TRIPURA UNIVERSITY
(A CENTRAL UNIVERITY)

CURRICULUM STRUCTURE

OF

4 YEARS

BACHELOR OF TECHNOLOGY

DEPARTMENT OF ELECTRICAL ENGINEERING(EE)

4th Semester

2021

4th SEMESTER

Sl. No.	Course Category	Subject Code	Subject Title	L	T	P	Contact Hours/week	Credit	Full Marks
1.	Humanities Science - 3	HS 401	Engineering Economics and Accountancy	3	0	0	3	3	100
2.	Humanities Science - 4	HS 402	Universal Human Values-II: Understanding Harmony	2	1	0	3	3	100
3.	Program Core - 6	PC EE 403	Electromagnetic Fields Theory	3	1	0	4	4	100
4.	Program Core - 7	PC EE 404	Electrical Machines-I	3	1	0	4	4	100
5.	Program Core - 8	PC EE 405	Digital Electronics	3	0	0	3	3	100
6.	Program Core - 9	PC EE 406	Power Electronics	3	0	0	3	3	100
7.	Program Core - 10	PC EE 407	Electrical Machines laboratory-I	0	0	2	1	1	100
8.	Program Core - 11	PC EE 408	Power Electronics Laboratory	0	0	2	1	1	100
9.	Program Core - 12	PC EE 409	Basic Electrical Measurements Laboratory Practices	0	0	2	1	1	100
10.	Mandatory Course - 4	MC 410	Essence of Indian Knowledge Tradition	2	0	0	2	0	100
			Total:	19	3	6	28	**23**	**1000**

ENGINEERING ECONOMICS AND ACCOUNTANCY

Course Code	HS 401
Course Title	Engineering Economics and Accountancy
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	-
Course Category	Humanities Science (HS)
Number of classes	38 hours

Course Outcomes:

At the end of the course, the student will be able to

CO Number	CO Description	K-level
CO-1	Understand the importance of engineering economics in business.	K2
CO-2	Demonstrate the necessary knowledge and skills for running a business organisation.	K2
CO-3	Understand the financial statement and position of an organisation.	K2
CO-4	Analyze the accounting information for decision making.	K4
CO-5	Develop the knowledge & skill on business and management.	K3

Course Content:

Module 1: Engineering economics (9 hrs)

- Engineering economy and its importance;
- Demand & supply: Wants, satisfaction of wants, demand, supply, elasticity of demand, estimation of demand, supply chain economy;
- Production-Factors of production (land, labor, capital, and entrepreneurship), Laws of return.
- Money – Value of money, quantity theory; inflation and deflection.

Module 2: Business Skills for Engineers (9 hrs)

- Business Structure: Proprietorship, Partnership and Joint Stock Company;
- Basic management for businesses: Basic functions of management,
- Risk Management: Type of risk, Risk management steps
- Entrepreneur and Leadership: Leadership styles, Qualities of a good leader for a business;
- Financing and the business: Objectives and sources of funds;
- Taxation: Basics of Income tax & Goods and Services Tax (GST)

Module 3: Financial Accounting for Business (10 hrs)

- Transactions: Financial event, Features of transactions; Recording of transactions;
- Basic accounting: Ledger, Trail balance, Cash book (double column only);
- Final account: Objectives, Preparation of final accounts (Trading A/C, Profit & Loss A/C and Balance Sheet).

Module 4: Managerial Accounting for Decision-making (10 hrs)

- Cost classifications – Material cost control, labor cost control and overhead cost control (only theory);
- Cost sheet: Objective and preparation of Cost sheet (Basic problem);
- Capital budgeting: Objectives Pay-back period and NPV method for feasibility testing of investment
- Working capital management: Factors and sources of WC
- Ratio analysis: Interpretation for industrial control, Basic ratios- Current Ratio, Debt-equity ratio, proft ratio

References / Suggested Learning Resources:

