7. (a) A 8-pole generator has an induced emf of 400 V when driven at a speed of 600 rpm. The armature is lap wound has 730 conductors, its resistance being 0.25 ohm. The Bore of the pole shoe is 350 mm diameter, the pole subtends an angle of 60 degree and is 200 mm long. Calculate the flux density in the air gap. 10

b) Derive an expression for the emf generated in a DC machine. 10

SECTION – D

8. (a) Derive an expression for the torque of a DC motor. Also draw torque vs. speed characteristics for DC shunt and series motors. 10

(b) A 220 V DC series motor runs at 480 rpm when taking a current of 24A. The resistance of The armature is 0.45 ohm and that of field is 0.3 ohm. if the current remains constant, Calculate the resistance necessary to reduce the speed to 240 rpm. 10

9. (a) Explain Swinburne's test for DC motors with its merits and demerits. 10

(b) How is the speed control of DC shunt motor obtained by changing the resistance in the Armature circuit ? Describes various applications of DC motors. 10

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B. Tech 3rd Semester (EE) Examination – December, 2022

ELECTRICAL MACHINES - I

Time : Three Hours] *[Maximum Marks : 75*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt ***five*** questions in all, selecting ***one*** question from each Section. Question No. **1** is ***compulsory***.

1. Explain the following : 5 x 4 = 20

(i) What is Leakage Reactance of transformer ?

(ii) Inrush current.

(iii) What is significance of back emf in a DC machines and derive the expressions for it.

(iv) Methods of Excitation of DC machines.

SECTION – A

2. (a) Discuss the necessity of parallel operation of transformer. Also explain necessary Conditions

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that should be fulfilled by transformers for operation in parallel. 12

(b) A 240/110, 1-phase transformer is rated 12 kVA. If the transformer is connected as an Auto-transformer across a 60 V supply, what is the maximum output voltage that can be obtained from the transformer ? If the load current is now 10 A, determine the kVA output and the input current. 8

3. (a) A 10 KVA 220/110V transformer has maximum efficiency of 96% at 0.8 power factor Lagging it core is 100 watt and full load regulation at .08 power factor lagging is 5%. Find the efficiency and Regulation at 80% full load , 0.9 power factor lagging. 10

R_2 = 0.01 ohm, X_2 = 0.035 ohm. The applied voltage is 240 V. Find :

(i) Total impedance as referred to primary.

(ii) Voltage regulation and output voltage at 0.8 power factor lagging at full load.

(b) Describe Sumpner's (back to back) test for determination of efficiency of transformers. indicate its advantages. 10

SECTION – B

4. (a) Explain the simple zig-zag connection and state the group. 8

(b) In an auto transformer how the current flows in different parts of its windings ? Derive an expression for the saving of copper in an auto-transformer as compared to an equivalent two winding transformer. Draw and explain the phasor diagram pf an auto-transformer on load. Give the constructional features of an auto-transformer. 12

5. (a) What are the various methods of three- to-six phase conversion ? Explain any one in detail. 10

(b) Two single-phase furnaces working at 200V and are supplied from 2400V 3-phase Scott connected transformers. Calculate the currents in 3-phase side when the power drawn by each furnaces 800 kW at a power factor of 0.85 lagging, neglecting losses. 10

SECTION – C

6. (a) A 220 V DC shunt motor runs at 900 rpm and on load takes 4A. Armature and Field resistance are 0.2 ohm and 240 ohm respectively. Calculate the speed when loaded and taking current of 46 A. Assume that flux get weakened by 3% due to armature reaction. 10

(b) Draw and explain the circuit diagrams of different types of DC Generators. 10