Ref No:

< Sri Krishna Institute of Technology, Bangalore>

COURSE PLAN

Academic Year 2019

Program:	B E – Electrical and Electronics Engineering
Semester :	4
Course Code:	18EE42
Course Title:	Power Generation and Economics
Credit / L-T-P:	4 / 4-0-0
Total Contact Hours:	50
Course Plan Author:	Chaitra A S

Academic Evaluation and Monitoring Cell

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Table of Contents

Note : Remove “Table of Content” before including in CP Book
Each Course Plan shall be printed and made into a book with cover page
Blooms Level in all sections match with A.2, only if you plan to teach / learn at higher levels

A. COURSE INFORMATION

1. Course Overview

Degree:	BE	Program:	EE
Semester:	4	Academic Year:	2019
Course Title:	Power Generation and Economics	Course Code:	18EE42
Credit / L-T-P:	4-0-0	SEE Duration:	180 Minutes
Total Contact Hours:	50 Hours	SEE Marks:	60 Marks
CIA Marks:	30 Marks	Assignment	1 / Module
Course Plan Author:	Chaitra A S	Sign ..	Dt:
Checked By:		Sign ..	Dt:
CO Targets	CIA Target : ..... %	SEE Target:	..... %

Note: Define CIA and SEE % targets based on previous performance.

2. Course Content

Content / Syllabus of the course as prescribed by University or designed by institute. Identify 2 concepts per module as in G.

Module	Content	Teaching Hours	Blooms Learning Levels
1	**Hydroelectric Power Plants:** Hydrology, run of f and stream flow, hydrograph, flow duration curve, Mass curve, reservoir capacity, dam storage. Hydrological cycle, merits and demerits of hydroelectric power plants, Selection of site. General arrangement of hydel plant, elements of the plant, Classification of the plants based on water flow regulation, water head and type of load the plant has to supply. Water turbines –Pelton wheel, Francis, Kaplan and propeller turbines. Characteristic of water turbines Governing of turbines, selection of water turbines. Underground, small hydro and pumped storage plants. Choice of size and number of units, plant layout and auxiliaries.	10 (5, 5)	UnderstandingL2, UnderstandingL2
2	**Steam Power Plants:** Introduction,Efficiency of steam plants, Merits and demerits of plants, selection of site. Working of steam plant, Power plant equipment and layout, Steam turbines, Fuels and fuel handling, Fuel combustion and combustion equipment, Coal burners, Fluidized bed combustion, Combustion control, Ash handling, Dust collection, Draught systems, Feed water, Steam power plant controls, plant auxiliaries. **Diesel Power Plant:** Introduction, Merits and demerits, selection site, elements of diesel power plant, applications. **Gas Turbine Power Plant :** Introduction, Merits and demerits, selection site, Fuels for gas turbines, Elements of simple gas turbine power plant, Methods of improving thermal efficiency of a simple steam power plant, Closed cycle gas turbine power plants. Comparison of gas power plant with steam and diesel power plants.	10 (5, 5)	UnderstandingL2, UnderstandingL2
3	**Nuclear Power Plants:** Introduction, Economics of nuclear plants, Merits and demerits, selection of site, Nuclear reaction, Nuclear fission process, Nuclear chain reaction, Nuclear energy, Nuclear fuels, Nuclear plant and layout, Nuclear reactor and its control, Classification of reactors, power reactors in use, Effects of nuclear plants, Disposal of nuclear waste and effluent, shielding.	10 (5, 5)	UnderstandingL2, UnderstandingL2

4	**Substations**: Introduction to Substation equipment; Transformers, High Voltage Fuses, High Voltage Circuit Breakers and Protective Relaying, High Voltage Disconnect Switches, Lightning Arresters, High Voltage Insulators and Conductors, Voltage Regulators, Storage Batteries, Reactors, Capacitors, Measuring Instruments, and power line carrier communication equipment. Classification of substations – indoor and outdoor, Selection of site for substation, Busbar arrangement schemes and single line diagrams of substations Interconnection of power stations. Introduction to gas insulated substation, Advantages and economics of Gas insulated substation. **Grounding:** Introduction, Difference between grounded and ungrounded system. System grounding – ungrounded, solid grounding, resistance grounding, reactance grounding, resonant grounding. Earthing transformer. Neutral grounding and neutral grounding transformer	10 (5, 5)	Understanding L2, Analyzing L4
5	**Economics:** Introduction, Effect of variable load on power system, classification of costs, Cost analysis. Interest and Depreciation, Methods of determination of depreciation, Economics of Power generation, different terms considered for power plants and their significance, load sharing. Choice of size and number of generating plants. Tariffs, objective, factors affecting the tariff, types. Types of consumers and their tariff. Power factor, disadvantages, causes, methods of improving power factor, Advantages of improved power factor, economics of power factor improvement and comparison of methods of improving the power factor. Choice of equipment.	10 (5, 5)	Analyzing L4, Analyzing L4
-	**Total**	**50**	**-**

3. Course Material

Books & other material as recommended by university (A, B) and additional resources used by course teacher (C).

1. Understanding: Concept simulation / video ; one per concept ; to understand the concepts ; 15 – 30 minutes
2. Design: Simulation and design tools used – software tools used ; Free / open source
3. Research: Recent developments on the concepts – publications in journals; conferences etc.

