

**B.Tech. - VIEP - ELECTRICAL ENGINEERING
(BTELVI)**

00555

**Term-End Examination
December, 2014**

**BIEE-016 : ELECTRO-MECHANICAL ENERGY
CONVERSION - III**

Time : 3 hours

Maximum Marks : 70

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

1. (a) With the help of suitable diagram, describe the common essential features of rotating electrical machines.
- (b) Deduce Park's transformations relating the 3-phase currents of a synchronous machine to its corresponding d-q axes currents. Express 3-phase currents in terms of d-q axes currents and its inverse. $2 \times 7 = 14$
2. (a) Obtain the transfer function of a separately excited dc generator for its (i) no load and (ii) on-load operation.
- (b) Develop an electrical circuit which is equivalent to a separately excited dc motor. $2 \times 7 = 14$

3. (a) A 3-phase star connected 50 Hz synchronous generator has direct axis synchronous reactance of 0.65 p.u. and quadrature axis synchronous reactance 0.5 p.u. The generator delivers rated KVA at rated voltage. Draw the phasor diagram at full load 0.8 pf lagging and hence calculate the open circuit voltage and voltage regulation. Resistance drop at full load is 0.02 p.u.
- (b) Why is it important to investigate the transient behaviour of a synchronous generator ? Plot the steady state and transient power-angle characteristics of a synchronous machine. $2 \times 7 = 14$
4. (a) Explain the various reactances associated with an alternator and how they are caused.
- (b) Derive expressions for the following :
- (i) Direct axis short circuit transient time constant
- (ii) Direct axis short circuit subtransient time constant $2 \times 7 = 14$
5. (a) A 3-phase induction motor is connected to an unbalanced supply voltage. Under this condition, derive its equivalent circuits and show that the net electromagnetic torque is reduced.

(b) Sketch the typical torque-slip characteristic of a 3-phase induction motor. How is this characteristic modified if

(i) Rotor circuit resistance is increased ?

(ii) Rotor circuit reactance is increased ?

$2 \times 7 = 14$

6. (a) Draw the generalized mathematical model of a polyphase induction machine. Write down the voltage equations for this model in matrix form and obtain therefrom the equivalent circuit for a polyphase induction motor.

(b) Draw the generalized model of a single phase induction motor based on cross-field theory and obtain the expression for the steady state electromagnetic torque. $2 \times 7 = 14$

7. Discuss the working principle and constructional features of any *two* of the following : $2 \times 7 = 14$

(a) Stepper motor

(b) Hysteresis motor

(c) DC Servo motor