CURRICULUM

FOR

DIPLOMA

PROGRAMME

IN

ELECTRICAL ENGINEERING

2nd Year
(3rd & 4th Semester)

FOR THE STATE OF HIMACHAL PRADESH

Implemented w.e.f. Session 2022-23

Prepared by:-

Composite Curriculum Development Centre
Directorate of Technical Education,
Vocational & Industrial Training, Sundernagar (H.P.)

Undertaking

The following committee members have dedicatedly crafted the curriculum for Electrical Engineering, thoroughly exploring cutting-edge trends and technologies to effectively bridge the gap between Industries and Academics.

Sh. Ashwani Kumar
Principal Govt. Polytechnic Kangra
Co-ordinator Electrical Engg.

Sh. Rajesh Choudhary
H.O.D. Electrical Engg.
Member

Sh. Aman Anand
Sr. Lect. Electrical Engg.
Member

Sh. Ishan Thakur
Sr. Lect. Electrical Engg.
Member

Sh. Sudhir Dhiman
Sr. Lect. Electrical Engg.
Member

Smt. Jyoti Bala
Lect. Electrical Engg.
Member

Industry Expert:

Sh. Ashwani Kumar Dhiman
Chief Project Manager
Salasar Techno Engineering Ltd.
Ghaziabad(U.P.)

INDEX

SALIENT FEATURES

Programme	Diploma in Electrical Engineering
Duration	Three years (Six Semesters)
Entry Qualification	As prescribed by H.P. Takniki Shiksha Board /AICTE
Intake	As approved by H.P. Takniki Shiksha Board
Pattern	Semester System
Curriculum for	Second Year Electrical Engineering

DIPLOMA PROGRAMME OUTCOMES

Electrical Engineering Diploma students will be able to:

PO 1: Basic and Discipline Specific Knowledge: Apply knowledge of basic mathematics, science and engineering fundamentals and engineering specialization to solve the engineering problems.

PO 2: Problem Analysis: Identify and analyze well-defined engineering problems using codified standard methods.

PO 3: Design/ Development of Solutions: Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.

PO 4: Engineering Tools, Experimentation and Testing: Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.

PO 5: Engineering Practices for Society, Sustainability and Environment: Apply appropriate technology in context of society, sustainability, environment and ethical practices.

PO 6: Project Management: Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well-defined engineering activities.

PO 7: Life-long Learning: Ability to analyse individual needs and engage in updating in the context of technological changes.

PROGRAMME SPECIFIC OUTCOMES

PSO 1: Apply the fundamentals of mathematics, science and engineering knowledge to identify, formulate, design and investigate complex engineering problems of electric circuits, analog and digital electronics circuits, control systems, electrical machines and Power system.

PSO 2: Apply the appropriate techniques and modern engineering hardware and software tools in electrical engineering to engage in life-long learning and to successfully adapt in multi-disciplinary environments.

PSO 3: Aware of the impact of professional engineering solutions in societal, environmental context, professional ethics and be able to communicate effectively.

Course code and Definitions:

Course Code	Definitions
L	Lecture
DCS	Doubt Clearing Session
P	Practical
HS	Humanities & Social Sciences Courses
BS	Basic Science Courses
ES	Engineering Science Courses
PC	Program Core Courses
PE	Program Elective Courses
OE	Open Elective Courses
AU	Audit Courses
SI	Summer Internship
PR	Project
SE	Seminar

STUDY AND EVALUATION SCHEME

THIRD SEMESTER

Sr. No.	Category	Code	Subjects	Study Scheme Hours/Week			Total Study Hrs	Credits	Evaluation Scheme								Total Marks
									Internal Assessment			External Assessment					
				Th	Pr	DCS			Th	Pr	Total	Th	Hrs	Pr	Hrs	Total	
1	**Program Core Course**	EEPC201	Introduction to Electrical Generation System	3	-	1	4	**3**	40	-	**40**	60	3	-	-	**60**	**100**
2	**Program Core Course**	EEPC203	Introduction to Electrical Generation System Laboratory	-	2	-	2	**1**	-	40	**40**	-	-	60	3	**60**	**100**
3	**Program Core Course**	EEPC205	# Electrical Circuits	3		2	5	**3**	40	-	**40**	60	3	-	-	**60**	**100**
4	**Program Core Course**	EEPC207	Electrical Circuits Laboratory	-	2	-	2	**1**	-	40	**40**	-	-	60	3	**60**	**100**
5	**Program Core Course**	EEPC209	Electrical and Electronics Measurement	3	-	1	4	**3**	40	-	**40**	60	3	-	-	**60**	**100**
6	**Program Core Course**	EEPC211	Electrical and Electronics Measurement Laboratory	-	2	-	2	**1**	-	40	**40**	-	-	60	3	**60**	**100**
7	**Program Core Course**	EEPC213	# # Electrical Motors and Transformers	3	-	2	5	**3**	40	-	**40**	60	3	-	-	**60**	**100**
8	**Program Core Course**	EEPC215	Electrical Motors and Transformers Laboratory	-	2	-	2	**1**	-	40	**40**	-	-	60	3	**60**	**100**
9	**Program Core Course**	EEPC217	# # # Electronics Devices and Circuits	3	-	1	4	**3**	40	-	**40**	60	3	-	-	**60**	**100**
10	**Program Core Course**	EEPC219	Electronics Devices and Circuits Laboratory	-	2	-	2	**1**	-	40	**40**	-	-	60	3	**60**	**100**
11			Student Centered Activities	-	2	-	2	**0**	-	25	**25**	-	-	-	-	-	**25**
Total				**15**	**12**	**7**	**34**	**20**	**200**	**225**	**425**	**300**	**15**	**300**	**15**	**600**	**1025**

The students shall undergo Internship-I at the end of 3rd semester (During semester break after board examinations of duration 04 weeks) which will be evaluated and reflected in study and evaluation scheme of 4th semester.

 # Common with. Diploma in Electrical & Electronics Engineering.

 # # Common with. Diploma in Electrical & Electronics Engineering.

 # # # Common with. Diploma in Electrical & Electronics Engineering, Electronics & Communication Engineering and Mechatronics.

STUDY AND EVALUATION SCHEME

FOURTH SEMESTER

Sr. No.	Category	Code	Subjects	Study Scheme Hours/Week			Total Study Hrs	Credits	Evaluation Scheme								Total Marks
									Internal Assessment			External Assessment					
				Th	Pr	DCS			Th	Pr	Total	Th	Hrs	Pr	Hrs	Total	
1	**Program Core Course**	EEPC202	Electrical Power Transmission and Distribution	3	-	1	4	**3**	**40**	-	40	60	3	-	-	**60**	**100**
2	**Program Core Course**	EEPC204	Electrical Power Transmission and Distribution Laboratory	-	2	-	2	**1**	-	40	40	-	-	60	3	**60**	**100**
3	**Program Core Course**	EEPC206	# Induction, Synchronous and Special Electric Machines	3	-	1	4	**3**	**40**	-	40	60	3	-	-	**60**	**100**
4	**Program Core Course**	EEPC208	Induction, Synchronous and Special Electric Machines Laboratory	-	2	-	2	**1**	-	40	40	-	-	60	3	**60**	**100**
5	**Program Elective Course**	EEPE202 - i EEPE202 - ii	i) # # Fundamentals of Power Electronics ii) Communication Technologies	3	-	1	4	**3**	**40**	-	40	60	3	-	-	**60**	**100**
6	**Program Elective Course**	EEPE204 - i EEPE204 - ii	i) Fundamentals of Power Electronics Laboratory ii) Communication Technologies Laboratory	-	2	-	2	**1**	-	40	40	-	-	60	3	**60**	**100**
7	**Program Elective Course**	EEPE206 - i EEPE206 - ii	i) Electrical Estimating And Contracting ii) Bio Mass And Micro-Hydro Power Plants	3	-	1	4	**3**	**40**	-	40	60	3	-	-	**60**	**100**
8	**Program Elective Course**	EEPE208 - i EEPE208 - ii	i) Electrical Estimating And Contracting Laboratory ii) Bio Mass And Micro-Hydro Power Plants Laboratory	-	2	-	2	**1**	-	40	40	-	-	60	3	**60**	**100**
9	**Project Course**	PR202	Minor Project	-	6	-	6	**3**	-	40	40	-	-	60	3	**60**	**100**
10	**Audit Course**	AU202	Essence of Indian Knowledge and Tradition	2	-	-	2	**0**	**40**	-	40	60	3	-	-	**60**	**100**
11		SI-I	Internship - I	-	-	-	0	**2**	-	40	40	-	-	60	3	**60**	**100**
12			Student Centered Activities	-	2	-	2	**0**	-	25	25	-	-	-	-	-	**25**
Total				**14**	**16**	**4**	**34**	**21**	**200**	**265**	**465**	**300**	**15**	**360**	**18**	**660**	**1125**

The students shall undergo Internship-II at the end of 4th semester (During semester break after board examinations of duration 06 weeks) which will be evaluated and reflected in study and evaluation scheme of 5th semester.

Note: Students have to opt any one program elective each from Sr. No. 5 and Sr. No. 7 respectively and laboratories must he selected from Sr. No. 6 and Sr. No. 8 accordingly.

 # Common with. Diploma in Electrical & Electronics Engineering.

 # # Common with. Diploma in Electrical & Electronics Engineering.

Detailed Contents of 3rd semester

THIRD SEMESTER

Course Code	**:**	**EEPC201**
Course Title	**:**	**INTRODUCTION TO ELECTRICAL GENERATION SYSTEM**
Number of Credits	**:**	**3 (L:3, T:0, P:0, DCS:1)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**PC**

INTRODUCTION TO ELECTRICAL GENERATION SYSTEM

Course Objectives:

The aim of this course is to help the student to attain the following industry identified competency throughvarious teaching learning experiences; maintain the efficient operation of various electric power generatingplants.

