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**Question Paper Code : 91487**

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019  
Fourth Semester

Electrical and Electronics Engineering  
EE 6401 – ELECTRICAL MACHINES – I  
(Regulations 2013)

(Common to PTEE 6401, Electrical Machines – I – for B.E. (Part-Time)  
Third Semester – Electrical and Electronics Engineering – Regulations 2014)

Time : Three Hours

Maximum : 100 Marks

Answer ALL questions

PART – A

(10×2=20 Marks)

1. What is Hysteresis Losses ?
2. Define Flux Linkage.
3. Define all day efficiency of a transformer.
4. What is Inrush current in a transformer ?
5. Define the synchronous speed. Write the expression also.
6. Define the term pole pitch and coil pitch.
7. Specify the role of Interpoles in DC machine.
8. What is meant by residual emf in DC generator ?
9. State Fleming's Left hand rule.
10. Why DC series motor is called as Variable speed motor ?

PART – B

(5×13=65 Marks)

11. a) Derive the expression for self inductance and mutual inductance and also the 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) i) Derive the expression for saving of copper in autotransformer. (8)  
ii) Calculate the efficiency for half, full load of a 100 KVA transformer for the P.F. of unity and 0.8 the copper loss at full load is 1000 W and iron loss is 1000 W. (5)

(OR)

b) The primary of the transformer is rated at 10 A and 1000 V. The open circuit reading are  $V_1 = 1000$  V,  $V_2 = 500$  V,  $I = 0.42$  A,  $P_{ac} = 100$  W. The short circuit readings are  $I_1 = 10$  A,  $V_1 = 125$  V and  $P_{ac} = 400$  W. Draw the equivalent circuit for the Transformer. Predict the output voltage for the load impedance  $Z_L = 19 + j12$  ohms and draw the phasor diagram.

13. a) Obtain the expression for energy in a attracted armature relay magnetic system.

(OR)

b) With an example explain the Multiple-excited magnetic field system.

14. a) Explain the construction and operation of D.C. generator.

(OR)

b) Describe the process of commutation in D.C. machine.

15. a) i) Why starting current is high at the moment of starting a DC motor ?  
Explain the method of limiting the starting current in DC motors. (9)  
ii) A 400 volts DC shunt motor has a no load speed of 1450 RPM, the line current being 9 Amperes. At full loaded condition, the Line current is 75 Amperes. If the shunt field resistance is 200 Ohms and armature resistance is 0.5 Ohm. Calculate the full load speed. (4)

(OR)



- b) i) Draw the speed Torque characteristics of DC shunt and series motor. Also from the characteristics specify the applications for each motor. (8)
- ii) A 230 Volts DC shunt motor on no-load runs at a speed of 1200 RPM and draws a current of 4.5 Amperes. The armature and shunt field resistances are 0.3 ohm and 230 ohms respectively. Calculate the back EMF induced and speed, when loaded and drawing a current of 36 Amperes. (5)

PART – C

(1×15=15 Marks)

16. a) The parameters of approximate equivalent circuit of a 4KVA, 200/400 V, 50 Hz, single phase transformer are :  $R_{p1} = 0.15 \text{ ohm}$ ;  $X_{p1} = 0.37 \text{ ohm}$ ;  $R_0 = 600 \text{ ohm}$ ;  $X_m = 300 \text{ ohm}$ ; When rated voltage of 200 V is applied to the primary, a current of 10 A 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 250 V supply and takes a line current of 50A. Its armature and field resistances are  $0.4 \Omega$  and  $125 \Omega$  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 800 rpm when the armature current is 40 A.
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