- Fundamentals of Engineering Economics, 4th Edition, by Chan S. Park, Pearson Publishing;
- Engineering Economics And Financial Accounting Paperback, by Arasu, Scitech publication
- Engineering Economics and Financial Accounting for Anna University Paperback by A. Bagad, Technical Publications;
- Financial Management- An analytical framework , Nayak & Manna, Parul Library;
- Principles of Management, Ghose and Basu,ABS Publishing House;

UNIVERSAL HUMAN VALUES-II: UNDERSTANDING HARMONY

Course Code	HU-402
Course Title	Universal Human Values-II: Understanding Harmony
Number of Credits	3(L: 2, T: 1, P: 0)
Prerequisites	Induction Programme and Universal Human Values –I
Course Category	Humanities Science (HS)
Number of classes	36 hours

Course Outcome:

At the end of the course, the student will be able to

CO Number	CO Description	K-level
CO-1	Explain the term self-exploration and its application for self-evaluation and development.	K2
CO-2	Identify the holistic perception of harmony at level of self, family, society, nature and explain it by various examples.	K3
CO-3	Illustrate the role of a human being in ensuring harmony in society and nature.	K2
CO-4	Distinguish between ethical and unethical practices, and start identifying a strategy to actualize a harmonious environment wherever they work.	K4

Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education (8 Hrs)

Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration.

Continuous Happiness and Prosperity- A look at basic Human Aspirations.

Right understanding, Relationship and Physical Facility- the basic requirements for fulfillment of aspirations of every human being with their correct priority.

Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario.

Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

Module 2: Understanding Harmony in the Human Being (10 Hrs)

Understanding human being as a co-existence of the sentient 'I' and the material 'Body'.

Understanding the needs of Self ('I') and 'Body' - happiness and physical facility.

Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer).

Understanding the characteristics and activities of 'I' and harmony in 'I'.

Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship.

Understanding the meaning of Trust; Difference between intention and competence

Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals

Module 3: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence (8Hrs)

Understanding the harmony in the Nature Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space. Holistic perception of harmony at all levels of existence.

Module 4: Implications of the above Holistic Understanding of Harmony on Professional Ethics (10Hrs)

Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order.

Competence in professional ethics:

a. Ability to utilize the professional competence for augmenting universal human order

b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems,

c. Ability to identify and develop appropriate technologies and management patterns for above production systems.

References / Suggested Learning Resources:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010
2. Jeevan Vidya: EkParichaya, A Nagaraj,Jeevan Vidya Prakashan, Amarkantak, 1999
3. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi.
5. Bharat Mein Angreji Raj - PanditSunderlal
6. Rediscovering India - by Dharampal
7. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
8. India Wins Freedom - Maulana Abdul Kalam Azad
9. Vivekananda - Romain Rolland (English)
10. Gandhi - Romain Rolland (English)

ELECTROMAGNETIC FIELD THEORY

Course Outcomes: After Completion of this course students will able to

Course Code	PC EE 403
Course Title	Electromagnetic Field Theory
Number of Credits	4(L: 3, T: 1, P: 0)
Prerequisites	10+2 Mathematics & Physics
Course category	Program Core - 6
Number of Classes	48

CO Number	CO Description	k-level
CO-1	Apply vector calculus to static electric-magnetic fields in different engineering situations	K3
CO-2	Apply their knowledge on higher Courses of Electrical Engineering like Electrical Machine, Power System, Instrumentation etc.	K3
CO-3	Analyse Maxwell's equation in different forms (differential and integral) and apply them to diverse engineering problems	K4
CO-4	Examine the phenomena of wave propagation in different media and its interfaces and in applications of microwave engineering	K4

Module 1: Review of Vector Calculus and Electrostatics (18 hrs)

Review of Vector Analysis, Vector algebra-addition, subtraction, components of vectors, scalar and vector multiplications, Orthogonal Coordinate Systems: rectangular, cylindrical and spherical coordinate systems, gradient, divergence, curl, Laplacian in different rectangular, cylindrical and spherical coordinate system, Divergence theorem, Stoke's theorem. Electric vector field and scalar potential field, Relation between electric field intensity and potential, Gauss's integral law for electric displacement field, Gauss's law in differential and integral form, Poisson's and Laplace's equation.

