

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 5 – EXAMINATION – SUMMER 2026

Subject Code: 3152001

Date: 06/06/2026

Subject Name: Electro Mechanical Energy Conversion

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.**

- Q.1**
- (a)** Define: Magnetic Flux Density, MMF, Reluctance **03**
 - (b)** State and Explain Faraday's Law and Lenz's Law. **04**
 - (c)** Derive expression for force on current carrying conductor placed in a magnetic field. Also explain with diagram when two current carrying conductor placed nearer to each other what happens? **07**

- Q.2**
- (a)** What is fringing and leakage flux? Explain. **03**
 - (b)** Explain hysteresis loop in detail with the help of B-H curve. **04**
 - (c)** Explain linear magnetic system excited by single source and derive its necessary equations for the energy balance and torque. **07**

OR

- Q.2**
- (c)** What is electro-mechanical energy conversion? Explain induced emf in detail with neat sketch diagram. **07**

- Q.3**
- (a)** Distinguish between singly excited and doubly excited systems. **03**
 - (b)** Explain the working principle of DC generator with neat sketch diagram. **04**
 - (c)** A resistance of field winding of a DC shunt generator is $250\ \Omega$. When output of the generator is 100 KW, the terminal voltage is 500 Volts and the generated EMF is 525 Volts. Calculate (1) the Armature Resistance (2) Value of generated EMF when the output is 60 KW. **07**

OR

- Q.3**
- (a)** Why starter is necessary to start the DC motor? Explain. **03**
 - (b)** Explain the working principle of DC motor. **04**
 - (c)** A 400 V, 4 pole DC shunt motor has 1200 conductors in lap connected winding. It draws 60 A current from supply mains. The resistance of shunt field winding and armature winding are $200\ \Omega$ and $0.15\ \Omega$ respectively. Flux per pole is 20 mWb. If the output of the motor is 30 HP. Calculate (1) Speed (2) Torque. **07**

- Q.4**
- (a)** A 4 pole, 50 Hz induction motor is running at 1400 rpm. Find the synchronous speed and percentage slip of the induction motor. **03**
 - (b)** Draw and explain torque-slip characteristic of 3 phase induction motor. **04**
 - (c)** Explain how rotating magnetic field is produced in 3 phase induction motor using vector diagrams. **07**

OR

- Q.4**
- (a)** Why single phase induction motor is not self-starting? List out the starting methods of single phase induction motor. **03**
 - (b)** Give difference between salient pole rotor and non-salient pole rotor of synchronous machine. **04**
 - (c)** Explain types of losses in induction motor. Also draw its power stages-flow diagram and explain efficiency of it. **07**

- Q.5**
- (a)** Write advantages and applications of BLDC motor. **03**
 - (b)** Write short note on Universal motor. **04**
 - (c)** List the various types of stepper motor and describe the operation of hybrid stepper motor. **07**

OR

- Q.5**
- (a)** Write short note on PMDC motor. **03**
 - (b)** What do you mean by servo motor? Briefly explain the principle of operation of DC servo motor. **04**
 - (c)** With neat circuit diagram explain the construction and working operation of BLDC motor. **07**
