



**Maratha Vidya Prasarak Samaj's**

**Rajarshi Shahu Maharaj Polytechnic, Nashik**

**Udoji Maratha Boarding Campus, Near Pumping Station, Gangapur Road, Nashik-13.**

**Affiliated to MSBTE Mumbai, Approved by AICTE New Delhi, DTE Mumbai & Govt. of Maharashtra, Mumbai.**

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*Subject: Mechatronics (22643)*



# SYLLABUS

Chapter No.	Name of chapter	Marks With Option
1	Sensors for Mechatronics system	22
2	Basic Mechatronics system	16
3	Pneumatic system	22
4	Hydraulic system	20
5	Robotics & Mechatronics Applications	22
<b>Total Marks: -</b>		<b>102</b>



# **BOARD THEORY**

# **PAPER PATTERN**

# **FOR MEC (22643)**

<b>Q.1</b>		<b>Attempt any FIVE</b>	<b>5*2=10</b>
	a)	Sensors for Mechatronics system	
	b)	Pneumatic system	
	c)	Basic Mechatronics system	
	d)	Hydraulic system	
	e)	Sensors for Mechatronics system	
	f)	Pneumatic system	
	g)	Robotics & Mechatronics Applications	
<b>Q.2</b>		<b>Attempt any THREE</b>	<b>3*4=12</b>
	a)	Sensors for Mechatronics system	
	b)	Basic Mechatronics system	
	c)	Hydraulic system	
	d)	Pneumatic system	
<b>Q.3</b>		<b>Attempt any THREE</b>	<b>3*4=12</b>



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	a)	Pneumatic system
	b)	Sensors for Mechatronics system
	c)	Hydraulic system
	d)	Robotics & Mechatronics Applications
<b>Q.4</b>		<b>Attempt any THREE</b> <span style="float: right;"><b>3*4=12</b></span>
	a)	Robotics & Mechatronics Applications
	b)	Hydraulic system
	c)	Basic Mechatronics system
	d)	Sensors for Mechatronics system
	e)	Pneumatic system
<b>Q.5</b>		<b>Attempt any TWO</b> <span style="float: right;"><b>2*6=12</b></span>
	a)	Pneumatic system
	b)	Robotics & Mechatronics Applications
	c)	Hydraulic system
<b>Q.6</b>		<b>Attempt any TWO</b> <span style="float: right;"><b>2*6=12</b></span>
	a)	Basic Mechatronics system
	b)	Sensors for Mechatronics system
	c)	Robotics & Mechatronics Applications



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# CLASS TEST - I

## PAPER PATTERN

**COURSE: - Mechatronics (22643)**

**PROGRAMME: - E & TC Engineering**

**Syllabus: -**

Unit No.	Name of the Unit	Course Outcome (CO)
1	Sensors for Mechatronics system	CO-643.1
2	Basic Mechatronics system	CO-643.2
3	Pneumatic system	CO-643.3

Q.1	Attempt any FOUR	4*2=8Marks	Course Outcome (CO)
a)	Sensors for Mechatronics system		CO-643.1
b)	Pneumatic system		CO-643.3
c)	Basic Mechatronics system		CO-643.2
d)	Pneumatic system		CO-643.3
e)	Sensors for Mechatronics system		CO-643.1
f)	Basic Mechatronics system		CO-643.2
Q.2	Attempt any THREE	3*4=12 Marks	
a)	Sensors for Mechatronics system		CO-643.1
b)	Basic Mechatronics system		CO-643.2
c)	Pneumatic system		CO-643.3
d)	Sensors for Mechatronics system		CO-643.1



# CLASS TEST - II

## PAPER PATTERN

**COURSE: - Mechatronics (22643)**

**PROGRAMME: - E & TC Engineering**

**Syllabus: -**

Unit No.	Name of the Unit	Course Outcome (CO)
3	Pneumatic system	CO-643.3
4	Hydraulic system	CO-643.4
5	Robotics & Mechatronics Applications	CO-643.5

		Course Outcome (CO)
<b>Q.1</b>	<b>Attempt any FOUR</b> <span style="float: right;"><b>4*2=8Marks</b></span>	
a)	Hydraulic system	CO-643.4
b)	Robotics & Mechatronics Applications	CO-643.5
c)	Robotics & Mechatronics Applications	CO-643.5
d)	Hydraulic system	CO-643.4
e)	Robotics & Mechatronics Applications	CO-643.5
f)	Pneumatic system	CO-643.3
<b>Q.2</b>	<b>Attempt any THREE</b> <span style="float: right;"><b>3*4=12 Marks</b></span>	
a)	Hydraulic system	CO-643.4
b)	Robotics & Mechatronics Applications	CO-643.5
c)	Pneumatic system	CO-643.3
d)	Robotics & Mechatronics Applications	CO-643.5



# **COURSE OUTCOME**

## **(CO)**

**COURSE: - Mechatronics (22643)**

**PROGRAMME: - E & TC Engineering**

<b>CO. NO.</b>	<b>Course Outcome</b>
<b>CO-643.1</b>	Install and maintain the sensors and transducers of mechatronics system.
<b>CO-643.2</b>	Install and maintain CNC Machine
<b>CO-643.3</b>	Install and maintain Pneumatic components in mechatronics system.
<b>CO-643.4</b>	Install and maintain Hydraulic components in mechatronics system.
<b>CO-643.5</b>	Install and maintain different components of Robotics system.





