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## EE/EX-404(N)

B. E. (Fourth Semester) EXAMINATION, June, 2011

(Common for EE & EX Engg. Branch)

ELECTRO MECHANICAL ENERGY CONVERSION - I

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 35

**Note :** Solve any *one* question from each Unit. Assume any missing data. All questions carry equal marks.

### Unit - I

1. (a) Explain the following : 10
  - (i) Per unit system and its significance.
  - (ii) Distinguish among excitation current, the core loss current and the magnetising current.
  - (iii) Why core loss is not affected by the load and the copper loss varies with the load ?
  - (iv) All day efficiency is calculated for distribution transformer.
  - (v) If the pri. current of a transformer is twice as much as sec. current, is this a step up or step down transformer ?
- (b) A transformer has its max. efficiency of 98% at 15 kVA at unity p.f. During the day it is loaded as under : 10  
 12 hours : 2 kW at 0.5 p.f. lagging

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6 hours : 12 kW at 0.8 p.f. lagging

6 hours : 18 kW at 0.9 p.f. lagging

Find the all-day efficiency.

Or

2. (a) Explain why transformers are required to operate in parallel. Identify and explain the conditions which are absolutely necessary and which are desirable. 10
- (b) The high and low voltage windings of a 6600/250 V, 50 Hz, 1- $\phi$ , transformer have resistances of  $0.20 \Omega$  and  $3.1 \times 10^{-4} \Omega$  and reactances of  $1.0 \Omega$  and  $1.69 \times 10^{-3} \Omega$  respectively. Find the input current and power when the high voltage winding is connected to a 200 V, 50 Hz supply and the low voltage winding is short circuited. 10

### Unit - II

3. (a) Explain in detail the commutation process in a d. c. machine. On what factors does the current in the commutated coil depends ? Explain in brief *two* methods of improving commutation. 10
- (b) A shunt generator supplies 100 ampere at a terminal voltage of 200 V. The prime mover is developing 32 B. H. P.  $R_{sh} = 50 \Omega$  and  $R_a = 0.1 \Omega$ . Find : 10
  - (i) The iron and friction losses.
  - (ii) The copper losses and.
  - (iii) The commercial efficiency.

Or

4. (a) Draw and comment on all the performance characteristics of a separately excited D. C. generator.

- (b) List the reasons why a shunt generator fails to build up the voltage. What is critical speed and critical field resistance for a shunt generator ? Explain with appropriate diagram. 10

### Unit – III

5. (a) Derive the torque equation of a D. C. shunt motor. 10  
 (b) Explain the various methods of speed control of d. c. motors. Mention the limitations of each method. 10

Or

6. (a) List the advantages and disadvantages of Swinburne's test. This test may be performed on which type of machines ? Comment. 10  
 (b) A 220 V d. c. shunt motor at no-load takes a current of 2.5 A. The resistances of armature and shunt field are  $0.8 \Omega$  and  $200 \Omega$  respectively. Estimate the efficiency of the motor when the input current is 37 amperes. 10

### Unit – IV

7. (a) Discuss the advantages of slipring induction motor over squirrel cage induction motor. Give their applications. 5  
 (b) Draw the diagram representing the approximate equivalent circuit of a 3-ph. induction motor and briefly discuss its validity. 5  
 (c) A 3-ph. star connected, 400 V, 50 Hz, 4-pole induction motor has the following per phase parameters referred to the stator : 10  
 $R_1 = 0.15 \Omega$ ,  $X_1 = 0.45 \Omega$ ,  $R_2' = 0.12 \Omega$ ,  
 $X_2' = 0.45 \Omega$  and  $X_m = 28.5 \Omega$ .

Calculate the stator current and power factor when the motor is operated at rated voltage and frequency with slip  $S = 0.04$ .

(b)

8. (a) Justify the following statements : 2 each
- The airgap in a 3-phase induction motor is kept as short as possible.
  - Power factor of a 3-phase induction motor is low at no-load.
  - The rotor of a squirrel cage motor is skewed.
  - Double squirrel cage rotor improves the starting torque.
  - The max. torque of a SCIM is called pull out torque.
- (b) The input power to a 6 pole, 3-phase, 50 Hz induction motor is 42 W. The speed is 970 r. p. m. The stator losses are 1.2 kW and the friction and windage losses are 1.8 kW.
- Find : 10
- The rotor copper loss
  - The efficiency of the motor

#### Unit – V

9. (a) Give the procedure for conducting no-load and blocked rotor test on a 3-phase induction motor. How are the parameters of the equivalent circuit determined from the test results ? Draw the equivalent circuit of the 3-phase induction motor. 10
- (b) A 50 HP, 440 V, 3-phase, 50 Hz, induction motor with  $\Delta$  connected stator winding gave the test results ahead : 10

	Applied Voltage (Volts)	Line Current (Amps.)	Wattmeter Reading (Watts)
(i) No load test	440	24	5150
(ii) Blocked rotor test	36.6	65	3350
			2150
			766

Calculate the parameters of equivalent circuit.

Or

10. (a) Describe a method suitable to start a 10 H. P squirrel case 3-phase induction motor. Also list the various starting methods. 10
- (b) Which tests are conducted to draw the circle diagram of a 3-phase induction motor ? Explain how these data are utilized to draw the circle diagram. Give step by step procedure. 10