Registration No.: | | | | | | | | | | |

Total Number of Pages: 02 **Course: B.Tech/IDD**
Sub_Code: EEPC2003

4th Semester Regular Examination: 2024-25
SUBJECT: ELECTRICAL MACHINES-II
BRANCH(S): EEE, ELECTRICAL, EE
Time: 3 Hours
Max Marks: 100
Q.Code: S338

Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) Derive the relation between electrical and mechanical angle in case of rotating machine.
b) An 8-pole synchronous generator is running at 750 rpm. What is the frequency? At what speed must the generator be run so that frequency shall be 25 Hz?
c) Name different methods of finding the voltage regulation of alternators. Which method gives more accurate results?
d) State the advantages of short pitched coils in armature of AC machines.
e) Describe the slip test method-for the measurement of X_d and X_q of synchronous machines.
f) A synchronous motor is operating at half full-load. An increase in its field current causes a decrease in its armature current. Before the change in field current, did the armature current lead or lag the terminal voltage? Justify your answer.
g) Why is the induction motor called asynchronous motor?
h) What does crawling of induction motor mean?
i) Discuss few differences between single phase and three phase induction motors.
j) Why single-phase induction motor has low power factor?

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) A 500 kVA, 1,100 V, 50 Hz star connected 3-phase alternator has armature resistance per phase of 0.1 Ω and synchronous reactance per phase of 1.5 Ω. Find its voltage for (I) 0.9 pf lag and (II) 0.8 pf lead. Also find the voltage regulation in each case and draw phasor diagram.
b) What is meant by “armature reaction” of a synchronous machine? What are the relations of armature reaction and power factor of a synchronous machine?
c) Derive the equation for power developed in a cylindrical rotor alternator.

d) A 3-phase, Y-connected syn. generator supplies current of 10 A having phase angle of 20° lagging at phase voltage of 400 V. Find the load angle and the components of armature current Id and Iq if Xsd = 10 ohm and Xsq = 6.5 ohm. Assume that Ra to be negligible. Also, calculate voltage regulation.

e) Explain the effect of increasing driving torque and speed of one of the alternators in a parallel connected two alternators.

f) Define synchronizing power? What is synchronizing power and synchronizing Torque Coefficient?

g) Justify, synchronous motor is not self-starting. Explain the method of starting of synchronous motor.

h) Draw the V-curve and inverted V-curve at different loading conditions.

i) What are the differences between synchronous motor and induction motor?

j) An 1100V, 50Hz delta-connected induction motor has a star-connected slip-ring rotor with a phase transformation ratio of 3.8. The rotor resistance and standstill leakage reactance are 0.012Ω/phase and 0.25Ω/phase respectively. Neglecting stator impedance and magnetizing current determine,

I. The rotor current at start with slip-rings shorted.
II. The rotor power factor at start with slip-rings shorted.
III. The rotor current at 4% slip with slip-rings shorted.
IV. The rotor power factor at 4% slip with slip-rings shorted.

k) With neat sketch explain different starters used for starting of 3-Phase Induction Motor.

l) Why are the single phase induction motor not self starting? Explain different methods of starting of the single phase induction motor.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four) **(16 x 2)**

Q3 Derive the EMF equation of alternators. A three phase, 16-pole alternator has a star-connected winding with 144 slots and 10 conductors per slot. The flux per pole is 0.03 Wb, sinusoidally distributed and the speed is 375 rpm. Find the frequency and the phase and line EMF. Assume the coil span as 150°. **(16)**

Q4 **a)** What are the conditions required for the parallel operation of alternator? What are the advantages of parallel operation of two alternators? **(8 + 8)**

b) Explain "Two bright and One dark lamp" method of synchronization of three phase alternator with infinite bus-bar.

Q5 **a)** Describe with a neat diagram, the principle of operation of induction generator. **(8 + 8)**

b) Develop the equivalent circuit of a poly phase induction motor. Explain how this equivalent circuit is similar to the transformer equivalent circuit?

Q6 State and explain the double field revolving theory of single phase induction motor with detailed diagram. Also draw torque-speed characteristic curve. **(16)**