Diploma
in
ElectricalEngineering(EE)
CurriculumStructure

(IIItoVISemester)

SemesterIII

Sl. No.	Category	Course Code	CourseTitle	Hours per Week			Total Contact Hours/ Week	Credits
				L	T	P		
1.	Programme core course-1	EEPC-301	IntroductiontoElectricGeneration Systems	3	0	0	3	3
2.	Programme recourse-2	EEPC-302	IntroductiontoElectricGenerationSy	0	0	2	2	1
3.	Programme core course-3	EEPC-303	ElectricalCircuits	2	1	0	3	3
4.	Programme core course-4	EEPC-304	ElectricalCircuits Laboratory	0	0	2	2	1
5.	Programme recourse-5	EEPC-305	ElectricalandElectronic Measurements	3	0	0	3	3
6.	Programme core course-6	EEPC-306	Electrical and ElectronicMeasurements Laboratory	0	0	2	2	1
7.	Programme core course-7	EEPC-307	ElectricMotorsandTransformers	2	1	0	3	3
8.	Programme recourse-8	EEPC-308	ElectricMotorsandTransformers Laboratory	0	0	2	2	1
9.	Programme recourse-9	EEPC-309	FundamentalofAnalog&DigitalElectronics	2	0	0	2	2
10.	SummerInternship-I (4weeks)after IInd Semester	EESI-310	SummerInternship – I	0	0	0	0	2
	Total			**12**	**2**	**8**	**22**	**20**

.SemesterIV

Sl. No.	Category	Course Code	CourseTitle	Hours perWeek			TotalContactHours/ Week	Credits
				L	T	P		
1.	Programme corecourse-10	EEPC-401	FundamentalsofPowerElectronics	3	0	0	3	3
2.	Programme corecourse-11	EEPC-402	Fundamentals of Power ElectronicsLaboratory	0	0	2	2	1
3.	Programme corecourse-12	EEPC-403	Electric Power Transmission andDistribution	2	1	0	3	3
4.	Programme corecourse-13	EEPC-404	Electric Power Transmission andDistributionLaboratory	0	0	2	2	1
5.	Programme corecourse-14	EEPC-405	Induction, Synchronous and SpecialElectricalMachines	2	1	0	3	3
6.	Programme corecourse-15	EEPC-406	Induction, Synchronous and SpecialElectricalMachines Laboratory	0	0	2	2	1
7.	Programmeelectivecourse-1 (Any One to be selected)	EEPE-407/A	Electrical Estimation andContracting	3	0	0	3	3
		EEPE-407/B	IlluminationPractices					
		EEPE-407/C	Electrical Testing andCommissioning					
8.	Humanities & Social Science- 4	HS-408	Professional Skill Development	2	1	0	3	3
9.	MinorProject	PR-401	MinorProject	0	0	4	4	2
10.	Mandatory Course-1	AU-402	Essence of Indian Knowledge andTradition	2	0	0	2	0
	Total			**15**	**2**	**10**	**27**	**20**

.SemesterV

Sl. No.	Category	Code No.	Course Title	Hours per week			Total Contact Hrs/Week	Credit
				L	T	P		
1	Programme core course-16	EEPC-501	Microprocessor and its Application	2	1	0	3	3
2	Programme core course-17	EEPC-502	Microprocessor and its Application Lab	0	0	2	2	1
3	Programme core course-18	EEPC-503	Energy Conservation and Audit	3	0	0	2	3
4	Programme core course-19	EEPC-504	Energy Conservation and Audit Laboratory	0	0	2	2	1
5	Programme core course-20	EEPC-505	Renewable Energy Power Plants	3	0	0	3	3
6	Programme elective course-2 (Any One to be selected)	EEPE-506/A	Industrial Instrumentation and Condition Monitoring	3	0	0	3	3
		EEPE-506/B	Industrial Automation & Control					
		EEPE-506/C	Switchgear and Protection					
7	Programme elective course-3 (Any One to be selected)	EEPE-507/A	Industrial Instrumentation and Condition Monitoring Lab	0	0	2	2	1
		EEPE-507/B	Industrial Automation & Control Lab					
		EEPE-507/C	Switchgear and Protection Lab					
8	Open elective course-1	(Any one to be selected from Annexure-I)		3	0	0	3	3
9	Summer Internship-II (6 weeks) after IV Semester	EESI-509	Summer Internship – II	0	0	0	0	3
10	Major Project	EEPR-510	Major Project	0	0	2	2	1
Total				**15**	**1**	**6**	**22**	**22**

SEMESTER-VI

Sl. No.	Category	Code No.	Course Title	Hours per week			Total Contact Hrs/Week	Credit
				L	T	P		
1	Programme core course-21	EEPC-601	Building Electrification	3	0	0	3	3
2	Programme core course-22	EEPC-602	Building Electrification Laboratory	0	0	2	2	2
3	Programme elective course-4 (Any One to be selected)	EEPE-603/A	Communication Technologies	3	0	0	3	3
		EEPE-603/B	Electric Vehicles					
		EEPE-603/C	Industrial Drives					
4	Humanities and Social Science course-5	HS-604	Entrepreneurship and Start-up's	3	1	0	4	4
5	Open elective-2	(Any one to be selected from Annexure-II)		4	0	0	4	4
6	Mandatory Course-2	AU-606	Indian Constitution	2	0	0	2	0
7	Major Project	EEPR-607	Major Project	0	0	6	6	3
8	Seminar	EESE-608	Seminar	2	0	0	2	1
Total				**17**	**1**	**8**	**26**	**20**

DETAILED SYLLABUS

SemesterIII

Sl. No.	Category	Course Code	Course Title	Hours per Week			Total Contact Hours/ Week	Credits
				L	T	P		
1.	Programme core course-1	EEPC-301	Introduction to Electric Generation Systems	3	0	0	3	3
2.	Programme recourse-2	EEPC-302	Introduction to Electric Generation Sy	0	0	2	2	1
3.	Programme core course-3	EEPC-303	Electrical Circuits	2	1	0	3	3
4.	Programme core course-4	EEPC-304	Electrical Circuits Laboratory	0	0	2	2	1
5.	Programme recourse-5	EEPC-305	Electrical and Electronic Measurements	3	0	0	3	3
6.	Programme core course-6	EEPC-306	Electrical and Electronic Measurements Laboratory	0	0	2	2	1
7.	Programme core course-7	EEPC-307	Electric Motors and Transformers	2	1	0	3	3
8.	Programme recourse-8	EEPC-308	Electric Motors and Transformers Laboratory	0	0	2	2	1
9.	Programme recourse-9	EEPC-309	Fundamental of Analog & Digital Electronics	2	0	0	2	2
10.	Summer Internship-I (4weeks) after IInd Semester	EESI-310	Summer Internship – I	0	0	0	0	2
	Total			**12**	**2**	**8**	**22**	**20**

INTRODUCTIONTOELECTRICGENERATIONSYSTEMS

CourseCode	:	EEPC-301
CourseTitle	:	IntroductionToElectricGenerationSystems
NumberofCredits	:	3(L: 3,T:0, P:0)
Prerequisites	:	NIL
CourseCategory	:	PC

CourseOutcomes:

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

a) Maintaintheoptimizedworkingofthethermalpowerplant.(K-2)

b) Maintaintheoptimizedworkingoflargeandmicro hydropowerplants.(K-2)

c) Maintaintheoptimizedworkingofsolarandbiomass-basedpowerplants.(K-2)

d) Maintaintheoptimizedworkingofwindpowerplants.(K-2)

e) Selecttheadequatemixofpower generationbasedoneconomicoperation.(K-3)

CourseContents:

Module– I: ThermalPowerPlants: Coal,Gas/ Diesel andNuclear-base.

Number of Class hours: 8

hoursSuggestiveLearningOutco

me:

Studentswould beable to -

1. Drawthelayoutofdifferentpower plants.
2. Knowthepropertiesofconventionalfuels.
3. Understandthe functionofdifferentpartsofathermalpowerplant.

Detailedcontentofthe unit: -

Layoutandworkingofatypicalthermalpowerplantwithsteamturbinesandelectricgenerators.Properties ofconventional fuelsusedin theenergyconversionequipmentusedinthermalpower plants: Coal, Gas/ diesel, Nuclear fuels –fusion and fission action Safe Practices andworkingofvariousthermalpowerplants:Coal-based,Gas-based,Diesel-basedandNuclear-based.

Functionsofthefollowingtypesofthermal powerplantsandtheirmajorauxiliaries:Coal firedboilers:fire tubeand watertube.

Gas/dieselbasedcombustionengines.

Typesofnuclearreactors:Disposalofnuclearwasteandnuclearshielding.Thermal powerplants inTripura.

Module– II:Large andMicro-HydroPowerPlants

Number of Class hours: 8

hoursSuggestiveLearningOutco

me:

Studentswould beable to-

1. Knowthe Energyconversion processof hydropowerplant.
2. KnowtheSafePracticesforhydropowerplants
3. Understanddifferent partsof aturbine

Detailedcontentofthe unit: -

Energyconversion processof hydro powerplant.Selection of sites for Hydro Power Plant.

Classificationofhydropower plant: High,mediumandlowhead.

Constructionandworkingofhydroturbinesusedindifferent typesofhydropowerplant:

a. Highhead–Peltonturbine
b. Mediumhead –Francisturbine
c. Lowhead–

Kaplanturbine.SafePracticesforhydropo

wer plants.

Differenttypesofmicro-hydroturbinesfordifferentheads:Pelton,FrancisandKaplanturbinesLocations of these different types of large and micro-hydro power plants in Maharashtra andTripura.Potentiallocationsofmicro-hydropower plantsinTripura.

Module –III:SolarandBiomassbasedPowerPlants

Number of Class hours: 8

hoursSuggestiveLearningOutco

me:

Studentswould beable to -

1. Knowthe Solar Map of India
2. Knowaboutdifferent typesofsolarpowerplants

Detailed contentoftheunit:-

SolarMapof India:Globalsolarpowerradiation.

SolarPower Technology

a. ConcentratedSolarPower(CSP)plants,constructionandworkingofPowerTower,ParabolicTrough, ParabolicDish, FresnelReflectors.
b. SolarPhotovoltaic(PV)powerplant:layout,construction,working.Bio

mass-basedPower Plants-

a. LayoutofaBio-chemicalbased(e.g.biogas)powerplant:
b. LayoutofaThermo-chemicalbased (e.g.Municipalwaste)powerplant
c. Layout of an Agro-chemical based (e.g. bio-diesel) power

plantFeaturesofthesolid,liquidandgasbiomassesasfuelforbiomasspowerplant.

Module – IV: Wind Power

Plants. Number of Class hours: 8

hoursSuggestive

LearningOutcome:

Studentswould beable to define

1. Knowthe wind Mapof India
2. Knowaboutdifferent typesofsolarpowerplants
3. Know about the Salient Features of electric generators used in large wind power plants:Constant

Detailedcontentofthe unit: -

Wind Map of India**:** Wind power density in watts per square meterLayout of Horizontal axis largewind powerplant:Gearedwindpower plant.Direct-drivewindpowerplant.

SalientFeaturesofelectricgeneratorsusedin largewindpowerplants:ConstantSpeedElectric Generators: Squirrel Cage Induction Generators (SCIG), Wound Rotor InductionGenerator(WRIG).

VariableSpeedElectricGenerators:Doubly-fedinductiongenerator(DFIG),woundrotorsynchronousgenerator (WRSG),permanentmagnet synchronous generator(PMSG).

Module–V:EconomicsofPowerGenerationandInterconnectedPowerSystem.

NumberofClasshours:8 hours

Suggestive Learning

Outcome:Studentswould

beableto

1. Definedifferent termsrelated toenergygeneration.
2. KnowThe causesand Impactand reasonsof Gridsystemfault

Detailedcontentofthe unit: -

Relatedterms:connectedload,firmpower,coldreserve,hotreserve,spinningreserve.Baseloadandpeakloadplants;Loadcurve,loaddurationcurve,integrated durationcurve.

Costofgeneration:Averagedemand,maximumdemand,demandfactor,plantcapacityfactor,plantusefactor,diversityfactor,loadfactorand plantloadfactor.

Choiceofsizeandnumberofgeneratorunits,combinedoperationofpowerstation.

CausesandImpactandreasonsofGridsystemfault:Stategrid,nationalgrid,brownoutandblackout;sample blackoutsatnational andinternationallevel.

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INTRODUCTION TO ELECTRIC GENERATION SYSTEMSLABORATORY

CourseCode	:	EEPC-302
CourseTitle	:	IntroductiontoElectricGenerationSystemsLaboratory
NumberofCredits	:	1(L:0,T:0,P:2)
Prerequisites	:	NIL
CourseCategory	:	PC

CourseOutcomes:

Thetheory,practicalexperiencesandrelevantsoftskillsassociatedwiththiscoursearetobetaught and implemented, so that the student demonstrates the following industry orientedCOsassociated withthe abovementionedcompetency:

a) Maintaintheoptimisedworkingof thethermal powerplant.(K-2)
b) Maintaintheoptimisedworkingoflargeandmicro hydropowerplants.(K-2)
c) Maintaintheoptimisedworkingofsolarandbiomass-based powerplants.(K-2)
d) Maintainthe optimisedworkingofwind powerplants. (K-2)
e) Selecttheadequatemixofpower generationbasedoneconomicoperation. (K-3).

Practical:

1. Identifytheroutinemaintenancepartsofthecoalfiredthermalpowerplantafterwatchinga video program.
2. Identifytheroutinemaintenancepartsofthegasfiredthermalpowerplantafterwatchingavi deo program.
3. Assembleanddismantle asmalldieselgenerator powerplant.
4. Identifytheroutinemaintenancepartsofthenuclearfiredthermalpowerplantafterwatchin gavideoprogram.
5. Identifytheroutinemaintenancepartsofthelargehydropowerplantafterwatchingavideop rogram.
6. Identifytheroutinemaintenancepartsofthemicrohydropowerplantafterwatchingavideop rogram.
7. Assembleamicrohydropowerplantandthendismantleit.

8. Assembletheparabolictroughorparabolicdish ConcentratedSolarPower(CSP)plant.
9. Dismantletheparabolictroughor parabolicdishCSPplant.
10. Assemblethesolar PVplant toproduceelectricpower andthen dismantleit.
11. Assembleasmallbiogas planttogenerate electricpower.
12. Dismantlethebiogasplant.
13. Identifytheroutinemaintenancepartsofthelarge wind powerplantafterwatchingavideoprogramme.
14. Assembleahorizontal axissmall windturbinetoproduceelectricpower.
15. Dismantleahorizontalaxis smallwindturbine.
16. Assembleaverticalaxissmallwindturbinetoproduceelectricpowerandthendismantleit.
17. Identifytheroutinemaintenancepartsofthehorizontalaxissmallwindturbineafterwatchin gavideoprogramme.
18. Identifytheroutinemaintenancepartsoftheverticalaxissmallwindturbineafterwatching video programme.

ELECTRICCIRCUITS

CourseCode	:	EEPC-303
CourseTitle	:	ElectricCircuits
NumberofCredits	:	3 (L:2,T: 1,P:0)
Prerequisites	:	NIL
CourseCategory	:	PC

CourseOutcomes:

Thetheory,practical experiencesandrelevantsoftskillsassociatedwiththiscoursearetobe taught and implemented, so that the student demonstrates the following industryorientedCOs associatedwith theabovementionedcompetency:

a) Troubleshootproblemsrelatedtosinglephase A.Cseriescircuits.(K-3)

b) Troubleshootproblemsrelatedtosinglephase A.Cparallelcircuits.(K-3)

c) Troubleshootproblemsrelatedtothreephase circuits.(K-3)

d) Useprinciplesofcircuitanalysistotroubleshootelectriccircuits.(K-3)

e) Applynetworktheorems to troubleshoot electriccircuits. (K-4)

CourseContents:

Module–I:SinglePhaseA.CSeries Circuits

Number of Class hours: 7

hoursSuggestiveLearningOutco

me:

Studentswould beable to –

a) Defineimpedance,reactance,Powerfactor,activepower,reactivepower,apparentpower ,power triangleetcforan A.Cseries circuit.
b) SolvetheproblemsofA.CseriesR-L,R-CandR-L-C circuits
c) Drawthephasordiagramfordifferenttypes of A.C seriescircuit.

Detailedcontentofthe unit: -

Generationofalternatingvoltage,Phasorrepresentationofsinusoidalquantities R,L, C circuitelements its voltageandcurrent response.

R-L,R-C,R-L-CcombinationofA.Cseriescircuit,impedance, reactance,Powerfactor,activepower,reactivepower,apparentpower,powertriangleandvect ordiagram.

Resonance,Bandwidth,QualityfactorandvoltagemagnificationinseriesR-L,R-C,R-L-Ccircuit.

Module–II:SinglePhaseA.C ParallelCircuits

Number of Class hours: 7

hoursSuggestiveLearningOutco

me:

Studentswould beable to -

a) Defineimpedance,reactance,Powerfactor,activepower,reactivepower,apparentpow er, power triangleetc. foran A.C parallel circuit.
b) SolvetheproblemsofA.CparallelR-L,R-CandR-L-Ccircuits
c) Drawthephasordiagramfordifferenttypesof A.C parallelcircuit.

Detailedcontentofthe unit: -

R-L,R-CandR-L-

CparallelcombinationofA.C.circuits.Impedance,reactance,phasordiagram, impedancetriangle.

R-L,R-C,R-L-

CparallelA.C.circuitspowerfactor,activepower,apparentpower,reactivepower, power triangle.

ResonanceinparallelR-L,R-C,R-L-

Ccircuit,Bandwidth,Qualityfactorandvoltagemagnification.

Module–

III:ThreePhaseCircuits NumberofC

lass hours:6 hoursSuggestive

LearningOutcome:

Studentswould beable to -

a) Drawthephasordiagramfor threephasestarordeltaconnected circuits.
b) DefinePhaseandlinequantitiesinthreephasestaranddeltaconnectedsystemforbalance d and unbalanced load
c) Compute

threephaseactivepower,reactivepowerandapparentpowerinstaranddeltathree phasesystem.

Detailedcontentofthe unit: -

Phasorandcomplexrepresentationofthreephasesupply.phasesequenceand polarity.Typesof three-phaseconnections,Phase andlinequantitiesinthree phasestar anddeltasystem.Balancedandunbalancedload,neutralshiftinunbalancedload.Threephasepower, active,reactiveandapparentpower instarand deltasystem.

Module – IV: Network Synthesis Number of Class hours:4 hoursSuggestive LearningOutcome:

Studentswould beableto define–

a) Networkreductiontechniques.
b) Howto do Mesh Analysis.
c) Howto do NodeAnalysis

Detailedcontentofthe unit: -

NetworkReductionandPrinciplesofCircuitAnalysis.Sourcetransformation. Star/deltaanddelta/startransformationMeshAnalysis, NodeAnalysis

Module– V:NetworkTheorems Number of Class hours: 6 hoursSuggestive LearningOutcome:

Studentswouldbeabletosolvedifferentcircuitsbyapplyingtheknowledgeofdifferentnetworktheorems like

a) TheveninandMaximumpowertransfertheorem.
b) SuperpositionandReciprocitytheorem.
c) Norton'stheorem

Detailedcontentofthe unit: -

Superpositiontheorem,Thevenin'stheorem,Norton'stheorem,Maximumpowertransferthe
orem&Reciprocitytheorem

Dualityin electriccircuits

References:

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ELECTRICCIRCUITSLABORATORY

CourseCode:	:	EEPC-304
CourseTitle :	:	ElectricCircuits Laboratory
NumberofCredits	:	1 (L:0,T: 0,P:2)
Prerequisites	:	NIL
CourseCategory	:	PC

Courseoutcomes:

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

1. Troubleshootproblemsrelatedtosinglephase A.Cseriescircuits.(K-3)
2. Troubleshootproblemsrelatedtosinglephase A.Cparallelcircuits.(K-3)
3. Troubleshootproblemsrelatedtothreephase circuits.(K-3)
4. Useprinciplesof circuitanalysistotroubleshootelectriccircuits.(K-3)
5. Applynetworktheorems totroubleshootelectriccircuits.(K-4)

Practicals:

1. UsedualtraceoscilloscopetodetermineA.CvoltageandcurrentresponseingivenR,L,C circuit.
2. Use voltmeter, ammeter, wattmeter to determine active, reactive and apparent powerconsumedin givenR-L,R-Cand R-L-Cseries circuit.Draw phasordiagram.
3. Use variable frequency supply to create resonance in given series/Parallel R-L-C circuitor byusingvariable inductor orvariable capacitor.
4. Use Voltmeter, Ammeter and Wattmeter to determine current, p.f., active, reactive andapparentpower in R-C parallel A.C. circuit.
5. Use voltmeter, ammeter, wattmeter, p.f meter to determine current, p.f., active, reactiveand apparent power for given R-L-C parallel circuit with series connection of resistorandinductorin parallel with capacitor.
6. Use voltmeter, ammeter to determine current through the given branch of a electricnetworkbyapplyingmeshand Nodal analysis.

7. Usevoltmeter,ammetertodeterminecurrentthroughthegivenbranchandvoltageacrossthegivenelementofcircuit byapplyingsuperposition theorem.
8. Usevoltmeter,ammetertodetermineequivalentcircuitparameterinagivencircuitbyapplying Thevenin's theorem
9. Usevoltmeter,ammetertodetermineequivalentcircuitparameterinagivencircuitbyapplying Norton'stheorem
10. Usevoltmeter,ammetertodetermineloadresistanceformaximumpowertransferforagiven circuit byapplying maximum power transfer theorem.

ListofEquipments:

1. BreadBoardTrainer&Functiongenerator.
2. Studycard forR-L-C series &parallel circuit.
3. Studycard forThevenin's&MaximumPower transfer theorem.
4. StudycardforReciprocity& SuperpositionTheorem.
5. Studycard forNorton Theorem.
6. TrainingPanelforACpower supplymeasurement.
7. ElectricaltrainingSystemkit.
8. TwochannelAnalogOscillator.
9. Transducer&InstrumentationTrainer.
10. DigitalMustimeter.
11. AnalogAmmeters.
12. ColorDigitalStorageOscilloscope.

ElectricalandElectronicMeasurements

CourseCode	:	EEPC-305
CourseTitle	:	ElectricalandElectronicMeasurements
NumberofCredits	:	3(L:3,T: 0,P:0)
Prerequisites	:	NIL
CourseCategory	:	PC

CourseOutcomes:-

Studentswillbeable:

1. Tounderstandtheworkingoftheelectrical measuringinstrument(K-3).
2. Tousedifferenttypesofmeasuringinstrumentsformeasuringvoltageandcurrent(K-4).
3. Tousedifferent typesofmeasuringinstrumentsfor measuringelectricpower(K-4).
4. Tousedifferenttypes ofmeasuringinstruments for measuringelectricenergy(K-4).
5. Tousedifferenttypesofelectricalinstrumentsformeasuringvariousrangesofelectricalparameters(K-4).