Module-2 : Conductors and Dielectrics (10 hrs)

Matching boundary conditions at the interface of different dielectric media, Electric stress and mechanical force in charged conductors, Energy stored in electric field, Electric dipole fields, Electric polarization, and its relation to the permittivity of dielectric media Solution of Laplace's equation by separation of variables method, Capacitance of coaxial cables and two wire transmission lines and related electric fields, Numerical analysis of electric fields by solving Laplace's equation, Iterative methods, Finite elements. Uniqueness theorem, Method of Images for the solution of electric fields.

Module-3: Electromagnetics (10 hrs)

Magnetic field intensity, Scalar and Vector magnetic potential, Lorentz force, Motoring and generating principles, Faraday's Law of electromagnetic induction, Ampere's law in both integral and differential forms, Biot-Savart's law, Boundary conditions, Solution of field problem by image method, Self and mutual inductance, Inductance of coaxial cable and two wire transmission lines.

Module-4: Electromagnetic Wave (10 hrs)

Energy in magnetic field, Force due to magnetic field in magnetic medium. Maxwell's field equations, Displacement current density and continuity equation, Electromagnetic wave equation in loss-free and lossy media, Plane and polarized waves and their propagation as solutions of wave equation, Poynting's vector, Power flow through electromagnetic media.

Text/Reference Books

1. R. K. Shevgaonkar, **"**Electromagnetic Waves**"**, Tata McGraw Hill, 2005.
2. D. K. Cheng, "Field and Wave Electromagnetics**"**, Addison-Wesley, 1989.
3. M. N.O. Sadiku, "Elements of Electromagnetics**"**, Oxford University Press, 2007.
4. C. A. Balanis, "Advanced Engineering Electromagnetics", John Wiley & Sons, 2012.
5. C. A. Balanis, "Antenna Theory: Analysis and Design**"**, John Wiley & Sons, 2005.

ELECTRICAL MACHINES - I

Course Code	PC EE 404
Course Title	Electrical Machines - I
Number of Credits	4 (L: 3, T: 1, P:0)
Prerequisites	10+2 Physics and Basic Electrical Engineering
Course Category	PC
Number of Classes	48

Course Outcomes:-

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

CO Number	CO Description	K-level
CO1	Remember the concepts of magnetic circuits.	K-1
CO2	Understand the operation of dc machines.	K-2
CO3	Apply the differences in operation of different dc machine configurations.	K-3
CO4	Analyse single phase and three phase transformers circuits.	K-4

Course Contents:-

Module- 1: Magnetic Circuits and Electromagnetic force (14 hours)

Review of magnetic circuits – MMF, flux, reluctance, inductance; review of Ampere Law and BiotSavart Law; Visualization of magnetic fields produced by a bar magnet and a current carrying coil – through air and through a combination of iron and air; influence of highly permeable materials on the magnetic flux lines.B-H curve of magnetic materials; flux-linkage vs current characteristic of magnetic circuits; linear and nonlinear magnetic circuits; energy stored in the magnetic circuit; force as a partial derivative of stored energy with respect to position of a moving element; torque as a partial derivative of stored energy with respect to angular position of a rotating element. Examples – galvanometer coil, relay contact, lifting magnet, rotating element with eccentricity or saliency.

Module- 2: DC Machines (8 hours)

Basic construction of a DC machine, magnetic structure – stator yoke, stator poles, pole-faces or shoes, air gap and armature core, visualization of magnetic field produced by the field winding excitation with armature winding open, air gap flux density distribution, flux per pole, induced EMF in an armature coil. Armature winding and commutation – Elementary armature coil and commutator, lap and wave windings, construction of commutator, linear commutation. Derivation of back EMF equation, armature MMF wave, derivation of torque equation, armature reaction, air gap flux density distribution with armature reaction.