# 1. Sensors for Mechatronics system

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**Position in Question Paper**

**Total Marks-22**

Q.1. a) 2-Marks.

Q.1. e) 2-Marks.

Q.2. a) 4-Marks.

Q.3. b) 4-Marks.

Q.4. d) 4-Marks.

Q.6. b) 6-Marks.

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## Descriptive Question

1. State and elaborate importance of mechatronics in various fields of engineering
2. List any four applications of Hall Effect sensor.
3. Define sensor. Enlist any two sensor
4. Sketch block diagram of real time mechatronics system.
5. Draw LVDT accelerometer.
6. Sketch the diagram of signal conditioner. Explain it.
7. Describe working of stroboscope with neat diagram
8. State Hall Effect. Enlist its application. Explain any one.
9. Draw a block diagram of 'Mechatronics System' and indicate the basic element on it.
10. List velocity sensors and with diagram explain any one Type.
11. Explain photoelectric sensors and proximity sensors w.r.t. their construction and applications.
12. State and elaborate the importance of mechatronics in various field of engineering.





## MCQ Question

(Total number of Question=Marks\*3=20\*3=60)

Note: Correct answer is marked with **bold**.

- Where and when was the word Mechatronics invented?
  - Japan (1960)**
  - Japan (1980)
  - Europe (1960)
  - Europe(1980)
- A servo motor is a typical example of \_\_\_\_\_.
  - Electronics system
  - Mechanical system
  - Computer system
  - Mechatronics system**
- What is the function of an input signal conditioning unit?
  - To produce control signals
  - To amplify the signal and convert it into digital form**
  - To perform mechanical work
  - To produce electrical signals
- The main function of Actuator is \_\_\_\_\_.
  - To produce motion**
  - Detect input
  - Detect output
  - detect the state of the system
- Example of 'Stand-alone system' is \_\_\_\_\_.
  - Machining centers
  - Washing machine**
  - Robots for parts handling
  - Automated inspection stations
- Which among the following carry out the overall control of a system?
  - Graphical display
  - Sensors
  - Actuators
  - Digital controls**
- A humanoid robot is an example of \_\_\_\_\_.
  - Artificial intelligence**
  - Stand-alone systems
  - Large factory systems
  - High level distributed sensor microcontroller actuator
- Where is the feedback generated by sensors in a mechatronics system given?
  - Input sensors
  - Comparators**
  - Mechanical actuators
  - Output sensors
- Which is the first aspect which needs to be considered in the Mechatronics design process?
  - Hardware integration and simulation
  - Conceptual design
  - Mathematical modeling
  - Modeling and simulation**



10. In the level of integration of Mechatronics system, an example of the first level is \_\_\_\_\_
- a) **Fluid valves**
  - b) Automatic machine tools
  - c) Industrial robots
  - d) Microprocessors
11. What is the role of the second level in the mechatronics system design?
- a) **Integrates microelectronics into electrically controlled devices**
  - b) Integrates electrical signal with mechanical action
  - c) Advanced control strategy level
  - d) Providing artificial intelligence
12. Microprocessor based electrical motors are used for \_\_\_\_\_
- a) Prediction of fault in the system
  - b) Correction before a fault occurs
  - c) **Actuation purpose in robots**
  - d) Providing intelligence
13. Which phase of a mechatronics system consists of hardware designing?
- a) **Prototyping**
  - b) Modeling
  - c) Simulation
  - d) Deployment
14. Describing the behavior characteristics through block diagram is done in \_\_\_\_\_
- a) **Modeling and simulation**
  - b) Prototyping
  - c) Deployment
  - d) Design optimization
15. Prototyping involves \_\_\_\_\_
- a) Conceptual design
  - b) **Replacing non-computer systems with actual hardware**
  - c) Database for maintaining project information
  - d) Sub models for eventual reuse
16. What converts physical input into output, among the basic parts of a measuring system?
- a) **Transducer or sensor**
  - b) Signal conditioning
  - c) Intelligence
  - d) Display
17. The analog to digital conversion in a measurement system takes place inside \_\_\_\_\_
- a) Transducer
  - b) **signal processor**
  - c) display
  - d) led
18. The light emitting diodes are used as a/an \_\_\_\_\_
- a) Intelligence
  - b) **display**
  - c) transducer
  - d) sensor
19. Which type of error is caused due to friction or electrical capacitance?
- a) **Hysteresis**
  - b) Zero
  - c) Systematic
  - d) Random
20. The largest value for which the instrument output remains zero is \_\_\_\_\_