Modules	Details	Chapters in book	Availability
A	**Text books (Title, Authors, Edition, Publisher, Year.)**	**-**	**-**
1, 2,3	Power Plant Engineering, P.K. Nag Mc GrawHill 4th Edition, 2014	1, 2, 3, 4, 5	In Lib
3	Generation of Electrical Energy B.R.Gupta S. Chand 2015		
4, 5	Electrical power Generation, Transmission and Distribution S.N. Singh PHI 2nd Edition, 2009		
B	**Reference books (Title, Authors, Edition, Publisher, Year.)**	**-**	**-**
1, 2	Power Plant Engineering, P.K. Nag Mc GrawHill 4th Edition, 2014	?	In dept
1, 2	Electrical power Generation, Transmission and Distribution S.N. Singh PHI 2nd Edition, 2009		
C	**Concept Videos or Simulation for Understanding**	**-**	**-**

C1	https://www.youtube.com/watch?v=uy9lZCdkQIM Lecture Series on Power System Generation, Transmission and Distribution		
C2	https://www.youtube.com/watch?v=gd1nruo4_iA		
C3	https://www.youtube.com/watch?v=lr1jgbR5ca8 https://www.youtube.com/watch?v=dhmYOIBcwOU		
C4	https://www.youtube.com/watch?v=lr1jgbR5ca8 https://www.youtube.com/watch?v=dhmYOIBcwOU		
C5	https://nptel.ac.in/courses/108102047/12		
C6	https://nptel.ac.in/courses/108102047/12		
C7	https://nptel.ac.in/courses/108105104/21		
C8	https://nptel.ac.in/courses/108102047/18		
C9	https://www.youtube.com/watch?v=_iz8ZkjD7z8		
C10	https://nptel.ac.in/courses/108107112/3		
D	**Software Tools for Design**	**-**	**-**
E	**Recent Developments for Research**	**-**	**-**
	https://ieeexplore.ieee.org/document/7836860		
F	**Others (Web, Video, Simulation, Notes etc.)**	**-**	**-**
1	Www.youtube.com		
?			

4. Course Prerequisites

Refer to GL01. If prerequisites are not taught earlier, GAP in curriculum needs to be addressed. Include in Remarks and implement in B.5.
Students must have learnt the following Courses / Topics with described Content . . .

Modules	Course Code	Course Name	Topic / Description	Sem	Remarks	Blooms Level
1	17ELE15/25	Basic Electrical Engineering	Single phase AC circuits Synchronous Generator	1/2		L2

5. Content for Placement, Profession, HE and GATE

The content is not included in this course, but required to meet industry & profession requirements and help students for Placement, GATE, Higher Education, Entrepreneurship, etc. Identifying Area / Content requires experts consultation in the area.
Topics included are like, a. Advanced Topics, b. Recent Developments, c. Certificate Courses, d. Course Projects, e. New Software Tools, f. GATE Topics, g. NPTEL Videos, h. Swayam videos etc.

Modules	Topic / Description	Area	Remarks	Blooms Level
1,2,3,4,5	Electric Power system	Advanced Topics		L3,L4

B. OBE PARAMETERS

1. Course Outcomes

Expected learning outcomes of the course, which will be mapped to POs

Modules	Course Code.#	Course Outcome **At the end of the course, student should be able to . . .**	Teach. Hours	Instr Method	Assessment Method	Blooms' Level
1	17EE42.1	Analyze the working of hydroelectric, steam, nuclear power plants and mention the functions of various equipment of the power plants.	10	Lecture	unit Test and Assignment	UnderstandingL2,
2	17EE42.2	Classify various substations and explain the operation of different equipment's in substations.	10	Lecture	unit Test and Assignment	UnderstandingL2,
3	17EE42.3	Explain the types of grounding and its importance.	10	Lecture / PPT	unit Test and Assignment	UnderstandingL2,
4	17EE42.4	Understand the economic aspects of power system operation and its effects.	10	Lecture / PPT	unit Test and Assignment	Analyzing L4
5	17EE42.5	Explain the importance of power factor improvement.	10	Lecture	unit Test and Assignment	Analyzing L4
-	**-**	**Total**	**50**	**-**	**-**	**L2-L4**

2. Course Applications

Write 1 or 2 applications per Module
Students should be able to employ / apply the course learnings to . . .

Modules	Application Area Compiled from Module Applications.	CO	Level
1	Used to in Hydroelectric power plant	CO1	L1,L2
1	Used to in Hydroelectric power plant design	CO1	L4
2	In design and installation of Stream power plants	CO1	L4
2	In design and installation of Diesel power plants	CO1	L3
3	In design of Nuclear power plants	CO1	L3
3	In installation of Nuclear power plants	CO2	L4
4	Substantiation inhalation and commissioning	CO2	L2
4	Inhalation of grounding systems	CO3	L4
5	Tariff building and revenue generation	CO5	L4
5	Power factor improvements in real time applications	CO5	L2

3. Articulation Matrix

CO – PO Mapping with mapping level for each CO-PO pair, with course average attainment.

-	-	Course Outcomes	Program Outcomes														-
Modules	CO.#	**At the end of the course student should be able to . . .**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3	Level
1	17EE42.1	Analyze the working of hydroelectric, steam, nuclear power plants and mention the functions of various equipment of the power plants.																
1	17EE42.2	Classify various substations and explain the operation of different																

		equipment's in substations.																	
2	17EE42.3	Explain the types of grounding and its importance.																	
2	17EE42.4	Understand the economic aspects of power system operation and its effects.																	
3	17EE42.5	Explain the importance of power factor improvement.																	
-	**15EE81**	**Average attainment (1, 2, or 3)**																	**-**
-	*PO, PSO*	*1.Engineering Knowledge; 2.Problem Analysis; 3.Design / Development of Solutions; 4.Conduct Investigations of Complex Problems; 5.Modern Tool Usage; 6.The Engineer and Society; 7.Environment and Sustainability; 8.Ethics; 9.Individual and Teamwork; 10.Communication; 11.Project Management and Finance; 12.Life-long Learning; S1.Software Engineering; S2.Data Base Management; S3.Web Design*																	

4. Curricular Gap and Content

Topics & contents not covered (from A.4), but essential for the course to address POs and PSOs.

Modules	Gap Topic	Actions Planned	Schedule Planned	Resources Person	PO Mapping
1					
2					

C. COURSE ASSESSMENT

1. Course Coverage

Assessment of learning outcomes for Internal and end semester evaluation. Distinct assignment for each student. 1 Assignment per chapter per student. 1 seminar per test per student.

