

Scheme – I
Sample Question Paper

Program Name : **Electronics & Telecommunication, Digital Electronics, Industrial Electronics**
Program Code : **EJ, DE, IE**
Semester : **SIXTH**
Course Title : **Mechatronics**
Marks : **70** **Time: 3Hrs.**

22643

Instructions:

- (1) All questions are compulsory.
- (2) Illustrate your answers with neat sketches wherever necessary.
- (3) Figures to the right indicate full marks.
- (4) Assume suitable data if necessary.
- (5) Preferably, write the answers in sequential order.

Q.1 Attempt any FIVE of the following. (10 Marks)

- a. Define sensor. Enlist any two sensor.
- b. Sketch block diagram of real time mechatronics system.
- c. State any two applications of pneumatic system.
- d. Draw LVDT accelerometer.
- e. State any two applications of Hydraulic System.
- f. State any two applications of Robot.
- g. Define end effector. List any two end effector.

Q.2 Attempt any Three of the following. (12 Marks)

- a. Sketch the diagram of signal conditioner. Explain it.
- b. State the advantages of CNC machine. Explain G code and M code.
- c. Draw a neat diagram of poppet valve.
- d. State belt. Enlist its type.

Q.3) Attempt any Three of the following. (12 Marks)

- a. Describe working of load cell with neat sketch.
- b. Illustrate construction features of pneumatic linear actuator.
- c. Explain Hydraulic system with neat sketch.
- d. Describe the working of ABS.

Q.4) Attempt any Three of the following. (12 Marks)

- a. Describe working of stroboscope with neat diagram.
- b. Describe the working of electromechanical system with neat diagram.
- c. Explain rack pinon with neat sketch.
- d. Describe degree of freedom w.r.t. robot.
- e. Draw a neat diagram of spool valve.

Q.5) Attempt any Two of the following.

(12 Marks)

- a. State Hall Effect. Enlist its application. Explain any one.
- b. Draw the block diagram of CNC based drilling machine. Explain each block.
- c. Explain basic Pneumatic circuit with neat schematic. Enlist its advantages.

Q.6) Attempt any Two of the following.

(12 Marks)

- a. Explain working of tachogenerator with neat sketch. Enlist its advantages.
- b. Describe the working of hydraulic rotary actuator with neat sketch. Compare it with linear actuator.
- c. Describe basic concept of automated guided vehicle with neat block diagram.

Scheme – I
Sample Test Paper - I

Program Name : **Electronics & Telecommunication, Digital Electronics, Industrial Electronics**
Program Code : **EJ, DE, IE**
Semester : **SIXTH**
Course Title : **Mechatronics**
Marks : **20**

22643

Time:1 Hour

Instructions:

- (1) All questions are compulsory.
- (2) Illustrate your answers with neat sketches wherever necessary.
- (3) Figures to the right indicate full marks.
- (4) Assume suitable data if necessary.
- (5) Preferably, write the answers in sequential order.

Q.1 Attempt any FOUR.

(8 Marks)

- a. List any four sensors.
- b. Give any two advantages of mechatronics system.
- c. Draw LVDT accelerometer.
- d. Draw electromechanical system block diagram.
- e. Describe G code & M code.
- f. Enlist different components of pneumatic system.

Q.2 Attempt any THREE.

(12 Marks)

- a. Describe mechatronics system with neat sketch.
- b. Describe the working of Hall Effect sensor with neat sketch.
- c. Draw the diagram of mechanical system building block. Explain it in brief.
- d. Describe the working of stroboscope with neat sketch.
- e. Describe the blocks of signal conditioning circuit.

Scheme – I
Sample Test Paper - II

Program Name : **Electronics & Telecommunication, Digital Electronics, Industrial Electronics**
Program Code : **EJ, DE, IE**
Semester : **SIXTH**
Course Title : **Mechatronics**
Marks : **20**

22643

Time:1 Hour

Instructions:

- (1) All questions are compulsory.
- (2) Illustrate your answers with neat sketches wherever necessary.
- (3) Figures to the right indicate full marks.
- (4) Assume suitable data if necessary.
- (5) Preferably, write the answers in sequential order.

Q.1 Attempt any FOUR.

(8 Marks)

- a. Draw poppet valve.
- b. Draw spool valve.
- c. Define degree of freedom.
- d. Give application of robot.
- e. Differentiate pneumatic and hydraulic system.
- f. Enlist different types of gear and draw anyone.

Q.2 Attempt any THREE.

(12 Marks)

- a. Describe with neat sketch the working Spherical robot.
- b. Describe the working of double acting cylinder.
- c. Draw and explain block diagram of pneumatic control system.
- d. Draw and explain block diagram of hydraulic control system
- e. Draw and explain working of pick and place robot.
- f. Draw and explain working of Microcontroller based car park barrier system.



22643

12223

3 Hours / 70 Marks

Seat No.

