



R18 Regulation

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY
(Autonomous, Accredited by NAAC with 'A' Grade)

Subject code: 2E5BA

B.Tech V Semester Regular/Supplementary Examinations, December 2021

ELECTRICAL MACHINE DESIGN

(Electrical and Electronics Engineering)

Maximum Marks: 70

Date: 07.01.2022 Duration: 3 hours

- Note:
1. This question paper contains two parts A and B.
 2. Part A is compulsory which carries 20 marks.
 3. Part B consists of 5 Units. Answer any one full question from each unit.
 4. Each question carries 10 marks and may have a, b, c, d as sub questions.

Part-A

All the following questions carry equal marks

(10x2M=20 Marks)

- 1 Name the types of magnetic materials based on hysteresis loops.
- 2 Write an expression for the MMF to be produced by each pole?
- 3 State merits of three phase transformer over single phase transformers?
- 4 What is the cause of noise in transformer?
- 5 How the induction motor can be designed for best power factor?
- 6 What type of slot is preferred in induction motor?
- 7 What is meant by Runaway speed?
- 8 State the factors that must be considered in choosing air-gap length in case of a synchronous generator?
- 9 Explain about Finite Element Method.
- 10 Write down the different types approaches of computer aided design?

Part-B

Answer All the following questions.

(5X10M=50Marks)

- 11 a) What are the limitations in the design of electrical apparatus? Explain them. [5]
b) Write notes on temperature gradient in conductors placed in slots, with help of equations. [5]

OR

- 12 a) Write notes on classification of insulating materials. [5]
b) Explain heat flow in two dimensions. [5]
- 13 a) Derive the voltage per turn equation for a single-phase transformer. [5]
b) Compute the main dimensions of the core of a 5 KVA, 11000/400 volts, 50Hz single phase core type transformer. Window space factor = 0.2; The height of the window is 3 times its width; Current density = 1.4 A/mm²; B_{max} = 1.0 Tesla; Stacking factor = 0.9; Net conductor area in the window = 0.6 times the net cross-sectional area of iron in the core. Assume square cross-section for the core. [5]

OR

- 14 a) Explain different methods of cooling a transformer with relevant sketches. State relative merits and limitations of these methods. [5]

b) A tank of 1250KVA natural oil cooled transformer has the dimension length, Width & height as 1.55x0.65x1.85m respectively. The full load loss=13.1KW. Find the number of tubes for this transformer. Assume the values due to radiation is 6W/m² & due to convection is 6.5. Improvement is convection due to provision of tubes is 40%. Maximum Temperature rise is 40 degree C. Length of each tube is 1m, diameter of tube is 50mm. neglect the top& bottom surfaces of the tank have regard of cooling. [5]

- 15 a) Discuss the rules for the selection of rotor slots for a cage induction rotor. [5]
b) Determine the main dimensions for a 15 HP, 400 volt, 3-phase, 4-pole, 1425 rpm Induction motor. Adopt a specific magnetic loading of 0.45 Wb/m² and a specific electric loading of 230 ac/m. Assume that a full load efficiency of 85% and a full load power factor of 0.88, will be obtained. [5]

OR

- 16 a) State and justify the criteria for selection of average flux density in the air-gap of three phase induction motor. [5]
b) A 5 HP, 440 volts, 3 phase, 4 pole cage motor with 375 turns/phase in the stator has the following design data for its rotor. Slots = 30, rotor bar size = 8.5 mm X 6 mm; length of the bar = 12.5 cm; end ring size = 10 mm X 15 mm; inner diameter of the end ring = 11.5 cm. Calculate the rotor resistance when referred to the stator winding. Assume specific resistance as 2×10^{-6} cm. [5]

- 17 a) Discuss the effects of short circuit ratio on the performance of a synchronous machine. [5]
b) 2 pole, 50 Hz turbo alternator has a core length of 1.5 m. the mean flux density over the pole pitch is 0.5 Wb/m², the stator ampere conductors per cm are 260 and peripheral speed 100 metre/second. The average span of the stator coils is one pole pitch. Determine the output which can be obtained from the machine. [5]

OR

- 18 a) What are the various types of synchronous machines based on rotor construction? Bring out the constructional differences between them. [5]
b) A 1250 KVA, 3 phase, 6000 volt alternator has the following data: air-gap diameter = 160 cm, core length = 45 cm, number of poles = 20, armature ampere Conductors per metre = 2800, pole pitch = 0.68, stator slot pitch = 2.8 cm and current density in the damper bars 3A/mm². Design a suitable damper winding for the machine. [5]

- 19 a) Explain the different approaches of computer aided design of electrical procedure. [5]
b) Explain the preprocessing features of CAD packages for design the electric machine with suitable example. [5]

OR

- 20 a) Describe in detail the synthesis method of design with flow chart. [5]
b) Explain the advantages of CAD compared with conventional designing of electrical apparatus. [5]