Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**B.E. - SEMESTER – VIII EXAMINATION – OCTOBER 2012**

**Subject Code: 181702** **Date: 29/10/2012**

**Subject Name: Motion Control**

**Time: 02.30pm - 05.00pm** **Total Marks: 70**

## Instructions:

1. **Attempt any five questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

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|---|---|---|---|
| **Q.1** | **(a)** | For rotational motion prove that the inertia is proportional to the fourth power of radius. Derive the relation between the translational and rotational motions. | **07** |
| | **(b)** | Why incremental encoders are needs? What are the types of it? Explain each parts of the incremental encoder in details. | **07** |
| **Q.2** | **(a)** | What are the advantages and disadvantages of step motors? Explain the step motor performance characteristics in detail. | **07** |
| | **(b)** | Explain single stator stack VR step motors with its advantages and disadvantages compare to multi stator stack. | **07** |
| | | **OR** | |
| | **(b)** | How active-suppression driver schemes different from the conventional driver schemes for VR step motors. Explain active-suppression controller scheme for step motors with necessary voltage waveforms. | **07** |
| **Q.3** | **(a)** | Derive the expression for displacement and velocity for incremental motion given to viscous friction with inertia load with input voltage e(t)=1 for 0<=t<=1 ; e(t)=0 for 1<=t<=4 ; e(t)=1 for 4<=t<=5 ; e(t)=0 for t>=5. Draw the corresponding waveforms for displacement and velocity. | **07** |
| | **(b)** | Give different types of mechanical commutating dc motors according to armature design and explain each. **OR** | **07** |
| **Q.3** | **(a)** | Explain the effect of backlash and dead zone in incremental motion. Draw and explain the displacement and velocity waveforms for backlash with low and high friction. | **07** |
| | **(b)** | What is torsional resonance? Explain its effect in three-body structure. | **07** |
| **Q.4** | **(a)** | Explain linear bidirectional dc servo amplifier operation with its different types. | **07** |
| | **(b)** | What are the design conditions for velocity control of dc motor? Explain velocity control systems with current amplifier in detail. | **07** |
| | | **OR** | |
| **Q.4** | **(a)** | Explain bipolar PWM dc motor amplifiers. | **07** |
| **Q.4** | **(b)** | Give the difference between the PLL and PLS systems. Derive the linearized model for the phase-locked servo systems. | **07** |
| **Q.5** | **(a)** | Draw and explain bidirectional four-phase single and two phase on logic sequencer circuit with waveform of output phase for each pulses. | **07** |
| | **(b)** | Explain effect of lead angle in closed-loop control of step motors. | **07** |
| | | **OR** | |
| **Q.5** | **(a)** | What is the stepping and slewing mode operation of step motors? List out the open-loop acceleration and deceleration control scheme for step motors and explain any one of them. | **07** |
| | **(b)** | What are the limitations of encoder over waveform sensing control for step motors? Draw and explain typical current waveforms and current-peak detectors. | **07** |

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