(v) A pressure relief valve is used in a hydraulic circuit,
(a) to control pressure in the system
(b) to set limiting pressure in the system
(c) to set back pressure in the system
(d) none of these.

(vi) A differential amplifier
(a) amplifies the difference between the input voltages
(b) compares which of the two voltages is larger
(c) inverts the potential difference
(d) none of these.

(vii) Laplace transform of an unit step function is
(a) $1/s^2$ (b) $1/s^{0.5}$ (c) $1/s$ (d) 1.

(viii) 1 : n de-multiplexer should have m select line such that
(a) $2^n = m$ (b) $2^m = n$ (c) $m = n$ (d) none of these.

(ix) The stability for a open loop system compared to closed loop system is
(a) more
(b) less
(c) same
(d) does not depend on system type.

(x) An ideal op amp is an ideal
(a) voltage controlled current source
(b) current controlled voltage source
(c) voltage controlled voltage source
(d) current controlled current source.

Group – B

2. (a) What is Mechatronics? Explain with an example the knowledge domains that are involved in studying a Mechatronic system.

(b) Discuss with neat sketches, 3 (three) mechanisms that transform rotary motion into linear motion.

(c) Giving neat sketch explain recirculating ball-screw-nut system. Mention its advantages.

(1 + 3) + 3 + (4 + 1) = 12

3. (a) Give a comparison between a pneumatic drive and a hydraulic drive.

(b) Explain with the help of a neat hydraulic circuit diagram the operation of a hydraulic cylinder for forward and reverse motion using a manually operated D C valve.

6 + 6 = 12

Group – C

4. (a) What are the characteristics of an ideal op-amp? Draw the circuit diagram of a non-inverting amplifier and also find out its gain.

(b) How op-amp is used as differential amplifier? What is the use of a comparator?

(4 + 4) + (3 + 1) = 12

5. (a) Explain the working of a adaptive controller with block diagram. Sketch the step responses of *P*, PI and PD.

(b) Write short notes on Schmitt trigger.

(4 + 3) + 5 = 12

Group – D

6. (a) What are the advantages of digital system over analog system? State De Morgan theorem?

(b) Construct the simplest logic circuit with 3 inputs using different types of logic gate which will give the output as
$Q = A.\bar{B}.C + A.B.\bar{C} + \bar{A}.B.C + A.B.C$

(4 + 2) + 6 = 12

7. (a) Why NAND gates and NOR gates are called universal gates? What is multiplexing?

(b) What is register? How flip-flop stores data? Explain with an example.

(5 + 2) + (2 + 3) = 12

Group – E

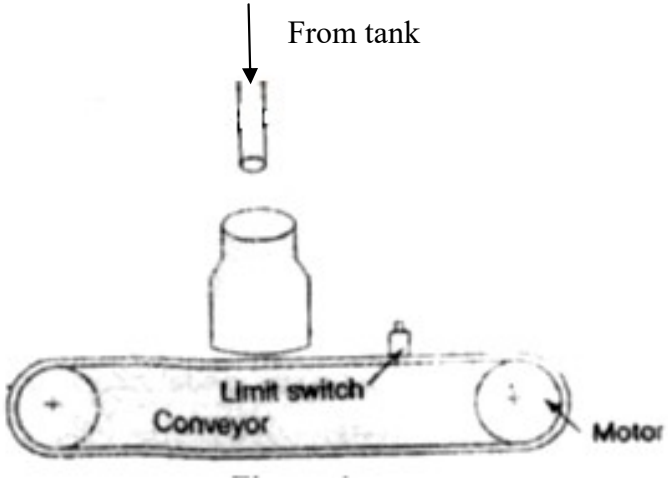
8. (a) Explain the structure of assembly language programming.

(b) What is interrupt signal?

10 + 2 = 12

9. (a) Explain the main components of a PLC with a suitable block diagram.

(b) Draw a ladder logic diagram to control a motor which is driving a conveyer used in refilling station. The conveyer carries the bottle to the filling point where a limit switch is there to indicate the position of the bottle. The bottle waits at the filling point for 30 sec for filling and then departs from there.



7 + 5 = 12

B.TECH/ME/6TH SEM/MECH 3252/2017

MECHATRONICS
(MECH 3252)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

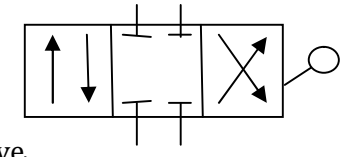
Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) A body in space has the following degrees of freedom
(a) two (b) four (c) six (d) eight.

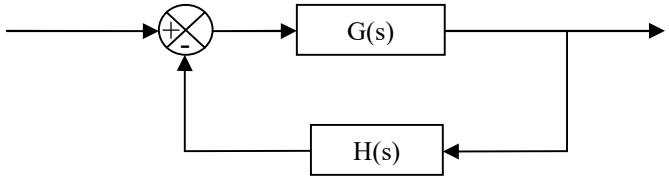
(ii) Linear to rotary motion transformation is obtained by following mechanism,
(a) Gear and pinion (b) Ball & socket
(c) Rack & pinion (d) worm & worm-wheel.

(iii) Identify the valve whose symbolic representation is,



(a) 3/2 D C Valve (b) 4/3 D C Valve
(c) 4/2 D C Valve (d) 3/3 D C Valve.

(iv) For a closed loop system the transfer function for the following system is



(a) G / (H + G) (b) 1 / (1 + HG)
(c) G / (1 + HG) (d) 1 / (H + G)