GANPAT UNIVERSITY

B.TECH SEM. VII - MECHATRONICS ENGINEERING
CBCS REGULAR EXAMINATION NOV/DEC - 2014
2MC701 - ADVANCE CONTROLLER

Total Marks: 70

Time: 3 Hours

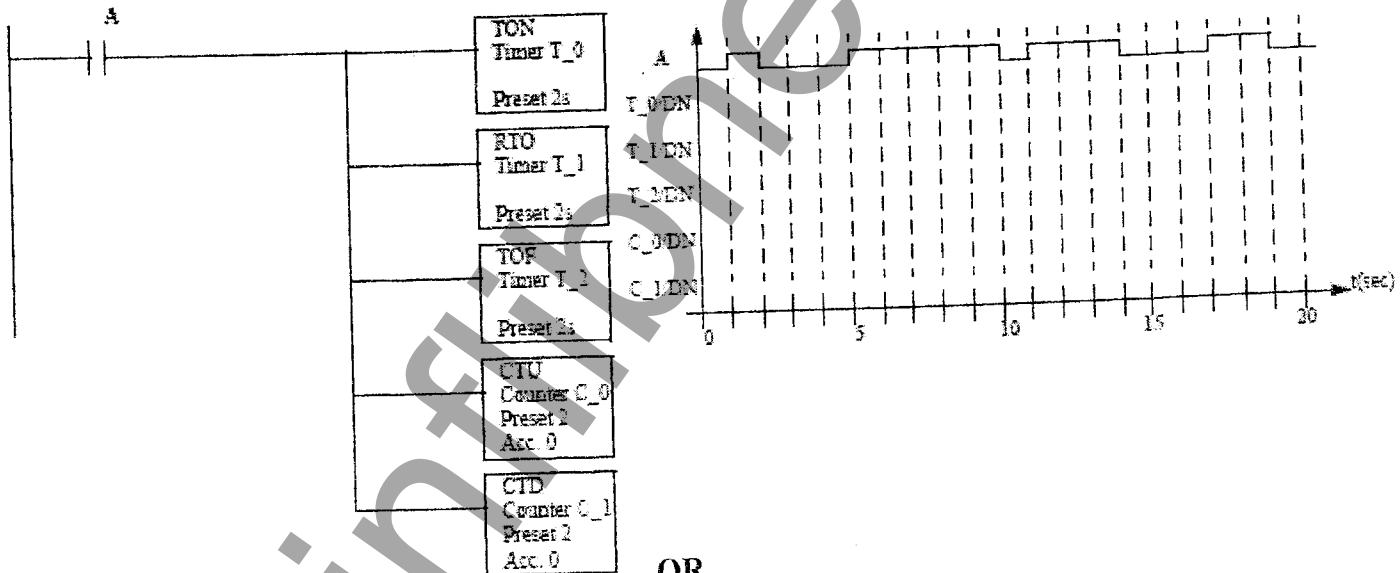**Instructions:**

1). All questions are **compulsory**.

2). Figures to the **right** indicate full marks.

3). Answers to the two sections must be written in **separate** answer books.

4). Assume **all** necessary data.

5). Consider **Allen Bradley PLC** instructions only.
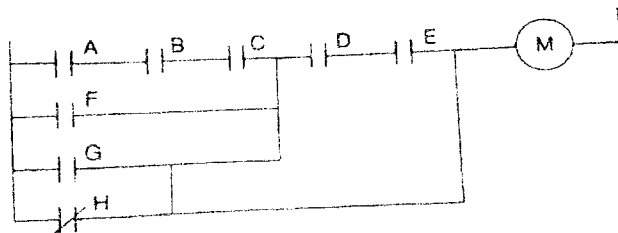
Section – I

Que:-1

(A) What is bidirectional counter? Explain with an example. [06]

(B) Draw the timer and counter done bits for the ladder logic below. Assume that the accumulator of all the timers and counters are begin with 0. [05]

OR

Que:-1 [06]

(A) Explain EN, TT and DN bits of the off-delay timer.

(B) Convert the given PLC ladder diagram to gate diagram and Boolean algebra expression. [05]

Que:-2

   (A) Describe the UP Counter instruction.

