

Semester IV

Sl. No.	Category	Course Code	Course Title	Hours per Week			Total Contact Hours/ Week	Credits
				L	T	P		
1.	Programme core course-10	EEPC-401	Fundamentals of Power Electronics	3	0	0	3	3
2.	Programme core course-11	EEPC-402	Fundamentals of Power Electronics Laboratory	0	0	2	2	1
3.	Programme core course-12	EEPC-403	Electric Power Transmission and Distribution	2	1	0	3	3
4.	Programme core course-13	EEPC-404	Electric Power Transmission and Distribution Laboratory	0	0	2	2	1
5.	Programme core course-14	EEPC-405	Induction, Synchronous and Special Electrical Machines	2	1	0	3	3
6.	Programme core course-15	EEPC-406	Induction, Synchronous and Special Electrical Machines Laboratory	0	0	2	2	1
7.	Programme elective course-1 (Any One to be selected)	EEPE-407/A	Electrical Estimation and Contracting	3	0	0	3	3
		EEPE-407/B	Illumination Practices					
		EEPE-407/C	Electrical Testing and Commissioning					
8.	Humanities & Social Science- 4	HS 408	Professional Skill Development	2	1	0	3	3
9.	Minor Project	PR-401	Minor Project	0	0	4	4	2
10.	Mandatory Course-1	AU-402	Essence of Indian Knowledge and Tradition	2	0	0	2	0
	Total			15	2	10	27	20

FUNDAMENTALSOFPOWERELECTRONICS

CourseCode	:	EEPC-401
CourseTitle	:	Fundamentals of Power Electronics
NumberOfCredits	:	3(L:3,T:0,P:0)
Prerequisites	:	NIL
CourseCategory	:	PC

CourseOutcomes:-

With this course the student will be able to:

- 1) Explain the construction and characteristics of Power semiconductor devices and also select for specific applications (K-3).
- 2) Understand and explain the performance of Thyristors (K-2).
- 3) Troubleshoot turn-on and turn-off circuits of Thyristors (K-4).
- 4) Maintain phase-controlled rectifiers (K-3).
- 5) Maintain the application of industrial control circuits (K-3).

CourseContent:-

Module- 1: Power Electronic

Devices Number of class hours: 06

(Six) Hours Suggestive

Learning Outcomes:

Students will be able to:-

- 1) Explain with sketches the working of the given power electronic devices.
- 2) Describe with sketches the construction of the given power transistors.
- 3) Interpret the V-I characteristics of the given power electronic device.
- 4) Select suitable power electronic device for given situation with justification.
- 5) Suggest suitable IGBT for given application.

Detailed content of the unit: -

Power electronic devices

Power transistor: construction, working principle, V-I characteristics and uses. IGBT: Construction, working principle, V-I characteristics and uses.

Concept of single electron transistor (SET) - aspects of Nano-technology.

Module- 2: Thyristor Family

Devices Number of class hours: 12 (twelve) H

ours Suggestive Learning Outcomes:

Students will be able to:

- 1) Classify given power semiconductor devices.
- 2) Identify given thyristors and triggering devices with justification.
- 3) Interpret the V-I characteristics of the given thyristor family device.
- 4) Explain with sketches the working of the given type of thyristors.
- 5) Describe the procedure to troubleshoot the given type of thyristors.

Detailed content of the unit: -

SCR: construction, two transistor analogy, types,

working and characteristics. SCR mounting and cooling

Types of Thyristors: SCR, LASCR, SCS, GTO, UJT, PUT, DIAC and TRIAC

Thyristor family devices: Symbol, construction, operating principle and V-I characteristics.

Protection circuits: over-voltage, over-current, Snubber, Crowbar.

Module-3: Turn-on and Turn-off Methods of Thyristors

Number of class hours: 10 (ten) Hours Su

ggestive Learning Outcomes:

Students will be able to:

- 1) Explain with sketches the working of the given type of triggering circuit.
- 2) Explain the role of pulse transformer in the given triggering circuit.
- 3) Explain with sketches the working of the given type of Turn-On method.
- 4) Describe the procedure to troubleshoot the given type of Turn-On method.
- 5) Explain with sketches the working of the given type of Turn-Off method.
- 6) Describe the procedure to troubleshoot the given type of Turn-Off method.

Detailed content of the unit: -

SCR Turn-On methods: High Voltage thermal triggering, Illumination triggering, dv/dt triggering, Gate triggering.

Gate triggering circuits – Resistance and Resistance-Capacitance circuits.

SCR triggering using UJT, PUT: Relaxation Oscillator and Synchronized UJT circuit.

Pulse transformer and opto-coupler based triggering.

SCR Turn-Off methods: Class A- Series resonant commutation circuit, Class B – Shunt Resonant commutation circuit, Class C – Complimentary Symmetry commutation circuit, Class D – Auxiliary commutation, Class E- External pulse commutation, Class F- Line or natural commutation.

Module-4: Phase Controlled Rectifiers:

Number of class hours: 14 (fourteen) Hours

Suggestive Learning Outcomes:

Students will be able to:

- 1) Explain with sketches the operation of the phase control.
- 2) Calculate the average voltage of the given controlled rectifier.
- 3) Interpret/draw the input-output waveforms of the power electronic circuit.
- 4) Explain with sketches the operation of the given bridge configuration.
- 5) Describe the procedure to troubleshoot the given phase controlled rectifier circuit.

Detailed content of the unit:-

Phase control: firing angle, conduction angle.

Single phase half controlled full controlled and midpoint controlled rectifier with R, RL load: Circuit diagram, working, input-output waveforms, equations for DC output and effect of freewheeling diode.

Different configurations of bridge controlled rectifiers: Full bridge, half bridge with common anode, common cathode, SCRs in one arm and diodes in another arm.

Module- 5: Industrial Control

Circuits Number of class hours: 05 (five)

Hours Suggestive Learning Outcomes:

Students will be able to:

- 1) Explain with sketches the working of given industrial control circuits.
- 2) Describe the working of given type of SMPS.
- 3) Describe the troubleshooting procedure of the given type of online and offline UPS.
- 4) Explain with sketches the working of the given type of SCR-based circuit breaker.

Detailed content of the unit: -

Applications: Burglar's alarm system, Battery charger using SCR, Emergency light system, Temperature controller using SCR and; Illumination control / fan speed control TRIAC.

SMPS

UPS: Offline and Online.

SCR based AC and DC circuit breakers.