CourseContent:-

Module-1:FundamentalsofMeasurements

Number of class hours: 4

HoursSuggestiveLearningOutc

omes:

1. Tobeable todescribethesignificanceof the givenmeasuringinstrument.
2. To beable to classifythegiven measuringinstruments.
3. Tobeabletodeterminestaticanddynamiccharacteristicsofthemeasuringinstrumentswiththe given data.
4. Tobeabletoexplaintheprocedureforcalibrationofgiven device.

Detailedcontentofthe unit: -

Measurement:Significance,units,fundamentalquantitiesandstandards.

ClassificationofInstrumentSystems,Nullanddeflectiontypeinstruments,Absoluteandsecondaryinstruments,

Analoganddigitalinstruments,

Staticanddynamiccharacteristics,typesoferrors,Cal
ibration:need and procedure,
Classification of measuring instruments: indicating, recording and integratinginstruments,Essential requirementsof an indicatinginstrument.

Module-2:Measurementofvoltageandcurrent

Numberofclasshours:05HoursSu
ggestiveLearningOutcomes:

1. Tobeabletoexplainwithsketchestheconstructionandworkingprincipleofthespecifiedinstrument.
2. TobeabletoconvertPMMCinstrumentintoDCammeterforthe given range.
3. TobeabletoconvertPMMCinstrumentintoDCvoltmeterforagivenrange.
4. Tobeable toexplain with sketches theworkingof giventypeof voltmeter.

Detailedcontentofthe unit: -

DCAmmeter:Basic,Multirange, Universalshunt,
DCVoltmeter:Basic,Multi-
range,Conceptofloadingeffectandsensitivity,ACvoltmeter: Rectifiertype(half wave and fullwave),
CT and PT: construction, working and
applications,Clamp-onmeter.

Module-3:MeasurementofElectricPower

Number of class hours: 5
HoursSuggestiveLearningOutc
omes:

1. Tobeable todescribewithsketches theconstruction ofthegivenwattmeter.
2. Tobeable todetermine multiplyingfactorfor thegivenmeter.
3. Tobeableto connectwattmeterfor powermeasurementofthe givencircuit.
4. Tobeabletodeterminetheelectricalpowerandpower factorofthe givencircuit.
5. Tobeabletodescribetheselectionprocedureofthemetersformeasuringthegivenparameter.

Detailedcontentofthe unit: -

Analogmeters:Permanentmagnetmovingcoil(PMMC)andPermanentmagnetmovingiron(P

MMI)meter,their construction, working,salientfeatures,meritsand demerits.

Dynamometertypewattmeter:Constructionand working.

Range:Multiplyingfactorand extensionofrangeusingCTandPT.

Errorsandcompensations;Activeandreactivepowermeasurement:One,twoandthreewattmeter method.

Effect of Power factor on wattmeter reading in two wattmeter method.MaximumDemandIndicator.

Module-4:Measurementof ElectricEnergy

Numberofclasshours:07HoursSuggestiveLearningOutcomes:

1. Tobeableto describewithsketches the constructionofthegivenenergymeter.
2. Tobeabletodescribewithsketchestheconnectionofthegivensinglephaseenergymeterforelectrical energymeasurements.
3. Tobeable to determinethe errors in the given energymeter.
4. Tobeableto selectenergymeter forthegiven applicationwithjustification.
5. Tobeableto calibratethegiventypeofmeter.

Detailedcontentofthe unit: -

Singleandthreephaseelectronicenergymeter:Constructionalfeaturesandworkingprinciple.

Errorsandtheircompensations.

Calibration ofsingle phaseelectronicenergymeter usingdirect loading.

Module-5:CircuitParameterMeasurement,CROandOtherMeters

Numberofclasshours:11HoursSuggestiveLearningOutcomes:

1. Tobeabletochoosemethodformeasurementsofresistancesforgivenapplicationwithjustification.
2. Tobeabletodescribewithsketchesthespecifiedblocksandworkingofthegiventypeofoscilloscope.
3. Tobeabletodescribewithsketchestheproceduretomeasurethegivenparameterusing CRO.
4. Tobeabletodescribewithsketchesthevariousblocksandworkingofthegiventypeofsignal/ functiongenerator.

Detailedcontentofthe unit: -

Measurement of resistance: Low resistance: Kelvin's double bridge, Medium Resistance:Voltmeter and ammeter method, High resistance: Megger and Ohm meter: Series andshunt;

Measurement of inductance using Anderson bridge (no derivation and phasor diagram);Measurement of capacitance using Schering bridge (no derivation and phasor diagram);Singlebeam/singletraceCRO,DigitalstorageOscilloscope**:**Basicblockdiagram,working,Cathoderaytube,electrostaticdeflection,verticalamplifier,timebasegenerator,horizontalamplifier,measurementofvoltage/amplitude/timeperiod/frequency/phase angle delayline, specifications;

Othermeters:Earthtester,DigitalMultimeter;L-C-Rmeter,Frequencymeter(ferromagnetic and Weston type), Phase sequence indicator, power factor meter (singlephaseand three phasedynamometertype), Synchro scope,Tri-vector meter

Signal generator:need,workingandbasicblockdiagram.

Function generator:need,workingandbasicblockdiagram,functionofsymmetry.

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ElectricalandElectronicMeasurementsLaboratory

CourseCode	:	EEPC-306
CourseTitle	:	ElectricalandElectronicMeasurements Laboratory
NumberofCredits	:	1(L:0,T: 0,P:2)
Prerequisites	:	NIL
CourseCategory	:	PC

CourseOutcomes:-

Willbe able:

1. Toidentifyelectricalmeasuringinstrument.(K-3)
2. Tousevoltmeterandammeterfor electricalmeasurements (K-4).
3. Tousewattmeterforelectricalpower measurement(K-4).
4. To useenergymeterforelectrical energymeasurement (K-4).
5. Tousedifferenttypesofelectricalinstrumentsformeasuringelectricalparametersofvariousranges.(K-4).

CourseContent:-

Practicals:

1. Identifymeasuringinstrumentsonthebasisofsymbolsondial,type,accuracy,classpositionand scale. (*)
2. Identifythe componentsof PMMC and MIinstruments.(*)
3. TroubleshootPMMC and MIinstruments.(*)
4. MeasureAC andDC quantities ina workingcircuit.
5. Extendrangeofammeterandvoltmeterbyusing(i)shuntandmultiplier(ii)CTandPT.
6. UseClamp-onmeterformeasurementof AC/DCcurrent,AC/DCvoltage.
7. Useelectro-dynamicwatt-meterformeasurementofpowerinasinglephasecircuit.(*)
8. Troubleshootelectrodynamicwatt-meterformeasurementofpowerinasinglephasecircuit.(*)
9. Usesinglewattmeterformeasurementofactiveandreactivepowerofthreephasebalancedload.
10. Usetwowatt-meters for measuringactivepowerofthree-phasebalancedload.

11. Calibratesinglephase electronicenergymeterbydirectloading.(*)
12. Troubleshootsingle phaseelectronicenergymeter.(*)
13. Usedigitalmulti-meterformeasurementofAC/DCcurrent,AC/DCvoltage.
14. UseKelvin'sdoublebridge formeasurementoflowresistance.(*)
15. Usevoltmeterandammetermethodformeasurement ofmediumresistance.
16. UseMeggerforinsulationresistancemeasurements.
17. Useearthtesterformeasurementofearthresistance.
18. UseCRO for theMeasurement ofsupplyfrequencyin single-phasecircuit.
19. UseTri-vector meterformeasuringkW,kVAr andkVAof apower line.

Note:

Aminimumof10(ten)ormorepracticalneedtobeperformed,outofwhichthepractical'smarkedas'*' arecompulsory.

ListofEquipment's/Instrumentsrequired:

Sl. No.	Equipmentnamewithbroadspecifications	Practical No.
1.	Modelof PMMC andMItypeinstrument (Upto 50A)	2
2.	VoltmeterRange(0-110V),Ammeter(0to 5A)	3
3.	VoltmeterRange (0-110V),Ammeter (0to5A),CT (15/5,25/5),PT(230/110, 440/110).	4
4.	VoltmeterRange(0-110/230V),Ammeter(0to5A),Wattmeter(5/10, 110/230V)	5
5.	VoltmeterRange(0-300/600V),Ammeter(0to5/10A),Wattmeter(5/10, 300/600V)	6
6.	VoltmeterRange(0-300/600V),Ammeter(0to5/10A),Wattmeter(5/10, 300/600V)	7
7.	VoltmeterRange(0-150/300V),Ammeter(0to5/10A),Wattmeter(5/10, 150/300V),Energymeter(Analog/ digital) (15A/230V)	8
8.	DigitalMultimeter,Rheostat(5A,100ohm),Autotransformer(0to 300V)	9
9.	Wheatstonebridge, Megaohm bridge	11
10.	Megger(Insualtiontestingupto1000Vand 100Gohm)	12

11.	Clampon Meter(Range40A, resolution100mA, 10Hzto 100Hz	13
12.	CRO(Upto 100Mhz)	15
13.	SignalGenerator (Upto100MHz)	15
14.	FunctionGenerator (Upto100MHz)	15
15.	Tri-VectorMeter(upto100A), 3phase3 wire410V(PhasetoPhase)	16

ELECTRICMOTORSANDTRANSFORMERS

CourseCode	:	EEPC-307
CourseTitle	:	ElectricMotorsAndTransformers
NumberofCredits	:	3 (L:2,T:1,P:0)
Prerequisites	:	NIL
CourseCategory	:	PC

CourseOutcomes:-

Aftercompletion ofthiscoursethe studentswill beable to:

1) UnderstanddifferenttypesofDCgenerators.(K-2)
2) Analyzesinglephasetransformer.(K-4)
3) Understandthreephasetransformers.(K-2)
4) Applydifferent typesofspecialpurposetransformersused indifferent applications.(K-3)

CourseContents:-

Module – 1: DC Generators Numberofclasshours :04HoursSuggestiveLearningOut comes:

Studentswill beable to:

1. Todefineanddiscussthe principleofoperationandconstructionofDCgenerators.
2. Todescribeanddemonstratethedifferenttypesofgenerators,theirapplicationbasedonspecification andadvantage-disadvantagebytype.

Detailedcontentofthe unit:-

DCgenerator:construction,parts,materialsandtheirfunctions. PrincipleofoperationofDCgenerator:Fleming'srighthandrule,schematicdiagrams, e.m.f.equationofgenerator, Generator Characteristics(Basic circuits & curves), armaturereaction,commutationandapplicationsofDCgenerators.Simple numerical related to DC Generator.

Module – 2: D.C.

MotorsNumberofclasshours:06

HoursSuggestiveLearningOutco

mes:

Studentswill beable to:

1. Todefineanddiscusstheprincipleofoperationand constructionofDCmotors.
2. Todescribeanddemonstratethedifferenttypesofmotors,theirapplicationbasedonspecification andadvantage-disadvantagebytype.
3. Todeterminethetorque,speed,losses and efficiencyof aDC motor.
4. Todiscuss the speed control ofDC motors and thenecessityof astarter.
5. Todemonstrate thebrushless DCmotor.

Detailedcontentofthe unit:-

DC motor: Types of DC motors. Fleming's left hand rule, Principle of operation, Backe.m.f.and its significance, Voltage equation of DC motor. Torque and Speed; Armaturetorque,Shaft torque,BHP, Braketest, losses, efficiency. Simple numerical related to DC motor.

DC motor starters: Necessity, two point and three point starters. Speed control of DCshuntand series motor: Fluxand Armaturecontrol.

BrushlessDCMotor:Constructionandworking.

Module–

3:SinglePhaseTransformers Number of

class hours: 08 HoursSuggestive

LearningOutcomes:

Studentswill beable to:

1. DescribeanddemonstratetheprincipleofoperationandconstructionofSinglePhaseTransformers.
2. Definespecificationsandtheirmeaningontransformernameplate.
3. Describe anddiscusstestingmethodsoftransformers.
4. Determinethevoltageregulation,efficiencyandall-dayefficiencyofSinglePhaseTransformers.

Detailedcontentofthe unit:-

Typesoftransformers:Shelltypeandcoretype;Construction:Partsandfunctions,materialsused

fordifferentparts:CRGO,CRNGO,HRGO,amorphouscores.Transformer: Principle of operation, EMF equation of transformer: Derivation, Voltagetransformation ratio. Significance of transformer ratings. Transformer No-load and on-load phasor diagram, Leakage reactance, Equivalent circuit of transformer: Equivalentresistanceandreactance.VoltageregulationandEfficiency:Directloading,OC/SC method,All dayefficiency.Simple numerical related to single phase transformer.

Module–

4:ThreePhaseTransformers Number of

class hours: 08 HoursSuggestive

LearningOutcomes:

Studentswill beable to:

1. DescribeanddemonstratetheconstructionofThreePhaseTransformersincludingDistribution and Power Transformers.
2. Definespecificationsof ThreePhase Transformers.
3. Describeanddiscussthe differenttypesofconnectionsofThreePhaseTransformers.
4. DiscussparalleloperationanddifferenttestsonThreePhaseTransformers.

Detailedcontentofthe unit:-

Bankofthreesinglephasetransformers,Singleunitofthreephasetransformer.Distributionand Power transformers. Construction,cooling.

Threephasetransformers connectionsasper IS:2026(partIV)-1977.

Three phase to two phase conversion (Scott Connection), Selection of transformer as perIS: 10028 (Part I)-1985, Criteria for selection of distribution transformer, and powertransformer, Amorphous Core type Distribution Transformer, Specifications of three-phasedistribution transformers as per IS:1180 (partI)-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,Phasingout test on Three-phasetransformer.

Module–5:SpecialPurposeTransformers

Number of class hours: 06

HoursSuggestiveLearningOutco

mes:

Studentswill beable to:

1. Describeanddemonstratetheconstructionandworkingof SingleandThreePhaseAutoTransformers.
2. Discusstheconstructionalfeaturesandapplicationsof InstrumentTransformers,IsolationTransformers, Single phaseweldingandPulseTransformers.
3. Describeanddiscussthe differenttypesofconnectionsofThreePhaseTransformers.
4. DiscusstheKfactorsof Transformers.

Detailedcontentofthe unit:-

Single phase and three phase auto transformers: Construction, working and applications.Instrument Transformers: Construction, working and applications of Current transformerandPotential transformer.
Isolationtransformer:ConstructionalFeaturesand applications.
Singlephaseweldingtransformer:
constructionalfeaturesandapplications.Pulsetransformer:
constructionalfeatures and applications.
'K'factor oftransformers:overheatingduetonon-linear loadsand harmonics.

References:-

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7. Bandyopadhyay,M.N.,ElectricalMachinesTheoryandPractice,PHILearningPvt.Ltd.,NewDelhi,ISBN: 9788120329973 Vi
8. MurugeshKumar,K., DCMachinesandTransformers,ISBN:9788125916055

ELECTRICMOTORSANDTRANSFORMERSLABORATORY

CourseCode	:	EEPC-308
CourseTitle	:	ElectricMotorsAndTransformersLaboratory
NumberofCredits	:	1 (L:0,T:0,P:2)
Prerequisites	:	NIL
CourseCategory	:	PC

CourseOutcomes:-

Aftercompletion ofthiscoursethe studentswill beable to:

1) Identifydifferent typesof machines.(K-1)
2) Analyze andperformbraketest,speedcontrolonDC motors.(K-4)
3) Understand and demonstrate the various tests and operations on Single phasetransformers.(K-2)
4) analyzethefunctioningofAutotransformers,InstrumentTransformersandPulseTransformers .(K-4)

CourseContent:-

Practicals:

1. DismantleaDCmachine.
2. Reversethe direction ofrotation oftheDC shuntmotor.
3. Performbraketest onDC shunt motor.
4. Controlthespeed ofDCshuntmotor bydifferentmethods.
5. Controlthespeedof DCseriesmotor bydifferentmethods.
6. Performthebraketest onDCseriesmotor.
7. Checkthefunctioningof singlephasetransformer.
8. Determineregulationand efficiencyofsingle phasetransformerbydirectloading.

9. Performopencircuitandshortcircuittestonsinglephasetransformertodetermineequivalentcirc uit constants, voltageregulation and efficiency.
10. Performparalleloperationoftwosinglephasetransformerstodeterminetheloadcurrentsharing.
11. Performparalleloperationoftwosinglephasetransformersanddeterminetheapparentandreal power load sharing.
12. Performpolaritytest on asingle phasetransformerwhosepolaritymarkingsaremasked.
13. Performphasingouttest onathreephasetransformerwhosephasemarkingsaremasked.
14. Connecttheauto-transformerinstep-upandstep-downmodesnotingtheinput/outputreadings.
15. Checkthefunctioningof the CT,PTandisolationtransformer.
16. Testthepulsetransformer.

Note:

Aminimumof10(ten)ormorepracticalneedtobeperformed,outofwhichthepractical'smarked as'*'arecompulsory.

CourseCode:	:	ECPC-309
CourseTitle :	:	Fundamentalof AnalogandDigitalElectronics
NumberofCredits	:	2(L:2,T:0,P:0)
Prerequisites	:	NIL
CourseCategory	:	PC

Courseoutcomes:

Afterthe completion ofthecoursestudentwould beableto

1. Acquire basic knowledge of physical and electrical conducting properties ofsemiconductors(K-3).
2. UnderstandthedesignandworkingofBJT/FETandOperational amplifiers(K-2).
3. Understandandexaminethestructureofvariousnumbersystems anditsapplicationindigitaldesign (K-2).
4. Apply their knowledge to build, and troubleshoot digital logic gates, multiplexer and De-multiplexer(K-3).
5. Analyze and design various combinational and sequential digital electronic circuits andalsothe(K-4).

CourseContents:

Module–

1:SemiconductorDevices Numberof

Class hours:5 hoursSuggestive

LearningOutcome:

Studentswouldbeabletounderstand

1. Fundamentalpropertiesofsemiconductors.
2. Basicsof Diodes
3. Workingprincipleof rectifiers.

Detailedcontentofthe unit:-

Semiconductor and Diodes: Definition, Extrinsic/Intrinsic, N-type & p-typePNJunction Diode:Forward and ReverseBias Characteristics, ZenerDiode:Principle,characteristics,construction,workingDiodeRectifiers: Half WaveandFullWave rectifiers

Module–2:BipolarJunctionTransistor&Field EffectTransistors

Number of Class hours: 5

hoursSuggestiveLearningOutco

mes

Studentswouldbeableto understand

1. Fundamentalof BJT.
2. BasicsofFET/MOSFET
3. Basicsofoperationalamplifiers

Detailedcontentofthe unit:-

Bipolar Junction Transistor (BJT): NPN and PNP Transistor, Operation andcharacteristics

Common Base Configuration: characteristics and workingCommonEmitterConfiguration: characteristicsandworking

Common Base Configuration: characteristics and workingWorking Principle and Classification of FET and MOSFET,BasicsofOperational Amplifier.

Module–3:NumberSystems&BooleanAlgebra

Number of Class hours: 5

hoursSuggestiveLearningOutco

mes

Studentswould beable tounderstand -

1. Fundamentalnumbersystem
2. Boolean AlgebraandsimplificationofBooleanexpressions
3. Basicsof KarnaughMaps

Detailedcontentofthe unit:-

NumberSystems&BooleanAlgebraIntroductiontodifferentnumbersystems:Binary,Octal,DecimalandHexadecimal, Conversionfrom onenumber system toanother.

Booleanvariables:RulesandlawsofBooleanAlgebraDe-Morgan'sTheoremKarnaughMapsand theiruseforsimplification ofBooleanexpressions.

Module – 4: Logic

GatesNumber of Class hours: 5

hoursSuggestiveLearningOutco

mes

Studentswouldbeableto understand –

1. LogicGatesandtruthtable
2. Combinationallogiccircuits.
3. MultiplexerandDe-multiplexer.

Detailedcontentofthe unit:-

Logic Gates Logic Gates: AND, OR, NOT, NAND, NOR, XOR, XNOR: SymbolicrepresentationandtruthtableImplementationofBooleanexpressionsandLogicFunctionsusinggates Simplification ofexpressions.

CombinationalLogicCircuitsArithmeticCircuits:Addition,Subtraction,1's2'sComplement, Half Adder,Full Adder,Half Subtractor, FullSubtractor,

Multiplexer,2 to1 MUX, 4to 1MUX, 8to 1 MUX.

De-multiplexer:1to 2DEMUX, 1-4 DEMUX,1-8 DEMUX.

Module–5:SequentialLogicCircuits&basicsof Memory

Number of Class hours: 5

hoursSuggestiveLearningOutco

mes

Studentswouldbeableto understand

1. OperationsofFlipFlops, differenttypesofregisters,counters
2. Basicdesign fordifferent typesofregisters
3. ConceptsofCounters

Detailedcontentofthe unit:-

Sequential Logic Circuits Flip Flops: SR, JK, T, D, FF, JK-MS,TriggeringCounters:4 bitUp–Down Counters,

RingCounterRegisters:4bitShiftRegister:SerialInSerialOut,SerialinParallelOut,ParallelIn Serial Out, ParallelIn Parallel Out.

References:

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Summer Internship-I

Course Code	EESI-310
Course Title	Summer Internship-I
Number of Credits	2 (L: 0, T: 0, P: 0)
Prerequisites	Nil
Course Category	Internship

Internships may be full-time or part-time; they are full-time in the summer vacation and part-time during the academic session.

Sl. no.	Schedule	Duration	Activities	Credits	Hours of Work
1	Summer Vacation after 2nd Semester	3-4 Weeks	Inter/ Intra Institutional Activities **	2	80 Hours

(** Students are required to be involved in Inter/ Intra Institutional Activities viz; Training with higher Institutions; Soft skill training organized by Training and Placement Cell of the respective Institutions; contribution at incubation/ innovation /entrepreneurship cell of the Institute; participation in conferences/ workshops/ competitions etc.; Learning at Departmental Lab/ Tinkering Lab/ Institutional workshop; Working for consultancy/ research project within the Institutes and Participation in all the activities of Institute's Innovation Council for e.g.: IPR workshop/Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos etc.)

Benefits to Students:

1. An opportunity to get hired by the Industry/ organization.
2. Practical experience in an organizational setting.
3. Excellent opportunity to see how the theoretical aspects learned in classes are integrated into the practical world. On-floor experience provides much more professional experience which is often worth more than classroom teaching.
4. Helps them decide if the industry and the profession is the best career option to pursue.
5. Opportunity to learn new skills and supplement knowledge.
6. Opportunity to practice communication and teamwork skills.
7. Opportunity to learn strategies like time management, multi-tasking etc. in an industrial setup.
8. Opportunity to meet new people and learn networking skills.
9. Makes a valuable addition to their resume.
10. Enhances their candidacy for higher education.
11. Creating network and social circle and developing relationships with industry people.
12. Provides opportunity to evaluate the organization before committing to a full-time position.

Course Outcome:-

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

C.O.1: Explain the real life organizational and industrial environment situations (K2).

