# **INSTITUTE OF AERONAUTICAL ENGINEERING**



(Autonomous) Dundigal, Hyderabad-500043

### **ELECTRICAL AND ELECTRONICS ENGINEERING**

### **TUTORIAL QUESTION BANK**

Course Name	:	POWER SYSTEM OPERATION AND CONTROL
Course Code	:	AEE016
Class	:	B.Tech VII Semester
Branch	:	Electrical and Electronics Engineering
Year	:	2020 - 2021
Course Coordinator	:	Dr. P Sridhar, Professor

#### **COURSE OBJECTIVES:**

The s	The students will try to learn:				
Ι	The economic operation through optimal generation - load dispatch, hydro -thermal and pumped				
	storage plant scheduling and their implementation through various classical methods.				
II	The required mathematical and engineering fundamentals for controlling the governing system,				
	turbine, excitation models and automatic, load frequency controllers in the power system.				
III	The necessity and effective management of generation, transmission and distribution of electrical				
	power for optimal operation of the system.				
IV	The concepts of load frequency control in interconnected systems, its operation, reactive power				
	control, compensation techniques in transmission line and types of loads with characteristics for real-				
	world engineering problems and applications.				
V	The control actions required on the system to meet the minute-to-minute variation of system demand				
	and its significance in power system operation and control by maintaining the frequency and voltage				
	as constant				

#### **COURSE OUTCOMES:**

Upon t	Upon the successful completion of this course, the students will be able to:				
CO1	<b>Apply</b> knowledge of engineering science including electrical circuits, control systems and electrical machines in power system operation and control.				
CO2	<b>Determine</b> economic scheduling of generation in a power system to supply specific amount of demand.				
CO3	<b>Outline</b> the problems related to the economic dispatch of power, plant scheduling, strategies for minimizing transmission line losses and penalties imbibed.				
CO4	<b>Calculate</b> the cost of generation, economic dispatch of power among 'n' thermal units using incremental cost curves and coordinate equation using iteration method.				
CO5	<b>Develop</b> the mathematical models of the mechanical and electrical components involved in the operation of power systems under steady and dynamic conditions.				

CO6	Model excitation system using the fundamental characteristics and transfer function method.
C07	<b>Analyze</b> the static performance of the system with automatic generation control, excitation voltage and reactive power control in an interconnected power system.
CO8	<b>Design</b> a compensation scheme in a transmission line for imparting knowledge of various controllers with its evolution, principle of operation and applications
CO9	<b>Determine</b> the optimal location of power capacitors for power factor improvement with economic justification.
CO10	<b>Demonstrate</b> the importance of load compensation in symmetrical as well as unsymmetrical loads with its characteristics.
CO11	<b>Solve</b> different numerical problems related to Economic Load Dispatch, Load Frequency Control and reactive power control.

## **TUTORIAL QUESTION BANK**

	τ	JNIT- I				
	ECONOMIC OPERATION OF POWER SYSTEMS					
	Part - A (Shor	t Answer Que	stions)			
S No	QUESTIONS	Blooms Taxonomy Level	How Does This Subsume the Level	Course Outcomes		
1	Define in detail the following? i. Control variables ii. Disturbance variables and iii. State variables.	Remember	This would require learner to recall different system variables to know the inequality constraints	CO 2		
2	Draw incremental fuel cost curve?	Understand	This would require learner to understand the importance of fuel on operating cost.	CO 1		
3	Define Production cost of power generating stations?	Understand	This would require learner to understand the input-output characteristics of generators.	CO 1		
4	Write the expression for hourly loss of economy resulting from error in Incremental cost representation?	Remember	This would require the learner to recall the Incremental Cost and Understand, what is hourly loss of economy and the derive the expression for hourly loss of economy resulting from error in incremental cost representation.	CO 1		
5	Mention the assumptions made in the formation of loss formula using B coefficient matrix?	Remember	This would help the learner to simplify the calculations in a basic system.	CO 2		
6	Draw flow chart for economic scheduling without considering line losses.	Remember	This would help the learner to recall and develop the computer- based programs to get the solutions in the bulk network.	CO 2		
7	What is the role of spinning reserve in unit commitment?	Remember	This would require learner to recall the effect of spinning reserve during load sharing in emergency.	CO 1		

8	Write the equality and inequality constraints considered in the economic dispatch problem	Remember	This would require the learner to recall the concept of unit commitment and explain the role of spinning reserve in unit commitment.	CO 1
9	Define "Load Curve"?	Remember	This would require learner to recall the load patterns over a period.	CO 1
10	Explain the long-term hydrothermal scheduling?	Remember	This would require the learner to recall the concept of hydrothermal scheduling and its classification then explain what long-term Hydrothermal scheduling is.	CO 1
11	What are the advantages of using forward dynamic programming method?	Remember	This would require learner to recall the static optimization problem for load scheduling.	CO 2
12	Write the relationship between $\lambda$ and power demand when the cost curve is given?	Remember	This would help the learners to develop coordination equation in generating stations.	CO 2
13	Explain the penalty factor?	Understand	This would help the learners to understand the penalties imbibed.	CO 2
14	Compare with unit commitment and economic load dispatch?	Understand	This would require learner to understand the concept of optimization with respect to load flows and economics.	CO 1
15	What is the purpose of economic dispatch?	Remember	This would require the learner to recall the concept of economic dispatch and its importance in thermal stations.	CO 1
16	What is meant by total generator operating cost?	Understand	This would require the learner to recall the concept of transmission loss formula and solve B- Coefficients.	CO 1
17	What are the factors affecting the cost of generation (or) list the various constraints in the modern power systems?	Remember	This would require the learner to recall the concept of economic dispatch & the factors influencing the cost. It is also discussed various equality and inequality constraints.	CO 1
18	How is incremental operating cost related to economic dispatch?	Remember	This would require the learner to recall the concept of the economic dispatch problem and explain the equality and inequality constraints of static optimization problem.	CO 1
	Part - B (Long	Answer Que	stions)	
1	Describe in detail, with suitable examples, the methods of optimum scheduling of generation of power from a thermal station.	Understand	This would require the learner to understand the concept of thermal station and discuss about the different methods of optimum scheduling of generation of thermal station.	CO 4

2	Derive transmission loss formula in terms of B-	Understand	This would require the learner to	CO 3
2	coefficients	Onderstand	understand the concept of	005
			transmission loss formula and	
			then derive the B-Coefficients.	
3	Explain in detail the terms production costs,	Understand	This would require the learner to	CO 4
5	total efficiency, efficiency, and incremental	Onderstand	understand the total efficiency,	00 4
	rates with respect to a thermal power plant.		efficiency, and incremental rates	
	rates with respect to a thermal power plant.		from input - output	
			characteristics of thermal	
			stations.	
4	Cive verious uses of general loss formula and	Understand		CO 3
4	Give various uses of general loss formula and	Understand	This would require the learner to	005
	state the assumptions made for calculating B coefficients.		understand the concept of transmission loss formula with	
	coefficients.			
			B-Coefficients and the	
			assumptions in terms of X/R	
			ratios.	~~ (
5	Give step by step procedure for computing	Understand	This would require the learner to	CO 4
	economic allocation of generation in a thermal		understand the economic	
	station.		dispatch of thermal generation	
			and then explain the complete	
			procedure of generation.	
6	What is the objective in economic load	Understand	This would require the learner to	CO 3
	scheduling? Describe the need for co-		understand the concept of	
	ordination of different power station.		economic load scheduling and	
			then explain the coordination of	
			different power station.	
7	Explain the $\lambda$ -iteration method for finding the	Understand	This would require the learner to	CO 3
	solution of economic dispatch including		understand economic load	
	transmission losses with a neat flow chart.		scheduling with transmission line	
			losses.	
8	What is mean by unit commitment problem?	Understand	This would require the learner to	CO 3
	Discuss a method for solving the same.		understand the concept of unit	
			commitment and explains load	
			scheduling among the generators.	
9	Explain the various factors to be considered in	Understand	This would require the learner to	CO 3
	allocating power generation to different power		understand the operation of	
	station s for optimum operation.		different plants and explain	
			allocating loads to different	
			power stations for optimum	
			operation.	
10	Give algorithm for economic allocation of	Understand	This would require the learner to	CO 4
	generation among generators of a thermal		understand the concept of	
	system considering transmission losses. Give		transmission loss formula and	
	steps for implementing this algorithm and also		develop algorithm for digital	
	derive necessary equations.		computations.	
11	Write a short note on	Understand	This would require the learner to	CO 3
	a) Inequality constraints and		understand the various inequality	
	b) Penalty function.		parameters and penalties	
			imbibed.	
12	What are the methods of scheduling power	Understand	This would require the learner to	CO 4
14	generation of steam plants? Explain their	Chaerbland	understand the concept of	UU T
	merits and demerits?		methods of scheduling power	
			generation of thermal plant and	
			explain with its merits and	
			demerits	
			ucilients	

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13	Discuss optimal power flow problems without and with inequality constraints. How are these	Understand	This would require the learner to understand the concept of the	CO 3
	problems solved?		economic dispatch problem and	
			then explain the equality and	
			inequality constraints	
14	Develop loss formula coefficients for a two-	Understand	This would require the learner to	CO 2
	plant system. State the assumption made?		understand the concept of losses	
			in transmission lines using B-	
			Coefficients with simplified	
			assumptions.	
15	Explain the problem of scheduling	Understand	This would require the learner to	CO 4
	hydrothermal power plants. What are the		understand the hydrothermal	
	constraints in the problem?		scheduling and its classification	
			and explain the scheduling of	
			load in hydrothermal stations.	
16	Explain the mathematical formulation of	Understand	This would require the learner to	CO 4
	optimal scheduling of hydrothermal system		understand the hydrothermal	
	with a typical example.		scheduling and its mathematical	
			models for optimal scheduling	
			with suitable examples.	
17	Derive general mathematical formulation of	Understand	This would require the learner to	CO 4
	long-term hydrothermal scheduling.		understand the hydrothermal	
			scheduling and its mathematical	
			models for optimal scheduling	
			with suitable examples.	
18	State what is meant by base and peak load	Understand	This would require the learner to	CO 4
	stations. Discuss the combined hydroelectric		understand the different load	
	and steam station operation.		patterns and the scheduling with	
			hydro stations in hydrothermal	
			systems.	
	Part - C (Problem Solving a			
1	Incremental fuel cost is Rs/MWhr for a plant of	Understand	This would require the learner to	CO 2
	two units. $dc1/dpg1 = 0.25 Pg1 + 40$ ; $dc2/dpg2$		understand economic operation	
	=0.3  Pg2 + 30  Assume that both the units are		of plant and recall the concept of	
	operating at all times and total load varies from		Incremental Cost. Apply the	
	40 MW to250 MW. How will the load be		formula to determine the fuel	
	shared for a load of 200 MW? What is the		cost as per coordination	
	corresponding value of plant incremental cost?		equation.	
	Also determine the saving in the fuel cost in			
	Rs/hr for one optimum scheduling of 250 MW			
	as compared to equal distribution of same load			
	between two plants.			
2	The fuel cost for a two-unit steam power plant	Understand	This would require the learner to	CO 2
	are given by		understand economic operation	
	$C1 = 0.1 P1^2 + 25 P1 + 1.6 Rupees/hour$		of plant and recall the	
	$C2 = 0.1 P_2^2 + 32 P2 + 2.1 Rupees/hour$		Coordination between different	
	Where p's are in megawatt. If there is an error		plants. Apply the formula to	
	of 1% in the representation of the input data,		determine the load sharing	
	and the loss in operating economy for a load of 250 MW.		among the power plants.	
3	A power System consists of two, 125 MW	Understand	This would require the learner to	CO 2
	units whose input cost data are represented by		understand economic operation	
	the equations:		of plant and recall the	
	$C1 = 0.04 P_1^2 + 22 P_1 + 800$ Rupees/hour		Coordination between different	