References:-

1. Bimbhra, P.S., Power Electronics, Khanna Publishers, New Delhi, ISBN-13: 978-8174092151
2. Sugandhi, Rajendra Kumar and Sugandhi, Krishna Kumar, Thyristors: Theory and Applications, New Age International (P) Ltd. Publishers, New Delhi, ISBN: 978-0-85226-852-0.
3. Bhattacharya, S.K., Fundamentals of Power Electronics, Vikas Publishing House Pvt. Ltd. Noida. ISBN: 978-8125918530.
4. Jain & Alok, Power Electronics and its Applications, Penram International Publishing (India) Pvt. Ltd, Mumbai, ISBN: 978-8187972228.
5. Rashid, Muhammad, Power Electronics Circuits Devices and Applications, Pearson Education India, Noida, ISBN: 978-0133125900.
6. Singh, M.D. and Khanchandani, K.B., Power Electronics, Tata McGraw Hill Publishing Co. Ltd, New Delhi, 2008 ISBN: 9780070583894.
7. Zbar, Paul B., Industrial Electronics: A Text – Lab Manual, McGraw Hill Publishing Co. Ltd., New Delhi, ISBN: 978-0070728226.
8. Grafham D.R., SCR Manual, General Electric Co., ISBN: 978-0137967711.

FUNDAMENTALS OF POWER ELECTRONICS LABORATORY

CourseCode	:	EEPC-402
CourseTitle	:	Fundamentals of Power Electronics Laboratory
NumberOfCredits	:	1(L:0,T: 0,P:2)
Prerequisites	:	NIL
CourseCategory	:	PC

Course Outcomes:-

With this course students will be able to:-

- 1) Select power electronic devices for specific applications (K-3).
- 2) Maintain the performance of Thyristors (K-3).
- 3) Troubleshoot turn-on and turn-off circuits of Thyristors (K-2).
- 4) Maintain phase-controlled rectifiers (K-3).
- 5) Maintain industrial control circuits (K-3).

Course Content:-

- 1) Test the proper functioning of power transistor.
- 2) Test the proper functioning of IGBT.
- 3) Test the proper functioning of DIAC to determine the breakover voltage.
- 4) Determine the latching current and holding current using V-I characteristics of SCR.
- 5) Test the variation of R , C in R and R C triggering circuits' on firing angle of SCR.
- 6) Test the effect of variation of R , C in UJT triggering technique.
- 7) Perform the operation of Class –A, B, C turn off circuits.
- 8) Perform the operation of Class –D, E, F turn off circuits.
- 9) Use CRO to observe the output waveform of half-wave controlled rectifier with resistive load and determine the load voltage.
- 10) Draw the output waveform of Full-wave controlled rectifier with R load, RL load, and freewheeling diode and determine the load voltage.
- 11) Determine the firing angle using DIAC and TRIAC phase-controlled circuit on output power under different loads such as lamp, motor or heater.
- 12) Simulate above firing angle control on SCILAB software.
- 13) Test the performance of given SMPS, UPS.
- 14) Troubleshoot the Burglar's alarm, Emergency lights system, Speed control system, Temperature control system.

ELECTRIC POWER TRANSMISSION AND DISTRIBUTION

Course Code	:	EEPC-403
Course Title	:	Electric Power Transmission and Distribution
Number of Credits	:	3(L:2,T:1,P:0)
Prerequisites	:	NIL
Course Category	:	PC

Course outcomes:-

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

- a) Interpret the normal operation of the electric transmission and distribution systems. (K2)
- b) Maintain the functioning of the medium and high voltage transmission system. (K3)
- c) Interpret the parameters of the extra high voltage transmission system. (K2)
- d) Maintain the functioning of the low voltage AC distribution system. (K3)
- e) Maintain the components of the transmission and distribution lines. (K3)

Course contents:-

Module–1: Basics of Transmission and Distribution

Number of class hours: 6

hours Suggestive Learning Outcome

s:

Students will be able to:-

- 1) Describe with sketches the features of the given type of electric supply systems.
- 2) Interpret the implications of the voltage levels in the given transmission systems.
- 3) Explain the characteristics of the specified high voltage transmission lines.
- 4) Describe with sketches the construction method of the given type of transmission/distribution line.

Detailed content of the unit: -

Single line diagrams with components of the electric supply transmission and distribution systems. Classification of transmission lines: Primary and secondary transmission; standard voltage level used in India. Classification of transmission lines: based on type of voltage, voltage level, length and others. Characteristics of high voltage for power transmission. Method of construction of electric supply transmission system—110kV, 220kV, 400kV. Method of construction of electric supply distribution systems—220V, 400V, 11kV, 33kV.

Module–2: Transmission Line Parameters and Performance

Number of class hours: 10 hours Suggestive

Learning Outcomes: Students will be able to:-

- 1) Describe with sketch the given line parameters and types of specified lines.
- 2) Interpret the performance of the specified short line.
- 3) Interpret the performance of the specified medium line.
- 4) Describe the need for transposition of conductors.
- 5) Explain the specified effects occurring in the given type of transmission line.

Detailed content of the unit: -

Line Parameters: Concepts of R, L and C line parameters and types of lines. Performance of short line: Efficiency, regulation and its derivation, effect of power factor, vector diagram for different power factor. Performance of medium line: representation, nominal 'T', nominal ' π ' and end condenser methods. Transposition of conductors and its necessity. Skin effect and proximity effect. Power Factor Improvement: Using Static condenser and Synchronous condenser.

Module–3: Extra High Voltage Transmission

Number of class hours: 8

hours Suggestive Learning Outcome

S:-

Students will be able to:-

- 1) Explain the specified features of the given type of extra high voltage transmission line.
- 2) Explain the specified effects occurring in the given type of high voltage transmission line.
- 3) Describe with sketches the layout of given HVDC transmission line as per the given criterion.
- 4) Explain the given feature of the Flexible AC transmission line.
- 5) Explain the features of given wireless transmission of electrical power.

Detailed content of the unit:-

Extra High Voltage AC (EHVAC) transmission line: Necessity, high voltage substation components such as transformers and other switch gears, advantages, limitations and applications and lines in India. Ferranti and Corona effect.

High Voltage DC (HVDC) Transmission Line: Necessity, components, advantages, limitations and applications. Layout of Monopolar, Bi-polar and Homo-polar transmission lines and Lines in India.

Features of EHVAC and HVDC transmission line.

Flexible AC Transmission line: Features, different types of FACTS controller. New trends in wireless transmission of electrical power.

Module–

4: A.C Distribution System

Number of class hours: 8 hours Suggestive

Learning Outcomes:-

Students will be able to:-

- 1) Describe with sketches the circuit components of the AC distribution system.
- 2) Describe the factors to be considered for design of specified feeder and distributor.
- 3) Describe with sketches the types of different schemes for given type of distribution system.
- 4) Calculate the sending and receiving end voltage of the given AC distribution system.

- 5) Describe with sketches the components and their functions for the given type of distribution sub-station.
- 6) Describe with sketches the single line diagram of a given type of distribution sub-station.

