



ACCRA TECHNICAL UNIVERSITY  
SCHOOL OF ENGINEERING  
DEPARTMENT OF MECHANICAL ENGINEERING

INDEX NUMBER

END OF SEMESTER EXAMINATION, 2020/2021 ACADEMIC YEAR

COURSE CODE: BME 473

COURSE TITLE: ROBOTICS AND MACHINE  
VISION SYSTEMS

INSTRUCTIONS: ANSWER ALL QUESTIONS

TIME ALLOWED: 2 HOURS

CLASS: BTECH MECHANICAL ENG. IV

SECTION A (20 MARKS)

1. The microcontroller is part of which of the following systems?

- a) The structural system
- b) The propulsion system
- c) The sensor and feedback system
- d) The control system

2. .... is the name for space inside which a robot unit operates?

- a) environment
- b) spatial base
- c) exclusion zone
- d) work envelope

3. For a robot unit to be considered a functional industrial robot, typically, how many degrees of freedom would the robot have?

- a) three
- b) four
- c) eight
- d) six

4. Which of the basic parts of a robot unit would include the computer circuitry that could be programmed to determine what the robot would do?

- a) controller
- b) sensor
- c) arm
- d) end effector

5. Which of the following systems provide support and stability?

- a) The structural system
- b) The propulsion system
- c) The sensor and feedback system
- d) The control system

6. Which type of sensor is used in smoke detectors?

- a) Optical Sensor
- b) Chemical sensor
- c) Motion Sensor
- d) Temperature

7. Devices which reduces the amount of interference in signals are called

- a) Signal reducers
- b) Actuators
- c) Controllers
- d) Signal Conditioners

8. \_\_\_\_\_ terms refers to the use of compressed gasses to drive (power) the robot device?

- a) hydraulic
- b) piezoelectric
- c) photosensitive
- d) pneumatic

9. \_\_\_\_\_ terms IS NOT one of the five basic parts of a robot?

- a) end effectors
- b) controller
- c) drive
- d) peripheral tools

10. Decision support programs are designed to help managers make \_\_\_\_\_

- a) budget projections
- b) business decision
- c) visual presentations
- d) vacation schedules

11. What do industrial robots look like?

- a) Humanoid with legs and arms
- b) A small vacuum cleaner
- c) A multi-jointed arm with a fixed base
- d) A soft, furry pet

12. Which of the following is NOT a type of input of an intelligent robot?

- a) Touch
- b) Hearing
- c) Vision
- d) Speech

13. The number of moveable joints in the base, the arm, and the end effectors of the robot determines \_\_\_\_\_

- a) payload capacity
- b) operational limits
- c) flexibility
- d) degrees of freedom

14. \_\_\_\_\_ represents muscles of a robot?

- a) Power supply
- b) Micro controllers
- c) Robotic arm
- d) Actuators

15. A type of control system which is designed to produce large quantities of a product but can be quickly altered to produce a new or alternative product is called \_\_\_\_\_ control

- a) Batch
- b) Continuous
- c) Discrete
- d) Quick

16. If a robot can alter its own trajectory in response to external conditions, it is considered to be \_\_\_\_\_

- a) open loop
- b) mobile
- c) intelligent
- d) non-servo

17. Which of the following systems uses motors and gears?

- a) The structural system
- b) The propulsion system
- c) The sensor and feedback system
- d) The control system

18. \_\_\_\_\_ terms refers to the rotational motion of a robot arm?

- a) swivel
- b) axle
- c) Retrograde
- d) roll

19. The main use of robots is in the area of.....

- a) Medicine
- b) Education
- c) Manufacturing
- d) Exploration

20. The common robotic arm has-----  
degrees of freedom
- a) Five
  - b) Six
  - c) Seven
  - d) Eight

### SECTION B (40 Marks)

#### Question One

- a) What is meant by robot anatomy? *4 marks*
- b) Name and explain the five types of robotic joint. *8 marks*
- c) Name and briefly explain the three types of drive systems that are generally used for industrial robots *4 marks*
- d) List and explain the two major categories of End-effectors *4 marks*

#### Question Two

- a) What are robotic joints and links? *3 marks*
- b) Explain the various parts of a robot with neat sketch *6 marks*
- c) Explain the principle of the following sensors and also mention how they are used in robots. *2 marks*
  - i) Inductive proximity sensor *2 marks*
  - ii) Touch sensor *2 marks*
  - iii) Slip sensor *2 marks*
- d) Sketch a robot wrist and explain it's the joint movements *5 marks*