Module- 3: DC Machines (Motoring and Generation) (14 hours)

Armature circuit equation for motoring and generation, Types of field excitations – separately excited, shunt and series. Open circuit characteristic of separately excited DC generator, back EMF with armature reaction, voltage build-up in a shunt generator, critical field resistance and critical speed. V-I characteristics and torque-speed characteristics of separately excited, shunt and series motors. Speed control through armature voltage. Losses, load testing and back-to-back testing of DC machines.

Module- 4: Transformers (12 hours)

Principle, construction and operation of single-phase transformers, equivalent circuit, phasor diagram, voltage regulation, losses and efficiency. Testing – open circuit and short circuit tests, polarity test, back-to-back test, separation of hysteresis and eddy current losses. Three-phase transformer – construction, types of connection and their comparative features, Parallel operation of single-phase and three-phase transformers. Autotransformers – construction, principle, applications and comparison with two winding transformer. Phase conversion – Scott connection, three-phase to six-phase conversion, Tap-changing transformers – No-load and on-load tap-changing of transformers, Three-winding transformers. Cooling of transformers.

References / Suggested learning Resources :-

1. A. E. Fitzgerald and C. Kingsley, “Electric Machinery”, New York, McGraw Hill Education, 2013.
2. A. E. Clayton and N. N. Hancock, “Performance and design of DC machines”, CBS Publishers, 2004.
3. M. G. Say, “Performance and design of AC machines”, CBS Publishers, 2002.
4. P. S. Bimbhra, “Electrical Machinery”, Khanna Publishers, 2011.
5. I. J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education, 2010.

DIGITAL ELECTRONICS

Course Code	PCEE 405
Course Title	Digital Electronics
Number of Credits	03 (3L:0T:0P)
Prerequisites	Basic circuit laws, Engineering Physics.
Course Category	Program Core (PC)
Number of classes	38

Course Outcomes:

After Completing this course, students will be able to		Knowledge Level
CO -1	Understand the fundamental concepts and techniques used in digital electronics.	K2
CO -2	Understand and examine the structure of various number systems and its application in digital design.	K2
CO-3	Analyze and design various combinational and sequential circuits	K4
CO -4	Identify basic requirements for a design application in digital electronics.	K3

Course Content:

Module 1: Fundamentals of Digital Systems and logic families (10 Hours)

Number Systems: Decimal, Binary, Octal and Hexadecimal systems, conversion from one base to another. Codes: BCD, Excess- 3, Gray Code, Algebra for logic circuits: Logic variables; Logic constants; Logic functions & gates- NOT, AND, OR, NAND, NOR, Ex-OR; Boolean algebra, Half adder, Full adder, Sub tractors. Families of logic circuits: Transistor inverter, RTL, Diode logic, DTL, TTL, Brief introduction to DCTL, IIL, HTL, ECL and MOS gates.

Module 2: Combinational Digital Circuits (10 Hours)

Canonical representations-min-term, max-term; Karnaugh map simplification. Analysis and synthesis of combinational circuits, Multiplexer, Demultiplexer, Encoder, Decoders and their uses & expansion, Code-converter, Adder, Sub-tractor, 2' complement Adder cum Sub tractor, Carry look-a header, Comparator, Parity generator/checker, Priority encoder.

Module 3: Sequential circuits and systems (8 Hours):

Sequential logic elements like RS, JK, T & D type flip flops. Implementation of Flip flops, Uses of flip flops in binary Counters: Asynchronous and Synchronous counters. Cascading of counters. Shift registers: serial / parallel input and serial / parallel output. Cascading of shift registers. Counters & Special functions like latch, decoder,

Module 4: A/D and D/A Converters (10 Hours)

Binary-weighted register, R-2R ladder. DAC characteristics & specifications. DAC errors. ADC: parallel comparator method, counter method, Successive-approximation, Dual-slope, Delta-sigma. ADC codes and errors.
Types: RAM, ROM, EAROM, EEROM, EEPROM and their Constructional features, their uses. Different Memory interfacing techniques, Bus contention, Expansion of Memory Capacity of digital System-different techniques.