Course Contents:

Unit – I Thermal Power Plants: Coal, Gas/ Diesel and Nuclear-based

Layout and working of a typical thermal power plant with steam turbines and electric generators. Properties of conventional fuels used in the energy conversion equipment used in thermal power plants: Coal, Gas/diesel, nuclear fuels–fusion and fission action.

Safe Practices and working of various thermal power plants: coal-based, gas-based, diesel-based, and nuclear-based. Functions of the following types of thermal power plants and their major auxiliaries: Coal fired boilers, fire tube and water tube.

Gas/diesel based combustion engines.

Types of nuclear reactors: Disposal of nuclear waste and nuclear shielding.Thermal power plants in India.

Unit – II Large and Micro-Hydro Power Plants

Energy conversion process of hydro power plant. Classification of hydro power plant: High, medium and lowhead.

Construction and working of hydro turbines used in different types of hydro power plant:

a. High head – Pelton turbine
b. Medium head – Francis turbine
c. Low head – Kaplan turbine.

Safe Practices for hydro power plants.

Different types of micro- hydro turbines for different heads: Pelton, Francis and Kaplan turbines, Locations of these different types of large and micro-hydro power plants in Himachal.

Potential locations of micro-hydro power plants in Himachal

Unit– III Solar and Biomass based Power Plants

Solar Map of India: Global solar power radiation. *Solar Power Technology*

a. Concentrated Solar Power (CSP) plants, construction and working of: Power Tower, Parabolic Trough, Parabolic Dish, Fresnel Reflectors

b. Solar Photovoltaic (PV) power plant: layout, construction, working. *Biomass-based Power Plants*

c. Layout of a Bio-chemical based (e.g. biogas) power plant:

d. Layout of a Thermo-chemical based (e.g. Municipal waste) power plant
e. Layout of an Agro-chemical based (e.g. bio-diesel) power plant, Features of the solid, liquid and gas biomasses as fuel for biomass power plant.

Unit– IV Wind Power Plants

Wind Map of India**:** Wind power density in watts per square meterLayout of Horizontal axis large wind power plant:

Geared wind power plant. Direct-drive wind power plant.

Salient Features of electric generators used in large wind power plants:

Constant Speed Electric Generators: Squirrel Cage Induction Generators (SCIG), Wound Rotor Induction Generator (WRIG)

Variable Speed Electric Generators: Doubly-fed induction generator (DFIG), wound rotor synchronousgenerator (WRSG), permanent magnet synchronous generator (PMSG)

Unit– V Economics of Power Generation and Interconnected Power System

Related terms: connected load, firm power, cold reserve, hot reserve, spinning reserve. Base load and peak load plants; Load curve, load duration curve, integrated duration curve Cost of generation: Average demand, maximum demand, demand factor, plant capacity factor, plant use factor, diversity factor, load factor and plant load factor. Choice of size and number of generator units, combined operation of power station.

Causes, Impact and reasons of Grid system fault: State grid, national grid, brown-out and black-out; sample blackouts at national and international level.

References:

a. Nag. P. K.Power Plant Engineering, McGraw Hill, New Delhi, ISBN: 978-9339204044
b. Tanmoy Deb, Electrical Power Generation, Khanna Publishing House, Delhi (Ed. 2018)
c. Gupta, B.R., Generation of Electrical Energy, S. Chand& Co. New Delhi,
d. Rachel, Sthuthi; Earnest, Joshua – Wind Power Technologies, PHI Learning, New Delhi, ISBN: 978-93-88028-49- 3; E-book 978-93-88028-50-9
e. Solanki, Chetan Singh, – Solar Photovoltaics: Fundamentals, Technologies and Applications, HI Learning, New Delhi, ISBN: 9788120351110
f. Hau**,** Erich, Wind Turbines, Springer-Verlag, Berlin Heidelberg, Germany, ISBN:978-3-642-27150-2
g. Gipe, Paul, Wind Energy Basics, Chelsea Green Publishing Co; ISBN: 978-1603580304
h. Wizelius, Tore; Earnest, Joshua – Wind Power Plants and Project Development, PHI
i. Gupta, J.B. A Course in Electrical Power– S. K Kataria and Sons, New Delhi. 2014,
j. Soni, Gupta, Bhatnagar, A Course in Electrical Power. – Dhanpatrai and Sons
k. System, S.Chand & Co. New Delhi, 2005, ISBN: 9788121924962

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:

a) Maintain the optimised working of the thermal power plant.
b) Maintain the optimised working of large and micro hydro power plants.
c) Maintain the optimised working of solar and biomass-based power plants.
d) Maintain the optimised working of wind power plants.
e) Select the adequate mix of power generation based on economic operation.

SUGGESTED DISTRIBUTION OF MARKS		
Topic No.	**Time Allotted (Hrs)**	**Marks Allotted**
1	11	10
2	11	10
3	14	14
4	14	14
5	14	12
Total	**64**	**60**

****

Course Code	**:**	**EEPC203**
Course Title	**:**	**INTRODUCTION TO ELECTRICAL GENERATION SYSTEM LABORATORY**
Number of Credits	**:**	**1 (L:0, T:0, P:2, DCS:0)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**PC**

INTRODUCTION TO ELECTRICAL GENERATION SYSTEM LABORATORY

Course Objectives:

The aim of this course is to help the student to attain the following industry identified competency throughvarious teaching learning experiences:

Maintain the efficient operation of various electric power generating plants.

Practicals: (Any 12 practical to be performed) Identify the routine maintenance parts of the coal fired thermal power plant after watching a videoprogramme

1. Identify the routine maintenance parts of the gas fired thermal power plant after watching a video programme
2. Assemble and dismantle a small diesel generator power plant.
3. Identify the routine maintenance parts of the nuclear fired thermal power plant after watching a video programme.
4. Identify the routine maintenance parts of the large hydro power plant after watching a video programme
5. Identify the routine maintenance parts of the micro hydro power plant after watching a video programme.
6. Assemble a micro hydro power plant and then dismantle it.
7. Assemble the parabolic trough or parabolic dish Concentrated Solar Power (CSP) plant.
8. Dismantle the parabolic trough or parabolic dish CSP plant.
9. Assemble the solar PV plant to produce electric power and then dismantle it.
10. Assemble a small biogas plant to generate electric power
11. Dismantle the biogas plant.
12. Identify the routine maintenance parts of the large wind power plant after watching a video programme.
13. Assemble a horizontal axis small wind turbine to produce electric power
14. Dismantle a horizontal axis small wind turbine.
15. Assemble a vertical axis small wind turbine to produce electric power and then dismantle it.
16. Identify the routine maintenance parts of the horizontal axis small wind turbine after watching a video programme.
17. Identify the routine maintenance parts of the vertical axis small wind turbine after watching a video programme.

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:

a) Maintain the optimized working of the thermal power plant.
b) Maintain the optimized working of large and micro hydro power plants.
c) Maintain the optimized working of solar and biomass-based power plants.
d) Maintain the optimized working of wind power plants.
e) Select the adequate mix of power generation based on economic operation.

****

Course Code	**:**	**EEPC205**
Course Title	**:**	**ELECTRICAL CIRCUITS**
Number of Credits	**:**	**3 (L:3, T:0, P:0, DCS:2)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**PC**

ELECTRICAL CIRCUITS

Course Objectives:

The aim of this course is to help the student to attain the following industry identified competency throughvarious teaching learning experiences:

- Maintain electrical systems applying AC and DC circuit fundamentals.

Course Contents:

Unit – I Single Phase A.C Series Circuits

Generation of alternating voltage, Phasor representation of sinusoidal quantitiesR, L, C circuit elements its voltage and current response

R-L, R-C, R-L-C combination of A.C series circuit, impedance, reactance, impedance triangle, Power factor, active power, reactive power, apparent power, power triangle and vector diagram, Resonance, Bandwidth, Quality factor and voltage magnification in series R-L, R-C, RL-C circuit

Unit – II Single Phase A.C Parallel Circuits

R-L, R-C and R-L-C parallel combination of A.C. circuits. Impedance, reactance, phasor diagram, impedance triangle

R-L, R-C, R-L-C parallel A.C. circuits power factor, active power, apparent power, reactive power, power triangle Resonance in parallel R-L, R-C, R-L-C circuit, Bandwidth, Quality factor and voltage magnification

Unit– III Three Phase Circuits

Phasor and complex representation of three phase supply, Phase sequence and polarity

Types of three-phase connections, Phase and line quantities in three phase star and delta system, Balanced and unbalanced load, neutral shift in unbalanced load.

Three phase power, active, reactive and apparent power in star and delta system.

Unit– IV Network Reduction and Principles of Circuit Analysis

Source transformation.

Star/delta and delta/star transformation.

Mesh Analysis.

Node Analysis.

Unit– V Network Theorems

Superposition theorem.

Thevenin's theorem.

Norton's theorem

Maximum power transfer theoremReciprocity theorem

Duality in electric circuits.