C.O.2: Develop organizational dynamics in terms of organizational behaviour, culture and professional ethics (K1).

C.O.3: Understand the importance of Team work (K2).

C.O.4: Explain invaluable knowledge and networking experience (K2).

C.O.5: Develop skill to build a relationship with a prospective employer (K3).

Course Content:-

Internships are educational and career development opportunities, providing practical experience in a field or discipline. The Summer Internship-I is a student centric activity that would expose Technical students to the industrial environment, which cannot be simulated in the classroom and hence creating competent professionals for the industry. They are structured, short-term, supervised placements often focused around particular tasks or projects with defined timescales. An internship may be compensated, non-compensated or some time may be paid. The internship has to be meaningful and mutually beneficial to the intern and the organization. It is important that the objectives and the activities of the internship program are clearly defined and understood. Following are the intended objectives of internship training:

1. Will expose Technical students to the industrial environment, which cannot be simulated in the classroom and hence creating competent professionals for the industry.
2. Provide possible opportunities to learn, understand and sharpen the real time technical / managerial skills required at the job.
3. Exposure to the current technological developments relevant to the subject area of training.
4. Experience gained from the 'Industrial Internship' in classroom will be used in classroom discussions.
5. Create conditions conducive to quest for knowledge and its applicability on the job.
6. Learn to apply the Technical knowledge in real industrial situations.
7. Gain experience in writing Technical reports/projects.
8. Expose students to the engineer's responsibilities and ethics.
9. Familiarize with various materials, processes, products and their applications along with relevant aspects of quality control.
10. Promote academic, professional and/or personal development.
11. Expose the students to future employers.
12. Understand the social, economic and administrative considerations that influence the working environment of industrial organizations
13. Understand the psychology of the workers and their habits, attitudes and approach to problem solving.

Overall compilation of Internship Activities / Credit Framework:

Major Head of Activity	Credit	Schedule	Total Duration	Sub Activity Head	Proposed Document as Evidence	Evaluated by	Performance appraisal/ Maximum points/ activity
Inter/ Intra Institutional Activities	2	Summer Vacation after 2nd Semester	3-4 Weeks	Inter/ Intra Institutional Workshop/ Training	Certificate	Programme Head	Satisfactory/ Good/ Excellent
				Working for consultancy/ research project	Certificate	Programme Head	Satisfactory/ Good/ Excellent
				Festival (Technical / Business / Others) Events	Certificate	Programme Head	Satisfactory/ Good/ Excellent
				Contribution in Incubation/ Innovation/ Entrepreneurship Cell/ Institutional Innovation Council	Certificate	Cell In-charge	Satisfactory/ Good/ Excellent
				Learning at Departmental Lab/Tinkering Lab/ Institutional workshop	Certificate	Cell In-charge	Satisfactory/ Good/ Excellent

STUDENT'S DIARY/ DAILY LOG

The main purpose of writing daily diary is to cultivate the habit of documenting and to encourage the students to search for details. It develops the students' thought process and reasoning abilities. The students should record in the daily training diary the day-to-day account of the observations, impressions, information gathered and suggestions given, if any. It should contain the sketches & drawings related to the observations made by the students.

The daily training diary should be signed at the end of each day by the supervisor/ in charge of the section where the student has been working. The diary should also be shown to the Faculty Mentor visiting the industry from time to time and get ratified on the day of his visit.

Student's Diary and Internship Report should be submitted by the students along with attendance record and an evaluation sheet duly signed and stamped by the industry to the Institute immediately after the completion of the training. It will be evaluated on the basis of the following criteria:

a) Regularity in maintenance of the diary.
b) Adequacy & quality of information recorded.
c) Drawings, sketches and data recorded.
d) Thought process and recording techniques used.
e) Organization of the information.

INTERNSHIP REPORT

After completion of Internship, the student should prepare a comprehensive report to indicate what he has observed and learnt in the training period. The student may contact Industrial Supervisor/ Faculty Mentor/TPO for assigning special topics and problems and should prepare the final report on the assigned topics. Daily diary will also help to a great extent in writing the industrial report since much of the information has already been incorporated by the student into the daily diary. The training report should be signed by the Internship Supervisor, TPO and Faculty Mentor. The Internship report will be evaluated on the basis of following criteria:

a) Originality.
b) Adequacy and purposeful write-up.
c) Organization, format, drawings, sketches, style, language etc.
d) Variety and relevance of learning experience.
e) Practical applications, relationships with basic theory and concepts taught in the course.

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SemesterIV

Sl. No.	Category	Course Code	CourseTitle	Hours perWeek			TotalContactHours/ Week	Credits
				L	T	P		
1.	Programme corecourse-10	EEPC-401	FundamentalsofPowerElectronics	3	0	0	3	3
2.	Programme corecourse-11	EEPC-402	Fundamentals of Power ElectronicsLaboratory	0	0	2	2	1
3.	Programme corecourse-12	EEPC-403	Electric Power Transmission andDistribution	2	1	0	3	3
4.	Programme corecourse-13	EEPC-404	Electric Power Transmission andDistributionLaboratory	0	0	2	2	1
5.	Programme corecourse-14	EEPC-405	Induction, Synchronous and SpecialElectricalMachines	2	1	0	3	3
6.	Programme corecourse-15	EEPC-406	Induction, Synchronous and SpecialElectricalMachines Laboratory	0	0	2	2	1
7.	Programmeelectivecourse-1 (Any One to be selected)	EEPE-407/A	Electrical Estimation andContracting	3	0	0	3	3
		EEPE-407/B	IlluminationPractices					
		EEPE-407/C	Electrical Testing andCommissioning					
8.	Humanities & Social Science- 4	HS 408	Professional Skill Development	2	1	0	3	3
9.	MinorProject	PR-401	MinorProject	0	0	4	4	2
10.	Mandatory Course-1	AU-402	Essence of Indian Knowledge andTradition	2	0	0	2	0
	Total			**15**	**2**	**10**	**27**	**20**

FUNDAMENTALSOFPOWERELECTRONICS

CourseCode	:	EEPC-401
CourseTitle	:	FundamentalsofPower Electronics
NumberofCredits	:	3(L:3,T:0,P:0)
Prerequisites	:	NIL
CourseCategory	:	PC

CourseOutcomes:-

Withthiscoursethestudentwillbeableto:

1) Explaintheconstructionandcharacteristicsof Powersemiconductordevicesandalsoc an selectforspecificapplications (K-3).
2) Understandandexplaintheperformanceof Thyristors(K-2).
3) Troubleshootturn-onandturn-offcircuitsof Thyristors(K-4).
4) Maintainphasecontrolledrectifiers(K-3).
5) Maintaintheapplicationofindustrialcontrolcircuits(K-3).

CourseContent:-

Module- 1: Power Electronic Devices Number of class hours: 06 (Six) HoursSuggestive LearningOutcomes:

Studentswill be ableto:-

1) Explainwithsketchestheworkingofthegivenpowerelectronicdevices.
2) Describewithsketchestheconstructionofthe givenpowertransistors.
3) Interpretthe V-Icharacteristicsofthegivenpower electronicdevice.
4) Selectsuitablepowerelectronicdeviceforgivensituationwithjustification.
5) SuggestsuitableIGBTforgivenapplication.

Detailedcontentofthe unit: -

Powerelectronicdevices

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

Conceptofsingle electrontransistor(SET)-aspectsofNano-technology.

Module- 2: Thyristor Family

DevicesNumberofclasshours:12(twelve)H

oursSuggestive LearningOutcomes:

Studentswill beable to:

1) Classifygivenpowersemiconductordevices.
2) Identifygiventhyristorsand triggeringdeviceswithjustification.
3) Interpretthe V-Icharacteristicsofthegiventhyristorfamilydevice
4) Explainwithsketchestheworkingof thegiventypeofthyristors.
5) Describetheprocedureto troubleshoot the given typeof thyristors.

Detailedcontentofthe unit: -

SCR:construction,twotransistoranalogy,types,

workingandcharacteristics.SCRmountingand cooling

TypesofThyristors:SCR, LASCR,SCS,GTO,UJT,PUT,DIACandTRIAC

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

Protectioncircuits:over-voltage,over-current,Snubber,Crowbar.

Module-3:Turn-onandTurn-offMethodsofThyristors

Numberofclasshours:10(ten)HoursSu

ggestive LearningOutcomes:

Studentswill be able to:

1) Explainwithsketchestheworkingofthegiven typeoftriggeringcircuit.
2) Explaintheroleofpulsetransformerinthe giventriggeringcircuit.
3) Explainwith sketches theworkingof thegiven typeofTurn-On method.
4) Describetheprocedureto troubleshoot thegiven typeof Turn-On method.
5) Explainwithsketches theworkingofthegiven typeof Turn-Offmethod.
6) Describetheprocedureto troubleshoot thegiven typeofTurn-Off method.

Detailedcontentofthe unit: -

SCRTurn-Onmethods:HighVoltagethermaltriggering,Illuminationtriggering,dv/dttriggering,Gate triggering.

Gatetriggercircuits –ResistanceandResistance-Capacitancecircuits.

SCRtriggeringusingUJT,PUT: RelaxationOscillatorandSynchronizedUJTcircuit.

Pulsetransformerandopto-couplerbasedtriggering.

SCR Turn-Off methods: Class A- Series resonant commutation circuit, Class B – Shunt Resonantcommutationcircuit,ClassC–ComplimentarySymmetrycommutationcircuit,ClassD–Auxiliarycommutation,ClassE-Externalpulsecommutation,ClassF-Lineornaturalcommutation.

Module-4:PhaseControlledRectifiers:

Numberofclasshours:14(fourteen)HoursSu

ggestive LearningOutcomes:

Studentswill beable to:

1) Explainwithsketches theoperationofthephase control.
2) Calculatetheaveragevoltageofthegivencontrolledrectifier.
3) Interpret/drawtheinput-outputwaveformsofthe powerelectroniccircuit.
4) Explainwithsketchestheoperationofthe givenbridge configuration.
5) Describetheproceduretotroubleshootthegivenphasecontrolledrectifier circuit.

Detailedcontentofthe unit:-

Phasecontrol:firingangle,conduction angle.

Single phase half controlled full controlled and midpoint controlled rectifier with R, RL load:Circuitdiagram,working,input-outputwaveforms,equationsforDCoutputandeffectoffreewheelingdiode.

Different configurations of bridge controlled rectifiers: Full bridge, half bridge with commonanode,common cathode, SCRs in one armand diodesin another arm.

Module- 5: Industrial Control Circuits Number of class hours:05 (five) HoursSuggestive LearningOutcomes:

Studentswill beable to:

1) Explainwithsketchestheworkingof givenindustrialcontrolcircuits.
2) Describetheworkingof given typeof SMPS.
3) DescribethetroubleshootingprocedureofthegiventypeofonlineandofflineUPS.
4) Explainwithsketches theworkingof thegiven typeofSCR-based circuitbreaker.

Detailedcontentofthe unit: -

Applications:Burglar'salarmsystem,BatterychargerusingSCR,Emergencylightsystem,Temperaturecontrollerusing SCRand; Illuminationcontrol /fanspeedcontrolTRIAC.

SMPS

UPS:OfflineandOnline.

SCRbasedACandDCcircuitbreakers.

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FUNDAMENTALSOFPOWERELECTRONICSLABORATORY

CourseCode	:	EEPC-402
CourseTitle	:	FundamentalsofPowerElectronicsLaboratory
NumberofCredits	:	1(L:0,T: 0,P:2)
Prerequisites	:	NIL
CourseCategory	:	PC

CourseOutcomes:-

Withthis coursestudents willbe able to:-

1) Selectpower electronicdevices forspecific applications (K-3).
2) MaintaintheperformanceofThyristors(K-3).
3) Troubleshootturn-onandturn-offcircuitsofThyristors(K-2).
4) Maintainphasecontrolledrectifiers (K -3).
5) Maintainindustrialcontrolcircuits(K-3).

CourseContent:-

1) Testtheproper functioningofpowertransistor.
2) TesttheproperfunctioningofIGBT.
3) TesttheproperfunctioningofDIACtodetermine thebreakovervoltage.
4) Determinethe latchingcurrent and holdingcurrent usingV-Icharacteristics of SCR.
5) TestthevariationofR,CinR andRCtriggeringcircuits'onfiringangleof SCR.
6) Testtheeffectof variationofR,C inUJTtriggeringtechnique.
7) Performtheoperationof Class –A,B,Cturnoff circuits.
8) Performtheoperation of Class –D, E,Fturn off circuits.
9) UseCROtoobservetheoutputwaveformofhalfwavecontrolledrectifierwithresistiveloadand determinetheload voltage.
10) DrawtheoutputwaveformofFullwavecontrolledrectifierwithRload,RLload,andfreewheeling diodeand determinethe load voltage.
11) DeterminethefiringangleusingDIACandTRIACphasecontrolledcircuitonoutputpowerunder different loads such as lamp, motor orheater
12) Simulateabovefiringangle controlonSCILABsoftware
13) Testtheperformanceof givenSMPS,UPS.
14) TroubleshoottheBurglar'salarm,Emergencylightsystem,Speedcontrolsystem,Temperaturec ontrol system.

ELECTRICPOWERTRANSMISSIONANDDISTRIBUTION

CourseCode	:	EEPC-403
CourseTitle	:	ElectricPower TransmissionandDistribution
NumberofCredits	:	3(L:2,T:1,P:0)
Prerequisites	:	NIL
CourseCategory	:	PC

Courseoutcomes:-

Afterthecompletion ofthe coursethestudents willbe ableto:

a) Interpretthenormaloperationoftheelectrictransmissionanddistributionsystems.(K2)
b) Maintainthefunctioningofthemediumandhigh voltagetransmissionsystem. (K3)
c) Interprettheparametersoftheextrahighvoltage transmissionsystem.(K2)
d) Maintainthefunctioningofthelow voltageACdistributionsystem.(K3)
e) Maintainthecomponentsofthetransmissionanddistributionlines.(K3)

Coursecontents:-

Module–1:Basicsof TransmissionandDistribution

Number of class hours: 6

hoursSuggestiveLearningOutcome

s:

Studentswill be ableto:-

1) Describewithsketchesthefeatures ofthe giventypeof electricsupplysystems.
2) Interprettheimplicationsofthevoltagelevels inthegiventransmissionsystems.
3) Explainthecharacteristicsofthespecifiedhighvoltagetransmissionlines.
4) Describe with sketches the construction method of the given type oftransmission/distributionline.

Detailedcontentofthe unit: -

Single line diagrams with components of the electric supply transmission and distributionsystems.Classificationoftransmissionlines:Primaryandsecondarytransmission; standardvoltagelevel used inIndia.Classificationoftransmissionlines:basedontypeofvoltage,voltagelevel,lengthandothers.Characteristicsofhighvoltage forpowertransmission.Methodofconstructionofelectricsupplytransmissionsystem– 110kV,220kV,400kV.Methodofconstructionofelectricsupplydistributionsystems– 220V,400V,11kV,33kV.

Module–2:Transmission LineParametersandPerformance

Numberofclasshours:10hoursSuggestive Learning Outcomes:Studentswill be able to:-

1) Describewithsketchesthegivenlineparametersandtypesofspecifiedlines.
2) Interprettheperformance of thespecifiedshortline.
3) Interprettheperformance ofthespecifiedmediumline.
4) Describetheneedfortranspositionofconductors.
5) Explainthespecifiedeffectsoccurringinthe giventypeoftransmissionline.

Detailedcontentofthe unit: -

Line Parameters: Concepts of R, L and C line parameters and types of lines. Performanceof short line: Efficiency, regulation and its derivation, effect of power factor, vectordiagramfordifferent power factor.Performance of medium line: representation, nominal 'T', nominal 'π' and end condensermethods.Transpositionofconductorsanditsnecessity.Skineffect and proximityeffect.PowerFactor Improvement:UsingStaticcondenserandSynchronouscondenser.

Module–3: ExtraHighVoltageTransmission

Number of class hours: 8

hoursSuggestiveLearningOutcome

s:-

Studentswill be ableto:-

1) Explainthespecifiedfeaturesofthegiventypeofextrahighvoltagetransmissionline.
2) Explainthespecifiedeffectsoccurringinthegiventypeofhighvoltagetransmissionline.
3) DescribewithsketchesthelayoutofgivenHVDCtransmissionlineasperthegiven criterion.
4) Explainthegiven featureoftheFlexibleAC transmissionline.
5) Explainthefeaturesof givenwirelesstransmissionofelectricalpower.

Detailedcontentofthe unit:-

Extra High Voltage AC (EHVAC) transmission line**:** Necessity, high voltage substationcomponentssuchastransformersandotherswitchgears,advantages,limitationsand applicationsand lines inIndia.Ferranti and Coronaeffect.

HighVoltageDC(HVDC)TransmissionLine**:**Necessity,components,advantages,limitations andapplications.LayoutofMonopolar,Bi-polarandHomo-polartransmissionlines andLines inIndia.

FeaturesofEHVACandHVDCtransmissionline.

Flexible AC Transmission line: Features, d types of FACTS controller.Newtrends in wirelesstransmission ofelectricalpower.

Module–

4:A.CDistributionSystem Number of

class hours: 8 hoursSuggestive

LearningOutcomes:-

Studentswill be able to:-

1) DescribewithsketchesthecircuitcomponentsoftheACdistributionsystem.
2) Describethefactorstobe consideredfordesignof specifiedfeederand distributor.
3) Describewithsketchesthetypesofdifferentschemesforgiventypeofdistributionsystem.
4) Calculatethesendingand receivingend voltageof thegiven AC distribution system.

5) Describewithsketchesthecomponentsandtheirfunctionsforthegiventypeofdistribution sub-station.
6) Describewithsketchesthesinglelinediagramofagiventypeofdistributionsub-station.

Detailedcontentofthe unit: -

ACdistribution:Componentsclassification,requirementsofanidealdistributionsyste m, primaryand secondarydistribution system.
Feederanddistributor,factorstobeconsideredindesignof feeder anddistributor.
Typesofdifferentdistributionschemes:radial,ring,andgrid,layout,advantages,disadvantages andapplications.
Voltagedrop,sendingend andreceivingendvoltage.
DistributionSub-
Station:Classification,siteselection,advantages,disadvantagesandapplications.
SingleLinediagram(layout)of33/11KVSub-Station,11KV/400Vsub-
station,Symbolsandfunctions of theircomponents.

Module–V:ComponentsofTransmission andDistributionLine

Number of class hours: 10
hoursSuggestive Learning Outcomes:-

Studentswill beable to:-

1) Describethe giventypeofoverheadconductorbasedonthe givencriteria.
2) Describewith sketchesthemethodoferectionofthe giventypeoflinesupports.
3) Describewithsketches thetypes andproperties ofspecified lineinsulators.
4) Calculate thestringefficiencyforthespecified stringof the given typeof insulator.
5) Describewithsketchesthespecifiedunderground cablebasedonthe givencriteria.

Detailedcontentofthe unit: -

OverheadConductors**:**Propertiesofmaterial,typesofconductorwithtradenames,significance of sag, Sag with level supports, effect of wind pressure, temperature and icedepositionon Sag.
Linesupports:Requirements,typesoflinestructuresandtheirspecifications,methodsof

erection.

LineInsulators**:**Propertiesofinsulatingmaterial,selectionofmaterial,typesofinsulators and their applications, causes of insulator failure, voltage distribution, derivation of equation ofstring efficiency for string of three suspension insulator, methods of improving stringefficiency.

UndergroundCables**:**Requirements,classification,construction,comparisonwithoverheadlines,cable lyingandcable jointing.

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ELECTRIC POWER TRANSMISSION AND DISTRIBUTIONLABORATORY

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

Courseoutcomes:

Afterthecompletionofthecoursethestudentswillbeableto:

a) Interpretthenormaloperationoftheelectrictransmissionanddistributionsystems.(K-2)
b) Maintainthefunctioningofthemediumandhigh voltagetransmissionsystem.(K-3)
c) Interprettheparameters oftheextrahighvoltage transmissionsystem..(K-2)
d) Maintainthefunctioningofthelow voltageACdistributionsystem.(K-3)
e) Maintainthecomponentsofthetransmissionanddistributionlines.(K-3)

Coursecontents:

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 thevarious outcomes in this course: Students should conduct following activities in group andprepare reports of about 5 pages for each activity, also collect/record physical evidences fortheir (student's) portfoliowhich will beuseful fortheirplacementinterviews:

a) Preparareportbasedontransmissionlinenetworkin Tripura.
b) Collecttheinformationon componentsof transmissionline.
c) Evaluatetransmissionlineperformanceparametersofagivenline.
d) Library/Internetsurveyofelectricalhighvoltagelineand HVDClines.
e) Visitto33/11KVand 11KV/400VDistributionSubstationandwriteareport.

Alsoonemicro-projectcanbeassignedtothestudent.Asuggestivelistofmicro-projectsisgivenhere. Similar micro-projectscould beaddedbytheconcernedfaculty:

1) Prepareamodelshowing:
    i. Singleline diagram ofelectricsupplysystem.

ii. Singlelinediagramofagivendistributionsystem.

iii. Shortlineand mediumtransmissionline.

iv. Write areport onthesamebygivingthe details oflinesin TripuraState.

2) CollectdifferentsamplesofOverheadConductors,UndergroundCables,LinesupportsandLineInsulators.

3) Prepareapowerpointpresentation:

i. ExtraHighVoltageACTransmissionline.

ii. HighVoltageDCTransmissionline.

iii. FlexibleACTransmissionline.

iv. Newtrendsinwirelesstransmissionofelectricalpower.

4) Collectinformationon:

i. A.CDistributionSystem adjacenttoyourinstitute.

ii. Drawalayoutdiagramof11KV/400Vsubstationinyourcampus/adjacentsubstation.

CourseCode	:	EEPC-405
CourseTitle	:	Induction,SynchronousandSpecialElectricMachines
NumberofCredits	:	3 (L:2,T:1,P: 0)
Prerequisites	:	NIL
CourseCategory	:	PC

Courseoutcomes:

The theory,practicalexperiencesandrelevantsoftskillsassociatedwiththiscoursearetobetaughtandimplemented,sothatthestudentdemonstratesthefollowingindustryorientedCosassociatedwiththeabovementionedcompetency:

1. Maintainthreephaseinductionmotorusedindifferentapplications.(K-4)
2. Maintainsinglephaseinductionmotorusedindifferentapplications. (K-4)
3. Maintainthreephasealternatorsusedindifferentapplications.(K-4)
4. Maintainsynchronousmotorsusedindifferentapplications.(K-4)
5. MaintainFHPmotorsusedindifferentapplications.(K-4)

CourseContents:-

Module – 1:- Three Phase Induction

MotorNumber of class hours: 8 (Four)

HoursSuggestive LearningOutcomes:

Studentswill beable to:

1. Knowabout workingprinciple3 phaseinductionmotors
2. KnowaboutRotorquantities:frequency,inducedemf,power factoratstartingandrunningcondition.
3. Knowabout Speed controlmethods

DetailedContentofthe Unit:-

Working principle: production of rotating magnetic field, Synchronous speed, rotor speedand slip.Constructionaldetailsof3phaseinductionmotors:SquirrelcageinductionmotorandSlip ringinduction motor.Rotorquantities:frequency, inducedemf,powerfactoratstartingandrunningcondition.Characteristics of torque versus slip (speed). Torques: starting, full load and maximumwith relations

amongthem.Inductionmotorasageneralizedtransformerwithphasordiagram.Fourquadranto peration,Powerflowdiagram.Starters: need and types; stator resistance, auto transformer, star delta, rotor resistance andsoftstarters.Speed control methods: stator voltage, pole changing, rotor resistance and VVVF. Motorselectionfordifferentapplicationsaspertheloadtorque-speedrequirements.Maintenanceof threephaseinductionmotors.