	$(20, 0.045 \text{ p}^2, 15 \text{ p}, 1000 \text{ p}, 4)$			
	$C2 = 0.045 P_2^2 + 15 P_2 + 1000 Rupees/hour$		plants. Apply the formula to	
	If the total received power $P_R = 200$ MW.		determine the load sharing	
	Determine the load sharing between units for		among the generating plants.	
	most economic operation.			
4	100 MW, 150 MW and 280 MW are the	Understand	This would require the learner to	CO 2
	ratings of three units located in a thermal		understand economic operation	
	power station. Their respective incremental		of plant and recall the	
	costs are given by the following equations:		Coordination between different	
	dc1/dp1 = Rs (0.15p1 + 12);		plants. Apply the formula to	
	dc3/dp3 = Rs (0.21p3 + 13)		determine the load sharing	
	dc2/dp2 = Rs (0.05p2 + 14)		among the generating plants.	
	Where P1, P2 and P3 are the loads in MW.			
	Determine the economical load allocation			
	between the three units, when the total load on			
	the station is 300 MW.			
5	The incremental fuel cost in rupees per MWhr	Understand	This would require the learner to	CO 2
5	for a plant consisting of two units are	Understand	understand economic operation	
	dC1/dPG1 = 0.20 PG1+40.0; dC2/dPG2 = 0.25		of plant and recall the	
1	PG2+30.0 Assume that both units are operating		Coordination between different	
	at all times and total load varies from 40 MW		plants. Apply the formula to	
	to 250 MW and maximum and minimum loads			
1	on each unit are to be 125 MW and 20MW		determine the load sharing among the generating plants.	
1			among the generating plants.	
	respectively .How will the load be shared			
	between the units as the system varies over full			
	range? What are the plant incremental costs?	** 1 1		<b>a</b> a <b>a</b>
6	The fuel inputs per hour of plants 1 and 2 are	Understand	This would require the learner to	CO 2
	given as		understand economic operation	
	$F1 = 0.2 P1^2 + 40 P1 + 120 Rs per hr.$		of plant and recall the	
	$F2 = 0.25 P_2^2 + 30 P2 + 150 Rs$ per hr.		Coordination between different	
	Determine the economic operating schedule		plants. Apply the formula to	
	and the corresponding cost of generation if the		determine the load sharing	
	maximum and minimum loading on each unit		among the generating plants.	
	is 100 MW and 25 MW, the demand is 180			
	MW and transmission losses are neglected. If			
	the load is equally shared by both the units,			
	determine the saving obtained by loading the			
	units as per the incremental production cost.			
7	Let us consider a generating station that	Understand	This would require the learner to	CO 3
	contains a total number of three generating		understand economic operation	
	units. The fuel costs of these units are given by		of plant and recall the	
	$F1 = (0.8/2) P_1^2 + 10 P_1 + 25 Rs./hr$		Coordination between different	
	$F2 = (0.7/2) P_2^2 + 5P_2 + 20 Rs./hr$		plants. Apply the formula to	
	$F3 = (0.95/2) \tilde{P}_3^2 + 15 P_3 + 35 Rs./hr$		determine the load sharing	
	The generation limits of the units are 30 MW		among the generating plants.	
	<= P1 <= 500 MW, 30 MW <= P2 <= 500			
	MW and $30 \text{ MW} \le P3 \le 250 \text{ MW}.$			
	The total load that these units supply varies			
	between 90 MW and 1250 MW. Assuming that			
	all the three units are operational all the time,			
	Compute the economic operating settings as			
	the load changes.			
8	Consider two generating plant with same fuel	Understand	This would require the learner to	CO 2
0	cost and generation limits. These are given by	Understand	understand economic operation	
	$F1 = (0.8/2) Pi^2 + 10 Pi + 25 Rs/hr; i = 1,2 and$		of plant and recall the	
	$\Gamma 1 = (0.8/2) \Gamma 1 + 10 \Gamma 1 + 23 \text{ Ks/m}, \Gamma = 1,2 \text{ and}$ 100MW <= Pi <=500 MW		Coordination between different	
1			Coordination between different	