   (B) Make a PLC ladder diagram for the given objectives:

      a). A green pushbutton is used to turn on a green led 1 after 2 seconds.

      b). After 3 seconds, the green led 1 is turned off & the green led 2 will be on.

      c). After 1.25 seconds, the green led 2 is turned off & the green led 1 will be on again.

      d). Repeat this process for 10 times. (Use UP Counter Only).

   e). A red push button is used to stop the process at any time.

OR

Que:-2

   (A) Explain the MOVE instruction. What is difference between Move and copy instruction? [06]

   (B) Make a PLC ladder diagram for the following application. [06]

      " Two SA cylinders 'A'& 'B' are at retract position in the initial position. When I press a START push button, the cylinders A & B start forward stoke simultaneously. After 10 seconds, the cylinder 'A' completes return stroke. Then the cylinder 'B' completes return stroke. Again the cylinders A & B start forward stroke and repeat the process. The STOP push button is used to stop the process at the initial position. Assume both cylinders are operated by single solenoid 3/2 direction control valves.

Que:-3   **Attempt all.**

   (A) What is difference between PLC ladder diagram and electrical ladder diagram? [02]

   (B) Make a PLC ladder diagram for the application as shown in fig. The objectives of this application are as follows: [08]

      i). START PB is used to start the process.

      ii). When liquid level is below than Ldn sensor then only Vin1 valve is ON.

      iii). When level reaches to Lmid, Vin valve is OFF, Vin2, Stirrer and Heater are ON (Only during filling time).

      iv). When level reach to Lup, Vin2 is OFF and when the sensor S2 is energized then stirrer and Heater are OFF and Vout valve is ON.

      v). When level goes below Ldn, Vin1 valve is ON again and steps (ii) – (iv) are repeated.

      vi). STOP PB is used to stop the process at current position. START PB is used to start the process from where it was stopped.
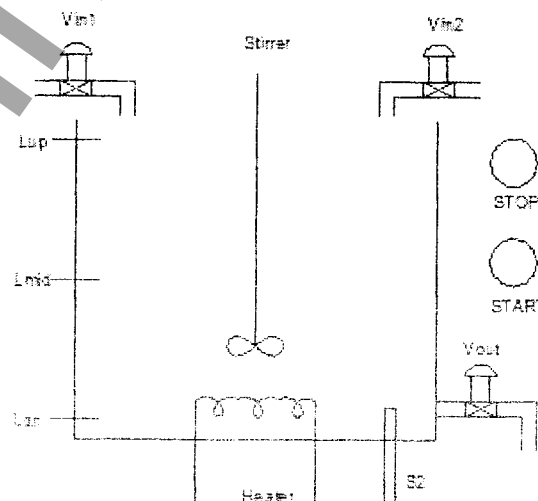
(C)   If starting source 16-bit word is: 1010 1010 1010 1010   [02]
        The bits be allowed to pass : Only bits 2, 3, 4, & 5 of the lower byte and bits 2, 3, 6 &
        7 of the upper byte.
        The beginning destination 16-bit word is: 1111 1101 0111 1101
        Then what will the mask & the destination bits after execution of MVM instruction?

Section II

Que:-4

(A)   What is sinking & sourcing concept?   [06]
(B)   Explain different types of PLC memory.   [06]

OR

Que:-4

(A)   Explain various layers of SCADA.   [04]
(B)   Explain the PLC scan cycle with figure.   [04]
(C)   Explain the OSR instruction.   [04]

Que:-5

(A)   Explain the discrete AC input module with the block diagram.   [06]
(B)   Describe the advantages & disadvantages of Solid-state switching.   [05]

OR

Que:-5

(A)   Discuss advantages and disadvantages of a PLC.   [06]
(B)   List the different types of output modules of a PLC. Brief any one in details. [05]

Que:-6   Attempt All.   [12]

(A)   Explain sequential function chart (SFC) programming method of a PLC.
(B)   How does the PLC work? Explain with the block diagram.
(C)   Describe the different processor operating modes of a PLC.