Modules	Title	Teach. Hours	No. of question in Exam						CO	Levels
			CIA-1	CIA-2	CIA-3	Asg	Extra Asg	SEE		
1	**Hydroelectric Power Plants**	10	2	-	-	1	1	2	CO1, CO2	L1, L2
2	**Steam Power Plants, Diesel Power Plant, Gas Turbine Power Plant**	10	2	-	-	1	1	2	CO1, CO2	L1,L2
3	**Nuclear Power Plants:**	10	-	2	-	1	1	2	CO1, CO2	L1,L2
4	**Substations Grounding**	10	-	2	-	1	1	2	CO3	L4
5	**Economics**	10	-	-	4	1	1	2	CO4,CO5	L4
-	**Total**	**50**	**4**	**4**	**4**	**5**	**5**	**10**	**-**	**-**

2. Continuous Internal Assessment (CIA)

Assessment of learning outcomes for Internal exams. Blooms Level in last column shall match with A.2.

Modules	Evaluation	Weightage in Marks	CO	Levels
1, 2	CIA Exam – 1	30	CO1, CO2	L2, L2, L3,L3
3, 4	CIA Exam – 2	30	CO1, CO2, CO3	L4,L4,L2,L4
5	CIA Exam – 3	30	CO5	L4,L2
1, 2	Assignment - 1	10	CO1, CO2	L2, L2, L3,L3
3, 4	Assignment - 2	10	CO1, CO2, CO3	L4,L4,L2,L4
5	Assignment - 3	10	CO5	L4,L2

1, 2	Seminar - 1		-	-
3, 4	Seminar - 2		-	-
5	Seminar - 3		-	-
1, 2	Quiz - 1		-	-
3, 4	Quiz - 2		-	-
5	Quiz - 3		-	-
1 - 5	Other Activities – Mini Project	-		
	Final CIA Marks	**40**	**-**	**-**

D1. TEACHING PLAN - 1

Module - 1

Title:	Introduction to power systems, Overhead transmission lines and insulators	Appr Time:	12 Hrs
a	***Course Outcomes***	-	**Blooms**
-		-	**Level**
1	Analyze the working of hydroelectric, steam, nuclear power plants and mention the functions of various equipment of the power plants.	CO1	L2
2	Classify various substations and explain the operation of different equipment's in substations.	CO2	L2
b	***Course Schedule***	-	-
Class No	**Module Content Covered**	**CO**	**Level**
1	Hydrology, run of f and stream flow, hydrograph, flow duration curve,	C01	L2
2	Mass curve, reservoir capacity	C01	L2
3	dam storage. Hydrological cycle, merits and demerits of hydroelectric power plants	C01	L2
4	, Selection of site. General arrangement of hydel plant,	C01	L2
5	elements of the plant, Classification of the plants based on water flow regulation,	C01	L2
6	water head and type of load the plant has to supply.	C02	L2
7	Water turbines –Pelton wheel, Francis, Kaplan and propeller turbines.	C02	L3
8	Characteristic of water turbines Governing of turbines, selection of water turbines.	C02	L3
9	Underground, small hydro and pumped storage plants.	C02	L2
10	Choice of size and number of units, plant layout and auxiliaries.	C02	L2
c	**Application Areas**	**CO**	**Level**
1	Construction of hydroelectric power generating plans	CO1	L2
2	Design and installation of hydroelectric power plants	CO2	L4
d	**Review Questions**	-	-
1	Discuss the factor which affect-the thermal efficiency of thermal power plant in short.	CO1	L2
2	What is the function of storage and pondage in hydro power plant?	CO1	L2
3	Write factor considered for selection of nuclear power plant.	CO1	L2
4	Why water hammer creates & How?.	CO1	L1
5	What is hydrology?	CO1	L2
6	When & where diesel electric power plants are used	CO2	L1
7	What is function of air pre heater in steam power plant?	CO1	L2

8	Explain condenser used in steam power plant.	CO1	L2
9	Discuss the factor which affect-the thermal efficiency of thermal power plant in short.	CO1	L2
10	What is the function of storage and pondage in hydro power plant?	CO2	L2
11	Write factor considered for selection of nuclear power plant.	CO2	L1
12	Why water hammer creates & How?.	CO1	L2
14			
e	**Experiences**	-	-
1		CO1	L2
2			
b	***Course Schedule***	-	-

Module – 2

Title:	Line Parameters	Appr Time:	7 Hrs
a	***Course Outcomes***	**CO**	**Blooms**
-	At the end of the topic the student should be able to . . .	-	**Level**
1	Analyze the working of hydroelectric, steam, nuclear power plants and mention the functions of various equipment of the power plants.	CO1	L2
2	Classify various substations and explain the operation of different equipment's in substations.	CO2	L2
b	***Course Schedule***		
Class No	**Portion covered per hour**	**CO**	**Level**
1	**Steam Power Plants:** Introduction, Efficiency of steam plants, steam power plant, Closed cycle gas turbine power plants.	CO5	L4
2	Merits and demerits of plants, selection of site. Working of steam plant		
3	Power plant equipment and layout, Steam turbines, Fuels and fuel handling	-	-
4	Fuel combustion and combustion equipment	CO3	L1
5	Coal burners, Fluidized bed combustion	CO3	L1
6	Combustion control, Ash handling, Dust collection, Draught systems, Feed water, Steam power plant controls	CO3	L2
7	, plant auxiliaries. **Diesel Power Plant**	CO3	L1
8	Introduction, Merits and demerits, selection site, elements of diesel power plant, applications		
9	**Gas Turbine Power Plant :** Introduction, Merits and demerits, selection site		
10	or gas turbines, Elements of simple gas turbine power plant		
11	Comparison of gas power plant with steam and diesel power plants.		
c	**Application Areas**	**CO**	**Level**
1	Installation and design of steam power plant	CO5	L4
2	Design and installation of gas turbine power plants	CO6	L4

d	**Review Questions**	-	-
1	What is the function of storage and pondage in hydro power plant?	CO3	L1
2	Write factor considered for selection of nuclear power plant.	CO3	L1
3	Why water hammer creates & How?.	CO3	L2
4	What is hydrology?	CO3	L1
5	When & where diesel electric power plants are used	CO3	L1
6	What is function of air pre heater in steam power plant?	CO4	L1
7	Explain condenser used in steam power plant.	CO4	L2
8	Discuss the factor which affect-the thermal efficiency of thermal power plant in short.	CO4	L2
9	What is the function of storage and pondage in hydro power plant?	CO4	L2
10	Write factor considered for selection of nuclear power plant.	CO4	L1