- a) Hysteresis error  
b) resolution  
c) sensitivity  
d) **dead zone**
21. In the mechatronics design process, what is the role of modelling?  
a) **Making understandable and behavioral models of physical phenomena**  
b) Numerical strategies for solving models  
c) Information for maintaining project data  
d) To supply efficient high-level source code
22. Numerical strategies for affected improvement and performance functions supported model parameters and signals is called as \_\_\_\_  
a) Simulation  
b) **design**  
c) modelling  
d) project management
23. The function of the code generator is \_\_\_\_  
a) project management  
b) simulation  
c) numerical strategies for solving models  
d) **to supply efficient high-level source code**
24. Hardware approach in integrated design approach in mechatronics is \_\_\_\_  
a) advanced control functions  
b) **bringing together sensors, actuators and computers in one system**  
c) to provide built-in intelligence  
d) to provide a coherent framework of component interactions
25. In mechatronics system design phase, prototyping phase consists of \_\_\_\_  
a) **hardware in loop simulation and design optimization**  
b) deployment of software  
c) finding the mathematical model  
d) selecting Sensors and Actuators
26. How is the integration of mechatronics system possible?  
a) By use of control systems  
b) **By combining hardware and software**  
c) By providing built-in intelligence  
d) By providing efficient high-level source code
27. The function of project management is \_\_\_\_  
a) **providing information for maintaining data and Sub models**  
b) deployment of software  
c) real-time programming  
d) integrated design approach
28. The IC LM35 is used as which type of sensor?  
a) Pressure sensor  
b) **Temperature sensor**  
c) Light sensor  
d) Mechanical sensor



29. What is the range of frequency of the waves produced by the Ultrasonic transducer?
- 20 Kilohertz to several Gigahertz**
  - 1 Kilohertz to several Gigahertz
  - 40 Kilohertz to several Megahertz
  - less than 20 Kilohertz
30. What is the full form of LVDT with respect to displacement transducer?
- Linear variable differential temperature
  - Linear variable differential transformer**
  - Liquid visible differential transformer
  - Liquefied visible differential transformer
31. What is measured by a Hall Effect transducer?
- Electric flux
  - Electric Field
  - Magnetic field**
  - Temperature
32. In which state of chemical substances does a chemical sensing device work?
- Solid
  - Liquid
  - Vapour**
  - Plasma
33. An Eddy current type displacement sensor can detect which types of objects?
- Wooden Objects
  - Metal Objects**
  - Plastic Objects
  - Bricks
34. Which displacement sensor has the slowest response time among Optical type, Eddy current type, Ultrasonic type and Laser focus type?
- Optical Type
  - Eddy Current Type
  - Ultrasonic Type**
  - Laser Focus Type
35. What is the International System of length used to measure displacement?
- Meter**
  - Kilo Meter
  - Centimeter
  - Yards
36. ECS in context to displacement measurement stands for \_\_\_\_
- Electronic Chirp Scaling
  - Extended Chirp Scaling**
  - Electronic Chip Scaling
  - Extended Chip Scaling
37. Bentley Nevada 3300 x1 5/8mm is an example of which type of sensor?
- Infrared Sensor
  - Proximity Sensor**
  - Ultrasonic Sensor
  - Temperature Sensor
38. Potentiometer as a displacement sensor works on the principle of \_\_\_\_\_
- Mutual Inductance
  - Self Inductance
  - Variable Resistance**
  - Hall Effect
39. In capacitive sensors the displacement is measured with respect to change in which internal factor of the sensor?





- a) **Capacitance** c) Inductance  
b) Resistance d) Effervescence
40. Which type of position can be determined by a position sensor?  
a) **Mechanical position** c) Prone position  
b) Lateral position d) Lithotomy position
41. What is the principle of operation of Potentiometric position sensor?  
a) **Resistive Effect** c) Mutual Inductance  
b) Hall Effect d) Eddy current effect
42. Which type of materials can be detected by Eddy current position sensor?  
a) **Conducting materials** c) Semi-Insulating Materials  
b) insulating materials d) Amorphous Materials
43. Proximity sensor is a \_\_\_\_\_ type of position sensor.  
a) Contact c) eddy current  
b) **non-contact** d) resistive
44. OptoNCDT 1420 is an example of which type of position sensor?  
a) Infrared type position sensor  
b) Proximity type position sensor  
c) Ultrasonic type position sensor  
d) **Laser triangulation type position sensor**
45. Inductive proximity sensor works on the principle of \_\_\_\_\_  
a) **Mutual Inductance**  
b) Faraday's law of Induction  
c) Variable Resistance Transduction  
d) Hall Effect
46. Which type of material can be sensed by inductive proximity sensor?  
a) Wooden type c) Plastic type  
b) **Metallic type** d) Glass type
47. Which metal will have a larger range of detection by inductive proximity sensor?  
a) **Iron** c) Copper  
b) Aluminum d) Lead
48. Inductive sensors are also referred as "NMR" coils. What does NMR stand for?  
a) Nuclei Magneto resonance c) Nuclear Magnetic resonator  
b) Nuclei Magnetic resonator d) **Nuclear Magnetic resonance**
49. Which is an example of infrared proximity sensor?  
a) **GP2Y0A41SK0F** c) SLB700A/06VA  
b) CMCP793V-500 d) BMP180
50. Which type of proximity sensor can be used as touch sensor?



