Seat No: _____ Enrollment No: _____

PARUL UNIVERSITY

FACULTY OF ENGINEERING & TECHNOLOGY

B.Tech. Winter 2022 - 23 Examination

Semester: 7 **Date: 06/10/2022**
Subject Code: 03106453/203106439 **Time: 10:30 am to 01:00 pm**
Subject Name: AC Machine & Transmission Line Design **Total Marks: 60**

Instructions:
1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1 Objective Type Questions - (All are compulsory) **(15)**

1. Specify the standard voltages used for transmission for short lines in India.
2. To predict the behavior of machine under short circuit conditions, estimation of which parameter is very necessary?
3. The rotor of alternator should be designed to withstand centrifugal forces produced under runaway speeds. State True or False.
4. The slip rings used in wound rotor induction machines are made of which material?
5. Quiet operation of induction motor is possible by using which type of slots?
6. For polished wires, the surface factor is equal to _____.
7. The size of feeder is selected on the basis of its _____capacity.
8. For turbo alternator, the value of stator bore D is limited by _____.
9. Distribution factor is always less than _____.
10. For induction motor, slots per pole per phase should not be less than _____.
11. Flicker depends on variation of _____.
    (a) voltage (c) current
    (b) frequency (d) power factor.
12. Thickness of asbestos paper used as inter-turn insulation in field windings is _____mm.
    (a) 0.18 (c) 0.36
    (b) 1 (d) 1.5
13. The minimum clearance between adjacent field coils of an alternator should be _____mm.
    (a) 15 (c) 20
    (b) 10 (d) 5
14. To design an induction motor with good efficiency the ratio of core length to pole pitch can be taken as _____.
    (a) 1.5 (c) 2
    (b) 1 (d) 1.25
15. The power factor of squirrel cage induction motor with larger air-gap will be _____.
    (a) poor (c) better
    (b) good (d) constant

Q.2 Answer the following questions. (Attempt any three) **(15)**

A) Define secondary distribution system and explain radial distribution system with figure.

B) Discuss factors affecting choice of specific magnetic loading in synchronous alternator.

C) Explain the methods to reduce harmonic torques in Induction Motor.

D) Find the main dimensions of a 15 kW, 3-phase, 415 V, 50 Hz, 2820 rpm squirrel cage induction motor having an efficiency of 0.88 and full load power factor of 0.9.
Assume following :
Specific magnetic loading = 0.5 wb / m^2, specific electrical loading = 25000 A/m, winding factor = 0.955.
Take the rotor peripheral speed as approximately 20 m/s at synchronous speed.

Q.3 A) Discuss design considerations for designing EHV transmission line. **(07)**

B) Write the steps to calculate full load field mmf. **(08)**

OR

B) A 1250 kVA, 3-phase, 50 Hz, 3300V, 300 rpm, synchronous generator with a concentric winding has the following design data: **(08)**

Specific magnetic loading = B_{av} = 0.58 Wb/ m^2.

Specific electrical loading = ac = 33000 A/m.

Air gap length = 5.5 mm.

SCR = 1.2.

Peripheral speed is 30 m/s. Find stator core length, stator bore, turns per phase, armature mmf per pole and field mmf per pole at no load. Consider winding factor as 0.955.

Q.4 A) Determine the main dimensions, number of ventilating ducts, net iron length and stator turns per phase of a 3.7 kW, 400 V, 3-phase, 4 pole , 50 Hz squirrel cage induction motor which is to be started with star – delta starter . **(07)**

Assume following data:-

Average flux density in air gap = 0.45 wb / m^2, Ampere conductors per meter = 23000, efficiency = 0.85, power factor = 0.84, winding factor = 0.955, stacking factor = 0.9.Consider core length to pole pitch ratio to give overall good design.

OR

A) A 11 kW, 3-phase, 6 pole, 50 Hz, 220V, star connected induction motor has 54 stator slots, each containing 9 conductors. Calculate the values of bar and end ring currents. The number of rotor bars is 64. The machine has an efficiency of 0.86 and a power factor of 0.85. The rotor mmf may be assumed as 85% of stator mmf. Also find the bar and end ring sections if current density in rotor bar and end-ring is 5 A / mm^2. **(07)**

B) A transmission line transmits 3-phase power of 85000 kW at 0.9 pf lag over a distance of 160 km. The receiving end voltage is 230 kV, conductor outer radius R= 0.827cm, the current carrying capacity of conductor = 300 A, resistance of line per km = 0.22 Ω and the spacing between conductors Dm = 10.2 m & Ds = 0.768R. The conductor used is ACSR 30/0.236, 7/0.236. Calculate sending end voltage and voltage regulation of line. **(08)**