END SEMESTER EXAMINATIONS (DECEMBER 2021/JANUARY 2022) - QUESTION PAPER - PART A

COURSE CODE : ICE 3151
COURSE NAME : Control System Components
SEMESTER : V
DATE OF EXAM : 23/12/2021
DURATION : 45 + 5 minutes

Instructions for Students:
(1) ANSWER ALL THE QUESTIONS.
(2) EACH QUESTION CARRIES 1 MARK.
(3) YOU ARE INSTRUCTED TO INFORM THE INVIGILATOR AFTER SUBMISSION OF THIS FORM IN THE CHAT SECTION.

* Required

* This form will record your name, please fill your name.

1

STUDENT NAME *

2

STUDENT REGISTRATION NUMBER *

3

An imaginary circle which by pure rolling action gives the same motion as the actual gear is called_____ (1 Point)

- dedundam circle
- clearance circle
- addendum circle
- none of the above

4

The minimum number of teeth on the pinion which will mesh with any gear without interference for 20 degrees full depth involute teeth will be _____ (1 Point)

- 12
- 18
- 22
- 24

5

The gear train employed to transmit high velocity ratio with wheels of smaller diameter and limited space is called_____. (1 Point)

- compound gear
- simple gear
- reverted gear
- epicyclic gear

6

A gear wheel has a mass of 100kg and has a radius of gyration of 0.7m. it has 300 teeth of module 5. if owing to incorrect tooth form, the speed fluctuates ±0.05 percent during the time of contact , find the variation in tooth pressure when the wheel rotates at 300 rpm. Assume constant acceleration and deceleration. (1 Point)

- ±15396N
- ± 15393N
- ±15391N
- ±15390N

7

The spur gears are used for gear ration up to _____ (1 Point)

- 6
- 8
- 2
- 4

8

In _____ type of cam, the follower moves in a radial direction from the centre of rotation of the cam. (1 Point)

- disc cam
- wedge cam
- Cylindrical cam
- all of the above

9

_____ are employed to provide internal feedback from roll, pitch, yaw to damp out vehicle oscillations about these axes. (1 Point)

- free gyro
- optical gyro
- rate gyro
- directional gyro

10

In _____ type of pump the maximum pressure capacity is limited to 20-30 bars. (1 Point)

- reciprocating pump
- vane pump
- gear pump
- centrifugal pump

11

Among the following which statement is true (1 Point)

statement1: In positive displacements pumps, output fluid flow is independent of the system pressure
statement 2: In non - positive displacement pumps, flow output increases with increase in load

- statement 1 only
- statement 2 only
- both are true
- both are false

12

Identify the true statement from the following statements (1 Point)

statement1: The high performance butterfly valves have a large offset in the way the disc is positioned.
statement 2: Ball valve is not used in shutoff applications

- statement 1 only
- statement 1 only
- both are true
- both are false

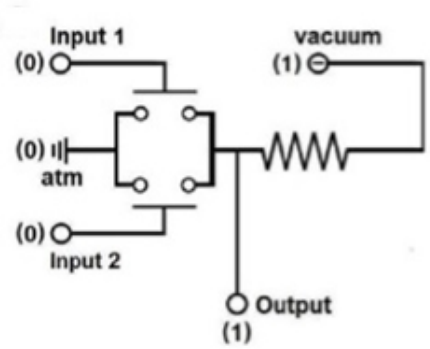
13

The output signal of bleed type controller is used as _____. (1 Point)

- input to actuators
- input to relay type controllers
- input to pilot positioners
- input to actuators and input to pilot positioners
- all of the above

14

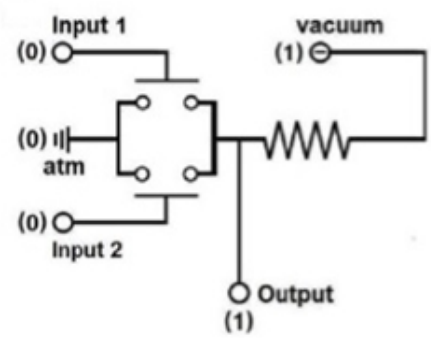
Identify the gate shown in figure (1 Point)



