Seat No.: _____                                          Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY
## BE - SEMESTER–IV (NEW) EXAMINATION – SUMMER 2021
**Subject Code:3140913**                                      **Date:06/09/2021**
**Subject Name:Electrical Machine- I**
**Time:02:30 PM TO 05:00 PM**                                 **Total Marks:70**
**Instructions:**
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

|        |      |                                                                                                                                                                                                                                         | Marks |
|--------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| **Q.1** | (a) | Give classification of DC generators with neat connection diagram.                                                                                                                                                                       | **03** |
|        | (b)  | Compare electric and magnetic circuits.                                                                                                                                                                                                  | **04** |
|        | (c)  | Derive an emf equation for transformer with usual notation.                                                                                                                                                                              | **07** |
| **Q.2** | (a) | State advantages and disadvantages of Swinburne's test.                                                                                                                                                                                  | **03** |
|        | (b)  | Derive the condition for maximum efficiency of single-phase transformer.                                                                                                                                                                 | **04** |
|        | (c)  | Explain O.C. and S.C. test on single phase transformer.                                                                                                                                                                                  | **07** |
|        |      | **OR**                                                                                                                                                                                                                                    |       |
|        | (c)  | What is the necessity of starter in a DC motor? Explain three-point starter for DC motor in brief.                                                                                                                                       | **07** |
| **Q.3** | (a) | Mention the parts of a DC machine. Explain the use of any one of them.                                                                                                                                                                   | **03** |
|        | (b)  | A long-shunt compound generator delivers a load current of 50 A at 500 V and has armature, series field and shunt field resistances of 0.05 Ω, 0.03 Ω and 250 Ω respectively. Calculate the generated voltage and the armature current. Allow 1 V per brush for contact drop. | **04** |
|        | (c)  | Explain voltage build up process of D.C. Generator. Also derive E.M.F. equation of D.C. Generator.                                                                                                                                       | **07** |
|        |      | **OR**                                                                                                                                                                                                                                    |       |
| **Q.3** | (a) | Discuss the conditions to be satisfied before connecting two single-phase transformers in parallel.                                                                                                                                      | **03** |
|        | (b)  | Explain Scott-connection of transformer in detail.                                                                                                                                                                                       | **04** |
|        | (c)  | Draw the vector and winding diagram for the following three-phase transformer connections: Dd6 and Yd11.                                                                                                                                  | **07** |
| **Q.4** | (a) | Define "All day efficiency" and % regulation of transformer.                                                                                                                                                                             | **03** |
|        | (b)  | Differentiate between core type and shell type transformer.                                                                                                                                                                              | **04** |
|        | (c)  | Enlist different speed control methods of DC shunt motor. Explain any one method.                                                                                                                                                        | **07** |
|        |      | **OR**                                                                                                                                                                                                                                    |       |
| **Q.4** | (a) | Give a comparison of an auto transformer with a two-winding transformer.                                                                                                                                                                 | **03** |
|        | (b)  | Explain the internal and external characteristics of D.C. Shunt Generator.                                                                                                                                                               | **04** |
|        | (c)  | Derive the expression of armature torque developed in a dc motor using fundamental equation and power equation. Also, draw the speed-torque characteristics of shunt, series and compound motors.                                        | **07** |

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**Q.5** **(a)** Why transformer rating is in KVA? **03**

**(b)** Briefly describe the principle of operation of a transformer. **04**

**(c)** A 30 KVA, 2400/120 V, 50 Hz transformer has a high voltage **07**
winding resistance of 0.1 Ω and a leakage reactance of 0.22 Ω. The
low voltage winding resistance is 0.035 Ω and the leakage reactance
is 0.012 Ω. Find the equivalent winding resistance, reactance and
impedance referred to (i) high-voltage side and (ii) low-voltage side.

**OR**

**Q.5** **(a)** Give the relation between energy and co-energy for linear system. **03**

**(b)** What is the eddy current and hysteresis loss? How they can be **04**
minimized?

**(c)** What is armature reaction? Explain cross magnetizing and **07**
demagnetizing effects of armature reaction in brief.

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