

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**BACHELOR OF ENGINEERING – SEMESTER 4 – EXAMINATION – SUMMER 2026**

**Subject Code: 3140913**

**Date: 25/05/2026**

**Subject Name: Electrical Machine- I**

**Time: 10:30 AM TO 01:00 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.**

- Q.1**
- (a) Explain with equation, the term 'voltage regulation of a transformer'. **03**
  - (b) Give classification of DC generators with neat connection diagram **04**
  - (c) Explain OC and SC test of single phase transformer. Also derive equations to obtain parameters can be obtained from it. **07**
- Q.2**
- (a) List out parts of D.C machine and briefly discuss any two. **03**
  - (b) Derive an EMF equation of transformer **04**
  - (c) Explain the terms (1) Pole pitch (2) Full pitch coil (3) Front pitch (4) Back pitch in relation to armature winding of a DC machine **07**
- OR
- Q.2**
- (c) A Shunt DC generator delivers 195 A at a terminal voltage 250 V. The armature resistance and shunt field resistance are 0.02 ohm and 50 ohm respectively. The iron and friction losses equals to 950 W. Find  
E.M.F. generated    b. Copper losses    c. Output of prime mover  
d. Commercial, Mechanical and Electrical efficiencies **07**
- Q.3**
- (a) Explain Biot Savart'S Law. **03**
  - (b) State the condition for parallel operation of three phase transformer. **04**
  - (c) Draw operating characteristics of DC shunt, series and compound wound motors. **07**
- OR
- Q.3**
- (a) Explain Energy Stored in a Magnetic Field. **03**
  - (b) Draw and explain DC three point starter. **04**
  - (c) Find the no load and full load speed, for a 4- pole, 220 V, 20 KW, DC Shunt motor having following data.  
Full load current = 5 A, armature resistance = 0.04 ohm  
Flux per pole = 0.04 Wb, no. of armature conductors = 160, Wave  
connection, Full load current = 95 Amp, No load current = 9 Amp., Neglect armature reaction effect, **07**
- Q.4**
- (a) Explain voltage build up process in DC Shunt Generator **03**
  - (b) What is Tap Changer? Explain on load tap changer and off load tap changer of transformer. **04**

- (c) Compare , an auto transformer with a two-winding transformer, with aspect to construction, application and performance. **07**

OR

- Q.4** (a) What is commutation in DC machine ? List out methods to improve it. **03**  
(b) Derive the torque equation of a DC motor from first principles **04**  
(c) Explain the methods of speed control on DC shunt motor. **07**

- Q.5** (a) Why starter is necessary for DC motor ? **03**  
(b) Define Armature reaction in DC Generator. Explain effect of it on performance of Machine in brief. **04**  
(c) A 3- phase , 33 / 6.6 KV, delta/ star, 2- MVA transformer has a primary resistance of 8 ohm/ phase and a secondary resistance of 0.08 ohm / phase. The % impedance is 7 % . **07**  
Calculate the secondary voltage with rated primary voltage and hence the regulation for full load 0.75 p.f. lagging condition.

OR

- Q.5** (a) List the applications of different types of DC motors. **03**  
(b) Draw the vector diagrams and winding connections for the following transformer connections. (1) Dd0 (2) Yd1 **04**  
(c) Explain with diagram and equations , the Swinburn's test for a DC shunt machine **07**

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