Detailed content of the unit: -

AC distribution: Components classification, requirements of an ideal distribution system, primary and secondary distribution system.

Feeder and distributor, factors to be considered in design of feeder and distributor.

Types of different distribution schemes: radial, ring, and grid, layout, advantages, disadvantages and applications.

Voltage drop, sending end and receiving end voltage.

Distribution Sub-

Station: Classification, site selection, advantages, disadvantages and applications.

Single Line diagram (layout) of 33/11 KV Sub-Station, 11 KV/400 V sub-station, Symbols and functions of their components.

Module–V: Component of Transmission and Distribution Line

Number of class hours: 10

hours Suggestive Learning Outcomes:-

Students will be able to:-

- 1) Describe the given type of overhead conductor based on the given criteria.
- 2) Describe with sketches the method of erection of the given type of line supports.
- 3) Describe with sketches the types and properties of specified line insulators.
- 4) Calculate the string efficiency for the specified string of the given type of insulator.
- 5) Describe with sketches the specified underground cable based on the given criteria.

Detailed content of the unit: -

Overhead Conductors: Properties of material, types of conductor with trade names, significance of sag, Sag with level supports, effect of wind pressure, temperature and ice deposition on Sag.

Line supports: Requirements, types of line structures and their specifications, methods of

erection.

Line Insulators: Properties of insulating material, selection of material, types of insulators and their applications, causes of insulator failure, voltage distribution, derivation of equation of string efficiency for string of three suspension insulator, methods of improving string efficiency.

Underground Cables: Requirements, classification, construction, comparison with overhead lines, cable laying and cable jointing.

References:

1. G.C. Garg, Utilization of Electric Power & Electric Traction, Khanna Book Publishing Co., New Delhi (ISBN:978-93-86173-355)
2. Mehta, V.K., Principles of Power System, S. Chand and Co. New Delhi, ISBN:9788121924962
3. Soni; Gupta; Bhatnagar, A Course in Electrical Power, Dhanpat Rai and Sons New Delhi, ISBN: 9788177000207
4. Gupta, J.B., A Course in Power Systems, S.K. Kataria and sons, New Delhi, ISBN:9788188458523
5. Theraja, B.L.; Theraja, A.K., A Textbook of Electrical Technology Vol. III, S. Chand and Co. New Delhi, ISBN:9788121924900
6. Uppal, S.L., A Course in Electrical Power, S.K. Khanna Publisher New Delhi, ISBN:9788174092380
7. Sivanagaraju S.; Satyanarayana S., Electrical Power Transmission and Distribution, Pearson Education, New Delhi, ISBN:9788131707913
8. Ned Mohan, Electrical Power System: A First Course, Wiley India Pvt. Ltd. New Delhi, ISBN: 9788126541959
9. Gupta, B.R., Power System Analysis and Design, S. Chand and Co. New Delhi, ISBN:9788121922388
10. Kamraju, V., Electrical Power Distribution System, Tata McGraw-Hill, New Delhi, ISBN:9780070151413

**ELECTRIC POWER TRANSMISSION AND
DISTRIBUTION LABORATORY**

CourseCode	:	EEPC-404
CourseTitle	:	ElectricPower TransmissionandDistributionLaboratory
NumberofCredits	:	1 (L:0,T:0,P:2)
Prerequisites	:	NIL
CourseCategory	:	PC

Courseoutcomes:

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

- a) Interpret the normal operation of the electric transmission and distribution systems. (K-2)
- b) Maintain the functioning of the medium and high voltage transmission system. (K-3)
- c) Interpret the parameters of the extra high voltage transmission system. (K-2)
- d) Maintain the functioning of the low voltage AC distribution system. (K-3)
- e) Maintain the components of the transmission and distribution lines. (K-3)

Course contents:

Laboratory work is not applicable for this course. Following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- a) Prepare a report based on transmission line network in Tripura.
- b) Collect the information on components of transmission line.
- c) Evaluate transmission line performance parameters of a given line.
- d) Library/Internet survey of electrical high voltage line and HVDC lines.
- e) Visit to 33/11KV and 11KV/400V Distribution Substation and write a report.

Also, a micro-project can be assigned to the student. A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

- 1) Prepare a model showing:
 - i. Single line diagram of electric supply system.

- ii. Single linediagram ofagivendistributionsystem.
 - iii. Shortlineand mediumtransmissionline.
 - iv. Write areport onthesamebygivingthe details oflinesin TripuraState.
- 2) CollectdifferentsofOverheadConductors,UndergroundCables,LinesupportsandLineInsulators.
- 3) Prepareapowerpointpresentation:
 - i. ExtraHighVoltageACTransmissionline.
 - ii. HighVoltageDCTransmissionline.
 - iii. FlexibleACTransmissionline.
 - iv. Newtrendsinwirelesstransmissionofelectricalpower.
- 4) Collectinformationon:
 - i. A.CDistributionSystem adjacenttoyourinstitute.
 - ii. Drawalayoutdiagramof11KV/400Vsubstationinyourcampus/adjacentsubstation.

CourseCode	:	EEPC-405
CourseTitle	:	Induction, Synchronous and Special Electric Machines
Number of Credits	:	3 (L:2, T:1, P: 0)
Prerequisites	:	NIL
CourseCategory	:	PC

Course outcomes:

The

theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented CoS associated with the above mentioned competency:

1. Maintain three phase induction motor used in different applications. (K-4)
2. Maintain single phase induction motor used in different applications. (K-4)
3. Maintain three phase alternators used in different applications. (K-4)
4. Maintain synchronous motors used in different applications. (K-4)
5. Maintain FHP motors used in different applications. (K-4)

Course Contents:-

Module – 1:- Three Phase Induction

Motor Number of class hours: 8 (Four)

Hours Suggestive Learning Outcomes:

Students will be able to:

1. Know about working principle 3 phase induction motors
2. Know about Rotor quantities: frequency, induced emf, power factor at starting and running condition.
3. Know about Speed control methods

Detailed Content of the Unit:-

Working principle: production of rotating magnetic field, Synchronous speed, rotor speed and slip. Constructional details of 3 phase induction motors: Squirrel cage induction motor and Slip ring induction motor. Rotor quantities: frequency, induced emf, power factor at starting and running condition. Characteristics of torque versus slip (speed). Torques: starting, full load and maximum with relations

among them. Induction motor as a generalized transformer with phasor diagram. Four quadrant operation, Power flow diagram. Starters: need and types; stator resistance, auto transformer, star delta, rotor resistance and soft starters. Speed control methods: stator voltage, pole changing, rotor resistance and VVVF. Motor selection for different applications as per the load torque-speed requirements. Maintenance of three phase induction motors.