E1. CIA EXAM – 1

a. Model Question Paper - 1

Crs Code:	17EE42	Sem:	IV	Marks:	30	Time:	75 minutes
Course:	Power Generation and Economics						

-	-	**Note: Answer all questions, each carry equal marks. Module : 1, 2**	**Marks**	**CO**	**Level**
1	a	Describe the merits and demerits of hydroelectric Power Plant?	5	CO1	L2
	b	What are characteristics of water Turbine?	5	CO1	L2
	c	With block diagram Explain the working of the steam Power Plant	5	CO1	L2
		OR			
2	a	Explain the working of pumped storage power plant. Stating its advantages with the help of a schematic diagram	5	CO2	L2
	b	Explain the underground hydro-electric power plant.	5	CO2	L2
	c	What are the merits and demerits of Steam power plants	5	CO2	L2
3	a	Explain Impulse and Reaction types of turbines	8	CO2	L2
	b	Explain the Components of steam Power plant.	7	CO1	L2
		OR			
4	a	Explain Mini and Micro hydro electric power plant.	6	CO2	L2
	b	The average Weekly discharge Q measured at a site is given below:	9	CO1	L3

Week	1	2	3	4	5	6	7	8	9	10
Q(m^3/ Sec)	500	500	350	200	300	800	1100	900	400	200

a. Calculate the average discharge available.
b. Plot the Hydrograph.
c. Plot flow duration Curve.
d. Plot mass curve.

b. Assignment -1

Model Assignment Questions

Crs Code:	17EE42	Sem:	IV	Marks:	10	Time:	90 – 120 minutes
Course:	Power Generation and Economics			Module : 1, 2			
Note: Each assignment carries equal mark.							

SNo	Assignment Description	Marks	CO	Level
1	Explain the working of pumped storage power plant. Stating its advantages with the help of a schematic diagram	10	CO1	L2
2	Explain the underground hydro-electric power plant.	10	CO1	L2
3	What are the merits and demerits of Steam power plants	10	CO1	L2
4	Explain the working of pumped storage power plant. Stating its advantages with the help of a schematic diagram	10	CO1	L2
5	Explain the underground hydro-electric power plant.	10	CO1	L2
6	What are the merits and demerits of Steam power plants	10	CO1	L2
7	Explain the working of pumped storage power plant. Stating its advantages with the help of a schematic diagram	10	CO1	L2
8	Explain the underground hydro-electric power plant.	10	CO2	L2
9	What are the merits and demerits of Steam power plants	10	CO2	L2
10	Explain the working of pumped storage power plant. Stating its advantages with the help of a schematic diagram	10	CO2	L2
11	Explain the underground hydro-electric power plant.	10	CO2	L2
12	What are the merits and demerits of Steam power plants	10	CO2	L2
13	Explain the working of pumped storage power plant. Stating its advantages with the help of a schematic diagram	10	CO2	L2
14	Explain the underground hydro-electric power plant.	10	CO2	L2
15	What are the merits and demerits of Steam power plants	10	CO2	L2
16	Derive from first principles, an expression for the inductance per phase per km of a 3 phase regularly transposed transmitting. Line. The conductors are of diameter d mt and placed at the corner of a triangle of sides a, b, c.	10	CO2	L3

D2. TEACHING PLAN - 2

Module – 3

Title:	**Nuclear Power Plants**	Appr Time:	12 Hrs
a	***Course Outcomes***	-	**Blooms**
-	The student should be able to:	-	**Level**
1	Analyze the working of hydroelectric, steam, nuclear power plants and mention the functions of various equipment of the power plants.	CO1	L2
2	Classify various substations and explain the operation of different equipment's in substations.	CO2	L2
b	***Course Schedule***		
Class No	**Module Content Covered**	**CO**	**Level**
1	introduction, Economics of nuclear plants, Merits and demerits	CO1	L2
2	selection of site, Nuclear reaction, Nuclear fission process, Nuclear chain reaction	CO1	L3
3	Nuclear energy, Nuclear fuels,	CO1	L3
4	Nuclear reactor and its control,	CO1	L3
5	Classification of reactors,	CO2	L3
6	power reactors in use	CO2	L3

7	Effects of nuclear plants,	CO2	L4
8	Disposal of nuclear waste	CO1	L2
9	Effluent, shielding.	CO1	L4
10	Nuclear plant and layout,	CO1	L2
c	**Application Areas**	**-**	**-**
-	Students should be able employ / apply the Module learning to . . .	-	-
1	**Performance of transmission lines includes the calculation of sending end voltage, sending end current, sending end power factor, power loss in the lines, efficiency of transmission, regulation and limits of power flows during steady state and transient conditions. Performance calculations are helpful in system planning.**	CO2	L4
2	**Performance of transmission lines includes the calculation of sending end voltage, sending end current, sending end power factor, power loss in the lines, efficiency of transmission, regulation and limits of power flows during steady state and transient conditions. Performance calculations are helpful in system planning.**	CO6	L4
d	**Review Questions**	-	-
-	The attainment of the module learning assessed through following questions	-	-
1	Explain the underground hydro-electric power plant.		
2	What are the merits and demerits of Steam power plants		
3	Explain the working of pumped storage power plant. Stating its advantages with the help of a schematic diagram		
4	Explain the underground hydro-electric power plant.		
5	What are the merits and demerits of Steam power plants		
6	Explain the working of pumped storage power plant. Stating its advantages with the help of a schematic diagram		
7	Explain the underground hydro-electric power plant.		
8	What are the merits and demerits of Steam power plants		
9	Derive from first principles, an expression for the inductance per phase per km of a 3 phase regularly transposed transmitting. Line. The conductors are of diameter d mt and placed at the corner of a triangle of sides a, b, c.		
10			
e	**Experiences**	-	-
1		CO6	L2
2			