Text/References:

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.
3. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.

POWER ELECTRONICS

Course Code	PCEE406
Course Title	Power Electronics
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	Basic Electrical Engineering and Basic Electronics
Course Category	Program Core-9 (PC-9)
Number of classes	36 hours

Course Outcome:-
After completion of the course, students will be able to:

CO No	CO Description	K-level
PCEE406.1	Illustrate the knowledge on basic principles and characteristics of different Power semiconductor Devices.	K2
PCEE406.2	Analyze various single phase and three phase power converter circuits and understand their applications.	K4
PCEE406.3	Explain the basic principles and characteristics of power Electronic based different Chopper Circuits and interpret the operation of inverters and cycloconverters.	K2

PCEE406.4	Apply the use of Power Electronic based Converters in the higher courses of Electrical Engineering.	K3

Course Content:-

Module- 1: Power semiconductor devices (10 hours):
Concept of power electronics, scope and applications, types of Power semiconductor devices and their V-I characteristics- Diode, SCR, GTO, TRIAC, Power BJT, Power MOSFET, IGBT , Thyristor ratings and protection, Voltage and current commutation of a thyristor; Gate drive circuits for MOSFET and IGBT. Protection using snubber circuit. Steady and switching power loss in devices: its effect & minimization. Cooling and Heat-sinks.

Module- 2: Diode rectifiers and Phase Controlled rectifiers (8 hours):
Single-phase half-wave and full-wave Diode rectifiers with R, RL, RC and RLE load. Study of same with highly inductive load. Effect of Freewheeling diode. Three-phase half-wave and full-wave Diode rectifiers with highly inductive load. Single-phase half-wave and full-wave SCR rectifiers with R, RL and RLE load. Study of same with highly inductive load. Effect of Free-wheeling diode. Three-phase half-wave and full-wave SCR rectifiers with highly inductive load. Commutation effects, overlap angle and voltage loss. Effect of load and source inductances. Single phase and three-phase dual converters. Principle of generation of control pulses for SCR converters: cosine, ramp and equidistant pulse methods.

Module- 3: DC-DC Converters (8 hours):
Introduction, Basic principles of step-down and step-up operation, chopper control strategies, types of chopper circuits, chopper classification-buck, boost and buck-boost Choppers. Principles of isolated dc/dc converters and SMPS- Fly back, Push-pull, half-bridge and full-bridge converters.

Module- 4: **Inverters, AC voltage controllers and Cycloconverters (10 hours):**
Inverters- Introduction , principle of operation, performance parameters, single phase bridge inverters with R, RL and RLC loads, 3-phase bridge inverters- 120 and 180 degrees mode of operation, Voltage control of single phase inverters- single pulse width modulation, multiple pulse width modulation, sinusoidal pulse width modulation. Current Source Inverters. AC voltage controllers- Introduction, principle of operation of single phase voltage controllers for R & RL loads and its applications. Principle operation of the Cyclo-converter.

References/ Suggested Learning Resources:-
1. P. S. Bimbhra, “Power Electronics”, 4th Edition, Khanna Publishers.
2. M. H. Rashid, “Power electronics: circuits, devices, and applications”, Pearson Education

India, 2009.
3. N. Mohan, T.M. Undeland & W.P. Robbins, “Power Electronics”, John Wiley & Sons.
4. V. Subramanian, “Power Electronics”, New Age International (P) Ltd.
5. P.C. Sen, “Power Electronics”, Tata McGraw-Hill Publishing Co. Ltd.
6. B.W. Williams, “Power Electronics”, Macmillan.
7. G.K. Dubey, S.R. Doradla, A. Joshi & R.M.K. Sinha, “Thyristorised Power Controllers”, Wiley Eastern Ltd.

