Registration No : | | | | | | | | | | |

Total Number of Pages : 03 **B.Tech.**
PEE6I102

6th Semester Regular Examination 2017-18
POWER SYSTEM & OPERATION & CONTROL
BRANCH : ELECTRICAL
Time : 3 Hours
Max Marks : 100
Q.CODE : C214

Answer Part-A which is compulsory and any four from Part-B.
The figures in the right hand margin indicate marks.

Part – A (Answer all the questions)

Q1. Answer the following questions: *multiple type or dash fill up type :* **(2 x 10)**

a) How is the voltage and frequency controlled in automatic generation control?
- i) By controlling the excitation
- ii) By controlling the turbine action
- iii) Turbine speed control for voltage and excitation control for frequency
- iv) Excitation control for voltage and turbine speed control for voltage.

b) What are the common assumptions made for the equal area criterion?
- i) The transmission line and machine resistances are neglected.
- ii) Rotor speed of the machine is constant
- iii) Mechanical input remains constant.
- iv) All of these

c) For which among the following cases is the equal area criterion of stability used?
- i) One machine and infinite bus bar
- ii) No load on bus bar
- iii) Many machines and infinite bus bar
- iv) All of these

d) The change in frequency for a 100 MVA machine working at 50 Hz whose inertia constant is 5 kW-sec/kVA of the generator capacity, when a load changes by 40 MW, and the governor requires 1 sec time lag for responding to this load change is _____.

e) Which among the following methods are highly accurate?
- i) Gauss Seidel method
- ii) Newton Raphson method
- iii) Fast decoupled low flow method
- iv) All of these

f) The initial voltage at all the PQ buses for solving the load flow problem using NR method is _____.

g) The incremental fuel cost of plant 2 in Rs/MWhr if plant 1 has an incremental cost of 9 Rs/MWhr with an ITL of 0.25 is _____.

h) The expression of steady state frequency change in two area control system is equal to _____.

i) A system where generators show a same change in delta when there is a disturbance is known as _____ system.

j) The size of the Jacobian matrix for a 25 bus system, having 10 generators connected to 10 different buses is _____.

Q2. **Answer the following questions: *Short answer type :*** **(2 x 10)**

a) Obtain the expression of governor model in a single area control showing the input-output relation.

b) How to evaluate the Power flow analysis in Gauss-Siedel when a PV bus changes to PQ bus?

c) Write the equality and inequality constraints for solving economic load dispatch problem.

d) A generator has a per unit value of 15% on a 300 MVA, 200 kV base. What would be the per unit value of the same on a 200 MVA, 150 kV base?

e) Calculate the sparsity in Y bus for a system with 200 bus connected by 380 lines. What will be the change in the sparsity if the no. of lines increases by 20?

f) For a particular system, the Jacobian matrix had a size of 32×32. During the N-R load flow in a particular iteration 3 PV buses changes to PQ bus. Will there be any change in the size of Jacobian? How much?

g) What is the difference between Economic load dispatch & Unit Commitment?

h) The machine is operating at δ = 28.44° when it is subjected to a slight temporary electrical system disturbance. Determine the frequency and period of oscillation of the machine rotor if the disturbance is removed before the prime mover responds. Take H = 5 MJ /MVA.

i) Enumerate the benefits of per unit system. Find the expressions of base values of different quantities in power system.

j) At what frequency does the change in rotor angle oscillate when a disturbance occurs? Find an equation to illustrate the same.

Part – B (Answer any four questions)

Q3. **a)** Derive the swing equation of the rotor. Derive the condition of a stability after following a disturbance. **(10)**

b) A two bus system is shown in Fig.1 If 100 MW is transmitted from plant 1 to the load; a transmission loss of 10 MW is incurred. Find the required generation for each plant and the power received by the load when the system λ is Rs. 25 /MWh. The incremental fuel costs of the two plants are : **(5)**

$$\frac{dF_1}{dP_1} = 0.02P_1 + 16$$
$$\frac{dF_2}{dP_2} = 0.04P_2 + 20$$

Q4. **a)** Describe the different assumptions taken in Decoupled Load flow method. Form the final expression of Decoupled load flow method. **(10)**

b) Derive the economic operation of units when there is losses in the system. **(5)**

Q5. **a)** Write down the equations governing the N-R load flow method. Derive the necessary expression of the Jacobian elements in the matrix. **(10)**

b) Derive the swing equation of machines in a system when they are in coherence and when they are in non-coherence in nature. **(5)**

Q6. **a)** Explain the Unit commitment method with an example. **(10)**

b) Derive the expressions of critical clearing angle and critical clearing time. **(5)**

Q7. **a)** Form the Y_{Bus} for the given network. **(10)**

Bus code	Z_{pq}	$Y'_{pq}/2$
1 – 2	0.02 + j0.08	0.00 + j0.03
1 – 3	0.08 + j0.24	0.00 + j0.025
2 – 3	0.06 + j0.18	0.00 + j0.02
2 – 4	0.06 + j0.18	0.00 + j0.02
2 – 5	0.04 + j0.12	0.00 + j0.015
3 – 4	0.01 + j0.03	0.00 + j0.01
4 – 5	0.08 + j0.24	0.00 + j0.025

b) What is a regulating transformer? What will be the change in the Y_{bus} when a regulating transformer is present? **(5)**

Q8. **a)** Two thermal generating units are operating in parallel at 60 Hz to supply a total load of 700 MW. Unit 1, with a rated output of 600 MW and 4% speed-droop characteristics, supplies 400 MW, and Unit 2, which has a rated output of 500 MW and 5% speed droop, supplies the remaining 300 MWof load. If the total load increases to 800 MW, determine the new loading of each unit and the common frequency change before any supplementary control action occurs. Neglect losses. **(10)**

b) Determine the exact and approximate dynamic response of Δf for a single area system. **(5)**

Q9. **a)** Draw the primary and secondary control loop for a two-area system? What is the ACE in these two area? **(10)**

b) A generator having H = 6.0 MJ /MVA is delivering power of 1.0 per unit to an infinite bus through a purely reactive network when the occurrence of a fault reduces the generator output power to zero. The maximum power that could be delivered is 2.5 per unit. When the fault is cleared, the original network conditions again exist. Determine the critical clearing angle and critical clearing time. **(5)**