END OF PAPER

GANPAT UNIVERSITY

B. Tech. Semester: VII(Mechatronics)Engineering
Regular Examination November – December 2014
Digital Image Processing and Machine Vision (2MC705)

Time: 3 Hours

Total Marks: 70

Instruction: 1 Start a new question from new page.
2 Draw the figure with full indication.
3 Each section must be answered in separate answer sheet.

Section - I

Que. – 1 [12]

(a) Perform the histogram equalization in for the given 8×8 image. (04)

r_k	0	1	2	3	4	5	6	7
P_k	8	10	10	2	12	16	4	2

(b) Give the bit plane slicing of the given image. If the MSB plane is remove then reconstruct the same image. (04)

$$A = \begin{bmatrix} 9 & 2 & 13 \\ 10 & 5 & 11 \\ 8 & 3 & 14 \end{bmatrix}$$

(c) Find the convolution and correlation of the following stream of data. (04)
1) $I = \{1 \quad 8 \quad 7 \quad 5\}$ and $f = \{1 \quad 2 \quad 4\}$
2) $I = \{1 \quad 3 \quad 5 \quad 1\}$ and $f = \{1 \quad 1\}$

OR

Que. – 1 [12]

(a) The intensity values in an image have PDF $P_r(r) = \begin{cases} \frac{4r}{(L-1)^2} ; for\ 0 \le r \le L-1 \\ 0 \quad ; \quad otherwise \end{cases}$ find the equation for transformed image. Apply the same transform for the image given below. Take L=10. (05)

$$B = \begin{bmatrix} 3 & 5 & 2 \\ 4 & 2 & 1 \end{bmatrix}$$

(b) Perform the histogram specification for the given 8×8 image histogram (07)

r_k	0	1	2	3	4	5	6	7
P_k	2	2	10	10	20	8	6	8

with specified histogram

r_k	0	1	2	3	4	5	6	7
S_k	0	0	0	0	20	20	16	8

Que. – 2 [11]

(a) Apply the DFT to the following image and prove that DFT works. (06)

$$A = \begin{bmatrix} 3 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

(b) Discuss the Butterworth High Pass Filter (BHPF). (05)

Que. – 3   Write any Three   [12]

(a)   Construct the Shannon-fano code for given table.   (04)

Symbol	A	B	C	D	E
Probability	12	8	7	6	5

(b)   Discuss Arithmetic coding.   (04)

       Discuss Homomorphic filtering in frequency domain.   (04)

       What is codding redundancy? Calculate the entropy for the symbols given in table below. (04)

Symbol	1	2	3	4	5	6
Probability	0.5	0.1	0.1	0.2	0.04	0.06

Section – II

Que. – 4   [12]

(a)   Discuss JPEG digital image storage type.   (04)

(b)   Write short note on Image Sampling.   (04)

(c)   Discuss the rod and cons distribution in the structure of the human eye.   (04)

OR

Que. – 4   [12]

(a)   Discuss different types of brightness adaption and discrimination.   (04)

(b)   Calculate time in minute to transfer an image of 560 X 512 resolutions with 256 gray levels   (04)
       between peripheral devices communicating at 2000 baud rate. Assume data package contains
       one start and one stop bit.

(c)   Discuss PNG and GIF image storage type.   (04)

Que. – 5   [11]

(a)   An image has size 512×512. What is the storage requirement if the size is binary or if it is   (05)
       24 bit color?

(b)   Explain the detail with constructional features and working of the Vidicon tube.   (06)

Que. – 6   Write any Three   [12]

(a)   A medical image has a size of 8×5 inches. The sampling resolution is 7cycles/mm. How   (04)
       many pixels are required? Will an image of size 512×256 enough?

(b)   Discuss Triangulation Geometry.   (04)

(c)   Discuss Machine Vision Components.   (04)

(d)   Write short note on Quantization, how it is differ from bit plane slicing.   (04)

END OF PAPER

Date: 25/11/2014

GANPAT UNIVERSITY

B.TECH SEM. VII- MECHATRONICS ENGINEERING
CBCS REGULAR EXAMINATION NOV/DEC-2014
2MC704 OPERATION MANAGEMENT

Time: 3 Hours **Total Marks: 70**

Instructions:

1) All questions are **compulsory**.
2) Figures to the **right** indicate full marks.
3) Answers to the two sections must be written in **separate** answer books.

