

GATE Robotics and Automation (RA)

Sample Paper – 4

Duration: 180 Minutes

Maximum Marks: 100

Instructions

- This paper is modelled on the **GATE Robotics and Automation (RA)** paper structure.
- Attempt **General Aptitude, Part A**, and either **Part B1 Electrical** or **Part B2 Mechanical**.
- General Aptitude carries **15 marks**, Part A carries **60 marks**, and the chosen optional section carries **25 marks**.
- Question types are **MCQ, MSQ**, and **NAT**. Questions carry either **1 mark** or **2 marks**.
- Negative marking applies only to wrong MCQs: **1/3 mark** for 1-mark MCQs and **2/3 mark** for 2-mark MCQs.
- There is **no negative marking** for MSQ or NAT questions. MSQ questions have **no partial marking**.

General Aptitude - Compulsory

GA1. [MCQ, 1 mark] Choose the correctly punctuated sentence.

- (A) After calibration, the robot started.
- (B) After calibration the robot started?
- (C) After calibration; the robot started?
- (D) After calibration the robot started! always

GA2. [MCQ, 1 mark] The antonym of 'precise' is:

- (A) Exact
- (B) Approximate
- (C) Accurate



(D) Calibrated

GA3. [NAT, 1 mark] A sensor costs Rs. 2400 after 20 percent GST is added. Find the pre-tax cost in rupees. *Answer type: Numerical Answer Type (enter the value).*

GA4. [MCQ, 1 mark] If no unsafe cell is enabled and cell R is enabled, which conclusion follows?

- (A) R is unsafe
- (B) All cells are enabled
- (C) R is not unsafe
- (D) No cell exists

GA5. [NAT, 1 mark] Find the least common multiple of 6 and 8. *Answer type: Numerical Answer Type (enter the value).*

GA6. [MCQ, 2 marks] Defects per shift are 3, 4, 4, 5 and 9. The mode is:

- (A) 3
- (B) 9
- (C) 5
- (D) 4

GA7. [NAT, 2 marks] Two robots complete a task in 12 min. Four identical robots complete it in how many minutes? *Answer type: Numerical Answer Type (enter the value).*

GA8. [NAT, 2 marks] A fair die is rolled. Probability of getting a number greater than 4 is: *Answer type: Numerical Answer Type (enter the value).*

GA9. [MCQ, 2 marks] Which evidence best shows a navigation algorithm improved?



- (A) Path length decreased for the same start and goal
- (B) Robot colour changed
- (C) Battery label changed
- (D) Operator changed shoes

GA10. [NAT, 2 marks] A robot's uptime improves from 90 percent to 95 percent. Find the increase in percentage points. *Answer type: Numerical Answer Type (enter the value).*

Part A - Common Robotics and Automation Section

- A1. [NAT, 1 mark]** Find the determinant of $\begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$. *Answer type: Numerical Answer Type (enter the value).*
- A2. [MCQ, 1 mark]** A real symmetric matrix has eigenvectors that can be chosen:
- (A) Orthogonal
 - (B) Only complex
 - (C) Only zero
 - (D) Random only
- A3. [NAT, 1 mark]** If $y = \sin x$, find dy/dx at $x = 0$. *Answer type: Numerical Answer Type (enter the value).*
- A4. [NAT, 1 mark]** Evaluate the integral of 4 from 0 to 3. *Answer type: Numerical Answer Type (enter the value).*
- A5. [MCQ, 1 mark]** For independent events A and B, $P(A \text{ and } B)$ equals:
- (A) $P(A) + P(B)$
 - (B) $P(A)P(B)$
 - (C) $P(A) - P(B)$
 - (D) 1



- A6. [MCQ, 1 mark]** Variance is always:
- (A) Equal to mean only
 - (B) Negative
 - (C) Non-negative
 - (D) Imaginary
- A7. [MCQ, 1 mark]** Bisection method requires an interval where the function values at the ends have:
- (A) No values
 - (B) Same derivative only
 - (C) Same value only
 - (D) Opposite signs
- A8. [NAT, 1 mark]** Three 6 ohm resistors in parallel have equivalent resistance in ohms: *Answer type: Numerical Answer Type (enter the value).*
- A9. [MCQ, 1 mark]** An XOR gate output is 1 when its two inputs are:
- (A) Different
 - (B) Both 0 only
 - (C) Both 1 only
 - (D) Missing
- A10. [NAT, 1 mark]** A 4-bit binary counter has how many distinct states? *Answer type: Numerical Answer Type (enter the value).*
- A11. [MCQ, 1 mark]** An RTD is used to measure:
- (A) Angular velocity only
 - (B) Temperature
 - (C) pH only
 - (D) Mass flow only



