

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION MO2022)**

**CLASS: B.TECH.
BRANCH: ELECTRICAL & ELECTRONICS ENGINEERING**

**SEMESTER : VII
SESSION : MO/2022**

**SUBJECT: EE437 INDUSTRIAL DRIVES AND CONTROL
TIME: 03 Hours**

FULL MARKS: 50

INSTRUCTIONS:

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates

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| Q.1(a) | List few applications of electrical drives. | [2] | CO1
(BL1-Knowledge) |
| Q.1(b) | List three advantages of electrical drives for electric vehicle application. | [3] | CO1
(BL1-Knowledge) |
| Q.1(c) | Discuss at least five types of power modulators used in electrical drives. | [5] | CO1
(BL1-Knowledge) |
| Q.2(a) | Describe closed loop control of a motor using generalized block diagram. | [2] | CO2
(BL2-Understand) |
| Q.2(b) | Classify different types of motor duty cycle. | [3] | CO2
(BL2-Understand) |
| Q.2(c) | Explain thermal model of a motor. | [5] | CO2
(BL2-Understand) |
| Q.3(a) | Explain why DC series motor is more suitable for heavy torque applications as compared to other types of DC motors. | [2] | CO3
(BL3-Apply) |
| Q.3(b) | A 250 V, 12 Ampere and 2000 RPM shunt motor has the armature and field resistance of 1.0 Ω and 500 Ω . It drives at constant rated motor torque. Calculate the motor speed if the source voltage drops to 150 V. | [3] | CO3
(BL3-Apply) |
| Q.3(c) | Show interconnection of armature and field winding of a separately excited DC motors, series DC motor, and compound DC motor using appropriate diagram. Obtain speed torque characteristics in each case. | [5] | CO3
(BL3-Apply) |
| Q.4(a) | Analyze the equivalent circuit of a three phase induction motor and obtain expression of maximum torque. | [2] | CO4
(BL4-Analyze) |
| Q.4(b) | Compare dynamic braking with regenerative braking and comment which one more suitable for vehicular application. | [3] | CO4
(BL4-Analyze) |
| Q.4(c) | A star connected, 400V, 50Hz, 4 Pole, 1370 RPM three phase squirrel cage induction motor has per phase stator resistance of 1 Ω , rotor resistance referred to primary side is 4 Ω , stator leakage reactance of 3.5 Ω , and rotor leakage reactance referred to primary side of 3.5 Ω . The motor is controlled by a voltage source inverter between 10Hz and 50Hz only using constant V/F ratio control. Compute (i) maximum torque at 50Hz, (ii) maximum torque at 10Hz, (iii) starting torque at 10Hz, and (iv) starting current at 10Hz. | [5] | CO4
(BL4-Analyze) |
| Q.5(a) | Evaluate suitability of permanent magnet synchronous motor as compared to wound field synchronous motor for electric cars. | [2] | CO5
(BL5-Evaluate)
(BL6-Create) |
| Q.5(b) | Compile list of critical issues during starting of a synchronous motor that can have detrimental effect on the motor. Discuss briefly. | [3] | CO5
(BL5-Evaluate)
(BL6-Create) |
| Q.5(c) | Develop a closed loop control strategy for synchronous motor drive using Thyristor. Explain its operating principle. | [5] | CO5
(BL5-Evaluate)
(BL6-Create) |