Enrolment No./Seat No_____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE- SEMESTER– VII EXAMINATION – SUMMER 2026**

**Subject Code:3170908 Date:01-06-2026**

**Subject Name: Switchgear And Protection**

**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)** | Define following terms in context to protective relay (i) Reliability (ii) Selectivity (iii) Discrimination | **03** |
| | **(b)** | Distinguish DMT, IDMT, VI and EI over current relay. | **04** |
| | **(c)** | Discuss the working principle of an induction relay and derive an expression for the torque produced by it. | **07** |
| **Q.2** | **(a)** | Describe with a neat diagram the time-graded protection of a radial feeder | **03** |
| | **(b)** | What are the drawbacks of a simple differential scheme? Explain how the percentage differential relay overcomes the drawbacks of simple differential relay. | **04** |
| | **(c)** | What are the incipient faults? Discuss The protection provided in transformers for such faults with net sketch. | **07** |
| | | **OR** | |
| | **(c)** | Explain directional over current relay with neat sketch. Also, draw the phasor diagram for 30˚, 60˚ and 90˚ connection. | **07** |
| **Q.3** | **(a)** | Define following terms in context to distance relay “Reach”, “under reach” and “over reach” of the relay. | **03** |
| | **(b)** | Explain the Mho and Offset Mho relay with a neat R-X characteristic. | **04** |
| | **(c)** | Compare the performance Simple Impedance relay, Reactance relay and MHO relay with respect to an Effect of arc resistance and Effect of power swing. | **07** |
| | | **OR** | |
| **Q.3** | **(a)** | Explain harmonic restrain relay. | **03** |
| | **(b)** | Explain restricted earth fault protection of three-phase transformer. | **04** |
| | **(c)** | Implement the percentage differential protective scheme for star-star (Y-Y) and delta-delta (D-D) transformer connection configuration. | **07** |
| **Q.4** | **(a)** | Describe protection against loss of excitation in generator briefly. | **03** |
| | **(b)** | What causes the loss of the prime mover in the Generator? Explain the loss of prime mover protection. A generator can be allowed to run with its prime mover lost. If not, why? | **04** |
| | **(c)** | Explain the protection scheme for stator inter-turn faults of a generator. | **07** |
| | | **OR** | |

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| **Q.4** | **(a)** | Define the following: (i) CT ratio error, (ii) CT phase angle error, (iii) CT Burden | **03** |
| | **(b)** | What is the different between measuring CT and protection CT? | **04** |
| | **(c)** | Classify various types of faults and abnormal condition in Induction motors and protections used for them. | **07** |
| **Q.5** | **(a)** | Classify various bus bar protection schemes. | **03** |
| | **(b)** | Draw and explain the general block diagram of numerical relay | **04** |
| | **(c)** | With a neat figure, explain the construction and working of an SF6 circuit breaker including its advantages and disadvantages. | **07** |

**OR**

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|---|---|---|---|
| **Q.5** | **(a)** | Explain in brief the concept of adaptive protection. | **03** |
| | **(b)** | Write a technical note on dielectric properties of SF6 gas. | **04** |
| | **(c)** | Discuss Recovery Rate Theory (Slepian's Theory) and Energy Balance Theory (Cassie's Theory) for arc extinction in Circuit breaker. | **07** |

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