A12. [MCQ, 1 mark] A tachometer is used to measure:

- (A) Colour
- (B) Linear strain only
- (C) Rotational speed
- (D) Voltage phase only

A13. [MCQ, 1 mark] A solenoid converts electrical energy into:

- (A) Data sorting
- (B) Image processing
- (C) Chemical pH
- (D) Linear mechanical motion

A14. [MCQ, 1 mark] Armature current in a DC motor is directly related to:

- (A) Torque
- (B) QR code size
- (C) Robot colour
- (D) Memory address

A15. [NAT, 1 mark] A mass of 2 kg has acceleration 3 m/s^2 . Force in newtons is: *Answer type: Numerical Answer Type (enter the value).*

A16. [MCQ, 1 mark] The expression `7 // 2` in Python evaluates to:

- (A) 3.5
- (B) 3
- (C) 4
- (D) 2

A17. [MCQ, 1 mark] A hash table is mainly used for efficient:

- (A) Torque conversion



- (B) Analog filtering
- (C) Key-based lookup
- (D) Beam bending

A18. [MCQ, 1 mark] Depth-first search is commonly implemented using:

- (A) Wheatstone bridge
- (B) ADC
- (C) Thermocouple
- (D) Stack

A19. [MCQ, 1 mark] Workspace of a robot means:

- (A) Region reachable by the end-effector
- (B) Only controller memory
- (C) Only base weight
- (D) Only link colour

A20. [NAT, 1 mark] A revolute joint contributes how many degrees of freedom?
Answer type: Numerical Answer Type (enter the value).

A21. [MCQ, 2 marks] A homogeneous transformation combines:

- (A) Only voltage and current
- (B) Rotation and translation
- (C) Only stress and strain
- (D) Only sorting and searching

A22. [MCQ, 2 marks] A 90 degree clockwise rotation in 2D maps point (0, 1) to:

- (A) (0, -1)
- (B) (-1, 0)



(C) (1, 0)

(D) (1, 1)

A23. [NAT, 2 marks] A prismatic joint extends by 0.25 m. What linear displacement does it add in metres? *Answer type: Numerical Answer Type (enter the value).*

A24. [MCQ, 2 marks] The inertia matrix in robot dynamics is generally:

(A) A Boolean table

(B) Always zero

(C) Always scalar one

(D) Configuration dependent

A25. [MCQ, 2 marks] A vacuum gripper is most suitable for:

(A) Flat nonporous objects

(B) Hot molten metal only

(C) Invisible objects only

(D) Loose powder only

A26. [MCQ, 2 marks] Odometry estimates pose using:

(A) Only paint colour

(B) Motion measurements such as wheel encoder data

(C) Only barcode font

(D) Only temperature

A27. [NAT, 2 marks] A differential drive robot has wheel radius 0.05 m and wheel angular speed 20 rad/s on both wheels. Forward speed in m/s is: *Answer type: Numerical Answer Type (enter the value).*

A28. [MSQ, 2 marks] Which are commonly used for robot perception?



- (A) Camera
- (B) Lidar
- (C) Ultrasonic sensor
- (D) Plain washer

A29. [MCQ, 2 marks] A timer instruction in PLC logic is used to:

- (A) Perform casting
- (B) Generate mechanical torque
- (C) Introduce a time-based condition
- (D) Measure strain directly

A30. [MCQ, 2 marks] The M03 command in many CNC systems is used for:

- (A) Coolant off always
- (B) Rapid linear interpolation
- (C) Program rewind only
- (D) Spindle on clockwise

A31. [MCQ, 2 marks] Teach pendant is used to:

- (A) Jog and program robot positions
- (B) Calculate eigenvalues only
- (C) Melt metal automatically only
- (D) Store compressed air

A32. [MCQ, 2 marks] A flexible manufacturing system is characterized by:

- (A) Only one fixed manual operation
- (B) Ability to handle product variety with automation
- (C) No control system
- (D) No machine tools