References:

1. Ashfaq Husain, Networks & Systems, Khanna Book Publishing, New Delhi.

2. Gupta, B.R; Singhal, Vandana;, Fundamentals of Electrical Network, S.Chand and Co., New Delhi, ISBN :978-81-219-2318-7

3. Saxena, S.B Lal; Dasgupta, K; Fundamentals of Electrical Engineering, Cambridge UniversityPress Pvt. Ltd., New Delhi, ISBN : 978-11-0746-435-3

4. Theraja, B. L. : Theraja, A. K;, A Text Book of Electrical Technology Vol-I, S. Chand & Co. Ramnagar,New Delhi, ISBN : 9788121924405

5. Sudhakar, A. ; Shyammohan, S. Palli; Circuit and network, McGraw Hill Education, New Delhi,ISBN : 978-93-3921-960-4
6. Bell, David A., Electric Circuits, Oxford University Press New Delhi, ISBN : 978-01-954-2524-6
7. Boylested, R.L., Introductory circuit Analysis, Wheeler, New Delhi,ISBN: 978-00-231-3161-5
8. Mittle, V.N. ;Mittle, Arvind; Basic Electrical Engineering, McGraw Hill Education, Noida, ISBN:978-00-705-9357-2
9. Sivanandam,S.N, Electric Circuit Analysis, Vikas Publishing House Pvt. Ltd, Noida, ISBN:978-81259-1364-1
10. Salivahanan, S.; Pravinkumar, S; Circuit theory, Vikas Publishing House Pvt. Ltd, Noida;ISBN:978-93259-7418-0

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:

a) Troubleshoot problems related to single phase A.C series circuits.
b) Troubleshoot problems related to single phase A.C parallel circuits.
c) Troubleshoot problems related to three phase circuits.
d) Use principles of circuit analysis to troubleshoot electric circuits.
e) Apply network theorems to troubleshoot electric circuits.

SUGGESTED DISTRIBUTION OF MARKS		
Topic No.	**Time Allotted(Hrs)**	**Marks Allotted**
1	12	10
2	12	10
3	14	15
4	12	10
5	14	15
Total	**64**	**60**

 # Common with Diploma in Electrical & Electronics Engineering.

.**********

Course Code	**:**	**EEPC207**
Course Title	**:**	**ELECTRICAL CIRCUITS LABORATORY**
Number of Credits	**:**	**1 (L:0, T:0, P:2, DCS:0)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**PC**

ELECTRICAL CIRCUITS LABORATORY

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain electrical systems applying AC and DC circuit fundamentals.

Practicals: (Any 12 practical to be performed)

1. Use dual trace oscilloscope to determine A.C voltage and current response in given R, L, C circuit.
2. Use voltmeter, ammeter, wattmeter to determine active, reactive and apparent power consumed in given R-L series circuit. Draw phasor diagram.
3. Use voltmeter, ammeter to determine active, reactive and apparent power consumed in given R-C series circuit. Draw phasor diagram.
4. Use voltmeter, ammeter, wattmeter to determine active, reactive and apparent power consumed in given R-L-C series circuit. Draw phasor diagram.
5. Use variable frequency supply to create resonance in given series R-L-C circuit or by using variable inductor or variable capacitor.
6. Use voltmeter, ammeter, and wattmeter to determine current, p.f., active, reactive and apparent power in R-C parallel A.C. circuit.
7. Use voltmeter, ammeter, wattmeter, p.f meter to determine current, p.f., active, reactive and apparent power for given R-L-C parallel circuit with series connection of resistor and inductor in parallel with capacitor.
8. Use variable frequency supply create resonance in given parallel R-L-C circuit or by using variable inductor or capacitor.
9. Use voltmeter, ammeter, wattmeter, p.f meter to determine line and phase quantities of voltage and current for balanced three phase star and delta connected load and calculate active, reactive, and apparent power. Draw phasor diagram.
10. Use voltmeter, ammeter, wattmeter, p.f meter to determine line and phase quantities of voltage and current for unbalanced three phase star and delta connected load and calculate active, reactive, and apparent power. Draw phasor diagram.
11. Use voltmeter, ammeter to determine current through the given branch of a electric network by applying mesh analysis.
12. Use voltmeter, ammeter to determine current through the given branch of a electric network by applying node analysis.
13. Use voltmeter, ammeter to determine current through the given branch and voltage across the given element of circuit by applying superposition theorem.
14. Use voltmeter, ammeter to determine equivalent circuit parameter in a given circuit by applying Thevenin's Theorem
15. Use voltmeter, ammeter to determine equivalent circuit parameter in a given circuit by applying Norton's Theorem
16. Use voltmeter, ammeter to determine load resistance for maximum power transfer for a given circuit by applying maximum power transfer theorem.

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:

a) Troubleshoot problems related to single phase A.C series circuits.
b) Troubleshoot problems related to single phase A.C parallel circuits.
c) Troubleshoot problems related to three phase circuits.
d) Use principles of circuit analysis to troubleshoot electric circuits.
e) Apply network theorems to troubleshoot electric circuits.

****

Course Code	**:**	**EEPC209**
Course Title	**:**	**ELECTRICAL AND ELECTRONICS MEASUREMENT**
Number of Credits	**:**	**3 (L:3, T:0, P:0, DCS:1)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**PC**

ELECTRICAL AND ELECTRONICS MEASUREMENT

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Use relevant measuring instrument in different electrical applications.

Course contents:

Unit – I Fundamentals of Measurements

Measurement: Significance, units, fundamental quantities and standardsClassification of Instrument Systems: Null and deflection type instrumentsAbsolute and secondary instrumentsAnalog and digital instruments
Static and dynamic characteristics, types of errors, Calibration: need and procedure
Classification of measuring instruments: indicating, recording and integrating instruments. Essentialrequirements of an indicating instruments

Unit – II Measurement of voltage and current

DC Ammeter: Basic, Multi range, Universal shunt,
DC Voltmeter: Basic, Multi-range, concept of loading effect and sensitivityAC voltmeter: Rectifier type (half wave and full wave)
CT and PT: construction, working and applications.Clamp-on meter.

Unit– III Measurement of Electric Power

Analog meters: Permanent magnet moving coil (PMMC) and Permanent magnet moving iron (PMMI) meter, their construction, working, salient features, merits and demerits.
Dynamometer type wattmeter: Construction and working
Range: Multiplying factor and extension of range using CT and PT Errors and compensations.Active and reactive power measurement: One, two and three wattmeter method.
Effect of Power factor on wattmeter reading in two wattmeter method.Maximum Demand indicator

Unit– IV Measurement of Electric Energy

Single and three phase electronic energy meter: Constructional features and working principle, Errors and their compensations.
Calibration of single phase electronic energy meter using direct loading.

Unit– V Circuit Parameter Measurement, CRO and Other Meters

Measurement of resistance: Low resistance: Kelvin's double bridge, Medium Resistance: Voltmeter and ammeter method, High resistance: Megger and Ohm meter: Series and shuntMeasurement of inductance using Anderson Bridge (no derivation and phasor diagram)
Measurement of capacitance using Schering bridge (no derivation and phasor diagram)
Single beam/single trace CRO, Digital storage Oscilloscope**:** Basic block diagram, working, Cathode ray tube, electrostatic deflection, vertical amplifier, time base generator, horizontal amplifier, measurement of voltage/ amplitude/ time period/ frequency/ phase angle delay line, specifications.
Other meters: Earth tester, Digital Multi-meter; L-C-R meter, Frequency meter (ferromagnetic and Weston type), Phase sequence indicator, power factor meter (single phase and three phase dynamometer type), Synchroscope, Tri-vector meter, Signal generator need, working and basic block diagram. Function generator: need, working and basic block diagram, function of symmetry.

References:

1. Theraja B. L., Theraja A. K., A Text Book of Electrical Technology Vol-I(Basic Electrical Engg.),S.Chand and Co. New Delhi, ISBN: 9788121924405
2. Mittle V. N., Basic Electrical Engineering, McGraw-Hill New Delhi, ISBN : 978-0-07-0088572-5,

3. Edward Hughes, Electrical Technology, Pearson Education, New Delhi, ISBN-13: 978-0582405196
4. Rajput R.K., Electrical and Electronic Measurement and Instrumentation, S.Chand and Co. New Delhi, ISBN : 9789385676017
5. Sawhney A.K., Electrical and Electronics Measurements and Instrumentation., Dhanpai Rai andn Sons,New Delhi, ISBN : 9780000279744
6. Suryanarayna N.V., Electrical Measurements and Measuring Instruments, S.Chand and Co. NewDelhi , ISBN :8121920116

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:

a) Check the working of the electrical measuring instrument.
b) Use different types of measuring instruments for measuring voltage and current.
c) Use different types of measuring instruments for measuring electric power
d) Use different types of measuring instruments for measuring electric energy.
e) Use different types of electrical instruments for measuring various ranges of electrical parameters.

SUGGESTED DISTRIBUTION OF MARKS		
Topic No.	**Time Allotted (Hrs)**	**Marks Allotted**
1	14	12
2	12	10
3	12	12
4	08	8
5	18	18
Total	**64**	**60**

****

Course Code	**:**	**EEPC211**
Course Title	**:**	**ELECTRICAL AND ELECTRONICS MEASUREMENT LABORATORY**
Number of Credits	**:**	**1 (L:0, T:0, P:2, DCS:0)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**PC**

ELECTRICAL AND ELECTRONOCS MEASUREMENT LABORATORY

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency throughvarious teaching learning experiences:

- Use relevant measuring instrument in different electrical applications.

Practicals: (Any 12 practical to be performed)

1. Identify measuring instruments on the basis of symbols on dial, type, accuracy, class position and scale.
2. Identify the components of PMMC and MI instruments.
3. Troubleshoot PMMC and MI instruments.
4. Measure AC and DC quantities in a working circuit.
5. Extend range of ammeter and voltmeter by using (i) shunt and multiplier (ii) CT and PT.
6. Use Clamp-on meter for measurement of AC/DC current, AC/DC voltage.
7. Use electro-dynamic watt-meter for measurement of power in a single phase circuit
8. Troubleshoot electrodynamic watt-meter for measurement of power in a single phase circuit
9. Use single wattmeter for measurement of active and reactive power of three phase balanced load.
10. Use two watt-meters for measuring active power of three-phase balanced load.
11. Calibrate single phase electronic energy meter by direct loading.
12. Troubleshoot single phase electronic energy meter.
13. Use digital multi-meter for measurement of AC/DC current, AC/DC voltage.
14. Use Kelvin's double bridge for measurement of low resistance.
15. Use voltmeter and ammeter method for measurement of medium resistance.
16. Use Megger for insulation resistance measurements.
17. Use earth tester for measurement of earth resistance.
18. Use CRO for the Measurement of supply frequency in single-phase circuit.
19. Use Tri-vector meter for measuring kW, kVAr and kVA of a power line.