Module – 4

Title:	**Substations** and Grounding	Appr Time:	13 Hrs
a	***Course Outcomes***	-	**Blooms**
-		-	**Level**
1	Explain the types of grounding and its importance.	CO3	L2
b			
Class No	**Module Content Covered**	**CO**	
1	Introduction to Substation equipment; Transformers,	CO3	**-**
2	High Voltage Fuses, High Voltage Circuit Breakers and Protective Relaying, High Voltage Disconnect Switches,	CO3	L2
3	Lightning Arresters, High Voltage Insulators and Conductors, Voltage Regulators, Storage Batteries, Reactors, Capacitors, Measuring Instruments,	CO3	L2

	and power		
4	line carrier communication equipment Classification of substations – indoor and outdoor, Selection of site for substation	CO3	L2
5	Busbar arrangement schemes and single line diagrams of substations Interconnection of power stations. Introduction to gas insulated substation,	CO3	L2
6	Introduction, Difference between grounded and ungrounded system. System grounding – ungrounded,	CO3	L2
7	solid grounding, resistance grounding,	CO3	L4
8	reactant grounding, resonant grounding.	CO3	L4
9	Advantages and economics of Gas insulated substation.	CO3	L4
10	Neutral grounding and neutral grounding transformer	CO3	L4
			L4
c	**Application Areas**	**CO**	L4
1	Rectifiers are used in DC regulated power supply.	CO3	L4
2	DAC and ADC are used in data acquition system.	CO3	
			-
d	**Review Questions**	-	-
1	Discuss factor to be taken into account while selecting site for a thermal power station.	CO3	L2
2	Explain Ash handling in thermal power plant.	CO3	L4
3	Explain stage of coal handling in thermal power plant	CO3	
4	Write in short about gas plant fuel.	CO3	-
5	Write application where solar energy used.	CO3	-
6	What are forms of geothermal energy?	CO3	L2
7	Write in short about gas plant fuel.	CO3	L2
8	Write application where solar energy used.	CO3	L2
9	What are forms of geothermal energy?	CO3	L2
10	Draw sketch of wind power mills.	CO3	L2
11	List the method of finding out the depreciation cost.	CO3	L2
		CO3	
e	**Experiences**	-	-
1		CO7	L2
2			

E2. CIA EXAM – 2

a. Model Question Paper - 2

Crs Code:	17EE42	Sem:	IV	Marks:	30	Time:	75 minutes
Course:	Transmission and Distribution						

-	-	**Note: Answer all questions, each carry equal marks. Module : 3, 4**	**Marks**	**CO**	**Level**
1	a	Write in short about gas plant fuel.	8	CO1	L4
	b	Write application where solar energy used.	7	CO2	L4
		OR			
2	a	Write in short about gas plant fuel.	8	CO2	L2
	b	Write application where solar energy used.	7	CO2	L2
	c	What are forms of geothermal energy?	8	CO1	L2
3	a	Discuss factor to be taken into account while selecting site for a thermal power station.	8	CO3	L2

	b	Explain Ash handling in thermal power plant.	7	CO3	L2
	c	Explain stage of coal handling in thermal power plant	8	CO3	L2
		OR		CO3	
4	a	Write short note on choice of size and number of generator units.	10	CO3	L2
	b	Write short note on constrains of economic generation.	5	CO3	L2
	c	What is importance of solar power in present energy used in world?	10	CO3	L2

b. Assignment – 2

Model Assignment Questions							
Crs Code:	17EE42	Sem:	IV	Marks:	10	Time:	90 – 120 minutes
Course:	Power Generation and Economics			Module : 3,4			
Note: Each assignment carries equal mark.							

SNo	Assignment Description	Marks	CO	Level
1	Explain the working of pumped storage power plant. Stating its advantages with the help of a schematic diagram	10	CO1	L2
2	Explain the underground hydro-electric power plant.	10	CO1	L2
3	What are the merits and demerits of Steam power plants	10	CO1	L2
4	Explain the working of pumped storage power plant. Stating its advantages with the help of a schematic diagram	10	CO1	L2
5	Explain the underground hydro-electric power plant.	10	CO1	L2
6	What are the merits and demerits of Steam power plants	10	CO1	L2
7	Explain the working of pumped storage power plant. Stating its advantages with the help of a schematic diagram	10	CO1	L2
8	Explain the underground hydro-electric power plant.	10	CO2	L2
9	What are the merits and demerits of Steam power plants	10	CO2	L2
10	Explain the working of pumped storage power plant. Stating its advantages with the help of a schematic diagram	10	CO2	L2
11	Explain the underground hydro-electric power plant.	10	CO2	L2
12	What are the merits and demerits of Steam power plants	10	CO2	L2
13	Explain the working of pumped storage power plant. Stating its advantages with the help of a schematic diagram	10	CO2	L2
14	Explain the underground hydro-electric power plant.	10	CO2	L2
15	What are the merits and demerits of Steam power plants	10	CO2	L2
16	Derive from first principles, an expression for the inductance per phase per km of a 3 phase regularly transposed transmitting. Line. The conductors are of diameter d mt and placed at the corner of a triangle of sides a, b, c.	10	CO2	L3