SECTION – I

Que:-1 **Answer the following questions.** [12]

(A) Define the term Production planning and control. Explain the need of PPC.

(B) Explain the A-B-C approach for inventory control.

(C) What is benchmarking? Explain the process of benchmarking.

OR

Que:-1 **Answer the following questions.** [12]

(A) What is sales forecasting? Explain the need of forecasting.

(B) Explain the different sampling method.

(C) What is statically quality control? Explain the statically quality control techniques.

Que:-2 **Answer the following questions.**

(A) Explain the following terms. [5]

    1. Loading   3. AOQL   4. Dispatching

    2. Producer's Risk   5. Consumer's Risk

(B) What is Quality control? Explain the objective of Quality Control. [3]

(C) Explain the purpose of product design. State the requirements of good design. [3]

OR

Que:-2 **Answer the following questions.**

(A) Explain the Operating Characteristics Curve with appropriate points. [05]

(B) A nursing home has one year moving average forecasting method to produce particular medicine requirements. The actual demand for the item is shown in table below: [06]

Month	1	2	3	4	5	6	7	8	9	10	11	12
Demand	90	80	65	70	100	85	60	75	90	85	60	75

Using the 12 month moving Average, find the exponential smoothing

forecast for the 13th month.

Que:-3 Attempt All.

(A) Using the following data relating to 10 samples of 5 items each, calculate the control limits for mean chart. Draw the chart and plot the values on it.

Samples	Dimensions in Cms.				
	Item 1	Item 2	Item 3	Item 4	Item 5
1	1.01	0.98	0.99	1.00	1.01
2	0.98	0.98	0.98	1.03	1.01
3	1.01	1.02	1.02	1.04	0.98
4	0.97	0.99	1.01	0.95	0.97
5	1.04	1.02	1.01	1.00	1.00
6	1.03	1.01	0.97	0.98	0.99
7	1.00	1.02	0.98	1.01	1.01
8	1.00	1.01	0.99	0.99	0.95
9	0.99	1.02	1.03	1.01	0.97
10	0.96	0.95	1.02	1.03	1.01

(B) What is total quality management? Explain the different elements of TQM.

(C) A textile mill buys its raw material from vendor. The annual demand of the raw material is 9000 units. The ordering cost is Rs.100 per order and the carrying cost is 20% of the purchase per unit per month, where the purchase price per unit is Re. find the following

- Economic order quantity(EOQ)
- total cost w.r.t EOQ
- number of orders per year
- time between consecutive two orders

SECTION – II

Que:-4 Answer the following questions.

(A) A company operates in four territories and four salesmen available for an [06] assignment. The territories are not equally rich in their sales potential. It is estimated that a typical salesman operating in each territory would bring in the following annual sales:

Annual Sales(Rs.) : 1.26.000   1,05,000   84,000   63,000

The four salesmen also in their ability. It is estimated that, working under the same conditions. Their yearly sales would be proportionately as follows:

Salesmen   : A   B   C   D
Proportion : 7   5   5   4

If the criterion is maximum expected totals sales the intuitive answer is to assign the best salesman to assign the best salesman to reach richest territory the next best salesman it the second richest and so on; verify the this answer by the assignment technique.

(B) Solve the following LP problem using graphical method.   [04]

$$\text{Maximize } Z = 2X1+3X2$$

Subject to constraints

$$X1+X2 \leq 30$$
$$X2 \geq 3$$
$$0 \leq X2 \leq 12$$
$$0 \leq X1 \leq 20$$

X1 & X2 $\geq$ 0.

(C) Define the term with Sketch.   1. Dummy Activities   2. Predecessor Activities   [02]

OR

Que:-4 **Answer the following questions.**

(A) A solicitations firm employs typists on hourly piece-rate basis for their daily work. [06] There are five typists and their charges and speed are different according to an understanding only one job was given to one typist and the typist was paid for a full hour. Even if he worked for a fraction of an hour. Find the least lost cost allocation for the following data.

