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Question Paper Code : P 1280

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2009.

Third Semester

(Regulation 2004)

Electrical and Electronics Engineering

EE 1202 — ELECTRICAL MACHINES — I

(Common to B.E. (Part-Time) Second Semester – EEE – Regulation 2005)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State Lenz's Law.
2. Define Field energy and Co-energy.
3. What is meant by armature reaction?
4. List the Losses in a D.C generator.
5. Draw the mechanical characteristics of a dc compound motor.
6. Give the applications of D.C series motor.
7. Draw the phasor diagram of Transformer on No-load.
8. Write down the condition for maximum efficiency of a transformer.
9. Why is Transformer rating given in KVA?
10. Write down the advantages of Hopkinson's test.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Explain the concept of MMF Space wave of single phase distributed winding (8)

(ii) A 3-phase, 50 KW, 4-pole, 50 Hz induction motor has a winding (ac) designed for delta connection. The winding has 24 conductors per slot arranged in 60 slots. The rms value of the line current is 48 A. Find the fundamental of the mmf wave of phase–A When the current is passing through its maximum value. What is the speed and peak value of the resultant mmf/pole? (8)

Or

(b) (i) Draw the schematic diagram indicating flow of energy in the conversion of mechanical energy to electrical form. (8)

(ii) For the electromechanical system shown in Fig. (b) (ii).the air-gap flux density under steady operating condition is $B(t) = Bm \sin \omega t$. Find (1) The coil voltage (2) the force of field origin as a function of time. (3) The motion of armature as a function of time. (8)

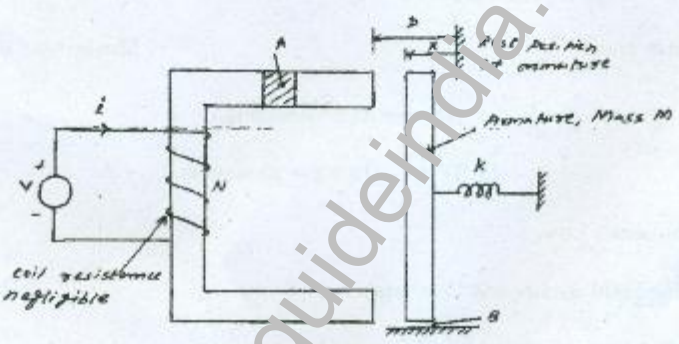

Fig. (b) (ii)

12. (a) (i) Explain the effects of armature reaction on the operation of D.C machines. How the armature reaction is minimized? (8)

(ii) Explain the performance characteristics of D.C generators. (8)

Or

(b) (i) Two shunt generators, each with a no load voltage of 125 V are running in parallel. Their external characteristics can be taken as straight lines over these operating ranges. Generator no : 1 is rated at 25 KW and its full load voltage is 119 V, generator no : 2 is rated at 200 KW at 116 V. Calculate the bus-bar voltage when the total load is 3500A. How is the load divided between the two. (8)

(ii) Explain the process of commutation in a dc machine and describe the methods to improve it. (8)

13. (a) (i) Explain the necessity of starter in a dc motor and describe three point starter with a neat sketch. (8)

(ii) Derive the Torque equation of a D.C motor. (8)

Or

(b) (i) Sketch and explain the electrical characteristics of D.C shunt and series motor. (8)

(ii) A 6 pole, 500 V wave-connected shunt motor has 1200 armature conductors and useful flux/pole of 20 mWb. The armature and field resistance are 0.5 Ω and 250 Ω respectively. What will be the speed and torque developed by the motor when it draws 20 A from the supply mains. Neglect the armature reaction. If magnetic and mechanical losses amount to 900 W, find (1) useful torque (2) output in KW and (3) efficiency at this load. (8)

14. (a) (i) Derive an expression for saving in conductor material in an autotransformer over two winding transformer of equal rating. State its merits and demerits. (8)

(ii) What is meant by three-phase transformer groups? What is the significance of these groups? (8)

Or

(b) (i) Two 100 KW, single-phase transformers are connected in parallel both on the primary and secondary. One transformer has an ohmic drop of 0.5% at full-load and an inductive drop of 8% at full-load current. The other has an ohmic drop of 0.75% and inductive drop of 2%. Show how they will share a load of 180 KW at 0.9 power factor. (8)

(ii) Derive and explain the equivalent circuit of a single-phase transformer. (8)

15. (a) (i) Explain briefly Hopkinson's test for determination of efficiency of dc shunt machines. Mention the merits and limitation of this test. (8)

(ii) A retardation test is made on a separately-excited D.C. machine as a motor. The induced voltage falls from 240V to 225V in 25 seconds on opening the armature circuit and 6 seconds on suddenly changing the armature connection from supply to a load resistance taking 10 A (average). Find the efficiency of the machines when running as a motor and taking a current of 25A on a supply of 250V. The resistance of its armature is 0.4 Ω and that of its field winding is 250 Ω. (8)

Or

(b) (i) Two 100 KW transformers each has a maximum efficiency of 98% but in one the maximum efficiency occurs at full-load while in the other, it occurs at half-load. Each transformer is on full-load for 4 hours, on half–load for 6 hours and on one–tenth load for 14 hours per day. Determine the all-day efficiency of each transformer. (8)

(ii) Derive an expression for maximum efficiency of a transformer. (8)
