PAPER ID-410606

Subject Code: KEE503

Roll No:

B.TECH.
(SEM V) THEORY EXAMINATION 2021-22
ELECTRICAL MACHINES-II

Time: 3 Hours *Total Marks: 100*

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. **2 x 10 = 20**

a. Name the method of regulation known as optimistic method and why it is so called?
b. What is the necessity of chording in the armature winding of alternator?
c. What is the need of parallel operation of two alternators?
d. Define d-axis and q-axis synchronous reactance of the salient pole machine
e. Name two types of induction motor based on rotor construction
f. Calculate the slip for 2-pole, 50 Hz induction motor running at 2950 rpm.
g. Define crawling in an induction motor
h. What are the advantages of skewing rotor bars in squirrel cage induction motor?
i. Classify single phase induction motor
j. Single phase induction motor is not self-starting. Give reason

SECTION B

2. Attempt any *three* of the following: **10 x 3 = 30**

a. Discuss the effects of armature reaction on the terminal voltage of alternator at (i) Zero pf lagging (ii) Zero pf leading and (iii) 0.8 pf lagging & (iv) Unity pf. Also, discuss synchronous impedance method for finding voltage regulation of a cylindrical rotor machine.
b. Explain in detail hunting phenomenon in synchronous motor. Classify its causes and explain how they can be reduced
c. Sketch and derive the Torque-Slip characteristics of a 3-phase induction motor indicating starting and maximum torque and the operating region. A 3-phase induction motor has a starting torque of 100% and maximum torque of 200% of full load torque. Determine slip at maximum torque and full load slip
d. A 3- phase delta connected cage type induction motor when connected directly to 400 V, 50 Hz supply takes a starting current of 100A in each stator phase calculate (i) The line current for DOL starting. (ii) Line and phase starting currents for star-delta starting. (iii) Line and phase currents for 70 % tapping on auto transformer starting.
e. Develop equivalent circuit diagram of single-phase induction motor based on double revolving field theory

SECTION C

3. Attempt any *one* part of the following: **10 x 1 = 10**

(a) Derive emf equation for an alternator. Also, develop expressions of pitch factor and distribution factor
(b) A 3-phase, 2-pole, 50 Hz, star-connected turboalternator has 54 slots with 4 conductors per slot. The pitch of the coil is 2 slots less than the pole pitch. Determine the useful flux per pole required to generate a line voltage of 3.3 kV.

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4. **Attempt any *one* part of the following:** **10 x 1 = 10**

(a) Draw and explain the phasor diagram of a salient pole synchronous generator supplying full-load lagging current. Show that the power output per phase is given by $P = \frac{E_f V_t}{X_d} \sin \partial + \frac{V_t^2 \left(\frac{1}{X_q} - \frac{1}{X_d}\right)}{2} \sin 2\partial$ where the notations have their usual meaning

(b) Explain how a synchronous motor operates as a synchronous condenser with the help of phasor diagram. A small industrial load of 500 kW at 0.6 pf lagging is supplied from a 3300 V, 3-phase, 50 Hz system. It is desired to raise the pf of the entire system to 0.8 lagging by means of a synchronous motor, which is also driving a pump so that the synchronous motor takes 100 kW from the lines. Determine the rating of synchronous motor

5. **Attempt any *one* part of the following:** **10 x 1 = 10**

(a) Explain the (i) effect of varying of excitation of a synchronous generator connected to infinite busbar on the power factor, armature current and load angle and (ii) effect of load changes on a synchronous motor with the help of phasor diagrams.

(b) Draw power flow diagram showing how electrical input is converted in to mechanical power output in an induction motor. A 4 pole, 400 V 3- phase, 50 Hz squirrel cage induction motor runs at speed of 1450 rpm at 0.85 pf lagging developing 11 kW power. The stator losses are 1100 W and mechanical losses are 400 W. Calculate (i) slip (ii) rotor copper loss (iii) rotor frequency (iv) line current (v) efficiency.

6. **Attempt any *one* part of the following:** **10 x 1 = 10**

(a) What is the necessity of starter in induction motor? With the help of neat diagram, discuss auto transformer and star-delta method of starting a squirrel cage induction motor. Also, discuss the limitations of these methods

(b) With the help of circuit diagram discuss speed control of induction motor by consequent pole method (ii) Rotor rheostat control and (iii) stator voltage control

7. **Attempt any *one* part of the following:** **10 x 1 = 10**

(a) Write short notes on (i) Capacitor start motor (ii) Shaded pole motor and (iii) Repulsion motor

(b) A 220 V, 1 phase induction motor give the following test results:

Blocked rotor test : 120 V 9.6 A 460W

No load test : 220V 4.6 A 125 W

The stator winding resistance is 1.5 Ω and during blocked rotor test, the starting winding is open. Determine equivalent circuit parameters