Typist	Rate per hour	No. of pages typed/hours	Jobs	No. of pages
A	5	12	P	199
B	6	14	Q	175
C	3	8	R	145
D	4	10	S	298
E	4	11	T	178

(B) Solve the following LP problem using graphical method.   [04]
Maximize Z = 6x1+8x2
Subject to constraints
$$5x1+10x2 \leq 60$$
$$4X1+4x2 \leq 40$$
x1 & x2 $\geq$ 0.

(C) Explain the scope of Operation Management.   [02]

Que:-5 **Answer the following questions.**

(A) Explain Various Properties of LP Solution.

(B) The following table gives data on normal time, and cost and crash time, and cost for a project.

activity	normal		Crash	
	time(weeks)	cost(rs)	time(weeks)	cost(rs)
1-2	3	300	2	400
2-3	3	30	3	30
2-4	7	420	4	580
2-5	9	720	7	810
3-5	5	250	4	300
4-5	0	0	0	0
5-6	6	320	4	410
6-7	4	400	3	470
6-8	13	780	10	900
7-8	10	1000	9	1200

Indirect cost is Rs 50 per week.   Determine the followings.

1. Draw the network diagram for the project and identify the critical path.
2. What are the normal project duration and associated cost?
3. Find out the total float associated with each activity.
4. Crash the relevant activities systematically and determine the optimal project completion time and cost.

OR

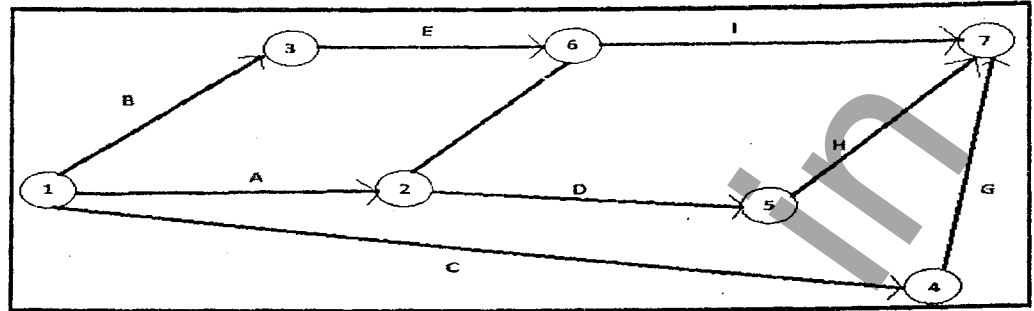Que:-5   Answer the following questions.

(A) Explain Various Phases of Operation Research.   [2]

(B) Explain Hungarian Method for assignment Problem.   [3]

(C) The following network diagram represents activities related with a project: [6]

Activities	: A	B	C	D	E	F	G	H	I
Optimistic time :	5	18	26	16	15	6	7	7	3
Pessimistic time :	10	22	40	20	25	12	12	9	5
Most likely time :	8	20	33	18	20	9	10	8	4

Determine the following:

a) Expert activity time and variance.
b) The earliest and latest expected competition times of each event.
c) The critical path.

Que:-6 Attempt any two. [12

(A) Use the simplex method to solve the following LP problem.

$$\text{Maximize } Z = x_1 + 4x_2 + 5x_3$$

Subject to constraints

(i) $3x_1 + 3x_3 \leq 22$, (ii) $x_1 + 2x_2 + 3x_3 \leq 104$, (iii) $3x_1 + 2x_2 \leq 15$

$$x_1, x_2, x_3 \geq 0.$$

(B) A company has three production facilities s1, s2, and s3 with production capacity of 7,9 and 18 units (in 100s) per week of a product, respectively. These units are to be shipped to four warehouses D1, D2, D3 and D4 with requirement of 5, 6, 7 and 14 units (in 100s) per week. Respectively, The transportation costs (in rupees) per units between factories to warehouses are given in the table below:

	D1	D2	D3	D4	Capacity
S1	19	30	50	10	7
S2	70	30	40	60	9
S3	40	8	70	20	18
Demand	5	8	7	14	34

Find the initial basic feasible solution using each of following methods and compare their total costs.
1. NWCM
2. LCM
3. VAM

(C) Use the penalty (Big-M) method to solve the following LP problem.

$$\text{Maximize } Z = 5x_1 + 3x_2$$

Subject to constraints

(i) $2x_1 + 4x_2 \leq 12$, (ii) $2x_1 + 2x_2 = 10$, (iii) $5x_1 + 2x_2 \geq 10$ and $x_1, x_2 \geq 0$.

