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# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE - SEMESTER–VI (NEW) - EXAMINATION – SUMMER 2018**

**Subject Code: 2160912 Date: 28/04/2018**

**Subject Name: Design of DC Machines and Transformer**

**Time: 10:30 AM to 01:30 PM Total Marks: 70**

**Instructions:**

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

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|---|---|---|---|
| **Q.1** | **(a)** | Define: (1) Specific Electric Loading (2) Specific Magnetic Loading | **03** |
| | **(b)** | Explain design difference between power transformer and distribution transformer. | **04** |
| | **(c)** | Write a short note on classification of insulating materials. | **07** |
| **Q.2** | **(a)** | Why circular coils are preferred in transformer winding? | **03** |
| | **(b)** | Explain: (1) Window space factor (2) Stacking factor. | **04** |
| | **(c)** | Derive the output equation of a 3-phase core type transformer. | **07** |
| | | **OR** | |
| | **(c)** | Determine the dimensions of core and yoke for a 200 kVA, 50 Hz single phase core type transformer. A cruciform core is used with distance between adjacent limbs equal to 1.6 times the width of core laminations. Assume voltage per turn 14 V, maximum flux density 1.1 $Wb/m^2$, Window space factor 0.32, current density 3 $A/mm^2$ and stacking factor = 0.9. The net iron area is 0.56 $d^2$ in a cruciform core where d is the diameter of circumscribing circle. Also the width of largest stamping is 0.85 d. | **07** |
| **Q.3** | **(a)** | Explain: Bracing in transformer winding. | **03** |
| | **(b)** | Explain: Significance of mitred joints in transformer. | **04** |
| | **(c)** | What is design optimization? Derive the condition for maximum efficiency of a transformer. | **07** |
| | | **OR** | |
| **Q.3** | **(a)** | Give technical reason for low flux density for yoke of a three phase transformer. | **03** |
| | **(b)** | Explain effect of change in frequency on losses of transformer. | **04** |
| | **(c)** | Derive the expression of leakage reactance of a 3-phase core type distribution transformer. | **07** |
| **Q.4** | **(a)** | Discuss the factors to be considered when selecting a suitable value of core length of a D.C. machine. | **03** |
| | **(b)** | Explain any two factors while deciding the length of air gap in the design of a D.C. machine. | **04** |
| | **(c)** | A design is required for a 50 kW, 4 pole, 600 r.p.m. D.C. shunt generator, the full load terminal voltage being 220 V. If the maximum gap density is 0.83 $Wb/m^2$ and the armature ampere conductors per meter are 30,000, calculate suitable dimensions of armature core to give a square pole face.<br>Assume that the full load armature voltage drop is 3 percent of the rated terminal voltage, and that the field current is 1 percent of rated full load current. Ratio of pole arc to pole pitch is 0.67. | **07** |
| | | **OR** | |
| **Q.4** | **(a)** | State factor to be consider for selection of specific loading. | **03** |
| | **(b)** | Derive output equation of a D.C. machine. | **04** |
| | **(c)** | Explain guideline used for the selection of number of armature slots in D.C. machine design. | **07** |



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|---|---|---|---|
| **Q.5** | **(a)** | Explain the losses at commutator surface. | **03** |
| | **(b)** | How to reduce the cross magnetizing effect of armature reaction in a D.C. machine? | **04** |
| | **(c)** | Explain steps to design shunt field winding of a D.C. machine. | **07** |

**OR**

| | | | |
|---|---|---|---|
| **Q.5** | **(a)** | How inter pole improves commutation in D.C. machine? | **03** |
| | **(b)** | Explain: Staggering of Brushes in a D.C. machine. | **04** |
| | **(c)** | Explain various factors affecting selection of number of poles for D.C. machine. | **07** |

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