Module–

II:Singlephaseinductionmotors Number of

class hours: 8 (Four) HoursSuggestive

LearningOutcomes:

Studentswill beable to:

1. KnowaboutDoublefieldrevolvingtheory,principleofmakingthesemotorsself-start
2. KnowaboutTorque-speedcharacteristicsforallof theabovemotors.
3. KnowaboutMaintenanceofsinglephaseinductionmotors

DetailedContentofthe Unit:-

Double field revolving field theory, principle of making these motors self-start. Constructionand working: Resistance start induction run, capacitor start induction run, capacitor startcapacitorrun,shadedpole,repulsiontype,seriesmotor,universalmotor,hysteresismotor.Torque-speedcharacteristicsforalloftheabove motors.

Motor selectionfor differentapplicationsasper the load torque-speedrequirements.Maintenanceof singlephaseinduction motors.

Module–3:-

ThreephaseAlternatorsNumber of

class hours: 8 (Four) HoursSuggestive

LearningOutcomes:

Studentswill beable to:

1. Knowabout Principleof working,movingandstationaryarmatures.
2. KnowaboutE.M.F.equationofanAlternator
3. Knowabout Armature reaction

DetailedContentofthe Unit:-

Principleofworking,movingandstationaryarmatures.

Constructionaldetails:partsandtheirfunctions,rotorconstructions.Windings:Singleand Doublelayer.E.M.F.equationofanAlternatorwithnumericalbyconsideringshortpitchfacto randdistributionfactor.Regulation of Alternator, Alternatorloading:Factorsaffectingtheterminalvoltageofalternator;Armatureresistance and leakagereactancedrops.

Armaturereactionatvariouspowerfactorsandsynchronousimpedance.

Voltageregulation:directloadingandsynchronousimpedancemethods.Maintenanceofalte rnators, Simple numerical related to alternator.

Module – 4:- Synchronous motors Numberofclasshours:8(Four)H oursSuggestive LearningOutcomes:

Studentswill beable to:

1. Knowabout Principleof working/operation Synchronousmotor
2. KnowaboutdifferentTorques:
3. Know aboutV-Curves andInvertedV-Curves.

DetailedContentofthe Unit:-

Principleofworking/operation,significanceofloadangle.
Torques:startingtorque,runningtorque, pullin torque,pull outtorque.
Synchronousmotoronloadwithconstantexcitation(numerical), effectof excitationatconstantload (numerical).
V-Curves and Inverted V-Curves.Huntingand Phaseswinging.
MethodsofStartingofSynchronous Motor.
Lossesinsynchronousmotorsandefficiency(nonumerical).App licationsareas

Module–5:- Fractionalhorsepower(FHP)Motors

Numberofclasshours:8(Four)HoursSu ggestive LearningOutcomes:

Studentswill beable to:

1. KnowaboutConstructionandworking differenttypeofFHPmotors
2. Know aboutTorquespeedcharacteristicsofabovemotors.

3. KnowaboutApplicationsofabovemotors.

DetailedContentofthe Unit:-

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

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INDUCTION, SYNCHRONOUS AND SPECIAL ELECTRIC MACHINESLABORATORY

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

Courseoutcomes:-

The theory, practical experiences and relevant soft skills associated with this course are to betaught and implemented, so that the student demonstrates the following industry oriented Cosassociatedwith the abovementionedcompetency:

1. Maintainthreephaseinductionmotorusedindifferentapplications.(K-4)
2. Maintainsinglephaseinductionmotorusedindifferentapplications.(K-4)
3. Maintainthreephasealternatorsusedindifferentapplications.(K-4)
4. Maintainsynchronousmotorsusedindifferentapplications.(K-4)
5. MaintainFHPmotorsusedindifferentapplications.(K-4)

CourseContents:-

Practicals:

1. Identifythe different parts(alongwith functionand materials)forthegivensinglephaseand threephaseinduction motor.
2. Connectandrunthethreephasesquirrelcageinductionmotors(inbothdirections)usingthe DOL, star-delta, auto-transformer starters (anytwo).
3. Perform the directload teston thethreephasesquirrelcageinductionmotor andplotthe i) efficiencyversusoutput,ii)power factor versusoutput,iii)power factorversus motorcurrentand iv) torque– slip/speed characteristics.

4. ConducttheNo-loadandBlocked-rotortestsongiven3-phasesquirrelcageinductionmotoranddetermine theequivalent circuitparameters.
5. ConducttheNo-loadandBlocked-rotortestsongiven3-phasesquirrelcageinductionmotorandplot the Circlediagram.
6. Controlthespeedofthegiventhreephasesquirrelcage/slipringinductionmotorusingtheapplicable methods: i) auto-transformer, ii) VVVF.
7. Measuretheopencircuit voltage ratioofthethree phaseslip ringinductionmotor.
8. Conductthedirectloadtesttodeterminetheefficiencyandspeedregulationfordifferent loads on the given single phase induction motor; plot the efficiency and speedregulationcurves with respect to the outputpower.
9. Perform the direct loading test on the given three phase alternator and determine theregulationandefficiency.
10. DeterminetheregulationandefficiencyofthegiventhreephasealternatorfromOCandSC tests (Synchronous impedancemethod).
11. Conduct the test on load or no load to plot the 'V' curves and inverted 'V' curves (atno-load)of 3-f synchronous motor.
12. Dismantling and reassembling of single phase motors used for ceiling fans, universalmotor formixer.
13. Controlthespeed andreversethe directionofsteppermotor.
14. Control thespeed and reversethedirection oftheAC servomotor.
15. Control thespeed and reversethedirection oftheDC servomotor.

ELECTRICAL ESTIMATIONANDCONTRACTING

CourseCode:	**:**	EEPE-407/A
CourseTitle :	**:**	ElectricalEstimationand Contracting
NumberofCredits	**:**	3(L:3,T: 0,P:0)
Prerequisites	**:**	NIL
CourseCategory	**:**	PE

Courseoutcomes:

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

1. Follow National ElectricalCode2011 in electrical installations.(K-1)
2. Understand the purpose of Estimation and Contracting in electrical installation works (K-2)
3. Estimate the work of non-industrial electrical installations.(K-5)
4. Estimate the work of industrial electrical installations and Public Lighting Installation (K-5)
5. Prepare abstract, tender, quotation of low tension (LT) substations. (K-6).

CourseContents:

Module–I:**SafetyScopeandfeaturesof Nationalelectriccode**

Number of Class hours: 6 hours

SuggestiveLearningOutcomes:

Studentswouldbeableto understand

1. SafetyScopeandfeatures of National electriccode2011.
2. Principlesforelectrical installation.
3. Safetyinstructions and safetypractices.

DetailedContentofthe Unit:-

Electric Installation and Safety Scope and features of National electric code 2011, Typesofelectricalinstallation,Fundamentalprinciplesforelectricalinstallation,Permittowork ,safetyinstructions andsafetypractices, Purposeofestimating and costing.

Module–II:Meaning andPurposeof Estimating andCosting

Number of Class hours: 6

hoursSuggestiveLearningOutco

mes:

Studentswouldbeableto understand

1. Purposeof Estimation and Costing
2. Conceptsofcontracts
3. Tendersand Quotations

DetailedContentofthe Unit:-

EstimationandCostingMeaningandpurposeof-Roughestimate,detailedestimate,supplementaryestimate,annual maintenanceestimateand revised estimate.

Factorstobeconsideredwhile preparation ofdetailedestimateandeconomicalexecutionofwork

Contracts- Concepts of contracts, types of contracts, contractor, role of contractor.TendersandQuotations-Typeoftender,tendernotice, preparation oftenderdocument,andmethodofopeningoftenderQuotation,quotationformat,comparisonbetweentenderandquotationComparativestatement,formatcomparativestatement,Orderformat,placingofpurchasingorder.Principlesofexecutionofworks,planning,organizingand completion of work,Billingof work.

Module–III:ElectricalInstallation&Earthingin residentialandcommercialbuildings.

Number of Class hours: 6

hoursSuggestiveLearningOutco

mes:

Studentswouldbeableto understand

1. Electrical Installationinresidentialandcommercialbuildings.
2. Earthingofcommercialinstallation

DetailedContentofthe Unit:-

Non-IndustrialInstallations,TypesofNon-industrialinstallations-Officebuildings,shoppingandcommercialcentre,residentialinstallation,Electricserviceandsupply Designconsideration ofelectrical installationin commercial buildings.

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

unitEarthingof commercial installation.Design electrical installation scheme of commercial complex. Erection, Inspection andtestingof installation asper NEC.

Module–IV:Electrical Design consideration in industrial installations and PublicLightingInstallation

Number of Class hours: 6

hoursSuggestiveLearningOutco

mes:

Studentswouldbeableto understand

1. Drawingofwiringdiagramand singleline diagramforsinglephaseandthreephaseMotors.
2. Design electricalinstallationschemeoffactory/smallindustrialunit.
3. Study ofPublicLightingInstallation

DetailedContentofthe Unit:-

IndustrialInstallation,Classificationofindustrialbuildings Classificationbasedonpower consumption, Drawing of wiring diagram and single line diagram for single phaseandthreephaseMotors.

Design consideration in industrial installations, Design procedure of installation-detailedsteps.

Design electrical installation scheme of factory/ small industrial unit, Preparation ofmaterial schedule and detailed estimation Installation and estimation of agricultural pumpand flourmill.

PublicLightingInstallation,Classificationofoutdoorinstallationsstreetlight/publiclightingin stallation Street light polestructures.

Module – V: Design of LT

SubstationNumber of Class hours: 6

hoursSuggestive LearningOutcomes:

Studentswouldbeableto understand

1. DistributionLinesandLTSubstation
2. 11KVDistributionsubstations &theirlinediagram
3. Estimationand costingof outdoorand indoor 11KVsubstations.

DetailedContentofthe Unit:-

DistributionLinesandLTSubstation.

Introductiontooverhead andundergrounddistributionline.

Materials used for distribution line HT and LV Cables used for distribution line, factorsdeterminingselectionofLT/HTpowerCables,cablelayingandcableterminationmethod according to IS Design, estimation and costing of HT LT overhead line andundergroundcabling.

Types of 11 KV Distribution substations & their line diagram, Estimation of load, Loadfactor,diversityfactorand determination ofratingof distribution.

Transformer Design,estimationandcostingofoutdoorandindoor11KVsubstation.

References:

1. Raina,K.B.;Dr.S.K.BhattacharyaNewAgeInternationalPublisherFirst,Reprint2010,Electrical DesignEstimatingandCostingISBN: 978-81-224-0363-3
2. Allagappan,,N.S.Ekambarram,TataMc-GrawHillPublishingCo.Ltd,ElectricalEstimatingand Costing,ISBN 13: 9780074624784
3. Singh,SurjitRaviDeepSingh,DhanpatRaiandSons,ElectricalEstimatingandCosting,ISBN 13:1234567150995
4. Gupta,J.B.S.K.KatariaandSonsReprintEdition,ACourseinElectricalInstallationEstimatingand CostingISBN 10: 935014279113: 978-9350142790.
5. BureauofIndianStandard.IS:732-1989,CodeofPracticeforElectricalWiringInstallation
6. Bureauof IndianStandard.SP-30:2011,NationalElectricalCode2011

ILLUMINATIONPRACTICES

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

CourseOutcomes:-

Aftercompletion ofthiscoursethe studentswill beable to:

1. Selectrelevantlampsfor variousapplicationsconsideringilluminationlevels.(K-2)
2. Understandthe lightingaccessoriesrequiredforselected wiringscheme.(K-2)
3. Design relevantilluminationschemesforinteriorapplications.(K-4)
4. AnalyzeIlluminationschemesforvariousapplications.(K-4)
5. DesignIlluminationschemesforvariousoutdoorapplications.(K-4)

CourseContents:-

Module–

1:FundamentalsofIllumination Number of class hours: 04 (Four) HoursSuggestive LearningOutcomes:

Studentswillbe ableto:

1. Definethelawsofillumination andconceptofphotometry.
2. Describeanddemonstratethepolarcurvesanditsapplications.
3. Understandthelightingcalculationmethods.
4. Remember the standards of illumination and demonstrate the measurement ofillumination.

Detailedcontentofthe unit:-

Basicillumination,Terminology,Lawsofillumination.

Polarcurves,polarcurve:itsmeaningandapplicationsfordesigningthelamp.ConceptofPhotometry, Measurement ofillumination.

Lightingcalculationmethods,Watt/m^2method,Lumensorlightfluxmethod,Pointtopoint method.

Standardsforillumination.

Module –2:TypesofLamps Number

of class hours: 06 (Six)

HoursSuggestive LearningOutcomes:

Studentswillbe ableto:

1. Definetheselection criteriaforlamps.
2. Describeanddemonstratethedifferenttypesoflamps.

Detailedcontentofthe unit:-

SelectionCriteriaforlamps.

Incandescentlamp,ARClamps–ACandDCarc lamps,Fluorescentlamp.

Types of other lamps: Mercury vapour lamp, HPMV lamp, Mercury iodide lamp, Sodiumva- pour lamp, Halogen Lamps, Ultraviolet Lamps, Neon Lamps. Neon Sign Tubes.Metalhalides, HIDandArclamps.

LEDlamps,CFL,Lasers.

Module–3:Illumination ControlandControlCircuits

Numberofclasshours:08(Eight)HoursSu

ggestive LearningOutcomes:

Studentswillbe ableto:

1. Describe anddemonstratethe principleofoperation andconstructionofDimmer.
2. Definethe workingprinciplefordifferent typesofDimmer.
3. Describeanddiscussthe various controlcircuitsforlamps.

Detailedcontentofthe unit:-

WorkingprincipleandoperationofDimmer.Re

sistancetypeSalt waterDimmer.

DimmerTransformerandtheirtypes,Autotransformerdimmer,Twowindingtransformerdim mer.

ElectronicDimmer: workingprincipleandoperation

a. Thyristoroperateddimmer

b. Triacoperateddimmer

Purposeoflightingcontrol,ControlofEnhanceLighting,Methodsusedforlightcontrol,Control circuits forlamps: ON/OFF control.

Controlcircuitsforlamps:singlelampcontrolledbysingleswitch,twoswitches.SingleLampcontrol bytwo point method, threepointmethod and four point method.

Module-4:IlluminationforInteriorApplications

Numberofclasshours:08(Eight)HoursSuggestive LearningOutcomes:

Studentswillbe ableto:

1. DefinetheStandardsfor variouslocationsofInterior Illumination.
2. UnderstandtheDesignconsiderationsforInteriorlocation.
3. DescribeanddiscusstheIlluminationschemefordifferentInteriorlocations.

Detailedcontentofthe unit:-

StandardforvariouslocationsofInteriorIllumination.

DesignconsiderationsforInteriorlocationofresidences(1/2/3/4BHK),Commercial,Industrial premises.

IlluminationschemefordifferentInteriorlocationsofResidential,Commercial,industrial unit.

Module–5:IlluminationforInteriorApplications

Number of class hours: 06 (Six)

HoursSuggestive LearningOutcomes:

Studentswillbe ableto:

1. Design anddemonstratethevarioustypesofinteriorapplicationsoflighting.
2. Definethe Special purposelamps used in photographyvideo films.

Detailedcontentofthe unit:-

FactoryLighting,StreetLighting(LatestTechnology),FloodLighting,RailwayLighting.Lightingforadvertisement/Hoardings/sportslighting,AgricultureandHorticulturelighting,Health CareCentres/Hospitals,DecoratingPurposes,StageLighting,Aquariumsand Shipyards.Specialpurposelamps used in photographyvideofilms.

References:-

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

ELECTRICALTESTINGANDCOMMISSIONING

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

CourseOutcomes:-

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

Aftercompletion ofthiscoursethe studentswill beable to:

1. Followsafetyprocedureswithrespecttoearthingandinsulationofelectricaleq uipment.(K-4)
2. Selectpropertools,equipment,forinstallation,testing,maintenanceofelectri calmachinesand transformers.(K-3)
3. Testandcommissionelectricalequipmentinaccordance with IScodes.(K-4)
4. Makeplansfor troubleshootingelectricalmachines.(K-4)
5. Undertakeregularpreventiveandbreakdownmaintenance.(K-3)

CourseContents:-

Module–1:-ElectricalSafetyandInsulation

Numberofclasshours:8(Four)Hours

Suggestive LearningOutcomes:

Studentswill beable to:

1. KnowDo'sanddon'tsregardingsafety.
2. Knowabout measuringinsulation resistancebydifferentmethods.
3. KnowaboutReconditioningofinsulation.

DetailedContentofthe Unit:-

Do'sanddon'tsregardingsafetyindomesticelectricalappliancesaswellforsubstation/powerstati

on operators.

Electricalsafetyinindustry/powerstations/substationsatthetimeofoperation/control/maintenance.

Firedetectionalarm, fire-fightingequipment.

Factorsaffectinglifeofinsulatingmaterials,classificationsofinsulatingmaterialsasperIS:1271-1958.

Measuringinsulationresistancebydifferentmethodssuchasi)Polarization,ii)Dielectricabsorption,iii) Megger and to predictthe condition of insulation

Reconditioningof insulation,

Insulatingoil-propertiesofinsulatingoil,causesofdeteriorationofoil,Testingoftransformeroil asperIS1866-1961

Module–2:InstallationandErection Number of class hours: 8 (Eight) Hours

Suggestive LearningOutcomes:

Studentswill beable to:

1. Knowthe Conceptoffoundationfor installationofmachinery.
2. KnowConceptoflevelingandaligningProcedure forlevelingandaligningalignmentofdirect coupleddrive, effects ofmisalignment.
3. KnowDevicesandtoolsrequiredforloading,unloadingetc.

DetailedContentofthe Unit:-

Conceptoffoundationfor installationofmachinery.Requirementsoffoundationforstaticand rotatingelectrical machinery.ConceptoflevelingandaligningProcedureforlevelingandaligningalignment ofdirectcoupleddrive,effectsofmis-alignment.

InstallationoftransformerasperI.S.-1886-1967andprocedureofinstallationoftransformer,Requirementsofinstallationofpolemountedtransformer.

RequirementsofinstallationofrotatingelectricalmachinesasperI.S.900-1965

Devicesandtoolsrequiredforloading,unloading,lifting,andcarryingheavyequipmentand precautions to betaken while handlingthem.

Module–3:TestingandCommissioning

Number of class hours: 8 (Eight) Hours

Suggestive LearningOutcomes:

Studentswill beable to:

1. Knowthe Conceptoftesting.
2. Knowabout tolerancesfor thevarious itemsforequipment.
3. KnowaboutCommissioning,TestsbeforeCommissioningofdifferentmachine.

DetailedContentofthe Unit:-

Conceptoftesting,Objectivesoftesting.RolesofI.S.S.intestingofelectricalequipment, Types of tests and concepts, Routine tests, type tests, supplementary test,specialtests, Methods of testing-Direct/Indirect/Regenerativetesting.
Tolerances for the various items for equipment –transformer, induction motor, dc motor,synchronousmachines.
Commissioning,TestsbeforeCommissioningfortransformer,inductionmotor,alternator .Testingof transformerasperI.S.1886-1967 and I.S.2026-1962
Testingofthree-phaseInductionmotorasperI.S.325-1970.Testing of single-phase induction motor as per I.S.990-1965.Testingofsynchronousmachinesas per ISS
Testingof D.C.machines

Module – 4: Troubleshooting Plans

Numberofclasshours:8(Eight)Hours

Suggestive LearningOutcomes:

Studentswill be able to:

1. KnowaboutInternaland externalcausesforfailure
2. KnowaboutUseoftoolslikebearingpullerfillergaugesetc.
3. KnowaboutCommontroublesinelectricalequipment’sandmachines.

DetailedContentofthe Unit:-

Internaland externalcausesforfailure /abnormaloperationofequipment.
Listofmechanicalfaults,electricalfaultsandmagneticfaultsintheelectricalequipmentre
medies,applications.
Useoftoolslikebearingpullerfillergauges,dialindicator,spiritlevel,megger,earthtester,a
ndgrowler.Common troublesin electricalequipmentand machines.
PreparationoftroubleshootingchartsforD.C.Machines,ACMachinesandtransf
ormers.

Module–5:Maintenance

Numberofclasshours:8(Eight)HoursSuggestive
LearningOutcomes:

Studentswillbe ableto:

1. Knowaboutconceptofmaintenance.
2. KnowaboutCausesof failureofelectricalmachines.
3. KnowaboutPreventive maintenance-procedure.

DetailedContentofthe Unit:-

Conceptofmaintenance,typesofmaintenance,routine,preventiveandbreakdown maintenance & Total Quality Maintenance (TQM)
Causesoffailureofelectricalmachines.
Preventivemaintenance-procedureordevelopingmaintenanceschedulesforelectricalmachines.
Factors affecting preventive maintenance schedules, Concept of TPM, Pillars of
TPM.Identificationofdifferenttypesoffaultsdevelopedsuchasmechanical/electr
ical/magneticfaults.
MaintenanceschedulesofthefollowingasperI.S.S.

a) DistributiontransformerasperI.S.1886-1967
b) SinglephaseandthreephaseInductionmotorsas perI.S.900-1965.
c) Batteries

References:

1. Deshpande.M. V. PHI Learning Pvt. Ltd., 2010, Design and Testing of Electrical MachinesISBNNo 8120336453,9788120336452.
2. Rao, B V SAsia ClubHouse, FirstReprint,2011,OperationandMaintenance of ElectricalEquipmentVol-I,ISBNNo8185099022.
3. Rosenberg.McGRAW-HILL,1stEdition,May2003,MaintenanceandRepairs,ISBNNo9780071396035.
4. Sharotri,S.K.Glencoe/Mcgraw-Hill;2nd Edition,June1969;PreventiveMaintenanceofElectricalApparatus,ISBN No 10: 007030839X13:978-0070308398.