END OF PAPER

Student Exam No._____

GANPAT UNIVERSITY

B. Tech. Semester: VII Mechanical/ MechatronicsEngineering

Regular Examination November – December2014

2ME703 - PRODUCTION TECHNOLOGY

Time: 3 Hours

Total Marks: 70

Instruction: 1 Attempt all questions.
2 Assume suitable data if necessary.
3 Figures to the right indicate full marks.

Section - I

Que. – 1 (a) Explain briefly with neat sketch the following: 4
Orthogonal cutting and Oblique cutting

(b) Enlist and explain any six cutting tool materials briefly. What are 4
the importance of positive and negative rake angles?

(c) Explain briefly the following types of chips: 4
Continuous chip, Discontinuous chip and Build up chip

OR

Que. – 1 (a) What is Build up edge? Why a Build up edge on a tool is undesirable? 4

(b) Discuss the various types of tool wear and failures. 4

(c) List and explain various types of single point cutting tools. 4

Que. – 2 (a) A Carbide tool with a mild steel work-piece was found to give life of 2 5
hours while cutting at 48 m/min. If Taylor's exponent n=0.27, determine
(i) The tool life if the same tool is used at a speed of 20 percent
higher than the previous one.

(ii) The value of cutting speed if the tool is required to have tool life of 3
hours.

(b) What is chip thickness ratio? With usual notion, derive the expression 6
showing relationship between shear plane, chip thickness ratio and rack
angle.

OR

Que. – 2 (a) In an orthogonal cutting operations the following data has been observed: 5
Chip length obtained = 96 mm
Uncut chip length = 240 mm
Rake angle used = 20°
Depth of cut = 0.6 mm
Horizontal and vertical components of cutting force = 2400 N and 240 N
respectively.
Determine the value of shear plane angle, chip thickness, frictional angle,
and resultant cutting force.

(b) Using tool life equation, derive the expression for optimum cutting speed 6
for minimum total cost.

Que. – 3 Attempt All. 12

(a) Discuss briefly 'Friction in metal cutting'.

P.T.O.

Page 1 of 2

(b) During orthogonal machining with a cutting tool having a 12° rake angle, the chip thickness is measured to be 0.44 mm, the uncut chip thickness being 0.18 mm. Determine Shear plane angle and shear strain.

(c) Discuss briefly the following:
Side cutting angle, Side relief angle, Back rake angle, nose radius

(d) What is machinability index? What is the function of chip breakers?

Section – II

Que. – 4 **(a)** Enumerate various types of clamps. Explain in detail with neat sketch any three clamping devices.   4

(b) Classification of method for gear manufacturing. Explain any three methods in details.   4

(c) Describe briefly with a neat diagram the working principle of Laser Beam Machining (LBM)? What are its advantages, limitations and applications?   4

OR

Que. – 4 **(a)** What do you understand by 'Degree of freedom'? List the main components or elements of jigs and fixtures.   4

(b) Explain the factor affecting the Torque and Axial thrust in drilling machining operation.   4

(c) What is Chemical Machining? State its advantages and limitations.   4

Que. – 5 **(a)** Differentiate the following: a) ECG and ECM   b) AJM and PAM   6

(b) Explain the working principle of Electro-Chemical machining process.   3

(c) Why LBM cannot be used for machining Al and Ag?   2

OR

Que. – 5 **(a)** Give the comparison of gear hobbing and gear shaping. Explain with neat sketch the thread rolling method of making threads.   6

(b) Explain briefly the following methods of gear finishing.   5
1. Gear shaving
2. Gear burnishing
3. Gear grinding
4. Gear lapping
5. Gear honing

Que. – 6 **Attempt All**   12

(a) Explain Six-pin method (3-2-1 method).