Prof a particular time of a year, the total total in a day varies as shown in Fig. 52. Also an additional cost of Rs. 5,000 is incurred by switching of a unit during the off-peak hours and switching if back on during the direk hours and switching in back on during the direk hours and mine dating on each unit is 100 MW and transmission losses are neglected. If the load is equal incremental products and cost.Understand tonderstand conomic operation of plant and recall the Coordination between different plants. Apply the formula to determine the load sharing among the generating plants.CO 2 tonderstand conseponding cost of generation if the max anong the generating plants.CO 2 tonderstand contenderstand conomic operation of plant and recall the Coordination between different plants. Apply the formula to determine the load sharing among the generating plants.CO 2 tonderstand conomic operation of plant and recall the Coordination between different plants. Apply the formula to determine the load sharing among the generating plants.CO 3 tonderstand conomic operation of plant and recall the Coordination between different plants. Apply the formula to determine the load sharing among the generating plants.CO 3 tonderstand conomic operation of plant and recall the Coordination between different plants. Apply the formula to deter		For a particular time of a man the total load in		alarta Analy the fermina to	
additional cost of Rs. 5,000 is incurred by switching it back on during the diverse hours and switching it back on during the during the peak hours. We have to determine whether it is economical to have both units operational all the imeamong the generating plants.9The fuel inserts per all of plants I and II are given as $F_1 = 0.1P_1^2 + 40 P_1 + 120 R_s/Hr$ $F_2 = 0.2P_2^2 - 30P_2 + 150 R_s/Hr. Determine thecorresponding cost of generation if the maxand min loading on each unit is 100 MW andtransmission poset in some hum its in 100 MW andtransmission plants are given byfind the loss formula co-efficients inreciprocal MW?Understandthe load istequality back of the board istequality back of the board is a set in 100 V/A, whatwill be the magnitudes of B -coefficients inreciprocal MW?Understandthe load istequality of the load istequality back of the coefficients inreciprocal MW?Understandtermine thetequalities of B -coefficients inreciprocal MW?Understandtermine thetermine the load sharingamong the generating plants.CO 3to 0.02 Atermine the load sharingamong the generating plants.CO 3termine the load sharingamong the generating plants.11The fuel cost functions in Rs/hr for twot$		For a particular time of a year, the total load in		plants. Apply the formula to	
switching of a unit during the off-peak hours and switching it back on during the during the peak hours. We have to determine whether it is economical to have both units operational all the time 9 The fuel inserts per all of plants I and II are given as $F_1=0.1P_1 + 40 P_1 + 120 Rs/Hr$ $F_2=0.2SP_2^2 + 30P_2 + 150 Rs/Hr$ . Determine the economic operating schedule and corresponding cost of generation if the max and min loading on each unit is 100 MW and 25 MW and the demand is 180 MW and transmission losses are neglected. If the load is equall system 3b whe both the units, determine the saving obtained by loading the units as per equal incremental products and cost. I For the system 3bown in figure, with bus I as reference bus with a voltage of 1.0V < 0 <sup>0</sup> pu, find the loss formula co-efficient if the branch currents and impedances are: Ia=1.00+j0.15 pu; Za=0.02+j0.15 pu, I, B=-1.25+j0.20 pu; Zb=0.03+j0.25pu, L = 0.20-j0.05pu; Zc =0.02+0.25pu II the base is 100 MV A, what will be the magnitudes of B -coefficients in reciprocal MW? $f_{nerth} = \frac{c}{\sqrt{1-1}} + \frac{c}{1-1$				0	
and switching it back on during the during the peak hours. We have to determine whether it is economical to have both units operational all the timeUnderstandCO 39The fuel inserts per all of plants I and II are given as $F_i = 0.1P^2_i + 40 P_i + 120 Rs/Hr.$ $F_z = 0.25P^2_z + 30 P_z + 150 Rs/Hr.$ Determine the coornomic operation generation if the max and min loading on each unit is 100 MW and transmission losses are neglected. If the load is equally shared by the both the units, determine the saving obtained by loading the units as per equal incremental products and cost.Understand UnderstandThis would require the learner to understand conomic operation of plant and recall the Coordination between different plants. Apply the formula to determine the load sharing among the generating plants.CO 210For the system shown in figure, with bus 1 as reference bus with a voltage of 1.0V4, what will be the magnitudes of B – coefficients in reciprocal MW?Understand thermal plants are given by the cost functions in Rs/hr for two thermal plants are given by the expression Pi(p,u) = 0.0346P^2(p,u) -0.0048P_2; C,=350+8.5P_{+}0.0029P_2; Where P1, P2 are in MW. Determine the optimal scheduling of generation if the load is 640.82 MW. Fistimate value of $A^{-1}$ Rs/MWhr. The transmission power loss is given by the expression Pi(p,u) = 0.0346P^2(p,u) -0.0048P_2;-16 Rs/hr. The loss coefficients are given as B_1=0.0015/MW. B_{12}= 0.00023 /MW Gr.422 Sky(MWr, B_{12}= 0.0015/MW, B_{12}= 0.00023 /MW Gr.422 Sky(MWr, Find the real power generations, total load demand, and the transmission power loss.Understand Understand This would require the learner to understand conomic operation of plant and recall the Coordination between different		•		among the generating plants.	
peak hours. We have to determine whether it is economical to have both units operational all the timeUnderstandThis would require the learner to understand economic operation of plant and recall the Coordination between different plants. Apply the formula to determine the load sharing among the generation if filer max and min loading on each unit is 100 MW and transmission losses are neglected. If the load is equally shared by loading the units, determine the system shown in figure, with bus 1 as reference bus with a voltage of $1.0V < 0^6$ pu, find the loss formula co-efficient if the branch currents and impedances are: la=1.00 ij 0.15 p.u; Za=0.02+10.15 p.u. (b=1.25+j0.20 p.u; Zb=-0.03+j0.25 pu. (b= 2.02-0).05 pu.; Zc = 0.02+0.25 pu If the base is 100 MV A, what will be the magnitudes of B - coefficients in reciprocal MW?Understand the system shown in figure, with was the system shown in figure, with was the system shown in figure, with was thermal plants are given by the system shown in figure, with was thermal plants are given by the case are: la=1.00 ij 0.15 p.u; Za=0.02+0.25 pu If the base is 100 MV A, what will be the magnitudes of B - coefficients in reciprocal MW?Understand the system shown in figure, with was thermal plants are given by the case are is allowed by the operation of plant and recall the Coordination between different plants. Apply the formula to determine the load sharing among the generating plants.CO 311The fuel cost functions in Rs/hr for two thermal plants are given by the case df (-12 Rs/MWh. The transmission power loss is given by the expression P(t, p.1) = 0.00450 <sup>4</sup> (p.1) 0.00430 <sup>4</sup> (p.1) 0.004					
e comomical to have both units operational all the timeUnderstandThis would require the learner to understand economic operation of plant and recall the Coordination between different plants. Apply the formula to determine the saving obtained by hading the units as per equal incremental products and cost.CO 310For the system shown in figure, with bus 1 as reference bus with a voltage of 1.0×0 <sup>4</sup> 0 <sup>4</sup> µ.Understand transmission losses are neglected. If the load is reference bus with a voltage of 1.0×0 <sup>4</sup> 0 <sup>4</sup> µ.Understand transmission losses are neglected. If the load is determine the saving obtained by loading the units as per equal incremental products and cost.Understand to determine the coordination between different plants. Apply the formula to determine the load sharing among the generating plants.CO 211The fuel cost functions in Rs/hr for two thermal plants are given by C, =320+9.2P.10.000PP_2; t_us_1					
the timenumber of the three degree of the part of plants 1 and II are given as $F_1 = 0.1P_1^2 + 40 P_1 + 120 Rs/Hr$ $F_2 = 0.2P_1^2 + 30 P_1 + 120 Rs/HrF_2 = 0.2P_1^2 + 30 P_1 + 120 Rs/Hrthe saving obtained by loading the units as perequal incremental products and cost.Understandthe conduct of the board isequally shared by the both the units, determinethe saving obtained by loading the units as perequal incremental products and cost.UnderstandThis would require the learner tounderstand economic operationof plant and recall theCoordination between differentplants. Apply the formula todetermine the load sharingamong the generating plants.CO 210For the system shown in figure, with bus 1 asreference bus with a voltage of 1.0V <00 pu,find the loss formula co-efficients ifthe branch induces are: la=1.00+0.15pu, Lz=0.02+0.10 25pu, lb=1.25+0.10 20, pu,L=0.20+0.05 pu, lb=1.25+0.10 20, pu,L=0.20+0.02 25pu, lb=0.02+0.25pu formula toedeficients inreciprocal MW?UnderstandThis would require the learner tounderstand economic operationof plant and recall theCoordination between differentplants. Apply the formula todetermine the load sharingamong the generating plants.CO 311The fuel cost functions in RS/hr for twothermal plants are given byQ_1=40.004P_2;C_2=30+8.5P_+0.002P_2;C_2=30+8.5P_+0.002P_2;C_2=30+8.5P_+0.004P_2;C_2=30+8.5P_+0.004F_2;C_2=30+8.5P_+0.004F_2;C_2=30+8.5P_+0.004F_2;C_2=30+8.5P_+0.004F_2;C_2=30+8.5P_+0.004F_2;C_2=30+8.5P_+0.004F_2;C_2=30+8.5P_+0.004F_2;C_2=30+8.5P_+0.004F_2;C_2=30+8.5P_+0.004F_2;$		peak hours. We have to determine whether it is			
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given as $F_{=} 0.1P_{1}^{2} + 40 P_{1} + 120 Rs/HrF_{=} 0.2P_{2}^{2} + 30P_{2} + 150 Rs/Hr. Determine theeconomic operation schedule andcorresponding cost of generation if the maxand min loading on each unit is 100 MW and25 MW and the demand is 180 MW andtransmission losses are neglected. If the load isequally shared by the both the units, determine thesaving obtained by loading the units as perequal incremental products and cost.UnderstandUnderstandCoordination between differentplants. Apply the formula todetermine the load sharingamong the generating plants.CO 210For the system shown in figure, with bus 1 asreference bus with a voltage of 1.0V p.u; Za=0.02+i0.15 p. u, b=1.25+i0.20 p.u;Za=0.02+i0.15 p.u, b=1.25+i0.20 p.u;Za=0.02+i0.15 p.u, b=1.25+i0.20 p.u;Za=0.02+i0.15 p.u; b=1.25+i0.20 p.u;Law 4UnderstandThis would require the learner tounderstand economic operationof plant and recall theCoordination between differentplants. Apply the formula todetermine the load sharingamong the generating plants.CO 211The fuel cost functions in Rs/hr for twothermal plants are given byC_1=420+9.2P_{+0.004P_2^{-1};C_2=350+8.5P_{+0.0029P_2^{-2}}Whiter P1, P2 are in MW. Determine theoptimal scheduling of generation if the load is640.82 MW. Estimate value of A=12Rs/MWhr. The transmission power loss isgiven by the expression Pi_{(p,u)}UnderstandThis would require the learner tounderstand economic operationof plant and recall theCoordination between differentplants. Apply the formula todetermine the load sharingamong the generating plants.CO 311The fuel cost functions in Rs/hr for twothermal plants are given byC_1=350+8.5P_{+1}(0.0029P_2)$					
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Image: Sec: Sec: Sec: Sec: Sec: Sec: Sec: Se		$F_1 = 0.1P_1^2 + 40 P_1 + 120 Rs/Hr$		of plant and recall the	
conomic operating schedule and corresponding cost of generation if the max and min loading on each unit is 100 MW and 25 MW and the demand is 180 MW and transmission losses are neglected. If the load is equally shared by the both the units, determine the saving obtained by loading the units as per equal incremental products and cost.Understand10For the system shown in figure, with bus 1 as reference bus with a voltage of $1.0V \times 0^9$ pu, find the loss formula co-efficient if the branch currents and impedances are: 1a=1.00+j0.15 p.u; Za=0.02+j0.15 p.u, Ib=1.25+j0.20 p.u; Zb=-0.03+j0.25pu, I the base is 100 MVA, what will be the magnitudes of B - coefficients in reciprocal MW?UnderstandThis would require the learner to understand economic operation of plant and recall the Coordination between different plants. Apply the formula to determine the load sharing among the generating plants.CO 311The fuel cost functions in Rs/hr for two thermal plants are given by C, $-420+9.2P_{1+0.004P_{2,2}^{+2}$ . C $2=350+8.5P_{2}+0.0029P_{2}^{+2}$ . Where P1, P2 are in MW. Determine the optimal scheduling of generation if the load is 640.82 MW. Estimate value of $\Lambda = 12$ Rs/MWhr. The transmission power loss is given by the expression P(n_0) $= 0.0346P_1^{+}(p.u) + 0.00643P_3(p.u)$ Understand the swidt require the learner to understand economic operation of plant and recall the Coordination between different plants. Apply the formula to determine the load sharing among the generating plants.CO 311The loss coefficients are given as B_1=0.0015/NW, B_{12}=-0.00004' MW, B_{22}= 0.0032' MW for $\Lambda = 23$ Rs/MWhr. Find the real power generations, total load demand, and the transmission power loss.UnderstandThis would r		$F_2 = 0.25P_2^2 + 30P_2 + 150$ Rs/Hr. Determine the		Coordination between different	
corresponding cost of generation if the max and min loading on each unit is 100 MW and 25 MW and the demand is 180 MW and transmission losses are neglected. If the load is equally shared by the both the units, determine the saving obtained by loading the units as per equal incremental products and cost.determine the load sharing among the generating plants.10For the system shown in figure, with bus 1 as reference bus with a voltage of $1.0V < 0^{9}$ pu, find the loss formula co-efficient if the branch currents and impedances are: $1a=1.00+j0.15$ p. u; $2a=0.02+j0.15$ p. u, $1b=1.25+j0.20$ p. u; $2b=0.03+j0.25$ pu, $1b=2.25+j0.20$ p. u; $2b=0.03+j0.25$ pu, $1b=2.25+j0.20$ p. u; $2b=0.03+j0.25$ pu if the base is 100 MVA, what will be the magnitudes of B -coefficients in reciprocal MW?UnderstandThis would require the learner to understand economic operation of plant and recall the Coordination between different plants. Apply the formula to determine the load sharing among the generating plants.CO 311The fuel cost functions in Rs/hr for two thermal plants are given by $C_1 = 420+9.2P_1+0.004P_2^{2};$ $C_2=350+8.5P_2+0.0029P_2^{2};$ Where P1, P2 are in MW. Determine the optimal scheduling of generation if the load is $640.82$ MW. Estimate value of $A=12$ Rs/MWhr. The transmission power loss is given by the expression $P_1(p,u)$ $=0.0346P_1(p,u) + 0.00643P_2(p,u)$ Understand $2(-2d_{P2}=-0.02R_2+16$ Rs/hr. The loss coefficients are given as $B_{11}=0.0015/MW$ , $B_{12}=-0.0004/MW$ , $B_{22}=$ $0.0032/MW for A=25 Rs/MWhr. Find the realpower generations, total load demand, and thetransmission power loss.Understand2n = 0.00346P_1(p,u) + 0.00043P_2(p,u)CO 32n = 0.0032/MW for A=25 Rs/MWhr. Find the realpower generations, sto$				plants. Apply the formula to	
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25 MW and the demand is 180 MW and transmission losses are neglected. If the load is equally shared by the both the units, determine the saving obtained by loading the units as per equal incremental products and cost.CO 210For the system shown in figure, with bus 1 as reference bus with a voltage of $1.0V < 0^{\circ}$ pu, find the loss formula co-efficient if the branch currents and impedances are: 1a=1.00+j0.15 p.u; Za=0.02+j0.15 p.u, th=1.25+j0.20 p.u; Zb=0.3+j0.25pu; It he base is 100 MVA, what will be the magnitudes of B – coefficients in reciprocal MW?UnderstandThis would require the learner to understand economic operation of plant and recall the Coordination between different plants. Apply the formula to determine the load sharing among the generating plants.CO 311The fuel cost functions in Rs/hr for two thermal plants are given by CC = 350+8.5P_{2}+0.002PP_2^{2}; C = 350+8.5P_{2}+0.002PP_2^{2}; Where P1, P2 are in MW. Determine the optimal scheduling of generation if the load is 640.82 MW. Estimate value of $\lambda = 12$ Rs/MWhr. The transmission power loss is given by the expression $P_{1}(p, u)$ = 0.0346P <sup>2</sup> (p, u) + 0.0048P <sup>2</sup> , (p, u)Understand economic operation of plant and recall the Coordination between different plants. Apply the formula to determine the load sharing among the generating plants.CO 312The IFC for two plants are Gl/dP_{0}=0.075 Pg]+18 Rs/hr, dC2/dP_{02=}= 0.008P_{02}+16 Rs/hr. The loss coefficients are given as B_{11=0.0015/MW, B_{12}=-0.00040/MW, B_{22}= 0.0032/1MW for $\lambda = 25$ Rs/MWhr. Find the real power generations, total load demand, and the transmission power loss.Understand economic operation of plant and recall the Coordination between different plants. Apply				0	
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equally shared by the both the units, determine the saving obtained by loading the units as per equal incremental products and cost.CO 210For the system shown in figure, with bus 1 as reference bus with a voltage of $1.0^{V < 0^6}$ pu, find the loss formula co-efficient if the branch currents and impedances are: 1a=1.00+j0.15 p.u; Za=0.02+j0.15 p.u, Ib=1.25+j0.20 p.u; Zb=0.03+j0.25pu, Ic = 0.20-j0.05pu; Zc = 0.02+0.25pu If the base is 100 MVA, what will be the magnitudes of B -coefficients in reciprocal MW?Understand centre the load sharing among the generating plants.CO 211The fuel cost functions in Rs/hr for two thermal plants are given by C <sub>1</sub> = 420+9.2P <sub>1</sub> +0.004P <sup>2</sup> <sub>2</sub> ; C <sub>2</sub> =350+8.5P <sub>2</sub> +0.0029P <sup>2</sup> <sub>2</sub> ; Where P1, P2 are in MW. Determine the optimal scheduling of generation if the load is 640.82 MW. Estimate value of $A=12$ Rs/MWhr. The transmission power loss is given by the expression P <sub>1</sub> (p.u) = 0.0032/ MW for $A=25$ Rs/MWhr. Find the real power generation, stotal load demand, and the transmission power loss.Understand the real the Coordination between different plants. Apply the formula to determine the load sharing among the generating plants.CO 312The IPC for two plants are $4Cl/dP_{G1}=0.075$ Pg1+18 Rs/hr, $4C2/dP_{G2}=0.08P_{G2}+16$ Rs/hr. The loss coefficients are given as B <sub>11</sub> =-0.00015/MW, B <sub>125</sub> =-0.00004/MW, B <sub>22</sub> = 0.0032/ MW for $A=25$ Rs/MWhr. Find the real power generation, stotal load demand, and the transmission power loss.Understand the real generating plants.CO 313A system consists of two power plantsUnderstand This would require the learner to to determine the load sharing among the generating plants.					
the saving obtained by loading the units as per equal incremental products and cost.10For the system shown in figure, with bus 1 as reference bus with a voltage of $1.0V < 0^0$ pu, find the loss formula co-efficient if the branch currents and impedances are: Ia=1.00-ij0.15 p.u; Za=0.02+j0.15 p.u, Ic=0.20-j0.05pu; Zc = 0.02+0.25pu, Ic=0.20-j0.05pu; Zc = 0.02+0.25pu If the base is 100 MVA, what will be the magnitudes of B -coefficients in reciprocal MW?UnderstandThis would require the learner to understand economic operation of plant and recall the Coordination between different plants. Apply the formula to determine the load sharing among the generating plants.CO 211The fuel cost functions in Rs/hr for two thermal plants are given by C_1=420+9.2P_1+0.004P_2; C_2=350+8.5P_2+0.0029P_2 Where P1, P2 are in MW. Determine the optimal scheduling of generation if the load is 640.82 MW. Estimate value of $A=12$ Rs/MWhr. The transmission power loss is given by the expression P_1(p.u) =0.00346P^2(p.u) +0.00643P^2_2(p.u)Understand UnderstandThis would require the learner to understand economic operation of plant and recall the Coordination between different plants. Apply the formula to determine the load sharing among the generating plants.CO 311The fuel cost functions in Rs/hr for two thermal plants are given by C_2=350+8.5P_2+0.0043P^2_2(p.u)UnderstandThis would require the learner to understand economic operation of plant and recall the Coordination between different plants. Apply the formula to determine the load sharing among the generation genetion of plant and recall the Coordination between different plants. Apply the formula to determine the load sharing among the		e			
equal incremental products and cost.       Image: constraint of the system shown in figure, with bus 1 as reference bus with a voltage of 1.0V <0 <sup>0</sup> pu, find the loss formula co-efficient if the branch currents and impedances are: Ia=1.00+j0.15 p.u; Za=0.02+j0.15 p.u, Ib=1.25+j0.20 p.u; Zz = 0.02+0.25pu If the base is 100 MVA, what will be the magnitudes of B -coefficients in reciprocal MW?       Understand       This would require the learner to understand economic operation of plant and recall the Coordination between different plants. Apply the formula to determine the load sharing among the generating plants.       CO 3         11       The fuel cost functions in Rs/hr for two thermal plants are given by C <sub>1</sub> = 420+9.2P <sub>1</sub> +0.004P <sup>2</sup> <sub>2</sub> ; C <sub>2</sub> = 350+8.5P <sub>1</sub> +0.002P <sup>2</sup> <sub>2</sub> ; Where P1, P2 are in MW. Determine the optimal scheduling of generation if the load is 640.82 MW. Estimate value of <i>f</i> =12 Rs/MWhr. The transmission power loss is given by the expression P <sub>1</sub> (p.u) = 0.0346P <sup>2</sup> <sub>1</sub> (p.u) + 0.00643P <sub>2</sub> (p.nu)       Understand       This would require the learner to understand economic operation of plant and recall the Coordination between different plants. Apply the formula to determine the load sharing among the generating plants.       CO 3         11       The fuel cost functions in Rs/hr for two thermal plants are given by the expression P <sub>1</sub> (p.u) = -0.0346P <sup>2</sup> <sub>1</sub> (p.u) + 0.00643P <sub>2</sub> (p.u)       Understand       This would require the learner to understand economic operation of plant and recall the Coordination between different plants. Apply the formula to determine the load sharing among the generating plants.         11       The fuel cost functions are given as B <sub>1</sub> = -0.0015/MW for <i>k</i> =25 Rs/MWhr. Find the real power generations, total load demand, and the transmission power loss. <t< td=""><td></td><td></td><td></td><td></td><td></td></t<>					
10For the system shown in figure, with bus 1 as reference bus with a voltage of $1.0 \times 0^0$ pu, find the loss formula co-efficient if the branch currents and impedances are: $la=1.00+i0.15$ p.u; $Za=0.02+j0.15$ p.u, $lb=2.25+j0.20$ p.u; $Zb=0.03+j0.25$ pu, $lc=0.20-j0.05$ pu, $Zc$ $=0.02+0.25$ pu If the base is 100 MVA, what will be the magnitudes of B -coefficients in reciprocal MW?UnderstandThis would require the learner to understand economic operation of plant and recall the Coordination between different plants. Apply the formula to determine the load sharing among the generating plants.CO 311The fuel cost functions in Rs/hr for two thermal plants are given by $C_1 = 420+9.2P_1+0.004P^2_2;$ $C_2=350+8.5P_2+0.0029P^2_2$ Where P1, P2 are in MW. Determine the optimal scheduling of generation if the load is $640.82$ MW. Estimate value of $\pounds = 12$ Rs/MWhr. The transmission power loss is given by the expression $P_1(p.u)$ $= 0.0346P^1_1(p.u) + 0.00643P^2_1(p.u)$ UnderstandThis would require the learner to understand economic operation of plant and recall the Coordination between different plants. Apply the formula to determine the load sharing among the generating plants.CO 312The IFC for two plants are dC <sub>1</sub> /dP <sub>G1</sub> =0.075 Pg1+18 Rs/hr; dC2/dP <sub>G2</sub> =0.08P <sub>G2</sub> +16 Rs/hr. The loss coefficients are given as B <sub>11</sub> =0.0015/MW, B <sub>12</sub> = -0.00004/ MW, B <sub>22</sub> = 0.0032/ MW for $\pounds = 25$ Rs/MWhr. Find the real power generations, total load demand, and the transmission power loss.UnderstandThis would require the learner to understand economic operation of plant and recall the Coordination between different plants. Apply the formula to determine the load sharing among the generating plants.13A sys					
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Pg1+18 Rs/hr; $dC2/dP_{G2}=0.08P_{G2}+16$ Rs/hr. The loss coefficients are given as B11=0.0015/MW, B12= -0.00004/ MW, B22 = 0.0032/ MW for $\lambda=25$ Rs/MWhr. Find the real power generations, total load demand, and the transmission power loss.understand economic operation of plant and recall the Coordination between different plants. Apply the formula to determine the load sharing among the generating plants.13A system consists of two power plantsUnderstandThis would require the learner toCO 3			<b>.</b>		<i>a a a</i>
The loss coefficients are given as $B_{11}=0.0015/MW$ , $B_{12}= -0.00004/MW$ , $B_{22} =$ $0.0032/MW$ for $\hbar=25$ Rs/MWhr. Find the real power generations, total load demand, and the transmission power loss.of plant and recall the Coordination between different plants. Apply the formula to determine the load sharing among the generating plants.13A system consists of two power plantsUnderstandThis would require the learner toCO 3	12		Understand		CO 3
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transmission power loss.among the generating plants.13A system consists of two power plantsUnderstandThis would require the learner toCO 3					
13A system consists of two power plantsUnderstandThis would require the learner toCO 3				-	
		transmission power loss.		among the generating plants.	
connected by a transmission line. The total understand economic operation	13	A system consists of two power plants	Understand	This would require the learner to	CO 3
		connected by a transmission line. The total		understand economic operation	

