No. of Printed Pages : 4 **BIEE-022**

B.Tech. – VIEP – ELECTRICAL ENGINEERING (BTELVI)

Term-End Examination

00655

June, 2019

BIEE-022 : POWER SYSTEMS

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **five** questions. All questions carry equal marks. Assume missing data suitably (if any). Use of scientific calculator is allowed.*

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1. (a) Explain the difference between feeder, distributor and service mains. Draw single-line diagram of a three-bus system having generator G_1 connected to bus-1 through transformer T_1, generator G_2 connected to bus-2 through transformer T_2, four synchronous motors M_1 to M_4 connected to bus-3 through transformer T_3, transmission lines TL_1, TL_2 and TL_3 connected between bus 1-2, 2-3 and 3-1 respectively. 7

(b) Discuss the principle of symmetrical components. Derive the necessary equations to convert symmetrical components into phase quantities. 7

2. (a) Draw a diagram showing interconnection of sequence network for a double line to ground fault. Derive equations for sequence currents. 7

(b) The estimated short circuit MVA at the bus bars of a generating station is 2,500 and of another station is 1,500. The generated voltage of each station is 13·2 kV. Calculate the possible short circuit MVA at each station when they are linked by an interconnector cable having a reactance of 0·6 ohm. 7

3. (a) Describe the flow chart diagram for a load flow study of a power system having only P-Q buses using G-S method. How does the flow chart get modified for P-V buses ? 7

(b) A station operating at 33 kV is divided into two sections A and B interconnected through a reactor X. Section A has three generators each 15 MVA having 15% reactance. Section B is fed from a grid through a 75 MVA transformer with 8%

reactance. The circuit breakers have a rupturing capacity of 750 MVA. Find the reactance of reactor X to prevent the breakers being overloaded if a three-phase fault occurs on outgoing feeder connected to A. 7

4. (a) Obtain the Y_{bus} matrix if the line series impedances between the various buses in a power system are given in the table below : 7

Buses	Impedances in pu
1 – 2	0·15 + j 0·6
1 – 3	0·1 + j 0·4
1 – 4	0·15 + j 0·6
2 – 3	0·05 + j 0·2
3 – 4	0·05 + j 0·2

(b) Discuss the NR method for solving non-linear algebraic equations. 7

5. (a) Derive the power angle equation. Distinguish between steady state and transient stability. 7

(b) A 4 pole, 50 Hz, turbo generator rated 100 MVA, 11 kV has an inertia constant H = 8·0 kW-s per kVA. Find out the kinetic energy stored in the rotor at synchronous speed. Also find the acceleration if the input less the rotational losses is 30,000 HP and the electrical power developed is 16,000 kW. 7

6. (a) Derive an equation to find the transient current in an RL series excited by an AC source. 7

(b) Explain the mechanism of lightning stroke. What are the main characteristics of lightning stroke ? 7

7. (a) What is critical angle ? A large 3-phase cylindrical rotor generator is delivering 1·0 p.u. power to an infinite bus through a transmission network. The maximum power which can be transferred for pre-fault, during fault and post fault conditions is 1·8 p.u., 0·4 p.u. and 1·3 p.u. Find the critical clearing angle. 7

(b) An overhead line has a surge impedance of 400 ohm. A step wave of 20 kV travels on the line. At a certain point the line terminates into a junction and is continued by 2 cables in parallel. The surge impedances of cables are 150 and 200 ohm. Find the voltage and current transmitted into each cable. Also find reflected voltage and current. 7