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- Instructions :**
- (1) All Questions are *compulsory*.
 - (2) Answer each next main Question on a new page.
 - (3) Illustrate your answers with neat sketches wherever necessary.
 - (4) Figures to the right indicate full marks.
 - (5) Assume suitable data, if necessary.
 - (6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following :

10

- (a) Define real time mechatronic system.
- (b) State types of optical encoder.
- (c) State the need of signal conditioning.
- (d) Explain the concept of AGV.
- (e) State any two advantages of hydraulic system.
- (f) List applications of Robot.
- (g) State the two types of actuators used in pneumatic system.

2. Attempt any THREE of the following :

12

- (a) Describe the mechatronics system architecture with neat diagram.
- (b) Draw a neat sketch and describe the working of Double Acting Cylinder (DAC).
- (c) Describe the building blocks of translational system.
- (d) State the function of hydraulic filter. State the applications of Spur and Helical gear.



- 3. Attempt any THREE of the following :** **12**
- (a) Briefly describe different components of basic pneumatic system.
 - (b) Describe the working principle of hydraulic rotary actuator.
 - (c) Explain pyroelectric sensors.
 - (d) Explain the working principle of microcontroller based ABS system with neat diagram.
- 4. Attempt any THREE of the following :** **12**
- (a) State the applications of pneumatic system.
 - (b) Describe constructional features of hydraulic linear actuator.
 - (c) Describe briefly G codes and M codes.
 - (d) Draw and explain operation principle of Photoelectric Sensors.
 - (e) Describe Microcontroller based pick and place Robot.
- 5. Attempt any TWO of the following :** **12**
- (a) State the different types of acceleration sensors. Explain Piezoelectric accelerometer working with neat diagram.
 - (b) Draw and explain general configuration of CNC system. State any two advantages of CNC machine.
 - (c) State the function of direction control valves. Explain spool valve with neat diagram.
- 6. Attempt any TWO of the following :** **12**
- (a) State the types of CAM. Explain the principle of operation of CAM with neat diagram. State its applications (any two).
 - (b) With neat block diagram explain the working principle of microcontroller based car park barrier system.
 - (c) Explain the working of Hall Effect sensors. State its applications.



22643

21222

3 Hours / 70 Marks

Seat No.

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15 minutes extra for each hour

- Instructions :**
- (1) Answer each next main Question on a new page.
 - (2) Illustrate your answers with neat sketches wherever necessary.
 - (3) Figures to the right indicate full marks.
 - (4) Assume suitable data, if necessary.
 - (5) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following :

10

- (a) Define sensor. Enlist any two sensors.
- (b) Sketch the block diagram of real time mechatronics system.
- (c) State different types of Torque sensors. (any four)
- (d) Draw LVDT accelerometer.
- (e) State any two applications of pneumatic system.
- (f) State different types of gear. Define gear.
- (g) Define end effector. List any two end effector.
- (h) Explain the function of regulator in pneumatic system.

2. Attempt any THREE of the following :

12

- (a) Sketch the diagram of signal conditioner. Explain it.
- (b) State the advantages of CNC machine. Explain G Code and M Code.
- (c) Draw & explain the operation of double acting cylinder.
- (d) State different types of CAM & explain any one.
- (e) Explain degree of freedom with respect to Robot.

- 3. Attempt any THREE of the following :** **12**
- (a) Explain torque measurement using strain gauge method.
 - (b) Explain Hydraulic system with neat sketch.
 - (c) With block diagram explain Computer Integrated Machines (CIM).
 - (d) Draw the diagram of Electro-mechanical system & write the function of each component.
 - (e) Explain the working of tachogenerator.
- 4. Attempt any THREE of the following :** **12**
- (a) Explain the model of translational mechanical system.
 - (b) Draw and explain block diagram of Robot.
 - (c) Define Belt. State different types of belts.
 - (d) Explain the working of load cell with neat diagram.
 - (e) Explain the general configuration of CNC system.
- 5. Attempt any TWO of the following :** **2 × 6 = 12**
- (a) Explain Hydraulic system with neat diagram. State its advantages.
 - (b) Draw and explain micro-controller based pick and place robot.
 - (c) State and explain building blocks of electrical system.
- 6. Attempt any TWO of the following :** **2 × 6 = 12**
- (a) Explain the concept of Automated Guided Vehicle (AGV) with block diagram.
 - (b) Explain the function of directional control valve & explain with diagram poppet-valve.
 - (c) Explain the working of hydraulic rotary actuator with neat diagram. Write the types of linear actuator.
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17660

21415

3 Hours / 100 Marks

Seat No.

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- Instructions :** (1) All Questions are *compulsory*.
(2) Illustrate your answers with neat sketches wherever necessary.
(3) Figures to the right indicate full marks.
(4) Assume suitable data, if necessary.
(5) Use of Non-Programmable Electronic Pocket Calculator is permissible.
(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. (A) Attempt any THREE : **3 × 4 = 12**
- (a) Explain the scope of Mechatronics in industry. Give any four examples.
 - (b) Differentiate between 'Sensor' and 'Transducer'.
 - (c) Explain electronic PID controller with the help of diagram.
 - (d) State the working principle of 'solenoid valve' with neat sketch.
- (B) Attempt any ONE : **1 × 6 = 6**
- (a) Explain the construction and working of LVDT accelerometer with the help of diagram.
 - (b) What is 'Part Programming' ? Enlist basic requirements for Part programming with suitable example.
2. Attempt any TWO : **2 × 8 = 16**
- (a) What is the significance of signal conditioners ? Explain the need of following in Mechatronic system
 - (i) Isolator
 - (ii) Filter
 - (iii) Amplifier
 - (iv) Data converter
 - (b) Develop a ladder diagram / programming using PLC for following :
 - (i) To ON-OFF a motor
 - (ii) To control conveyor belt motor.
 - (c) What is belt ? Explain the operation of belt. List the different types of belt & give one example of each.