Module–

II: Single phase induction motors Number of

class hours: 8 (Four) Hours Suggestive

Learning Outcomes:

Students will be able to:

1. Know about Double field revolving theory, principle of making these motors self-start
2. Know about Torque-speed characteristics for all of the above motors.
3. Know about Maintenance of single phase induction motors

Detailed Content of the Unit:-

Double field revolving field theory, principle of making these motors self-start. Construction and working: Resistance start induction run, capacitor start induction run, capacitor start capacitor run, shaded pole, repulsion type, series motor, universal motor, hysteresis motor. Torque-speed characteristics for all of the above motors.

Motor selection for different applications as per the load torque-speed requirements. Maintenance of single phase induction motors.

Module–3:-

Three phase Alternators Number of

class hours: 8 (Four) Hours Suggestive

Learning Outcomes:

Students will be able to:

1. Know about Principle of working, moving and stationary armatures.
2. Know about E.M.F. equation of an Alternator
3. Know about Armature reaction

Detailed Content of the Unit:-

Principle of working, moving and stationary armatures.

Constructional details: parts and their functions, rotor constructions. Windings: Single and Double layer. E.M.F. equation of an Alternator with numerical by considering short pitch factor and distribution factor. Regulation of Alternator, Alternator loading: Factors affecting the terminal voltage of alternator; Armature resistance and leakage reactance drops. Armature reaction at various power factors and synchronous impedance. Voltage regulation: direct loading and synchronous impedance methods. Maintenance of alternators, Simple numerical related to alternator.

Module – 4:- Synchronous

motors Number of class hours: 8 (Four) H

ours Suggestive Learning Outcomes:

Students will be able to:

1. Know about Principle of working/operation Synchronous motor
2. Know about different Torques:
3. Know about V-Curves and Inverted V-Curves.

Detailed Content of the Unit:-

Principle of working/operation, significance of load angle.
 Torques: starting torque, running torque, pull in torque, pull out torque.
 Synchronous motor on load with constant excitation (numerical), effect of excitation at constant load (numerical).
 V-Curves and Inverted V-Curves. Hunting and Phaseswinging.
 Methods of Starting of Synchronous Motor.
 Losses in synchronous motors and efficiency (non numerical). Applications areas

Module-5:- Fractional horsepower (FHP) Motors

Number of class hours: 8 (Four) Hours Su

ggestive Learning Outcomes:

Students will be able to:

1. Know about Construction and working different type of FHP motors
2. Know about Torque speed characteristics of above motors.

3. KnowaboutApplicationsofabovemotors.

DetailedContentofthe Unit:-

Construction and working: Synchronous Reluctance Motor, Switched Reluctance Motor,BLDC,PermanentMagnetSynchronousMotors,steppermotors,ACandDCservomotors.Torque speed characteristics of above motors.Applicationsof abovemotors.

References:

1. P.S.Bimbhra,ElectricMachines,KhannaBookPublishingCo.,NewDelhi(ISBN:978-93-86173-294)
2. Mittle,V.N.andMittle,Arvind.,BasicElectricalEngineering,McGrawHillEducation,NewDelhi,ISBN :9780070593572
3. Kothari, D. P. and Nagrath, I. J., Electrical Machines, McGraw Hill Education. New Delhi,ISBN:9780070699670
4. Bhattacharya,S.K.,ElectricalMachines,McGrawHillEducation,NewDelhi,ISBN:9789332902855
5. Theraja,B.L.,ElectricalTechnologyVol-II(ACandDCmachines),S.ChandandCo.Ltd.,New Delhi,ISBN :9788121924375
6. Sen,S.K.,SpecialPurposeElectricalMachines,KhannaPublishers,NewDelhi,ISBN:9788174091529
7. JanardananE.G,SpecialElectricalMachines,PrenticeHallIndia,NewDelhiISBN:9788120348806
8. HughesE.,ElectricalTechnology,ELBS
9. CottonH.,ElectricalTechnology,ELBS

INDUCTION, SYNCHRONOUS AND SPECIAL ELECTRIC MACHINES LABORATORY

CourseCode	:	EEPC-406
CourseTitle	:	Induction, Synchronous and Special Electric Machines Laboratory
NumberOfCredits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	NIL
CourseCategory	:	PC

Course outcomes:-

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented competencies associated with the abovementioned competency:

1. Maintain three phase induction motor used in different applications. (K-4)
2. Maintain single phase induction motor used in different applications. (K-4)
3. Maintain three phase alternators used in different applications. (K-4)
4. Maintain synchronous motors used in different applications. (K-4)
5. Maintain FHP motors used in different applications. (K-4)

Course Contents:-

Practicals:

1. Identify the different parts (along with function and materials) for the given single phase and three phase induction motor.
2. Connect and run the three phase squirrel cage induction motors (in both directions) using the DOL, star-delta, auto-transformer starters (any two).
3. Perform the direct load test on the three phase squirrel cage induction motor and plot the
i) efficiency versus output, ii) power factor versus output, iii) power factor versus motor current and iv) torque-slip/speed characteristics.

4. Conduct the No-load and Blocked-rotor tests on given 3-phase squirrel cage induction motor and determine the equivalent circuit parameters.
5. Conduct the No-load and Blocked-rotor tests on given 3-phase squirrel cage induction motor and plot the Circle diagram.
6. Control the speed of the given three phase squirrel cage/slip ring induction motor using the applicable methods: i) auto-transformer, ii) VVVF.
7. Measure the open circuit voltage ratio of the three phase slip ring induction motor.
8. Conduct the direct load test to determine the efficiency and speed regulation for different loads on the given single phase induction motor; plot the efficiency and speed regulation curves with respect to the output power.
9. Perform the direct loading test on the given three phase alternator and determine the regulation and efficiency.
10. Determine the regulation and efficiency of the given three phase alternator from OC and SC tests (Synchronous impedance method).
11. Conduct the test on load or no load to plot the 'V' curves and inverted 'V' curves (at no-load) of 3-phase synchronous motor.
12. Dismantling and reassembling of single phase motors used for ceiling fans, universal motor for mixer.
13. Control the speed and reverse the direction of stepper motor.
14. Control the speed and reverse the direction of the AC servomotor.
15. Control the speed and reverse the direction of the DC servomotor.

ELECTRICAL ESTIMATION AND CONTRACTING

Course Code:	:	EEPE-407/A
Course Title :	:	Electrical Estimation and Contracting
Number of Credits	:	3(L:3,T: 0,P:0)
Prerequisites	:	NIL
Course Category	:	PE

Course outcomes:

The theory, practical experiences and relevant of skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

1. Follow National Electrical Code 2011 in electrical installations.(K-1)
2. Understand the purpose of Estimation and Contracting in electrical installation works (K-2)
3. Estimate the work of non-industrial electrical installations.(K-5)
4. Estimate the work of industrial electrical installations and Public Lighting Installation (K-5)
5. Prepare abstract, tender, quotation of low tension (LT) substations. (K-6).