- a) **Inductive proximity sensor** c) Ultrasonic proximity sensor  
b) capacitive proximity sensor d) photoelectric proximity sensor
51. Which type of lens is generally used in the PIR sensors?  
a) Concave lens c) Bifocal lens  
b) **Convex lens** d) Fresnel lens
52. The Samuel motion sensor works on which principle?  
a) Hall effect c) **Doppler effect**  
b) Inductive effect d) Capacitive Effect
53. The distance range of detection of the PIR sensor is \_\_\_\_\_  
a) 5-10 cm c) **Up to 12 m**  
b) 5-7 m d) 5-12 cm
54. Which type of velocity sensor has a fixed permanent magnet attached to it?  
a) Pyro electric type c) **Moving coil type**  
b) Piezoelectric type d) Stationary coil type
55. What is the unit in which tachometers measure velocity?  
a) **Revolution per minute** c) Kilometer per hour  
b) Meter per second d) Rotation per minute
56. Which type of tachometer contain primary and secondary stators with fixed windings?  
a) **AC tachometers** c) Alternating tachometers  
b) DC tachometers d) Brushless tachometers
57. For what purpose, a “tachometer” is used?  
a) It is used for calculating velocity in revolution per minute  
b) It is used for calculating the number of revolutions  
c) It is used for calculating velocity in revolution per second  
d) **It is used for calculating the velocity in rpm and number of revolutions**
58. Which is the most common load cell used in the force sensors?  
a) Hydraulic load cells c) Pneumatic load cells  
b) **Strain-Gauge based load cells** d) capacitive load cells
59. Which force sensor is not a strain gauge type force sensor?  
a) Load pins c) Tension links  
b) Shear beams d) **ALC annular load cell**
60. What will be the value measured by an accelerometer in free fall?  
a) **Zero** c) Error  
b) Infinite d) 9.81



# 2. Basic Mechatronics system

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**Position in Question Paper**

**Total Marks-16**

Q.1. c) 2-Marks.

Q.2. b) 4-Marks.

Q.4. c) 4-Marks.

Q.6. b) 6-Marks.

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## Descriptive Question

1. Define end effector. List any two end effector
2. State the advantages of CNC machine. Explain G code and M code.
3. Describe the working of electromechanical system with neat diagram.
4. Draw the block diagram of CNC based drilling machine. Explain each block.
5. Give the block diagram of CNC based drilling machine.
6. State four advantage of CNC system. What are G codes and M codes?
7. State four advantage of CNC system. What are G codes and M codes?





## MCQ Question

(Total number of Question=Marks\*3=10\*3=30)

Note: Correct answer is marked with **bold**

- The built-in intelligence provided through \_\_\_\_
  - Advanced control functions
  - Real-time programming**
  - Control systems
  - Integrated design approach
- In mechatronics system design phase, prototyping phase consists of \_\_\_\_
  - hardware in loop simulation and design optimization**
  - deployment of software
  - finding the mathematical model
  - selecting Sensors and Actuators
- How is the integration of mechatronics system possible?
  - By use of control systems
  - By combining hardware and software**
  - By providing built-in intelligence
  - By providing efficient high-level source code
- The function of project management is \_\_\_\_
  - providing information for maintaining data and Sub models**
  - deployment of software
  - real-time programming
  - integrated design approach
- What is the full form of CNC?
  - Computer numerical control**
  - Computer number control
  - Computer network control
  - Computer numbers count
- What does CNC machine use to control motion and speed?
  - Numerical
  - Programs, as well as computer keyboard, Graphical user interface**
  - Feedback system
  - GUI
- What is the function of the GUI (Graphical user interface)?
  - To control motion and speed
  - Converts program into the action of the driver
  - To record the data from the sensor
  - To understand the position of the tool according to the input program**
- The punch tape reader in a CNC machine is \_\_\_\_
  - Feedback system
  - input device**
  - program
  - driving system



9. What is the function of the driving system in CNC?  
a) Auxiliary control functions such as coolant  
b) Speed and position control  
c) **Consist of amplifier circuits, driving motors and ball lead screw**  
d) To understand the position of the tool according to the input program
10. Sensors used in measurement systems are \_\_\_\_  
a) **speed and position sensor**  
b) consist of amplifier circuits, driving motors and ball lead screw  
c) numerical control sensors  
d) measurement sensors
11. Speed and Position in CNC can be controlled using \_\_\_\_  
a) **Slide table and spindle**  
b) machine code unit  
c) feedback system  
d) graphic user interface
12. In the block diagram of the CNC machine, data processing and control loop are a part of \_\_\_\_  
a) Speed and position sensor  
b) feedback system  
c) **machine control unit**  
d) input device
13. Who developed FMS (Flexible manufacturing system)?  
a) **Jerome H. Lemelson**  
b) Charles Wheatstone  
c) Charles manes  
d) Samuel Hunter Christie
14. What is done in make-to-order production?  
a) Production is ordered by the owner  
b) Regular production  
c) Production stops due to less order  
d) **Production is done according to customer requirements**
15. Which is a false statement on FMS (Flexible manufacturing system)?  
a) Accuracy in the final goods produced is high  
b) The cost of production is less  
c) Quality and quantity of produced goods can be changed easily  
d) **The cost of initial setup is less due to less Labour cost**
16. What was the original design of Jerome H. Lemelson which he patented for FMS (Flexible manufacturing system)?  
a) **Robot based system**  
b) Conveyer  
c) Motor based pulley  
d) Shredder
17. Which is not a property of FMS (Flexible manufacturing system)?  
a) High accuracy  
b) less production cost  
c) **Less initial cost**  
d) Flexibility in production
18. What happens to labour workforce when FMS (Flexible manufacturing system) concept is used?