- A33. [MCQ, 2 marks]** Edge detection in images primarily finds:
- (A) Hydraulic pressure
 - (B) Battery voltage
 - (C) Intensity discontinuities
 - (D) Beam stress
- A34. [NAT, 2 marks]** A load needs force 100 N at speed 0.5 m/s. Mechanical power in watts is: *Answer type: Numerical Answer Type (enter the value).*
- A35. [NAT, 2 marks]** A gearbox has efficiency 0.8. If input power is 500 W, output power in watts is: *Answer type: Numerical Answer Type (enter the value).*
- A36. [MCQ, 2 marks]** A flow control valve in pneumatics is mainly used to control:
- (A) Program syntax
 - (B) ADC resolution
 - (C) Gear hardness
 - (D) Actuator speed
- A37. [MCQ, 2 marks]** A pressure relief valve protects a hydraulic system by:
- (A) Limiting maximum pressure
 - (B) Increasing pressure without limit
 - (C) Removing all oil
 - (D) Measuring voltage
- A38. [MCQ, 2 marks]** Robot risk assessment is performed to:
- (A) Increase cycle time only
 - (B) Identify hazards and reduce risk
 - (C) Remove guarding



(D) Ignore human access

A39. [MCQ, 2 marks] The A-star algorithm uses:

- (A) Only ADC values
- (B) Only random moves
- (C) Cost-to-come and heuristic estimate
- (D) Only motor current

A40. [MCQ, 2 marks] Closed-loop control differs from open-loop control because it uses:

- (A) Only manual inspection
- (B) No sensors ever
- (C) Only mechanical gears
- (D) Feedback



Part B1 - Electrical Engineering Optional

B11. [MCQ, 1 mark] A high-pass filter passes:

- (A) High frequencies
- (B) Only DC
- (C) Only zero frequency
- (D) Only hydraulic pressure

B12. [MCQ, 1 mark] A voltage follower has voltage gain approximately:

- (A) 0
- (B) 1
- (C) 10
- (D) Infinite only

B13. [NAT, 1 mark] A 6-bit ADC has how many quantization levels? *Answer type: Numerical Answer Type (enter the value).*

B14. [MCQ, 1 mark] GPIO pins are used for:

- (A) Only beam testing
- (B) Only analog filtering
- (C) General digital input and output
- (D) Only welding

B15. [MCQ, 1 mark] UART communication is generally:

- (A) Casting method
- (B) Hydraulic actuation
- (C) Beam loading
- (D) Asynchronous serial communication



- B16. [NAT, 2 marks]** For $R = 1 \text{ kohm}$ and $C = 1 \text{ microfarad}$, the RC time constant in milliseconds is: *Answer type: Numerical Answer Type (enter the value).*
- B17. [MCQ, 2 marks]** A pole in the right half of the s-plane indicates:
- (A) Instability for a continuous-time system
 - (B) Guaranteed stability
 - (C) No effect
 - (D) Only quantization
- B18. [MCQ, 2 marks]** Phase margin is read from:
- (A) Only beam diagram
 - (B) Open-loop frequency response
 - (C) Only truth table
 - (D) Only CAD model
- B19. [NAT, 2 marks]** A unity-feedback system has position error constant $K_p = 9$. Step steady-state error is: *Answer type: Numerical Answer Type (enter the value).*
- B110. [MSQ, 2 marks]** Which are common serial communication protocols?
- (A) SPI
 - (B) I2C
 - (C) UART
 - (D) Rack and pinion
- B111. [MCQ, 2 marks]** A moving average filter mainly performs:
- (A) Hydraulic relief
 - (B) Gear cutting
 - (C) Smoothing



(D) Welding

B112. [MCQ, 2 marks] The unit delay operator in discrete time is:

(A) ω^2

(B) s

(C) j

(D) z^{-1}

B113. [MCQ, 2 marks] Integral windup occurs when:

(A) Integrator accumulates large error during saturation

(B) Motor has no current

(C) A beam is unloaded

(D) A graph is sorted

B114. [MCQ, 2 marks] A flyback diode across a relay coil protects against:

(A) Low friction

(B) Inductive voltage spike

(C) Gear wear

(D) Memory leak only

B115. [MCQ, 2 marks] Signal conditioning before ADC may include:

(A) Casting only

(B) Welding only

(C) Amplification and filtering

(D) Sorting only



Part B2 - Mechanical Engineering Optional

B21. [MCQ, 1 mark] Hooke's law in the linear elastic range relates stress to:

- (A) Memory
- (B) Velocity
- (C) Voltage
- (D) Strain

B22. [MCQ, 1 mark] In a simply supported beam, reactions occur at:

- (A) Only neutral axis
- (B) Only midspan
- (C) Supports
- (D) Only centroid

B23. [MCQ, 1 mark] A key in a shaft-hub assembly is used to transmit:

- (A) Temperature
- (B) Torque
- (C) ADC count
- (D) Data packet

B24. [MCQ, 1 mark] Spring stiffness is force divided by:

- (A) Deflection
- (B) Voltage
- (C) Speed
- (D) Time

B25. [MCQ, 1 mark] A butt joint weld joins plates:

- (A) Only by threads
- (B) Only at right angle



- (C) Only by adhesive
- (D) Edge to edge

- B26. [NAT, 2 marks]** A 5 kN tensile load acts on area 50 mm^2 . Stress in MPa is: *Answer type: Numerical Answer Type (enter the value).*
- B27. [NAT, 2 marks]** A spring of stiffness 200 N/m is stretched by 0.1 m. Strain energy in joules is: *Answer type: Numerical Answer Type (enter the value).*
- B28. [NAT, 2 marks]** A system has natural frequency 5 Hz. Its angular natural frequency in rad/s using $\pi = 3.14$ is: *Answer type: Numerical Answer Type (enter the value).*
- B29. [MCQ, 2 marks]** Module of a gear is defined as:
- (A) Torque divided by area
 - (B) Number of teeth divided by voltage
 - (C) Pitch diameter divided by number of teeth
 - (D) Speed divided by mass
- B210. [MCQ, 2 marks]** Bearing life is commonly expressed in:
- (A) Only volts
 - (B) Millions of revolutions or hours
 - (C) Only pascals
 - (D) Only lines of code
- B211. [MCQ, 2 marks]** Stress concentration generally:
- (A) Reduces fatigue strength
 - (B) Improves all fatigue strength
 - (C) Has no effect
 - (D) Eliminates cracks



B212. [MCQ, 2 marks] Maximum principal stress theory is often applied to:

- (A) Brittle materials
- (B) Only fluids
- (C) Only Boolean circuits
- (D) Only sensors

B213. [MCQ, 2 marks] In CNC machining, feed rate controls:

- (A) ADC resolution
- (B) Tool advance speed
- (C) Bearing clearance only
- (D) Battery chemistry

B214. [MCQ, 2 marks] A parametric CAD model allows dimensions to be changed by:

- (A) Removing all constraints
- (B) Melting the part
- (C) Editing parameters
- (D) Deleting geometry only

B215. [MCQ, 2 marks] Slicing software converts a 3D model into:

- (A) Only hydraulic circuits
- (B) Only hand sketches
- (C) Only stress tensors
- (D) Layer toolpaths



Detailed Solutions

General Aptitude - Compulsory

GA1.

Solution

Concept — Verbal Aptitude: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: The comma after the introductory phrase gives a clear, correctly punctuated sentence.

Question Type: MCQ; **Marks:** 1.

Final Answer: The correct answer is $\Rightarrow$

Answer: (A) [Go Back to GA1](#)

GA2.

Solution

Concept — Vocabulary: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: Precise means exact; approximate is its opposite in this context.

Question Type: MCQ; **Marks:** 1.

Final Answer: The correct answer is $\Rightarrow$

Answer: (B) [Go Back to GA2](#)

GA3.

Solution

Concept — Arithmetic: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: If pre-tax cost is x , then $1.2x = 2400$, so $x = 2000$.

Question Type: NAT; **Marks:** 1.

Final Answer: The correct answer is $\Rightarrow$

Answer: (2000) [Go Back to GA3](#)



GA4.

Solution

Concept — Logical Reasoning: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: If unsafe cells are never enabled, an enabled cell cannot be unsafe.

Question Type: MCQ; **Marks:** 1.

Final Answer: The correct answer is $\Rightarrow$

Answer: (C) [Go Back to GA4](#)

GA5.

Solution

Concept — Numbers: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: The least common multiple of 6 and 8 is 24.

Question Type: NAT; **Marks:** 1.

Final Answer: The correct answer is $\Rightarrow$

Answer: (24) [Go Back to GA5](#)

GA6.