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:

a) Check the working of the electrical measuring instrument.
b) Use different types of measuring instruments for measuring voltage and current.
c) Use different types of measuring instruments for measuring electric power
d) Use different types of measuring instruments for measuring electric energy.
e) Use different types of electrical instruments for measuring electrical parameters of various ranges.

****

Course Code	**:**	**EEPC213**
Course Title	**:**	**ELECTRICAL MOTORS AND TRANSFORMERS**
Number of Credits	**:**	**3 (L:3, T:0, P:0, DCS:2)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**PC**

ELECTRICAL MOTORS AND TRANSFORMERS

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain electric motors and transformers.

Course contents

Unit – I DC Generators

DC generator: construction, parts, materials and their functions. Principle of operation of DC generator: Fleming's right hand rule, schematic diagrams, e.m.f. equation of generator, armature reaction, commutation and Applications of DC generators.

Unit – II D.C. Motors

DC motor: Types of DC motors. Fleming's left hand rule, Principle of operation, Back e.m.f. and its significance, Voltage equation of DC motor. Torque and Speed; Armature torque, Shaft torque, BHP, Brake test, losses, efficiency.

DC motor starters: Necessity, two point and three point starters.

Speed control of DC shunt and series motor: Flux and Armature control.Brushless DC Motor: Construction and working.

Unit– III Single Phase Transformers

Types of transformers: Shell type and core type; Construction: Parts and functions, materials used for different parts: CRGO, CRNGO, HRGO, amorphous cores.

Transformer: Principle of operation, EMF equation of transformer: Derivation, Voltage transformation ratio, Significance of transformer ratings.

Transformer No-load and on-load phasor diagram, Leakage reactance, Equivalent circuit of transformer: Equivalent resistance and reactance.

Voltage regulation and Efficiency: Direct loading, OC/SC method, All-day efficiency.

Unit– IV Three Phase Transformers

Bank of three single phase transformers, Single unit of three phase transformer.

Distribution and Power transformers, Construction, cooling, Three phase transformers connections as per IS:2026 (part IV)-1977, Three phase to two phase conversion (Scott Connection), Selection of transformer asper IS: 10028 (Part I)-1985, Criteria for selection of distribution transformer, and power transformer, Amorphous Core type Distribution Transformer, Specifications of three-phase distribution transformers as per IS:1180 (part I)-1989

Need of parallel operation of three phase transformer, Conditions for parallel operation. Polarity tests on mutually inductive coils and single phase transformers; Polarity test, Phasing out test on Three-phase transformer.

Unit V Special Purpose Transformers

Single phase and three phase auto transformers: Construction, working and applications.

Instrument Transformers: Construction, working and applications of Current transformer and Potential transformer. Isolation transformer: Constructional Features and applications.

Single phase welding transformer: constructional features and applications. Pulse transformer: constructional features and applications.

'K' factor of transformers: overheating due to non-linear loads and harmonics.

References:

1. G.C. Garg & P.S. Bimbhra, Electrical Machines, Vol-I, II, Khanna Book Publishing House (ISBN:978-9386173-447, 978-93-86173-607), New Delhi
2. Mittle, V.N. and Mittle, Arvind., Basic Electrical Engineering, McGraw Hill Education, New Delhi, ISBN: 9780070593572
3. Kothari, D. P. and Nagrath, I. J., Electrical Machines, McGraw Hill Education. New Delhi,ISBN: 9780070699670
4. Bhattacharya, S. K., Electrical Machines, McGraw Hill Education, New Delhi, ISBN: 9789332902855
5. Mehta, V. K. and Mehta, Rohit, Principles of Electrical Machines, S. Chand and Co. Ltd., New Delhi, ISBN: 9788121930888
6. Theraja, B.L., Electrical Technology Vol-II (AC and DC machines), S. Chand and Co. Ltd., New Delhi,ISBN: 9788121924375
7. Bandyopadhyay, M. N., Electrical Machines Theory and Practice, PHI Learning Pvt. Ltd., New Delhi, ISBN: 9788120329973 Vi
8. Murugesh Kumar, K., DC Machines and Transformers, ISBN: 9788125916055

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:

a) Maintain different types of DC generators.
b) Maintain different types of DC motors.
c) Maintain single phase transformer.
d) Maintain three phase transformers.
e) Maintain different types of special purpose transformers used in different applications.

SUGGESTED DISTRIBUTION OF MARKS		
Topic No.	**Time Allotted (Hrs)**	**Marks Allotted**
1	10	10
2	12	12
3	12	12
4	20	16
5	10	10
Total	**64**	**60**

 # # Common with Diploma in Electrical & Electronics Engineering.

****

Course Code	**:**	**EEPC215**
Course Title	**:**	**ELECTRICAL MOTORS AND TRANSFORMERS LABORATORY**
Number of Credits	**:**	**1 (L:0, T:0, P:2, DCS:0)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**PC**

ELECTRICAL MOTORS AND TRANSFORMERS LABORATORY

Course objectives

The aim of this course is to help the student to attain the following industry identified competency throughvarious teaching learning experiences:

- Use electric motors and transformers

Practicals: (Any 12 practical to be performed)

1. Dismantle a DC machine.
2. Reverse the direction of rotation of the DC shunt motor.
3. Perform brake test on DC shunt motor.
4. Control the speed of DC shunt motor by different methods.
5. Control the speed of DC series motor by different methods.
6. Perform the brake test on DC series motor.
7. Check the functioning of single phase transformer.
8. Determine regulation and efficiency of single phase transformer by direct loading.
9. Perform open circuit and short circuit test on single phase transformer to determine equivalent circuitconstants, voltage regulation and efficiency.
10. Perform parallel operation of two single phase transformers to determine the load current sharing.
11. Perform parallel operation of two single phase transformers and determine the apparent and real power load sharing.
12. Perform polarity test on a single phase transformer whose polarity markings are masked.
13. Perform phasing out test on a three phase transformer whose phase markings are masked.
14. Connect the auto-transformer in step-up and step-down modes noting the input/output readings.
15. Check the functioning of the CT, PT and isolation transformer.
16. Test the pulse transformer.

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:

a) Maintain different types of DC generators.
b) Maintain different types of DC motors.
c) Maintain single phase transformer.
d) Maintain three phase transformers.
e) Maintain different types of special purpose transformers used in different applications.

****

Course Code	**:**	**EEPC217**
Course Title	**:**	**ELECTRONICS DEVICES AND CIRCUITS**
Number of Credits	**:**	**3 (L:3, T:0, P:0, DCS:1)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**PC**

ELECTRONIC DEVICES AND CIRCUITS

Course Objective:

1	To introduce semiconductor devices BJT, FET, MOSFET and their characteristics, operations, circuits and applications.
2	To introduce concepts of rectifier, oscillator, amplifier and various amplifier configuration.
3	Description of SCR and family devices, their characteristics and applications.

Course Content:

1. **Semiconductor and Diodes:** Definition, Extrinsic/Intrinsic, N-type & P-type. PN Junction Diode – Forward and Reverse Bias Characteristics. Zener Diode – Principle, characteristics, construction, and working. Diode Rectifiers – Half Wave and Full Wave. Filters – C, LC, and PI Filters**.**

2. **Bipolar Junction Transistor (BJT):** NPN and PNP Transistor – Operation and characteristics. Common Base Configuration – characteristics and working. Common Emitter Configuration – characteristics and working. Common Collector Configuration – characteristics and working. High frequency model of BJT. Classification of amplifiers, negative feedback.

3. **Field Effect Transistors:** FET – Working Principle, Classification. MOSFET Small Signal model. N-Channel/ P-Channel MOSFETs – characteristics, enhancement, and depletion mode, MOS- FET as a Switch. Common Source Amplifiers. Uni-Junction Transistor – equivalent circuit and operation.

4. **SCR DIAC &TRIAC: SCR** – Construction, operation, working, characteristics. DIAC - Construction, operation, working, characteristics. TRIAC - Construction, operation, working, characteristics. SCR and MOSFET as a Switch, DIAC as bidirectional switch. Comparison of SCR, DIAC, TRIAC, MOSFET.

5. **Amplifiers and Oscillators:** Feedback Amplifiers – Properties of negative Feedback, impact of feedback on different parameters. Basic Feedback Amplifier Topologies: Voltage Series, Voltage Shunt, Current Series, Current Shunt. Oscillator – Basic Principles, Crystal Oscillator, Non-linear/ Pulse Oscillator.

Course Outcomes (COs)

CO 1	To understand various diodes and transistors used in analog electronics.
CO 2	Recognition of amplifier configuration and cascading of amplifiers.

CO 3	Analyze small signal model of FET and MOSFET
CO 4	Demonstration of rectifier, Feedback and oscillators.

SUGGESTED LEARNING RESOURCES:

1. Analog Circuits A.K. Maini Khanna Publishing House Ed. 2018 (ISBN: 978-93-86173- 584).
2. Electronic Devices and Circuits S. Salivahanan and N. Suresh Kumar McGraw Hill Education; Fourth edition (1 July 2017) ISBN: 978-9339219505.
3. Electronics Devices and circuit theory Boyestad&Nashelsky Pearson Education India; 11 edition (2015) ISBN: 978-9332542600.
4. Electronic Principles Albert Malvino& David Bates Tata McGraw Hill Publication 2010 ISBN: 9780070634244.
5. Electronics Devices & Circuits Jacob Millman McGraw Hill Education; 4 edition (2015) ISBN: 978-9339219543.

