Seat No. _____ Enrolment No. _____

THE CHARUTAR VIDYA MANDAL UNIVERSITY

M. Sc. INSTRUMENTATION AND CONTROL – SEMESTER 4

SUMMER 2022 EXAMINATION

Course Title: MEDICAL IMAGING SYSTEMS AND THERAPEUTIC EQUIPMENTS

Course Code: 101390401

Total Printed Pages : 2

Date: 11/04/2022 **Time: 10:00 am to 12:00 pm** **Maximum Marks: 60**

Instructions:

- Attempt all questions.
- Numbers to the right indicate full marks for each question.
- Make suitable assumptions wherever necessary.

Q. 1 Answer the following multiple choice questions. **(12)**

(1) Each picture element value corresponds to the .....of voxel in the object slice in CT scan.
(a) intensity (b) pitch (c) attenuation coefficient (d) index

(2) Two properties of X-ray which qualify them for biomedical diagnosis.
(a) Spin & Charge
(b) Penetration Power & Illumination on photographic film
(c) High Current & Low frequency
(d) None

(3) Which is suitable material as anode in X-ray tube?
(a) Xeon (b) Aluminium (c) Tungsten (d) All

(4) For NMR, atoms with ..... number of protons or neutrons have spin.
(a) zero (b) even (c) two (d) odd

(5) Smaller the Noise Equivalent Temperature Difference, better the .....
(a) Stability (b) Resolution (c) Sensitivity (d) Reproducibility

(6) Spinning particles with mass have .....
(a) angular momentum (b) velocity (c) acceleration (d) displacement

(7) ..... resolution is the ability of the system to resolve structures that are very close to one another at the same depth.
(a) Axial (b) Lateral (c) Contrast (d) Spatial

(8) In normal conditions PR and QRS intervals are of .....and ..... respectively.
(a) 120 to 210 ms & 80 to 110 ms (c) 80 to 110 ms & 120 to 210 ms
(b) 20 to 100 ms & 120 to 210 ms (d) 60 to 240 ms & 12 to 21 ms

(9) In surgical diathermy machine if the current concentration is high then electrode size is
(a) Large (b) Small (c) Zero (d) Equal

(10) Lamp that acts as an energy source by emitting white light, which excites ruby atoms and causes them to emit photon is .....

(a) reflecting cylinder (c) cooling cylinder
(b) laser beam (d)flash tube

(11) Electrode which create stronger electric field than magnetic field is

(a) inductive (b) capacitive (c) both (a) and (b) (d) none

(12) Heparin pump is used to prevent .....

(a) blood clotting (b) purification of blood (c) kidney stone (d) Oxygen

Q.2 Attempt **any eight** of the following. **(16)**

(1) What is the limitation of Single phase supply for X-ray circuits?
(2) What is Positron and how it is produce?
(3) Write Stefan Boltzman formula with interpretations.
(4) Define factors which affect the amount of IR radiation from human body.
(5) Which atoms are best suited for MRI? Why?
(6) Enlist advantages and applications of Medical thermograph.
(7) Enlist types through which pulses are delivered in External Pacemaker.
(8) What is Galvanic current with respect to Electro therapy?
(9) What are applications of Argon LASER?
(10) List the parameters which are used to monitor and control in Ventilator system.

Q. 3 Explain High Voltage and High Frequency generator circuits used in X-rays with necessary figure. **(08)**

OR

Q.3 Describe processing system of X-ray Computed Tomography. **(08)**

Q. 4 Write the basic principle of MRI and explain Free induction decay and Excitation and Emission process. **(08)**

OR

Q. 4 Write a note on Probe used in Ultrasound. List the requirements for real time imaging. **(08)**

Q. 5 What are basic requirements of implantable pacemakers? Discuss types of Implantable pacemakers. **(08)**

OR

Q. 5 Discuss types of electrodes used for Defibrillation and explain DC defibrillator. **(08)**

Q. 6 Describe Haemodialysis machine. **(08)**

OR

Q. 6 Write a note on Pulsed Ruby LASER. **(08)**

****

Seat No. _____ Enrolment No. _____

THE CHARUTAR VIDYA MANDAL UNIVERSITY

M. Sc. INSTRUMENTATION AND CONTROL – SEMESTER 4

SUMMER 2022 EXAMINATION

Course Title: FABRICATION AND CHARACTERIZATION TECHNIQUES

Course Code: 101390402

Total Printed Pages : 2

Date: 12/04/2022 **Time: 10:00 am to 12:00 pm** **Maximum Marks: 60**

Instructions:

- Attempt all questions.
- Numbers to the right indicate full marks for each question.
- Make suitable assumptions wherever necessary.