Solution

Concept — Data Interpretation: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: The value 4 appears most often.

Question Type: MCQ; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

Answer: (D) [Go Back to GA6](#)



GA7.

Solution

Concept — Time and Work: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: Doubling the number of identical robots halves the time, so 6 min.

Question Type: NAT; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

Answer: (6) [Go Back to GA7](#)

GA8.

Solution

Concept — Probability: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: Outcomes are 5 and 6, so probability is $2/6 = 1/3$, approximately 0.3333.

Question Type: NAT; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

Answer: (0.3333) [Go Back to GA8](#)

GA9.

Solution

Concept — Critical Reasoning: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: For the same task, a reduced path length directly supports improved navigation.

Question Type: MCQ; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

Answer: (A) [Go Back to GA9](#)



GA10.

Solution

Concept — Percentages: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: Percentage point increase = $95 - 90 = 5$.

Question Type: NAT; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

Answer: (5) [Go Back to GA10](#)

Part A - Common Robotics and Automation Section

A1.

Solution

Concept — Linear Algebra: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: Determinant = $0 \times 0 - 1 \times (-1) = 1$.

Question Type: NAT; **Marks:** 1.

Final Answer: The correct answer is $\Rightarrow$

Answer: (1) [Go Back to A1](#)

A2.

Solution

Concept — Eigenvalues: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: Real symmetric matrices have orthogonal eigenvectors for distinct eigenvalues.

Question Type: MCQ; **Marks:** 1.

Final Answer: The correct answer is $\Rightarrow$

Answer: (A) [Go Back to A2](#)



A3.

Solution

Concept — Calculus: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: Derivative of $\sin x$ is $\cos x$, and $\cos 0 = 1$.

Question Type: NAT; **Marks:** 1.

Final Answer: The correct answer is $\Rightarrow$

Answer: (1) [Go Back to A3](#)

A4.

Solution

Concept — Calculus: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: The integral of a constant 4 over length 3 is 12.

Question Type: NAT; **Marks:** 1.

Final Answer: The correct answer is $\Rightarrow$

Answer: (12) [Go Back to A4](#)

A5.

Solution

Concept — Probability: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: For independent events, joint probability is the product of probabilities.

Question Type: MCQ; **Marks:** 1.

Final Answer: The correct answer is $\Rightarrow$

Answer: (B) [Go Back to A5](#)



A6.

Solution

Concept — Statistics: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: Variance is the expected squared deviation from mean and cannot be negative.

Question Type: MCQ; **Marks:** 1.

Final Answer: The correct answer is $\Rightarrow$

Answer: (C) [Go Back to A6](#)

A7.

Solution

Concept — Numerical Methods: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: A sign change indicates a root in the interval for continuous functions.

Question Type: MCQ; **Marks:** 1.

Final Answer: The correct answer is $\Rightarrow$

Answer: (D) [Go Back to A7](#)

A8.

Solution

Concept — DC Circuits: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: For three equal resistors in parallel, equivalent resistance is $6/3 = 2$ ohm.

Question Type: NAT; **Marks:** 1.

Final Answer: The correct answer is $\Rightarrow$

Answer: (2) [Go Back to A8](#)



A9.

Solution

Concept — Digital Logic: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: XOR gives 1 when inputs are unequal.

Question Type: MCQ; **Marks:** 1.

Final Answer: The correct answer is $\Rightarrow$

[Go Back to A9](#)

A10.

Solution

Concept — Flip-Flops: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: A 4-bit counter has $2^4 = 16$ states.

Question Type: NAT; **Marks:** 1.

Final Answer: The correct answer is $\Rightarrow$

[Go Back to A10](#)

A11.

Solution

Concept — Sensors: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: An RTD measures temperature through resistance change.

Question Type: MCQ; **Marks:** 1.

Final Answer: The correct answer is $\Rightarrow$

[Go Back to A11](#)



A12.

Solution

Concept — Sensors: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: A tachometer measures speed of rotation.

Question Type: MCQ; **Marks:** 1.

Final Answer: The correct answer is $\Rightarrow$

Answer: (C) [Go Back to A12](#)

A13.

Solution

Concept — Actuators: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: A solenoid produces linear motion through electromagnetic force.

Question Type: MCQ; **Marks:** 1.

Final Answer: The correct answer is $\Rightarrow$

Answer: (D) [Go Back to A13](#)

A14.