14	load located at a plant-2 is as shown in below. Data of evaluating loss coefficients consists of information that a power transfer of 100 MW from station-1 to station-2 results in a total loss of 8 MW. Find the required generation at each station and power received by the load when $\Lambda$ of the system is Rs. 100/MWhr. The IFCs of the two plants are given by dC <sub>1</sub> /dP <sub>G1</sub> =0.12P <sub>G1</sub> +65 Rs/MWhr; dC <sub>2</sub> /dP <sub>G2</sub> =0.25P <sub>G2</sub> +75 Rs/MWhr Determine the incremental cost of received power and the penalty factor of the plant shown, if the incremental cost of production is dC <sub>1</sub> /dP <sub>G1</sub> =0.1P <sub>G1</sub> + 3.0 Rs/MWhr.	Understand	of plant and recall the Coordination between different plants. Apply the formula to determine the load sharing among the generating plants. This would require the learner to understand economic operation of plant and recall the Coordination between different plants. Apply the formula to determine the load sharing among the generating plants.	CO 3
15	Assume that the fuel input in Btu per hour for units 1 and 2 are given by $C_1=(8P_{G1}+0.024P_{G2}^2+80)10^{6};$ $C_2=(6P_{G2}+0.04P_{G2}^2+120)10^{6}$ The maximum and min loads on the units are 100 and 10 MW, respectively. Determine the min cost of generation when the following load is supplied. The cost of fuel is Rs.2 per million Btu.	Understand	This would require the learner to understand economic operation of plant and recall the Coordination between different plants. Apply the formula to determine the load sharing among the generating plants.	CO 2
17	Two power plants are connected together by a transmission line and load at plant-2. When 100 MW is transmitted from plant-1, the transmission loss is 100 MW. The cost characteristics of two plants are $C_1 = 0.05P_{G1}^2+13P_{G1}$ ; $C_2=0.06P_{G2}^2+12P_{G2}$ Find the optimum generation for $\lambda=22$ , $\lambda=25$ and $\lambda=30$ .	Understand	This would require the learner to understand economic operation of plant and recall the Coordination between different plants. Apply the formula to determine the load sharing among the generating plants.	CO 2
18	A two-plant hydro-thermal system with negligible losses has the following characteristics. Fuel cost as a function of active power generated at the thermal plant is $F = (2p_1+0.01p_2^2)$ RS/hr. The optimal water conversion co-efficient is found to be 12.01RS/MCF. The load on the system is Duration (b) 9 15 PD (MW) 700 350 Compute the optimal active thermal and hydro power generations (in MW) in each of the subintervals and the allowable volume of water at the hydro plant	Understand	This would require the learner to understand economic operation of plant and recall the Coordination between different plants. Apply the formula to determine the load sharing among the generating plants.	CO 4
		UNIT-II		
	MODELING OF GOVERNOR, TU		EXCITATION SYSTEMS	
	Part – A (Short			
1	Distinguish D.C excitation system and A.C excitation system.	Understand	This would require the learner to understand the concept of DC	CO 6

			and AC avaitation system	
			and AC excitation system.	
			Distinguish DC excitation system and AC excitation system	
2	What are the equations governing the	Understand	This would require the learner to	CO 5
Z	What are the equations governing the	Understand	<b>_</b>	005
	movement of point C in "speed governor mechanism"?		understand the working of speed	
			governing system and develop mathematical model of it.	
2	What are the equations conversions the	I In danatan d		CO 5
3	What are the equations governing the	Understand	This would require the learner to	CO 5
	movement of point D (i.e. hydraulic amplifier)?		understand the working of speed governing system and develop	
			mathematical model of it.	
4	Briefly explain the movement of point E (i.e.,	Understand	This would require the learner to	CO 5
4	open or close the valve)	Understand	understand the working of speed	005
	open of close the valve)		governing system and develop	
			mathematical model of it.	
5	Define inertia constant	Remember	This would require the learner to	CO 5
5	Define mertia constant	Remember	Recall the concept of inertia	005
			constant which will be useful for	
			droop characteristics.	
6	State any two necessities to put alternators in	Understand	This would require the learner to	CO 5
0	parallel	Onderstand	understand the concept of	005
	puruner		parallel operation, this will help	
			them for the analysis of droop	
			characteristics.	
7	Give two conditions for proper synchronizing	Remember	This would require the learner to	CO 5
,	of alternators	Remember	understand the concept of	005
			parallel operation, this will help	
			them for the analysis of droop	
			characteristics.	
9	Compare speed Governor and speed changer.	Understand	This would require the learner to	CO 5
			understand the working of speed	
			governing system and develop	
			mathematical model of it.	
10	What are the various functions of excitation	Understand	This would require the learner to	CO 6
	system?		understand the concept of exciter	
			and then explain the types with	
			its components.	
11	Generalize the importance of Generator	Remember	This would require the learner to	CO 6
	modeling?		recall the concept of AVR and	
			ALFC control loops of a	
			generator and distinguish AVR	
			and ALFC control loops of a	
			generator.	
12	Compute the importance of Exciter modeling?	Remember	This would require the learner to	CO 6
			recall the exciter and explain the	
			working principle of excitation	
			system with its modelling.	
13	Explain the importance of dynamic modeling	Understand	This would require the learner to	CO 2
	of generators?		understand the isolated power	
			system and analyse the dynamic	
			behavior of the system with step	
			input.	
14	Derive Small signal transfer function?	Understand	This would require the learner to	CO 5
			understand the incremental	
			variations in the power system	

			constraints. The sudden changes could be modelled as small	
			signal transfer function.	
15	What is the IEEE-I model?	Remember	This would require the learner to	CO 5
			recall the excitation system and	
			describe it with standard IEEE	
			type I model.	
16	Write transfer function of modeling of	Remember	This would require the learner to	CO 6
	excitation?		recall the excitation unit and	
			develop mathematical modeling.	
	Part - B (Lo	ong Answer Q		
1	Discuss the mechanical - hydraulic control and	Understand	This would require the learner to	CO 5
	electro - hydraulic control speed governing		understand the speed governing	
	system of steam turbine.		system of steam turbine. Also	
			explain the mechanical -	
			hydraulic control and electro –	
			hydraulic control in detail.	
2	Derive the transfer function of overall	Understand	This would require the learner to	CO 6
	excitation system?		understand the concept of	
			excitation system and the transfer	
			function of excitation system of	
			overall excitation system.	
3	Draw the block diagram of a power system	Understand	This would require the learner to	CO 5
_	showing the governor, turbine and		understand the concept of	
	Synchronous generator, indicating their transfer		governor, turbine and	
	functions for a step disturbance of PD.		synchronous generator and	
	I I I I I I I I I I I I I I I I I I I		understand their transfer	
			functions then the block diagram	
			for a step disturbance.	
4	Obtain the response of "increment in	Understand	This would require the learner to	CO 5
	frequency", make suitable assumptions.		understand the concept of	
	(a) Without proportional plus integral		increment in frequency and	
	controller and		discuss with and without	
	(b) With proportional plus integral control		proportional plus integral	
			controller.	
5	Explain the classifications of excitation	Understand	This would require the learner to	CO 6
	systems?		understand the concept of	
			excitation systems and explain	
			the classification.	
6	Explain the various components of a block	Understand	This would require the learner to	CO 6
	diagram representation of a general excitation		understand the concept of	
	system?		excitation systems explain the	
			operation and various	
			components.	
7	Explain the different types of limiters and their	Understand	This would require the learner to	CO 5
	role in speed- governing system modeling.		understand the concept of speed-	
			governing system modeling and	
			explain the different limiters with	
			its importance	
8	Explain the effect of varying excitation of a	Understand	This would require the learner to	CO 5
	synchronous generator?		understand the concept of	
	-		excitation and explain the effect	
			of varying excitation of a	
			synchronous generator.	

10	Derive the mathematical modeling of Speed	Understand	This would require the learner to	CO 5
10	governing system.	Understand	understand the concept of speed	05
	governing system.		governing system and derive the	
			mathematical modeling.	
11	Discuss the first order modeling of turbine with	Understand		CO 5
11	neat block diagram?	Understand	understand the concept of	05
			excitation systems and explain	
			the operation with neat diagram.	
12	Explain the methods of providing excitation	Understand	This would require the learner to	CO 6
12		Understand	understand the concept of	000
	systems.		excitation system and explain in	
			detail the necessity of it in the	
			alternators.	
13	Outline the fundamental characteristics of	Understand	This would require the learner to	CO 6
15		Understand	understand the fundamental	000
	excitation system?		characteristics of excitation unit	
			from the basic principles.	
	Part - C (Problem Solving a	nd Critical T	hinking Questions)	
1	Determine the primary ALFC loop parameters	Understand	This would require the learner to	CO 5
	for a control area with the following data: Total		understand the economic	
	generation capacity = $2500 \text{ MW}$		operation of plant and recall	
	Normal operating load =1500 MW		ALFC loop parameters. Apply	
	Inertia constant=5 kW-seconds per kVA; Load		those formulas to determine the	
	damping constant, B=1 %; frequency, f=50 Hz;		primary ALFC loop parameters	
	and Speed regulation, R=2.5 Hz / p.u MW.		in a control area.	
2	A 100 MVA Synchronous generator operates at	Understand	This would require the learner to	CO 5
	50 Hz, runs at 3000 rpm under no- load. A load		understand the economic	
	of 25 MW is suddenly applied to the machine.		operation of plant and recall	
	Due to the time lag in the governor system the		ALFC loop parameters. Apply	
	turbine commences to open after 0.6 sec.		those formulas to determine the	
	Assuming inertia constant H= 5 MW- sec per		primary ALFC loop parameters	
	MVA of generator capacity, calculate the		in a control area.	
	frequency of the system before steam own			
	commences to increase to meet the new load.			
3	Two generating stations 1 and 2 have full load	Understand	This would require the learner to	CO 5
	capacities of 200 MW and 100 MW		understand the speed governing	
	respectively at a generating frequency of 50		system and interconnected by an	
	Hz. The two stations are interconnected by an		induction motor. Apply those	
	induction motor and synchronous generator		formulas to determine load	
	with a full load capacity of 25 MW. The speed		shared by the motor-generator	
	regulation of station 1, station 2 and induction		set.	
	motor and synchronous generator sets are 4 %,			
	3.5% and 2.5% respectively. The load on			
	respective bus bars is 75 MW and 50 MW			
	respectively. Find the load taken by the motor			
	generator set.			
4	Two turbo alternators rated for 110 MW and	Understand	This would require the learner to	CO 5
			understand the speed governing	
	220 MW have governor drop characteristics of			
	5% from no load to full load. They are		system and interconnected by an	
	5% from no load to full load. They are		system and interconnected by an	
	5% from no load to full load. They are connected in parallel to share a load of 250		system and interconnected by an induction motor. Apply those	