Suggested Distribution of Marks (For Paper Setters and Students)

Topic /Unit	Time (In Hrs.)	Marks Allotted
1	12	12
2	14	12
3	12	12
4	14	12
5	12	12
Total	**64**	**60**

 # # # Common with Diploma in Electrical Engineering, Electrical & Electronics Engineering and Mechatronics.

****

Course Code	**:**	**EEPC219**
Course Title	**:**	**ELECTRONICS DEVICES AND CIRCUITS LABORATORY**
Number of Credits	**:**	**1 (L:0, T:0, P:2, DCS:1)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**PC**

ELECTRONIC DEVICES AND CIRCUITS LABORATORY

Course Content:

1. Construct the circuit and plot the VI characteristics of the PN Junction Diode, find the cut in voltage.
2. Construct the circuit and plot the characteristics of a Zener Diode. Find the breakdown voltage.
3. Construct a Half Wave Rectifier and obtain regulation characteristics – Without Filters and with Filters Compare the results.
4. Construct a Full Wave center tap Rectifier and obtain regulation characteristics – Without Filters and with Filters Compare the results.
5. Construct a Bridge Rectifier and obtain regulation characteristics – Without Filters and with Filters.
6. Obtain the characteristics of DIAC and TRIAC.
7. Simulate half wave, full wave and bridge rectifier using simulation tool like PSpice/ ORCAD/ Multisim.
8. Develop a simulation model for Voltage Series and Voltage Shunt Feedback Amplifiers.

   OR

   Develop circuits for Voltage Series and Voltage Shunt Feedback Amplifiers and obtain output plots. Compare the results with the simulation model.
9. Develop a simulation model for Current Series and Current Shunt Feedback Amplifiers.
10. Develop circuits for Current Series and Current Shunt Feedback Amplifiers and obtain output plots. Compare the results with the simulation model.

Practical Outcomes(PrOs):

1. To understand the characteristics of diode, Zener diode, DIAC and TRIAC.
2. Verification of output waveforms of half wave and full wave bridge rectifier circuits.
3. Simulate half wave and full wave bridge rectifier circuits using suitable software.
4. Develop the circuit for all types of feedback amplifiers.

****

Detailed Contents of 4th semester

FOURTH SEMESTER

Course Code	**:**	**EEPC202**
Course Title	**:**	**ELECTRICAL POWER TRANSMISSION AND DISTRIBUTION**
Number of Credits	**:**	**3 (L:3, T:0, P:0, DCS:1)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**PC**

ELECTRICAL POWER TRANSMISSION AND DISTRIBUTION

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency throughvarious teaching learning experiences:

Maintain the proper functioning of the electrical transmission and distribution systems.

Course contents:

Unit – I Basics of Transmission and Distribution

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 – 110 kV, 220 kV, 400 kV. Method of construction of electric supply distribution systems – 220 V, 400V, 11 kV, 33 kV

Unit – II Transmission Line Parameters and Performance

Line Parameters: Concepts of R, L and C of 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.

Unit– III Extra High Voltage Transmission

Extra High Voltage AC (EHVAC) transmission line**:** Necessity, high voltage substation components such as transformers and other switchgears, 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 mono-polar, bi-Polar and homo-polar transmission lines. Lines in India. Features of EHVAC and HVDC transmission line. Flexible AC Transmission line: Features, d types of FACTS controller.

New trends in wireless transmission of electrical power.

Unit– IV A.C Distribution System

AC distribution: Components classification, requirements of an ideal distribution system, primary andsecondary 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 andapplications.

Voltage drop, sending end and receiving end voltage.

Distribution Sub-Station: Classification, site selection, advantages, disadvantages and applications.

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

Unit– V Components of Transmission and Distribution Line

Overhead Conductors**:** Properties of material, types of conductor with trade names, significance of 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, 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 layingand 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

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:

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

SUGGESTED DISTRIBUTION OF MARKS		
Topic No.	**Time Allotted (Hrs)**	**Marks Allotted**
1	12	10
2	12	10
3	14	15
4	14	15
5	12	10
Total	**64**	**60**

****

Course Code	**:**	**EEPC204**
Course Title	**:**	**ELECTRICAL POWER TRANSMISSION AND DISTRIBUTION LABORATORY**
Number of Credits	**:**	**1 (L:0, T:0, P:2, DCS:0)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**PC**

ELECTRICAL POWER TRANSMISSION AND DISTRIBUTION LABORATORY

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency throughvarious teaching learning experiences:

- Maintain the proper functioning of the electrical transmission and distribution systems

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 Himachal
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 33/11 KV and 11KV/400V Distribution Substation and write a report

Also one 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:

a. Prepare a model showing:
i. Single line diagram of electric supply system.
ii. Single line diagram of a given distribution system.
iii. Short line and medium transmission line.
iv. Write a report on the same by giving the details of lines in Maharashtra State.
b. Collect different samples of Overhead Conductors, Underground Cables, Line supports and Line Insulators.
c. Prepare a power point presentation:
i. Extra High Voltage AC Transmission line.
ii. High Voltage DC Transmission line.
iii. Flexible AC Transmission line.
iv. New trends in wireless transmission of electrical power.
d. Collect information on:
i. A.C Distribution System adjacent to your institute.
ii. Draw a layout diagram of 11KV/400 V substation in your campus/ adjacent substation.

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:

a) Interpret the normal operation of the electric transmission and distribution systems.
b) Maintain the functioning of the medium and high voltage transmission system.
c) Interpret the parameters of the extra high voltage transmission system.

****

Course Code	**:**	**EEPC206**
Course Title	**:**	**INDUCTION, SYNCHRONOUS AND SPECIAL ELECTRIC MACHINES**
Number of Credits	**:**	**3 (L:3, T:0, P:0, DCS:1)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**PC**

INDUCTION, SYNCHRONOUS AND SPECIAL ELECTRIC MACHINES

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency throughvarious teaching learning experiences:

- Maintain Induction, Synchronous and FHP Machines used in different applications.

Course contents:

Unit – I Three Phase Induction Motor

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.

Unit – II Single phase induction motors

Double field revolving 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 singlephase induction motors

Unit– III Three phase Alternators

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. Alternator loading: Factors affecting the terminal voltage of alternator; Armature resistance and leakagereactance drops.

Armature reaction at various power factors and synchronous impedance.

Voltage regulation: direct loading andsynchronous impedance methods.

Maintenance of alternators

Unit– IV Synchronous motors

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 Phase swinging.

Methods of Starting of Synchronous Motor.

Losses in synchronous motors and efficiency (no numerical).Applications areas

Unit– V Fractional horse power (FHP) Motors

Construction and working: Synchronous Reluctance Motor, Switched Reluctance Motor, BLDC, Permanent Magnet Synchronous Motors, stepper motors, AC and DC servomotors.

Torque speed characteristics of above motors. Applications of above motors.

References:

1. P.S. Bimbhra, Electric Machines, Khanna Book Publishing Co., New Delhi (ISBN: 978-93-86173-294)
2. Mittle, V.N. and Mittle, Arvind., Basic Electrical Engineering, McGraw Hill EducationNew Delhi, ISBN :9780070593572161
3. Kothari, D. P. and Nagrath, I. J., Electrical Machines, McGraw Hill Education. New Delhi, ISBN:9780070699670
4. Bhattacharya, S. K., Electrical Machines, McGraw Hill Education, New Delhi,ISBN:9789332902855
5. Theraja, B.L., Electrical Technology Vol-II (AC and DC machines), S.Chand and Co. Ltd., New Delhi,ISBN : 9788121924375
6. Sen, S. K., Special Purpose Electrical Machines, Khanna Publishers, New Delhi, ISBN:9788174091529
7. Janardanan E. G, Special Electrical Machines, Prentice Hall India, New Delhi ISBN: 9788120348806
8. Hughes E., Electrical Technology, ELBS
9. Cotton H., Electrical Technology, ELBS

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:

a) Maintain three phase induction motor used in different applications.
b) Maintain single phase induction motor used in different applications.
c) Maintain three phase alternators used in different applications.
d) Maintain synchronous motors used in different applications.
e) Maintain FHP motors used in different applications.

SUGGESTED DISTRIBUTION OF MARKS		
Topic No.	**Time Allotted(Hrs)**	**Marks Allotted**
1	16	15
2	12	10
3	16	15
4	12	12
5	8	8
Total	**64**	**60**

 # Common with Diploma in Electrical & Electronics Engineering.

****

Course Code	**:**	**EEPC208**
Course Title	**:**	**INDUCTION, SYNCHRONOUS AND SPECIAL ELECTRIC MACHINES LABORATORY**
Number of Credits	**:**	**1 (L:0, T:0, P:2, DCS:0)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**PC**

INDUCTION, SYNCHRONOUS AND SPECIAL ELECTRIC MACHINES LABORATORY

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency throughvarious teaching learning experiences:

- Maintain Induction, Synchronous and FHP Machines used in different applications.

Practicals: (Any 12 practical to be performed)

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-f squirrel cage induction motor and determine the equivalent circuit parameters.
5. Conduct the No-load and Blocked-rotor tests on given 3-f 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 applicablemethods: 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 andefficiency.
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-f 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 servo motor
15. Control the speed and reverse the direction of the DC servo motor

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:

a) Maintain three phase induction motor used in different applications.
b) Maintain single phase induction motor used in different applications.
c) Maintain three phase alternators used in different applications.
d) Maintain synchronous motors used in different applications.