Course Contents:

Module–I: Safety Scope and features of National electric code

Number of Class hours: 6 hours

Suggestive Learning Outcomes:

Students would be able to understand

1. Safety Scope and features of National electric code 2011.
2. Principles for electrical installation.
3. Safety instructions and safety practices.

Detailed Content of the Unit:-

Electric Installation and Safety Scope and features of National electric code 2011, Types of electrical installation, Fundamental principles for electrical installation, Permittowork , safety instructions and safety practices, Purpose of estimating and costing.

Module–II: Meaning and Purpose of Estimating and Costing

Number of Class hours: 6

hours Suggestive Learning Outcomes:

Students would be able to understand

1. Purpose of Estimation and Costing
2. Concepts of contracts
3. Tenders and Quotations

Detailed Content of the Unit:-

Estimation and Costing Meaning and purpose of-

Rough estimate, detailed estimate, supplementary estimate, annual maintenance estimate and revised estimate.

Factors to be considered while preparation

of detailed estimate and economical execution of work

Contracts- Concepts of contracts, types of contracts, contractor, role of

contractor. Tenders and Quotations- Type of tender, tender notice, preparation

of tender document, and method of opening of tender Quotation, quotation format, comparison between

tender and quotation Comparative statement, format comparative statement, Order format, placing of

purchasing order. Principles of execution of works, planning, organizing and

completion of work, Billing of work.

Module–III: Electrical Installation & Earthing in residential and commercial buildings.

Number of Class hours: 6

hours Suggestive Learning Outcomes:

Students would be able to understand

1. Electrical Installation in residential and commercial buildings.
2. Earthing of commercial installation

Detailed Content of the Unit:-

Non-Industrial Installations, Types of Non-industrial installations-

Office buildings, shopping and commercial centre, residential installation, Electric service and supply

Design consideration of electrical installation in commercial buildings.

Design procedure of installation- steps involved in detail. Estimating and costing of

unit Earthing of commercial installation. Design electrical installation scheme of commercial complex. Erection, Inspection and testing of installation as per NEC.

Module–IV: Electrical Design consideration in industrial installations and Public Lighting Installation

Number of Class hours: 6

hours Suggestive Learning Outcomes:

mes:

Students would be able to understand

1. Drawing of wiring diagram and single line diagram for single phase and three phase Motors.
2. Design electrical installation scheme of factory/ small industrial unit.
3. Study of Public Lighting Installation

Detailed Content of the Unit:-

Industrial Installation, Classification of industrial buildings Classification based on power consumption, Drawing of wiring diagram and single line diagram for single phase and three phase Motors.

Design consideration in industrial installations, Design procedure of installation- detailed steps.

Design electrical installation scheme of factory/ small industrial unit, Preparation of material schedule and detailed estimation Installation and estimation of agricultural pump and flour mill.

Public Lighting Installation, Classification of outdoor installations street light/ public lighting installation Street light pole structures.

Module – V: Design of LT

Substation Number of Class hours: 6

hours Suggestive Learning Outcomes:

Students would be able to understand

1. Distribution Lines and LT Substation
2. 11 KV Distribution substations & their line diagram
3. Estimation and costing of outdoor and indoor 11 KV substations.

Detailed Content of the Unit:-

Distribution Lines and LT Substation.

Introduction to overhead and underground distribution line.

Materials used for distribution line HT and LV Cables used for distribution line, factors determining selection of LT/HT power Cables, cable laying and cable termination method according to IS Design, estimation and costing of HT LT overhead line and underground cabling.

Types of 11 KV Distribution substations & their line diagram, Estimation of load, Load factor, diversity factor and determination of rating of distribution.

Transformer Design, estimation and costing of outdoor and indoor 11 KV substation.

References:

1. Raina, K.B.; Dr. S.K. Bhattacharya New Age International Publisher First, Reprint 2010, Electrical Design Estimating and Costing ISBN: 978-81-224-0363-3
2. Allagappan, N.S. Ekambarram, Tata McGraw Hill Publishing Co. Ltd, Electrical Estimating and Costing, ISBN 13: 9780074624784
3. Singh, Surjit Ravi Deep Singh, Dhanpat Rai and Sons, Electrical Estimating and Costing, ISBN 13: 1234567150995
4. Gupta, J.B.S.K. Kataria and Sons Reprint Edition, A Course in Electrical Installation Estimating and Costing ISBN 10: 9350142791 ISBN 13: 978-9350142790.
5. Bureau of Indian Standard. IS: 732-1989, Code of Practice for Electrical Wiring Installation
6. Bureau of Indian Standard. SP-30:2011, National Electrical Code 2011

ILLUMINATION PRACTICES

CourseCode	:	EEPE-407/B
CourseTitle	:	IlluminationPractices
NumberOfCredits	:	3(L:3,T:0,P:0)
Prerequisites	:	NIL
CourseCategory	:	PE

CourseOutcomes:-

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

1. Select relevant lamps for various applications considering illumination levels. (K-2)
2. Understand the lighting accessories required for selected wiring scheme. (K-2)
3. Design relevant illumination schemes for interior applications. (K-4)
4. Analyze illumination schemes for various applications. (K-4)
5. Design illumination schemes for various outdoor applications. (K-4)

CourseContents:-

Module–

1: Fundamental of Illumination Number of

class hours: 04 (Four) Hours Suggestive

Learning Outcomes:

Students will be able to:

1. Define the laws of illumination and concept of photometry.
2. Describe and demonstrate the polar curves and its applications.
3. Understand the lighting calculation methods.
4. Remember the standards of illumination and demonstrate the measurement of illumination.

Detailed content of the unit:-

Basic illumination, Terminology, Laws of illumination.

Polar curves, polar curve: its meaning and applications for designing the lamp. Concept of Photometry, Measurement of illumination.

Lighting calculation methods, Watt/m² method, Lumen or light flux method, Point to point method.

Standards for illumination.

Module –2: Types of Lamps

Number of class hours: 06 (Six)

Suggestive Learning Outcomes:

Students will be able to:

1. Define the selection criteria for lamps.
2. Describe and demonstrate the different types of lamps.

Detailed content of the unit:-

Selection Criteria for lamps.

Incandescent lamp, AR Clamps – AC and DC arc lamps, Fluorescent lamp.

Types of other lamps: Mercury vapour lamp, HPMV lamp, Mercury iodide lamp, Sodium vapour lamp, Halogen Lamps, Ultraviolet Lamps, Neon Lamps. Neon Sign Tubes. Metal halides, HID and AR clamps.

LED lamps, CFL, Lasers.