5	Two generating stations 1 and 2 have full load capacities of 300 MW and 200 MW respectively at a generating frequency of 50 Hz. The two stations are interconnected by an induction motor and synchronous generator with a full load capacity of 50 MW. The speed regulation of station 1, station 2 and induction motor and synchronous generator sets are 45%, 4% and 3% respectively. The load on respective bus bars is 70 MW and 60 MW respectively. Find the load taken by the motor generator set.	Understand	This would require the learner to understand the speed governing system and interconnected by an induction motor. Apply those formulas to determine load shared by the motor-generator set.	CO 5
6	Two turbo alternators rated for 150 MW and 250 MW have governor drop characteristics of 8% from no load to full load. They are connected in parallel to share a load of 300 MW. Determine the load shared by each machine assuming free governor action.	Understand	This would require the learner to understand the speed governing system and interconnected by an induction motor. Apply those formulas to determine load shared by the motor-generator set.	CO 5
7	Two generators rated 200MW and 400MW are operating in parallel. Draw the characteristics of their governors are 4% and 5% respectively from no load to full load. Assuming that the generators are operating at 50 Hz at no load, how would a load of 600MW is shared between them? What will be the system frequency at this load, assume free governor operation, repeat the problem if both governors have drop of 4%.	Understand	This would require the learner to understand the speed governing system and interconnected by an induction motor. Apply those formulas to determine load shared by the motor-generator set.	CO 5
8	Two generators rated 400MW and 700MW are operating in parallel. Draw the characteristics of their governors are 6% and 8% respectively from no load to full load. Assuming that the generators are operating at 50 Hz at no load, how would a load of 900MW be shared between them? What will be the system frequency at this load, assume free governor operation, repeat the problem if both governors have drop of 7%.	Understand	This would require the learner to understand the speed governing system and interconnected by an induction motor. Apply those formulas to determine load shared by the motor-generator set.	CO 5
9	Determine the primary ALFC loop parameters for a control area with the following data: Total generation capacity = 3500 MW Normal operating load =2500 MW Inertia constant=25 kW-seconds per kVA; Load damping constant, B=2 %; frequency, f=50 Hz; and Speed regulation, R=3.5 Hz / p.u MW	Understand	This would require the learner to understand the speed governing system and interconnected by an induction motor. Apply those formulas to determine load shared by the motor-generator set.	CO 5
10	A 400 MVA Synchronous generator operates at 50 Hz, runs at 3000 rpm under no- load. A load of 50 MW is suddenly applied to the machine. Due to the time lag in the governor system the turbine commences to open after 0.6 sec. Assuming inertia constant $H=9$ MW- sec per MVA of generator capacity, calculate the	Understand	This would require the learner to understand the speed governing system and interconnected by an induction motor. Apply those formulas to determine load shared by the motor-generator set.	CO 5

	frequency of the system before steam own commences to increase to meet the new loa d.			
11	Two generating stations 1 and 2 have full lo ad capacities of 200 MW and 100 MW respectively at a generating frequency of 50 Hz. The two stations are interconnected by an induction motor and synchronous generator with a full load capacity of 25 MW. The speed regulation of station 1, station 2 and induction motor and synchronous generator sets are 4 %, 3.5% and 2.5% respectively. The load on respective bus bars is 75 MW and 50 MW respectively. Find the load taken by the motor generator set.	Understand	This would require the learner to understand the speed governing system and interconnected by an induction motor. Apply those formulas to determine load shared by the motor-generator set.	CO 5
12	Two turbo alternators rated for 110 MW and 220 MW have governor drop characteristics of 5% from no load to full load. They are connected in parallel to share a load of 250 MW. Determine the load shared by each machine assuming free governor action.	Understand	This would require the learner to understand the speed governing system and interconnected by an induction motor. Apply those formulas to determine load shared by the motor-generator set.	CO 5
13	Two generating stations 1 and 2 have full load capacities of 300 MW and 200 MW respectively at a generating frequency of 50 Hz. The two stations are interconnected by an induction motor and synchronous generator with a full load capacity of 50 MW. The speed regulation of station 1, station 2 and induction motor and synchronous generator sets are 45%, 4% and 3% respectively. The load on respective bus bars is 70 MW and 60 MW respectively. Find the load taken by the motor generator set.	Understand	This would require the learner to understand the speed governing system and interconnected by an induction motor. Apply those formulas to determine load shared by the motor-generator set.	CO 5
14	Two turbo alternators rated for 150 MW and 250 MW have governor drop characteristics of 8% from no load to full load. They are connected in parallel to share a load of 300 MW. Determine the load shared by each machine assuming free governor action.	Understand	This would require the learner to understand the speed governing system and interconnected by an induction motor. Apply those formulas to determine load shared by the motor-generator set.	CO 5
15	Two generators rated 200MW and 400MW are operating in parallel. Draw the characteristics of their governors are 4% and 5% respectively from no load to full load. Assuming that the generators are operating at 50 Hz at no load, how would a load of 600MW is shared between them? What will be the system frequency at this load, assume free governor operation, repeat the problem if both governors have drop of 4%.	Understand	This would require the learner to understand the speed governing system and interconnected by an induction motor. Apply those formulas to determine load shared by the motor-generator set.	CO 6
		UNIT -III		
	SINGLE AREA AND TWO AREA LO	DAD FREQU	ENCY CONTROL SYSTEMS	
	Part - A (Short	Answer Que	stions)	

1	Define control area.	Remember	This would require the learner to recall the concept of control area,	CO 7
2	Write Short notes on control area concept.	Remember	explain it in detail This would require the learner to recall the concept of control area	CO 7
			with the basic properties and explain it in detail.	
3	Write Short notes on area control error.	Understand	This would require the learner to understand the concept of static response and explain it in detail in coherent area.	CO 7
4	What is tie line bias control?	Remember	This would require the learner to recall the concept of line bias control and explain it in detail.	CO 7
5	Define the static response.	Remember	This would require the learner to recall the concept of static response and explain it in detail.	CO 7
6	What is the function of Load Frequency Control	Understand	This would require the learner to understand the concept of load frequency control and explain its function in LFC loop.	CO 7
7	Identify the purpose power factor primary ALFC?	Understand	This would require the learner to understand the concept of ALFC, also discuss its purpose for power factor in primary ALFC loop.	CO 7
8	List out the various needs for frequency regulation in power system.	Remember	This would require the learner to recall the importance of frequency as constant.	CO 7
9	List out the various methods of voltage control in transmission system?	Understand	This would require the learner to understand the concept of voltage control techniques and explain them in detail.	CO 7
10	Define single area system	Understand	This would require the learner to understand the concept of single area and explain it in detail.	CO 7
11	Write expression for steady state response of a load frequency controller with integral control	Understand	This would require the learner to understand the concept of load frequency controller and derive its expression for steady state response with integral control.	CO 7
12	What are the merits of proportional plus integral?	Remember	This would require the learner to recall the concept of proportional plus integral and discuss its merits.	CO 7
13	Define control variables?	Remember	This would require the learner to recall the concept of control variables.	CO 7
14	State the basic role of ALFC?	Understand	This would require the learner to recall the concept of ALFC and discuss its importance.	CO 7

15	Define steady state response??	Remember	This would require the learner to	CO 7
15	Define steady state response??	Kennennber	recall the concept of steady state	01
			response and discuss it in detail.	
16	List out the methods to keep the frequency	Remember	This would require the learner to	CO 7
10	constant.	Remember	recall the importance of	007
	constant.		frequency as constant.	
17	Compute the necessity of keeping the	Understand	This would require the learner to	CO 7
17	frequency constant in a power system	Chaerstand	understand the importance of	007
	frequency constant in a power system		frequency as constant.	
18	Define two Area load frequency control.	Remember	This would require the learner to	CO 7
10	Define two files fous frequency control.	itemenioer	recall the concept of two area	007
			and explain it in detail.	
19	Define dynamic response.	Remember	This would require the learner to	CO 7
			recall the concept of static	
			response and explain it in detail.	
20	Define pool operation?	Understand	This would require the learner to	CO 7
	FF		recall the concept of pool	
			operation and explain it in detail	
			with grid concept.	
	Part - B (Long	A new on Ouo		
	-	-		
1	Explain the state variable model of single area	Understand	This would require the learner to	CO 7
	load frequency controller with integral action.		understand the concept of single	
			area load frequency controller	
			and explain with its the state	
		** 1 . 1	variable model.	00 <b>7</b>
2	Discuss the importance of combined load	Understand	This would require the learner to	CO 7
	frequency control and economic dispatch		understand the concept of single	
	control with a neat block diagram		area load frequency controller,	
			economic dispatch control and	
2	Discuss in detail the dynamic memory of a	Understand	explain its importance.	
3	Discuss in detail the dynamic response of a single area system, without integral control	Understand	This would require the learner to understand the concept of single	
	following a step load disturbance		area load frequency controller	
	Tonowing a step toad disturbance		and derive the expression for	
			dynamic response with step	
			input.	
4	Define control area. Obtain the transfer	Understand	This would require the learner to	CO 7
-	function model and explain ALFC of a single	Understand	understand the concept of single	007
	area of an isolated power system.		area load frequency controller	
	area of an isofaced power system.		and economic dispatch control	
			and find transfer function.	
5	Describe the nature of the steady state response	Understand	This would require the learner to	CO 7
-	of the uncontrolled load frequency control of a		understand the concept of single	•
	single area?		area load frequency controller	
			with its steady state response.	
6	List out the basic requirements of a closed loop	Understand	This would require the learner to	CO 7
	control system employed for obtaining the		understand the concept of closed	
	frequency constant?		loop control system and discuss	
			the methods to obtain frequency	
			constant.	
7	With a neat block diagram explain the load	Understand	This would require the learner to	CO 7
	frequency control for a single area system.		understand the concept of turbo-	
	· - · ·		generator and discuss the	
		1	response of the system for a	

			sudden change in load demand.	
8	Draw and explain complete block diagram representation of single area having a turbo- generator supplying an isolated load for load frequency problem. Discuss the response of the system for a sudden change in load demand	Understand	This would require the learner to understand the concept of turbo- generator and discuss the response of the system for a sudden change in load demand by developing its mathematical model.	CO 7
9	Explain the importance of flat tie-line and flat frequency control	Understand	This would require the learner to understand the tie line bias control for droop and load sharing.	CO 7
10	List out the requirements of control strategy in integral control? Explain the role played by the controller's gain setting in the frequency control.	Understand	This would require the learner to understand the concept of frequency control and discuss control strategy in integral control.	CO 7
11	Obtain an expression for steady state response of a load frequency controller with integral control. How it is different from without integral control.	Understand	This would require the learner to understand the steady state response of a load frequency controller with integral control.	CO 7
12	Discuss the merits of proportional plus integral load frequency control of a system with a neat block diagram.	Understand	This would require the learner to understand the proportional plus integral load frequency control and discuss the merits.	CO 7
13	State briefly how the time response of the frequency error depends upon the gain setting of the integral control	Understand	This would require the learner to understand the frequency control and discuss control strategy in integral control to minimize the error in frequency.	CO 7
14	Draw the block diagram of load frequency control of two- area control systems with gain blocks	Understand	This would require the learner to understand the frequency control in two area system with its blocks.	CO 7
15	Give a typical block diagram for a two-area system interconnected by a tie line and explain each block. Also deduce relations to determine the frequency of oscillations of tie line power and static frequency drop. List out assumptions made.	Understand	This would require the learner to understand the two area LFC system and also determine the oscillations in tie line. Also discuss the assumptions made.	CO 7
16	Describe the steady state analysis in controlled case and un-controlled case?	Understand	This would require the learner to understand the steady state analysis and discuss it in controlled and un-controlled case.	CO 7
17	Draw the transfer function block diagram for a two-area system provided with governor control and obtain the steady state frequency error following a step load change in both the areas.	Understand	This would require the learner to understand the two-area load frequency control systems block diagram and discuss control strategy in integral control.	CO 7

