QP Code: RA22BTECH409 | Reg. No | | | | | | | | | | | AR 21/22

Gandhi Institute of Engineering and Technology University, Odisha, Gunupur
(GIET University)

B. Tech (Sixth Semester) Examinations, April 2025

21BELPC36002/21BEEPC36002/22BELPC36002/22BEEPC36002 – Power System Operation & Control

(EE/EEE)

Time: 3 hrs | Maximum: 70 Marks

Answer ALL questions

(The figures in the right hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

Q.1. Answer ***ALL*** questions		CO #	Blooms Level
a.	Distinguish between unit commitment and economic dispatch.	CO4	K1
b.	How the elements of Jacobian matrix are computed in load flow analysis?	CO3	K2
c.	Why the per unit system is used for the studies in power system?	CO1	K2
d.	Write the equality and inequality constraints considered in economic dispatch problem?	CO4	K1
e.	What is critical clearing angle in power system stability?	CO5	K1

PART – B **(15 x 4 = 60 Marks)**

Answer ***All*** the questions		Marks	CO #	Blooms Level
2. a.	Develop necessary equation and describe the load flow solution using gauss seidel method.	7	CO3	K2
b.	A 2-bus system with one unknown voltage problem statement is given below. Bus 1 (Slack Bus) $V_1=1.0\angle 0^0$ Per Unit Bus 2 (PQ Bus): P_2= - 0.5 Per unit, Q_2= -0.2 Per Unit Line Impedance Z_{12}=0.02+ j0.04 Per Unit Using Gauss-Seidel method, calculate the voltage at bus-2 performing one iteration.	8	CO3	K3
	(OR)			
c.	A120 MVA, 19.5 KV generator has a synchronous reactance of 0.15pu and it is connected to a transmission line through a transformer rated 150 MVA, 230/18 KV (star/delta) with X=0.1pu. (i) Calculate the pu reactance by taking generator rating as base values (ii) Calculate the pu reactance by taking transformer rating as base values Calculate the pu reactance for a base value of 100 MVA and 220KV on the HV side of transformer.	8	CO1	K3
d.	A 2-bus system with the following data: Bus 1 (Slack Bus) $V_1=1.0\angle 0^0$ Per Unit Bus 2 (PQ Bus): P_2= - 1.0 Per unit, Q_2= -0.5 Per Unit Line Impedance Z_{12}=0.1+ j0.2 Per Unit Determine the voltage at bus-2 using Newton Raphson method, with one complete iteration.	7	CO3	K3
3.a.	Explain the modeling of load frequency scheme of a single generator system?	8	CO5	K2
b.	Two generators rated with 221MW and 429MW are operating in parallel. The droop characteristics of their governors are 4.15% and 5.35% respectively from no load to full load. The speed changers are so set that the generators operate at	7	CO5	K3

50Hz sharing the full load of 650MW in the ratio of their ratings. If the load reduces to 550 MW, what will be the load shared by each generator? Also, find out the frequency under this condition.

(OR)

c.	Derive the solution of the economic load dispatch problem of a 2-generator system without considering the transmission loss.	8	CO4	K2
d.	The incremental fuel cost characteristics of two generating units in plants are $\frac{dF1}{dP1} = 0.1P1 + 8.0$ Rs/MWh $\frac{dF2}{dP2} = 0.15P2 + 3.0$ Rs/MWh When the total load supplied by the power plant is 100MW, what is the economic sharing of load?	7	CO4	K3
4.a.	Draw the schematic diagram of Load Frequency Control and Automatic Voltage Regulator installed for a generation and explain the function of different blocks.	8	CO5	K1
b.	A power system is supplied by only 2-plants both of which are operating on economic dispatch. At the bus of plant-1 the incremental cost is Rs6.6/MWh and at the plant-2 is Rs7.2 Rs/MWh. (i) Which plant has higher penalty factor? (ii)What is the penalty factor of plant-1, if the cost per hour of increasing the load on the system by 1MW is Rs 8.2.	7	CO4	K3

(OR)

c.	Explain how the equal area criterion is used for the stability study of power system under transient conditions.	8	CO5	K2
d.	A synchronous generator is receiving 50% of its power from an infinite bus. If the load on the rotor is suddenly reduced to 80% of the previous value, what would be the maximum swing around its new equilibrium position?	7	CO6	K3
5.a.	Derive the swing equation and also explain its applications in the study of power system stability.	8	CO6	K2
b.	A synchronous generator is connected with the infinite bus bar through the double circuit transmission line. The generator is delivering 1.0 pu with an angle of 30^0. A sudden fault reduces the peak power to 0.5pu. After clearance of fault the peak power that can be transmitted becomes 1.5pu. Find fault clearing angle.	7	CO6	K3

(OR)

c.	Distinguish between steady state, transient & dynamic stability of power system. Derive the power angle equation.	8	CO6	K1
d.	A generator with H = 4MJ/MVA, operating at 60Hz has an initial rotor angle of $\boldsymbol{\delta}=30^0$. Due to disturbance, the net accelerating power becomes 0.1pu for 0,2 sec. Calculate the change in rotor angle during this time.	7	CO6	K3

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