Q. 1 Answer the following multiple choice questions. **(12)**

(1) Which evaporation technique is used for the deposition of films whose constituents have different vapor pressure?
(a) Molecular beam (b) Flash (c) MOCVD (d) Thermal

(2) ……..is used for fabrication of Super-lattices and hetero-junction MESFET.
(a) Molecular beam (b) Flash (c) Sputtering (d) Thermal

(3) The sputter yield depends on:
(a) Energy of the incident ions
(b) Masses of the ions and target atoms
(c) Binding energy of atoms in the solid
(d) All the above

(4) Which pumps have no moving parts and use no oil?
(a) rotary pump (b) ion getter (c) diffusion pump (d) all

(5) In vacuum applications, a ……. is a device that condenses all vapors except the permanent gases into a liquid or solid.
(a) Diffusion (b) depletion (c) back scattering (d) cold trap

(6) Ultra high vacuum is achieved by
(a) Rotary pump (b) diffusion pump (c) cryopump (d) all

(7) In an epitaxy, if same material is used for substrate and the film, it is .....
(a) homo epitaxy (b) hetero epitaxy (c) thin epitaxy (d) clean epitaxy

(8) ……printing provides high resolution and low defect densities and dominates today.
(a) Projection (b) Proximity (c) Contact (d) all

(9) Polarized laser light is incident on the oxide covered wafer, a method is ……..
(a) Profilometry (b) Ellipsometry (c) Colour chart (d) none

(10) In TEM condenser lenses are used for
(a) focus beam (b) beam formation (c) expand beam (d) none

(11) Resolution in a microscope is primarily determined by which lens?
(a) Objective (b) Projector (c) Intermediate (d) Condenser

(12) X-ray technique based on monochromatic radiations is important because the'd-spacing' can be calculated from the observed.....
(a) incident angles (c) diffraction pattern
(b) reflected angles (d) none of above

Q.2 Attempt **any eight** of the following. **(16)**

(1) Classify PVD and CVD techniques.
(2) List desirable properties of Precursor in MOCVD?
(3) What is back streaming? Why it is to be avoided?
(4) Explain principle of Penning Gauge.
(5) What is the function of photo resist? List its types.
(6) Show block diagram for wafer preparation steps.
(7) List wafer characterization methods.
(8) Which gases are used in Si epitaxy?
(9) Which factors affect secondary electron emission in SEM?
(10) Write Braggs' equation and interpret all terms.

Q. 3 Describe Molecular Beam Epitaxy for compound semiconductor and enlist its advantages and disadvantages. **(08)**

OR

Q. 3 Write a note on RF sputtering technique. **(08)**

Q. 4 With sequential figures explain mechanism of Rotary vane pump. **(08)**

OR

Q. 4 Enlist film thickness monitoring methods and explain Quartz crystal thickness monitoring method. **(08)**

Q. 5 Describe all the steps for Photolithography process. **(08)**

OR

Q. 5 What are different methods for single crystal growth? Show with neat figures crystal pulling steps and explain Czochralski method. **(08)**

Q. 6 Discuss Wavelength Dispersive and Energy Dispersive methods for X-Ray. **(08)**

OR

Q. 6 Draw neat diagram of Transmission Electron Microscope and explain working principle and its applications. **(08)**

******

Seat No. _____ Enrollment No. _____

THE CHARUTAR VIDYA MANDAL UNIVERSITY

M.Sc. INSTRUMENTATION & CONTROL – SEMESTER 4

SUMMER (REGULAR) 2022 EXAMINATION

Course Title: Robotics & Fuzzy Logic

Course Code: 101390403

Total Printed Pages : 03

Date: 13/04/2022 **Time: 10.00 am to 12.00 pm** **Maximum Marks: 60**

Instructions:

- Attempt all questions.
- Numbers to the right indicate full marks for each question.
- Make suitable assumptions wherever necessary.