	Part – C (Problem Sol	ving and Crit	ical Thinking)	
1	A 125 MVA turbo alternator operates on full load at 50 Hz. A load of 50MWis suddenly reduced on the machine. The steam valves to the turbine commence to close after 0.5 seconds due to the time lag in the governor system. Assuming inertia constant $H= 6 \text{ kW}$ - sec per kVA of generator capacity, calculate the change in frequency that occurs in this time.	Understand	This would require the learner to understand the load frequency controller and interconnected with an induction motor and synchronous generator. Apply the formulas to determine the change in frequency that occurs during the specified time.	CO 7
2	The single area control system has the following data: TP=10 sec, Tg = 0.3 sec, Tt=0.2 sec, KP =200 Hz/pu MW, R=6 Hz/pu MW, PD=0.5 pu MW, Ki=0.5. Compute the time error caused by a step disturbance of magnitude 0.5 pu (as given above). Prove, in particular, that the error is reduced by increasing the given Ki. Express the error in seconds and cycles if the system frequency is 50 Hz.	Understand	This would require the learner to understand the load frequency controller and interconnected with an induction motor and synchronous generator. Apply the formulas to determine the change in frequency that occurs during the specified time with its steady state error.	CO 7
3	A single area consists of two generators with the following parameters: Generator 1 = 1200 MVA; R=6 % (on machine base) Generator 2 = 1000 MVA; R=4 % (on machine base) The units are sharing 1800 MW at normal frequency 50 Hz. Unit supplies 1000 MW and unit 2 supplies 800 MW. The load now increased by 200 MW. (a) Find steady state frequency and generation of each unit if B=0. (b) Find steady state frequency and generation of each unit if B=1.5.	Understand	This would require the learner to recall the concept of single area load frequency controller and then understand the interconnected by an induction motor and synchronous generator. Apply the formula to determine the steady state frequency and generation by each unit.	CO 7
4	A single area consists of two generating unitsunitRating in MVASpeed regulation R (p.u on unit MVA base)16006%25004%with the following characteristics. The units are operating in parallel, sharing 900 MW at a nominal frequency. Unit 1 supplies 500 MW and unit 2 supplies 400 MW at 60 Hz. The load is increased by 90 MW.(a) Assume there is no frequency dependent load i,e., B=0. Find the steady state frequency deviation and new generation on each unit.(b) The load varies 1.5 % for every 1 % change in frequency deviation and new generation on each unit.	Understand	This would require the learner to recall the concept of single area load frequency controller and then understand the interconnected by an induction motor and synchronous generator. Apply the formula to determine the steady state frequency and generation by each unit.	CO 7
5	A Generator in single area load frequency control has the following parameters: Total generation capacity = 2500 MW Normal	Understand	This would require the learner to recall the concept of single area load frequency controller and	CO 7

6	operating load =1500 MW Inertia constant=5 kW-seconds per kVA; Load damping constant, B=1 %; frequency, f=50 Hz; and Speed regulation, R=2.5 Hz / p.u MW. If there is a 1.5 % increase in the load, find the frequency drop (a) without governor control and (b) With governor control. A250MVA synchronous generator is operating at 1500 rpm, 50 Hz. A load of 50 MW is suddenly applied to the machine and the station valve to the turbine opens only after 0.35 sec due to the time lag in the generator action. Calculate the frequency at which the generated voltage drops before the steam flow commences to increase to meet the new load. Given that the valve of H of the generator energy.	Understand	then understand the interconnected by an induction motor and synchronous generator. Apply the formula to determine the steady state frequency and generation by each unit. This would require the learner to recall the concept of single area load frequency controller and then understand the interconnected by an induction motor and synchronous generator. Apply the formula to determine the steady state frequency and generation by each unit.	CO 7
7	Two power systems, A and B, having capacities of 3000 and 2000 MW, respectively, are interconnected through a tie-line and both operate with frequency-bias-tie-line control. The frequency bias for each area is 1 % of the system capacity per 0.1 Hz frequency deviation. If the tie-line interchange for A is set at 100 MW and for B is set (incorrectly) at 200 MW, calculate the steady state change in frequency.	Understand	This would require the learner to recall the concept of single area load frequency controller and understand the interconnection with an induction motor and synchronous generator. Apply the formula to determine the tie- line power flow change.	CO 7
8	Two control areas have the following characteristics: Area-1: Speed regulation = $0.02$ pu, Damping coefficient = $0.8$ pu ,Rated MVA = $1500$ Area-2: Speed regulation = $0.025$ pu, Damping co-efficient = $0.9$ pu, Rated MVA = $500$ Determine the steady state frequency change and the changed frequency following a load change of $120$ MW occurs in area-1. Also find the tie-line power flow change.	Understand	This would require the learner to recall the concept of single area load frequency controller and understand the interconnection with an induction motor and synchronous generator. Apply the formula to determine the tie- line power flow change.	CO 7
9	The two area system has the following data: Capacity of area 1, Pr1 =1000 MW, Capacity of area 2, Pr2 =2000 MW, Nominal load of area 1, PD1=500 MW Nominal load of area 1, PD1=1500 MW Speed regulation of area 1=4% Speed regulation of area 2=3% Find the new steady state frequency and change in the line ow for a load change of area 2 by 125 MW. For both the areas each percent change in frequency causes 1 percent change in load. Find also the amount of additional frequency drop if the interconnection is lost due to certain reasons.	Understand	This would require the learner to recall the concept of single area load frequency controller and understand the interconnection with an induction motor and synchronous generator. Apply the formula to determine the tie- line power flow change.	CO 7
10	Explain the state variable model of two area load frequency controller with integral action.	Understand	This would require the learner to recall the concept of single area	CO 7

	m 1 1 1 1 1 1 1		I	
	Two control areas connected by a tie line have the following characteristics.		load frequency controller and understand the interconnection	
	Area 1 Area 2		with an induction motor and	
	R=0.01 pu R=0.02 pu ; D=0.8 pu D=1.0 pu		synchronous generator. Apply	
	Base MVA=2000 Base MVA=500		the formula to determine the tie-	
	A load change of 100 MW (0.2 pu) occurs in			
			line power flow change.	
	area 1. What is the new steady state frequency			
	and what is the change in the tie own? Assume			
	both areas were at nominal frequency (60 Hz)			
	to begin.			
11	Two generators rated 250 MW and 500 MW	Understand	This would require the learner to	CO 7
	are operating in parallel. The droop		recall the concept of single area	
	characteristics are 4% and 6% respectively.		load frequency controller and	
	Assuming that the generators are operating at		understand the interconnection	
	50 HZ at no load, how a load of 750 MW		with an induction motor and	
	would be shared. What is the system		synchronous generator. Apply	
	frequency? Assume free governor action?		the formula to determine the tie-	
			line power flow change.	
12	Two control areas have the following	Understand	This would require the learner to	CO 7
	characteristics:		recall the concept of single area	
	Area-1: Speed regulation = 0.04 p.u, Damping		load frequency controller and	
	coefficient = $0.6$ p.u, Rated MVA = $1300$		understand the interconnection	
	Area-2: Speed regulation = $0.03$ p.u, Damping		with an induction motor and	
	co-efficient = $0.85$ p.u, Rated MVA = $500$		synchronous generator. Apply	
	Determine the steady state frequency change		the formula to determine the tie-	
	and the changed frequency following a load		line power flow change.	
	change of 150MW occurs in area-1. Also find		F	
	the tie-line power flow change.			
13	Two areas of a power system network are	Understand	This would require the learner to	CO 7
	interconnected by a tie-line, whose capacity is		recall the concept of single area	
	350MW, operating at a power angle of 450. If		load frequency controller and	
	each area has a capacity of 3000 MW and the		understand the interconnection	
	equal speed regulation of 6Hz/P.u MW,		with an induction motor and	
	determine the frequency of oscillation of the		synchronous generator. Apply	
	power for step change in load. Assume that		the formula to determine the tie-	
	both areas have the same inertia constants of H		line power flow change.	
	= 5 sec. If a step load change of 120MW		1 C	
	occurs in one of the areas determine the change			
	in tie-line power.			
14	Two Generating Stations A and B have full	Understand	This would require the learner to	CO 7
	load capacities of 350 and 500MW,		recall the concept of single area	201
	respectively. The interconnector connecting the		load frequency controller and	
	two stations has an induction		understand the interconnection	
	motor/synchronous generator of full load		with an induction motor and	
	capacity 40 MW; percentage changes of speeds		synchronous generator. Apply	
	of A, B and C are 5, 4 and 2 respectively.		the formula to determine the tie-	
	Determine the load taken by plant C and		line power flow change.	
	indicate the direction of the power flow		inte power now enange.	
	indicate the direction of the power now			
		UNIT –IV		
CO	MPENSATION FOR POWER FACTOR IMP	ROVEMEN	<b>FAND REACTIVE POWER CO</b>	NTROL
	Part – A (Shor	t Answer Que	stions)	
1	List out the disadvantages of low voltage and	Remember	This would require the learner to	CO 9
	low power factor of the system.		recall the concept of power	
	•			

		r		
			factor and discuss the	
			disadvantages with low voltage	
			and low power factors in the	
			system.	
2	Write the importance of power factor	Remember	This would require the learner to	CO 9
	correction		recall the concept of power	
			factor and discuss its importance	
			and why the correction is	
			necessary.	
3	List the financial benefits due to voltage	Remember	This would require the learner to	CO 8
	improvement		recall the concept of voltage	
			improvement and discuss the	
			financial benefits due to voltage	
			improvement.	
4	Write advantages of series compensation.	Remember	This would require the learner to	CO 8
-	write advantages of series compensation.	Kemember	recall the concept of series	000
			compensation and discuss the	
			advantages with this	
			configuration in the system.	
			configuration in the system.	
5	List out the advantages of shunt compensation.	Understand	This would require the learner to	CO 8
5	List out the advantages of shuft compensation.	Understand	recall the concept of shunt	000
			compensation and discuss its	
6		D 1	advantages.	CO 0
6	Define voltage regulation?	Remember	This would require the learner to	CO 8
			recall the concept of automatic	
			voltage booster and discuss its	
			advantages and disadvantages.	
7	Define voltage drop?	Understand	This would require the learner to	CO 8
			understand the concept of	
			voltage drop and discuss the	
			effects on the system.	
8	Define nominal voltage?	Understand	This would require the learner to	CO 8
			understand the concept of	
			nominal voltage and discuss the	
			effects of it.	
9	Define rated voltage?	Understand	This would require the learner to	CO 9
			understand the concept of rated	
			voltage and discuss the	
			importance of it.	
10	Define utilization voltage?	Understand	This would require the learner to	CO 9
	~		understand the concept of	
			utilization voltage and discuss	
			the effects of it.	
11	What are the advantages and disadvantages of	Remember	This would require the learner to	CO 8
	automatic voltage booster?		recall the concept of automatic	
	C		voltage booster and discuss its	
			advantages and disadvantages.	
12	Write two applications of induction regulators.	Understand	This would require the learner to	CO 8
		Chaorbuild	recall the concept of induction	200
			regulators and discuss some of	
			its applications.	
13	Generalize how the generators act as VAR	Understand	This would require the learner to	CO 8
15	sources in a power network?	Charistand	recall the concept of VAR and	
	sources in a power network:		discuss how the generators act as	
			uiscuss now the generators act as	

			VAR sources in a power network.	
14	Generalize how the voltage control is achieved by injection of power at nodes?	Understand	This would require the learner to recall the concept of injection of power and discuss how the generators act as VAR sources in a power system and how the voltage control is achieved by injection of power at nodes network.	CO 8
15	List out different sources of reactive power absorbers in a power system?	Remember	This would require the learner to recall the concept of reactive power absorbers discuss its different sources.	CO 8
16	Compute the need for voltage and frequency regulation in power system?	Understand	This would require the learner to understand the importance of voltage and frequency regulation in the power system.	CO 8
	Part – B (Long	Answer Que	stions)	
1	Discuss the effect of shunt compensation on distribution system.	Understand	This would require the learner to understand the concept of shunt compensation and discuss the effect of shunt compensation on distribution system.	CO 8
2	Compare and explain the role of shunt and series capacitors in power factor correction.	Understand	This would require the learner to understand the concept of power factor correction and explain the role of shunt and series capacitors in power factor correction.	CO 9
3	What are the differences between fixed and switched capacitors? What are their effects on distribution systems?	Understand	This would require the learner to understand the concept of fixed and switched capacitors and distinguish between them and also explain its effects on distribution systems.	CO 9
4	Discuss the procedure employed to determine the best capacitor location.	Understand	This would require the learner to understand the concept of capacitor location and explain the procedure for best capacitor location.	CO 9
5	Discuss how a series capacitor boosts the voltage with the help of a phasor diagram? What are the drawbacks of this method?	Understand	This would require the learner to recall the concept of series capacitor and explain how it boosts the voltage and list the drawbacks.	CO 8
6	Discuss different types of capacitors used in distribution network to improve power factor.	Understand	This would require the learner to understand the concept of power factor correction and explain different types of capacitors used in distribution network to improve power factor.	CO 8