- OR gate
- AND gate
- NOR gate
- NAND gate

15

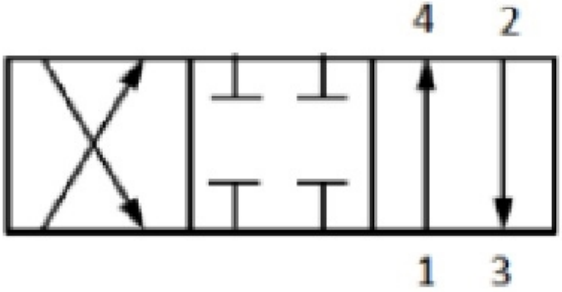
Identify the gate shown in figure (1 Point)



- OR gate
- AND gate
- NOR gate
- NAND gate

16

identify the valve shown in figure. (1 Point)



- 4/1 valve
- 4/2 valve
- 4/3 valve
- none of the above

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Suppose a force of 400 N must be applied to open a valve. Find the diaphragm area if a control gauge pressure of 70 kPa must provide this force. (1 Point)

- $5.71 \times 10^{-3} m^2$
- $5.8 \times 10^{-2} m^2$
- $5.81 \times 10^{-3} m^2$
- $5.9 \times 10^{-2} m^2$

18

A hydraulic piston actuator with a 4 inch bore and 3 inch stroke is used with a pump having a maximum delivery of 5 gpm. neglecting acceleration and output load, calculate the time to travel the complete stroke. (1 Point)

- 1.92 sec
- 1.94 sec
- 1.96sec
- 1.98 sec

19

The use of positioner with actuator provides _____ (1 Point)

- reduction in hysteresis
- handle higher static friction force
- increase in speed of response
- all of the above

20

_____ actuator is used for large thrust forces (1 Point)

- springless
- spring
- Electro - pneumatic
- none of the above

21

Increase in center distance of involute gear causes increase in _____. (1 Point)

- backlash
- pressure ngle
- addendum of gear
- velocity of gear

22

_____ is the clearance between mating teeth measured along the circumference of the pitch circle. (1 Point)

- pressure angle
- center distance
- backlash
- none of the above

23

_____type of follower is used in oil and gas engines. (1 Point)

- Knife edge follower
- Roller follower
- Spherical face follower
- Translating follower

24

Which of these principles is not utilized in design and use of induction motors (1 Point)

- Lenz's Law
- Newton's first law
- Conservation of energy
- Maxwell's right hand rule
- Biot-Savart law
- Conservation of momentum

25

A soft iron core variable reluctance stepper motor has (1 Point)

- High detent torque
- Infinite detent torque
- Zero detent torque
- Non zero but finite detent torque

26

Which of these are not an integral part of the pneumatic control valve control assembly (1 Point)

- P to I converter
- I to P converter
- Flow manipulating assembly
- Compressed air supply

27

Which of the following is not a control system component? (1 Point)

- Fixed Power Supply
- Switched mode power supply
- Sensor
- Controller
- Actuator
- Transducer

28

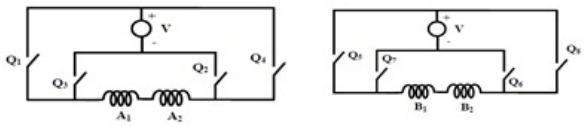
Select the incorrect option with regard to a variable voltage, constant frequency drive (1 Point)

- The voltage output from the drive can be regulated from 0 to the rated voltage while the torque is proportional to the square of the voltage input to the motor.
- The voltage output from the drive can be regulated from 0 to the rated voltage while the torque is proportional to the square of the voltage output from the drive
- These are useful in applications such as fans and blowers where it is primarily the windage friction at play
- All statements are incorrect
- All statements are correct