Solution

Concept — DC Machines: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: For a given field, motor torque is proportional to armature current.

Question Type: MCQ; **Marks:** 1.

Final Answer: The correct answer is $\Rightarrow$

Answer: (A) [Go Back to A14](#)



A15.

Solution

Concept — Mechanics: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: Force = mass x acceleration = $2 \times 3 = 6$ N.

Question Type: NAT; **Marks:** 1.

Final Answer: The correct answer is $\Rightarrow$

Answer: (6) [Go Back to A15](#)

A16.

Solution

Concept — Python: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: The // operator performs integer floor division, so $7 // 2$ is 3.

Question Type: MCQ; **Marks:** 1.

Final Answer: The correct answer is $\Rightarrow$

Answer: (B) [Go Back to A16](#)

A17.

Solution

Concept — Data Structures: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: Hash tables provide efficient lookup using keys.

Question Type: MCQ; **Marks:** 1.

Final Answer: The correct answer is $\Rightarrow$

Answer: (C) [Go Back to A17](#)



A18.

Solution

Concept — Algorithms: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: DFS uses a stack explicitly or through recursion.

Question Type: MCQ; **Marks:** 1.

Final Answer: The correct answer is $\Rightarrow$ D

Answer: (D) [Go Back to A18](#)

A19.

Solution

Concept — Robotics: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: Workspace is the set of end-effector positions or poses the robot can reach.

Question Type: MCQ; **Marks:** 1.

Final Answer: The correct answer is $\Rightarrow$ A

Answer: (A) [Go Back to A19](#)

A20.

Solution

Concept — Robot Joints: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: An ideal revolute joint contributes one rotational degree of freedom.

Question Type: NAT; **Marks:** 1.

Final Answer: The correct answer is $\Rightarrow$ 1

Answer: (1) [Go Back to A20](#)



A21.

Solution

Concept — Homogeneous Transform: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: It represents both orientation and position in one matrix.

Question Type: MCQ; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

Answer: (B) [Go Back to A21](#)

A22.

Solution

Concept — Rotation: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: Clockwise 90 degree rotation maps the positive y-axis unit vector to positive x.

Question Type: MCQ; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

Answer: (C) [Go Back to A22](#)

A23.

Solution

Concept — Forward Kinematics: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: An ideal prismatic joint contributes a translation equal to its extension.

Question Type: NAT; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

Answer: (0.25) [Go Back to A23](#)



A24.

Solution

Concept — Robot Dynamics: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: The manipulator inertia matrix depends on joint configuration.

Question Type: MCQ; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

Answer: (D) [Go Back to A24](#)

A25.

Solution

Concept — End Effectors: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: Vacuum grippers work well on flat, nonporous surfaces.

Question Type: MCQ; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

Answer: (A) [Go Back to A25](#)

A26.

Solution

Concept — Mobile Robots: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: Odometry integrates motion sensor data such as wheel encoder counts.

Question Type: MCQ; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

Answer: (B) [Go Back to A26](#)



A27.

Solution

Concept — Differential Drive: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: Forward speed = $r \omega = 0.05 \times 20 = 1 \text{ m/s}$.

Question Type: NAT; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

Answer: (1) [Go Back to A27](#)

A28.

Solution

Concept — Robot Sensors: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: Cameras, lidars and ultrasonic sensors are common perception sensors.

Question Type: MSQ; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

Answer: (ABC) [Go Back to A28](#)

A29.

Solution

Concept — PLC: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: PLC timers provide delay or time-accumulation logic.

Question Type: MCQ; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

Answer: (C) [Go Back to A29](#)



A30.

Solution

Concept — CNC: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: M03 commonly starts the spindle clockwise.

Question Type: MCQ; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

Answer: (D) [Go Back to A30](#)

A31.

Solution

Concept — Industrial Robotics: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: A teach pendant lets operators jog, teach and program robot motion.

Question Type: MCQ; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

Answer: (A) [Go Back to A31](#)

A32.

Solution

Concept — Automation: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: FMS combines automation with flexibility for different part families.

Question Type: MCQ; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

Answer: (B) [Go Back to A32](#)



A33.

Solution

Concept — Computer Vision: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: Edges are locations of significant intensity change.

Question Type: MCQ; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

Answer: (C) [Go Back to A33](#)

A34.