7	Why the improvement of power factor is very	Understand	This would require the learner to	CO 9
/	important for both consumers and generating	Understand	recall the concept of power	09
	stations? List the various causes of low power		factor correction and explain the	
	-		importance with causes for low	
	factor and explain?		-	
0		<b>XX</b> 1 . 1	power factor in the system.	
8	How economic power factor arrived at for a	Understand	This would require the learner to	CO 9
	given distribution system with different loads?		understand the concept of power	
			factor correction and explain	
			power factor at distribution	
			system with different loads.	
9	Voltage control and p.f correction are necessary	Understand	This would require the learner to	CO 9
	in power systems. Explain. What are the		understand the concept of power	
	disadvantages of low voltage and low p.f of the		factor correction and explain the	
	system?		disadvantages of low voltage and	
			low p.f in the system.	
10	Discuss how an overexcited synchronous	Understand	This would require the learner to	CO 9
10	machine improves power factor.	Understand	understand the concept of power	007
	machine improves power factor.		factor correction and explain the	
			<b>^</b>	
			overexcited synchronous	
			machine which improves power	
			factor.	
11	How an AVR can control voltage? With the aid	Understand	This would require the learner to	CO 8
	of suitable diagram, explain its function?		understand the concept of AVR	
			control strategy and explain with	
			suitable diagram.	
12	Briefly explain the line drop compensation on	Understand	This would require the learner to	CO 8
	voltage control?		understand the concept of	
			voltage compensation	
			techniques.	
13	How do the shunt capacitors and reactors	Understand	This would require the learner to	CO 8
10	control the voltage? List the disadvantages of		understand the working of shunt	000
	using a shunt capacitor for voltage control?		reactors to control the voltage,	
	using a shuft capacitor for voltage control:		discuss the merits and demerits.	
1.4	Discuss about the lasses accurred due to VAD	I in denoton d		CO 9
14	Discuss about the losses occurred due to VAR	Understand	This would require the learner to	CO 8
	flow in power system?		understand the concept of VAR	
			flows with its losses in the power	
			system.	
15	Describe the generators are acted as VAR	Understand	This would require the learner to	CO 8
	sources in a power network?		understand the concept of VAR	
			sources with its working	
			principles.	
16	Explain compensated and uncompensated	Understand	This would require the learner to	CO 8
	transmission lines.		understand the classification of	-
			transmission lines with	
			compensation.	
17	Explain clearly what you mean by	Understand	This would require the learner to	CO 8
1/	compensation of line and discuss briefly	Understand	understand the classification of	
	different methods of compensation.		transmission lines with	
			compensation.	
	Part – C (Problem Sol	ving and Crit	ical Thinking)	
1	A 3-phase substation transformer has a name	Understand	This would require the learner to	CO 8
	plate rating of 7500 kVA and a thermal		recall the concept of power	
	capability of 125% of the name plate rating. If		factor correction and understand	
	the connected load is 8816 kVA with a		it is connected to the 3-phase	
	The connected road is oo to KVA with a		it is connected to the 3-phase	

1				
	0.9power factor (lagging), determine the		substation transformer. Apply the	
	following:		formula to determine the power	
	i. the kVAR rating of the shunt capacitor bank		factor at the corrected level.	
	required to decrease the kVA load of the			
	transformer to its capability level and			
	ii. The power factor of the corrected level.			
2	A 3phase transformer rated 7000kVA and has	Understand	This would require the learner to	CO 8
	an overload capability of 125 % of the rating. If		recall the concept of shunt	
	the connected load is 1150 kVA with a 0.8		capacitor bank and then	
	p.f(lag), determine the following:		understand it is connected to a 3-	
	i. The kVAR rating of shunt capacitor bank		phase substation transformer.	
	required to decrease the kVA load of the		Apply the formula to determine	
	transformer to its capability level,		the power factor of the corrected	
	ii. The kVAR raring of the shunt capacitor		level and the kVAR rating of	
	bank required to correct the load p.f. to unity		shunt capacitor bank.	
			shuht capacitor bank.	
3	and iii. The p.f. of the corrected level.	Undonator	This would require the learner to	CO 8
3	A 440 V, 50 cycles three phase line delivers 250 KW at 0.7 p f (log). It is desired to bring	Understand	This would require the learner to	
	250 KW at 0.7 p.f (lag). It is desired to bring		recall the concept of shunt	
	the line p.f to unity by installing shunt		capacitor bank and then	
	capacitors. Calculate the capacitance if they		understand it is connected to a 3-	
	are: i. star connected ii. delta connected		phase substation transformer.	
			Apply the formula to determine	
			the capacitance in star	
			connected and in delta	
			connected.	
4	A 3 phase substation transformer has a name	Understand	This would require the learner to	CO 8
	plate rating of 7250 KVA and a thermal		recall the concept of shunt	
	capability of 120% of the name plate rating. If		capacitor bank and then	
	the connected load is is 8816 KVA with a 0.85		understand it is connected to a 3-	
	of lag p.f determine the following		phase substation transformer.	
	a. The KVAR rating of the shunt capacitor tank		Apply the formula to determine	
	required to decrease the KVA load of the		the power factor of the corrected	
	transformer to its capability level		level and the kVAR rating of	
	b. The power factor of the corrected level.		shunt capacitor bank.	
5	A single-phase motor takes a current of 10	Understand	This would require the learner to	CO 8
	amps at a p.f. of 0.707 lagging from a 230V, 50		recall the concept of shunt	
	Hz supply. What value must a shunting		capacitor bank and then	
	capacitor have to raise the p.f. to unity		understand it is connected to a 3-	
			phase substation transformer.	
			Apply the formula to determine	
			the capacitance in star	
			connected and in delta	
			connected.	
6	Discuss the computerized method to determine	Understand	This would require the learner to	CO 9
U	the economic power factor.	Understand	recall the concept of shunt	0.09
			-	
			capacitor bank and then	
			understand it is connected to a 3-	
			phase substation transformer.	
			Apply the formula to determine	
			the capacitance in star	
			connected and in delta	
			connected.	~ ~ -
7	A 750 KVA load has a power factor of 0.75 lag.	Understand	This would require the learner to	CO 8
	It is derived to improve the power factor to 0.9 lag. Find the KVAR rating of the capacitor for		recall the concept of shunt	
			capacitor bank and then	

	the newer factor improvement		understand it is connected to a 3-	]
	the power factor improvement.			
			phase substation transformer.	
			Apply the formula to determine	
			the capacitance in star	
			connected and in delta	
			connected.	~ ~ ~
8	A synchronous motor having a power	Understand	This would require the learner to	CO 9
	consumption of 40 KW is connected with a		recall the concept of shunt	
	load of 150KW, a lag power factor of 0.8. if the		capacitor bank and then	
	combined load has a power factor of 0.9, what		understand it is connected to a 3-	
	is the leading reactive KVA supplied by the		phase substation transformer.	
	motor and at what p.f is it working.		Apply the formula to determine	
			the capacitance in star	
			connected and in delta	
			connected.	
9	A 3 phase substation transformer has a name	Understand	This would require the learner to	CO 9
	plate rating of 7000 KVA and a thermal		recall the concept of shunt	
	capability of 125% of the name plate rating. If		capacitor bank and then	
	the connected load is is 1150 KVA with a 0.8		understand it is connected to a 3-	
	of lag p.f, determine the following		phase substation transformer.	
	a) The KVAR rating of the shunt capacitor tank		Apply the formula to determine	
	required to decrease the KVA load of the		the capacitance in star	
	transformer to its capability level		connected and in delta	
	b) The power factor of the corrected level.		connected.	
10	A 400 V 50 cycles three phase line delivers	Understand	This would require the learner to	CO 8
10	207KW at 0.8 p.f lag. It is desired to bring the	enderstand	recall the concept of shunt	000
	line p.f to unity by installing shunt capacitors,		capacitor bank and then	
	calculate the capacitance if they are i. star		understand it is connected to a 3-	
	connected ii. delta connected.		phase substation transformer.	
	connected in dena connected.		Apply the formula to determine	
			the capacitance in star	
			connected and in delta	
11	Briefly explain the different methods of	Understand	connected. This would require the learner to	CO 9
11		Understand	-	09
	reactive power injection in the power system.		recall the concept of shunt	
	10 In a radial transmission system shown in		capacitor bank and then	
	figure, all p.u values are referred to the voltage		understand it is connected to a 3-	
	bases shown and 100 MVA. Determine the		phase substation transformer.	
	power factor at which the generator must		Apply the formula to determine	
	operate.		the capacitance in star	
			connected and in delta	
	G 160Km D 0.04PhC 48Km B 0.1P4	A	connected.	
	m tent co tent co f	1 Inid		
	m	- D waa		
	-eu-(D-eoo-+-(D-	SOMW		
	O'IDU ANDU O'IPU OUPU	Pital		
	ZOOMW			
	0-8 f. to log			
12	Find the rating of synchronous compensator	Understand	This would require the learner to	CO 8
	connected to the tertiary winding of a 132kV		recall the concept of shunt	
	star connected, 33 kV star connected, 11 kV		capacitor bank and then	
	delta connected three winding transformer to		understand it is connected to a 3-	
	supply a load of 66 MW at 0.8 p.f. lagging at		phase substation transformer.	
	33 kV across the secondary. The equivalent		Apply the formula to determine	
	primary and secondary winding reactances are		the capacitance in star	
	primary and secondary winding reactances are		ine capacitance in stat	

Assume that the primary side voltage is       essentially constant at 128 VA and maximum of nominal setting between transformer primary and secondary is1.1.       CO 8         13       A 3-phase single circuit, 220kV, line runs at is 0 load. Voltage at the receiving end of the line is 0.20kV. Find the sending end voltage, if the line has resistance of 21.70ms, reactance of 5.32X10*/*mho. The transmission line is to be represented by Pie-model.       Understand       This would require the learner to recall the concept of shunt capacitance in star connected.       CO 8         14       Design a static VAR compensator for a low voltage distribution system with the following specifications:       Understand       This would require the learner to recall the concept of shunt capacitance in star connected.       CO 8         14       Design a static VAR compensator for a low voltage distribution system with the following specifications:       Understand       This would require the learner to recall the concept of shunt capacitance in star connected to a 3-phase substation transformer. Apply the formula to determine the capacitance in star connected at in delta       CO 8         15       The load at receiving end of a three-phase, overhead line is 2.5.5 MW, power factor 0.8 lagging, at a line voltage of 33 kV. A synchronous compensator is situated at receiving end of a woltage of 34 kV. As synchronous compensator is situated at receiving end of a woltage at bhe he eds of the lone is maintained at 33 kV. Calculate the MVAR of the onegretator is star connected and in delta       CO 10         14       WAR per phase.       Understand tin would require the learner to recall the concept of load an resis		32 ohms and 0.16 ohms respectively while the secondary winding reactance is negligible.		connected and in delta connected.	
Image: Note of the concept of shunt (capacitor bank and then understand it is connected to a 3- phase substation transformer. Apply the formula to determine the capacitance in star connected and in delta connected and in		essentially constant at 132 kV and maximum of nominal setting between transformer primary and secondary is1.1.			
voltage distribution system with the following specifications: System frequency = 50 Hz Coil inductance, L=5.37 mH The inductor saturates at 950 A and settles to a value of 1.8 mH at 1800 A. Compensation is required over a range of -80 kVAR to +30 kVAR per phase.understand it is connected to a 3- phase substation transformer. Apply the formula to determine the capacitance in star connected.CO 815The load at receiving end of a three-phase, overhead line is 25.5 MW, power factor 0.8 lagging, at a line voltage of 33 kV. A synchronous compensator is situated at receiving end and the voltage at both the ends of the line is maintained at 33 kV. Calculate the MVAR of the compensator. The line has a resistance of 4.5 ohms per phase and inductive reactance (line to neutral) of 20 ohms per phase.Understand time connected.CO 81Write short notes on load management functionsUnderstandThis would require the learner to recall the concept of load management functions and explain them in detail.CO 102Define coincidence Factor?UnderstandThis would require the learner to recall the concept of demand and explain in detail.CO 103Define contribution factor.RememberThis would require the learner to recall the concept of demand and explain in idetail.CO 104Define contribution factor.RememberThis would require the learner to recall the concept of concidence factor and explain in idetail.CO 10	13	no load. Voltage at the receiving end of the line is 205kV. Find the sending end voltage, if the line has resistance of 21.7ohms, reactance of 85.2ohms and the total susceptance of 5.32X10 <sup>-4</sup> mho. The transmission line is to be	Understand	recall the concept of shunt capacitor bank and then understand it is connected to a 3- phase substation transformer. Apply the formula to determine the capacitance in star connected and in delta connected.	
overhead line is 25.5 MW, power factor 0.8 lagging, at a line voltage of 33 kV. A synchronous compensator is situated at receiving end and the voltage at both the ends of the line is maintained at 33 kV. Calculate the MVAR of the compensator. The line has a resistance of 4.5 ohms per phase and inductive reactance (line to neutral) of 20 ohms per phase.recall the concept of shunt capacitor bank and then understand it is connected to a 3- phase substation transformer. Apply the formula to determine the capacitance in star connected.COMPENSATION FOR POWER FACTOR IMPROVEME NT AND REACTIVE POWER CONTROL Part - A (Short Answer Questions)CO 101Write short notes on load management functionsUnderstand recall the concept of load management functions and explain in detail.CO 102Define demand?RememberThis would require the learner to recall the concept of demand and explain in detail.CO 103Define contribution factor.RememberThis would require the learner to recall the concept of coincidence factor and explain it in detail.CO 10		voltage distribution system with the following specifications: System voltage = 440 V System frequency = 50 Hz Coil inductance, L=5.37 mH The inductor saturates at 950 A and settles to a value of 1.8 mH at 1800 A. Compensation is required over a range of -80 kVAR to +30 kVAR per phase.		recall the concept of shunt capacitor bank and then understand it is connected to a 3- phase substation transformer. Apply the formula to determine the capacitance in star connected and in delta connected.	
COMPENSATION FOR POWER FACTOR IMPROVEME NT AND REACTIVE POWER CONTROL         Part - A (Short Answer Questions)         1       Write short notes on load management functions       Understand       This would require the learner to recall the concept of load management functions and explain them in detail.       CO 10         2       Define demand?       Remember       This would require the learner to recall the concept of demand and explain in detail.       CO 10         3       Define coincidence Factor?       Understand       This would require the learner to recall the concept of coincidence factor and explain it in detail       CO 10         4       Define contribution factor.       Remember       This would require the learner to recall the concept contribution factor.       CO 10	15	overhead line is 25.5 MW, power factor 0.8 lagging, at a line voltage of 33 kV. A synchronous compensator is situated at receiving end and the voltage at both the ends of the line is maintained at 33 kV. Calculate the MVAR of the compensator. The line has a resistance of 4.5 ohms per phase and inductive reactance (line to neutral) of 20 ohms per	Understand	recall the concept of shunt capacitor bank and then understand it is connected to a 3- phase substation transformer. Apply the formula to determine the capacitance in star connected and in delta	CO 8
Part - A (Short Answer Questions)1Write short notes on load management functionsUnderstand recall the concept of load management functions and explain them in detail.CO 10 recall the concept of load management functions and explain them in detail.CO 10 recall the concept of load management functions and explain in detail.2Define demand?RememberThis would require the learner to recall the concept of demand and explain in detail.CO 10 recall the concept of demand and explain in detail.3Define coincidence Factor?UnderstandThis would require the learner to recall the concept of coincidence factor and explain it in detailCO 10 recall the concept of coincidence factor and explain it in detail.4Define contribution factor.RememberThis would require the learner to recall the concept contribution factor and explain it in detail.CO 10			UNIT -V		
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functionsrecall the concept of load management functions and explain them in detail.2Define demand?RememberThis would require the learner to recall the concept of demand and explain in detail.CO 103Define coincidence Factor?UnderstandThis would require the learner to recall the concept of coincidence factor and explain it in detailCO 104Define contribution factor.RememberThis would require the learner to recall the concept of coincidence factor and explain it in detail.CO 10		Part - A (Short	t Answer Que	stions)	
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3       Define coincidence Factor?       Understand       This would require the learner to recall the concept of coincidence factor and explain it in detail       CO 10         4       Define contribution factor.       Remember       This would require the learner to recall the concept contribution factor.       CO 10         4       Define contribution factor.       Remember       This would require the learner to recall the concept contribution factor and explain it in detail.       CO 10	2	Define demand?	Remember	This would require the learner to recall the concept of demand and	CO 10
recall the concept contribution factor and explain it in detail.	3		Understand	This would require the learner to recall the concept of coincidence	CO 10
5 Define loss factor? Demombra This manual description of the loss factor?	4	Define contribution factor.	Remember	This would require the learner to recall the concept contribution	CO 10
5 Define loss factor? Remember This would require the learner to CO 10					

