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ME 1818 PE 22

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Roll No. of candidate

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2023

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Girijananda Chowdhury University
Hatkhowapara, Azara, Ghy-17

B.Tech. 8th Semester End-Term Examination

Mechanical Engineering

MECHATRONICS (PROGRAM ELECTIVE – 2)

(New Regulation w.e.f. 2017-18 & New Syllabus w.e.f. 2018-19)

Full Marks – 70

Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any *four* from the rest.

1. Fill in the blanks : (10 × 1 = 10)
- (a) A _____ system is said to be a black box which is used to control its output to some particular value or sequence of values. (control / measuring)
 - (b) _____ detects the state of system parameters, inputs and outputs. (Digital controls/ Sensors)
 - (c) _____ energy storing element. (Resistor/ Capacitor)
 - (d) The dwell section of the cam is the part that _____ (allows the follower to remain at the same level for a significant period of time / drives the follower upwards)
 - (e) Hydraulic power equals to pressure time the _____ (velocity / discharge)
 - (f) The simplest form of direction control valve is a _____ (needle / check)
 - (g) 3/2 Directional Control valves means _____ positions and _____ ways. (two, three / three, two)
 - (h) A limited rotation hydraulic motor provides rotary output over a _____ angle. (finite / infinite)

[Turn over

- (i) An adder circuit is used to add two _____ signals. (digital / analogue)
- (j) _____ system has three parts viz., CPU, input/output interfaces and memory. (Microprocessor / Micro-controller)
2. (a) Define mechatronics. Cite an example. (1+1 = 2)
- (b) Show the conversion of '*mechanical thermostat*' to mechatronic design with respect to its principal components. (5)
- (c) Explain briefly the application of mechatronics in '*Copying machine*'. (8)
3. (a) Name the basic electrical components used in a mechatronic circuit. (4)
- (b) What are sensors? What are factors on which a sensor is selected? (1+5 = 6)
- (c) Describe the working of a '*Bourdon tube*'. (5)
4. (a) Show that the flow through a constricted pipe is proportional to the square root of the pressure difference. (4)
- (b) What will be the change in resistance of an electrical resistance strain gauge with a gauge factor of 2.1 and resistance 50Ω if it is subjected to a strain of 0.001? (3)
- (c) How Piezo-electric effect can be used to change mechanical vibrations into alternating voltage? (8)
5. (a) A hydraulic cylinder is to compress a car body down to bale size in 8sec. The operation requires a 3m stroke and a 40,000N force. If 10 MPa pump has been selected, and assuming the cylinder is 100% efficient, find:
- (i) The required piston area. Bina Chowdhury Central Library
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- (ii) The necessary pump flow rate.
- (iii) The hydraulic power(kW) delivered to the cylinder.
- (iv) The output power(kW) delivered by the cylinder to the load.
- (v) Solve parts (i), (ii), (iii) and (iv) assuming a 400 N friction force and a leakage of 1 Lpm. What is the efficiency of the cylinder with the given friction force and leakage. (1+1+1+1+2+3+1+1+1 = 12)
- (b) What function do '*pressure control valves*' perform in a hydraulic circuit? Show the ANSI symbol of a pressure relief valve. (2+1 = 3)
6. (a) What is the purpose of regenerative circuit? With a neat circuit diagram, explain how regenerative circuit is applied during drilling operation. (1+8=9)
- (b) Discuss briefly the control of double acting pneumatic cylinder. (6)

7. Write short notes on (any *three*) :

(3 × 5 = 15)

- (a) Stepper motor.
- (b) Microprocessor v/s Microcontroller.
- (c) Inverting and non-inverting amplifiers.
- (d) Proportional mode Controllers.
- (e) Comparators.
- (f) Programming sequence in CNC turning.

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