P.T.O.

- 3. Attempt any FOUR :** **4 × 4 = 16**
- (a) When to select 'P-I' controller ? Give any two applications of P-I controller.
 - (b) Explain the Mechatronics system with the help of block diagram and labelled the various elements.
 - (c) State the working principle of capacitive sensor with neat diagram.
 - (d) Differentiate between pneumatic and hydraulic system.
 - (e) Enlist any eight applications of 'ROBOT'.
 - (f) Explain in brief, how antilock braking system works.
- 4. (A) Attempt any THREE :** **3 × 4 = 12**
- (a) Explain in brief 'Hall effect sensor'.
 - (b) What are the advantages and disadvantages of Mechatronics System ?
 - (c) Define 'PLC' and draw its labelled diagram.
 - (d) How robots are classified on the basis of work place ? Give one example of each Robot.
- (B) Attempt any ONE :** **1 × 6 = 6**
- (a) State the working principle of Gear and give its applications.
 - (b) What is 'MEMS' ? Explain with neat block diagram.
- 5. Attempt any FOUR :** **4 × 4 = 16**
- (a) State the principle of 'Tachogenerator' with the help of diagram.
 - (b) Enlist the advantages of Microcontroller (any four).
 - (c) What are 'Linear Actuators' ? State any four applications.
 - (d) Explain how MEMS accelerometer is used as airbag sensor for car system.
 - (e) Draw block diagram for CNC drilling machine and explain its working.
 - (f) How PLC based automatic car parking system works ? Explain in brief.
- 6. Attempt any FOUR :** **4 × 4 = 16**
- (a) List and explain the components of a hydraulic system.
 - (b) What is 'Degree of Freedom' ? List the functions of end effector.
 - (c) Explain in brief Cartesian robot.
 - (d) Draw the block diagram of robot system. Explain the role of sensor in robot system.
 - (e) Draw the block diagram of PLC based car parking system. Explain its working.
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17660

15116

3 Hours / 100 Marks

Seat No.

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- Instructions* – (1) All Questions are *Compulsory*.
- (2) Illustrate your answers with neat sketches wherever necessary.
- (3) Figures to the right indicate full marks.
- (4) Assume suitable data, if necessary.
- (5) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

- 1. Attempt any FIVE of the following :** **20**
- a) Define sensors, signal conditioners, controllers and actuators in mechatronics system.
- b) Distinguish between a transducer and a sensor. (Any Four)
- c) Give advantages, disadvantages of electronic controllers. (Two Each)
- d) Explain implementation of proportional hydraulic controller.
- e) Explain the basic components of pneumatic systems with neat sketch.
- f) List any four applications of robot.
- g) Give the block diagram of CNC based drilling machine.

P.T.O.

- 2. Attempt any TWO of the following :** **16**
- a) Explain in detail photoelectric sensors and hall effect sensors.
 - b) Explain solenoid valve with neat diagram. Give its principle of operation, advantages, disadvantages and applications.
 - c) What is Robotics ? Draw the block diagram of robot and explain it.
- 3. Attempt any FOUR of the following :** **16**
- a) State advantages and disadvantages of mechatronics system. (Two Each)
 - b) Explain the principle of inductive and capacitive sensors. Give two applications of each.
 - c) Describe the PLC program scan sequence.
 - d) What is DC motor ? Give its working principle with neat diagram.
 - e) Define MEMS. List its application. (Any Two)
 - f) Explain the PLC based automatic car park barrier system.
- 4. Attempt any TWO of the following :** **16**
- a) Draw the block diagram of Fuzzy logic controller and explain the function of each block.
 - b) State the working principle of cam. List its types. Give any four applications of cam.
 - c) With neat block diagram explain microcontroller based antilock brake system.

- 5. Attempt any FOUR of the following :** **16**
- a) What is mechatronics ? Write its applications. (Any Two)
 - b) Draw and explain piezoelectric accelerometer.
 - c) Draw the ladder diagram for ON-OFF control of lamp.
 - d) Explain the types of gears.
 - e) Explain the construction of spherical robot in brief.
 - f) Explain PLC based Pick and Place robot.
- 6. Attempt any FOUR of the following :** **16**
- a) Explain LVDT accelerometer with neat diagram. Give its applications.
 - b) Explain torque measurement using strain gauge.
 - c) Give general configuration of CNC system. Give advantages of CNC. (Any Two)
 - d) What is actuator ? Explain the principle of linear actuator.
 - e) Classify the robots based on workspace.
 - f) Give the advantages and disadvantages of CNC based drilling machine. (Two Each)
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17660

15162

3 Hours / 100 Marks

Seat No.

