(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2055 Roll No. | | | | | | | | | | |

B. Tech.

(SEM. V) ODD SEMESTER THEORY EXAMINATION 2010-11

ELECTROMECHANICAL ENERGY CONVERSION—II

Time : 3 Hours *Total Marks : 100*

Note : (1) Attempt **all** questions.

(2) All questions carry equal marks.

1. Attempt any **four** parts of the following :— **(5×4=20)**

(a) Derive e.m.f. equation of an alternator. Also explain the meaning of Distribution factor and coil span factor.

(b) A 3-phase star-connected 1000 kVA, 2000 V, 50 Hz alternator gave the following O.C. and S.C. test readings :

Field Current (A)	10	20	25	30	40	50
O.C. Voltage (V)	800	1500	1760	2000	2350	2600
S.C. Armature Current (A)		200	250	300		

Determine the full-load percentage regulation at 0·8 p.f. lagging.

(c) Explain Potier's triangle with the help of neat diagram.

(d) Explain the magnetomotive force method with suitable phasor diagram and e.m.f. versus I_f curve representing OCC and SCC.

(e) A 500 kVA, 3-phase, 6-pole, 11 kV star-connected alternator is running in parallel with the synchronous

machine on 11,000 V bus. The synchronous reactance of the machine is 5 Ω/phase. Calculate the synchronizing power per mechanical degree at full load.

(f) Explain voltage regulation using synchronous impedance method.

2. Attempt any **two** parts of the following :— **(10×2=20)**

(a) What is an infinite bus ? State the operating characteristics of an infinite bus for an alternator connected to an infinite bus. Also show that the behaviour of a synchronous machine on an infinite bus is quite different from its isolated operation.

(b) Explain the Two-Reaction Theory applicable to salient-pole synchronous machine. Derive an expression for finding regulation for the same. Also draw the phasor diagram.

(c) Explain torque-angle characteristics of a salient-pole synchronous machine. A 2-pole, 50 Hz, 3-phase turbo alternator is excited to generate the bus-bar votlage of 11 kV on no load. The machine is star-connected and a short-circuit current of this excitation is 1000 A. Calculate P_{syn} and τ_{syn}.

Attempt any **two** parts of the following :— **(10×2=20)**

(a) What is the principle of operation of 3-phase induction machine ? Explain analytically or graphically (showing all necessary waveform and phasor diagram) how rotating magnetic field is produced in a 3-phase induction motor.

(b) Derive the relationship for torque developed by a 3-phase induction motor. Draw the torque-slip characteristics and deduce the condition for maximum torque.

(c) Explain the procedure of no-load and blocked rotor test on a 3-phase induction motor. A cage induction motor when started by means of a star-delta starter takes 180% of full-load line current and develops 35% of full-load torque at starting. Calculate :

(i) starting torque for star-delta in terms of full-load values.

(ii) starting torque for auto-transformer with 75% tapping.

4. Attempt any **two** parts of the following :— **(10×2=20)**

(a) Compare a single-cage motor with a double-cage induction motor of the same rating. Draw the equivalent circuit of a double-cage induction motor. Sketch torque and current characteristics of the same.

(b) Explain the phenomenon of crawling and cogging in a 3-phase induction motor.

(c) Discuss briefly the method of speed control of 3-phase induction motor. Also explain the method of speed control by varying frequency and rotor resistance in a 3-phase induction motor.

5. Attempt any **two** parts of the following :— **(10×2=20)**

(a) Using double-revolving field theory, explain why a single-phase induction motor is not self-starting.

(b) Discuss the procedure for determining the parameters of equivalent circuit of a single-phase induction motor.

(c) Explain the operation of a stepper motor. What are the advantages and disadvantages of a stepper motor ? State some important applications of stepper motors.