Solution

Concept — Motor Sizing: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: Power = force x velocity = $100 \times 0.5 = 50$ W.

Question Type: NAT; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

Answer: (50) [Go Back to A34](#)

A35.

Solution

Concept — Gear Trains: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: Output power = efficiency x input power = $0.8 \times 500 = 400$ W.

Question Type: NAT; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

Answer: (400) [Go Back to A35](#)



A36.

Solution

Concept — Pneumatics: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: Flow rate affects cylinder speed.

Question Type: MCQ; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

[Go Back to A36](#)

A37.

Solution

Concept — Hydraulics: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: It opens when pressure exceeds a set value.

Question Type: MCQ; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

[Go Back to A37](#)

A38.

Solution

Concept — Safety: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: Risk assessment identifies hazards and defines measures to reduce risk.

Question Type: MCQ; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

[Go Back to A38](#)



A39.

Solution

Concept — Path Planning: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: A-star combines actual path cost and heuristic estimate to guide search.

Question Type: MCQ; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

[Go Back to A39](#)

A40.

Solution

Concept — Control: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: Closed-loop control measures output and feeds it back to adjust control action.

Question Type: MCQ; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

[Go Back to A40](#)

Part B1 - Electrical Engineering Optional

B11.

Solution

Concept — Filters: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: A high-pass filter attenuates low frequencies and passes high frequencies.

Question Type: MCQ; **Marks:** 1.

Final Answer: The correct answer is $\Rightarrow$

[Go Back to B11](#)



B12.

Solution

Concept — Op-Amp: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: A voltage follower has unity gain and high input impedance.

Question Type: MCQ; **Marks:** 1.

Final Answer: The correct answer is $\Rightarrow$

Answer: (B) [Go Back to B12](#)

B13.

Solution

Concept — ADC: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: A 6-bit ADC has $2^6 = 64$ levels.

Question Type: NAT; **Marks:** 1.

Final Answer: The correct answer is $\Rightarrow$

Answer: (64) [Go Back to B13](#)

B14.

Solution

Concept — Microcontrollers: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: GPIO means general-purpose input/output.

Question Type: MCQ; **Marks:** 1.

Final Answer: The correct answer is $\Rightarrow$

Answer: (C) [Go Back to B14](#)



B15.

Solution

Concept — Communication: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: UART is an asynchronous serial communication interface.

Question Type: MCQ; **Marks:** 1.

Final Answer: The correct answer is $\Rightarrow$

Answer: (D) [Go Back to B15](#)

B16.

Solution

Concept — RC Filter: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: $RC = 1000 \times 1 \times 10^{-6} = 0.001 \text{ s} = 1 \text{ ms}$.

Question Type: NAT; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

Answer: (1) [Go Back to B16](#)

B17.

Solution

Concept — Control: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: Right-half-plane poles lead to exponentially growing modes.

Question Type: MCQ; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

Answer: (A) [Go Back to B17](#)



B18.

Solution

Concept — Control: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: Phase margin is obtained from the loop transfer function frequency response.

Question Type: MCQ; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

Answer: (B) [Go Back to B18](#)

B19.

Solution

Concept — Steady-State Error: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: For a type-0 system, step error = $1/(1 + K_p) = 1/10 = 0.1$.

Question Type: NAT; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

Answer: (0.1) [Go Back to B19](#)

B110.

Solution

Concept — Embedded Systems: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: SPI, I2C and UART are serial communication protocols.

Question Type: MSQ; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

Answer: (ABC) [Go Back to B110](#)



B111.

Solution

Concept — Digital Signal Processing: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: A moving average filter smooths short-term fluctuations.

Question Type: MCQ; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

[Go Back to B111](#)

B112.

Solution

Concept — Discrete Systems: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: The factor z^{-1} denotes a one-sample delay.

Question Type: MCQ; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

[Go Back to B112](#)

B113.

Solution

Concept — Compensation: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: Actuator saturation can cause the integral term to grow excessively.

Question Type: MCQ; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

[Go Back to B113](#)



B114.

Solution

Concept — Power Electronics: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: The diode provides a current path for coil energy when switched off.

Question Type: MCQ; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

[Go Back to B114](#)

B115.

Solution

Concept — Sensors: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: Signal conditioning scales and cleans the signal before digitization.

Question Type: MCQ; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

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Part B2 - Mechanical Engineering Optional

B21.