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- Instructions :**
- (1) All Questions are *compulsory*.
 - (2) Answer each next main Question on a new page.
 - (3) Illustrate your answers with neat sketches wherever necessary.
 - (4) Figures to the right indicate full marks.
 - (5) Assume suitable data, if necessary.
 - (6) Use of Non-programmable Electronic Pocket Calculator is permissible.
 - (7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.
 - (8) Use of Steam tables, logarithmic, Mollier's chart is permitted.

Marks

1. Attempt any FIVE :

20

- (a) Draw block diagram of mechatronic system and explain the key elements of mechatronics system.
- (b) Define : (i) Sensor (ii) Transducer with examples of each.
- (c) List any four advantages of mechatronic system.
- (d) State and elaborate the importance of mechatronics in various field of engineering.
- (e) Draw and explain the block diagram of fuzzy logic controller.
- (f) List the types of belt and give one application of each.
- (g) Explain in brief Spherical Robot. Why it is called as spherical robot ?

2. Attempt any FOUR :

16

- (a) List any four applications of Hall Effect Sensor.
- (b) Draw practical ABS system. List any four advantages of it.
- (c) Draw and explain MEMS microactuator.
- (d) Draw PI controller using Op-Amp and explain in brief.
- (e) Draw block diagram of pneumatic system. What is the role of filter in pneumatic system ?
- (f) Draw and explain the working principle of Inductive and Capacitive sensor.

P.T.O.

- 3. Attempt any FOUR : 16**
- (a) Draw block diagram of pick and place Robot. List the required movements of it.
 - (b) Draw and explain pneumatic PID controller.
 - (c) State the types of Actuators. Draw and explain single acting cylinder.
 - (d) How MEMS accelerometer is used as air bag sensors for car safety ? Describe in brief.
 - (e) Define degree of freedom. What is the significance of degree of freedom in robot ?
 - (f) Draw schematic of PLC based automatic car park barrier system.
- 4. Attempt any FOUR : 16**
- (a) Explain CNC drilling machine with neat diagram.
 - (b) How Torque is calculated using Torsion-bar torque transducer ? Explain.
 - (c) Draw and explain DC motor speed control using microcontroller.
 - (d) List out the types of gears & give their applications. (One each)
 - (e) State any four applications of stepper motor.
 - (f) Draw and explain the PLC ladder diagram for ON-OFF control of lamp.
- 5. Attempt any FOUR : 16**
- (a) How the piezoelectric effect is used to measure acceleration ? List the features of piezoelectric accelerometer.
 - (b) State the functions of (1) Isolators (2) Filters (3) Amplifiers and (4) Data converters in Mechatronic system.
 - (c) List the advantages of PLC based car parking system. (Any four)
 - (d) Draw block diagram of Robot system. List functions of an end effector.
 - (e) With neat block diagram explain the various components of MEMS.
 - (f) Draw and explain Gear type rotary actuator.
- 6. Attempt any FOUR : 16**
- (a) Explain the implementation of proportional type hydraulic controller.
 - (b) Compare pneumatic and hydraulic system (four points).
 - (c) Draw and explain LVDT accelerometer.
 - (d) List various photoelectric sensors. Explain any one of them in detail.
 - (e) Explain fuzzy logic control in fully automatic washing machine.
 - (f) Explain the working principle of solenoid valve. List the applications of solenoid valve.
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17660

16117

3 Hours / 100 Marks

Seat No.

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- Instructions* – (1) All Questions are *Compulsory*.
- (2) Answer each next main Question on a new page.
- (3) Illustrate your answers with neat sketches wherever necessary.
- (4) Figures to the right indicate full marks.
- (5) Assume suitable data, if necessary.
- (6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. **Attempt any FIVE of the following:** **20**
- a) Draw a block diagram of ‘Mechatronics System’ and indicate the basic elements on it.
- b) List velocity sensors and with diagram explain any one type.
- c) State four advantages of CNC system. What are G codes and M codes?
- d) State the characteristics of ‘Quick opening control valve’.
- e) State the function of manipulator and end effector.
- f) Define the term ‘MEMS’. List down the various engineering applications of MEMS.
- g) Enlist the various mechanical actuating system and explain any one in brief.

P.T.O.

- 2. Attempt any FOUR of the following:** **16**
- a) What is 'Mechatronics'? State its importance in engineering with suitable examples.
 - b) State the function of 'Signal Conditioner' in measurement system.
 - c) Explain how a PLC can be used to handle an analog input.
 - d) State the working principle of 'Solenoid valve' with neat sketch.
 - e) Explain the basic elements of Robotic system with block diagram.
 - f) Describe the working of PLC based automatic car park barrier system with block diagram.
- 3. Attempt any FOUR of the following:** **16**
- a) Explain the function of PLC. Draw a block diagram of basic PLC configuration.
 - b) State and explain working principle of 'Hall effect sensor' with sketch.
 - c) Draw block diagram of 'Fuzzy logic' controller and explain function of each block.
 - d) Explain the principle of process control valves.
 - e) Draw and explain the basic elements of 'MEMS'.
 - f) Explain with sketch, principle of working of 'Pick and place Robot'.
- 4. Attempt any TWO of the following:** **16**
- a) Explain with sketch, torque measurement using:
 - (i) Stroboscope method
 - (ii) Capacitive method
 - b) Explain with diagram how micro-controller is used for stepper motor control.
 - c) Describe with sketch, basic details of;
 - (i) Poppet valve
 - (ii) Shuttle valve

