



PAPER ID-410606

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 $P = \frac{E_f V_t}{X_d} \sin \delta + \frac{V_t^2 \left(\frac{1}{X_q} - \frac{1}{X_d} \right)}{2} \sin 2\delta$ 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