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Question Paper Code : X 60497

B.E./B.Tech. DEGREE EXAMINATIONS, NOV./DEC. 2020

Fourth Semester

Electrical and Electronics Engineering

EE 2251/EE 42/EE 1251 A/10133 EE402/080280003 – ELECTRICAL MACHINES – I

(Regulations 2008/2010)

(Common to PTEE2251/10133EE402 For B.E. (Part Time)-Third Semester-Electrical and Electronics

Engineering-Regulations 2009/2010)

Time : Three Hours

Maximum : 100 Marks

Answer ALL questions

PART – A

(10×2=20 Marks)

1. Clearly define the MMF and EMF.
2. What are the core losses and how can this loss be minimized ?
3. Which equivalent circuit parameters can be determined from the open-circuit test on a transformer ?
4. The emf per turn for a single-phase 2200/220 V, 50 Hz transformer is 11 V. Calculate the number of primary and secondary turns.
5. Draw the power flow diagram for motor and generator operation.
6. In a magnetic circuit with a small air gap, in which part the maximum energy is stored and why ?
7. What is meant by SPP ? What is its significance ?
8. Enumerate the advantages of using short-pitched winding in a synchronous machine.
9. List the factors involved in the voltage build up of a shunt generator.
10. Why the external characteristics of a DC shunt generator is more drooping than that of a separately excited generator ?



PART – B

(5×16=80 Marks)

11. a) i) Define inductance of a coil. (4)
 ii) For the magnetic circuit shown in Fig. 11 (a) (ii) determine the current required to establish a flux density of 0.5 T in the air gap. (12)

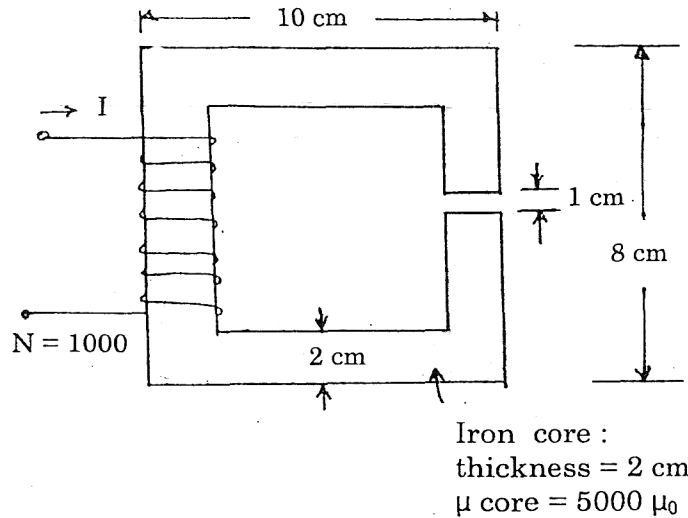


Figure 11 (a) (ii)

(OR)

- b) i) Define permeability of a magnetic material and the factors on which it depends. (4)
 ii) Explain the operation of a magnetic circuit when A.C. current is applied to the coil wound on iron core. Draw the B-H curve and obtain an expression for hysteresis loss. (12)
12. a) i) Describe the construction and principle of operation of single phase transformer. (8)
 ii) Derive an expression for maximum efficiency of a transformer. (8)
- (OR)
- b) A 500 kVA transformer has 95% efficiency at full load and also at 60% of full load both at upf.
 i) Separate out the transformer losses.
 ii) Determine the transformer efficiency at 75% full load, upf.
13. a) i) Describe the flow of energy in electromechanical devices. (6)
 ii) Discuss about the 'field energy' and 'coenergy' in magnetic system. (4)
 iii) The magnetic flux density on the surface of an iron face is 1.6 T which is a typical saturation level value for ferromagnetic material. Find the force density on the iron face. (6)

(OR)



- b) A doubly-excited magnetic field system has coil self- and mutual-inductances of $L_{11} = L_{22} = 2\text{H}$ and $L_{12} = L_{21} = \cos\theta$

Where θ is the angle between the axes of the coils.

- i) The coils are connected in parallel to a voltage source $v = V_m \sin \omega t$. Derive an expression for the instantaneous torque as a function of the angular position θ . Find there from the time-average torque. Evaluate for $\theta = 30^\circ$, $v = 100 \sin 314t$. (8)
- ii) If coil 2 is shorted while coil 1 carries a current of $i_1 = I_m \sin \omega t$, derive expressions for the instantaneous and time-average torques. Compute the value of the time-average torque when $\theta = 45^\circ$ and $i_1 = \sqrt{2} \sin 314t$. (8)

14. a) Explain the construction and principle of operation of synchronous machines. (16)

(OR)

- b) A 2000V, three phase star connected synchronous motor has an effective resistance and synchronous reactance of 0.2Ω and 2.2Ω per phase respectively. The input is 800kW at normal voltage and the induced line emf is 2500V. Calculate the line current and power factor. (16)

15. a) i) Derive from the fundamental, emf and torque equations and explain the characteristics of DC shunt motor. (12)
- ii) What are the merits and demerits of Hopkinson's test? (4)

(OR)

- b) i) Discuss in detail about shunt armature speed control of dc shunt motor. (8)
- ii) A 500 V dc shunt motor running at 700 rpm takes an armature current of 50A. Its effective armature resistance is 0.4Ω . What resistance must be placed in series with the armature to reduce the speed to 600 rpm, the torque remaining constant? (8)
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