Solution

Concept — Stress: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: In linear elasticity, stress is proportional to strain.

Question Type: MCQ; **Marks:** 1.

Final Answer: The correct answer is $\Rightarrow$

[Go Back to B21](#)



B22.

Solution

Concept — Beams: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: Support reactions are forces at beam supports.

Question Type: MCQ; **Marks:** 1.

Final Answer: The correct answer is $\Rightarrow$

Answer: (C) [Go Back to B22](#)

B23.

Solution

Concept — Shafts: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: A key prevents relative rotation and transmits torque.

Question Type: MCQ; **Marks:** 1.

Final Answer: The correct answer is $\Rightarrow$

Answer: (B) [Go Back to B23](#)

B24.

Solution

Concept — Springs: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: Linear spring stiffness $k = F/\text{deflection}$.

Question Type: MCQ; **Marks:** 1.

Final Answer: The correct answer is $\Rightarrow$

Answer: (A) [Go Back to B24](#)



B25.

Solution

Concept — Welding: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: A butt joint joins members in the same plane edge to edge.

Question Type: MCQ; **Marks:** 1.

Final Answer: The correct answer is $\Rightarrow$

Answer: (D) [Go Back to B25](#)

B26.

Solution

Concept — Stress: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: Stress = $5000/50 = 100 \text{ N/mm}^2 = 100 \text{ MPa}$.

Question Type: NAT; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

Answer: (100) [Go Back to B26](#)

B27.

Solution

Concept — Strain Energy: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: Energy = $0.5 k x^2 = 0.5 \times 200 \times 0.01 = 1 \text{ J}$.

Question Type: NAT; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

Answer: (1) [Go Back to B27](#)



B28.

Solution

Concept — Vibrations: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: Angular frequency = $2\pi f = 2 \times 3.14 \times 5 = 31.4 \text{ rad/s}$.

Question Type: NAT; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

Answer: (31.4) [Go Back to B28](#)

B29.

Solution

Concept — Gears: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: Gear module $m = \text{pitch diameter}/\text{number of teeth}$.

Question Type: MCQ; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

Answer: (C) [Go Back to B29](#)

B210.

Solution

Concept — Bearings: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: Bearing life is rated in revolutions or operating hours.

Question Type: MCQ; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

Answer: (B) [Go Back to B210](#)



B211.

Solution

Concept — Fatigue: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: Stress concentrations raise local stress and reduce fatigue life.

Question Type: MCQ; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

[Go Back to B211](#)

B212.

Solution

Concept — Failure: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: Brittle materials are often evaluated using maximum principal stress.

Question Type: MCQ; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

[Go Back to B212](#)

B213.

Solution

Concept — Manufacturing: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: Feed rate is the rate at which the tool advances relative to the workpiece.

Question Type: MCQ; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

[Go Back to B213](#)



B214.**Solution**

Concept — CAD: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: Parametric models are driven by dimensions and constraints.

Question Type: MCQ; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

[Go Back to B214](#)

B215.**Solution**

Concept — 3D Printing: Identify the relevant concept, formula or rule and apply it to the given data.

Reasoning: Slicing generates layer-wise paths or instructions for additive manufacturing.

Question Type: MCQ; **Marks:** 2.

Final Answer: The correct answer is $\Rightarrow$

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Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
GA1	A	GA2	B	GA3	2000	GA4	C	GA5	24
GA6	D	GA7	6	GA8	0.3333	GA9	A	GA10	5
A1	1	A2	A	A3	1	A4	12	A5	B
A6	C	A7	D	A8	2	A9	A	A10	16
A11	B	A12	C	A13	D	A14	A	A15	6
A16	B	A17	C	A18	D	A19	A	A20	1
A21	B	A22	C	A23	0.25	A24	D	A25	A
A26	B	A27	1	A28	ABC	A29	C	A30	D
A31	A	A32	B	A33	C	A34	50	A35	400
A36	D	A37	A	A38	B	A39	C	A40	D
B11	A	B12	B	B13	64	B14	C	B15	D
B16	1	B17	A	B18	B	B19	0.1	B110	ABC
B111	C	B112	D	B113	A	B114	B	B115	C
B21	D	B22	C	B23	B	B24	A	B25	D
B26	100	B27	1	B28	31.4	B29	C	B210	B
B211	A	B212	A	B213	B	B214	C	B215	D