ELECTRICAL MACHINES LABORATORY– I

Course Code	PC EE 407
Course Title	Electrical Machines Laboratory- I
Number of Credits	1 (L: 0, T: 0, P:2)
Prerequisites	Electrical Machines - I
Course Category	PC
Number of Classes	20

Course Outcomes:-
After completion of this course the students will be able to:

CO Number	CO Description	K-level
CO1	Understand the basic concept of Transformers.	K-2
CO2	Understand the basic knowledge of DC Machines.	K-2
CO3	Apply the knowledge of transformer for Industrial Applications	K-3
CO4	Apply the knowledge of DC machines for Industrial Applications.	K-3

Course Content:-
List of Experiments:

1. O.C and S.C test on single phase transformer
2. Parallel operation of two single phase transformers
3. Study of dc machine starter and variation of speed of dc shunt motor by armature and field control method.
4. No load characteristics of dc shunt generator
5. Load characteristics of dc series motor
6. Load characteristics of dc compound generator
7. Load test on dc shunt motor
8. To study the characteristics of Auto-Transformer

References/ Suggested Learning Resources:-

1. A. E. Fitzgerald and C. Kingsley, “Electric Machinery”, New York, McGraw Hill Education, 2013.
2. A. E. Clayton and N. N. Hancock, “Performance and design of DC machines”, CBS Publishers, 2004.
3. M. G. Say, “Performance and design of AC machines”, CBS Publishers, 2002.
4. P. S. Bimbhra, “Electrical Machinery”, Khanna Publishers, 2011.
5. I. J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education, 2010.

POWER ELECTRONICS LABORATORY

Course Code	PCEE408
Course Title	Power Electronics Laboratory
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	Basic Electrical Engineering and Power Electronics
Course Category	Program Core-11
Number of classes	20 hours

Course Outcome:-
After completion of the course, students will be able to:

CO No.	CO Description	K-level
PCEE408.1	Demonstrate the characteristics of the Power Semiconductor devices.	K2
PCEE408.2	Illustrate the different triggering techniques of Power Electronic devices for their applications in Electrical Engineering.	K2
PCEE408.3	Examine the characteristics of Single and three-phase half and fully controlled Converters.	K4
PCEE408.4	Apply the use of power electronic based converter circuits in the higher courses of Electrical Engineering.	K3

List of Experiments ***(Minimum 6 experiments to be performed). Use of virtual laboratory to perform few experiments if available may be explored.***
1. Study of VI characteristics of SCR
2. Study of VI characteristics of TRIAC.
3. Study of VI characteristics of MOSFET.
4. Study of VI characteristics of IGBT.
5. Study of R firing circuits for SCR.
6. Study of RC firing circuits for SCR.
7. Study of UJT firing circuits for SCR.
8. Study of Characteristics of SCR based Half controlled Single Phase Converters with R and

RL Load.
9. Study of Characteristics of SCR based Fully controlled Single Phase Converters with R and RL load.
10. Study of Characteristics of SCR based Half and Fully controlled Three Phase Converters.
11. Study of DC Jones Chopper.
12. Study of Thyristorised speed control of a DC motor.

References/ Suggested Learning Resources:-

1. P. S. Bimbhra, "Power Electronics", 4th Edition, Khanna Publishers.
2. M. H. Rashid, "Power electronics: circuits, devices, and applications", Pearson Education India, 2009.
3. N. Mohan, T.M. Undeland & W.P. Robbins, "Power Electronics", John Wiley & Sons.
4. G.K. Dubey, S.R. Doradla, A. Joshi & R.M.K. Sinha, "Thyristorised Power Controllers", Wiley Eastern Ltd.
5. P.C. Sen, "Power Electronics", Tata McGraw-Hill Publishing Co. Ltd.

BASIC ELECTRICAL MEASUREMENTS LABORATORY PRACTICES

Course Code	PC EE-409
Course Title	Basic Electrical Measurements Laboratory Practices
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	Electrical Measurements
Course Category	Program Core-12
No of Classes	20

Course Outcome:

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

CO Number	CO Description	K-level
CO-1	Apply the DC and AC bridges in measurement.	K3
CO-2	Demonstrate the application of various measurement devices, their characteristics, operation and limitations.	K3
CO-3	Understand the characteristics of different sensors	K2
CO-4	Understand the application of different transducers	K2

List of Experiments ***(Minimum 6 experiments to be performed).***

1. Measurement of L using a bridge technique.
2. Measurement of C using a bridge technique.
3. Measurement of Low Resistance using Kelvin's double bridge.
4. Measurement of High resistance and Insulation resistance using Megger.
5. Measure power in 3-phase load by Two-wattmeter method .
6. Use and Limitations of DC Ammeter and DC Voltmeters
7. Determination of Characteristics of Thermistors.

