Question Paper Code: 1053194

B.E. / B.Tech. DEGREE EXAMINATIONS, NOV/ DEC 2024
Third Semester
Electrical and Electronics Engineering
EE8301 – ELECTRICAL MACHINES - I
(Regulation 2017)

Time: Three Hours   Maximum: 100 Marks

Answer ALL questions

PART – A   (10 x 2 = 20 Marks)

1.   What are the types of magnetic losses?

2.   Define Permeability of free space.

3.   Why is transformer rated in KVA? Justify.

4.   How does the transformer manufacturer find their transformer efficiency?

5.   Tell why fractional pitched winding is preferred over full.

6.   Draw a flow of energy in electro mechanical energy conversion devices via coupling field.

7.   List the factors involved in the voltage buildup of a Shunt Generator.

8.   Discuss the purpose of commutator in DC machine.

9.   Mention the merits and demerits of Swinburne's test.

10.   Criticize "belt drive not suitable for DC Series Motor why?"

PART – B   (5 x 13 = 65 Marks)

11. (a) An iron rod 1.8 cm diameter is bent to form a ring of mean diameter 25 cm and wound with 250 turns of wire. A gap of 1 mm exists in between the end faces. Calculate the current required to produce a flux of 0.6 mWb. Take relative permeability of iron as 1200.   (13)

(OR)

(b) With neat diagram explain the speed EMF or Motional EMF. Also derive its expression. (13)

12. (a) Explain the construction, working principle and operation of a transformer. (13)

(OR)

(b) A single-phase transformer has 180 turns respectively in its secondary and primary windings. The respective resistances are 0.233 and 0.067. Calculate the equivalent resistance of
(i) the primary in terms of the secondary winding.
(ii) the secondary in terms of the primary winding.
(iii) the total resistance of the transformer in terms of the primary. (13)

13. (a) Two coupled coils have self and mutual inductance of L_{11} = 3+0.5x; L_{22} = 2+0.5x; L_{12} = L_{21} = 0.3x over a certain range of linear displacement x. the first coil is excited by a constant current of 15 A and the second by a constant current of -8 A. Determine
(i) Mechanical work done if x changes from 0.6m to 1m.
(ii) Energy supplied by each electrical source. (13)

(OR)

(b) Derive the field energy, co-energy and force for a doubly excited system. (13)

14. (a) A separately excited generator when running at 1200 rpm supplies 200 A at 125 V to a circuit of constant resistance. What will be the current when the speed dropped to 1000 rpm and field current is reduced to 80%. Given that armature resistance=0.4 Ω and the total drop at brushes = 2 V. Ignore the saturation and armature reaction. (13)

(OR)

(b) Describe the different characteristics of DC shunt generator with suitable diagram. Also demonstrate the procedure to obtain it. (13)

15. (a) A DC motor drives a 100 kW generator having an efficiency of 87%.
(i) What should be the kW rating of the motor?
(ii) If the overall efficiency of the motor generator set is 74%, what is the efficiency of the motor?
(iii) Calculate the losses in each machine. (13)

(OR)

(b) With the help of neat circuit diagram, explain Swinburne's test and Hopkinson's Test. derive the relations for efficiency (Both for generator and Motor). (13)
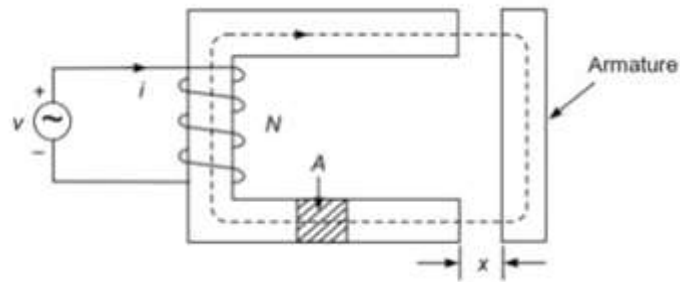
PART – C   (1 x 15 = 15 Marks)

16. (a) Construct a detailed explanation of how the MMF space wave for a single phase in a distributed AC winding.   (15)

(OR)

(b) In the electromagnetic relay of Fig. shown below excited from a voltage source, the current and flux linkages are related as $i = \lambda^2 + + 2\lambda (1 - x)^2$, $x < 1$ Find the force on the armature as a function of λ.   (15)

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