PROFESSIONAL SKILL DEVELOPMENT

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

Course Outcomes:

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

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

CO2: Communicate uprightly while looking for a job. K3

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

CO4: Demonstrate effective writing skills for professional excellence. K2

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

Unit – 1Soft Skills & Personality Development

Number of Class Hours: 06
Marks: 08

Learning Outcomes:

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

Detailed Content:

1. **Soft skills - Demand of Every Employer:** How soft skills complement hard skills, Soft skills as competitive weapon, Classification of soft skills into personal and interpersonal traits, Soft skills needed for career growth- Time management, Leadership traits, Communication and networking skills, Teamwork and Interpersonal skills, Empathy and Listening skills, Responsibility, Attitude, Ethics, Integrity, Values and Trust.

2. **Personality Development – A must for career Growth:** Grooming one's personality as a signal that others read, mapping different personality types – Perfectionists, Helpers, Achievers, Romantics, Observers, Questioners, Enthusiasts or adventurers, Bosses or asserters, Mediators or peacemakers.

Unit – 2 Looking for a Job

Number of Class Hours: 05 **Marks: 08**

Learning Outcomes:

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

Detailed Content

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

Unit – 3 Job Interviews

Number of Class Hours: 05 Marks: 08

Learning Outcomes:

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

Detailed Content

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

Unit – 4 Enhancing Writing skills

Number of Class Hours: 12 Marks: 08

Learning Outcomes:

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

Detailed Content

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

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

Unit – 5 Conversations, Panel Discussion and Public Speaking

Number of Class Hours:12 Marks: 08

Learning Outcomes:

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

Detailed Content

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

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

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

List of Software/Learning Websites

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

Reference Books:
(Name of Authors/ Title of the Book /Edition /Name of the Publisher)

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

Minor Project

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

Course Outcome:-

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

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

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

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

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

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

Course Content:-

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

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

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

Essence of Indian Knowledge and Tradition

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

Course Outcomes: -

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

CO 1: Understand the essence of Indian tradition and the importance of carrying them forward. (**K_2**)
CO 2: Understand the Vedic literature and important ideas discussed in the Vedas. (**K_2**)
CO 3: Describe scientific heritage of ancient India along with comprehending its relevance and application in various modern scientific disciplines. (**K_1**)
CO 4: Relate the theoretical and practical sides of the science of Yoga and Aurveda with modern knowledge systems. (**K_1**)
CO 5: Explain the worth of Indian intellectual heritage, traditional practices and Indian lifestyle from scientific lenses. (**K_4**)

Module- 1

Name of the Module: Introduction to Vedic Literature

Number of class hours:**05**

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

- Educational system in the Vedic times
- subject-matter of Ṛgveda-samhitā, *Sāmaveda -Saṁhitā, Yajurveda-Saṁhitā, Atharvaveda-Saṁhitā, Brāhmaṇa*and *Āraṇyaka* literature, Upaveda

Learning outcomes of the Module

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

Module- 2

Name of the Unit: Fundamental doctrines of the *Upaniṣad*s

Number of class hours:**05**
Content:

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

Learning outcomes of the Module

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

Module- 3

Name of the Unit: *Vedāṅga*s, Purāṇasand Dharmaśāstra Literature

Number of class hours:**05**

Content:

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

Learning outcomes of the Module

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

Module- 4

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

Number of class hours:**05**

Content:

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

Learning outcomes of the Module

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

Module- 5

Name of the Unit: Introduction to Yoga &Āyurveda

Number of class hours:**05**

Content:

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

Learning outcomes of the Module

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

References: -

1) Capra, Fritjof. *The Tao of Phisics*. New York: Harpercollins, 2007.

2) Capra, Fritjof. *The Web of Life*. London: Harpar Collins Publishers, 1996.

3) Dasgupta, Surendranath & De, Sushil Kumar. *A History of Sanskrit Literature.*Delhi: Motilal Banarsidass, 2017.

4) Dasgupta, Surendranath. *A History of Indian Philosophy*. Delhi: Motilal Banarsidass, 1991.

5) Gonda, Jan. *A History of Vedic Literature*. Delhi: Monohar Publishers and Distributors, 2020.

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

Semester V

Sl. No.	Category	Code No.	Course Title	Hours per week			Total Contact Hrs/Week	Credit
				L	T	P		
1	Programme core course-16	EEPC-501	Microprocessor and its Application	2	1	0	3	3
2	Programme core course-17	EEPC-502	Microprocessor and its Application Lab	0	0	2	2	1
3	Programme core course-18	EEPC-503	Energy Conservation and Audit	3	0	0	2	3
4	Programme core course-19	EEPC-504	Energy Conservation and Audit Laboratory	0	0	2	2	1
5	Programme core course-20	EEPC-505	Renewable Energy Power Plants	3	0	0	3	3
6	Programme elective course-2 (Any One to be selected)	EEPE-506/A	Industrial Instrumentation and Condition Monitoring	3	0	0	3	3
		EEPE-506/B	Industrial Automation & Control					
		EEPE-506/C	Switchgear and Protection					
7	Programme elective course-3 (Any One to be selected)	EEPE-507/A	Industrial Instrumentation and Condition Monitoring Lab	0	0	2	2	1
		EEPE-507/B	Industrial Automation & Control Lab					
		EEPE-507/C	Switchgear and Protection Lab					
8	Open elective course-1	(Any one to be selected from Annexure-I)		3	0	0	3	3
9	Summer Internship-II (6 weeks) after IV Semester	EESI-509	Summer Internship – II	0	0	0	0	3
10	Major Project	EEPR-510	Major Project	0	0	2	2	1
Total				**15**	**1**	**6**	**22**	**22**

SEMESTER -V

MICROPROCESSORANDITSAPPLICATIONS

Course Code :	EEPC-501
Course Title :	MICROPROCESSORANDITSAPPLICATIONS
Number of Credits	3 (L: 2, T: 1, P: 0)
Prerequisites	NIL
Course Category	PC

Course Outcomes:

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

a) Interpret the salient features of intel-8085

b) Develop assembly language program with 8085 microprocessor

c) Understand Memory Organization and interfacing of different peripheral devices

d) Use of Microprocessor for measurement of electrical parameters and wave generations

e) Interpret the salient features of microcontroller IC 8051

Course Contents:

Module – I (BASICARCHITECTUREOF8-BITMICROPROCESSOR)

Number of Class hours: 8 hours

Suggestive Learning Outcome: Students would be able to know

1. Hardware features of intel-8085
2. Different Functional blocks of 8085
3. Pindescription of 8085.

Hardware features of intel-8085-functional blocks, bus structure, arithmetic logic unit, generalpurpose registers and special purpose registers, interrupts, serial input and output ports, pindescriptions.

Module – II(MICROPROCESSORPROGRAMMING)

Number of Class hours: 8 hours

Suggestive Learning Outcome: Students would be able to know

1. InstructionsetofIntel-8085
2. Differenttypesofprogrammingmodel
3. Branchandsubroutine

InstructionsetofIntel-8085-
Move,arithmetic,Logic,branchingandmachinecycleinstructionand their timing diagrams.Differenttypesofprogrammingmodel.Simpleprogrammingof8085
Addressingmodes-
Direct,indirect,immediate,register,indexedandrelativemodeof addressing
Introductiontobranchandsubroutine.

Module – III(MEMORYORGANIZATION)

Number of Class hours: 8 hours

Suggestive Learning Outcome: Students would be able to know

1. Memory mapped I/O, I/O mapped I/O
2. HardwareandSoftware&VectoredInterrupts
3. InterfacingofA/DandD/Aconverterswith8085microprocessor

Address space partitioning, memory mapped I/O, I/O mapped I/O, serial, parallel,
synchronous,asynchronousdatatransferanddirectmemoryaccess,MemoryInterfacingconsiderations,Buffered System.
Interrupt–hardwareandSoftware&VectoredInterrupts
Interfacing- SerialandParallel(8251,8255), InterfacingofA/DandD/Aconverterswith8085microprocessorandsimpleprogramming.

Module – IV(APPLICATIONSOF MICROPROCESSOR)

Number of Class hours: 8 hours

Suggestive Learning Outcome: Students would be able to

1. MeasureVoltage,Current, Frequency
2. Generate various types of waveforms
3. Know DC MotorController and temperaturemonitoringandcontroller

MeasurementofVoltage,Current,Frequency ,Generation of square, triangular & Staircase Waveforms.Overcurrent/ under voltage relay, Zero crossing defection & phase sequence detectionSoftwareforthyristortriggering, Briefidea of DC MotorController (SCRControlled). (Tacho generatorfeedback withbang-bang ControlStrategyonly).Hardware&Softwareforthefollowing:-
temperaturemonitoringandcontroller.(ON/OFFController only).Steppermotor controller.

Module – V(APPLICATIONSOF MICROCONTROLLERS)

Number of Class hours: 8 hours

Suggestive Learning Outcome: Students would be able to Know

1. Introduction to Microcontrollers
2. Compare Microprocessor and Microcontrollers
3. Architecture and Block diagram of Microcontroller 8051

Introduction to Microcontrollers, Evolution of Microcontrollers ,Block diagram of Microcomputer, Elements of Microcomputer, types of buses, Von Neuman and Harward Architecture ,Compare Microprocessor and Microcontrollers, Need of Microcontroller ,Family of Microcontrollers and their specifications. Architecture of Microcontroller 8051 Block diagram of 8051, function of each block Pin diagram.

References:

1. MicroprocessorArchitecturesandApplications ,Gaonkar

2. Microprocessors:Principles and Applications , A.K. Pal, Tata Mc-Graw-Hill

3. Microprocessorsandits applications, Leventhal

4. TextofMicroprocessorbaseexperimentsandProjects, A.K.Mukhopadhaya

5. Microprocessorsanditsinterfacing, B.RAM, Dhanpat Rai Publications

6. Kenneth, Ayala, 8051 Microcontroller Architecture Programming and Application, PHI Learning, New Delhi,ISBN: 978-1401861582

MICROPROCESSOR AND ITS APPLICATIONLAB

Course Code :	EEPC-502
Course Title :	MICROPROCESSOR AND ITS APPLICATIONLAB
Number of Credits	1(L: 0, T: 0, P: 2)
Prerequisites	NIL
Course Category	PC

Course outcomes:

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

a) Interpret the salient features of 8085 microprocessor

b) Maintain the program features of the 8085 microprocessor based application

c) Develop assembly language program and demonstrate outcome

d) Develop program to interface 8085 microprocessor with different peripheral devices

Practicals:

1. Hands on practice and observation& study on 8085 microprocessor.
2. Develop and execute Assembly language programs using Arithmetic Instructions and demonstrate outcome for a given input data
3. Develop and execute Assembly language programs using Logical Instructions and demonstrate outcome for a given input
4. Develop and execute an Assembly language program for Addition of series of 8 bit nos, 16 bit result and demonstrate outcome for a given input data
5. Develop and execute Assembly language program for addition/subtraction of 16 bit no/multibyte nos. and demonstrate outcome for a given input data
6. Measurementofdifferentphysicalparameterssuchasvoltage,frequency, speed,temperature using 8085microprocessor.
7. Generationofdifferentwaveformusing8085basedD/Aconverters.
8. Thyristor triggering using 8085 based system
9. Studyof 8255 PPIatdifferent modes.
10. Electromagneticrelayoperationusing8085basedsystem.
11. Studyofinterfacing&executionofsteppermotor using8085basedsystem.

List of Equipments:

1. Microprocessor 8085 Training and Development System
2. 8255 PPI Study Card
3. 8253 Timer/Counter Study Card
4. Analog to Digital Converter

5. Digital to Analog Converter

ENERGY CONSERVATION AND AUDIT

Course Code :	EEPC-503
Course Title :	ENERGY CONSERVATION AND AUDIT
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	NIL
Course Category	PC

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences: • Undertake energy conservation and energy audit.

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 energy conservation policies in India(k3).

b) Implement energy conservation techniques in electrical machines(k3).

c) Apply energy conservation techniques in electrical installations(k3).

d) Use Co-generation and relevant tariff for reducing losses in facilities(k3).

e) Analyse the report of energy audit for electrical system(k4).

Course contents:

Module – I Energy Conservation Basics

No of Class Hours-6

Suggested Learning Outcomes: Students would be able to understand

1. Energy Scenario in India.
2. Concept of Energy Conservation.
3. Concept of Energy Audit.

Energy Scenario: Primary and Secondary Energy, Energy demand and supply, National scenario. Energy conservation and Energy audit; concepts and difference Indian Electricity Act 2001; relevant clauses of energy conservation BEE and its Roles, MEDA and its Roles, Star Labelling: Need and its benefits.

Module – II Energy Conservation in Electrical Machines

No of Class Hours- 8

Suggested Learning Outcomes: Students would be able to understand

1. Need for Energy Conservation.
2. Need for Energy efficient Machines

Need for energy conservation in induction motor and transformer. Energy conservation techniques in induction motor by: Improving Power quality. Motor survey, Matching motor with loading. Minimizing the idle and redundant running of motor. Operating in star mode. Rewinding of motor, Replacement by energy efficient motor, Periodic maintenance, Energy conservation techniques in Transformer, Loading sharing, Parallel operation, Isolating techniques. Replacement by energy efficient transformers, Periodic maintenance, Energy Conservation Equipment: Soft starters, Automatic star delta convertor, Variable Frequency Drives, Automatic p.f. controller (APFC), Intelligent p.f. controller (IPFC) Energy efficient motor; significant features, advantages, applications and limitations, Energy efficient transformers, amorphous transformers; epoxy Resin cast transformer / Dry type of transformer.

Module– III Energy conservation in Electrical Installation systems

No of Class Hours-8

Suggested Learning Outcomes: Students would be able to

1. Understand Aggregated Technical and commercial losses.
2. Understand the concept of Energy Conservation in Electrical Machines.

Aggregated Technical and commercial losses (ATC); Power system at state, regional, national and global level. Technical losses; causes and measures to reduce by. a) Controlling I^2R losses. b) Optimizing distribution voltage c) Balancing phase currents d) Compensating reactive power flow Commercial losses: pilferage, causes and remedies, Energy conservation equipments, Maximum Demand Controller, kVAR Controller, Automatic Power Factor controller(APFC) Energy Conservation in Lighting System a) Replacing Lamp sources. b) Using energy efficient luminaries. c) Using light controlled gears. d) Installation of separate transformer / servo stabilizer for lighting. e) Periodic survey and adequate maintenance programs. Energy Conservation techniques in fans, Electronic regulators.

Module– IV Energy conservation through Cogeneration and Tariff

No of Class Hours-8

Suggested Learning Outcomes: Students would be able to understand

1. Co-generation and it’s impact on tariff.
2. Different types of tariff.
3. Application of tariff system to reduce energy bill

Co-generation and Tariff concept, significance for energy conservation, Co-generation, Types of cogeneration on basis of sequence of energy use (Topping cycle, Bottoming cycle) Types of cogeneration basis of technology (Steam turbine cogeneration, Gas turbine cogeneration, Reciprocating engine cogeneration). Factors governing the selection of cogeneration system. Advantages of cogeneration. Tariff: Types of tariff structure: Special tariffs; Time-off-day tariff, Peak-off-day tariff, Power factor tariff, Maximum Demand tariff, Load factor tariff. Application of tariff system to reduce energy bill.

Module– V Energy Audit of Electrical System

No of Class hours-4

Suggested Learning Outcomes: Students would be able to understand

1. Impact of Energy Conservation Act.
2. How to prepare questionnaire for energy audit projects

Energy audit (definition as per Energy Conservation Act), Energy audit instruments and their use. Questionnaire for energy audit projects. Energy flow diagram (Sankey diagram), Simple payback period, Energy Audit procedure (walk through audit and detailed audit). Energy Audit report format.

References:

1.Guide Books No. 1 and 3 for National Certification Examination for Energy Managers and Energy Auditors, Bureau of Energy Efficiency (BEE), Bureau of Energy Efficiency (A Statutory body under Ministry of Power, Government of India) (Fourth Edition 2015).

2. O.P. Gupta, Energy Technology, Khanna Publishing House, New Delhi

3. Henderson, P. D., India - The Energy Sector, University Press, Delhi, 2016. ISBN: 978-0195606539 4. Turner, W. C., Energy Management Handbook, Fairmount Press, 2012, ISBN 9781304520708

5. Sharma, K. V., Venkataseshaiah; P., Energy Management and Conservation, I K International Publishing House Pvt. Ltd; 2011 ISBN 9789381141298

6. Mehta ,V. K., Principles of Power System, S. Chand &Co.New Delhi, 2016, ISBN 9788121905947

7. Singh, Sanjeev; Rathore, Umesh, Energy Management, S K Kataria&Sons,New Delhi ISBN-13: 9789350141014.

8. Desai, B. G.; Rana, J. S.; A. Dinesh, V.; Paraman, R., Efficient Use and Management of Electricity in Industry, Devki Energy Consultancy Pvt. Ltd.

9. Chakrabarti, Aman, Energy Engineering And Management, e-books Kindle Edition

ENERGY CONSERVATION AND AUDIT LABORATORY

Course Code :	EEPC-504
Course Title :	ENERGY CONSERVATION AND AUDIT LABORATORY
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	NIL
Course Category	PC

Course Objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences: • Undertake energy conservation and energy audit.

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) Understand energy conservation policies in India(k2).

b) Determine the reduction in power consumption techniques in electrical machines(k4).

c) Understand suitable tariff for energy conservation and its impact on energy bill(k2).

d) Estimate energy saving by improving power factor and load factor for given cases(k6).

e)Prepare an energy audit report(k3).

Practicals:

1. Identify star labelled electrical apparatus and compare the data for various star ratings.

2. Determine the '% loading' of the given loaded Induction motor.

3. Determine the reduction in power consumption in star mode operation of Induction motor compared to delta mode.

4. Use APFC unit for improvement of p. f. of electrical load.169 Electrical Engineering Curriculum Structure

5. Compare power consumption of different types of TL with choke, electronic ballast and LED lamps by direct measurements.

6. Determine the reduction in power consumption by replacement of lamps in a class room / laboratory.

7. Determine the reduction in power consumption by replacement of Fans and regulators in a class room / laboratory.

8. Collect electricity bill of an industrial consumer and suggest suitable tariff for energy conservation and its impact on energy bill.

9. Collect electricity bill of a commercial consumer and suggest suitable tariff for conservation and reduction of its energy bill.

10. Collect electricity bill of a residential consumer and suggest suitable means for conservation and reduction of the energy bill.

11. Estimate energy saving by improving power factor and load factor for given cases.

12. Prepare a sample energy audit questionnaire for the given industrial facility.

13. Prepare an energy audit report (Phase-I)

14. Prepare an energy audit report (Phase-II)

15. Prepare an energy audit report (Phase-III)

References:

1.Guide Books No. 1 and 3 for National Certification Examination for Energy Managers and Energy Auditors, Bureau of Energy Efficiency (BEE), Bureau of Energy Efficiency (A Statutory body under Ministry of Power, Government of India) (Fourth Edition 2015).

2. O.P. Gupta, Energy Technology, Khanna Publishing House, New Delhi

3. Henderson, P. D., India - The Energy Sector, University Press, Delhi, 2016. ISBN: 978-0195606539 4. Turner, W. C., Energy Management Handbook, Fairmount Press, 2012, ISBN 9781304520708

5. Sharma, K. V., Venkataseshaiah; P., Energy Management and Conservation, I K International Publishing House Pvt. Ltd; 2011 ISBN 9789381141298

6. Mehta ,V. K., Principles of Power System, S. Chand &Co.New Delhi, 2016, ISBN 9788121905947

7. Singh, Sanjeev; Rathore, Umesh, Energy Management, S K Kataria&Sons,New Delhi ISBN-13: 9789350141014.

8. Desai, B. G.; Rana, J. S.; A. Dinesh, V.; Paraman, R., Efficient Use and Management of Electricity in Industry, Devki Energy Consultancy Pvt. Ltd.

9. Chakrabarti, Aman, Energy Engineering And Management, e-books Kindle Edition

RENEWABLE ENERGY POWER PLANT

Course Code :	EEPC-505
Course Title :	RENEWABLE ENERGY POWER PLANT
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	NIL
Course Category	PC

Course outcomes:

After completion of this course students will be able to:

a). Maintain the optimized working of solar PV power plants.(K3)
b). Gain knowledge about working principle small wind turbines. (K1)
c). Maintain the optimized working of mini and micro hydro power plants.(K3)
d). To understand the role of Geo-thermal energy and ocean energy in the Energy Generation (K2)
e). Get the utilization of Biogas plants (K3)

Course contents:

Module – I: Solar Energy

Number of class hours: 6 Hours

Suggestive Learning Outcomes: Students will be able to:

1. Describe the Fundamentals of Solar Photo Voltaic Conversion process.
2. Understand the function of different parts of a solar power plant.
3. Explain the working of Solar PV Power Generation systems.
4. Know the applications of Solar PV.

Detailed content of the unit: -

Fundamentals of Solar Photo Voltaic Conversion, Solar Cells Solar Photovoltaic (PV) power plant: components layout, construction, working. Rooftop solar PV power system, Solar PV Power Generation systems: Off-grid systems, Grid connected systems, Solar PV Applications

Module – II: Wind Energy and Small Wind Turbines

Number of class hours: 10 Hours

Suggestive Learning Outcomes: Students will be able to

1. Know the Basic principles of wind energy conversion.
2. Know the application of Wind Energy.

3. Explain the working of different types of small wind turbine.

Detailed content of the unit: -

Scope for Wind energy in India, Basic principles of wind energy conversion. Site selection considerations, Basic components of wind energy conversion system, Application of Wind Energy, Solar wind hybrid system

Horizontal axis small wind turbine: direct drive type, components and working Horizontal axis small wind turbine: geared type, components and working

Vertical axis small wind turbine: direct drive and geared, components and working Types of towers and installation of small wind turbines on roof tops and open fields. Electric generators used in small wind power plants

Module – III: Mini and Micro-hydro Power Plants

Number of class hours: 8 Hours

Suggestive Learning Outcomes: Students will be able to:

1. Know the Overview of micro, mini and small hydro systems.
2. Know the site selection of small hydroelectric plant.
3. Draw the Layouts of micro-hydro power plants.
4. Describe the working of small (Mini and Micro) hydro-electric power generation system.

Detailed content of the unit: -

Small Hydropower Systems: Overview of micro, mini and small hydro systems,

Selection of site for small hydroelectric plant. Layouts of micro-hydro power plants, Main elements of small (Mini and Micro) hydro-electric power generation system, control requirements in small hydro power plants. Advantages of small hydro power plants over large hydro power generation systems

Module – IV: Geo-Thermal and Ocean Energy

Number of class hours: 8 Hours

Suggestive Learning Outcomes: Students will be able to:

1. Know the sites of Geothermal Energy in India.
2. Know the Resources of geothermal energy.
3. Understand the Principle of OTEC system.
4. Understand the Principle of Tidal Power.
5. Know the Classification of Tidal Power Plants.
6. Know the Electricity generation from Waves.

Detailed content of the unit: -

Geothermal Energy: Introduction, Geothermal sites in India Capacity and Potential, Resources of geothermal energy.Ocean Thermal Energy: Ocean Thermal Energy Conversion (OTEC), Principle of OTEC system, Methods of OTEC power generation. Tidal power plants: Basic Principle of Tidal Power, Components of Tidal Power Plant, Classification of Tidal Power

Plants. Electricity generation from Waves.

