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BIEE-012

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

Term-End Examination

00786

June, 2016

BIEE-012 : ELECTRO-MECHANICAL ENERGY CONVERSION – II

Time : 3 hours *Maximum Marks : 70*

Note :

(i) *Answer any **seven** questions out of ten questions.*

(ii) *All questions carry equal marks.*

(iii) *Any missing data may be assumed with proper justification.*

(iv) *Use of scientific calculator is allowed.*

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1. What do you mean by armature reaction ? Explain the effect of armature reaction on the terminal voltage of an alternator at (a) unity p.f. load, (b) zero lagging p.f. load, and (c) zero leading p.f. load. Draw the relevant phasor diagrams. *10*

2. A 22 kV, 3-phase, star-connected alternator is delivering 300 MW at unity power factor to 22 kV grid. Its synchronous impedance is j 1·5 Ω/phase. With the turbine power remaining constant, the alternator excitation is increased by 25%. Determine the machine current and power factor. At the new excitation, the turbine power is now increased till the machine delivers 350 MW. Calculate the new current and power factor. *10*

3. (a) Derive the power flow equation for a salient pole synchronous machine connected to an infinite bus bar. *5*

(b) What are the conditions for parallel operation of synchronous generators ? *5*

4. A synchronous motor is running at constant load, its field excitation is varied slowly from underexcited state to overexcited state. For the above operation,

(a) show the effect of field current variation on p.f. with the help of a phasor diagram.

(b) show and explain the effect of field excitation on motor armature current. *10*

5. A 1500 kW, 3-ϕ, Y-connected, 3·3 kV synchronous motor has reactance of $X_d = 6{\cdot}5$ and $X_q = 4{\cdot}2\ \Omega$/phase. All losses may be neglected. Calculate the excitation emf when the motor is supplying rated load at unity power factor. Also calculate the maximum mechanical power that the motor can supply with excitation held fixed at this value. *10*

6. (a) Explain why a 3-phase induction motor, at no load, operates at a very poor power factor. *5*

(b) Why is rotor leakage reactance at starting different from its value at normal running conditions in a 3-phase induction motor ? *5*

7. Explain No load and Blocked rotor test performed on a 3-phase induction motor. Also draw the equivalent circuit. *10*

8. A 3·3 kV, 50 Hz, 6-pole, star connected induction motor has a transformation ratio of 2·5 (stator/rotor). The rotor resistance is 0·1 Ω/phase and its per phase leakage inductance is 3 mH. The stator impedance may be neglected.

Find

(a) the starting current and torque on rated voltage with short circuited slip rings,

(b) the necessary external resistance to reduce the rated voltage starting current to 30 A and the corresponding starting torque. *10*

9. Why is a single phase induction motor not self-starting ? Explain the double revolving field theory as applied to a single phase induction motor. *10*

10. (a) Explain the importance of auxiliary winding in a single phase induction motor. *5*

(b) With the help of a neat sketch, explain the working of a universal motor. *5*