- a) Increases  
b) **Decreases**
19. Which does SMC stand for with respect to machine related manufacturing?  
a) Single machine control  
b) Singular machine control  
c) Slot machine cell  
d) **Single machine cell**
20. Which does CNC stand for with respect to machine related manufacturing?  
a) Computer Numb control  
b) Computer Number control  
c) **Computer Numerical control**  
d) Computerized Numerical controller
21. Which is a false statement on CIM (Computer integrated manufacturing)?  
a) Quality of the final goods produced is better  
b) The cost of production is less  
c) Quantity of produced goods can be changed easily  
d) **The cost of initial setup is less**
22. When did the 'digital manufacturing' concept become prominent?  
a) Early 1950's  
b) **Early 1970's**  
c) Late 1940's  
d) Late 1960's
23. What is the full form of CAD?  
a) **Computer aided Design**  
b) Computer arts Design  
c) Computer arts designing  
d) Computer assisted Design
24. Which does DNC stand for with respect to machine related manufacturing?  
a) Direct numb control  
b) Direct Number control  
c) **Direct Numerical control**  
d) Directed Numerical controller
25. Which among the following is a false statement regarding "Mechatronic system"?  
a) Its initial cost of setup is high  
b) **Does not require highly skilled labours for operating it**  
c) More output in less time  
d) It provides flexibility in production
26. Which among the following is a correct statement regarding "Mechatronic system"?  
a) Its initial cost of setup is low  
b) Cheaper maintenance  
c) **More output in less time**  
d) Any individual can operate these systems
27. The function of the engine control unit is \_\_\_\_  
a) **to collect, process, analyses and execute the data**  
b) to control injection timing  
c) to control idle speed  
d) to update program



28. Which mechatronic system is also called as Gantry robot?
- a) **Cartesian Robot**
  - b) Dual Arm Robots
  - c) SCARA(Selective Compliance Assembly Robot Arm)robot
  - d) 6 axis robots
29. Which among the following is a correct statement regarding “Mechatronic system”?
- a) Its initial cost of setup is low
  - b) Cheaper maintenance
  - c) It is suitable for short term business
  - d) **It provides flexibility in redesigning and manufacturing the products**
30. Which among the following is a false statement regarding “Mechatronic system”?
- a) Its initial cost of setup is high
  - b) Requires highly skilled labours for operating it
  - c) More output in less time
  - d) **Easy to identify faults and repair it**



# 3. Pneumatic system

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**Position in Question Paper**

**Total Marks-22**

Q.1. a) 2-Marks.

Q.1. f) 2-Marks

Q.2. d) 4-Marks

Q.3. a) 4-Marks

Q.4. e) 4-Marks.

Q.5. a) 6-Marks.

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## Descriptive Question

1. State any two applications of pneumatic system.
2. Draw a neat diagram of poppet valve.
3. Illustrate construction features of pneumatic linear actuator
4. Draw a neat diagram of spool valve.
5. Explain basic Pneumatic circuit with neat schematic. Enlist its advantages.
6. Explain the basic components of pneumatic system with neat sketch.
7. Compare pneumatic and hydraulic system.
8. State the working principle of cam. List its types. Give any four applications.
9. Describe with sketch, basic details of; (1) Poppet valve (2) Shuttle valve





## MCQ Question

(Total number of Question=Marks\*3=14\*3=42)

Note: Correct answer is marked with **bold**

- In which type of system does power transmission takes place through compressed air?
  - Fluid power system
  - Hydraulic system
  - Pneumatic system**
  - Stepper motors
- The compressed air flows to the actuator through \_\_\_\_
  - Pipes and valves**
  - shafts
  - motors
  - flow control valve
- What is the function of an air dryer?
  - Removes dirt
  - Removes moisture**
  - Controls the rate of flow
  - Controls the pressure
- Which part of the Pneumatic system stores the compressed air?
  - Air dryer
  - Air compressor
  - Air receiver tank**
  - Air lubricator
- Which type of mechanical device is used to give energy to the liquid?
  - Fluid power system
  - Hydraulic system
  - Pneumatic system
  - Hydraulic Pumps**
- Which among the following pumps have a definite amount of discharge?
  - Positive displacement pumps**
  - Non-positive displacement pumps
  - Self-priming pumps
  - Jet pumps
- Which among the following is not the component of FRL unit?
  - Air filter
  - Air dryer**
  - Air regulator
  - Air lubricator
- What is the function of the flow control valve?
  - Controls the direction of flow of air
  - The moisture is separated and removed
  - It converts the mechanical energy to hydraulic energy
  - It controls the rate of flow of compressed air**
- The direction control valve controls \_\_\_\_
  - Direction of flow**
  - rate of flow
  - moisture
  - force and motion
- Which among the following is an advantage of the Pneumatic system?