- 5. Attempt any FOUR of the following:** **16**
- a) State and explain working principle of Tacho generators.
 - b) Give the significance of Transducer and sensor with suitable example.
 - c) State the characteristics of PD and PID controllers with their control action equations.
 - d) Draw a block diagram indicating the application of Fuzzy logic control in fully automatic washing machine.
 - e) Explain the concept of degree of freedom of Robot with sketch.
 - f) Enlist and explain the various components of Mechatronic system.
- 6. Attempt any TWO of the following:** **16**
- a) Describe the principle of operation of;
 - (i) Linear actuators
 - (ii) DC motors
 - b) Explain the constructional features of MEMS accelerometer used in airbag sensors for car safety.
 - c) Explain with block diagram, working of micro-controller based anti lock braking system.
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17660

16172

3 Hours / 100 Marks

Seat No.

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- Instructions :**
- (1) *All questions are compulsory.*
 - (2) *Answer each next main question on a new page.*
 - (3) *Illustrate your answers with neat sketches wherever necessary.*
 - (4) *Figures to the right indicate full marks.*
 - (5) *Assume suitable data, if necessary.*
 - (6) *Use of Non-programmable Electronic Pocket Calculator is permissible.*
 - (7) *Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.*

- | | Marks |
|--|-----------------|
| 1. A) Attempt any three : | (3×4=12) |
| a) State the importance of mechatronics in various field of engineering. | |
| b) Explain in brief mechatronics. List its applications. | |
| c) What is optical encoder ? List its types. | |
| d) Distinguish between transducer and sensor. | |
| B) Attempt any one : | (1×6=6) |
| a) List advantages and disadvantages of CNC based drilling machine. | |
| b) Draw block diagram of practical ABS system. State its advantages. | |
| 2. Attempt any four : | (4×4=16) |
| a) Draw and explain general block diagram of Robotic system. | |
| b) Explain in brief cam. State the types of cam. List two applications. | |
| c) Explain working of Belt. List types of Belt. | |
| d) Draw and explain electronic PID controller. | |
| e) Define sensor, signal conditioner, controller and actuator in mechatronic system. | |
| f) List out various position sensors. Explain any one in detail. | |
| 3. Attempt any four : | (4×4=16) |
| a) Draw and explain Fuzzy logic controller. | |
| b) Compare Electronic controllers with pneumatic controllers. | |
| c) List different components of Industrial Robot. State functions of any two. | |
| d) Define DOF. Draw and explain six degrees of freedom. | |
| e) Draw and explain Rack and Pinion assembly. | |
| f) Classify bearing and explain any one in brief. | |

P.T.O.

**4. A) Attempt any three :****(3×4=12)**

- a) Draw block diagram of microcontroller based pick and place Robot. List the four movements required by this Robot.
- b) List advantages and applications of PLC.
- c) Draw block diagram of pneumatic system showing its basic components. State the functions of control valve and air actuator.
- d) Explain the principle of operation of solenoid. State two parameters on which selection of solenoid is based.

B) Attempt any one :**(1×6=6)**

- a) Draw and explain schematic of PLC based automatic car parking barrier system.
- b) Draw a ladder diagram for following conditions of conveyor motor.
 - I) Start push button to start the conveyor motor.
 - II) Bottle moves past the photo sensor and the conveyor motor stops automatically after count of 25 bottles.
 - III) The counter is to be reset to zero after 25 bottles.
 - IV) The conveyor motor can be stopped manually at any time.
 - V) The accumulated count of the counter is reset manually by means of count reset button.

5. Attempt any four :**(4×4=16)**

- a) Draw and explain the working principle of Linear Velocity Transducer (LVT).
- b) Explain working principle of stroboscope with neat sketch.
- c) Draw and explain pneumatic proportional controller.
- d) Draw and explain block diagram of MEMS.
- e) List advantages and disadvantages of MEMS.
- f) For a signal conditioner explain the terms linearization and signal conversion.

6. Attempt any four :**(4×4=16)**

- a) Give two applications of each :
 - 1) Eddy current sensor
 - 2) Optical sensor.
 - b) Draw and explain implementation of proportional type Hydraulic controller.
 - c) List different types of Gears and state two applications of each.
 - d) Draw and explain the working principle of MEMS accelerometer.
 - e) Draw a ladder diagram for
 - I) To ON-off a motor with push button.
 - II) To off a motor after 5 sec.
 - f) Explain the working principle of capacitive sensor with neat diagram.
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17660

11718

3 Hours / 100 Marks

Seat No.

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- Instructions :**
- (1) All questions are **compulsory**.
 - (2) Answer **each** next main Question on a new page.
 - (3) Figures to the **right** indicate **full marks**.
 - (4) Assume suitable data, if **necessary**.