Module–3: Illumination Control and Control Circuits

Number of class hours: 08 (Eight) Hours

Suggestive Learning Outcomes:

Students will be able to:

1. Describe and demonstrate the principle of operation and construction of Dimmer.
2. Define the working principle for different types of Dimmer.
3. Describe and discuss the various control circuits for lamps.

Detailed content of the unit:-

Working principle and operation of Dimmer.

Resistance type Salt water Dimmer.

Dimmer Transformer and their types, Auto transformer dimmer, Two winding transformer dimmer.

Electronic Dimmer: working principle and operation

- a. Thyristor operated dimmer
- b. Triac operated dimmer

Purpose of lighting control, Control of Enhance Lighting, Methods used for light control, Control circuits for lamps: ON/OFF control.

Control circuits for lamps: single lamp controlled by single switch, two switches. Single Lamp control by two point method, three point method and four point method.

Module-4: Illumination for Interior Applications

Number of class hours: 08 (Eight) Hours

Suggestive Learning Outcomes:

Students will be able to:

1. Define the Standards for various locations of Interior Illumination.
2. Understand the Design considerations for Interior location.
3. Describe and discuss the Illumination scheme for different Interior locations.

Detailed content of the unit:-

Standard for various locations of Interior Illumination.

Design considerations for Interior location of residences (1/2/3/4 BHK), Commercial, Industrial premises.

Illumination scheme for different Interior locations of Residential, Commercial, industrial unit.

Module-5: Illumination for Interior Applications

Number of class hours: 06 (Six)

Suggestive Learning Outcomes:

Students will be able to:

1. Design and demonstrate the various types of interior applications of lighting.
2. Define the Special purpose lamps used in photography video films.

Detailed content of the unit:-

Factory Lighting, Street Lighting (Latest Technology), Flood Lighting, Railway Lighting. Lighting for advertisement/Hoardings/sports lighting, Agriculture and Horticulture lighting, Health Care Centres/Hospitals, Decorating Purposes, Stage Lighting, Aquariums and Ship-yards. Special purpose lamps used in photography video films.

References:-

1. Lindsey,Jack L.,Applied IlluminationEngineering,TheFairmontPress Inc.
2. Simons,R.H.,Bean,Robert;LightingEngineering:AppliedCalculations,ArchitecturalPress.ISBN: 0750650516.
3. CasimerMDecusatis,HandbookofAppliedPhotometry,Springer, ISBN1563964163.
4. Butterworths,LyonsStanley,HandbookofIndustrialLighting,Butterworths
5. SimpsonRobertS,LightingControlTechnologyandApplications,FocalPress
6. KaoChen,EnergyManagementin IlluminatingSystems,CRCPress

CourseCode	:	EEPE-407/C	
CourseTitle	:	ElectricalTestingand Commissioning	
NumberofCredits	:	3 (L:3,T:0,P: 0)	
Prerequisites	:	NIL	
CourseCategory	:	PC	

CourseOutcomes:-

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

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

1. Follow safety procedures with respect to earthing and insulation of electrical equipment. (K-4)
2. Select proper tools, equipment, for installation, testing, maintenance of electrical machines and transformers. (K-3)
3. Test and commission electrical equipment in accordance with IS codes. (K-4)
4. Make plans for troubleshooting electrical machines. (K-4)
5. Undertake regular preventive and breakdown maintenance. (K-3)

CourseContents:-

Module–1:-ElectricalSafetyandInsulation

Number of class hours: 8 (Four) Hours

Suggestive Learning Outcomes:

Students will be able to:

1. Know Do's and don'ts regarding safety.
2. Know about measuring insulation resistance by different methods.
3. Know about Reconditioning of insulation.

Detailed Content of the Unit:-

Do's and don'ts regarding safety in domestic electrical appliances as well for substation/power station

on operators.

Electrical safety in industry/power stations/substations at the time of operation/control/maintenance.

Fire detection alarm, fire-fighting equipment.

Factors affecting life of insulating materials, classification of insulating materials as per IS:1271-1958.

Measuring insulation resistance by different methods such as i) Polarization, ii) Dielectric absorption, iii) Megger and to predict the condition of insulation

Reconditioning of insulation,

Insulating oil-properties of insulating oil, causes of deterioration of oil, Testing of transformer oil as per IS 1866-1961

Module–2: Installation and Erection Number of class hours: 8 (Eight) Hours

Suggestive Learning Outcomes:

Students will be able to:

1. Know the Concept of foundation for installation of machinery.
2. Know Concept of leveling and aligning Procedure for leveling and aligning alignment of direct coupled drive, effects of misalignment.
3. Know Devices and tools required for loading, unloading etc.

Detailed Content of the Unit:-

Concept of foundation for installation of machinery. Requirements of foundation for static and rotating electrical machinery. Concept of leveling and aligning Procedure for leveling and aligning alignment of direct coupled drive, effects of mis-alignment.

Installation of transformer as per I.S.-1886-1967 and procedure of installation of transformer, Requirements of installation of pole mounted transformer.

Requirements of installation of rotating electrical machines as per I.S. 900-1965

Devices and tools required for loading, unloading, lifting, and carrying heavy equipment and precautions to be taken while handling them.

Module–3: Testing and Commissioning

Number of class hours: 8 (Eight) Hours

Suggestive Learning Outcomes:

Students will be able to:

1. Know the Concept of testing.
2. Know about tolerances for the various items for equipment.
3. Know about Commissioning, Tests before Commissioning of different machine.

Detailed Content of the Unit:-

Concept of testing, Objectives of testing. Roles of I.S.S. in testing of electrical equipment, Types of tests and concepts, Routine tests, type tests, supplementary test, special tests, Methods of testing-Direct/Indirect/Regenerative testing.

Tolerances for the various items for equipment –transformer, induction motor, dc motor, synchronous machines.

Commissioning, Tests before Commissioning for transformer, induction motor, alternator . Testing of transformer as per I.S. 1886-1967 and I.S. 2026-1962

Testing of three-phase Induction motor as per I.S. 325-

1970. Testing of single-phase induction motor as per

I.S. 990-1965. Testing of synchronous machines as per ISS

Testing of D.C. machines

Module – 4: Troubleshooting Plans

Number of class hours: 8 (Eight) Hours

Suggestive Learning Outcomes:

Students will be able to:

1. Know about Internal and external causes for failure
2. Know about Use of tools like bearing puller, filler gauges etc.
3. Know about Common troubles in electrical equipment's and machines.

Detailed Content of the Unit:-

Internal and external causes for failure / abnormal operation of equipment.

List of mechanical faults, electrical faults and magnetic faults in the electrical equipment remedies, applications.

Use of tools like bearing puller, filler gauges, dial indicator, spirit level, megger, earth tester, and growler. Common troubles in electrical equipment and machines.

Preparation of troubleshooting charts for D.C. Machines, A.C. Machines and transformers.