- a) The requirement of a lubricator  
b) **runs continuously**  
c) Use of silencers  
d) Low viscosity
11. Which among the following is a disadvantage of Pneumatic system?  
a) **The requirement of a lubricator**  
b) runs continuously  
c) Used better in mines  
d) Produces a dust-free surroundings
12. Which among the following are not the applications of Pneumatic system?  
a) Aerospace  
b) **packing systems**  
c) Mining  
d) Agriculture equipment
13. What prevents the leakage of oil inside an unbalanced vane pump?  
a) **Vanes**  
b) Cylindrical rotor  
c) Screw  
d) Difference between the pressure of inlet and outlet
14. Which among the following are not the main selection criteria for selection of hydraulic pumps?  
a) Discharge  
b) Pressure  
c) Speed  
d) **Weight**
15. In which type of system does power transmission take place through compressed air?  
a) Fluid power system  
b) Hydraulic system  
c) **Pneumatic system**  
d) Stepper motors
16. The compressed air flows to the actuator through \_\_\_\_  
a) **Pipes and valves**  
b) shafts  
c) motors  
d) flow control valve
17. The direction control valve controls \_\_\_\_  
a) **Direction of flow**  
b) rate of flow  
c) moisture  
d) force and motion
18. Which among the following is an advantage of the Pneumatic system?  
a) The requirement of a lubricator  
b) **runs continuously**  
c) Use of silencers  
d) Low viscosity
19. Which among the following is a disadvantage of Pneumatic system?  
a) **The requirement of a lubricator**  
b) runs continuously  
c) Used better in mines  
d) Produces a dust free surroundings







32. How many directions are there, for a fluid to flow in shuttle valves?
- a) 1  
b) 2  
c) 3  
d) 4
33. What is the full form DCV in terms of pneumatic control systems?
- a) Delicate Control Valve  
b) Distance Control Valve  
c) **Directional Control Valve**  
d) Diameter Control Valve
34. Which valve should be used if there is a need of fluid to flow in 4 directions?
- a) **Spool valve**  
b) Shuttle Valve  
c) Check valve  
d) Rubber valve
35. Which valve works on electricity and not on pressure difference?
- a) Rubber valve  
b) Pilot Valve  
c) Check valve  
d) **Solenoid valve**
36. Which is an example of pressure regulator?
- a) **R100UD**  
b) CMCP793V-500  
c) SLB700A/06VA  
d) FN2060A-6-06
37. Who invented check valve?
- a) Norbert wiener  
b) Robert Wiener  
c) Charles young  
d) **Frank P. Cotter**
38. What type of motion can be achieved using thermal actuator?
- a) **Rectilinear**  
b) Spiral  
c) Circular  
d) Parabolic
39. Which is an example of push pull solenoid electromagnet?
- a) R100UD  
b) CMCP793V-500  
c) SLB700A/06VA  
d) **JF-0630B**
40. Which is not an output device?
- a) Seven Segment display  
b) Liquid crystal display  
c) Lithium battery indicator  
d) **Lithium battery**
41. Whose pressure can be determined by the bourdon tube pressure gauge?
- a) Solids  
b) **Fluids**  
c) Only Gas  
d) only liquids
42. What is the sequence followed by the automatic washing machine?
- a) Washing, soaking, rinsing and drying  
b) **soaking, washing, rinsing and drying**  
c) Washing, soaking, drying and rinsing  
d) drying, soaking, rinsing and washing

# 4. Hydraulic system

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Position in Question Paper

Total Marks-20

Q.1. d) 2-Marks

Q.2. c) 4-Marks.

Q.3. c) 4-Marks

Q.4. b) 4-Marks

Q.5. c) 6-Marks.

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## Descriptive Question

1. State any two applications of Hydraulic System.
2. State belt. Enlist its type.
3. Describe working of load cell with neat sketch.
4. Explain Hydraulic system with neat sketch.
5. Explain rack pinon with neat sketch
6. Describe the working of hydraulic rotary actuator with neat sketch. Compare it with linear actuator.
7. State the types of Actuators. Draw and explain signal acting cylinder.
8. Explain the implementation of proportional type hydraulic controller.
9. State and explain working principle of tachogenerator.
10. Describe implementation of hydraulic controller.
11. Explain the working principle of Gear. State its classification. List applications of Gear.



## MCQ Question

(Total number of Question=Marks\*3=14\*3=42)

Note: Correct answer is marked with **bold**.

- Which type of mechanical device is used to give energy to the liquid?
  - Fluid power system
  - Hydraulic system
  - Pneumatic system
  - Hydraulic Pumps**
- Which among the following pumps have a definite amount of discharge?
  - Positive displacement pumps**
  - Non-positive displacement pumps
  - Self-priming pumps
  - Jet pumps
- Which type of pumps can give discharge even at high pressure?
  - Multistage Pumps
  - Mon block pumps
  - Rotary pumps**
  - Single stage pumps
- Which type of component in a hydraulic system supports less vibration and noise?
  - Flow control valve
  - Oil reservoir
  - Rotatory pumps**
  - Pressure gauge
- Which type of pump consists of two spur or helical gears?
  - External gear pumps**
  - internal gear pumps
  - Rotary pumps
  - Vane pumps
- What is the property of a screw pump?
  - Discharge is continuous, smooth and non-pulsating
  - Very less vibration and noise
  - Has two or more rotating components
  - Consists of a left handed and a right handed screw**
- What prevents the leakage of oil inside an unbalanced vane pump?
  - Vanes**
  - Cylindrical rotor
  - Screw
  - Difference between pressure of inlet and outlet
- Which among the following are not the main selection criteria for selection of hydraulic pumps?
  - Discharge
  - Pressure
  - Speed
  - Weight**
- Which type of system uses 'oil under pressure' means for power transmission?
  - Fluid power system
  - Hydraulic system**
  - Pneumatic system
  - Stepper motors