Module – V: Biomass-based Power Plants

Number of class hours: 8 Hours

Suggestive Learning Outcomes: Students will be able to:

1. Describe the properties of fuel used in Biomass-based Power Plants.
2. Know the Bio-mass Conversion Technologies.
3. Know the types of biogas plants.
4. Describe the Methods for obtaining energy from biomass.
5. Explain the Advantages and disadvantages of types of biogas plants.

Detailed content of the unit: -

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. Bio-mass Conversion Technologies: Wet and Dry processes. Generation-Factors affecting biogas Generation,

Types of biogas plants, Methods for obtaining energy from biomass. Advantages and disadvantages of types of biogas plants

Industrial Instrumentation and Condition Monitoring

Course Code	EEPE-506/A
Course Title	Industrial Instrumentation and Condition Monitoring
Number of Credits	3 (L: 3, T: 0, P:0)
Prerequisites	NIL
Course Category	PE

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:

- CO-1 Select relevant instruments used for measuring electrical and non-electrical quantities.(k3)
- CO-2 Select relevant transducers/sensors for various applications. (k3)
- CO-3 Use relevant instruments for measuring non-electrical quantities.(k4)
- CO-4 Check the signal conditioning and telemetry system for their proper functioning.(k3)
- CO-5 Use data acquisition systems in various applications.(k4)
- CO-6 Undertake condition monitoring for diagnostic analysis of electrical equipment(k3)

Course Contents:-

Module- 1:- Fundamentals of instrumentation
Number of class hours: 8 (Four) Hrs

Suggestive Learning Outcomes:-
Students will be able to:
1. Gather knowledge about Basic purpose of instrumentation
2. Know about Basic block diagram(transduction, signal conditioning, signal presentation) and their function.
3. Know about Construction, working and application of switching devices

Detailed Content of the Unit:-
Basic purpose of instrumentation.
Basic block diagram (transduction, signal conditioning, signal presentation) and their function.
Construction, working and application of switching devices- Push button, limit switch, float Switch, pressure switch, thermostat, electromagnetic relay.

Module 2:- Transducer
Number of class hours: 8 (Four) Hrs

Suggestive Learning Outcomes:-

Students will be able to:

1. Distinguish between different transducer
2. Know about Construction and principle of resistive transducer & Inductive transducers
3. Know about Construction, principle and applications of transducers – Piezo-Electric transducer, photoconductive

Detailed Content of the Unit:-

Distinguish between Primary and Secondary, Electrical and Mechanical, Analog and Digital, Active and Passive. Mechanical devices pry. And sec. transducers
Advantages of electric transducers
Required characteristics of transducers.
Factors affecting the choice of transducers
Construction and principle of resistive transducer-Potentiometer –variac and strain gauges -No derivation. Only definition and formula for gauge factor
Types of strain gauges like unbonded, bonded and semiconductor.
Construction and principle of Inductive transducers-L.V.D.T. and R.V.D.T, their applications.
Construction, principle and applications of transducers – Piezo-Electric transducer, photoconductive
cells, photo voltaic cells.

Module 3:- Measurement of Non-Electrical Quantities
Number of class hours: 8 (Four) Hrs

Suggestive Learning Outcomes:-

Students will be able to:

1. Know about Construction and Working of RTD, Thermistor and Thermocouple, radiation pyrometer ctc
2. Know about Construction and Working of Speed Measurement by contacting and non-Contact
3. Know about Construction and Working ofLiquid & Thickness level measurement by resistive, inductive, Capacitive,

Detailed Content of the Unit:-

Temperature measurement - Construction and Working of RTD, Thermistor and Thermocouple,radiation pyrometer, technical specifications and ranges.
Pressure measurement – Construction and working of bourdon tube, bellow diaphragm and strain gauge, Combination of diaphragm and inductive transducer, Bourdon tube and LVDT, bellow and LVDT, diaphragm capacitance and bridge Circuit.
Construction and Working of Speed Measurement by contacting and non-Contact Type- DC tachometer, photo- electric tachometer, toothed rotor tachometer Generator - magnetic pickup

and Stroboscope. Construction and Working of Vibration measurement by accelerometer-LVDT accelerometer, Piezo electric type.
Construction and Working of Flow measurement by electromagnetic and Turbine Flow meter.
Construction and Working of Liquid level measurement by resistive, inductive, Capacitive gamma rays and Ultrasonic methods.
Construction and Working of Thickness measurement by resistive, inductive, capacitive, ultrasonicand Nuclear methods

Module 4:- Signal Conditioning

Number of class hours: 8 (Four) Hrs

Suggestive Learning Outcomes:

Students will be able to:

1. Know about Basic Concept of signal conditioning System.
2. Know about Different Parameters of op-amp
3. Know about Filters

Detailed Content of the Unit:-

Basic Concept of signal conditioning System.
Draw pin configuration of IC 741.
Define Ideal OP-AMPand Electrical Characteristics of OP-AMP.
Different Parameters of op-amp:-Input offset voltage, Input offset current, Input bias current, Differential input resistance, CMMR, SVRR, voltage gain, output voltage, slew rate, gain bandwidth.
Output, short circuit current.
Use of op-amp as inverting, non- inverting mode, adder, subtractor, and Working of Differentialamplifier and instrumentation amplifier.
Filters: Types of RC filters and frequency response -no derivation.
Sample and hold circuits - operation and its application.

Module 5:- Data Acquisition System

Number of class hours: 8 (Four) Hrs

Suggestive Learning Outcomes:-

Students will be able to:

1. Know about Generalized DAS- Block diagram and description of Transducer, signal conditioner, multiplexer etc.
2. Know about Digital to Analog conversion
3. Know about Concept and methods of data transmission of electrical and electronic transmission.

Detailed Content of the Unit:-

Generalized DAS- Block diagram and description of Transducer, signal conditioner, multiplexer,converter and recorder
Draw Single Channel and Multi-channel DAS- Block diagram only. Difference between Signal
Channel and Multi-Channel DAS.

Data conversion- Construction and Working of Analog to digital conversion- successive approximationmethod, ramp type method.
Digital to Analog conversion- Construction and Working of binary weighted resistance method.
Concept and methods of data transmission of electrical and electronic transmission.
Construction and principle of telemetry system and its type - Electrical telemetering system-
Digital display device- operation and its application of seven segment display, dot matrix displayand concept of 3½, 4½ digits, LED and LCD applications

References:

1. Sawhney, A.K. Electric and Electronic Measurement and instrumentation, Dhanpat Rai and Co.,Nineteenth revised edition 2011 reprint, 2014**,** ISBN:10: 8177001000
2. Rangan, C.S. G.R.Sharma. andV.S.V.Mani, Instrumentation devices and system, Pen ram International*Publishing* India Pvt. Ltd. Fifth edition, ISBN:10: 0074633503
3. Mehta, V.K. Electronics and instrumentation, Third edition-S.Chand and company Pvt Ltd Reprint,2010, ISBN:81-219-2729-3
4. Singh, S.K. Industrial instrumentation and control, Tata McGraw-Hill, 1987. ISBN: 007451914X,9780074519141.
5. J.G. Joshi, Electronic Measurement and Instrumentation, Khanna Publishing House, New Delhi(ISBN: 978-93-86173-621)

INDUSTRIAL AUTOMATION & CONTROL

Course Code	EEPE-506/B
Course Title	Industrial Automation & Control
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	EEPC307, EEPC405
Course Category	PE

Course Outcomes: -

After completion of the course student will be able to :

1.identify different types of automation systems (K-3 Level).
2.interface I/O devices with the PLC modules (K-4 Level).
3.develop PLC ladder programs for various applications (K-4 Level).
4.prepare simple SCADA applications(K-4 Level).

Course Content:-

Module- 1: Introduction to Industrial Automation

Number of class hours: 04(Four) Hrs

Suggestive Learning Outcomes: Studentswillbe ableto:

1. To be able to explain significance of automation.
2. To be able to state advantages of automation.
3. To be able to differentiate Relay based & PLC based controlsystem.

Detailed content of the unit: -

Automation: Need and benefits; Types of automation system: Fixed, Programmable, Flexible; Different systems used for Industrial automation: PLC, HMI, SCADA, DCS, Drives; Evolution of PLC.

Module- 2: PLC Fundamentals

Number of class hours: 06(six) Hrs

Suggestive Learning Outcomes: Studentswillbe ableto:

1. To be able to draw generalized block diagram of PLC.
2. To be able to draw simple block diagrams and functions of different input modules.
3. To be able to know type and use of memory.
4. To be able to compare PC and PLC.
5. To be able to develop block diagram ofPLC power supply.

Detailed content of the unit: -

Building blocks of PLC**:** CPU, Memory organization, Input- output modules (discrete and analog),Specialty I/O Modules, Power supply;Fixed and Modular PLC and their types,

Redundancy in PLC module;I/O module selection criteria; Interfacing different I/O devices with appropriate I/O modules.

Module- 3: PLC Programming basics

Number of class hours: 5(Five) Hrs

Suggestive Learning Outcomes: Studentswillbe ableto:

1. To be able to name different PLC Programming languages.
2. To be able to understand Ladderdiagram development.
3. To be able to develop the PLC ladder programs for the given situation

Detailed content of the unit: -

PLC I/O addressing;PLC programming Instructions**:** Relay type instructions, Timer instructions: On delay, off delay, retentive, Counter instructions: Up, Down, High speed, Logical instructions, Comparison Instructions, Data handling Instructions, Arithmetic instructions; PLC programming language**:** Functional Block Diagram (FBD), Instruction List. Structuredtext, Sequential Function Chart (SFC), Ladder Programming.Simple Programming examples using ladder logic**:** Language based on relay, timer counter,logical, comparison, arithmetic and data handling instructions.

Module- 4: PLC wiring diagrams and Ladder logic

Number of class hours: 08(Eight) Hrs

Suggestive Learning Outcomes: Studentswillbe ableto:

1. To be able to develop ladder diagrams for the given situations
2. To be able to prepare the relevant wiring diagram for connecting the given type of PLC
3. To be able to describe the method to troubleshoot the given PLC ladder diagram and wiring diagram.

Detailed content of the unit: -

Seal in circuits using PLC.Ladder and wiring diagram of DOL starter with OLRLatching relay using PLCBased Applications: Motor sequence control, Traffic light control, Elevator control, TankLevel control, Conveyor system, Stepper motor control, Reactor Control Gate trigger circuits– Resistance and Resistance-Capacitance circuits.

Module- 5:Supervisory Control and Data Acquisition System (SCADA)

Number of class hours:8(Eight) Hrs

Suggestive Learning Outcomes: Studentswillbe ableto:

1. To be able to identify the specific components of the given SCADA system.
2. To be able to prepare block diagram of the given architecture of SCADA.
3. To be able to understand various applications of SCADA.

Detailed content of the unit: -

Introduction to SCADA: Typical SCADA architecture/block diagram, Benefits of SCADA;
Various editors of SCADA;Interfacing SCADA system with PLC: Typical connection diagram, Object Linking & embeddingfor Process Control(OPC) architecture, Steps in Creating SCADA Screen for simple object,Steps for Linking SCADA object (defining Tags and Items) with PLC ladder program usingOPC;Applications of SCADA: Traffic light control, water distribution, pipeline control.

References: -

1. Dunning, G., Introduction to Programmable Logic Controllers, Thomson /Delmar learning, New Delhi, 2005,ISBN 13 : 9781401884260
2. Jadhav, V. R., Programmable Logic Controller, Khanna publishers, New Delhi, 2017, ISBN : 9788174092281
3. Petruzella, F.D., Programmable Logic Controllers, McGraw Hill India, New Delhi, 2010, ISBN: 9780071067386
4. Hackworth, John; Hackworth, Federic, Programmable Logic Controllers, PHI Learning, New Delhi, 2003, ISBN : 9780130607188
5. Stenerson Jon, Industrial automation and Process control, PHI Learning, New Delhi, 2003, ISBN : 9780130618900
6. Mitra, Madhuchandra; Sengupta, Samarjit, Programmable Logic Controllers and Industrial Automation - An introduction, Penram International Publication, 2015, ISBN: 9788187972174
7. Boyar, S. A., Supervisory Control and Data Acquisition, ISA Publication, USA, ISBN: 978-1936007097 Electrical Engineering Curriculum Structure
8. Bailey David ; Wright Edwin, Practical SCADA for industry, Newnes (an imprint of Elsevier), UK 2003, ISBN:0750658053

SWITCHGEAR AND PROTECTION

Course Code :	EEPE-501/C
Course Title :	SWITCHGEAR AND PROTECTION
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	NIL
Course Category	PE

Course outcomes:

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

1.Identify various types of faults in power system (K1).
2.Select suitable switchgears for different applications (K3).
3.Test the performance of different protective relays (K5).
4.Maintain protection systems of alternators and transformers (K3).
5.Maintain protection schemes for motors and transmission lines (K3).
6.Maintain protection schemes for power system against over voltages (K3).

Course contents:

Module – I Basics of Protection

Number of class hours: 6(six) Hrs
Suggested Learning Outcomes: Students would be able to understand

1 Functions of protective system.
2 Types of faults and their causes.
3 Short circuit fault calculations.

Detailed content of the unit: -

Necessity, functions of protective system.Normal and abnormal conditions.Types of faults and their causes.Protection zones and backup protectionShort circuit fault calculations in lines fed by generators through transformers. Need of current limiting reactors and their arrangements.

Module – II Circuit Interruption Devices

Number of class hours: 8 (Eight) Hrs
Suggested Learning Outcomes: Students would be able to understand
1 Arc formation process.
2 HT circuit breakers
3 LT circuit breakers

Detailed content of the unit: -

Isolators- Vertical break, Horizontal break and Pantograph type.HRC fuses – Construction, working, characteristics and applications.Arc formation process, methods of arc extinction (High resistance and Low resistance), Arcvoltage, Recovery voltage, Re-striking voltage, RRRV.HT circuit breakers (Sulphur-hexa Fluoride (SF6), Vacuum circuit breaker) - Working, construction,specifications and applications.L.T. circuit breaker (Air circuit breakers (ACB), Miniature circuit breakers (MCB), Moulded case circuit breakers (MCCB) and Earth leakage circuit breaker (ELCB)) - Working and applications.Selection of LT and HT circuit breakers (ratings), Selection of MCCB for motors.Gas insulated switchgear.

Module– III Protective Relays

Number of class hours: 8 (Eight) Hrs
Suggested Learning Outcomes: Students would be able to

1 Understand Aggregated Basic relay terminology.
2 Understand the concept of Protective relays.

Detailed content of the unit: -

Fundamental quality requirements: Selectivity, Speed, Sensitivity, Reliability, Simplicity,Economy.Basic relay terminology- Protective relay, Relay time, Pick up, Reset current, current setting, Plug setting multiplier, Time setting multiplier.Protective relays: Classification, principle of working, construction and operation of – Electromagnetic (Attracted armature type, Solenoid type, Watt-hour meter type) relay, Thermal relay. Block diagram and working of Static relay.Over current relay-Time current characteristics.Microprocessor based over current relays: Block diagram, working.
Distance relaying- Principle, operation of Definite distance relays.Directional relay: Need and operation. Operation of current and voltage differential relay.

Module– IV Protection of Alternator and Transformer

Number of class hours: 6 (Six) Hrs
Suggested Learning Outcomes: Students would be able to understand

1 Protection of Alternator
2 Protection of Transformer

Detailed content of the unit: -

Alternator Protection: Faults, Differential protection Over current, earth fault, overheating and field failure, protection.Reverse power protection.

Transformer Protection: Faults, Differential, over current, earth fault, over heating protection, Limitations of differential protection.Buchholz relay: Construction, operation, merits and demerits.

Module– V Protection of Motors, Bus-bar and Transmission Line

Number of class hours: 6 (Six) Hrs

Suggested Learning Outcomes: Students would be able to understand

1 Different types of protection of Motor.
2 Different types of protection of Busbar and Transmission line

Detailed content of the unit: -

Motor: Faults. Short circuit protection, Overload protection, Single phase preventer**.**

Bus bar and Transmission line: Faults on Bus bar and Transmission Lines.Bus bar protection: Differential and Fault bus protection.Transmission line: Over current, Distance and Pilot wire protection.

References:

1. Mehta V. K ;Rohit Mehta, Principles of Power System, S .Chand and Co., NewDelhi., ISBN: 978-81-2192-496-2.
2. Rao.Sunil S., Switchgear and Protection, Khanna Publishers, New Delhi, ISBN: 978-81-7409-232-3.
3. Singh, R. P., Switchgear and Power System Protection, PHI Learning, New Delhi,ISBN: 978-81-203-3660-5.
4. Gupta. J. B.. Switchgear and Protection, S. K. Kataria and Sons, New Delhi, ISBN: 978-93-5014-372-8.
5. Veerapan, N.,Krishnamurty, S. R., Switchgear and Protection, S .Chand and Co., New Delhi. ISBN: 978-81-2193-212-7.
6. Ram, Badri; Vishwakarma D. N., Power System Protection and Switchgear, McGraw-Hill, New Delhi. ISBN : 978-07-107774-X

Industrial Instrumentation and Condition Monitoring Laboratory

Course Code	:EEPE507/A
Course Title	: Industrial Instrumentation and Condition Monitoring Laboratory
Number of Credits	: 1(L: 0, T: 0, P: 2)
Prerequisites	:NIL
Course Category	: PE

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:

CO-1 Select relevant instruments used for measuring electrical and non-electrical quantities.

CO-2 Select relevant transducers/sensors for various applications.

CO-3 Use relevant instruments for measuring non-electrical quantities.

CO-4 Check the signal conditioning and telemetry system for their proper functioning.

CO-5 Use data acquisition systems in various applications.

CO-6 Undertake condition monitoring for diagnostic analysis of electrical equipment

Practicals:-

1. Identify different switches used in instrumentation system.
2. Measure linear displacement by L.V.D.T.
3. Measure the strain with the help of strain gauge
4. Measure temperature by PT-100, thermistor, thermocouple along with simple resistance bridge.
5. Use Thermocouple to control the temperature of a furnace/machine.8. Measure the flow using flow meter.
6. Measure pressure using pressure sensor kit.
7. Measure angular speed using stroboscope and tachometer.
8. Measure the flow using flow meter.
9. Use op-amp as inverter, non-inverting mode, adder, differentiator and integrator.
10. Convert digital data into analog data by using analog to digital converters and analog data

into digital data by digital to analog converter.

11. Visit to testing center of electrical testing lab for tan delta and diagnostic tests and determine

polarization index

12. Prepare a Report on various tools and equipment used for condition monitoring of electrical

Machines.

Industrial Automation & Control Laboratory

Course Code	EEPE-507/B
Course Title	Industrial Automation & Control Laboratory
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	EEPC308, EEPC406
Course Category	PE

Course Outcomes: -

After completing the course student will be able to:-

CO-1 identify different types of automation systems (K-3 Level).

CO-2 interface I/O devices with the PLC modules (K-4 Level).

CO-3 develop PLC ladder programs for various applications (K-4 Level).

CO-4 prepare simple SCADA applications(K-4 Level).

Course Content:-

Practicals:

1. Identify various automation systems available in different appliances/ devices/ machines in day to day use. (*)
2. Identify various parts of the given PLC and front panel status indicators.(*)
3. Use PLC to test the START STOP logic using two inputs and one output.(*)
4. Develop/Execute a ladder program for the given application using following: - timer, counter, comparison, logical, arithmetic instructions.
5. Use PLC to control the following devices like lamp, motor, push button switches, proximity sensor.(*)
6. Measure the temperature of the given liquid using RTD or Thermocouple and PLC.
7. Develop/test ladder program to blink the LED/lamp.(*)
8. Develop / test the Ladder program for sequential control application of lamps/ DC motors.
9. Develop ladder program for Traffic light control system.(*)
10. Develop /test ladder program for Automated car parking system.
11. Develop / test ladder program for Automated elevator control.
12. Develop / test ladder program for rotating stepper motor in forward and reverse direction at constant speed.
13. Develop /test ladder program for tank water level control.
14. Develop / test ladder program for control of speed of stepper motor with suitable drivers.
15. Use various functions of SCADA simulation editors to develop simple project.
16. Develop a SCADA mimic diagram for Tank level control.
17. Develop SCADA mimic diagram for Flow control in a given system.
18. Simulate Tank level control using available SCADA system.

Note:

A minimum of 10(ten) or more practical need to be performed, out of which the practicals marked as '*' are compulsory.

List of Equipments/Instruments required:

Sl. No.	Equipment name with broad specifications	Practical No.
1.	Control components: Push bottons(5 Nos), indicating lamps (5 Nos), float switch(2 Nos)	2-14
2.	Three phase AC contactors (2 Nos)	2-14
3.	PLC with minimum 8 I/O and HMI and its simulation/ programming software.(1 Nos)	2-14
4.	Stepper motor drive module	12
5.	Traffic light simulation practical module	9
6.	Temperature control system	6
7.	Elevator Control Module for PLC	11

SWITCHGEAR AND PROTECTION LABORATORY

Course Code :	EEPC-507/C
Course Title :	SWITCHGEAR AND PROTECTION LABORATORY
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	NIL
Course Category	PE

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 switchgear and protection schemes used in electrical power systems.

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 various types of faults in power system (K1).
b) Select suitable switchgears for different applications (K3).
c) Test the performance of different protective relays (K4).
d) Maintain protection systems of alternators and transformers (K3)
e) Maintain protection schemes for motors and transmission lines (K3).
f) Maintain protection schemes for power system against over voltages (K3).

Practicals:

1. Identify various switchgears in the laboratory and write their specifications.
2. Test HRC fuse by performing the load test.
3. Test MCB by performing the load test
4. Dismantle MCCB/ELCB and identify various parts.
5. Dismantle ACB/VCB and identify different parts.
6. Set the plug and time (with PSM, TSM) of induction type electromagnetic relay.
7. Test electromagnetic over-current relay by performing load test.
8. Simulate differential protection scheme for transformer with power system simulation kit.
9. Test the working of the single phasing preventer using a three phase induction motor.
10. Simulate transmission line protection by using the impedance relay/over current relay for various faults. (On transmission line protection simulation Kit).
11. Dismantle Thyrite type arrester and identify different parts.
12. Perform neutral earthing at different substations / locations.

Summer Internship-II

Course Code	EESI-509
Course Title	Summer Internship-II
Number of Credits	3 (L: 0, T: 0, P: 0)
Prerequisites	Fundamental and basic practical skills of relevant discipline/programme
Course Category	Internship

Internships may be full-time or part-time; they are full-time in the summer vacation and part-time during the academic session.

