

**ELECTRICAL MACHINES**

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Time: Three Hours

Full Marks: 100 (40 Marks for part-I)

**Use a separate Answer-Script for each part**

**PART - I**

**Answer Question No. 1 and any two from the rest.**

- 1. Answer any four** **3x4=12**
- a) What do you mean by three phase balanced load?
  - b) Why 3-wattmeter method is not suitable for measuring power in 3-phase, 3-wire circuits.
  - c) Why an induction motor can not run at synchronous speed?
  - d) Explain with reasons what happens when: In a 3-phase induction motor, any two supply terminals are interchanged.
  - e) Explain with reasons what happens when: The ends of the rotor bars of squirrel cage induction motor are not shorted by end rings.
  - f) Why the air-gap between stator core and rotor is made as small as possible.
- 2. a)** Show that the total power in a 3-phase balanced load is  $P = \sqrt{3} VI \cos \phi$  where  $V$  is the rms line voltage,  $I$  is the rms line current and  $\phi$  is the angle between phase voltage and phase current. **4+10**
- b) A three-phase, star-connected alternator feeds a 2000 hp delta-connected induction motor having a power-factor of 0.85(lag) and an efficiency of 93%. Calculate the current and its active and reactive components in (a) each alternator phase, (b) each motor phase. The line voltage is 2200V.

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**PART - I**

3. a) Derive and plot the torque speed characteristics of three phase induction motors. 10+4
- b) When 50 Hz 3 phase voltage is applied across a three phase induction motor, the rotor speed with the rated load is 1450 rpm. Find Slip and no. of poles of the machine.
4. a) Using per phase equivalent circuit of three phase induction motor, discuss how you can determine the parameters of this circuit. Show the schematic circuit diagram. 10+4
- b) Draw the arrangement of star delta-starter power circuit.
5. Write short notes on (any two). 7x2
- a) 3 phase power measurement using two wattmeter method
- b) Rotor construction of SQIM and WRIM

B.E. Mechanical Engineering - First Year - Second Semester EXAMINATION, 2018

(1<sup>st</sup>/2<sup>nd</sup> Semester/Repeat/Supplementary/Spl. Supplementary/Old/Annual/Bi-Annual)

SUBJECT Electrical Machines

(Name in full)

PAPER

Full Marks 30/ 100

Time : Two hours/Three hours/Four hours/Six hours

(15/60 marks for part-I)

Use a separate Answer-Script for each part

No. of  
questions

## PART – II

Marks

**Question No 1 is compulsory and answer Question no 2.a) or 2.b)****& 3.a) or 3.b)****Answer any 6 of Question No 1**

- Justify with necessary corrections, if any
1. a) The stator core of a dc machine is made of wood. 4
  - b) DC series motor is being used in conveyor belt applications. 4
  - c) Ideal transformer is the example of a real life transformer. 4
  - d) Armature reaction effect in a dc a machine can be reduced with interpoles. 4
  - e) No load current for a single phase transformer is only the magnetizing current. 4
  - f) Rating of the transformer is generally made in kVA not in kW. 4
  - g) The voltage buildup process for a shunt generator may fails because of lower speed only. 4
  - h) Load current -torque characteristics of a dc series motor is always parabolic in nature. 4
  - 2.a) i) Develop the equivalent circuit of a single phase transformer by mentioning all the circuit parameters clearly. 8
  - ii) Develop the current-voltage phasor diagram for resistive, inductive and capacitate load individually for a single phase transformer. 7
  - iii) No load power factor of a single phase transformer is poor.-Justify with necessary corrections if any. 3

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Ref. No. Ex/ME/EE/T/122/2018

B.E. Mechanical Engineering - First Year - Second Semester

EXAMINATION, 2018

(1<sup>st</sup>/2<sup>nd</sup> Semester/Repeat/Supplementary/Spl. Supplementary/Old/Annual/Bi-Annual)

SUBJECT Electrical Machine

(Name in full)

PAPER

Full Marks 30/ 100

(15/60 marks for part-I)

Time : ~~Two hours~~/Three hours/~~Four hours~~/Six hours

Use a separate Answer-Script for each part

No. of questions

## PART – II

Marks

OR

- 2.b) i) A 40 kVA transformer with a ratio of 2000/250 V has a primary resistance of 1.15 ohms and a secondary resistance of 0.155 ohms calculate (a) the total resistances, reactances referred to primary and secondary side, (b) the total resistance drop on full load and (c) the total copper loss on full load. 8
- ii) Write a note on 'losses in a single phase transformer.' 4
- iii) Develop the expression of emf for a single phase transformer 6
- 3.a) i) Discuss the voltage build-up procedure for a dc shunt generator with a characteristics curve. 8
- ii) What is the speciality of external characteristics of a dc shunt generator? 4
- iii) A lap connected 4 Pole, 250 V DC generator has 1200 number of conductors in winding. The generator is running with 1000 rpm. If the numbers of turns in each field coil is 1000, what is the average value of the emf induced in each coil on breaking the field if the flux dies away completely in 0.4 second? 6

OR

- 3.b) i) Why starter is required for dc motor starting? Explain the operating principle of a three point starter with a clear circuit diagram. 10
- ii) Discuss about different speed control methods of dc shunt motor. 3
- iii) A 250 V unsaturated shunt motor has an armature resistance (including brushes and interpoles) of 0.04 ohms and a field resistance of 100 ohms. (a) Find what resistance must be added to the field circuit to increase the speed from 1200 to 1500 rpm when the supply current is 200A (b) with the field resistance as in (a) find the speed when supply current is 100 A. 5