Module-5: Maintenance

Number of class hours: 8 (Eight) Hours Suggestive

Learning Outcomes:

Students will be able to:

1. Know about concept of maintenance.
2. Know about Causes of failure of electrical machines.
3. Know about Preventive maintenance-procedure.

Detailed Content of the Unit:-

Concept of maintenance, types of maintenance, routine, preventive and breakdown maintenance & Total Quality Maintenance (TQM)

Causes of failure of electrical machines.

Preventive maintenance-

procedure or developing maintenance schedules for electrical machines.

Factors affecting preventive maintenance schedules, Concept of TPM, Pillars of

TPM. Identification of different types of faults developed such as mechanical/electrical/magnetic faults.

Maintenance schedules of the following as per I.S.S.

- a) Distribution transformer as per I.S. 1886-1967
- b) Single phase and three phase Induction motors as per I.S. 900-1965.
- c) Batteries

References:

1. Deshpande.M. V. PHI Learning Pvt. Ltd., 2010, Design and Testing of Electrical Machines ISBN No 8120336453, 9788120336452.
2. Rao, B V S Asia Club House, First Reprint, 2011, Operation and Maintenance of Electrical Equipment Vol-I, ISBN No 8185099022.
3. Rosenberg.McGraw-Hill, 1st Edition, May 2003, Maintenance and Repairs, ISBN No 9780071396035.
4. Sharotri, S.K. Glencoe/McGraw-Hill; 2nd Edition, June 1969; Preventive Maintenance of Electrical Apparatus, ISBN No 10: 007030839X 13: 978-0070308398.

PROFESSIONAL SKILL DEVELOPMENT

Course Code		HS 408
Course Title		Professional Skill Development (Theory)
Number of Credits		3 (L: 2, T: 1, P:0)
Prerequisites		NIL
Course Category		HS

Course Outcomes:

After successful completion of this course, students would be able to:

CO1: Understand the importance of soft skills and personality in a person's career growth. K2

CO2: Communicate uprightly while looking for a job. K3

CO3: Learn and utilize the key skills while facing job interview. K2 & K3

CO4: Demonstrate effective writing skills for professional excellence. K2

CO5: Explore ways to make oral communications interesting and captivating. K3

Unit – 1 Soft Skills & Personality Development

Number of Class Hours: 06

Marks: 08

Learning Outcomes:

- 1) Get acquainted with the details of soft skills and the importance of personality K1
- 2) Understand the importance of communication skills in developing one's personality. K2
- 3) Understand the importance of soft skills and personality in a person's career growth K2

Detailed Content:

1. **Soft skills - Demand of Every Employer:** How soft skills complement hard skills, Soft skills as competitive weapon, Classification of soft skills into personal and interpersonal traits, Soft skills needed for career growth- Time management, Leadership traits, Communication and networking skills, Teamwork and Interpersonal skills, Empathy and Listening skills, Responsibility, Attitude, Ethics, Integrity, Values and Trust.
2. **Personality Development – A must for career Growth:** Grooming one's personality as a signal that others read, mapping different personality types – Perfectionists, Helpers, Achievers, Romantics, Observers, Questioners, Enthusiasts or adventurers, Bosses or asserters, Mediators or peacemakers.

Unit – 2 Looking for a Job

Number of Class Hours: 05

Marks: 08

Learning Outcomes:

- 1) Learn to write Job Applications, Cover Letter, Resume, Curriculum Vitae, bio data K2
- 2) Develop interpersonal skills/ soft skills through Group Discussion. K3

Detailed Content

1. Job Application : Job Application Letters in response to advertisements, Self-application letters for Jobs
2. Curriculum Vitae/Resume: Formats of Resume and CV for a fresher and for someone with experience, Differences between Resume, CV, Bio-data, and choice of referees.
3. Group Discussion : A test of soft skills

Unit – 3 Job Interviews

Number of Class Hours: 05 Marks: 08

Learning Outcomes:

- 1) Understand the importance of Job interviews in the selection procedure K2
- 2) Comprehend and Adapt to various types, stages and processes of job interviews K1&K3
- 3) Demonstrate appropriate body language in interviews K3

Detailed Content

1. Job Interviews: Definition, processes of Interviews, Types of Interviews
2. Stages in Job interviews: Before interview stage, On D' Day, After interview stage.
3. Importance of Body language in Interviews: : Facing an interview, Using proper verbal and non- verbal cues, the perfect handshake ,Exhibiting confidence, the business etiquettes to maintain, body language ,and dress code - what to speak, how to speak in an interview and answer interview questions, negative body language, handling an awkward situation in an interview.
4. Probable interview questions and answers.
5. Mock interviews to be conducted by mock interview boards.

Unit – 4 Enhancing Writing skills

Number of Class Hours: 12 Marks: 08

Learning Outcomes:

- 1) Write dialogues on given topics / situations K3
- 2) Express facts & ideas effectively in written form K3
- 3) Learn to write formal and informal letters & emails. K2

Detailed Content

- 1) **Art of Condensation:** Principles to increase clarity of written communication.
- 2) **Dialogue Writing:** Meeting and Parting, Introducing and Influencing, Requests, Agreeing and Disagreeing, Inquiries and Information.
- 3) **Letter Writing:** Placing an order, Letter to Inquiry, Letter of Complaint, Letter seeking permission.
- 4) **E- mail writing:** writing the perfect e-mail, steps to the perfect e-mail, formal and informal greetings, requests through an e-mail, writing an

apology, complaint and seeking help and information in an e-mail, informing about a file attached in an email, writing the formal ending of an e-mail.

Unit – 5 Conversations, Panel Discussion and Public Speaking

Number of Class Hours:12 Marks: 08

Learning Outcomes:

1. Speak persuasively on a given topic fluently and clearly. K3
2. Participate in formal and informal conversations. K3
3. Express ideas and views on given topics. K3

Detailed Content

1) Conversation & Dialogue Practice:

- a) Introducing oneself
- b) Introduction about family
- c) Discussion about the weather
- d) Seeking Permission to do something
- e) Seeking Information at Railway Station/ Airport
- f) Taking Appointments from superiors and industry personnel
- g) Conversation with the Cashier- College/ bank
- h) Discussing holiday plans
- i) Asking about products in a shopping mall
- j) Talking over the Telephone

2) Panel Discussion: Act of a moderator - ways to respond to audience questions.
Suggested topics: Current Affairs

3) Public Speaking: Art of Persuasion, Making speeches interesting, Delivering different types of speeches: Ceremonial, Demonstrative, Informative, Persuasive.