	Marks
1. Attempt any five :	20
1) Draw block diagram of mechatronics system and explain the key elements of mechatronics system.	4
2) Distinguish between a transducer and a sensor. (any four point)	4
3) Give advantages and disadvantages of electronic controller.	4
4) Explain implementation of proportional hydraulic controller.	4
5) State applications of rack and pinion.	4
6) List any four application of robot.	4
7) Give the block diagram of CNC based drilling machine.	4
2. Attempt any four :	16
a) What is “mechatronics”? State its importance in engineering with suitable example.	4
b) What is the significance of signal conditioner?	4
c) Draw block diagram of pneumatic system. What is the role of filter in pneumatic system?	4
d) State the working principle of ‘solenoid valve’ with neat sketch.	4
e) Draw and explain MEMS microactuator.	4
f) Describe the working of PLC based automatic carport barrier system with block diagram.	4
3. Attempt any four :	16
a) Draw block diagram of pick and place robot. List the required movement of it.	4
b) Draw and explain electronics PID controller.	4
c) State the types of actuators. Draw and explain single acting cylinder.	4
d) How MEMS accelerometer is used as air bag sensors for car safety? Describe in brief.	4
e) Draw and explain fuzzy logic controller.	4
f) Explain microcontroller based antilock brake system.	4

P.T.O.



- 4. Attempt any two of the following :** **16**
- a) Explain with sketch torque measurement using **8**
 - i) stroboscope method
 - ii) capacitive method.
 - b) Describe with sketch basic details of **8**
 - i) poppet valve
 - ii) shuttle valve.
 - c) Draw construction of Cartesian and cylindrical robots and explain briefly their degree of freedoms. **8**
- 5. Attempt any four :** **16**
- a) Draw and explain PLC ladder diagram of ON-OFF control of lamp. **4**
 - b) How the piezoelectric effect is used to measure acceleration ? List the features of piezoelectric accelerometer. **4**
 - c) Draw and explain gear type rotary actuator. **4**
 - d) State the characteristics of PD and PI controller with their control equation. **4**
 - e) Write note on evolution of mechatronics. **4**
 - f) State function of **4**
 - i) Isolator
 - ii) Filter
 - iii) Amplifier
 - iv) Data convertor in mechatronics system.
- 6. Attempt any four :** **16**
- a) Compare pneumatic and hydraulic system (4 point). **4**
 - b) Draw and explain LVDT accelerometer. **4**
 - c) Explain hall effect proximity sensor with diagram. **4**
 - d) Describe the principle of operation of DC motor. **4**
 - e) Give general configuration of CNC system. Give advantages of CNC (any two). **4**
 - f) Draw and explain block diagram of Robot. **4**
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17660

16172

3 Hours / 100 Marks

Seat No.

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- Instructions :**
- (1) *All questions are compulsory.*
 - (2) *Answer each next main question on a new page.*
 - (3) *Illustrate your answers with neat sketches wherever necessary.*
 - (4) *Figures to the right indicate full marks.*
 - (5) *Assume suitable data, if necessary.*
 - (6) *Use of Non-programmable Electronic Pocket Calculator is permissible.*
 - (7) *Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.*

- | | Marks |
|--|-----------------|
| 1. A) Attempt any three : | (3×4=12) |
| a) State the importance of mechatronics in various field of engineering. | |
| b) Explain in brief mechatronics. List its applications. | |
| c) What is optical encoder ? List its types. | |
| d) Distinguish between transducer and sensor. | |
| B) Attempt any one : | (1×6=6) |
| a) List advantages and disadvantages of CNC based drilling machine. | |
| b) Draw block diagram of practical ABS system. State its advantages. | |
| 2. Attempt any four : | (4×4=16) |
| a) Draw and explain general block diagram of Robotic system. | |
| b) Explain in brief cam. State the types of cam. List two applications. | |
| c) Explain working of Belt. List types of Belt. | |
| d) Draw and explain electronic PID controller. | |
| e) Define sensor, signal conditioner, controller and actuator in mechatronic system. | |
| f) List out various position sensors. Explain any one in detail. | |
| 3. Attempt any four : | (4×4=16) |
| a) Draw and explain Fuzzy logic controller. | |
| b) Compare Electronic controllers with pneumatic controllers. | |
| c) List different components of Industrial Robot. State functions of any two. | |
| d) Define DOF. Draw and explain six degrees of freedom. | |
| e) Draw and explain Rack and Pinion assembly. | |
| f) Classify bearing and explain any one in brief. | |

P.T.O.

4. A) Attempt **any three** :**(3×4=12)**

- a) Draw block diagram of microcontroller based pick and place Robot. List the four movements required by this Robot.
- b) List advantages and applications of PLC.
- c) Draw block diagram of pneumatic system showing its basic components. State the functions of control valve and air actuator.
- d) Explain the principle of operation of solenoid. State two parameters on which selection of solenoid is based.