10. The force developed in hydraulic systems is high due to \_\_\_\_
- a) **High pressure**
  - b) more oil
  - c) less pressure
  - d) less oil
11. Which component of a hydraulic system is used to store a sufficient amount of hydraulic oil?
- a) Rotatory pumps
  - b) **Oil reservoir**
  - c) Flow control valve
  - d) Pressure gauge
12. What pumps hydraulic oil to the hydraulic circuit?
- a) **Flow control valve**
  - b) Oil reservoir
  - c) Rotatory pumps
  - d) Pressure gauge
13. What is the function of a pressure control valve?
- a) **To control the force generated by actuators**
  - b) To perform two operations in sequence
  - c) To control the direction of flow
  - d) To avoid the development of excess of pressure
14. Which among the following fluid parameters are not controlled by the control valves?
- a) Pressure
  - b) Rate of flow
  - c) **Speed**
  - d) Direction of flow
15. Once the pressure comes to normal, the diaphragm \_\_\_\_
- a) **deflects downwards**
  - b) deflects upwards
  - c) has no effect
  - d) expands
16. The function of the pressure relief valve is \_\_\_\_
- a) **to open when the inlet pressure is more**
  - b) to control the force generated by actuators
  - c) to control different parameters of the fluid
  - d) to control the direction of flow
17. What is the function of a pressure gauge?
- a) It controls the rate of flow of oil
  - b) **It shows the pressure reading**
  - c) Controls the direction of flow of oil
  - d) It converts the mechanical energy to hydraulic energy
18. What happens when the pressure increases its pre-set value?
- a) **The pressure relief valve opens**
  - b) Deflects upwards
  - c) Deflects downwards
  - d) has no effect
19. What is the formula for the force of a cylinder?
- a)  **$F = (p \cdot a)$**
  - b)  $F = (p + a)$
  - c)  $F = (p/a)$
  - d)  $F = (p/ap)$
20. The force developed in hydraulic systems is high due to \_\_\_\_







- a) Pressure  
b) Rate of flow  
c) **Speed**  
d) Direction of flow
31. What is the function of the pressure control valve?  
a) **To control the force generated by actuators**  
b) To perform two operations in sequence  
c) To control the direction of flow  
d) To avoid the development of excess of pressure
32. The valve packing of control valves is used \_\_\_\_  
a) **to prevent the fluid from escaping**  
b) to control the force generated by actuators  
c) to control different parameters of the fluid  
d) to control the direction of flow
33. What is the formula of speed control valve during extension of a flow control valve?  
a)  **$V=(Q/A)$**   
b)  $V=Q.A$   
c)  $V=A/Q$   
d)  $V=Q(A-a)$
34. Which among the following are not the 'work parameters' of the fluid?  
a) Direction  
b) Speed  
c) Pressure  
d) **Temperature of flow**
35. Which among the following are not the main selection criteria of the control valves?  
a) Type of actuation  
b) Environmental conditions  
c) Space requirement  
d) **Software support**
36. Who invented hydraulic press?  
a) Norbert wiener  
b) **Joseph Bramah**  
c) Charles young  
d) Charles Wheatstone
37. What is the push provided by a hydraulic fluid used in fluid based actuator, if a steel ball of radius 3cm is immersed in it, Given that the fluid has a density of  $1200\text{kg/m}^3$ , Take  $g=10\text{m/s}^2$ ?  
a) 1.695N  
b) 3.2N  
c) 2.26N  
d) **1.356N**
38. What is the push provided by water used in fluid based actuator, if a wooden ball of radius 3cm is immersed in it, Given that the water has a density of  $1000\text{kg/m}^3$ , wood has a density of  $900\text{kg/m}^3$ , Take  $g=10\text{m/s}^2$ ?  
a) 1.695N  
b) 3.2N  
c) 2.26N  
d) **1.13N**
39. What is the push provided by a hydraulic fluid used in fluid based actuator, if a steel ball of radius 3cm is immersed in it, Given that the fluid has a density of  $2000\text{kg/m}^3$ , Take  $g=10\text{m/s}^2$ ?  
a) 5N  
b) 3.2N  
c) **2.26N**  
d) 4N







# 5. Robotics & Mechatronics Application

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**Position in Question Paper**

**Total Marks-22**

**Q.1. g) 2-Marks**

**Q.3. d) 4-Marks**

**Q.4. a) 4-Marks**

**Q.5. b) 6-Marks**

**Q.6. c) 6-Marks**

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## **Descriptive Question**

1. State any two applications of Robot.
2. Describe the working of ABS.
3. Describe degree of freedom w.r.t. robot.
4. Describe basic concept of automated guided vehicle with neat block diagram.
5. Explain in brief spherical robot. Why it is called as spherical robot?
6. Explain in brief, how antilock braking system works.
7. Draw block diagram of robot system. List functions of an end effector.
8. Explain the classification of robots on the basis of work place? Give one example of each Robot.
9. Draw block diagram of pick and place Robot. List the required movements of it.
10. Explain the concept of degree of freedom of Robot with sketch



## MCQ Question

(Total number of Question=Marks\*3=12\*3=36)

Note: Correct answer is marked with **bold**.

