D 11258 (Pages : 3) Name..............................

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SEVENTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, DECEMBER 2005

EE 2K 704—POWER SYSTEMS—II

(New Scheme)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

I. (a) Starting from the first principles, derive the equations for the real and reactive power in a power system.

(b) Give a critical comparison of the various load flow solution techniques.

(c) Discuss the speed governing mechanism of a generator with the help of a block diagram.

(d) Explain how an economic load dispatch problem is formulated.

(e) Discuss the impact of faults on power systems with relevance to the frequency of occurrence and their severity.

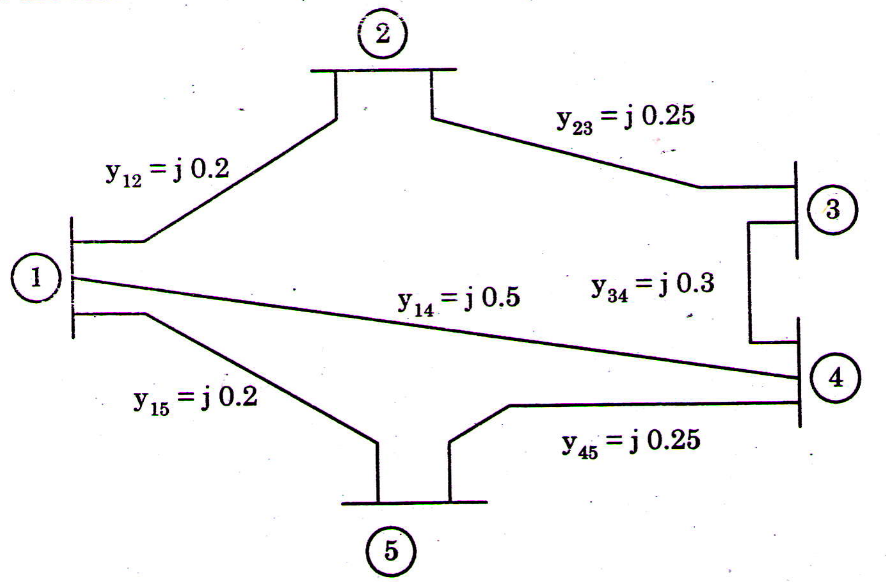
(f) Give a brief account of the zero sequence impedance of three-phase transformers.

(g) What are the factors that affect the stability of a power system ?

(h) Explain briefly the advantages of HVDC transmission over HVAC transmission.

($8 \times 5 = 40$ marks)

II. (a) For the network shown below, determine the bus admittance matrix.



(All values are in per unit)

If a new line with an impedance of $j\,0.4$ p.u. is added between buses 2 and 5 determine the modified bus admittance matrix.

Or

Turn over

(b) With the help of a flowchart explain the computational procedure of Newton Raphson method of load flow solution using polar co-ordinates.

III. (a) A power system consists of two generating stations is connected by a tie line. The load is connected to the plant 2. When 100 MW is transmitted from plant 1, a loss of 10 MW takes place on the tie line. Determine the generation schedule of both the plants and the power received by the load when the λ for the system is Rs. 25 / MWhr and the incremental fuel costs are given by :

$$\frac{dF_1}{dP_1} = 0.03\, P_1 + 17\ \text{Rs}/\text{MWhr}$$

$$\frac{dF_2}{dP_2} = 0.06\, P_1 + 19\ \text{Rs}/\text{MWhr}$$

Or

(b) Incremental fuel costs for a generating station consisting of two units are :

$$\frac{dF_1}{dP_1} = 0.2\, P_1 + 40\ \text{Rs}/\text{MWhr}$$

$$\frac{dF_2}{dP_2} = 0.4\, P_2 + 30\ \text{Rs}/\text{MWhr}$$

And the generation limits are :

$30 \le P_1 \le 175$ MW

$20 \le P_2 \le 125$ MW

Assuming both units working, how will the load be shared as the system load varies over the full range of the load values ? What are the corresponding incremental costs ?

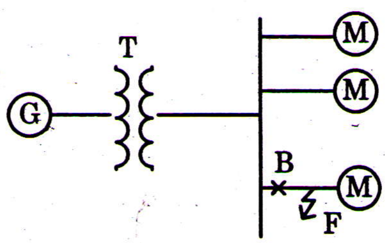
IV. (a) Show that in a generating station with N-section bus bar each connected with a machine rated at S MVA and 'x' per unit reactance connected on the tie bar system through bus bar reactance of 'y' per unit reactance has a total short circuit MVA on one section equal to

$$\left[\frac{S}{x} + \frac{S(N-1)}{yN + x}\right]$$

If S = 50 MVA, x = 20 % and y = 10% find the short circuit MVA when the number of section N = 3.

Or

(b) A 30 MVA, 11 kV generator has a sub-transient reactance of 0.1 p.u. It supplies power to three identical motors through a transformer as shown below.



Each motor is rated at 8 MVA, 6.6 kV with sub-transient and transient reactance of 0.15 and 0.25 p.u. respectively. The transformer is rated at 30 MVA, 11/6.6 kV with a leakage reactance of 0.06 p.u. The motor terminal voltage is 6.6 kV with a three-phase fault occurs at the point F. Determine :

(i) the sub-transient fault current,

(ii) sub-transient current in the breaker, and

(iii) the current to be interrupted by the breaker in 8 cycles.

V. (a) Starting from fundamentals, explain the process of step by step method of solving the swing equation.

Or

(b) Determine the kinetic energy stored by a 50 MVA, two pole, 50 Hz alternator with an inertia constant of H = 5 kWsec/kVA. When the machine is running at synchronous speed with a shaft input (less rotational losses) of 65000 HP, the electrical power is suddenly changed from normal value to 40 MW. Determine the acceleration or deceleration of the rotor. If the acceleration or deceleration computed for the generator is assumed to be constant for a period of 10 cycles, determine the change in torque angle and the speed at the end of 10 cycles.

(4 × 15 = 60 marks)