29

With reference to the following tables/diagrams for the control of a permanent magnet DC stepper motor with two rotor poles and four stator poles pick the incorrect option (1 Point)

	Step 1	Step 2	Step 3	Step 4
Q_1-Q_2	ON (S_1=1)	ON (S_1=1)		
Q_3-Q_4				ON (S_1= -1)
Q_5-Q_6				
Q_7-Q_8		ON (S_2=1)	ON (S_2=1)	ON (S_2=1)



- S1=1 or -1 implies magnetization of north and south polarities respectively
- Q1 to Q8 are power electronic switches for regulating the flow of power to the solenoids
- The control scheme is for half steeping and the step angle shall be 45°
- The given circuit can control the direction, magnitude and phase of current through the coils A1-2 and B1-2

30

A 220V DC shunt motor has the armature and field resistances as 0.5 Ω and 220 Ω respectively. The motor is running at 1000 rpm and drawing 20A from the supply. If an external resistance of 11 Ω is added in series with the field winding, Assuming the load torque to be constant. The new steady state armature current and speed of the motor would be. (1 Point)

- 20 A and 1152 RPM
- 19 A and 19.2 RPS
- 20 A and 1050 RPM
- 19 A and 17.5 RPS

31

Select the most incorrect option (1 Point)

- The emf induced and hence the current produced in the rotor conductors is proportional to the difference in the speed of rotating magnetic field and speed of rotor.
- The emf induced and hence the current produced in the rotor conductors is proportional to the sum of the speed of rotating magnetic field and speed of rotor.
- Slip is always the range [0,1]
- The slip of a synchronous motor is always zero

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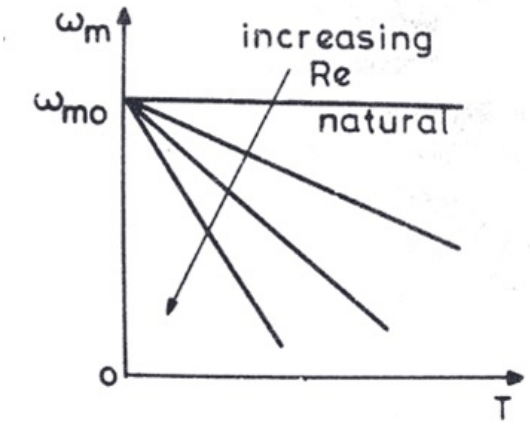
Study the following diagram with reference to a shunted DC motor and pick the most correct option (1 Point)



- These are speed torque characteristics where the speed of the motor is being controlled by adding a resistance to the armature and varying it. This is the most reliable method amongst voltage, field flux control and armature resistance control.
- These are load torque characteristics where the speed of the motor is being controlled by adding a resistance to the armature and varying it. This is the most reliable method amongst voltage, field flux control and armature resistance control.
- These are speed torque characteristics where the speed of the motor is being controlled by adding a resistance to the armature and varying it. This is seldom practiced in industrial applications as it would cause large heat dissipations which cause large deviations from the stated performance parameters.
- These are load torque characteristics where the speed of the motor is being controlled by adding a resistance to the armature and varying it. This is seldom practiced in industrial applications as it would cause large heat dissipations which cause large deviations from

33

With reference to the datasheet used in the earlier part https://www.tachogenerators.co.uk/pdf/59271be96d355GT5.pdf (also in your files section),
the electrical ratings specify a calibration tolerance of ±5 % and armature circuit time constant as <4.5 µs. Which of these is most appropriate: (1 Point)

- The instrument has been calibrated for measurement of speed with a precision of ±5 % to the available standard and the time taken to accurately measure would be <18 µs
- The instrument is reproducible to ±5 % of the actual speed and the time taken to accurately measure would be <4.5 µs
- The is repeatable to ±5 % to the available standard and the information provided is insufficient to predict on the time it takes to respond.
- The instrument has been calibrated for measurement of torque with a precision of ±5 % to the available standard and the time taken to accurately measure would be <18 µs