			recall the concept of loss factor	
			and explain it in detail.	
6	Define load factor?	Remember	This would require the learner to	CO 10
			recall the concept of load factor	
			and explain it in detail.	
7	Define load diversity factor?	Understand	This would require the learner to	CO 10
			recall the concept of load	
			diversity factor and explain it in	
			detail.	
8	What is Maximum demand?	Understand	This would require the learner to	CO 11
			recall the concept of maximum	
			demand and explain it in detail.	
9	Define coincident demand?	Understand	This would require the learner to	CO 11
)		Understand	recall the concept of coincident	0011
			*	
10		TT 1 ( 1	demand and explain it in detail.	CO 11
10	Define Non-coincident demand?	Understand	This would require the learner to	CO 11
			recall the concept of non-	
			coincident demand and explain it	
			in detail.	
11	What is meant by term load? How loads can be	Remember	This would require the learner to	CO 11
	classified?		recall the concept of term load	
			and also explain the	
			classifications of loads.	
12	Define distribution system?	Understand	This would require the learner to	CO 11
			recall the concept of distribution	
			system and explain it in detail.	
13	Define demand factor?	Remember	This would require the learner to	CO 10
			recall the concept of demand	
			factor and explain it in detail.	
14	Define load?	Understand	This would require the learner to	CO 10
17	Define foud:	Onderstand	recall the concept of load along	0010
			with its characteristics.	
15	List out types of loads and sive exemples?	Damanhan		CO 10
15	List out types of loads and give examples?	Remember	This would require the learner to	010
			recall the understand the types of	
			loads with suitable examples.	
	Part - B (Long	A	stions)	
		Answer Que	suons)	
1	List out the various factors affecting the	Understand	,	CO 11
1	List out the various factors affecting the distribution system planning?		This would require the learner to	CO 11
1	List out the various factors affecting the distribution system planning?		This would require the learner to recall the concept of distribution	CO 11
1	÷		This would require the learner to recall the concept of distribution system and explain the various	CO 11
1	÷		This would require the learner to recall the concept of distribution system and explain the various factors affecting the distribution	CO 11
	distribution system planning?	Understand	This would require the learner to recall the concept of distribution system and explain the various factors affecting the distribution system.	
1	distribution system planning? Draw a block diagram in flow chart form for a		This would require the learner to recall the concept of distribution system and explain the various factors affecting the distribution system. This would require the learner to	CO 11 CO 11
	distribution system planning? Draw a block diagram in flow chart form for a typical distribution system planning process	Understand	This would require the learner to recall the concept of distribution system and explain the various factors affecting the distribution system. This would require the learner to recall the concept of distribution	
	distribution system planning? Draw a block diagram in flow chart form for a typical distribution system planning process and explain the techniques for distribution	Understand	This would require the learner to recall the concept of distribution system and explain the various factors affecting the distribution system. This would require the learner to recall the concept of distribution system. Draw a typical	
	distribution system planning? Draw a block diagram in flow chart form for a typical distribution system planning process	Understand	This would require the learner to recall the concept of distribution system and explain the various factors affecting the distribution system. This would require the learner to recall the concept of distribution system. Draw a typical distribution system planning	
	distribution system planning? Draw a block diagram in flow chart form for a typical distribution system planning process and explain the techniques for distribution	Understand	This would require the learner to recall the concept of distribution system and explain the various factors affecting the distribution system. This would require the learner to recall the concept of distribution system. Draw a typical distribution system planning process and explain the	
	distribution system planning? Draw a block diagram in flow chart form for a typical distribution system planning process and explain the techniques for distribution	Understand	This would require the learner to recall the concept of distribution system and explain the various factors affecting the distribution system. This would require the learner to recall the concept of distribution system. Draw a typical distribution system planning process and explain the techniques for distribution	
2	distribution system planning? Draw a block diagram in flow chart form for a typical distribution system planning process and explain the techniques for distribution planning.	Understand	This would require the learner to recall the concept of distribution system and explain the various factors affecting the distribution system. This would require the learner to recall the concept of distribution system. Draw a typical distribution system planning process and explain the techniques for distribution planning.	CO 11
	distribution system planning? Draw a block diagram in flow chart form for a typical distribution system planning process and explain the techniques for distribution	Understand	This would require the learner to recall the concept of distribution system and explain the various factors affecting the distribution system. This would require the learner to recall the concept of distribution system. Draw a typical distribution system planning process and explain the techniques for distribution	
2	distribution system planning? Draw a block diagram in flow chart form for a typical distribution system planning process and explain the techniques for distribution planning.	Understand	This would require the learner to recall the concept of distribution system and explain the various factors affecting the distribution system. This would require the learner to recall the concept of distribution system. Draw a typical distribution system planning process and explain the techniques for distribution planning.	CO 11
2	distribution system planning? Draw a block diagram in flow chart form for a typical distribution system planning process and explain the techniques for distribution planning. Explain briefly the classification of loads and	Understand	This would require the learner to recall the concept of distribution system and explain the various factors affecting the distribution system. This would require the learner to recall the concept of distribution system. Draw a typical distribution system planning process and explain the techniques for distribution planning. This would require the learner to recall the concept of distribution	CO 11
2	distribution system planning? Draw a block diagram in flow chart form for a typical distribution system planning process and explain the techniques for distribution planning. Explain briefly the classification of loads and	Understand	This would require the learner to recall the concept of distribution system and explain the various factors affecting the distribution system. This would require the learner to recall the concept of distribution system. Draw a typical distribution system planning process and explain the techniques for distribution planning. This would require the learner to	CO 11
2	distribution system planning? Draw a block diagram in flow chart form for a typical distribution system planning process and explain the techniques for distribution planning. Explain briefly the classification of loads and	Understand	This would require the learner to recall the concept of distribution system and explain the various factors affecting the distribution system. This would require the learner to recall the concept of distribution system. Draw a typical distribution system planning process and explain the techniques for distribution planning. This would require the learner to recall the concept of distribution system and explain the	CO 11

4	Obtain the relation between the load factor and loss factor.			Understand	This would require the learner to recall the concept of load factor and loss factor. Derive the relation between the load factor and loss factor.	CO 11
5	Discuss in detail about agriculture and industrial loads and their respective characteristics.			Understand	This would require the learner to recall the concept of load diversity factor and explain the agriculture and industrial loads with their respective characteristics.	CO 11
6	Differentiate between DC and AC systems?			Understand	This would require the learner to recall the concept of DC and AC systems and then differentiate between DC and AC systems.	CO 10
7	Explain residential and commercial loads and their characteristics?			Understand	This would require the learner to recall the concept of load diversity factor and explain the agriculture and industrial loads with their characteristics.	CO 11
		Part – C (Pr	oblem Sol	ving and Crit	ical Thinking)	
1	At the end of a powe certain feeder suppli transformer, each on customers whose co if the diversity facto 1.3, find the maximu Transforme Load No.1 10kw No 2 12kw No.3 15kw Distribution substati	es three distribution nected loads are r among the transform load on the fee Demand D Factor y 0.65 1 0. 3 0.7 1	on up of as under, formers is eder. Diversit Factor .5 .5	Understand	This would require the learner to recall the concept of power distribution system and understand it is connected to three distribution transformers. Apply the formula to determine the maximum load on the feeder.	CO 10 CO 10
	peak load of 3, 500 l energy supplied to the 10 <sup>7</sup> kwh. Find i) The The annual Load Fac	KW. The total ann he primary feeder e annual average F ctor	ual circuits is Factor ii)		recall the concept of power distribution system and understand it is connected to three distribution transformers. Apply the formula to determine the maximum load on the feeder and annual load factor.	CO 10
3	Annual peak load in 2000kw at which the loss at the time of per The total annual ene end of the feeder is 5 i) Annual loss factor ii) Total annual copp value Rs.1.50 per kw	e power loss is tota eak load is $\sum I^2 R = 1$ rgy supplied to the 5.61*10 <sup>6</sup> kwh. Det and per loss energy and	al copper 100kw. e sending termine.	Understand	This would require the learner to recall the concept of power distribution system and understand it is connected to three distribution transformers. Apply the formula to determine annual loss factor and annual copper loss.	COTI
4	Assume that load of riverside substation, maximum demand is weekly energy const	the 15 min. week s given as 75 kw, a	ly and the	Understand	This would require the learner to recall the concept of power distribution system and understand it is connected to	CO 11

	Assuming a week is 7 days; find the demand factor and the 15 min. weekly load factor of the substation.		three distribution transformers. Apply the formula to determine the maximum load on the feeder.	
5	Discuss how the maximum demand and average demand can be obtained from daily demand variation curve.	Understand	This would require the learner to recall the concept of power distribution system and understand it is connected to three distribution transformers. Apply the formula to determine the maximum load on the feeder.	CO 10
6	A 50 MW hydro generator delivers 320 million kwh during the year. Calculate the plant load factor.	Understand	This would require the learner to recall the concept of power distribution system and understand it is connected to three distribution transformers. Apply the formula to determine the maximum load on the feeder and annual load factor.	CO 11
7	Annual peak load input to a primary feeder is 2000kw at which the power loss is total copper loss at the time of peak load is $\sum I^2 R=100$ kw. The total annual energy supplied to the sending end of the feeder is 5.61*10 <sup>6</sup> kwh. Determine. I) Annual loss factor ii) Total annual copper loss energy and its value Rs 0.03 per kwh	Understand	This would require the learner to recall the concept of power distribution system and understand it is connected to three distribution transformers. Apply the formula to determine the annual loss factor and annual copper loss.	CO 11
8	<ul> <li>Assume that the annual peak load of a primary feeder is 2000 kW, at which the power is 80 kw per three phase. Assuming an annual loss factor of 0.15, determine <ol> <li>The average annual power loss.</li> <li>The total annual energy loss due to the copper loss of the feeder.</li> </ol> </li> </ul>	Understand	This would require the learner to recall the concept of power distribution system and understand it is connected to three distribution transformers. Apply the formula to determine the maximum load on the feeder.	CO 11
9	<ul> <li>A small city experiences an annual peak load of 3500 kw. The total annual energy supplied to the primary feeder's circuits is 10* 10<sup>6</sup> kwh. The peak demand occurs in July/August and Is due to air Conditioning load.</li> <li>i) Find the annual average power demand ii) Find the annual load factor iii) Find the annual loss factor</li> </ul>	Understand	This would require the learner to recall the concept of power distribution system and understand it is connected to three distribution transformers. Apply the formula to determine the maximum load on the feeder.	CO 10
10	The annual average load is 1241 kw and monthly peak load is 3600 kW. Find the load factor by using approximate formula.	Understand	This would require the learner to recall the concept of power distribution system and understand it is connected to three distribution transformers. Apply the formula to determine the maximum load on the feeder and annual Load factor.	CO 10