Q. 1 Answer the following multiple choice questions. **(12)**

(1) Which of the following is not a part of fuzzy logic Systems Architecture?
   a. Fuzzification Module c. Interference base
   b. Defuzzification Module d. Knowledge Base

(2) Which of the following is not Application Areas of Fuzzy Logic?
   a. Domestic Control c. Environment Control
   b. Domestic Goods d. Automotive Systems

(3) What is the form of Fuzzy logic?
   a. Two-valued logic c. Crisp set logic
   b. Many-valued logic d. Binary set logic

(4) 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. Seven d. Six

(5) 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

(6) Radial movement (in & out) to the manipulator arm is provided by
   a. Elbow extension b. Wrist bend c. Wrist swivel d. Wrist yaw

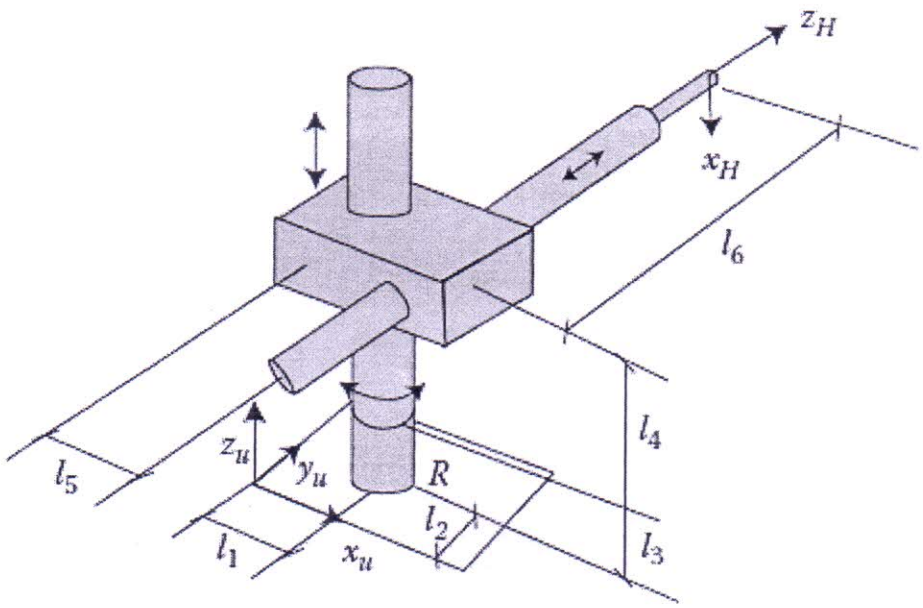
(7) Calculating the position and orientation of the hand of the robot is called _____.
   a. Kinematic c. Reverse kinematic
   b. Forward kinematic d. Inverse kinematic

(8) The Kinematic part of the robot or manipulator is called
   a. Links b. Sensors c. End-effectors d. Joints

(9) Which of the following is found using forward kinematics?
   a. Length b. End position c. Joint angle d. Twist angle

(10) Jacobean is related to _____
   a. Velocity b. Distance C. Time d. All of these

(11) D]=[J][D_θ] , D_θ is represent the_____
   a. Differential Translation c. Differential Rotation
   b. Differential Transformation d. All of these



Q. 5 Write short note about **The Jacobian.** **(08)**

OR

Q. 5 A camera is attached to the hand frame TH of a robot as given. The corresponding inverse Jacobian of the robot at this location is also shown. The robot makes a differential motion described as D= [0.05 0 −0.1 0 0.1 0.03] T . **(08)**

- a) Find which joints must make a differential motion, and by how much, in order to create the indicated differential motions.
- b) Find the change in the hand frame.
- c) Find the new location of the camera after the differential motion.
- d) Find how much the differential motions should have been, instead, if measured relative to frame TH, to move the robot to the same new location as in part c.

$$T_H = \begin{bmatrix} 0 & 1 & 0 & 3 \\ 1 & 0 & 0 & 2 \\ 0 & 0 & -1 & 8 \\ 0 & 0 & 0 & 1 \end{bmatrix} \qquad J^{-1} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 2 & 0 & -1 & 0 & 0 & 0 \\ 0 & -0.2 & 0 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

Q. 6 Write a short note on Methods for Determining Membership Functions. **(08)**

OR

Q. 6 Explain structure of Fuzzy controller in length. **(08)**

****

(12)

$$Rot(q,d\theta) = \begin{bmatrix} 1 & -0.05 & 0.04 & 0 \\ 0.05 & 1 & -0.03 & 0 \\ -0.04 & 0.03 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

What is δx?

a. 0.03 b. 0.3 c. 0.05 d. 0.04

Q.2 Attempt **any eight** of the following. **(16)**

(1) Define the term reflexivity and transitivity.
(2) What is degree of freedom?
(3) Write down robot application
(4) What is work envelope?
(5) Write Down rotation matrix for z and y axis.
(6) What is use of Inverse Kinematics matrices?
(7) Write the differential operator matrix for the following differential transformations: dx=0. 05, dy=0 .03, dz =0 .01 units and δx=0 .02, δy=0. 04, δz =0. 06 radians.
(8) Write The Fundamental Problem with the Denavit-Hartenberg Representation.
(9) Find D_θ using D and J matrixs are given below.

$$D = \begin{bmatrix} 0.01 \\ 0.02 \\ 0.03 \end{bmatrix} \qquad J = \begin{bmatrix} 5 & 10 & 0 \\ 3 & 0 & 0 \\ 0 & 1 & 1 \end{bmatrix}$$

(10) List different types of uncertainty associated with Fuzzy Control.

