

Total No. of Questions : 10] [Total No. of Printed Pages : 4

Roll No.

EE/EX-404(N)

B. E. (Fourth Semester) EXAMINATION, June, 2010

(New Scheme)

(Common for EE & EX Engg.)

ELECTRO MECHANICAL ENERGY CONVERSION—I

[EX/EE-404(N)]

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 35

- Note : (i) Attempt one question from each Unit.
(ii) All questions carry equal marks.
(iii) Assume suitable data wherever necessary.

Unit—I

1. (a) What are the conditions for satisfactory parallel operation of transformers ? Explain the most essential and the desirable conditions in detail. 10
(b) A 600 KVA, single phase transformer when working at unity p.f. has an efficiency of 92% at full load and also at half full load. Determine the efficiency when it operates at unity pf and 60% of full load. 10

Or

2. (a) Explain the following connections by which 3 phase power is transformer using 2 single phase transformers : 10
(i) Scott connection
(ii) Open-delta connection

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- (b) What is voltage regulation ? What is its importance ? For which type of load, the voltage regulation is negative ? Derive an expression for voltage regulation under lagging p.f. load. 10

Unit—II

3. (a) What is armature reaction ? What are the effects of armature reaction in dc machines ? How the armature reaction is minimised ? 10
(b) Estimate the reduction in speed of a generator with constant excitation on busbars to decrease its load from 500 kW to 250 kW. The resistance between terminals is 0.015Ω . The busbar voltage is 500 V. 10

Or

4. (a) Explain how do you obtain the internal characteristics of a dc shunt generator when external characteristics of same is known to you. 10
(b) A 1500 kW, 550 V, 16 pole dc generator runs at 1500 r.p.m. What must be the useful flux per pole if there are 2500 conductors in the armature and the winding is lap connected and full load armature copper loss is 25 kW ? Calculate the area of the pole shoe if the airgap flux density has uniform value of 0.9 Wb/m^2 . Also find the no-load terminal voltage. Neglect change in speed. 10

Unit—III

5. (a) Explain Swinburne's test to determine the efficiency of a dc machine with the help of a neat diagram. What are the main advantages and disadvantages of this test ?

10

- (b) A 230 V dc shunt motor takes a armature current of 3.33 A at rated voltage and at no load speed of 1000 r.p.m. The resistance of the armature circuit and field circuit are respectively 0.3 Ω and 160 Ω . The line current at full load and rated voltage is 40 A. Calculate the full load speed if the armature reaction weakens no load flux by 4%. 10

Or

- i. (a) Prove that the armature torque of a dc machine is given by : 10

$$T = \frac{PZ}{2\pi A} \phi I_a$$

- (b) A 100 HP, 500 V, shunt motor has 4 poles and a two circuit wave winding with 492 armature conductors. The flux is 50 milliWb. per pole and the full load efficiency is 92%. The armature and commutating field windings have a total resistance of 0.1 Ω . The shunt field resistance is 250 Ω . Calculate for full load : 5 each

- (i) The speed
(ii) The useful torque

Unit-IV

- (a) Draw and explain the torque-slip characteristics of a 3ph. induction motor indicating starting torque, max torque and operating region. 10
- (b) An 8 pole, 3 ph, 50 Hz induction motor running with a slip of 4% is taking 20 kW. Stator losses amount to 500 watts. If the mechanical torque lost in friction is 16.25 N-M, find : 10
- (i) The rotor copper loss
(ii) BHP
(iii) Efficiency

Or

8. (a) Explain the procedure for drawing circle diagram of an induction motor. What information can be drawn from the circle diagram ? 10
- (b) Show through power flow diagram, how electrical input is converted into mechanical power output in an induction motor. 10

Unit-V

9. (a) Discuss speed control methods used for 3 ph. induction motor. What are the advantages of solid state control employed for induction motor ? 10
- (b) Explain briefly various effects of unbalanced power supply on performance of 3 ph. induction motor. 10

Or

10. (a) How will you design the rotor of a squirrel cage rotor to have a high starting torque ? Explain. 10
- (b) Explain various methods of starting a 3 ph. induction motor. Explain with the help of a neat diagram the working of a star-delta starter. What is its limitation ? 10