R20 Regulation *Subject code:3E5BA*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A' Grade)

B.Tech V Semester Supplementary Examinations, June/July 2023

ELECTRICAL MACHINE DESIGN

(Professional Elective-I)

(Electrical and Electronics Engineering)

Maximum Marks: 70 Date:28.06.2023 Duration: 3 hours

Note: 1.This question paper contains two parts A and B.
2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.
3. Part B consists of 5 Units. Answer any one full question from each unit which carries 10M.
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 List the different types of magnetic materials.
2 Define space factor.
3 Distinguish between shell type and core type transformer
4 What is a conservator?
5 How the dimensions of induction generator differ from that of an induction motor?
6 Define integral slot winding and fractional slot winding.
7 Define short circuit ratio (SCR).
8 List the advantages of large airgap in synchronous machines.
9 What is the difference between BLDC and PMSM?
10 List the limitations of conventional designs.

Part-B

Answer All the following questions. (5X10M=50Marks)

11 Briefly explain about electrical engineering materials. (10 Marks)

OR

12 A. Describe the classification of insulating materials used for electrical machines. (4 Marks)
B. The temperature rise of a transformer is 25°C after one hour and 37.5° C after 2 hours of starting from cold conditions. Calculate its final steady temperature rise and the heating time constant. If its temperature falls from the final steady value to 40°C in 1.5 hours when disconnected, calculate its cooling time constant. The ambient temperature is 30°C. (6 Marks)

13 A 3 phase, 50Hz, oil cooled core type transformer has the following dimensions: Distance between core centers =0.2 m, height of window =0.24 m, Diameter circumscribing circle =0.14 m. The flux density in the core =1.25 Wb/m^2, the current density in the conductor =2.5 A/mm^2. Assume a window space factor of 0.2 and the core area factor of 0.56. The core is two stepped. Estimate KVA rating of the transformer. (10 Marks)

OR

14 Describe the methods of cooling of transformers. (10 Marks)

15 A 90 kW, 500V, 50 Hz, three phase, 8 pole induction motor has a star connected stator winding accommodated is 63 slots with a 6 conductors / slot. If slip ring voltage, an open circuit is to be about 400V at no load, find suitable rotor winding. Identify number of rotor slots, number of conductors / slot, coil span, number of slots per pole. P.F = 0.9 and the efficiency is 0.85. (10 Marks)

OR

16 Write short notes on: a) Design of rotor bars and slots (5 Marks)
b) Design of end rings. (5 Marks)

17 Illustrate the steps required for the design of damper winding of synchronous machine and show the position of damper bars in a diagram. (10 Marks)

OR

18 Identify for 500kVA, 6600V, 20Hz, 500 rpm and connected three phase salient pole machine diameter, core length for square pole face, number of stator slots and number of stator conductors for double layer winding. Assume specific magnetic loading = 0.68 tesla, ac = 30000 AC/m and Kws = 0.955. (10 Marks)

19 A. List the advantages of digital computers. (5 Marks)
B. Write the general procedure for design optimization. (5 Marks)

OR

20 Explain the different approaches of Computer Aided Design. (10 Marks)