Seat No.: _____  Enrolment No. 

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE - SEMESTER–VII (NEW) EXAMINATION – WINTER 2017**

**Subject Code: 2171707** **Date:02/11/2017**

**Subject Name: Industrial Drives and Control**

**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.**

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|---|---|---|---|
| **Q.1** | **(a)** | List out different selection criteria for the electrical drive. | **03** |
| | **(b)** | Obtain the state space model of the DC machine. | **04** |
| | **(c)** | Explain methods to measure the different DC machine constants. | **07** |
| **Q.2** | **(a)** | Explain shunt motor with its torque-speed characteristics. | **03** |
| | **(b)** | A series operated DC machine has 1.5 HP, 220V, 1600 rpm, armature resistance of 3Ω, field resistance of 1Ω, frictional coefficient of 0.002 Nm/(rad/sec) and mutual inductance of 0.0675H. Find (i) air gap torque (ii) armature current (iii) armature voltage. | **04** |
| | **(c)** | The separately excited DC machine has rating of 1200 KW, 500V, 2200 A, 400 rpm with brush drop of 3V, field power 35KW and armature resistance of 0.003Ω. It has variable armature voltage and fixed field current. Derive (i) Frictional torque with frictional coefficient 10 Nm/(rad/sec) (ii) Back EMF constant (iii) Input power (iv) Efficiency. | **07** |
| | | **OR** | |
| | **(c)** | Draw and explain equivalent circuit of DC machine. Derive the equation of electromagnetic torque. | **07** |
| **Q.3** | **(a)** | Draw the waveforms of 1st quadrant chopper operation for DC motor drive. | **03** |
| | **(b)** | Explain closed-loop speed control using DC drives. | **04** |
| | **(c)** | Explain the half-wave controlled rectifier based drives of DC motor with necessary waveforms and derive output voltage equation. | **07** |
| | | **OR** | |
| **Q.3** | **(a)** | Explain principle of operation of the chopper. | **03** |
| | **(b)** | Draw the waveforms of 3rd quadrant chopper operation for DC motor drive. | **04** |
| | **(c)** | Explain with waveforms fully controlled rectifier based DC motor drive. | **07** |
| **Q.4** | **(a)** | Explain multi-pulse modulation technique for the induction motor. | **03** |
| | **(b)** | Give properties of PWM waveforms. Explain PWM inverters. | **04** |
| | **(c)** | Explain PWM and HCC hysteresis chopper based closed operation of DC motor drive. | **07** |
| | | **OR** | |
| **Q.4** | **(a)** | Explain constant volts/Hz control for induction motor. | **03** |
| | **(b)** | Explain different input way to the chopper. | **04** |
| | **(c)** | Explain the operation of half-bridge modified McMurray inverter. | **07** |
| **Q.5** | **(a)** | Draw and explain torque versus stepping rate characteristic of stepper motors. | **03** |
| | **(b)** | Explain construction and working of VR stepper motors. | **04** |
| | **(c)** | Explain brushless DC motor. | **07** |

**OR**



| | | | |
|---|---|---|---|
| **Q.5** | **(a)** | List out important features of the stepper motors. | **03** |
| | **(b)** | Explain DC servo control. | **04** |
| | **(c)** | Explain drive circuits for the stepper motors. | **07** |

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