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Question Paper Code : 71772

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2017.

Fourth Semester

Electrical and Electronics Engineering

EE 6401 — ELECTRICAL MACHINES – I

(Regulations 2013)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define relative permeability
2. Give the expression for hysteresis losses and eddy current losses.
3. Why transformer rating is expressed in kVA?
4. Why wattmeter in OC test on transformer reads core loss and that in SC test reads copper loss at full load?
5. Define the synchronous speed. Write the expression also.
6. Define the term pole pitch and coil pitch.
7. What is meant by armature reaction?
8. State the conditions under which a DC shunt generator fails to excite.
9. Why a starter is necessary for a DC motor?
10. What are the applications of DC motor?

PART B — (5 × 13 = 65 marks)

11. (a) Derive the expression for self inductance and mutual inductance and also define coefficient of coupling.

Or

- (b) The core of an electromagnet is made of an iron rod of 1 cm diameter, bent in to a circle of mean diameter 10 cm, a radial air gap of 1 mm being left between the ends of the rod. Calculate the direct current needed in coil of 2000 turns uniformly spaced around the core to produce a magnetic flux of 0.2 mwb in the air gap. Assume that the relative permeability of the iron is 150, that the magnetic leakage factor is 1.2 and that the air gap is parallel.

12. (a) Explain the back to back method of testing for two identical single phase transformers.

Or

- (b) Draw the equivalent circuit of a single phase 1100/220V transformer on which the following results were obtained.

(i) 1100V, 0.5A, 55W on primary side, secondary being open circuited

(ii) 10V, 80A, 400W on LV side, high voltage side being short circuited

Calculate the voltage regulation and efficiency for the above transformer when supplying 100 A at 0.8 pf lagging.

13. (a) Explain the concept of electromechanical energy conversion with neat diagram.

Or

- (b) Explain in detailed MMF distribution in AC synchronous machine and derive the expression for fundamental MMF.

14. (a) Explain the effect of armature reaction in a DC generator. How are its demagnetizing and cross magnetizing ampere turns calculated?

Or

- (b) A four pole lap wound shunt generator supplies 60 lamps of 100W, 240V each; the field and armature resistances are 55Ω and 0.18Ω respectively. If the brush drop is 1V for each brush find (i) Armature Current (ii) Current per path (iii) Generated emf (iv) Power output of DC machine.

15. (a) Explain the different methods of speed control techniques of DC motors.

Or

- (b) With the help of neat circuit diagram, explain Swinburne's test and derive the relations for efficiency (Both for generator and Motor).

PART C — (1 × 15 = 15 marks)

16. (a) The parameters of approximate equivalent circuit of a 4KVA, 200/400V, 50Hz, single phase transformer are : $R_p^1 = 0.15 \text{ ohm}$; $X_p^1 = 0.37 \text{ ohm}$; $R_o = 600 \text{ ohm}$; $X_m = 300 \text{ ohm}$; When rated voltage of 200V is applied to the primary, a current of 10A at lagging power factor of 0.8 flows in the secondary winding. Calculate (i) the current in the primary (ii) terminal voltage at the secondary side.

Or

- (b) A shunt motor runs at 600 rpm from 250V supply and takes a line current of 50A. Its armature and field resistances are 0.4Ω and 125Ω respectively. Neglecting the effects of armature reaction and allowing 2V brush drop. Calculate : (i) The no-load speed if the no-load line current is 5A (ii) The percentage reduction in flux per pole in order that the speed may be 800rpm when the armature current is 40A.