. V. Rao &S.Pati, McGraw- Hill publication, 5th Edition ISBN-10:9781259062667
4. Engineering Mechanics statics and dynamics,A. K. Dhiman, P. Dhiman & D. Kulshreshtha, McGraw-Hill publication ISBN-10:9789339219178

Course Code-103306 Universal Human Values 3 0 0 3

Unit- 1.0: Introduction to Value Education 5 hrs

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Understanding Value Education Sharing about Oneself, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Exploring Human Consciousness, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations,

Unit- 2.0: Harmony in the Human Being 4 hrs

Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health.

Unit- 3.0: Harmony in the Family and Society 5 hrs

Harmony in the Family – the Basic Unit of Human Interaction, ‗Trust' – the Foundational Value in Relationship, ‗Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order.

Unit- 4.0: Harmony in the Nature/Existence 6 hrs

Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence.

Unit- 5.0: Implications of the Holistic Understanding – a Look at Professional 5 hrs

Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession .

Unit- 6.0: 3hrs

Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models- Typical Case Studies, Strategies for Transition towards Value-based Life and Profession.

Text /Reference:

1. A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-8703447.
2. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
3. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
4. The Story of Stuff (Book).
5. The Story of My Experiments with Truth – by Mohandas Karamchand Gandhi.
6. Small is Beautiful – E. F Schumacher.
7. Slow is Beautiful – Cecile Andrews.
8. Economy of Permanence – J C Kumarappa.
9. Bharat Mein Angreji Raj – Pandit Sunderlal.
10. Rediscovering India – by Dharampal.
11. Hind Swaraj or Indian Home Rule – by Mohandas K. Gandhi.
12. India Wins Freedom – Maulana Abdul Kalam Azad.
13. Vivekananda – Romain Rolland (English)

Course Code- 103307 Indian Knowledge System 3 0 0 0

Unit-1.0 **7 hrs**

Introduction to Indian Knowledge Systems

Overview of IKS, Organization of IKS , Conception and constitution of knowledge in indian tradition, The oral tradition, Models and Strategies of IKS.

Unit-2.0 **5 hrs**

Overview of IKS Domains

The vedasas the basis of IKS, Overview of all the six vedāṅgas.

Unit-3.0 **8 hrs**

Relevance in Current Technical Education System I

Relevance of following IKS domains in present technical education system: Arthashastra (Indian economics and political systems), Ganitaand Jyamiti(indianmathematics, astronomy and geometry, Rasayana (indianchemical Sciences).

Unit-4.0 **8 hrs**

Relevance in Current Technical Education System II

Ayurveda (Indian Biological Sciences / Diet & Nutrition), JyotishVidya (observational astronomy and calendar systems), PrakritiVidya(indian system of terrestrial/ material sciences/ecology and atmospheric sciences).

Unit-5.0 **7 hrs**

Relevance in Current Technical Education System III

VastuVidya(indian system of aesthetics-iconography and built-environment /architecture), NyayaShastra(indian systems of social ethics, logic and law).

Unit-6.0 **7 hrs**

Shilpa andNatyaShastra (indian classical arts: performing and fine arts), Sankhyaand Yoga Darshna(indian psychology, yoga and consciousness studies), Vrikshayurveda(plant science/sustainable agriculture/food preservation methods).

Text/Reference:-

1. Introduction to Indian Knowledge System: Concepts and Applications, Archak, K.B. (2012)., Kaveri Books, New Delhi, ISBN-13:978-9391818203
2. Introduction To Indian Knowledge System: Concepts and Applications, Mahadevan, B. Bhat, VinayakRajat, NagendraPavana R.N., PHI, ISBN: 9789391818203.
3. Glimpse into Kautilya's ArthashastraRamachandrudu P. (2010) , Sanskrit Academy, Hyderabad, ISBN:9788380171074.
4. "Introduction" in Studies in Epics and Purāṇas, (Eds.), KM Munshi and N ChandrashekaraAiyer BhartiyaVidyaBhavan.

Course Code-103301P Electrical Circuit Analysis Lab **0 0 2 1**

Perform the following experiments

List of Experiments:

1. Verification of the Superposition Theorem
2. Verification of Thevenin & Norton Theorem
3. Verification of the Maximum Power Transfer Theorem
4. To Calculate the Characteristics Impedance of T & Pi Network
5. To determine the Driving Point & Transfer Function of a Two-Port Network
6. To study Series, Parallel & Cascade Connection of Two-Port Network
7. To study Series & Parallel Resonance Circuit
8. To study Transient & Steady State Response Of R-L-C Circuit
9. To study the Frequency Response of the Twin T-Notch Filter
10. To study the Z-H Parameter of a Two-Port Network

Course Code-103302P **Analog Electronics Lab** **0 0 2 1**

Perform any 10 Experiments

List of Experiments

1. To verify and plot the V-I characteristics of silicon diode & Zener diode in forward and Reverse bias.
2. To verify and plot the wave form of half wave rectifier & full wave rectifier
3. To verify and draw input and output characteristics of BJT (PNP or NPN) in CE, CB & CC configuration.
4. To study h- parameter of transistors in C.E configuration, C.B configuration & C.C Configuration
5. To study Wein bridge oscillator.
6. To study phase shift oscillator.
7. To study of clipping circuit.
8. To study of clamping circuit.
9. To study of characteristics of MOSFET
10. To study the operational amplifier as differentiator& integrator.
11. To study the operational amplifier as inverting amplifier & non inverting Amplifier.

Course Code-103303P **Electrical Machine-I Lab** **0 0 2 1**

Perform the following Experiments

List of Experiments:

1. Experiment to determine self and mutual inductances of two coupled inductors
2. Open circuit and short circuit tests on a single-phase transformer and determination of parameters.
3. Calculating the regulation and efficiency of a Single-Phase transformer
4. Parallel Operation of Two Single-Phase Transformers
5. Study of different types of transformers
6. Vector Group Test of the Three-Phase Transformer
7. Determination of the characteristics of a DC Shunt Generator
8. Determination of the efficiency of the DC machine through Hopkinson's Test
9. Study of DC Shunt, DC Series, and DC Compound Machines
10. Speed Control of DC Motor using armature voltage and field control

Course Code-103308 **Internship – I** **02 Weeks (2 Credits)**

Internship I Guidelines:

Internship I is of a minimum duration of two weeks which can be completed in an Industry/Institute in consultation with concerned Engineering College/ Institute. After completion of internship a detailed report of the internship mentioning the training undertaken along with certificate should be submitted.