

II B. Tech I Semester Supplementary Examinations, September - 2021**ELECTRICAL MACHINES - I**

(Electrical and Electronics Engineering)

Time: 3 hours

Max. Marks: 75

Answer any **FIVE** Questions each Question from each unitAll Questions carry **Equal** Marks

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- 1 a) Distinguish between Wave winding and lap winding in a DC Machine. [7M]  
 b) A 100 KW, 230V, shunt generator has armature resistance of  $0.05\Omega$  and field resistance of  $57.5\Omega$ . If the generator operates at rated voltage, calculate the induced voltage at i) Full load and ii) half full load. Neglect brush contact drop. [8M]  
 Or
- 2 a) Derive the emf equation of a DC Machine. [7M]  
 b) A separately excited motor runs at 1045 rpm, with a constant field current, while taking an armature current of 50A at 120 V. The armature resistance is  $0.1\Omega$ . If the load on the motor changes such that it now takes 95 A at 120 V, determine the motor speed at this load. [8M]
- 3 a) List and explain the various losses that occur in a DC Machine. [7M]  
 b) A 4-pole dc motor is lap-wound with 400 conductors. The pole shoe is 20 cm long and average flux density over one-pole-pitch is 0.4 T, the armature diameter being 30 cm. Find the torque and gross mechanical power developed when the motor is drawing 25 A and running at 1500 rpm. [8M]  
 Or
- 4 The magnetization characteristic of a 4-pole de series motor may be taken as proportional to current over a part of the working range; on this basis the flux per pole is 4.5 mWb/A. The load requires a gross torque proportional to the square of the speed equal to 30 Nm at 1000 rev/min. The armature is wave-wound and has 492 active conductors. Determine the speed at which the motor will run and the current it will draw when connected to a 220 V supply, the total armature resistance of the motor being  $2\Omega$ . [15M]
- 5 a) List the advantages of compound motors over Series/ Shunt Motors. [7M]  
 b) A 10 hp, 230 V shunt motor takes a full load line current of 40A. The armature and field resistances are  $0.25\Omega$  and  $230\Omega$ , respectively. The total brush contact drop is 2v and the core and friction losses are 380 W. Calculate the efficiency of the motor. Assume that stray – load loss is 1% of output. [8M]  
 Or
- 6 a) Explain the working of a Three Point starter with a neat circuit diagram. [8M]  
 b) A 250V, 10 hp shunt motor has an armature resistance of  $0.5\Omega$ , and field resistance of  $250\Omega$ . The motor takes a current of 5A on no – load and 37.1 A on rated load. Determine it's rated – load efficiency. [7M]
- 7 a) Explain the constructional features of transformers. [8M]  
 b) Find i) active and reactive components of no – load current; and ii) no – load current of a 640/320 V single phase transformer if the power input on no – load to the high voltage winding is 120 W and power factor of no-load current is 0.42 lagging. [7M]

Or

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- 8 a) List and explain the various losses that occur in a transformer [7M]
- b) A 35 KVA, 2200/220 V, single – phase, 50Hz transformer has a primary resistance of  $4\Omega$  and a reactance of  $5\Omega$ . The secondary resistance and reactance are  $0.022\Omega$  and  $0.03\Omega$  respectively. Find: i) Equivalent resistance, reactance and impedance referred to primary. ii) Equivalent resistance, reactance and impedance referred to Secondary iii) Total copper loss of the transformer. [8M]
- 9 a) Justify and Explain why an open circuit test is generally performed at rated voltage on LV side of a transformer and the short circuit test is performed at reduced voltage on the HV side? [7M]
- b) The following data were obtained on a 20 kVA, 50 Hz, 2000/200 V distribution transformer: Draw the approximate equivalent circuit of the transformer referred to the HV and LV sides respectively. [8M]

|                                 | Voltage (V) | Current(A) | Power(W) |
|---------------------------------|-------------|------------|----------|
| OC test with HV open circuited  | 200         | 4          | 120      |
| SC test with LV short circuited | 60          | 10         | 300      |

Or

- 10 a) Explain the various core types of Three – phase transformers and also show the three – phase transformer connections. [7M]
- b) A 240V/120V, 12 kVA transformer has full-load unity power factor efficiency of 96.2%. It is connected as an auto-transformer to feed a load at 360 V. What is its rating and full-load efficiency at 0.85 power factor lagging? [8M]