****

PROGRAM ELECTIVES

Course Code	**:**	**EEPE202-i**
Course Title	**:**	**FUNDAMENTALS OF POWER ELECTRONICS**
Number of Credits	**:**	**3 (L:3, T:0, P:0, DCS:1)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**PC**

FUNDAMENTAL OF POWER ELECTRONICS

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency throughvarious teaching learning experiences:

- Maintain the proper functioning of power electronic devices.

Course contents:

Unit – I Power Electronic Devices

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.

Unit – II Thyristor Family Devices

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.

Unit– III Turn-on and Turn-off Methods of Thyristors

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

Unit– IV Phase Controlled Rectifiers

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.

Unit– V Industrial Control Circuits

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

UPS: Offline and Online

SCR based AC and DC circuit breakers.

References:

1. Ramamoorty M., An Introduction to Thyristors and their applications, East-West Press Pvt. Ltd., New Delhi, ISBN: 8185336679.

2. Sugandhi, Rajendra Kumar and Sugandhi, Krishna Kumar, Thyristors: Theory and Applications, New Age

Bhattacharya, S.K., Fundamentals of Power Electronics, Vikas Publishing House Pvt. Ltd. Noida. ISBN: 978-8125918530.
3. Jain & Alok , Power Electronics and its Applications, Penram International Publishing (India) Pvt. Ltd,Mumbai, ISBN: 978-8187972228.
4. Rashid , Muhammad, Power Electronics Circuits Devices and Applications, Pearson Education India, Noida, ISBN: 978-0133125900.
5. Singh, M. D. and Khanchandani, K.B., Power Electronics, Tata McGraw Hill Publishing Co. Ltd, New Delhi, 2008 ISBN: 9780070583894.
6. Zbar, Paul B., Industrial Electronics: A Text –Lab Manual, McGraw Hill Publishing Co. Ltd., New Delhi,ISBN: 978-0070728226.
7. Grafham D.R., SCR Manual, General Electric Co., ISBN: 978-0137967711.

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:

a) Select power electronic devices for specific applications.
b) Maintain the performance of Thyristors.
c) Troubleshoot turn-on and turn-off circuits of Thyristors.
d) Maintain phase controlled rectifiers.
e) Maintain industrial control circuits.

SUGGESTED DISTRIBUTION OF MARKS		
Topic No.	**Time Allotted (Hrs)**	**Marks Allotted**
1	10	10
2	14	13
3	16	15
4	14	12
5	10	10
Total	**64**	**60**

 # # Common with Diploma in Electrical & Electronics Engineering.

****

Course Code	**:**	**EEPE204-i**
Course Title	**:**	**FUNDAMENTALS OF POWER ELECTRONICS LABORATORY**
Number of Credits	**:**	**1 (L:0, T:0, P:2, DCS:0)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**PC**

FUNDAMENTAL OF POWER ELECTRONICS LABORATORY

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency throughvarious teaching learning experiences:

- Maintain the proper functioning of power electronic devices.

Practicals: (Any 12 practical to be performed)

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 break over 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 RC 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 determinethe load voltage.
10. Draw the output waveform of Full wave controlled rectifier with R load, RL load, 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 light system, Speed control system, Temperaturecontrol system.

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:

a) Select power electronic devices for specific applications.
b) Maintain the performance of Thyristors.
c) Troubleshoot turn-on and turn-off circuits of Thyristors.
d) Maintain phase controlled rectifiers.
e) Maintain industrial control circuits.

****

Course Code	**:**	**EEPE202-ii**
Course Title	**:**	**COMMUNICATION TECHNOLOGIES**
Number of Credits	**:**	**3 (L:3, T:0, P:0, DCS:1)**
Prerequisites (Course code)	**:**	**NIL**
Course Category	**:**	**PE**

COMMUNICATION TECHNOLOGIES

Course objectives:
The aim of this course is to help the student to attain the following industry identified competency throughvarious teaching learning experiences:

- Use relevant data communication technique.

Course contents:

Unit – I Data Communication and Modulation
Block diagram of communication system
Types of communication system: synchronous and asynchronous, simplex, half-duplex, Full duplex, serial and parallel communication
Classification of communication technique: AM, FM, & PM on the basis of definition, waveform, bandwidth, modulation index
Modulation and demodulation: Block diagram of AM, FM and PM
Pulse Modulation: Block diagram for waveform generation of PAM, PWM & PPM, working principle,advantages, disadvantages and applications.
Advantages of pulse modulation over AM and FM.

Unit – II Digital Modulation Techniques
Digital Communication: Block diagram and working principle, waveforms, strength and limitations Sampling process Nyquist sampling theorem, quantization process, quantization error, quantization noise
PCM: Block diagram, working principle, waveforms, advantages, disadvantages, application of PCM.Principle of ASK, PSK, FSK. Application of ASK, PSK, FSK

Unit– III Data Communication Media
Baud rate, Bit rate, types of errors in data communication and error correction techniques.Types of communication media and frequency band of operation
Guided media: Types of cable-twisted pair cable, co-axial cable, fiber optic cable.Unguided media: Microwave communication, Infrared communication.

Unit– IV Fiber Optics
Introduction to Fiber optic communication. Strength and limitations of fiber optic system
Light propagation: reflection, refraction, Snell's law
Light propagation through cable: Mode of propagation, index profile
Fiber optic cables: cable construction, fiber optics cable modes, single mode, step index fiber, multimode index fiber, multimode graded index fiber, fiber cable losses.
Light source and Detector: Light emitting diode (LED), Photo Transistor, Laser diode, optocoupler.

Unit– V Data Communication Protocols and Interfacing Standard
OSI (Open Systems Interconnection) Reference model
Introduction to protocol, FTP, SMTP, TCP/IP, UDP, LAN standards.Introduction to IEEE Standards for LAN and GPIB
RS-232 standard: Introduction, and working principle
Network topologies, introduction star, ring, tree, bus, mesh, and hybrid.
Basic functions of networking devices: modem, switches, routers, repeaters, hubs, bridges, gateway.

Unit– VI Advanced Data Communication

Introduction to Wi-Fi and Wi- Max. Bluetooth architecture and its layers,
Universal serial bus (USB) architecture. Bluetooth and USB

References:

1. Wayne Tomasi, Electronic Communication System, Prentice Hall of India, ISBN 13:9780130494924
2. Reynders D., Steve Macky, Wright Edvin, Practical Industrial Data Communications, Newnes publication, ISBN 10:07506639523
3. George F. Kennedy, Barnard Davis, Electronic Communication System, Tata McGraw Hill, , ISBN 13:9780074636824
4. Forouzan B.A., Data Communication & Networking, McGraw Hill Education; 5 edition ISBN-13**:**0073376226-978
5. Prasad K.V.K.K., Principles of Digital communication systems and computer networks, Dreamtech press,New Delhi, ISBN 13:9788177223620
6. Tanenbaum, Andrew S.David J. Wetherall , Computer Networks, Pearson; 5 edition ISBN13:9788121924252
7. Kumar A.,Text Book of Communication Engineering, Umesh Publication, ISBN 13:978818114160
8. A. Kumar,D. Manjunath, Joy Kuri, Communication Networking, Academic Press Publication ISBN 13:9780124287518
9. Hemant Kumar Garg, Soni Manish, Electronic Communication & Data Communication, UniversityBookHouse Private Ltd., ISBN 13:9788181980717
10. Kao, Charles K., Optical Fiber Systems: Technology, Design, and Applications, Published by Mc-Graw-Hill Inc.,US ISBN 13: 9780070332775.
11. Agrawal, Govind P., Fiber Optic Communication System, Wiley; 4 edition ISBN :139780470505113

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:

a) Identify the different types of data communication equipment and techniques.
b) Use relevant digital modulation techniques.
c) Interpret the specifications of the data communication media.
d) Maintain the fiber optics networks for data communication.
e) Use OSI model and relevant data communication protocols.
f) Maintain wireless network environment.

SUGGESTED DISTRIBUTION OF MARKS		
Topic No.	**Time Allotted (Hrs)**	**Marks Allotted**
1	16	15
2	10	10
3	10	08
4	12	12
5	10	10
6	06	05
Total	**64**	**60**

****

Course Code	**:**	**EEPE204-ii**
Course Title	**:**	**COMMUNICATION TECHNOLOGY LABORATORY**
Number of Credits	**:**	**1 (L: 0, T: 0, P: 2, DCS:0)**
Prerequisites (Course code)	**:**	**NIL**
Course Category	**:**	**PE**

COMMUNICATION TECHNOLOGY LABORATORY

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency throughvarious teaching learning experiences:

- Use relevant data communication technique

Practicals: (Any 12 practical to be performed)

1. Measure the modulation index of amplitude modulated wave and observe the effect of modulating signalvoltage on it.
2. Measure the modulation index of the frequency modulated wave and observe the effect of modulating and Carrier signal voltage on Frequency Modulation.
3. Test Pulse Amplitude Modulation (PAM) signal.
4. Test Pulse Width Modulation signal.
5. Test Pulse Position Modulation Signal.
6. Test Pulse Code Modulation Signal.
7. Test Amplitude Shift Keying Signal
8. Test Frequency Shift Keying Signal
9. Test Phase shift Keying Signal.
10. Plot the V-I Characteristics of given Infra-Red Light Source(IR-LED)
11. Test UTP/STP cable in straight and crossover mode and by line tester.
12. Plot the V-I Characteristics of given Light Source(LED) and detector(photo transistor)
13. Use OFT trainer Kit given 1mm. diameter Plastic optical fiber at 650 nm to determine the NumericalAperture (NA).
14. Create the scenario and study the performance of token ring LAN protocol through simulation and usingtrainer kit.
15. Install and configure TCP/IP protocol.
16. Perform the transfer of files from PC to PC using Windows
17. Perform the transfer of a file from PC to another PC using Serial port RS-232
18. Establish star topology using transmission media and network control device.
19. Establish Wireless Communication between five computers using wireless LAN.
20. Establish Bluetooth communication using 4G mobile and laptop.