Sl. no.	Schedule	Duration	Activities	Credits	Hours of Work
1	Summer Vacation after 4th Semester	6 Weeks	Industrial/Govt./NGO/MSME/ Rural Internship/Innovation / Entrepreneurship ##	3	120 Hours

(##During the summer vacation after 4th Semester, students are ready for industrial experience. Therefore, they may choose to undergo Internship /Innovation /Entrepreneurship related activities. Students may choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry/ NGO's/ Government organizations/ Micro/ Small/ Medium enterprises to make themselves ready for the industry. In case a student want to pursue his/her family business and don't want to undergo internship, a declaration by a parent may be submitted directly to the TPO.)

Course Outcome: -

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

C.O.1: **Describe a better understanding of the engineering / technological workplace**(K2).

C.O.2: **Develop and demonstrate workplace competencies necessary for professional and academic success (K2).**

C.O.3: **Classify career preferences and professional goals (K3).**

C.O.4: Develop preliminary portfolio including work samples from the internship (K2).

C.O.5: **Increase competitiveness for full-time engineering employment / start-up** (K3).

Course Content:-

Internships are educational and career development opportunities, providing practical experience in a field or discipline. The Summer Internship-II is a student centric activity that would expose Technical students to the industrial environment, which cannot be simulated in the classroom and hence creating competent professionals for the industry. They are structured, short-term, supervised placements often focused around particular tasks or projects with defined timescales. An internship may be compensated, non-compensated or some time may be paid. The internship has to be meaningful and mutually beneficial to the

intern and the organization. It is important that the objectives and the activities of the internship program are clearly defined and understood. Following are the intended objectives of internship training:

1. Will expose Technical students to the industrial environment, which cannot be simulated in the classroom and hence creating competent professionals for the industry.
2. Provide possible opportunities to learn, understand and sharpen the real time technical / managerial skills required at the job.
3. Exposure to the current technological developments relevant to the subject area of training.
4. Experience gained from the 'Industrial Internship' in classroom will be used in classroom discussions.
5. Create conditions conducive to quest for knowledge and its applicability on the job.
6. Learn to apply the Technical knowledge in real industrial situations.
7. Gain experience in writing Technical reports/projects.
8. Expose students to the engineer's responsibilities and ethics.
9. Familiarize with various materials, processes, products and their applications along with relevant aspects of quality control.
10. Promote academic, professional and/or personal development.
11. Expose the students to future employers.
12. Understand the social, economic and administrative considerations that influence the working environment of industrial organizations
13. Understand the psychology of the workers and their habits, attitudes and approach to problem solving.

Overall compilation of Internship Activities / Credit Framework:

Major Head of Activity	**Credit**	**Schedule**	**Total Duration**	**Sub Activity Head**	**Proposed Document as Evidence**	**Evaluated by**	**Performance appraisal/ Maximum points/ activity**
Innovation / IPR / Entrepreneurship	3	Summer Vacation after 4th Semester	6 Weeks	Participation in innovation related completions for eg. Hackathons etc.	Certificate	Faculty Mentor	Satisfactory/ Good/ Excellent
				Development of new product/ Business Plan/ registration of start-up	Certificate	Programme Head	Satisfactory/ Good/ Excellent
				Participation in all the activities of Institute's Innovation Council for eg: IPR workshop/ Leadership Talks/ Idea/ Design/ Innovation/ Business	Certificate	President/ Convener of ICC	Satisfactory/ Good/ Excellent

				Completion/ Technical Expos etc.			
				Work experience at family business	Declaration by Parent	TPO	Satisfactory/ Good/ Excellent
Internship	3	Summer Vacation after 4th Semester	6 Weeks	(Internship with Industry/ Govt. / NGO/ PSU/ Any Micro/ Small/ Medium enterprise/ Online Internship	Evaluating Report	Faculty Mentor/ TPO/ Industry supervisor	Satisfactory/ Good/ Excellent
Rural Internship	3	Summer Vacation after 4th Semester	6 Weeks	Long Term goals under rural Internship	Evaluating Report	Faculty Mentor/ TPO/ NSS/ NCC head	Satisfactory/ Good/ Excellent

STUDENT'S DIARY/ DAILY LOG

The main purpose of writing daily diary is to cultivate the habit of documenting and to encourage the students to search for details. It develops the students' thought process and reasoning abilities. The students should record in the daily training diary the day-to-day account of the observations, impressions, information gathered and suggestions given, if any. It should contain the sketches & drawings related to the observations made by the students.

The daily training diary should be signed at the end of each day by the supervisor/ in charge of the section where the student has been working. The diary should also be shown to the Faculty Mentor visiting the industry from time to time and get ratified on the day of his visit.

Student's Diary and Internship Report should be submitted by the students along with attendance record and an evaluation sheet duly signed and stamped by the industry to the Institute immediately after the completion of the training. It will be evaluated on the basis of the following criteria:

a) Regularity in maintenance of the diary.
b) Adequacy & quality of information recorded.
c) Drawings, sketches and data recorded.
d) Thought process and recording techniques used.
e) Organization of the information.

INTERNSHIP REPORT

After completion of Internship, the student should prepare a comprehensive report to indicate what he has observed and learnt in the training period. The student may contact Industrial Supervisor/ Faculty Mentor/TPO for assigning special topics and problems and should prepare the final report on the assigned topics. Daily diary will also help to a great extent in writing the industrial report since much of the information has already been incorporated by the student into the daily diary. The training report should be signed by the Internship Supervisor, TPO and Faculty Mentor. The Internship report will be evaluated on the basis of following criteria:

a) Originality.
b) Adequacy and purposeful write-up.
c) Organization, format, drawings, sketches, style, language etc.
d) Variety and relevance of learning experience.
e) Practical applications, relationships with basic theory and concepts taught in the course.

Major Project - I

Course Code	CEPR-510
Course Title	Minor Project
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	Nil
Course Category	Project Work (PR)

Course Outcome:-

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

C.O. 1: Demonstrate a sound technical knowledge of their selected project topic and the knowledge, skills and attitudes of a professional engineer (K2).

C.O. 2: Develop the skill of working in a Team (K3).

C.O. 3: Design engineering solutions to complex problems utilising a systems approach (K6).

C.O. 4: Design the solution of an engineering project involving latest tools and techniques (K6).

C.O. 5: Develop the skill of effective communication with engineers and the community at large in written an oral forms. (K3)

Course Content:-

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

1) Develop sound knowledge about the domain of the project work.
2) Perform detailed study about various components of a project.
3) Learn to be an important member of a team for successful execution of a project work.
4) Study about methodologies and professional way of documentation and communication related to project work.
5) Develop idea about problem formulation, finding the solution of a complex engineering problem.
6) Develop project report as per the suggested format to communicate the findings of the project work.
7) Acquire the skill of effective oral communication to the fellow engineers and people in the society at large.

8) Knowledge of how to organize, scope, plan, do and act within a project thesis.
9) Familiarity with specific tools (i.e. hardware equipment and software) relevant to the project selected.
10) Demonstrate the implementation of a major project work.

SEMESTER-VI

Sl. No.	Category	Code No.	Course Title	Hours per week			Total Contact Hrs/Week	Credit
				L	T	P		
1	Programme core course-21	EEPC-601	Building Electrification	3	0	0	3	3
2	Programme core course-22	EEPC-602	Building Electrification Laboratory	0	0	2	2	2
3	Programme elective course-4 (Any One to be selected)	EEPE-603/A	Communication Technologies	3	0	0	3	3
		EEPE-603/B	Electric Vehicles					
		EEPE-603/C	Industrial Drives					
4	Humanities and Social Science course-5	HS-604	Entrepreneurship and Start-up's	3	1	0	4	4
5	Open elective-2	(Any one to be selected from Annexure-II)		4	0	0	4	4
6	Mandatory Course-2	AU-606	Indian Constitution	2	0	0	2	0
7	Major Project	EEPR-607	Major Project	0	0	6	6	3
8	Seminar	EESE-608	Seminar	2	0	0	2	1
Total				**17**	**1**	**8**	**26**	**20**

Building Electrification

Course Code	EEPC-601
Course Title	Building Electrification
Number of Credits	3 (L: 3, T: 0, P:0)
Prerequisites	NIL
Course Category	PC

Course Outcomes:-

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

1) Select accessories, wires, cables and wiring systems for electrification..(K-3 level)
2) Design electrical wiring installation system for residential unit.(K-4 level)
3) Design proper illumination scheme for residential unit.(K-4 level)
4) Prepare wiring layouts on wiring board.(K-3 level)
5) Locate and diagnose faults in electrical wiring installation(K-3 and 4 level).
6) Do proper earthing for building electrification(K-3 level).

Course Contents:-

Module- 1: Wiring Tools and Accessories

Number of class hours: 06(Six) Hrs

Suggestive Learning Outcomes: Students will be able to:

1. to define and discuss the classification of electrical accessories.
2. To describe and demonstrate the different types of switch, holders, socket outlets and plugs and other modular accessories.

Detailed content of the unit:-

Various tools required for wiring- screwdrivers, pliers, Try square, saws, hacksaw, chisel, hammers, mallet, rawl punch, hand drill machine, portable drilling machine, files, plumb bob, line thread, electricians knife, test lamp, tester and their BIS specifications, application, care & maintenance of tools.

Classification of electrical accessories- controlling, holding, safety, outlet

BIS symbols of following electrical accessories.

Switch – Their types according to construction such as surface switch, flush switch, and pull switch, rotary switch, knife switch, pendent switch, Main-switch (ICDP, ICTP). Their types according to working such as single pole, double pole, two-way, two-way centre off, intermediate, series parallel switch

Holders- Their types such as bayonet cap lamp holder, pendent holder, batten lamp holder, angle holder, bracket holder, tube light holder, screw type Edison and goliath Edison lamp holder, swivel lamp holder.

Socket outlets and plugs- two pin, three-pin, multi pin sockets, two-pin and three-pin plug.

Others- Iron connector, adaptor, and ceiling rose, distribution box, neutral link, bus-barchamber.Wooden/ mica boards, Moulded/ MS Concealed boxes of different sizes. Modular accessories.

Module- 2: Electrical Wires and Underground Cables

Number of class hours: 06(Six) Hrs

Suggestive Learning Outcomes: Students will be able to:

1. to define and discuss the classification of conductors and cables.
2. to describe and demonstrate the wire jointing methods,cable jointing and laying methods.
3. To discuss the classification of cables.
4. To demonstrate the factors determining selection of electric cables.

Detailed content of the unit:-

Conductors: - wire, cable, bus bar, stranded conductor, cable, armouredcable, flexible cable, solid conductor, PVC wires, CTS wire, LC wire, FR (Fire retardant) wire, Size of wire according to BIS. Tools used for measurement of wire size, Wire jointing methods.

Classification of cables, low tension, high tension, and extra high tension cables, solid, oil filled and gas filled type

Cable insulation materials –vulcanized rubber (VIR), polyvinyl chloride (PVC), cross linked polythene (XLPE), impregnated paper, Selection of suitable cable size and type from standard data

Cable jointing methods, Cable laying methods.

Factors determining selection of electric cables.

Module- 3: Wiring Methods and wiring layout

Number of class hours: 06(Six) Hrs

Suggestive Learning Outcomes: Students will be able to:

1. describe and demonstrate the Conduit wiring
2. Define the factors determining the selection of wiring methods.
3. Design, working and drawing of various electrical circuits.

Detailed content of the unit:-

Factors determining the selection of wiring methods.Classification of wiring methods.PVC casing-capping wiring- wiring rules according to IS: 732-1983.

Conduit wiring- Types of conduit, comparison between Metal and PVC conduit, types of con- duit wiring (Surface/Concealed). Conduit wiring accessories, BIS rules for Metal and PVC conduit wiring.Comparison of various wiring systems. General BIS rules for domestic installations.

Design, working and drawing of following electrical circuits: Simple light and fan circuits, Stair case wiring, Go-down wiring circuit, Bedroom lighting circuit, Corridor lighting circuit, Series parallel circuit, Master switch control circuit, Different lighting circuit using - Intermediate switch, Call bell circuit using bell indicator, Design of wiring circuits according to user's requirement

Module- 4: Residential Building Electrification

Number of class hours: 08(Eight) Hrs

Suggestive Learning Outcomes: Students will be able to:

1. describe and demonstrate the Interpretation of electrical installation plan and electrical diagrams, electrical symbols as per IS: 732. Electrical installation for residential building as per part I section 9 of NEC-2011. Wiring and circuit Schematic diagram according to IS: 2042(Part-I)-1962: multiline and single line representationDefine specifications of Three Phase Transformers.
2. describe and discuss the Difference between residential and industrial load.
3. Design and draw, estimatethe costing of a residential installation having maximum 5 KW load.
4. Test wiring installation as per IS: 732-1982, test earth continuity path.

Detailed content of the unit:-

Domestic Dwellings/Residential Buildings: reading of Civil Engineering building drawing, Interpretation of electrical installation plan and electrical diagrams, electrical symbols as per IS: 732.Electrical installation for residential building as per part I section 9 of NEC-2011. Wiring and circuit Schematic diagram according to IS: 2042(Part-I)-1962: multiline and single line representation.

Difference between residential and industrial load, rules/requirements related to lighting load followed in electrical installations, Positioning of equipment.

Lighting and power circuits: Light and fan circuit, Power circuit

Load assessment: Selection of size of conductor, Selection of rating of main switch and protective switch gear.

Design and drawing, estimation and costing of a residential installation having maximum 5 KW load; Sequence to be followed for preparing estimate; Calculation of length of wire and other materials, labour cost

Testing of wiring installation as per IS: 732-1982: Insulation resistance - between earth and conductors, between conductors, polarity test of single pole switches. Testing of earth continuity path.

Residential building Service Connectiontypes- Underground and overhead. Calculation of Material required for service connection.

Module- 5: Protection of Electrical Installation

Number of class hours: 06(Six) Hrs

Suggestive Learning Outcomes: Students will be able to:

1. describe and demonstrate the Fuse, Miniature circuit Breaker (MCB).
2. Discuss the Methods of earthing as per IS 3043: 1987 and their procedure- Driven pipe, pipe and plate earthing, modern methods of earthing.

Detailed content of the unit:-

Fuse in electric circuit: fuse element, fuse current rating, minimum fusing current, cut-off current, fusing factor, Fuse material. Types of fuses –Re-wirable, cartridge fuses (HRC and LRC), Fuse material Selection of fuse.

Miniature circuit Breaker (MCB)-Construction, Principle rating and uses, Earth Leakage Circuit Breaker (ELCB)-Construction, Principle rating and uses.

System and equipment earthing and its requirements, Earth, earth electrode, earth current, earth terminal, earthing wire, earthing lead, fault current, leakage current, Measurement of earth resistance using earth tester, Methods of reducing earth resistance,Methods of earthing as per IS 3043: 1987 and their procedure- Driven pipe, pipe and plate earthing, modern methods of earthing.

References:-

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2. Allagappan,N. S.Ekambarram, Electrical Estimating and Costing, New Delhi, ISBN-13: 9780074624784
3. Singh, Surjit, Electrical Estimating and Costing, Dhanpat Rai and Co. New Delhi, ISBN: 1234567150995
4. Gupta, J B: A Course in Electrical Installation Estimating and Costing, S K Kataria and Sons,New Delhi, ISBN:978-93-5014-279-0

5. Bureau of Indian Standard, IS: 732-1989, Code of practice for electrical wiring installation
6. Bureau of Indian Standard, SP 30 National Electrical Code 2010
7. Bureau of Indian Standard, SP 72 National Lighting Codes 2010
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Building Electrification Laboratory

Course Code	EEPC-602
Course Title	Building ElectrificationLaboratory
Number of Credits	1 (L:0, T:0, P:2)
Prerequisites	NIL
Course Category	PC

Course Outcomes:-

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

1) Select accessories, wires, cables and wiring systems for electrification..(K-3 level)
2) Design electrical wiring installation system for residential unit.(K-4 level)
3) Design proper illumination scheme for residential unit.(K-4 level)
4) Prepare wiring installation on a board.(K-3 level)
5) Design 2 BHK residential installation scheme (K-4 level).
6) Do proper earthing for building electrification(K-3 level).

Course Content:-

Practicals:

1. Prepare series testing board.
2. Select the electric wire using measuring and testing instruments for particular applications.
3. Identify cables of different current ratings.
4. Prepare wiring installation on a board showing control of one lamp, one fan and one socket from one switch board in PVC surface conduit wiring system.
5. Prepare wiring installation on a board.
6. Control one lamp from two different places using PVC surface conduit wiring system.
7. Prepare wiring installation on a board. Control one lamp from three different places using PVC surface conduit wiring system.
8. Prepare wiring installation on a board.
9. Perform go-down wiring for three blocks using PVC casing capping.
10. Design 2 BHK residential installation scheme and estimate the material required. And draw the details required for installation on A4 size sheet.
11. Test wiring installation using megger.

Note: A minimum of 10(ten) or more practical need to be performed.

Communication Technologies

Course Code	EEPE-603/A
Course Title	Communication Technologies
Number of Credits	3 (L:3, T:0, P:0)
Prerequisites	Nil
Course Category	ProgramElective (PE)

Course objectives: After completing the course, the students will be able to-

CO1: Demonstrate the processes of analog and pulse modulation (K2)
CO2: Identify the advantages of digital modulation over analog modulation (K3)
CO3: Identify guided and unguided media for data communication (K3)
CO4: Demonstrate the basic principles of fiber optic communication(K2)
CO5: Distinguish network topologies and networking devices(K4)

Module 1: (8hrs): Data Communication and Modulation

Learning Outcomes:-
Students will be able to
1) Demonstrate the types of communication system.
2) Illustrate the analog communication systems (AM, FM and PM).
3) Compare pulse modulation with AM and FM.

Detailed content of the unit:-

Block diagram of communication system. Types of communication system: synchronous and asynchronous, simplex, half-duplex, Fullduplex, 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, workingprinciple, advantages, disadvantages and applications.Advantages of pulse modulation over AM and FM.

Module 2: (8hrs)Digital Modulation Techniques:

Learning Outcomes:-

Students will be able to

1) Demonstrate the sampling process.
2) Illustrate PCM with working principle, advantages and applications.
3) Summarize the principle of ASK, PSK and FSK.

Detailed content of the unit:-
Digital Communication: Block diagram and working principle, waveforms, strength and limitations. Sampling process Nyquist sampling theorem, quantization process, quantization error, quantizationNoisePCM: Block diagram, working principle, waveforms, advantages, disadvantages, applicationof PCM.Principle of ASK, PSK, FSK. Application of ASK, PSK, FSK.

Module 3: (8 hrs): Data Communication Media

Learning Outcomes:-
Students will be able to
1) Explain the terms like baud rate, bit rate, forward error correction techniques.
2) Identify the types of communication media and frequency band of operation.
3) Select appropriate guided and unguided media for data communication.

Detailed content of the unit:-
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.

Module 4: (8hrs)Fiber Optics

Learning Outcomes:-
Students will be able to
1) Demonstrate the basic principles of fiber optic communication.
2) Compare single mode fiber with multimode fiber.
3) Illustrate the application of LED, Photo Transistor, Laser diode, optocoupler as Light source and Detector.

Detailed content of the unit:-

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. Fibre optic cables: cable construction, fibre optics cable modes, single mode, step index fibre,multimode index fibre, multimode graded index fibre, fibre cable losses.Light source and Detector: Light emitting diode (LED), Photo Transistor, Laser diode, optocoupler.

Module 5: (8hrs)Data Communication Protocols and Interfacing Standard

Learning Outcomes:-

Students will be able to

1) Explain OSI reference model.
2) Illustrate IEEE standards for LAN, GPIB and RS-232.
3) Identifybasic networking devices.

Detailed content of the unit:-

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

References:

1 Wayne Tomasi, Electronic Communication System, Prentice Hall of India, ISBN13:9780130494924
2 Reynders D., Steve Macky, Wright Edvin, Practical Industrial Data Communications, Newnespublication, ISBN 10:07506639523
3 George F. Kennedy, Barnard Davis, Electronic Communication System, Tata McGraw Hill,, ISBN13:9780074636824
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, Dreamtechpress, 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, ISBN13:978818114160
8 A. Kumar,D. Manjunath, Joy Kuri, Communication Networking, Academic Press PublicationISBN 13:9780124287518
9 Hemant Kumar Garg, Soni Manish, Electronic Communication & Data Communication, UniversityBook House 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
12 Keiser, Gerd, Optical communications essentials, McGraw- Hill, New Delhi-2003,ISBN13:9780071412049

ELECTRIC VEHICLES

Course Code :	EEPE-603/B
Course Title :	ELECTRIC VEHICLES
Number of Credits	3 (L:3, T:0, P:0)
Prerequisites	NIL
Course Category	PE

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 below mentioned competency:

a) Interpret the salient features of Hybrid electric vehicles.
b) Interpret the Dynamics of hybrid and Electric vehicles
c) Maintain the DC-DC converters in EV applications
d) Maintain the DC-AC converters in EV applications

Course Contents:

Module – I(Salient features of Hybrid electric vehicles.)

Number of Class hours: 8 hours

Suggestive Learning Outcome: Students would be able to

1. Know Evolution of Electric vehicles
2. Get Knowledge on Components used Hybrid Electric Vehicle
3. Know Comparative study of vehicles for economic, environmental aspects

Detailed content of the unit:-

Introduction to Hybrid Electric Vehicles, Evolution of Electric vehicles, Advanced Electric drive vehicle technology Vehicles-Electric vehicles (EV), Hybrid Electric drive (HEV), Plug in Electric vehicle (PIEV), Components used Hybrid Electric Vehicle Economic and environmental impacts of Electric hybrid vehicle Parameters affecting Environmental and economic analysis, Comparative study of vehicles for economic, environmental aspects

Module – II (Dynamics of hybrid and Electric vehicles)

Number of Class hours: 8 hours

Suggestive Learning Outcome: Students would be able to Know

1. General description of vehicle movement
2. Factors affecting vehicle motion
3. Basic architecture of hybrid drive trains

Detailed content of the unit:-

Dynamics of hybrid and Electric vehicles ,General description of vehicle movement, Factors affecting vehicle motion- Vehicle resistance, tyre ground adhesion, rolling resistance, aerodynamic drag, equation of grading resistance, dynamic equation Drive train configuration, Automobile power train, classification of vehicle power plant Performance characteristics of IC engine, electric motor, need of gear box Classification of motors used in Electric vehicles Basic architecture of hybrid drive trains, types of HEVs Energy saving potential of hybrid drive trains HEV Configurations-Series, parallel, Series-parallel, complex.

