QPC: RN18001186 AR - 18 Reg. No.

GIET MAIN CAMPUS AUTONOMOUS GUNUPUR – 765022

B. Tech Degree Examinations, November – 2021

(Seventh Semester)

BELPC7010 / BEEPC7010 - POWER SYSTEM OPERATION AND CONTROL

(EE/EEE)

Time: 3 hrs Maximum: 100 Marks

Answer ALL Questions

The figures in the right hand margin indicate marks.

PART – A: (Multiple Choice Questions) (2 x 10 = 20 Marks)

Q.1. Answer ***ALL*** questions		[CO#]	[PO#]
a.	Incremental cost of two generators $I_{c1} = 0.2\ P_1+60$, $I_{c2} = 0.3\ P_2+40$ and the ratings of the generator are 150 and 250 MW. Find the load sharing of each generator for a load of 200 MW? i. $P_1 = 120$ MW, $P_2 = 80$ MW ii. $P_1 = 80$ MW, $P_2 = 120$ MW iii. $P_1 = 100$ MW, $P_2 = 100$ MW iv. $P_1 = 60$ MW, $P_2 = 140$ MW	2	2
b.	The Y bus matrix of 100 bus interconnected system is 90% sparse. Hence the number of transmission lines in the system must be i. 250 ii. 500 iii. 450 iv. 900	1	2
c.	A power system consists of 300 buses out of which 20 buses are generator buses, 25 buses are the ones with reactive power support buses and 15 buses are ones with fixed shunt capacitors. All the other buses are load buses. It is proposed to perform a load flow analysis for the system using Newton-Raphson Jacobian matrix is i. 553×553 ii. 554×554 iii. 555×555 (D) 540×540	2	2
d.	Incremental cost curve is i. Slope of Input output curve ii. Slope of load curve iii. Both (i) and (ii) iv. None of these	2	1
e.	The system constraint are i. Equality Constraint ii. Inequality constraint iii. Both (i) and (ii) iv. None of these		
f.	"Its loading from now on is held fixed at this value and the balance load is then shared between the remaining generators on equal incremental cost basis." This theory knows i. Patton's security theory ii. Kuhn-Tucker theory iii. Both (i) and (ii) iv. None of these	2	1
g.	The equal area criteria of stability are used for: i. Steady state stability limit ii. Transient state stability limit iii. Instability iv. None of the above	3	1
h.	If the torque angle of the alternator increases indefinitely the system will show: i. Steady state stability limit ii. Transient state stability limit iii. Instability iv. None of the above	3	1
i.	On slack bus _____ and _____ are specified i. Voltage Magnitude, Real power ii. Active, Reactive power iii. Voltage Magnitude, Phase angle iv. Active power, phase angle	1	1
j.	_____ are designed based on swing curve: i. Rotor windings ii. Transformer windings iii. Stator windings iv. Protection devices	2	1

PART – B: (Short Answer Questions) (2 x 10 = 20 Marks)

Q.2. Answer ***ALL*** questions		[CO#]	[PO#]
a.	What is per unit system?	1	1
b.	What is surge impedance loading?	1	1
c.	Why the Jacobian Matrix of a large power system is sparse?	1	1

d.	What is Incremental cost criterion?	2	1
e.	What is meant by unit commitment?	2	1
f.	What is meant by Load frequency control?	3	1
g.	What are typical conditions needed to be taken care of while distributing loads among the plants of a system?	3	1
h.	State swing equation of a generator.	3	1
i.	Define the transient stability of a generator	4	1
j.	What are the various methods of voltage control in transmission systems?	4	1

PART – C: (Long Answer Questions) **(15 x 4 = 60 Marks)**

Answer ***ALL*** questions

		Marks	[CO#]	[PO#]
3. a.	The following tables provide line admittance and real and reactive power data of a four-bus system. The line admittance of a 4-bus system is as under:	15	1	2

Bus Code	Admittance in Mho
1-2	2-j8.2
1-3	1-j4.1
2-3	0.667-j2.66
2-4	0.95-j4
3-4	2-j7.5

The schedule of active and reactive power is

Bus Code	P	Q	V	Bus Specification
1	-	-	1.058+j0	Slack
2	0.5	0.201	Not Specified	PQ
3	0.4	0.305	Not Specified	PQ
4	0.3	0.1	Not Specified	PQ

Compute the voltage at buses 2, 3 and 4 at the end of first iteration using Gauss-Seidel method.

(OR)

b.	Show that the diagonal elements of a YBUS matrix equals the sum of admittances connected to that bus and an off-diagonal element equals the negative of the sum of admittances directly connected between the buses	15	1	3
4. a.	The incremental cost characteristic of the two units in a plant are IC1= 0.1P1 + 8.0 Rs./MWh; IC2=0.15P2 +3.0 Rs./MWh When the total load is 100 mw, what is the optimum sharing of load?	15	2	2

(OR)

b.	Derive the solution of the economic load dispatch problem of a 2-generator system without considering the transmission loss	8	2	3
c.	A power system consisting of two generators of capacity 210MW each supplies a total load of 310 MW at a certain time. The respective incremental fuel cost of Generator-1 and Generator-2 are: $dC_1/dP_{G1} = 1.125P_{G1} + 18.9$ $dC_2/dP_{G2} = 1.131P_{G2} + 12$	7	2	2
5. a.	Differentiate between Load frequency control and economic dispatch control?	7	2	1
b.	A 50 Hz, 4 pole turbo generator of rating 20 MVA, 13.2 kV has an inertia constant of 9 kW-sec/kVA. Find the kinetic energy stored in the rotor at synchronous speed. Find the acceleration, if the input less the rotational loss is 26,800 hp and the electric Power developed is 16 MW equal at 115 kW	8	2	2

(OR)

c.	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 50 Hz 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 system frequency under this condition	8	2	2
d.	Develop a typical excitation arrangement to control the voltage of an alternator and explain briefly?	7	4	3
6. a.	Distinguish between steady-state stability and transient stability of a power system? How to improve transient stability of a power system?	8	4	3
b.	Derive The Power-Angle Equation?	7	4	3
	(OR)			
c.	Role of Automatic voltage regulator in improving stability	7	4	1
d.	Derive the swing equation of a single generator system.	8	4	3

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