1. Which organization has developed the humanoid robot “Sophia”?
  - a) Google
  - b) Amazon
  - c) Texas Instruments
  - d) **Hanson Robotics**
2. When was first humanoid robot created?
  - a) 1945
  - b) 1930
  - c) **1927**
  - d) 1975
3. Which type of sensors are used for tracking the humanoid’s body and joints movement, its orientation, position and speed?
  - a) Mpu6050
  - b) ECG monitoring sensor
  - c) **Proprioceptive**
  - d) Exteroceptive
4. The motors used in humanoid robots are called as \_\_\_\_\_.
  - a) **Actuators**
  - b) B-O motors
  - c) Orientation motors
  - d) Axis motors
5. ZMP in terms of humanoid robotics stands for \_\_\_\_\_.
  - a) **Zero Moment Point**
  - b) Zero Mean Point
  - c) Zenith Moment Point
  - d) Zenith Measurement Point
6. What is the use of proximity sensor?
  - a) It’s used for sensing humidity
  - b) It’s used for sensing heat
  - c) It’s used for measuring distance
  - d) **It’s used for sensing the presence of nearby objects**
7. What is the name of the famous humanoid robot developed by the company “Honda”?
  - a) Eskimo
  - b) Ansino
  - c) **Asimo**
  - d) Sophia
8. What are Dashpots?
  - a) **It works as a damper which resists motion by viscous friction**
  - b) Toothed parts which transfer power between two shafts
  - c) Used to transmit power between two parallel shafts
  - d) Convert the rotatory motion into translatory motion
9. The amount of water, pH value and detergent are input to \_\_\_\_\_.
  - a) Microprocessor
  - b) **Microcontroller**
  - c) Valve
  - d) Pump





- a) Tesla Model S  
b) NEXT TWO
20. Which is the first autopilot ship?  
a) Tesla Model S  
b) NEXT TWO  
c) **Renault duster**  
d) Nissan LEAF
21. Which among the following is a correct statement regarding “Mechatronic system”?  
a) Its initial cost of setup is low  
b) Cheaper maintenance  
c) **More output in less time**  
d) Any individual can operate these systems
22. Which is the first robot to understand human emotions?  
a) Eskimo  
b) Walker  
c) Asimo  
d) **Pepper**
23. What does SCARA stand for in terms of industrial mechatronic robots?  
a) Selectively Compliance Assembled Robot Arm  
b) Selective Complicated Assembly Robot Arm  
c) **Selective Compliance Assembly Robot Arm**  
d) Static Complicated Assembly Robot Arm
24. Which axis of SCARA (Selective Compliance Assembly Robot Arm) robot is rigid and static?  
a) X axis  
b) Y axis  
c) **Z axis**  
d) No axis
25. Which mechatronic system is also called as Gantry robot?  
a) **Cartesian Robot**  
b) Dual Arm Robots  
c) SCARA (Selective Compliance Assembly Robot Arm) robot  
d) 6 axis robots
26. Which organization has developed “ZENBO”, the non-humanoid robot?  
a) **Asus**  
b) Qihan Technology  
c) Space X  
d) Boston Dynamics
27. Who invented delta robot?  
a) Grueble Rowen  
b) Joseph Henry  
c) Norman Bel Geddes  
d) **Reymond Clavel**
28. Who invented first SCARA (Selective Compliance Assembly Robot Arm) robot?  
a) Grueblerowen  
b) Joseph Henry  
c) **Hiroshi Makino**  
d) Walther Bothe
29. What is the function of an Anti-lock braking system?  
a) Used for car parking  
b) **to maintain tractive force**  
c) Programming the system  
d) to drive the car





30. The skidding of vehicles, while sudden brakes are applied, is avoided through \_\_\_\_\_
- a) **Antilock braking system**
  - b) engine management system
  - c) automatic car parking system
  - d) driving system
31. What is the function of the Electronic control unit in Anti-lock braking system?
- a) **Monitoring the speed of the wheel**
  - b) Decreases the stopping distance
  - c) Provides electronic stability control
  - d) maintaining the tractive force
32. What detects the fault in the anti-lock brake system?
- a) **ECU**
  - b) Pump
  - c) Valves
  - d) Sensors
33. Which part of the antilock brake system is used to find the acceleration and deceleration of the wheel?
- a) Valves
  - b) ECU
  - c) **Speed sensors**
  - d) Pumps
34. What is the function of Pump in an automatic brake system?
- a) For fault detection
  - b) to sense the speed of the vehicle
  - c) **To restore pressure**
  - d) To find the acceleration and deceleration
35. The breaking valves are actuated and turned on and off through \_\_\_\_\_
- a) Pumps
  - b) valves
  - c) sensors
  - d) **modulator**
36. Microprocessor-based electrical motors are used for \_\_\_\_\_
- a) prediction of fault in the system
  - b) correction before the fault occurs
  - c) **actuation purpose in robots**
  - d) providing intelligence