8. Study of Characteristics of RTD for the Measurement of Temperature
9. Temperature Measurement using Thermocouple and study of its characteristics.
10. Strain measurement using strain gauges and cantilever assembly.
11. Determination of sensitivity of Strain gauges and cantilever assembly trainer.
12. To study the Input-Output characteristic of LVDT
13. To determine the sensitivity of LVDT.

References / Suggested Learning Resources:-

1. A course in Electrical & Electronics Measurement – A. K. Sawhney
2. Experiments on basic electrical engineering by S.K. Bhattacharya & K.M. Rastori.
3. Basic electrical engineering by Nagrath & Kothari
4. Electrical & Electronic Measurements by J.B. Gupta – S. K. Kataria Publication.
5. Electrical Measurements & Measuring Instruments by Golding & Widdis – Wheeler Publications.
6. Experiments on electrical engineering by A.K.Chakraborty.

INDIAN CONSTITUTION

Course Code	MC 410
Course Title	Indian Constitution
Number of Credits	0 (L: 2, T: 0, P: 0)
Prerequisites	Nil
Course Category	Mandatory Course (MC)
Number of classes	25 hours

Course Outcome:-

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

CO Number	CO Description	K-level
CO-1	Explain about framing and nature of Indian Constitution.	K2
CO-2	Identify the fundamental rights and duties of individual and demonstrate the knowledge on Directive Principles of State Policy.	K3
CO-3	Outline the Federal Structure, Centre- State relation, Union Executive and Amendment Procedure	K2
CO-4	Demonstrate the meaning of local self govt., types of local self govt. in rural and urban areas.	K2

Course Content:

Module 1: Constitutional Framework (05 hours)
1. Meaning of Constitutional Law and Constitutionalism.
2. Historical perspective of the Constitution of India.
3. Salient features of the Constitution of India.

Module 2: Fundamental Rights, Duties and Directive Principles of State Policy (06 hours)
1. Fundamental Rights- Articles 14, 19 and 21.
2. Fundamental Duties.
3. Directive Principles of State Policy; Its Legal Status and Significance

Module 3: Nature of India's Political system (07 hours)

1. Federal structure, Distribution of Legislative and Financial Powers between the Union and States.
2. Parliamentary Form of Government- Powers and Position of President of India.
3. Emergency Provisions.
4. Amendment Procedures of the Constitution of India.

Module 4: Rural and Urban Local Self Govt. (07 hours)

1. 73rd Amendment of the Constitution and Panchayati Raj Institutions.
2. 74th Amendment of the Constitution and Urban Local Self Govt. (Municipal Corporation, Municipal Council and Nagar Panchayat).
3. TTAADC

References / Suggested Learning Resources:
1. Fadia, B.L- "Indian Govt. and Politics" Sahitya Bhawan, Agra.
2. D.D.Basu- "An introduction to the Constitution of India" Lexis Nexis publichers.
3. M.V.Pylee- "Constitutional Govt. in India" S.Chand and Company Ltd.
4. S.C.Kashyap(ed)- "Perspectives on the constitution" Shipra Publication.
5. B.K. Sharma- "Introduction to the Constitution of India" Prentice Hall India Private Ltd.
6. Bhattacharya, D.C. and Banerjee, Malay- "Indian Govt. and Politics" Vijaya Publishing House
7. J.C. Johari- "Indian Govt. and Politics" (2 vols)
8. Das Nityananda- "Grassroot Democracy and Panchayati Raj in Tripura" Progressive Publichers