D3. TEACHING PLAN - 3

Module – 5

Title:	**Economics:**	Appr Time:	10 Hrs

a	***Course Outcomes***	**CO**	**Blooms**
-	At the end of the topic the student should be able to . . .	-	**Level**
1	Understand the economic aspects of power system operation and its effects.	CO4	L4
2	Explain the importance of power factor improvement.	CO5	L4
b	***Course Schedule***	-	-
Class No	**Portion covered per hour**	**-**	**-**
1	Introduction, Effect of variable load on power system	CO4	L4
2	Classification of costs, Cost analysis	CO4	L4
3	Interest and Depreciation, Methods of determination of depreciation	CO4	L4
4	Economics of Power generation, different terms considered for power plants and their significance	CO4	L4
5	load sharing. Choice of size and number of generating plants. Tariffs, objective	CO5	L4
6	factors affecting the tariff, types. Types of consumers and their tariff	CO5	L4
7	Power factor, disadvantages, causes, methods of improving power factor	CO5	L4
8	Advantages of improved power factor	CO5	L2
9	Economics of power factor improvement	CO5	L2
10	comparison of methods of improving the power factor. Choice of equipment.	CO5	L2
11			
c	**Application Areas**	**-**	**-**
-	Students should be able employ / apply the Module learnings to . . .	-	-
1	Electric power distribution is the final stage in the delivery of electric power; it carries electricity from the transmission system to individual consumers.	CO4	L4
2	The distribution system reliability evaluation considers the ability of the distribution system to transfer energy from bulk supply points such as typical transmission system end -stations, and from local generation points, to customer loads.	CO5	L2
d	**Review Questions**	-	-
-	The attainment of the module learning assessed through following questions	-	-
1	Write short note on radial and ring main distributors	CO4	L4
2	What is meant by DC distribution? Explain with diagram different types of DC distribution and discuss their merits and demerits.	CO4	L4
3	Write short note on radial distribution system	CO4	L4
4	In a 2 core dc distributor cable 400m long supplies there are concentrated loads of 120, 80, 50 and 120A at 50, 150, 200 and 300m, respectively from the end A. Determine the position of the lowest voltage when the cable is fed at 250V from both the ends.	CO4	L4
5	The points B and D of a d.c main ABCEDA are linked through a interconnector the supply is given at point "A". The resistances of both run and return conductors of various sections are shown in the figure. Calculate (i) current in interconnector (ii) voltage drop in interconnector	CO4	L4
6	A two wire d.c distributor 1200m long is loaded as shown in the figure, B being the midpoint.The power factor at the two load points refer to voltage C . the impedance of each line is (0.15+j0.2) ohms . Calculate the sending end voltage, current and power factor . the voltage at point C is 220V	CO4	L4
7	A two wire d.c. distributor AB 600 m long is loaded as under. Distance from a 150,300,350,450. Loads in amperes 100,200,250,300. The feeding point A is maintained at 440 V and that of B at 430V. if each conductor has a resistance of 0.001 ohms / 100m calculate (1) the current supplied from A to B (2) the power dissipated in the distributor? List down the necessary power requirements of a power distribution systems	CO5	L4
8	A single phase distributor is shown in the fig. The far end of the distributor has	CO5	L4

	load current of 80 a and power factor 0.8 lagging at 220v. The midpoint M of the distributor has a load current of 50 A at pf of 0.707 lag with reference to a voltage M. Calculate the sending end voltage and power factor.		
9	A 2-wire d.c. distributor cable AB is 2 km long and supplies loads of 100A, 150A, 200A and 50A situated 500 m, 1000 m, 1600 m and 2000 m from the feeding point A. Each conductor has a resistance of 0·01 Ω per 1000 m. Calculate the p.d. at each load point if a p.d. of 300 V is maintained at point A	CO5	L4
10	A 2-wire d.c. ring distributor is 300 m long and is fed at 240 V at point A. At point B, 150 m from A, a load of 120 A is taken and at C, 100 m in the opposite direction, a load of 80 A is taken. If the resistance per 100 m of single conductor is 0·03 Ω, find : (i) current in each section of distributor (ii) voltage at points B and C	CO5	L4
11	A single phase distributor one km long has resistance and reactance per conductor Of 0·1 Ω and 0·15 Ω respectively. At the far end, the voltage VB = 200 V and the current is 100 A at a p.f. of 0·8 lagging. At the mid-point M of the distributor, a current of 100 A is tapped at a p.f. of 0·6 lagging with reference to the voltage VM at the mid-point. Calculate : (i) voltage at mid-point (ii) sending end voltage VA (iii) phase angle between VA and VB	CO5	L4
12	A 3-phase ring main ABCD fed at A at 11 kV supplies balanced loads of 50 A at 0.8 p.f. lagging at B, 120 A at unity p.f. at C and 70 A at 0·866 lagging at D, the load currents being Referred to the supply voltage at A. The impedances of the various sections are : Section AB = (1 + j 0·6) Ω ; Section BC = (1·2 + j 0·9) Ω Section CD = (0·8 + j 0·5) Ω ; Section DA = (3 + j 2) Ω. Calculate the currents in various sections and station bus-bar voltages at B, C and D.	CO5	L4
13	Distinguish between reliability, availability, adequacy and security.	CO5	L2
14	Discuss the commonly used distributors for failure	CO5	L2
15	What are life failure rate curves?	CO5	L2
16	Why is PQ important?	CO5	L2
17	Define failure rate.	CO5	L2
18	Define under voltage, over voltage sag and swell.	CO5	L2
19	Distinguish between sag and interruption.	CO5	L2
20	What are transients?	CO5	L2
21	What are harmonics?	CO5	L2
22	Define THD.	CO4	L2
e	**Experiences**	-	-
1			L2
2			

