LIB

3/12/13 FN

Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 33438

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2013.

Seventh Semester

Electrical and Electronics Engineering

EE 1403 — DESIGN OF ELECTRICAL APPARATUS

(Regulation 2004/2007)

(Common to B.E. (Part-Time) Sixth Semester, Electrical and Electronics Engineering, Regulation 2005)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Distinguish between continuous rating and short time rating of an electrical machine.

2. What is the difference between real and apparent magnetic flux densities in rotating machines?

3. State the relationship between number of armature coils and number of commutator segments in a d.c. machine.

4. State different losses in a d.c. generator.

5. What is window space factor in a transformer?

6. What are the factors on which no load current of a transformer depend?

7. List the merits and demerits of slip ring Induction Motor.

8. What is Crawling in an Induction Motor?

9. What are the merits of computer aided design?

10. What is run away speed?

PART B — (5 × 16 = 80 marks)

11. (a) A laminated steel tooth of armature of a d.c. machine is 30 mm long and has a taper such that the maximum width is 1.4 times the minimum. Estimate the mmf required for a mean flux density of 1.9 wb/m² in the tooth. B-H characteristics of steel is given below : (16)

B_{wb}/m^2	1.6	1.8	1.9	2.0	2.1	2.2	2.3
$H_{A/m}$	3,700	10,000	17,000	27,000	41,000	70,000	1,09,000

Or

(b) Determine the apparent flux density in the teeth of a d.c. machine when the real flux density is 2.15 web/m². Slot pitch is 28 mm, slot width is 10 mm and the gross core length 0.35 metre. The number of ventilating ducts is 4. Each duct is 10 mm wide. The magnetizing force for a flux density of 2.15 wb/m² is 55000 H/m. The iron stacking factor is 0.9. (16)

12. (a) Calculate suitable dimensions of armature core to give a square pole face for a 50 kW, 4 Pole, 600 rpm DC Shunt Generator with full load terminal voltage of 220V. The maximum gap density is 0.83 Wb/sqm and armature ampere conductors per metre are 30,000. Assume full load armature voltage drop as 3% of the rated terminal voltage and that the field current as 1% of rated full load current. The ratio of pole arc to pole pitch is 0.67. (16)

Or

(b) (i) Derive the output equation of a DC Machine and explain specific electric and magnetic loadings. (8)

(ii) Discuss the design procedure of field system for shunt motor. (8)

13. (a) Determine the main dimensions of the core of a 5 KVA, 11000/400 volts, 50 Hz, single phase core type distribution transformer having the following data :

The net conductor area in the window is 0.6 times the net cross sectional area of iron in the core. The core is of square cross section, maximum flux density is 1 wb/m². Current density is 1.4 A/mm². Window space factor is 0.2. Height of the window is 3 times its width. (16)

Or

(b) (i) Derive output equation of a three phase transformer. (8)

(ii) State different methods of cooling the transformers and explain each method with relevant diagrams. State merits and limitations of each method. (8)

14. (a) (i) Derive the Output equation of an AC Machine. (8)

(ii) Discuss the factors affecting the choice of length of air gap of an Induction Motor. (8)

Or

(b) (i) What is dispersion Coefficient in an Induction Motor? Explain the effects of dispersion coefficient on (8)

(1) Power factor and

(2) Over load capacity.

(ii) Determine the main dimensions of a 250 HP, 3 Phase, 50 Hz, 400 V. 1410 rpm slip ring Induction Motor. Assume Specific Magnetic Loading. = 0.5 Wb/m^2 and Specific Electric loading = 30,000 A/m, efficiency = 0.9 and power factor = 0.9. The ratio of core length to pole pitch=1.2. (8)

15. (a) (i) Discuss the factors affecting the choice of specific magnetic loading in a synchronous machine. (8)

(ii) The field coils of a salient pole alternator are wound with a single layer winding of bare copper strip 30 mm depth with separating insulation of 0.15 mm thick. Compute winding length, no of turns and thickness of conductor to develop an mmf of 1200 AT with a potential difference of 5V per coil and with a loss of 1200 W/sqm of total coil surface. The mean length of turn is 1.2 m. The resistivity of copper is 0.021 Ω/m and mm^2. (8)

Or

(b) (i) Discuss the factors affecting the choice of specific electric loading in a synchronous machine. (8)

(ii) Estimate the main dimensions of a 100 MVA, 11 kV, 50 Hz, 150 rpm three phase water wheel generator. The average gap flux density is 0.65 Tesla and ampere conductor per meter is 40000. The peripheral speed should not exceed 65 m/s at normal running speed. (8)