B) Attempt **any one** :**(1×6=6)**

- a) Draw and explain schematic of PLC based automatic car parking barrier system.
- b) Draw a ladder diagram for following conditions of conveyor motor.
 - I) Start push button to start the conveyor motor.
 - II) Bottle moves past the photo sensor and the conveyor motor stops automatically after count of 25 bottles.
 - III) The counter is to be reset to zero after 25 bottles.
 - IV) The conveyor motor can be stopped manually at any time.
 - V) The accumulated count of the counter is reset manually by means of count reset button.

5. Attempt **any four** :**(4×4=16)**

- a) Draw and explain the working principle of Linear Velocity Transducer (LVT).
- b) Explain working principle of stroboscope with neat sketch.
- c) Draw and explain pneumatic proportional controller.
- d) Draw and explain block diagram of MEMS.
- e) List advantages and disadvantages of MEMS.
- f) For a signal conditioner explain the terms linearization and signal conversion.

6. Attempt **any four** :**(4×4=16)**

- a) Give two applications of each :
 - 1) Eddy current sensor
 - 2) Optical sensor.
 - b) Draw and explain implementation of proportional type Hydraulic controller.
 - c) List different types of Gears and state two applications of each.
 - d) Draw and explain the working principle of MEMS accelerometer.
 - e) Draw a ladder diagram for
 - I) To ON-off a motor with push button.
 - II) To off a motor after 5 sec.
 - f) Explain the working principle of capacitive sensor with neat diagram.
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17660

11819

3 Hours / 100 Marks

Seat No.

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- Instructions :** (1) *All questions are compulsory.*
(2) *Illustrate your answers with neat sketches wherever necessary.*
(3) *Figures to the right indicate full marks.*
(4) *Assume suitable data, if necessary.*
(5) *Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.*

Marks

1. A) Attempt **any three** of the following : **12**
- i) State and elaborate the importance of mechatronics in various field of engineering.
 - ii) Define :
 - a) sensor
 - b) transducer with examples of each.
 - iii) Draw PI controller using OP-AMP and explain in brief.
 - iv) Explain the basic components of pneumatic systems with neat sketch.
- B) Attempt **any two** of the following : **8**
- i) State the working principle of cam. List its types. Give any two applications of cam.
 - ii) What is 'Part Programming' ? Enlist basic requirements for Part programming with suitable example.
 - iii) Draw and explain strain guage accelerometer.
2. Attempt **any four** of the following : **16**
- a) With diagram, explain working hall effect sensor.
 - b) Explain in brief spherical Robot. Why it is called as spherical robot ?
 - c) Explain operation of solenoid valve with neat diagram.
 - d) Give the block diagram of CNC based drilling machine.
 - e) Draw and explain the working of inductive and capacitive sensors.
 - f) Draw and explain the block diagram of fuzzy logic controller.

P.T.O.



3. Attempt **any four** of the following : 16
- What is the significance of signal conditioners ?
 - State the types of Actuators. Draw and explain single acting cylinder.
 - Explain in brief, how antilock braking system works.
 - Draw block diagram of robot system. List functions of an end effector.
 - Explain how the piezoelectric effect is used to measure acceleration. List the features of piezoelectric accelerometer.
 - State the function of PLC. Draw a block diagram of basic PLC configuration.
4. Attempt **any four** of the following : 16
- Explain the mechatronics system with the help of block diagram and labelled the various elements.
 - Explain the classification of robots on the basis of work place ? Give one example of each Robot.
 - Draw the schematic and ladder diagram of PLC based automatic car park barrier system.
 - Explain the implementation of proportional type hydraulic controller.
 - List various photoelectric sensors. Explain any one of them in detail.
 - Explain fuzzy logic control in fully automatic washing machine.
5. Attempt **any four** of the following : 16
- Draw block diagram of pick and place Robot. List the required movements of it.
 - Explain MEMS accelerometer used as air bag sensors for car safety.
 - Draw and explain LVDT accelerometer.
 - Draw and explain PLC ladder diagram for ON-OFF control of lamp.
 - Explain how torque is calculated using Torsion-bar torque transducer.
 - Differentiate between pneumatic and hydraulic system.
6. Attempt **any four** of the following : 16
- Describe poppet valve with neat sketch.
 - Give general configuration of CNC system. Give advantages of CNC (Any two).
 - Explain with various components of MEMS with neat diagram.
 - Explain the concept of degree of freedom of Robot with sketch.
 - Enlist the advantages of Microcontroller (any four).
 - State and explain working principle of tachogenerator.
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17660

21819

3 Hours / 100 Marks

Seat No.

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- Instructions :**
- (1) All Questions are *compulsory*.
 - (2) Illustrate your answers with neat sketches wherever necessary.
 - (3) Figures to the right indicate full marks.
 - (4) Assume suitable data, if necessary.
 - (5) Use of Non-programmable Electronic Pocket Calculator is permissible.
 - (6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE :

20

- (a) List any four advantages of Mechatronic System.
- (b) Distinguish between a transducer and a sensor.
- (c) Draw the block diagram of CNC based drilling machine.
- (d) Describe the implementation of proportional type of controller using hydraulic controller.
- (e) Draw block diagram of Robot system. List functions of end effector.
- (f) State and elaborate the importance of mechatronics in various field of engineering.
- (g) State the applications of rack and pinion.