E3. CIA EXAM – 3

a. Model Question Paper - 3

Crs Code:	17EE42	Sem:	IV	Marks:	30	Time:	75 minutes
Course:	Electric Power Generation						

-	-	**Note: Answer all questions, each carry equal marks. Module : 5**	**Marks**	**CO**	**Level**
1	a	Write short note on radial and ring main distributors	7	CO4	L4
	b	A 2-wire d.c. ring distributor is 300 m long and is fed at 240 V at point A. At point B, 150 m from A, a load of 120 A is taken and at C, 100 m in the opposite direction, a load of 80 A is taken. If the resistance per 100 m of single conductor is 0·03 Ω, find :	8	CO5	L4

		(i) current in each section of distributor (ii) voltage at points B and C			
		OR			
1	a	In a 2 core dc distributor cable 400m long supplies there are concentrated loads of 120, 80, 50 and 120A at 50, 150, 200 and 300m, respectively from the end A. Determine the position of the lowest voltage when the cable is fed at 250V from both the ends.	8	CO5	L4
	b	The points B and D of a d.c main ABCEDA are linked through a interconnector the supply is given at point "A". The resistances of both run and return conductors of various sections are shown in the figure. Calculate (i) current in interconnector (ii) voltage drop in interconnector.	7	CO4	L4
2	a	Define under voltage, over voltage sag and swell.	5	CO4	L2
	b	Distinguish between sag and interruption.	5	CO4	L2
	c	Define THD.	5	CO5	
		OR			
2	a	Distinguish between reliability, availability, adequacy and security.	8	CO5	L2
	b	What are life failure rate curves and Define failure rate.	7	CO5	L2

b. Assignment – 3

Model Assignment Questions							
Crs Code:	17EE42	Sem:	IV	Marks:	10	Time:	90 – 120 minutes
Course:	Power Generation and Economics			Module : 3,4			
Note: Each assignment carries equal mark.							

SNo	Assignment Description	Marks	CO	Level
1	Explain the working of pumped storage power plant. Stating its advantages with the help of a schematic diagram	10	CO1	L2
2	Explain the underground hydro-electric power plant.	10	CO1	L2
3	What are the merits and demerits of Steam power plants	10	CO1	L2
4	Explain the working of pumped storage power plant. Stating its advantages with the help of a schematic diagram	10	CO1	L2
5	Explain the underground hydro-electric power plant.	10	CO1	L2
6	What are the merits and demerits of Steam power plants	10	CO1	L2
7	Explain the working of pumped storage power plant. Stating its advantages with the help of a schematic diagram	10	CO1	L2
8	Explain the underground hydro-electric power plant.	10	CO2	L2
9	What are the merits and demerits of Steam power plants	10	CO2	L2
10	Explain the working of pumped storage power plant. Stating its advantages with the help of a schematic diagram	10	CO2	L2
11	Explain the underground hydro-electric power plant.	10	CO2	L2
12	What are the merits and demerits of Steam power plants	10	CO2	L2
13	Explain the working of pumped storage power plant. Stating its advantages with the help of a schematic diagram	10	CO2	L2
14	Explain the underground hydro-electric power plant.	10	CO2	L2
15	What are the merits and demerits of Steam power plants	10	CO2	L2
16	Derive from first principles, an expression for the inductance per phase per km of a 3 phase regularly transposed transmitting. Line. The conductors	10	CO2	L3

	are of diameter d mt and placed at the corner of a triangle of sides a, b, c.			

F. EXAM PREPARATION

1. University Model Question Paper

Course:		Transmission and Distribution						Month / Year		May /2019	
Crs Code:		17EE42	Sem:	IV	Marks:	80		Time:		180 minutes	
Module	**Note**	Answer all FIVE full questions. All questions carry equal marks.							**Marks**	**CO**	**Level**
1	a	Explain about advantage of high voltage transmission?							5	CO1	L2
	b	Why are bundled conductors used? Lits out the advantages.							5	CO2	L2
		Write the comparison between. Overhead and underground transmission system							5	CO1	L2
		OR									
1	a	Obtain the expression for sag in a power conductor when the supports are at equal levels, taking into the effect of wind and ice loading							10	CO3	L2
	b	A transmission line conductor is supported by the towers of unequal height. The first has a height of 30m and the second tower has a height of 50m.The distance between the towers is 150m.Tension in the conductor is 2200Kg and cross section of the conductor is 2 cm2.The specific gravity of the conductor material is 9.5gm/cm3 and the wind pressure is 150kg/m2.Calculate the sag.							10	CO3	L2
2	a	Explain the terms self GMD and mutual GMD and prove that the inductance of a group of parallel wires carrying current can be represented in terms of their geometric distances.							10	CO5	L3
	b	Derive the expression for the capacitance of a 3 phase single circuit. Line with equilateral spacing							10	CO5	L3
		OR									
2	a	Find the capacitance between the conductors of a single-phase 10 km long line. The diameter of each conductor is 1.213cm. The spacing between conductors is 1.25m. Also find the capacitance of each conductor to neutral.							10	CO5	L3
	b	Calculate the inductance of single phase two wire line starting from fundamentals							10	CO5	L3
3	a	Derive expressions for generalized ABCD constants for a long transmission line using rigorous method of analysis							10	CO6	L4
	b	An overhead 3 phase transmitting line delivers 5000kw at 22kv at 0.8 pf lagging. The resistance and reactance of short transmitting line is 4 ohm and 6 ohms respectively. Determine (1) sending end voltage (ii) % reg (iii) transmitting							10	CO6	L4

