18356



# BRAINWARE UNIVERSITY

## Term End Examination 2025-2026
## Programme – M.Tech.(RA)-2025
## Course Name – Robotic Engineering and RTOS Programming
## Course Code - MEC10401
## ( Semester I )

**Full Marks : 60** **Time : 2:30 Hours**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

### Group-A
(Multiple Choice Type Question) 1 x 15=15

1. *Choose the correct alternative from the following :*

(i) Identify the term used for the part of the robot that interacts with the environment.
- a) Actuator
- b) Gripper
- c) Controller
- d) Sensor

(ii) Indicate the purpose of robot classification.
- a) Define control laws
- b) Predict efficiency
- c) Understand motion limits
- d) Group by capabilities

(iii) Select the difference between electric and hydraulic drives based on precision and control.
- a) Electric has higher torque
- b) Hydraulic is cheaper
- c) Electric has better precision
- d) Both have same control

(iv) Define the transformation for orientation of rigid bodies.
- a) Translation matrix
- b) Rotation matrix
- c) Euler formulation
- d) Inverse Jacobian

(v) Identify the Jacobian's role in robotic systems.
- a) Position estimation
- b) Mapping velocity
- c) Power regulation
- d) Load calculation

(vi) Distinguish between serial and parallel manipulators using kinematics.
- a) Serial has better stiffness
- b) Parallel is single link only
- c) Serial uses only one joint
- d) Parallel allows multiple paths

(vii) Recognize the function of process management.
- a) Allocate sensors
- b) Manage tasks
- c) Control keyboard
- d) Connect servers

(viii) Apply RTOS multitasking to control robotic arms.
- a) Create event-driven tasks
- b) Use camera input
- c) Launch mobile app
- d) Add cloud server

(ix) Distinguish between preemptive and cooperative multitasking.

a) Cooperative interrupts tasks
b) Preemptive allows manual switching
c) Preemptive interrupts lower priority tasks
d) Cooperative schedules high-priority tasks first

(x) Indicate the advantage of using Rate Monotonic Scheduling.



a) Highest CPU usage
b) Simplified coding
c) Optimal for periodic tasks
d) Minimum task count

(xi) Indicate the concept of non-preemptive scheduling.

a) Tasks are forced to yield
b) Tasks run till completion
c) Uses dynamic priority
d) Enables parallelism

(xii) Distinguish between fixed and dynamic priority scheduling.

a) Fixed depends on memory
b) Dynamic ensures static load
c) Fixed assigns priority before run, dynamic adjusts at runtime
d) Dynamic is non-preemptive

(xiii) Indicate how static memory allocation works.

a) Allocates at runtime
b) Allocates at compile time
c) Allocates after boot
d) Allocates after exception

(xiv) Describe the effect of resource sharing.

a) Reduces execution
b) Improves boot time
c) Enhances task concurrency
d) Prevents task creation

(xv) Differentiate between static and dynamic memory allocation.

a) Both occur at runtime
b) Static at runtime, dynamic during compile
c) Static at compile time, dynamic at runtime
d) Both allocate after boot

## Group-B

(Short Answer Type Questions) 3 x 5=15

2. List the major components of a robotic system. (3)
3. Describe the role of memory management in an RTOS. (3)
4. Analyse the difference between preemptive and non-preemptive scheduling with an example. (3)
5. Describe the difference between static and dynamic memory allocation. (3)
6. Differentiate between forward and inverse dynamics in robot manipulators. (3)

**OR**

Analyse the limitations caused by singularities in robotic manipulators. (3)

## Group-C

(Long Answer Type Questions) 5 x 6=30

7. Explain the various types of robot classifications and their characteristics. (5)
8. Analyse the role of end effector types across industrial applications. (5)
9. Describe the architecture of an RTOS with key components. (5)
10. Compare and contrast Rate Monotonic and Deadline Monotonic Scheduling in terms of performance and implementation. (5)
11. Compare deadlock avoidance, detection, and recovery techniques in RTOS. (5)
12. Analyse the role of manipulator Jacobian in identifying singularities. (5)

**OR**

Compare the kinematic behavior of serial and parallel manipulators. (5)

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