Q. 3 Explain Cartesian and polar configuration in robot with appropriate figures. **(08)**

OR

Q.3 Explain Robot reference frames with proper figures. **(08)**

Q. 4 Explain Denavit-Hartenberg Representation of Forward Kinematic Equations of Robots with appropriate figures. **(08)**

OR

Q. 4 A 3-DOF robot arm has been designed for applying paint on flat walls, as shown. **(08)**

- Assign coordinate frames as necessary based on the D-H representation.
- Fill out the parameters table.

• Find the UTH matrix.

Seat No. _____ Enrollment No._____

THE CHARUTAR VIDYA MANDAL UNIVERSITY

M.Sc. Instrumentation & Control

SEM – IV, April 2022

Programming in C

Subject Code: **101390407**

DATE: 14th April 2022 TIME: 10:00 AM TO 12:00 PM

DAY: Thursday TOTAL MARKS: 60

Q. 1 Choose the correct answer. **[12]**

(1) A size of **char** is _____ .

(A) 8 bit **(C)** 16 bit

(B) 32 bit **(D)** None of given

(2) Which of the following is not logical operator?

(A) ! **(C)** &&

(B) || **(D)** None of above

(3) **goto** in C language is _____ branch statement.

(A) conditional **(C)** Both (A) & (B)

(B) unconditional **(D)** None of above

(4) Which one is valid one dimension array declaration?

(A) Float height [400]: **(C)** Float height [30]

(B) Float height [200]; **(D)** None of above

(5) _____ Function determine the length of string.

(A) strcat() **(C)** Both (A) & (B)

(B) strlen() **(D)** None of above

(6) For loop control of any program, we can use _____ loop.

(A) Entry controlled **(C)** both (A) & (B)

(B) Exit controlled **(D)** None of above.

(7) if it requires a pre test loop, than we have two choices _____

(A) **do... while** **(C)** **do** and **for**

(B) **for** and **while** **(D)** None of above

(8) If the two string are identical, **strcmp()** function returns_____.

(A) YES **(C)** 1

(B) -1 **(D)** 0

(9) For High level I/O function _____ is used for create new file for use.

(A) fopen **(C)** fseek

(B) ftell **(D)** All of above

(10) Only _____ of variable can be stored in pointer variable.

(A) structure **(C)** address

(B) Union **(D)** Array

(11) A **struct** type in C is _____ data type.

(A) built-in **(C)** Both (A) & (B)

(B) extern **(D)** None of above

(12) In structure for unutilized float member assigned _____ value.

(A) 0 (zero) **(C)** \0

(B) /0 **(D)** None of above

Q.2 **Answer the following. (Attempt any eight, each two marks)** **[16]**

(1) List different logical operator in C.
(2) Write a important and use of **break** statement in C.
(3) Explain **If.. Else** statement in short.
(4) Write rule to declare variable name in C language.
(5) Write difference between **getchar()** & **putchar().**
(6) What kind values indicated by **%d, %f, %c,** & **%u,** for c programing?
(7) What is user define function? List advantage of user define function.
(8) Enlist character test functions.
(9) What is pointer array?
(10) What is program debugging?

Q.3 **(A)** List and write a note on different data types in C. **[08]**

OR

(B1) Write note on **for.... loop** in detail with suitable example. **[04]**
(B2) Write a program to calculate average of a set of N numbers using C. **[04]**

Q.4 **(A)** What is array in c? Explain one dimension, two dimension and multidimensional array in C with necessary examples. **[08]**

OR

(B) Given below is the list of marks obtain by a class of 20 students in annual examination **[08]**
43, 65, 51, 27, 79, 11, 56, 61, 82, 09, 25, 36, 07, 49, 55, 63, 74, 81, 49, 37
Write a program using arrays to count the number of students belonging to each of the following group of marks. 0-9, 10-19, 20-29,....., 80-89, 90-100.

Q.5 **(A)** What is importance of pointer in C? Write a note to initialization of pointer variables. **[08]**

OR

(B) Write a program to illustrate the use of indirection operator " * " to access the value printed by pointer. **[08]**

Q. 6 **(A)** Enlist different common error in C. **[08]**

OR

(B) Write a note on program testing and debugging in C. **[08]**

-: All The Best: -