		efficiency.			
		OR			
3	a	Derive expressions for ABCD constants for a medium transmission line using nominal T model. Hence prove AD-BC = 1.	10	CO6	L4
	b	Discuss the terms voltage regulation and transmission efficiency as applied to transmission line.	5	CO6	L4
	c	Write and explain the classification of overhead transmission lines	5	CO6	L4
4	a	Discuss the advantages and disadvantages of corona	5	CO7	L2
	b	Explain the terms with reference to corona. i)disruptive critical voltage ii) Power loss due to corona	5	CO7	L2
	c	Write short note on factors affecting corona and methods of reducing corona effect	5	CO7	L2
		OR			
4	a	Draw the cross sectional view of a single core cable and explain the construction.	10	CO8	L4
	b	Calculate the most economical diameter of a single core cable to be used on 132kV, 3 phase system. Find also the overall diameter of the insulation, if the peak permissible stress does not exceed 60kV/cm. also derive the formula used here	10	CO8	L4
5	a	In a 2 core dc distributor cable 400m long supplies there are concentrated loads of 120, 80, 50 and 120A at 50, 150, 200 and 300m, respectively from the end A. Determine the position of the lowest voltage when the cable is fed at 250V from both the ends.	10	CO9	L4
	b	Write short note on radial and ring main distributors	10	CO9	L4
		OR			
5	a	Distinguish between reliability, availability, adequacy and security.	8	CO10	L2
	b	Define failure rate and What are life failure rate curves?	6	CO10	L2
	c	Define under voltage, over voltage sag and swell.	6	CO10	L2

2. SEE Important Questions

Course:	Transmission and Distribution					Month / Year	May /2018
Crs Code:	17EE42	Sem:	IV	Marks:	60	Time:	180 minutes

	Note	Answer all FIVE full questions. All questions carry equal marks.	-	-	
Module	Qno.	Important Question	**Marks**	**CO**	**Year**
1	a	Write short note on feeders, distributors and service mains	05	CO1	2017
	b	Explain the different types of supporting structures used in transmission lines.	05	CO2	2018
	c	Draw the line diagram of a typical power supply scheme indicating the	05	CO1	2012

		standard voltages.			
	d	Derive an expression for string efficiency of s 3 disc string	06	CO3	2014
	e	Explain pin type insulator	05	CO4	2016
2	a	Derive the expression for the inductance of a 3 phase unsymmetrically spaced but transmission line/km.	10	CO5	2017
	b	Derive the expression for the capacitance of a 3 phase single circuit. Line with equilateral spacing	10	CO5	2016
	c	Show how the inductance of 3 phase transmission. Line with equilateral and symmetrical spacing between conductors can be calculated.	10	CO5	2018
	d	Calculate the inductance of single phase two wire line starting from fundamentals	10	CO5	2017
	e	Find the capacitance between the conductors of a single-phase 10 km long line. The diameter of each conductor is 1.213cm. The spacing between conductors is 1.25m. Also find the capacitance of each conductor to neutral.	10	CO5	2016
3	a	Derive expressions for generalized ABCD constants for a long transmission line using rigorous method of analysis	10	CO6	2016
	b	Derive expressions for ABCD constants for a medium transmission line using nominal T model. Hence prove AD-BC = 1.	10	CO6	2017
	c	Write short note on classification of transmission lines.	5	CO6	2018
	d	A 3 phase, 50hz transmission lines has the following constants R = 28 ohm, inductive reactance = 63 ohms, capacitive susceptance = $4^{*}10^{-}4$ .The load at the receiving end is 75MVA at 0.8 pf lag with 132 kv between lines. Calculate (1) voltage, (2) current (3) pf at sending end (4) reg and efficiency of the transmission for these loads using nominal t method?	10	CO6	2015
	e	Write short note on Ferranti effect	5	CO6	2016
			10		
4	a	What is corona? Derive expression for the disruptive critical voltage and visual critical voltage	10	CO7	2018
	b	What are the effects of corona?	5	CO7	2017
	c	Explain the terms with reference to corona. i)visual critical voltage ii) Power loss due to corona	5	CO7	2016
	d	Derive expressions for the maximum and minimum dielectric stress in a single core cable and obtain the criteria for keeping the dielectric stress to a minimum value.	10	CO8	2015
	e	Compare the merits and demerits of underground system overhead system	5	CO8	2014
5	a	Write short note on radial distribution system	5	C09	2018
	b	In a 2 core dc distributor cable 400m long supplies there are concentrated loads of 120, 80, 50 and 120A at 50, 150, 200 and 300m, respectively from the end A. Determine the position of the lowest voltage when the cable is fed at 250V from both the ends.	10	C09	2017
	c	Distinguish between reliability, availability, adequacy and	10	CO10	

		security.			
	d	What are life failure rate curves?	5	CO10	
	e	Why is PQ important?	5	CO10	

Course Outcome Computation

Academic Year:
Odd / Even semester

INTERNAL TEST	**T1**								**T2**									
Course Outcome	**CO1**		**CO2**		**CO3**		**CO4**		**CO5**		**CO6**		**CO7**	
QUESTION NO	**Q1**	**LV**	**Q2**	**LV**	**Q3**	**LV**	**Q1**	**LV**	**Q2**	**LV**	**Q3**	**LV**	**Q1**
MAX MARKS													10
USN-1													
USN-2													4
USN-3													6
USN-4													4
USN-5													10
USN-6													9
Average CO Attainment														

LV Threshold : 3:>60%, 2:>=50% and <=60%, 1: <=49%
CO1 Computation :(2+2+2+3)/4 = 10/4=2.5

PO Computation

Program Outcome	PO1	PO3	PO3	PO1	PO12	PO12	PO6
Weight of CO - PO	3	1	3	2	2	3	3
Course Outcome	CO1	CO2	CO3	CO4	CO5	CO6	CO7

Test/Quiz/ Lab	T1						T2						T3		
QUESTION NO	Q1	LV	Q2	LV	Q3	LV	Q1	LV	Q2	LV	Q3	LV	Q1	LV	Q2
MAX MARKS														-	10

USN-1		
USN-2	1	5
USN-3	2	10
USN-4	1	
USN-5	3	10
USN-6	3	10
Average CO Attainment	2	