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:

a) Identify the different types of data communication equipment and techniques.
b) Use relevant digital modulation techniques.
c) Interpret data communication media.
d) Use fiber optics in data communication.

****

Course Code	**:**	**EEPE206-i**
Course Title	**:**	**ELECTRICAL ESTIMATING AND CONTRACTING**
Number of Credits	**:**	**3 (L:3, T:0, P:0, DCS:1)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**PE**

ELECTRICAL ESTIMATING AND CONTRACTING

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency throughvarious teaching learning experiences:

- Design electrical installation with costing for tendering

Course contents:

Unit I Electric Installation and Safety

Scope and features of National electric code 2011Types of electrical installation

Fundamental principles for electrical installation Permit to work, safety instructions and safety practicesPurpose of estimating and costing.

Unit II Estimation and Costing

Meaning and purpose of - rough estimate, detailed estimate, supplementary estimate, annual maintenanceestimate and revised estimate

Factors to be considered while preparation of detailed estimate and economical execution of workContracts-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 oftender, 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

Unit III 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

Unit IV 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 anddetailed

estimation

Installation and estimation of agricultural pump and flourmill

Unit V Public Lighting Installation

Classification of outdoor installations streetlight/ public lighting installation

Street light pole structures. Selection of equipments, sources used in street light installations. Cables,recommended types and sizes of cable. Control of street light installation.

Design, estimation and costing of streetlightPreparation of tenders and abstracts.

Unit VI 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 andcable 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 factorand 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 Mc-Graw 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. Katariaand Sons Reprint Edition, A Course in Electrical Installation Estimating and Costing ISBN 10: 935014279113: 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

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:

a) Follow National Electrical Code 2011 in electrical installations.
b) Estimate the electrical installation works
c) Estimate the work of non-industrial electrical installations.
d) Estimate the work of industrial electrical installations.
e) Prepare abstract, tender, quotation of public lighting and other installations.
f) Prepare abstract, tender, quotation of low tension (LT) substations.

SUGGESTED DISTRIBUTION OF MARKS		
Topic No.	**Time Allotted (Hrs)**	**Marks Allotted**
1	08	06
2	12	12
3	11	10
4	11	10
5	10	10
6	12	12
Total	**64**	**60**

****

Course Code	**:**	**EEPE208-i**
Course Title	**:**	**ELECTRICAL ESTIMATING AND CONTRACTING LABORATORY**
Number of Credits	**:**	**1 (L:0, T:0, P:2, DCS:0)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**PE**

ELECTRICAL ESTIMATING AND CONTRACTING LABORATORY

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Design electrical installation with costing for tendering.

Practicals:

1. Prepare a tender notice for purchasing a transformer of 200 KVA for commercial installation.
2. Prepare a quotation for purchasing different electrical material required.
3. Prepare a comparative statement for above material Prepare purchase order for the same.
4. Design drawing, estimating and costing of hall / Cinema Theater / commercial installation Prepare reportand draw sheet.
5. Design electrical installation scheme for any one factory / small industrial unit. Draw detailed wiringdiagram. Prepare material schedule and detailed estimate. Prepare report and draw sheet.
6. Estimate with a proposal of the electrical Installation of streetlight scheme for small premises afterdesigning.
7. Estimate with a proposal of the L.T. line installation. Prepare report and draw sheet.
8. Estimate with a proposal of the 500 KVA, 11/0.433 KV outdoor substation and prepare a report

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:

a) Follow National Electrical Code 2011 in electrical installations.
b) Estimate the electrical installation works
c) Estimate the work of non-industrial electrical installations.
d) Estimate the work of industrial electrical installations.
e) Prepare abstract, tender, quotation of public lighting and other installations.
f) Prepare abstract, tender, quotation of low tension (LT) substations.

****

Course Code	**:**	**EEPE206-ii**
Course Title	**:**	**BIOMASS AND MICRO-HYDRO POWER PLANTS**
Number of Credits	**:**	**3 (L:3, T:0, P:0, DCS:1)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**PE**

BIOMASS AND MICRO-HYDRO POWER PLANTS

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain the efficient operation of various types of Biomass and Micro-hydro power plants.

Course contents:

Unit– I Basics of Biomass-based Power Plants

Properties of solid fuel for biomass power plants: bagasse, wood chips, rice husk, municipal waste Properties of liquid and gaseous fuel for biomass power plants: Jatropha, bio-diesel gobar gas Layout of a Bio-chemical based (e.g. biogas) power plant:

Layout of a Thermo-chemical based (e.g. Municipal waste) power plant Layout of a Agro-chemical based (e.g. bio-diesel) power plant Selection of biomass power plants.

Unit– II Biomass Gasification Power Plants

The basic principle to convert Agriculture and forestry products and wood processing remains (includingrick husks, wood powder, branches, offcuts, corn straws, rice straws, wheat straws, cotton straws, fruit shells, coconut shells, palm shells, bagasse, corncobs) into combustible gas

General Construction and working of a typical gasifier Power generating in gas engine:

Strengths and limitations of Agriculture and forestry products gasifier Preventive maintenance stepsdifferent types of biomass gasifiers.

Unit– III Different Types of Gasifiers

Construction and working of the following types of gasifiers:

Rice Husk Gasification Power Plant and their specifications Straw Gasification Power Plant and their specifications

Bamboo Waste, Bamboo Chips Gasification Power Plant and their specifications

Coconut shell, coconut peat, coconut husk, Gasification Power Plant and their specificationsBagasse/Sugar Cane Trash Gasification Power Plant and their specifications

Gobar gas plant and its specifications

Breakdown maintenance of biomass power plant at the module level.

Unit– IV Micro-hydro Power Plants

Locations of micro-hydro power plant

Energy conversion process of hydro power plant.

Classification of hydro power plant: High, medium and low head.General Layouts of typical micro-hydro power plant.

Strengths and limitations of micro-hydro power plants

Unit– V Different types of Micro-hydro power plants

Construction and working of High head – Pelton turbine and their specifications Construction and working of Medium head – Francis turbine and their specificationsConstruction and working of Low head – Kaplan turbine and their specifications Preventive and breakdown maintenance of micro-hydro power plants

Safe Practices for micro-hydro power plants.

References:

1. Khoiyangbam, R S Navindu; Gupta and Sushil Kumar; Biogas Technology :Towards Sustainable Development; TERI, New Delhi; ISBN: 9788179934043
2. David M. Buchla; Thomas E. Kissell; Thomas L. Floyd - Renewable Energy Systems, PearsonEducation New Delhi , ISBN: 9789332586826,
3. Kothari, D.P. et aL: Renewable Energy Sources and Emerging Technologies, PHI
4. Rachel, Sthuthi, Earnest, Joshua; -Wind Power Technologies, PHI Learning
5. O.P. Gupta, Energy Technology, Khanna Publishing House, ISBN: 978-93-86173-683

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:

a) Select the relevant biomass power plant
b) Undertake the preventive maintenance of different types of biomass gasifiers
c) Undertake the breakdown maintenance of different types of biomass gasifiers
d) Maintain the optimised working of large wind power plants
e) Maintain the optimised working of small wind turbines.

SUGGESTED DISTRIBUTION OF MARKS		
Topic No.	**Time Allotted (Hrs)**	**Marks Allotted**
1	14	14
2	14	14
3	14	14
4	10	08
5	12	10
Total	**64**	**60**

****

Course Code	**:**	**EEPE208-ii**
Course Title	**:**	**BIOMASS AND MICRO-HYDRO POWER PLANTS LABORATORY**
Number of Credits	**:**	**1 (L: 0, T: 0, P: 2, DCS:0)**
Prerequisites(Course code)	**:**	**NIL**
Course Category	**:**	**PE**

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency throughvarious teaching learning experiences:

- Maintain the efficient operation of various types of Biomass and Micro-hydro power plants.

Practicals: (Any 12 practical to be performed)

1. Identify different components of a typical Biomass power plant.
2. Identify different biomass resources and evaluate their energy potential.
3. Determine the carbon content of solid biomass.
4. Assemble the Biogas power plant.
5. Dismantle the Biogas power plant
6. Identify the components of the high head micro hydro power plant
7. Identify the components of the medium head micro hydro power plant
8. Identify the components of the low head micro hydro power plant
9. Assemble a high head micro hydro power plant
10. Assemble a medium head micro hydro power plant
11. Assemble a low head micro hydro power plant
12. Undertake preventive maintenance of the high head micro hydro power plant
13. Undertake preventive maintenance of the medium head micro hydro power plant
14. Undertake preventive maintenance of the low head micro hydro power plant
15. Check the performance of Pelton wheel micro hydro power plant

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:

a) Select the relevant biomass power plant
b) Undertake the preventive maintenance of different types of biomass gasifiers
c) Undertake the breakdown maintenance of different types of biomass gasifiers
d) Maintain the optimised working of large wind power plants
e) Maintain the optimised working of small wind turbines.
f) Maintain the optimised working of micro hydro power plants.

****

Course Code	**:**	**PR202**
Course Title	**:**	**MINOR PROJECT WORK**
Number of Credits	**:**	**03(L: 0, T: 0, P: 4, DCS:0)**
Prerequisites (Course code)	**:**	**NIL**
Course Category	**:**	**PR**

Minor project work aims at exposing the students to industrial/field practices so as to have an appreciation of size, scale and type of operations; and work culture in the industries. Minor project work aims at exposing the students to industrial/field practices so as to have an appreciation of size, scale and type of operations; and work culture in the industries.

