

BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE PILANI

First Semester 2022-23

Flexible Manufacturing Systems (BITS F431)

Mid Semester Test (Open Book)

Date: 03-11-2022

Maximum Time: 90 min.

Maximum Marks: 30

Note: Be succinct, no credit will be given for ambiguous answers. All parts of a question must be answered together and in sequence. Answer of a question must be started from a fresh page.

Q1. Write down your answer **briefly**. [10]

- i) Why is higher throughput rate achieved from dedicated storage system?
- ii) Write down joint notations for cylindrical body and arm assembly with proper sketch. Mention alternative configuration for the same assembly with suitable sketch?
- iii) Write down two major differences between passive sensor and active sensor?
- iv) Why is stepper motor not suitable for CNC lathe or CNC milling?
- v) Adaptive control is mostly applicable to machine level and manufacturing system level of automation. Justify the statement.

Q2.

A DC servomotor is directly coupled to a blower shaft for an industrial process. A voltage of 24 V is applied to the DC servomotor whose torque constant is $0.115 \text{ N} - \text{m}/\text{A}$ and voltage constant is $0.097 \text{ V}/(\text{rad}/\text{sec})$. The armature resistance is 1.9 ohms. a) What is the stall torque of the motor b) Determine the operating point of the motor if the torque-speed characteristics of the blower is given by the following equation:

$$T_L = K_{L1}\omega + K_{L2}\omega^2$$

where $T_L = \text{load torque}, \text{N} - \text{m}$; $\omega = \text{angular velocity}, \text{rad}/\text{sec}$;

$K_{L1} = 0.005 \text{ N} - \text{m}/(\text{rad} / \text{sec})$ and $K_{L2} = 0.00033 \text{ N} - \text{m}/(\text{rad} / \text{sec})^2$

c) What horsepower is being generated by the motor at the operating point. [10]

Q3.

Design an automated guided vehicle system to meet the required demand. The system must be capable of making 40 deliveries per hour. Determine i) Delivery cycle time per vehicle ii) Handling time iii) Number of deliveries per hour per vehicle iv) Number of vehicles required to meet the demand of delivery v) The handling system efficiency. The data of performance characteristics of the system are given below.

Vehicle velocity = 150 m/min

Average distance traveled per delivery = 450 m.

Loading time = 0.75 min.

Unloading time = 0.75 min.

Average distance traveling empty = 300 m.

Traffic factor = 0.9

Operator efficiency does not apply. [10]

******Best of luck******