2. Attempt any FOUR :**16**

- (a) Draw and explain LVDT accelerometer.
- (b) Describe the working of PLC based automatic car park barrier system with block diagram.
- (c) Explain MEMs microactuator with neat diagram.
- (d) Draw the PLC ladder diagram of ON-OFF control of lamp. Write the input and output devices.
- (e) Compare pneumatic and hydraulic system.
- (f) Draw and describe Hall effect sensor.

3. Attempt any FOUR :**16**

- (a) Draw and explain fuzzy logic controller.
- (b) List velocity sensors and explain any one type with neat diagram.
- (c) State four advantages of CNC system. What are G codes and M codes ?
- (d) State the working principle of 'Solenoid Valve' with neat sketch.
- (e) Explain the construction of spherical robot in brief. State its degree of freedom.
- (f) Give advantages and disadvantages of CNC based drilling machine.

4. Attempt any TWO :**16**

- (a) State the working principle of Cam. List its types. Give any four applications of Cam.
- (b) Explain microcontroller based antilock brake system with neat block diagram.
- (c) Explain with sketch torque measurement using (i) Stroboscope method, (ii) Capacitive method.

5. Attempt any FOUR :**16**

- (a) State the working principle of capacitive sensor with neat diagram.
- (b) State the function of 'Signal Conditioner' in measurement system.
- (c) How a PLC can be used to handle an analog input ? Justify.
- (d) Draw and explain pneumatic PID controller.
- (e) Classify the robots based on workspace.
- (f) Write a note on 'Evolution of Mechatronics'.

6. Attempt any TWO :**16**

- (a) Describe with sketch (i) Poppet valve, (ii) Spool valve.
 - (b) Draw construction of Cartesian and cylindrical robots and explain their degree of freedoms.
 - (c) Develop a ladder diagram for to control conveyor belt motor equipped with the :
 - (i) Counter of item.
 - (ii) Start & Stop functions.
 - (iii) Change of direction function.
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17660

11920

3 Hours / 100 Marks

Seat No.

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- Instructions :**
- (1) All Questions are *compulsory*.
 - (2) Answer each Section on same / separate answer sheet.
 - (3) Assume suitable data, if necessary.
 - (4) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE :

20

- (a) Write any four advantages and disadvantages of mechatronics.
- (b) Compare between Electronic and Pneumatic Controllers (any four points).
- (c) Define and explain the terms : (i) Sensor (ii) Transducer.
- (d) List components of Mechatronics System. Explain any two.
- (e) Draw schematic diagram of LVDT accelerometer. Explain in brief.
- (f) State type of bearing. Explain any one.
- (g) Describe the concept of degree of freedom in robotic.

2. Attempt any FOUR :

16

- (a) Draw and explain the block diagram of fuzzy logic controller.
- (b) Draw practical ABS system. List any four advantages of it.
- (c) Draw block diagram of robotic system and explain in brief.
- (d) State applications of mechatronics (any four).
- (e) Draw block diagram of pneumatic control system. What is the role of filter in Pneumatic System ?
- (f) List velocity sensors and explain any one with diagram.

3. Attempt any FOUR :**16**

- (a) Draw block diagram of PLC based automatic car park barrier system and explain.
- (b) Draw electronic PID controller with Op-Amp. Write its output expression.
- (c) State the types of actuators. Draw and explain single acting cylinder.
- (d) Explain Cartesian co-ordinate configuration with diagram.
- (e) Draw block diagram of MEMs and explain.
- (f) Draw block diagram of pick and place robot system. State role of each block.

4. Attempt any FOUR :**16**

- (a) Explain working of CNC drilling machine with neat block diagram.
- (b) State the principle of tachogenerator with the help of neat diagram.
- (c) Draw PLC ladder diagram for following condition :
 - (i) The start push button can be pressed to start the conveyor motor.
 - (ii) Bottles moves and photosensor detect, conveyor motor stop automatically after a count of 25 bottles.
- (d) List the types of gear and draw schematic of any one.
- (e) Write four advantages and disadvantages of solenoid valve.
- (f) Explain with an example the procedure to write a part program for drilling a hole.

5. Attempt any FOUR :**16**

- (a) Explain Hall effect sensor with schematic diagram.
- (b) Explain with diagram how torque is measured using strain gauge.
- (c) Explain use of MEM accelerometer for airbag sensors car safety.

- (d) Explain MEMs fabrication techniques.
- (e) List advantages of PLC based car parking system (any four).
- (f) Write the type of Car. Describe the working principle of any one type with diagram.

6. Attempt any FOUR :

16

- (a) Draw block diagram of fuzzy logic control in fully automatic washing machine.
 - (b) Draw architecture of micro-controller.
 - (c) Explain how stroboscope is used for measurement of speed of motor with suitable diagram.
 - (d) For a single conditioner explain the terms :
 - (i) Linearization
 - (ii) filters
 - (iii) isolation
 - (iv) signal conversion
 - (e) Draw construction of relay and explain its working.
 - (f) Explain operation of vane type Rotary Actuators with suitable diagram.
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