List of Software/Learning Websites

1. <http://www.free-english-study.com/>
2. <http://www.english-online.org.uk/course.htm>
3. <http://www.english-online.org.uk/>
4. <http://www.talkenglish.com/>
5. <http://www.learnenglish.de/>

Reference Books:

(Name of Authors/ Title of the Book /Edition /Name of the Publisher)

- 1) Sanjay Kumar & PushpLata Communications Skills , 2nd Edition, Oxford University Press
- 2) Meenakshi Raman & Sangeeta Sharma Technical Communication: Principles & Practice Oxford University Press
- 3) M. Raman & S. Sharma Technical Communication Oxford University Press
- 4) Barun Kumar Mitra, Personality Development and Soft Skills Oxford University Press

Minor Project

Course Code	CEPR-409
Course Title	Minor Project
Number of Credits	2 (L: 0, T: 0, P: 4)
Prerequisites	Nil
Course Category	Project Work (PR)

Course Outcome:-

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

C.O.1: Demonstrate a thorough and systematic understanding of project contents (K2).

C.O. 2: Identify the methodologies and professional way of documentation and communication (K3).

C.O. 3: Illustrate the key stages in development of the project (K2).

C.O. 4: Develop the skill of working in a Team (K3).

C.O. 5: Apply the idea of mini project for developing systematic work plan in major project (K3).

Course Content:-

The minor project topic should be selected / chosen to ensure the satisfaction of the urgent need to establish a direct link between education, national development and productivity and thus reduce the gap between the world of work and the world of study. The course should have the following-

- 1) Perform detailed study about various components of a project.
- 2) Study about methodologies and professional way of documentation and communication related to project work.
- 3) Develop idea about problem formulation.

- 4) Knowledge of how to organize, scope, plan, do and act within a project thesis.
- 5) Familiarity with specific tools (i.e. hardware equipment and software) relevant to the project selected.
- 6) Demonstrate the implementation of a minor project work.

Essence of Indian Knowledge and Tradition

Course Code	AU-410
Course Title	Essence of Indian Knowledge and Tradition
Number of Credits	0 (L: 2, T: 0, P: 0)
Prerequisites	NA
Course Category	Audit

Course Outcomes: -

After completion of the course the students will be able to-

CO 1: Understand the essence of Indian tradition and the importance of carrying them forward. **(K₂)**

CO 2: Understand the Vedic literature and important ideas discussed in the Vedas. **(K₂)**

CO 3: Describe scientific heritage of ancient India along with comprehending its relevance and application in various modern scientific disciplines. **(K₁)**

CO 4: Relate the theoretical and practical sides of the science of Yoga and Aurveda with modern knowledge systems. **(K₁)**

CO 5: Explain the worth of Indian intellectual heritage, traditional practices and Indian lifestyle from scientific lenses. **(K₄)**

Module- 1

Name of the Module: Introduction to Vedic Literature

Number of class hours:**05**

Content:

- General structure of Vedic Literature,
- Different theories on the age of the Vedas,

- Educational system in the Vedic times
- subject-matter of Ṛgveda-samhitā, Sāmaveda -Samhitā, Yajurveda-Samhitā, Atharvaveda-Samhitā, Brāhmaṇaand Āraṇyaka literature, Upaveda

Learning outcomes of the Module

1.	Describe the Vedic literature (K1)
2.	Outline the heritage of ancient India specially the scientific knowledge that is embedded in the Vedas will be shown through this module (K2)

Module- 2

Name of the Unit: Fundamental doctrines of the *Upaniṣads*

Number of class hours:**05**

Content:

- General introduction of Upaniṣadic literature
- Philosophical ideas and ethics in Upaniṣadas

Learning outcomes of the Module

1.	Understand Upaniṣads and its significance as the perennial source Indian philosophy (K2)
2.	Explain the scientific temperament, knowledge and methods of scientific enquiry that is embedded in the Upaniṣadas (K2)

Module- 3

Name of the Unit: *Vedāṅgas*, Purāṇasand Dharmaśāstra Literature

Number of class hours:**05**

Content:

- Introduction to Vedāṅga Literature
- History of Sanskrit Grammar
- An Overview of Purāṇic literature
- History of Dharmaśāstra

Learning outcomes of the Module

1.	Describe various scientific and academic disciplines of ancient India along with scientific knowledge that is rooted in the Puranic literature (K1)
2.	Remember ancient system of Law and Governance in a nutshell especially the principles and philosophy behind the ancient constitutions (K1)

Module- 4

Name of the Module: Introduction to Indian Philosophical Systems, Scientific aspects of Indian knowledge systems

Number of class hours:**05**

Content:

- General introduction to Indian Philosophical systems, i.e. Orthodox and Heterodox
- Glimpse of ancient Indian Science and technology.

Learning outcomes of the Module

1.	Describe the Indian Philosophical systems and their relevance and application in modern scientific enquiry (K1)
2.	Remember the various scientific methods, means and validity of knowledge as discussed in these systems, methods of discussion, debate and systemic learning as structured in ancient Indian knowledge literature (K1)

Module- 5

Name of the Unit: Introduction to Yoga & Āyurveda

Number of class hours:**05**

Content:

- General ideas about Yoga,
- Origin and Development of Pātañjala Yoga,
- Origin and Development of Āyurveda and its relevance

Learning outcomes of the Module

1.	Understand about principles and philosophy of Yogic sciences and Āyurveda. (K2)
2.	Identify various ancient texts, practices of Yoga and Āyurveda along with gaining basic practical and theoretical knowledge which they will be able to relate with modern healthcare systems (K4)

References: -

- 1) Capra, Fritjof. *The Tao of Physics*. New York: Harpercollins, 2007.
- 2) Capra, Fritjof. *The Web of Life*. London: Harper Collins Publishers, 1996.
- 3) Dasgupta, Surendranath & De, Sushil Kumar. *A History of Sanskrit Literature*. Delhi: Motilal Banarsidass, 2017.
- 4) Dasgupta, Surendranath. *A History of Indian Philosophy*. Delhi: Motilal Banarsidass, 1991.
- 5) Gonda, Jan. *A History of Vedic Literature*. Delhi: Monohar Publishers and Distributors, 2020.

- 6) Jha, R.N. *Science and Consciousness Psychotherapy and Yoga Practices*. Delhi: VidyanidhiPrakashan, 2016.
- 7) Kane. P.V. *History of Dharmasastra*, Poona: Bhandarkar Oriental Research Institute, 1930.
- 8) Max Muller. *Ancient Sanskrit Literature*, London: Spottiswoode and Co., 1859.
- 9) *Pride of India*, New Delhi: Samskrita Bharati, 2006.
- 10) Shastri, Gourinath. *A History of Vedic Literature*, Kolkata: Sanskrit Pustak Bhandar, 2006.
- 11) Sinha, Jadunath. *Indian Philosophy*. Delhi: Motilal Banarsidass, 1938.
- 12) Wujastyk, Dominik. *The Roots of Ayurveda*. India: Penguin India, 2000.