University of Mumbai

Examination May-June 2021 under cluster 9(FAMT)

Examinations Commencing from 1st June 2021

Program: BE Mechanical Engineering

Curriculum Scheme: Rev2016

Examination: Third Year Semester VI

Course Code: MEDLO6021and Course Name: Mechatronics

Time: 2hourMax. Marks: 80

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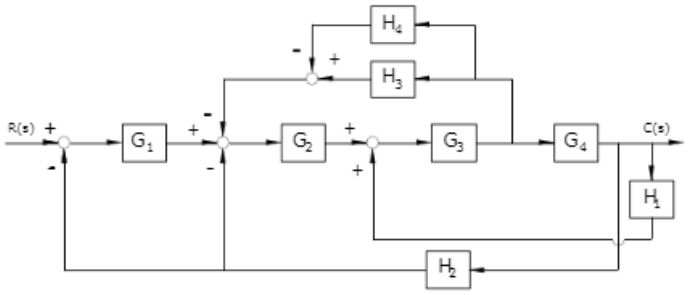
Q1.	**Choose the correct option for following questions. All the Questions are compulsory and carry equal marks**
1.	A one-way valve that lets air into the reservoir of a compressor, but doesn't let it out, is a
Option A:	Check valve
Option B:	Control valve
Option C:	Receiver valve
Option D:	Three way valve
2.	Which of the following logic valve is known as shuttle valve?
Option A:	OR gate
Option B:	AND gate
Option C:	NOR gate
Option D:	NAND
3.	What is the notation used for the sequence of operations mentioned below? 1. Cylinder B undergoes forward stroke 2. Cylinder A undergoes forward stroke 3. Cylinder A undergoes backward stroke 4. Cylinder B undergoes backward stroke
Option A:	B–A– A+ B+
Option B:	(BA)– (A B)+
Option C:	B+ A+ A– B–
Option D:	(BA)+ (A B)-
4.	Consider the open loop transfer function (K(s+5)) / ((s+2)(s+6)). In the root locus diagram the centroid will be located at:
Option A:	-1
Option B:	-2
Option C:	-3
Option D:	-4
5.	PID controller stands for
Option A:	Proportional-Internal-Divider Controller
Option B:	Proportional-Integral-Derivative Controller
Option C:	Practical-Internal-Differential Controller
Option D:	Practical-Integral-Derivative Controller
6.	Which of the following cannot be an input that is given to the PLC?
Option A:	Manual switch

Option B:	Relay
Option C:	Sensor
Option D:	LED Bulb
7.	For the programing of Programming Logic Controller (PLC) we use
Option A:	C-Programming
Option B:	Python Programming
Option C:	Ladder logic programming
Option D:	CNC Programming
8.	An example of discrete (digital) control is
Option A:	Varying the volume of a music system
Option B:	Turning a lamp ON or OFF
Option C:	Varying the brightness of a lamp
Option D:	Controlling the speed of a fan
9.	According to Hurwitz criterion the characteristic equation $S^3 + s^2 + 2s + 24 = 0$ is
Option A:	Stable
Option B:	Marginally stable
Option C:	Conditionally stable
Option D:	Unstable
10.	In Nyquist criterion roots of the characteristic equation are given by
Option A:	Zeros of open loop transfer function
Option B:	Zeros of closed loop transfer function
Option C:	Poles of closed loop transfer function
Option D:	Poles of open loop transfer function
11.	_____ is the time required for the response to reach 50% of the final value in the first attempt.
Option A:	Rise time
Option B:	Peak time
Option C:	Settling time
Option D:	Delay time
12.	With a stator having 8 teeth and a rotor having 6 teeth in a stepper motor, step angle will be
Option A:	7.5°.
Option B:	15°.
Option C:	30°.
Option D:	45°.
13.	Transducer is used to convert a _____
Option A:	physical quantity into an electrical signal
Option B:	electrical signal into a physical quantity
Option C:	physical quantity into a mechanical quantity
Option D:	physical quantity into a chemical quantity
14.	A low-pass filter has a cutoff frequency of 1.5 kHz. Determine the bandwidth of the filter.

Option A:	0.75 kHz.
Option B:	1.50 kHz.
Option C:	2.25 kHz
Option D:	3.00 kHz
15.	the output impedance of the R-2R resistor network is always equal to _____, regardless of the size (number of bits) of the network.
Option A:	0.5R
Option B:	R
Option C:	2R
Option D:	3R
16.	What is the input of the data acquisition system (DAQ) to which a transducer is connected called?
Option A:	control element
Option B:	interface
Option C:	channel
Option D:	function
17.	If blocks are in parallel, and the gain is G1 and G2. What will be the gain of resultant block
Option A:	G1+G2
Option B:	G1/G2
Option C:	G1*G2
Option D:	1+G1G2
18.	Match the following notations with their meanings: A. G(s) ---------- 1) Laplace of error signal B. H(s) ---------- 2) Laplace of output signal C. C(s) ---------- 3) Forward transfer function D. E(s) ---------- 4) Feedback transfer function
Option A:	A- 2, B- 3, C- 1, D- 4
Option B:	A- 3, B- 4, C- 2, D- 1
Option C:	A- 2, B- 3, C- 4, D- 1
Option D:	A- 1, B- 2, C- 3, D- 4
19.	While shifting a take-off point after the summing point, which among the following should be added?
Option A:	Summing point in series with take-off point
Option B:	Summing point in parallel with take-off point
Option C:	Block of reciprocal transfer function
Option D:	Block of inverse transfer function
20.	What does the numbers in 3/2 valve mean?
Option A:	3 positions and 2 ports
Option B:	2 positions and 2 ports
Option C:	2 positions and 3 ports
Option D:	3 positions and 3 ports

Q2	**Solve any Two Questions out of Three** **10 marks each**
A	Determine the transfer function of the mechatronic system shown in figure. 
B	Illustrate working of i) Tactile sensor ii) Thermocouple. Enlist four applications for each of this sensor.
C	Illustrate with a circuit diagram the working of i) R-2R circuit ii) ADC Successive Approximation .

Q3	**Solve any Two Questions out of Three** **10 marks each**
A	Two double acting pneumatic cylinders A and B are selected for an industrial application. The sequence of movement for piston of the cylinder is proposed as below. A+ B+ DelayA- B- Develop an electro-pneumatic circuit using 5/2 double solenoid as final directional control valves.
B	Sketch the Bode plots for the following transfer function. Determine phase margin, gain margin, phase crossover frequency, gain crossover frequency. Comment on the stability of the system. $G(s) = \frac{80}{s(s+2)(s+10)}$
C	Develop a ladder logic diagram to implement the process illustrated in Figure. An up-counter must be programmed as part of a batch-counting operation to sort parts automatically for quality control. The counter is installed to divert 1 part out of every 1000 for quality control or inspection purposes. The circuit operates as follows: • A star/stop pushbutton station is used to turn the conveyor motor on and off. • A proximity sensor counts the parts as they pass by on the conveyor. • When a count of 1000 is reached, the counter's output activates the gate solenoid, diverting the part to the inspection line. • The gate solenoid is energized for 2 s, which allows enough time for the part to continue to the quality control line. • The gate returns to its normal position when the 2 s time period ends. • The counter resets to 0 and continues to accumulate counts. • A reset pushbutton is provided to reset the counter manually.