Module – III (Various types of Converters for EV and HEV Applications)

Number of Class hours: 8 hours

Suggestive Learning Outcome: Students would be able to Know

1. DC-DC Converters for EV and HEV applications
2. Boost and Buck- Boost converters
3. Two quadrant and multi quadrant converters

Detailed content of the unit:-

DC-DC Converters for EV and HEV Applications,EV and HEV configuration based on power converters, Classification of converters –unidirectional and bidirectional, Principle of step down operation, Boost and Buck- Boost converters Principle of Step-Up operation Two quadrant converters; multi quadrant converters

Module – IV (Various types of DC-AC Inverter and Electric Machines used in EVs and HEVs)

Number of Class hours: 8 hours

Suggestive Learning Outcome: Students would be able to know

1. Principle of operation of half bridge DC-AC inverter (R load, R-L load)
2. Single phase Bridge DC-AC inverter with R load, R-L load
3. Electric Machines used in EVs and HEVs

Detailed content of the unit:-

DC-AC Inverter & Motors for EV and HEVs, DC-AC Converters ,Principle of operation of half bridge DC-AC inverter (R load, R-L load), Single phase Bridge DC-AC inverter with R load, R-L

load, Electric Machines used in EVs and HEVs, principle of operation, working & control Permanent magnet motors, their drives, switched reluctance motor Characteristics and applications of above motors

Module – V(Batteries,Fuel cells and Super Capacitors andControl system for EVs and HEVs)

Number of Class hours: 8 hours

Suggestive Learning Outcome: Students would be able to Know

1. Overview of batteries.
2. Fuel cells, super capacitors
3. Control system for EVs and HEVs

Detailed content of the unit:-

Batteries ,Overview of batteries ,Battery Parameters, types of batteries Battery Charging, alternative novel energy sources-solar photovoltaic cells, fuel cells, super capacitors, flywheels Control system for EVs and HEVs, overview, Electronic control unit ECU Schematics of hybrid drive train, control architecture,Regenerative braking in EVs .

References:

1 A.K. Babu, Electric & Hybrid Vehicles, Khanna Publishing House, New Delhi (Ed. 2018)
2 Fuhs, A. E. Hybrid Vehicles and the Future of Personal Transportation, CRC Press,
3 Gianfranco, Electric and Hybrid Vehicles: Power Sources, Models, Sustainability, Infrastructure And The Market, Pistoia Consultant, Rome, Italy,
4 Ehsani, M. Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press
5 Husain, I. Electric and Hybrid Electric Vehicles, CRC Press 6. Chan C. C. and K. T. Chau, Modern Electric Vehicle Technology, Oxford Science Publication,
6 Lechner G. and H. Naunheimer, Automotive Transmissions: Fundamentals, Selection,Design and Application, Springer
7 Rashid, M. H. Power Electronics: Circuits, Devices and Applications, 3rd edition, Pearson,
8 Moorthi, V. R. Power Electronics: Devices, Circuits and Industrial Applications, Oxford University Press
9 Krishnan, R. Electric motor drives: modelling, analysis, and control, Prentice Hall 11. Krause, O. P. ; C. Wasynczuk, S. D. Sudhoff, Analysis of electric machinery, IEEE Press .

INDUSTRIAL DRIVES

Course Code	EEPE-603/C
Course Title	Industrial Drives
Number of Credits	3 (L:3, T:0, P:0)
Prerequisites	EEPC307, EEPC405
Course Category	PE

Course Outcomes: -

After completing the course student will be ableto:-

1 Identify the relevant electric drive for the required speed torque characteristics(K-3 Level).
2 Describe the functioning of DC drive using converters (K-3 level).
3 Explain the functioning of DC drive using choppers (K-3 level).
4 Describe the functioning of AC drives (K-3 level).
5 Explain the microcontroller-based systems for motor control (K-3 level).

Course Content:-

Module- 1:Basics of Electric Drives

Number of class hours: 04(Four) Hrs

Suggestive Learning Outcomes:

1 To be able to describe the block diagram of the given type of electric drive.
2 To be able to state the selection criteria for the given types of electric drives.
3 To be able to determine the power rating for the given load curve by equivalent current, torque and power methods.
4 To be able to select the relevant motor on the basis of given duty cycles with justification.
5 To be able describe with sketches the characteristics of the given type of motor(s).
6 To be able to describe the procedure to maintain the given type of electric motor.

Detailed content of the unit: -

Need of Electric Drives, Functional Block diagrams of an electric drives, Types and Choice of electric drives, Parts of the electrical drive-source, power modulator, electric motor and control unit.Motor Duty class: Classification- continuous, short time, intermittent period.Motor power rating for continuous, short time and intermittent duty, equivalent torque current, and power

method for fluctuating and intermittent loads (simple numerical).Speed-torque characteristics of DC motor, Braking of DC motorSpeed-torque characteristics of AC motor, Braking of AC motor.

Module- 2: DC Drive using converters

Number of class hours: 07(seven) Hrs

Suggestive Learning Outcomes:

1 To be able to explain with sketches the operation of the given type of single-phase SCR converter.
2 To be able to explain with sketches the operation of the given type of three-phase SCR converter.
3 To be able to give the effect of power factor variation in the given type of SCR motor drive.
4 To be able to describe the procedure to maintain the given type of DC drive using converter.

Detailed content of the unit: -

Single phase SCR Drives
- a)Half wave converter
- b) Full wave converter
- c) Semi converter
- d) Dual converter

Three Phase SCR Drives
- a) Half wave converter
- b) Full wave converter
- c) Semi converter
- d) Dual converter

Reversible SCR Drives. Speed control method of DC series motor

Module- 3: DC Drives using choppers.

Number of class hours: 07(seven) Hrs

Suggestive Learning Outcomes:

1 To be able toexplain with sketches the operation of the given type of chopper circuit using SCR.
2 To be able to explain with sketches the operation of the given type of single-quadrant chopper drive with quadrant diagram.
3 To be able to explain with sketches the operation of the given type of two-quadrant chopper drive with quadrant diagram.
4 To be able to explain with sketches the operation of chopper controlled DC drive in solar and battery powered vehicles.
5 To be able to describe the procedure to maintain the given type of DC drive using chopper.

Detailed content of the unit: -

Basic chopper circuit using SCR. Classification based on output voltage and quadrant operation. Chopper Controlled DC Drives

a) Class A chopper drive.
b) Class B chopper drive.
c) Class C chopper drive.
d) Class D chopper drive.
e) Class E chopper drive.

Application of chopper control drive in Solar and battery powered vehiclesMaintenance procedure.

Module- 4: AC Drives

Number of class hours:07(seven) Hrs

Suggestive Learning Outcomes:

1 To be able toexplain with sketches the operation of three phase induction motor using the given type of control method.
2 To be able toexplain with sketches the operation of three phases induction motor using the given type of slip power recovery system.
3 To be able todescribe with sketches the working of the given type of solar powered pump drives.
4 To be able to describe the procedure to maintain the given type of AC drive.

Detailed content of the unit: -

- Stator voltage control
- Variable Frequency Control
- Voltage Source Inverter Control
- Current Source Inverter Control
- Rotor Resistance Control
- Slip Power Recovery
- Solar powered pump drives
- Maintenance procedure for AC drives
- Sequences of stages & drives required in each stage for following applications:
    a) Textile mills
    b) Steel rolling mills
    c) Paper mills
    d) Sugar mills

Module- 5:Advanced Techniques of Motor Control

Number of class hours:6(Six) Hrs

Suggestive Learning Outcomes:

1 To be able to explain with sketches the working of PLL control for the given type of DC motor.

2 To be able to explain with sketches the working of microprocessor control of the given type of AC/DC drive.
3 To be able to explain with sketches the working of microcontroller control of the given type of electric drive.
4 To be able to describe the procedure to maintain the given type of electric drive using microcontroller.

Detailed content of the unit: -

Microcontroller/ Microprocessor based control for drives.Phase locked loop control of DC motor.AC/DC motor drive using Microcomputer control.AC/DC motor drive using Microcontroller control.Synchronous Motor drives.Ratings & specifications of stepper motor.Stepper motor drives employing microcontroller (No programming)

References: -

1. P.S. Bimbhra, Electric Machines, Khanna Book Publishing Co., New Delhi (ISBN: 978-93-86173-294)
2. Saxena, S.B Lal ;Dasgupta, K., Fundamentals of Electrical Engineering, Cambridge university press pvt. Ltd., New Delhi, ISBN: 9781107464353
3. Theraja, B. L. ;Theraja, A. K., A Text Book of Electrical Technology Vol-II, S. Chand and Co. Ramnagar, New Delhi, ISBN :9788121924405
4. Mittle, V.N. ;Mittle, Arvind, Basic ElectricalEngineering, McGraw Hill Education, Noida, ISBN: 9780070593572
5. Sen P.C., Power Electronics, Mcgraw-Hill Publishing CompanyLimited, New Delhi. ISBN:9780074624005
6. Dubey Gopal K., Fundamentals of Electrical Drives, Second Edition, Narosa Publishing House, New Delhi.ISBN :9788173194283
7. Subrahmanyam, Vedam, Electrical Drives Concepts and Applications, Mcgraw-Hill Publishing CompanyLimited, New Delhi.ISBN:9780070701991
8. Agrawal , Jai P., Power Electronic Systems Theory and Design, Pearson Education, Inc. ISBN 9788177588859.
9. Deshpande M.V., Design and Testing of Electrical Machines, PHI Publication, ISBN: 9788120336452
10. Pillai, S.K., A first course on Electrical Drives, Wiley Eastern Ltd. New Delhi, ISBN :13: 978-

Justifications:

1. **Unit 1:-**

Topics excluded.

1) DC Motors, Motor Rating ; Series, Shunt and compound DC motors; Universal motor ; Permanent magnet motor ; DC servo motor ; Moving coil motor ; Torque motor
2) Starting and Braking of DC Motors
3) Brushless DC Motors for servo applications.
4) Maintenance procedure.

Justification: *These topics are already covered in EEPC-307 course.*

Topics included.

1) Need of Electric Drives, Functional Block diagrams of an electric drives,Types and Choice of electric drives, Parts of the electrical drive-source, power modulator, electric motor and control unit.
2) Motor Duty class: Classification- continuous, short time, intermittent period.
3) Motor power rating for continuous, short time and intermittent duty, equivalent torque current, and power method for fluctuating and intermittent loads (simple numerical).
4) Speed-torque characteristics of DC motor, Braking of DC motor
5) Speed-torque characteristics of AC motor, Braking of AC motor.

Justification: *These topics are the basics of Drives. Also, it will be a recap of the prerequisite courses.*

2. **Unit 2:-**

Topics excluded.

1) Single phase AC Motors
   a) Resistance split phase motors
   b) Capacitor run motors
   c) Capacitor start motors
   d) Shaded pole motors

Three phase Induction Motors
   a) Squirrel cage Induction motor
   b) Slip ring Induction Motor
   c) Starting methods of Induction Motor
   d) Braking methods of Induction Motor

Determination of Motor RatingMaintenance procedure.

Justification: *These topics are already covered either in EEPC-405 course or in Unit-1.*

Topics included.

1) Single phase SCR Drives
a)Half wave converter
   b) Full wave converter
   c) Semi converter
   d) Dual converter

2) Three Phase SCR Drives
   a) Half wave converter
   b) Full wave converter
   c) Semi converter
   d) Dual converter

3) Reversible SCR Drives.

Justification: *These topics are taken out from the Unit-3.*

3. **Unit 3:-**

Topics excluded.

1) Single phase SCR Drives
a)Half wave converter
b) Full wave converter
c) Semi converter
d) Dual converter
2) Three Phase SCR Drives
a) Half wave converter
b) Full wave converter
c) Semi converter
d) Dual converter
3) Reversible SCR Drives. Speed control method of DC series motor

Justification: *These topics are already included in Unit-2.*

Topics included.
1) Basic chopper circuit using SCR
2) Classification based on output voltage and quadrant operation

Justification: *These topics are basics of chopper and chopper controlled DC drive.*

4. Unit 4:-

Topics excluded.
1) Starting and Braking of Induction motors.

Justification: *These topics are already included in Unit-1.*

Entrepreneurship and Start-ups

Course Code	:	HS 604
Course Title	:	Entrepreneurship and Start-ups
Number of Credits	:	4
Prerequisites (Course code)	:	None
Course Category	:	HS

CO1 Understand the basic concepts of Entrepreneurship and Startups.

CO2 Illustrate skills of discovering business ideas, visualizing and planning a business.

CO3 Analyze market and business risk for strategy development.

CO4 Demonstrate skills of organizational management.

CO5 Exhibit knowledge of financing methods, institutions and skills for communication of ideas.

Course Content:

Unit1-Introduction and Basics of Entrepreneurship and Start–Ups

Suggestive Learning Outcomes:

(1) Describe the Basic Elements of Entrepreneur and Entrepreneurship

(2) Distinguish between Entrepreneur, Manager and Intrapreneur

Content:

- Definitions, Traits of an entrepreneur, Factors influencing entrepreneurship, Types and Functions of Entrepreneurs, Need for promotion of entrepreneurship, Intrapreneur, Motivation
- Role of Entrepreneurs in Economic Development
- Similarities/differences between - Entrepreneur and Manager, Entrepreneur and Intrapreneur.

Unit2–Business Ideas and their implementation

Suggestive Learning Outcomes:

(1) Illustrate different Types of Business Planning and Business Structure
(2) Select specific Institutions Assisting Entrepreneur

Content:

- Discovering ideas
- Visualizing the business
- Business Plan, - Types of planning, Importance of planning, Steps in planning
- Types of Business Structures
- Institutions assisting entrepreneur

Unit3–**Idea to Start-up**

Suggestive Learning Outcomes:

(1) Identify Steps for Starting a SSI
(2) Predict the Target Market and Associated Risk

Content:

- Market analysis – Identifying the target market
- Competition evaluation and Strategy Development
- Steps for starting a small enterprise
- Risk analysis

Unit4–Management of Enterprise

Suggestive Learning Outcomes:

(1) Apply the Basic Accounting Concepts in Business
(2) Demonstrate Knowledge of Pricing, Positioning and Advertising of Products

Content:

- Recruitment and management of talent.
- Determinants of Price, Pricing methods in practice.
- Market Positioning, Advertising and Sales Promotion
- Accounting - Understanding basics of Transaction, Journal, Ledger, Cashbook, Trial Balance, Cost Sheet and Final Accounts through simple problems

Unit5-Financing and Communication of Ideas

Suggestive Learning Outcomes:

(1) Exhibit Knowledge of various Financial Institutions and Financing Methods
(2) Illustrate Business Ideas through Communication Skills

Content:

- Financial Institutions
- Financing methods available for start-ups in India
- Communication of Ideas to potential investors–Investor Pitch

SUGGESTED LEARNING RESOURCES:

S.No.	Title of Book	Author	Publication
1.	The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company	Steve Blank and Bob Dorf	K & S Ranch ISBN–978-0984999392
2.	The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses	Eric Ries	Penguin UK ISBN–978-0670921607
3.	Demand: Creating What People Love Before They Know They Want It	Adrian J. Slywotzky with Karl Weber	Headline Book Publishing ISBN–978-0755388974
4.	Entrepreneurship	Alpana Trehan	Dreamtech PressISBN: 978-93-5004-026-3
5	Marketing and Sales Management	D C Kapoor	S Chand and Company Ltd. ISBN: 81-219-2430-8
S.No.	**Title of Book**	**Author**	**Publication**
6	Business Economics	H L Ahuja	S Chand and Company Ltd. ISBN: 81-219-1791-3
7	Financial Accounting (Principles and Practice)	Jawahar Lal & Seema Srivastava	S Chand Publishing
8	Accounting for Management	N.P. Srinivasan & Sakthivel Murugan	S Chand Publishing

9	Marketing	Harsh V Verma and Ekta Duggal	Oxford University Press ISBN: 0-19-945910-X
10	Marketing (Asian Edition)	Paul Baines, Chris Fill, Kelly Page and Piyush K. Sinha	Oxford University Press
11	Entrepreneurship	Rajeev Roy	Oxford University Press ISBN: 0-19-807263-5
12	Entrepreneurship Development	Kumar S Anil	New Age Publishers
13	Human Resource Management	Uday Kumar Haldar and Juthika Sarkar	Oxford University Press
14	Fundamentals of Entrepreneurship	S K Mohanty	Prentice Hall of India Private Limited ISBN: 81-203-2867-1
15	Entrepreneurship Development	S Skhanka	S Chand and Company Ltd. ISBN: 81-219-1801-4

SUGGESTED SOFTWARE/LEARNINGWEBSITES:

a. https://www.fundable.com/learn/resources/guides/startup
b. https://corporatefinanceinstitute.com/resources/knowledge/finance/corporate- structure/
c. https://www.finder.com/small-business-finance-tips
d. https://www.profitbooks.net/funding-options-to-raise-startup-capital-for-your-business/

Indian Constitution

Course Code	:	AU-606
Course Title	:	Indian Constitution
Number of Credits	:	0 (L: 2, T:0; P:0)
Prerequisites	:	None
Course Category	:	AU

Course Outcomes:

CO1. Illustrate Preamble, Basic Structure, Fundamental Rights and Duties of Indian Constitution(K3).

CO2. Discuss the Structure of The Indian Union Government (K2).

CO3. Memorize the Role andPower of Governor, Chief Minister and Council ofMinisters and explain the role of State Secretariat (K2).

CO4. Describe the role of Local Administration (K2).

CO5. Explain the Role andFunctioning of Election Commission (K2).

Detailed Course Content:

Unit 1 – **The Constitution – Introduction**

Number of Class hours:06

Learning Outcomes:

1. Describe the History of the Making of the IndianConstitution (K2)
2. Illustrate Preamble and the Basic Structure of Indian Constitution (K3)
3. Illustrate the Fundamental Rights and Duties set by Indian Constitution (K3)

Detailed content of the unit:

1. The History of the Making of the IndianConstitution
2. Preamble and the Basic Structure, and itsinterpretation
3. Fundamental Rights and Duties and theirinterpretation
4. State PolicyPrinciples

Unit 2 – **Union Government**

Number of Class hours:06

Learning Outcomes:

1. Discuss the Structure of the IndianUnion Government (K2).
2. Memorize the Role and Power of President, Prime Minister and Council of Ministers of India (K1)
3. Explain the role of Lok Sabha and RajyaSabha (K2)

Detailed content of the unit:

1. Structure of the IndianUnion
2. President – Role andPower
3. Prime Minister and Council ofMinisters
4. Lok Sabha and RajyaSabha

Unit 3 – **State Government**

Number of Class hours:06

Learning Outcomes:

1. Memorize the Role and Power of Governor, Chief Minister and Council ofMinisters of a state(K1)
2. Explain the role of StateSecretariat (K2)

Detailed content of the unit:

1. Governor – Role andPower
2. Chief Minister and Council ofMinisters
3. StateSecretariat

Unit 4 – Local Administration

Number of Class hours:06

Learning Outcomes:

1. Describe the role of District Administration (K2)
2. Explain the role of MunicipalCorporation (K2)
3. Discuss the role of Zila Panchayat (K2)

Detailed content of the unit:

1. DistrictAdministration
2. MunicipalCorporation
3. Zila Panchayat

Unit 5 – Election Commission

Number of Class hours:06

Learning Outcomes:

1. Explain the Role andFunctioning of Election Commission (K2)
2. Classify the role and functioning of Chief ElectionCommissioner and State Election Commissioner (K2).

Detailed content of the unit:

1. Role andFunctioning of Election commission
2. Chief ElectionCommissioner
3. State ElectionCommission

Suggested Learning Resources:

S. No.	Title of Book	Author	Publication
1.	Ethics and Politics of the	Rajeev Bhargava	Oxford University Press, New Delhi,

	In- dian Constitution		2008
2.	The Constitution of India	B.L. Fadia	Sahitya Bhawan; New edition (2017)
3.	Introduction to the Consti-tution of India	DD Basu	Lexis Nexis; Twenty-Third 2018 edition

Suggested Software/Learning Websites:

a. https://www.constitution.org/cons/india/const.html
b. http://www.legislative.gov.in/constitution-of-india
c. https://www.sci.gov.in/constitution
d. https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of-india/

MAJOR PROJECT - II

Course Code	CEPR-607
Course Title	Major Project
Number of Credits	3 (L: 0, T: 0, P: 6)
Prerequisites	Nil
Course Category	Project Work (PR)

Course Outcome:-

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

C.O. 1: Demonstrate a sound technical knowledge of their selected project topic and the knowledge, skills and attitudes of a professional engineer (K2).

C.O. 2: Develop the skill of working in a Team (K3).

C.O. 3: Design engineering solutions to complex problems utilising a systems approach (K6).

C.O. 4: Design the solution of an engineering project involving latest tools and techniques (K6).

C.O. 5: Develop the skill of effective communication with engineers and the community at large in written an oral forms (K3).

Course Content:-

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

1) Develop sound knowledge about the domain of the project work.
2) Perform detailed study about various components of a project.
3) Learn to be an important member of a team for successful execution of a project work.
4) Study about methodologies and professional way of documentation and communication related to project work.
5) Develop idea about problem formulation, finding the solution of a complex engineering problem.
6) Develop project report as per the suggested format to communicate the findings of the project work.
7) Acquire the skill of effective oral communication to the fellow engineers and people in the society at large.
8) Knowledge of how to organize, scope, plan, do and act within a project thesis.
9) Familiarity with specific tools (i.e. hardware equipment and software) relevant to the project selected.
10) Demonstrate the implementation of a major project work.

Seminar

Course Code	EESE-608
Course Title	Seminar
Number of Credits	1 (L: 0, T: 0, P: 1)
Prerequisites	Nil
Course Category	Seminar

Course Outcome:-

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

C.O.1: Demonstrate a thorough and systematic understanding of a seminar topic (K2).

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

C.O.3: Demonstrate the ability to construct a report consistent with expectations of the topic, including an appropriate organization, style, voice, and tone (K3).

C.O.4: Develop the ability to follow discussions, oral arguments, and presentations, noting main points or evidence and tracking through different comments given by the audience (K3).

C.O.5: Developthe communication skill as a speaker (K3).

Course Content:-

The seminar topics may be any aspect of the science and technology, entrepreneurship or any contemporary social issues to be solved by specific branch of engineering and technology (For example, Water logging problems in a particular city may be a seminar topic for Civil Engineering Students) must be approved by the instructor in advance.

The course should have the following-

1) Practice speaking in front of a scientific audience.
2) Explore topics in detail.
3) Research topics and organize presentations.
4) To improve as speakers, each student will receive feedback from the fellow students and the instructor.
5) PowerPoint, Key Note or overheads are acceptable media for Visual aids. Visual aids should look professional and be readable in the entire room; use spell check and proofread for typographical errors.
6) Students have to submit a hard copy contains detailed outline (4-5 pages) of their presentation and also a brief abstract (one or two paragraphs; **250 words max.**) describing their presentation.
7) Each student will give 20-minute presentations followed by 3 minutes of question-answer session.

Proposal Seminar Format for Students:

- Introduce yourself.
- Give an introduction and background information on your topic. What relevant research has been performed previously?
- State the problem(s) that remain unanswered.
- Clearly state your objectives and give the specific hypotheses you wish to test.
- Describe the methodology you will use to test your hypotheses. Be sure you fully understand your chosen methods. Give reasons why you chose these methods over other approaches.
- Present any data you have collected thus far.
- Describe what remains to be done, and what you expect to find.

Explain the significance of your findings (or potential future findings).

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