Course Content: List of Suggested Ideas for Minor Project

1. Various types of Cables available in the market, their current rating/ specifications, different makes/ manufacturing companies (minimum three), comparison of cost between different makes.
2. Various types of domestic/ wiring components such as switches, sockets, holders, conduits, battens, fixtures etc. : their specifications, different makes or manufacturing companies(minimum three), comparison of cost between different makes.
3. Various types of protective devices used in domestic and industrial wiring such as MCBs, ELCB/RCCB, fuses etc. their specifications, make (minimum three), and comparison of cost between different makes.
4. Various types of electric lamps (luminaries)available in the market, their specifications, different makes or manufacturing companies (minimum three), comparison of cost between different makes.
5. Various types of Electrical Appliances (domestic and commercial) available in the market, their specifications, different makes or manufacturing companies (minimum three), comparison of cost between different makes.
6. Students practice in minor repair works in the Institution and campus.

NOTE:-The students of the class may be divided into groups (3 to 5 students per group) and work may be assigned to each group as per their interest.

The components of evaluation will include the following:

Component Weightage

a) Punctuality/Attendance	20%
b) Initiative in learning new thing	10%
c) Performance as Individual in the Team	10%
d) Project Report	40%
e) Viva	20%

Course Outcomes: Minor project work aims at exposing the students to industrial/field practices so as to have an appreciation of size, scale and type of operations; and work culture in the industries. Also the studentwill be able to comprehend concepts, principles and practices taught in the classroom and their application insolving field/industrial problems. The work done in minor project work will also prepare them in taking up problem solving at latter stage under major project work.

Course Code	**:**	**AU202**
Course Title	**:**	**Essence of Indian Knowledge & Tradition**
Number of Credits (Teaching Load)	**:**	**0 (L: 2, T:0, P:0, DCS:0)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**AU (Audit Course)**

Course Learning Objectives

The objective of this course is to expose the students with the concepts of Indian traditional knowledge and to make them appreciate the importance of the roots of indigenous knowledge system.

Course Outcomes

After completing this course the students will be able to:

CO-1. Identify the concept of Indian Knowledge System (IKS).

CO-2. Understand the need and importance of protecting traditional knowledge.

CO-3. Compare the Indian traditional knowledge and modern science.

CO-4. Understand the use of Yoga in stress management, mental health, mindfulness, healthy eating, weight loss and quality sleep.

CO-5. Aware of the general knowledge of Himachal Pradesh.

Course Content

Unit 1: Indian Knowledge System (IKS)----------25%

- Introduction and Function of Indian Knowledge System (IKS).
- The Basic Structure of Indian Knowledge System(IKS) (only Introduction)
    1. The 4 Vedas, Namly ऋग्वेद (Rigveda) ,यजुर्वेद (Yajurveda), सामवेद (Samaveda) , अथर्ववेद (Atharvaveda).
    2. The 4 UpVedas, Namely आयुर्वेद (Ayurveda (health-care)), धनुर्वेद (Dhanurveda (archery)), गंधर्ववेद (Gandharva-veda (dance, music etc.)) and स्थापत्यवेद (Sthapatyaveda (architecture)).
    3. The 6 Vedagangs, namely Shiksha (शिक्षा), Kalpa (कल्प), Vykaraṇa (व्याकरण), Chhandas छंदस्), Nirukta (निरुक्त), and Jyotisha(ज्योतिष).
    4. Itihasa (इतिहास) (Ramayana रामायण and Mahabharata महाभारत) and Purana पुराण (Vishnupurana विष्णु पुराण, Bhagavata Purana (भागवत पुराण) etc.)
    5. Dharmashatra धर्मशास्त्र (Manusmriti मनुस्मृति, Yajnavalkya-smriti याज्ञवल्क्य, स्मृति etc.).

6. Darshan दर्शन (आस्तिक तथा नास्तिक)
7. Nyaya न्याय (Logic तर्कशास्त्र and Epistemology ज्ञानमीमांसा).

Unit 2 : Modern Science ---------- 20% Marks

- Modern science: Introduction, Characteristics, importance and Example
- Difference between modern Science and Indian knowledge system
- Role of IKS in modern science

Unit 3 : Traditional knowledge ---------- 15% Marks

- Traditional knowledge: Definition, nature, characteristics, scope and importance
- Indigenous Knowledge (IK): characteristics
- Traditional knowledge vis-a-vis Indigenous knowledge
- Traditional knowledge Vs western knowledge
- The need for protecting traditional knowledge

Unit 4 : Yoga and Holistic Health Care ---------- 25% Marks

- Yoga: Meaning and Importance of Yoga
- Yoga and physical health, Yoga and psychological health, Yoga and intellectual health, Yoga and spiritual health, Yoga and social approach.
- Introduction to Ashtanga Yoga, Yogic Kriyas (Shat Karma)
- Pranayama and its types; Active lifestyle and stress management through Yoga
- Physical Fitness, Health and wellness: Meaning and Importance of Wellness,
- Components of Wellness, Health and physical Fitness;
- Traditional sports & Regional Games for promoting wellness:
- Leadership through Physical Activity and Sports; Introduction to First Aid.

Unit 5 : Himachal Pradesh: A Basic Information ---------- 15% Marks

- History, Culture, Heritage/ Tradition, Customs & Manners,
- Regional Knowledge, Geographical Features, Constitutional History
- Tourism Place & Scope
- Festivals and Fairs

Suggested Text/ Reference Books

1. Cultural Heritage of India-Course Material by V. SivaramakrishnaBharatiya, VidyaBhavan, Mumbai, 5th Edition, 2014
2. Modern Physics and Vedant by Swami JitatmanandBharatiya, VidyaBhavan
3. The wave of Life by Fritz of Capra
4. Tao of Physics Fritz of Capra

5. Tarkasangraha of Annam Bhatta, International by V N Jha, Chinmay Foundation, Velliarnad, Ernakulam
6. Science of Consciousness Psychotherapy and Yoga Practices by RN Jha, Vidyanidhi Prakashan, Delhi, 2016
7. Himachal Pradesh History, Culture & Economy by Mian Goverdhan Singh & Prof. Dr. C.L. Gupta.

SUGGESTED DISTRIBUTION OF MARKS (Internal Assessment)		
Project Component	**Time Allotted (Hrs)**	**Marks Allotted (%)**
Unit 1 : Indian Knowledge System (IKS)	8	25%
Unit 2 : Modern Science	6	20%
Unit 3 : Traditional knowledge	5	15%
Unit 4 : Yoga and Holistic Health Care	8	25%
Unit 5 : Himachal Pradesh: A Basic Information	5	15%
Total	32	100%

-*-*-*-*-*-

Course Code	**:**	**SI-I**
Course Title	**:**	**Internship-I**
Number of Credits (Teaching Load)	**:**	**2 (L:0; T:0; P:0, DCS:0)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**SI (Internship)**

Guidelines

An internship of four weeks after 3rd semester during vacations should be undertaken in an industry/ Govt. or Pvt. Certified Agencies which are in social sector/ Govt. Skill Centres/ Institutes/ Schemes. The assessment of internship will be carried out in 4th semester. The faculty members must visit the internship site during the course of internship to monitor the progress of the students.

Evaluation Criteria

The internal assessment of internship is to be carried out by the Industry/ Organization where the students have undergone the internship. The internal assessment done by the industry/ organization may be rationalized by the Department, if needed. The external assessment is to be done at the Institute. The department shall finalize external assessment within a month of the beginning of the 4th semester. The students have to prepare a daily diary of their internship period and the same has to be submitted at the institute after completion of the internship. The students have also to present the experience gained during internship in a seminar for the purpose of external evaluation.

(a) The assessment criteria (Internal Assessment) by the industry/ organization where the students have undergone the internship is as follows:

- Attendance and general behavior : 20%
- Daily diary maintenance : 20%
- Initiative and participative attitude during internship : 20%
- Performance in the assigned activities by the industrial supervisor : 40%

(b) The assessment criteria (External Assessment) by the institute is as follows:

- Presentation : 60%
- Report : 20%
- Viva : 20%

Course Code	**:**	**SI-II**
Course Title	**:**	**Internship-II**
Number of Credits (Teaching Load)	**:**	**3 (L:0; T:0; P:0, DCS:0)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**SI (Internship)**

Guidelines

An internship of Six weeks after 4th semester during vacations should be undertaken by the students in relevant Industry. The objective of this mandatory internship is to expose the students to the real world of work and get experience with the latest tools, best practices, work & culture, etiquettes and ethics followed in modern industries. The assessment of internship will be carried out in 5th semester. The faculty members must visit the internship site during the course of internship to monitor the progress of the students.

Evaluation Criteria

The internal assessment of internship is to be carried out by the Industry/ Organization where the students have undergone the internship. The internal assessment done by the industry/ organization may be rationalized by the Department, if needed. The external assessment is to be done at the Institute. The department shall finalize external assessment within a month of the beginning of the 5th semester. The students have to prepare a daily diary of their internship period and the same has to be submitted at the institute after completion of the internship. The students have also to present the experience gained during internship in a seminar for the purpose of external evaluation.

(a) The assessment criteria (Internal Assessment) by the industry/ organization where the students have undergone the internship is as follows:

- Attendance and general behavior : 20%
- Daily diary maintenance : 20%
- Initiative and participative attitude during internship : 20%
- Performance in the assigned activities by the industrial supervisor : 40%

(b) The assessment criteria (External Assessment) by the institute is as follows:

- Presentation : 60%
- Report : 20%
- Viva : 20%