(b) How are jigs and fixtures classified? Write the principles of Jigs and Fixtures design.

(c) Describe briefly with a neat diagram the working principle of Ultra Sonic Machining (USM)? Give also its advantages, limitations and applications.

(d) Sketch the schematic diagram and explain the process principle of Electron Beam machining.

END OF PAPER

GANPAT UNIVERSITY
B.TECH SEM. VII - MECHATRONICS ENGINEERING
REGULAR EXAMINATION NOV/DEC - 2014
2MC-702 ROBOTICS

Time: 3 Hours   **Total Marks: 70**

Instructions:

    1). All questions are **compulsory**.

    2). Figures to the **right** indicate full marks.

    3). Answers to the two sections must be written in **separate** answer books.
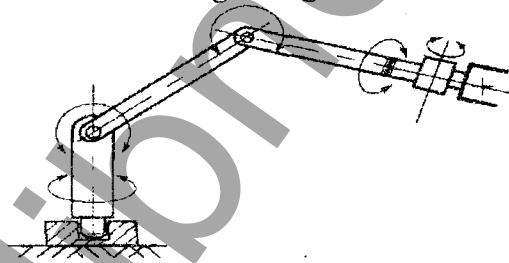
    4). Assume all necessary data.

Section – I

Que:-1   **Attempt All.**

  (A)   Find general Inverse kinematics solutions for the 3 DOF Cartesian Robotics Arm.   **[12]**

OR

Que:-1   **Attempt All.**

    Draw frame assignment and obtain DH parameter for each joint link. Also find the   **[08]**

  (A)   forward kinematics model for following configuration.

  (B)   Which are the different causes for existence of multiple solutions of joint variables?   **[04]** Explain in detail.

Que:-2   **Attempt All.**

  (A)   Find Forward kinematics of Spherical Robotics Arm.   **[06]**

  (B)   The homogeneous transformation matrices between frames {i}-{j} nad {i}-{k} are   **[05]**

$$^{i}T_{j} = \begin{bmatrix} 0.866 & -0.500 & 0 & 11 \\ 0.500 & 0.866 & 0 & -1 \\ 0 & 0 & 1 & 8 \\ 0 & 0 & 0 & 1 \end{bmatrix}; \quad ^{k}T_{i} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0.866 & -0.500 & 10 \\ 0 & 0.500 & 0.866 & -20 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Determine $_{j}T^{k}$

Que:-2   **Attempt All.**
(A) A vector P = 3i - 2j + 5k is first rotated by 90° about x-axis, then by 90° about z-axis. [05]
Finally, it is translated by -3i + 2j - 5k. Determine the new position of vector P.
(B) Explain DH notation and derive equation of DH parameter. [05]

Que:-3   **Attempt Any three.** [12]
(A) What is mapping? State any one case of mapping.
(B) Write a short note on screw transformation.
(C) The end-effectors of a robot is rotated about fixed axes starting with a yaw of -π/2, followed by a pitch of $-\pi/2$. What is the resulting rotation matrix?
(D) Give Detail About Fundamental rotation Matrices.

Section - II

Que:-4   **Attempt All.** [12]
(A) List and explain in brief robot co-ordinate systems (Cartesian, Cylindrical, polar, spherical & Revolve system)
(B) Define degree of freedom. Explain degree of freedoms associated with a robot wrist with a neat sketch.
(C) Write down different desirable features of sensors in robotics.

Que:-4   **Attempt All.** [12]
(A) Define stability, accuracy, repeatability and compliance of a robot.
(B) List and explain each object descriptor in machine vision system.
(C) Write short note on Touch sensors

Que:-5   **Attempt All.**
(A) Write a short note on CCD camera. [06]
(B) Explain a vacuum cup gripper. [05]

Que:-5   **Attempt All.**
(A) List the application of robotics. Explain any one application with neat sketch. [06]
(B) Write a short note on optical encoders. [05]

Que:-6   **Attempt Any three.** [12]
(A) Architecture of Robotic vision system.
(B) Compare a robot manipulator with human hand for their capabilities.
(C) Explain components required for Robotics/Machine vision.
(D) Enlist Robotic applications in which end effecter is a tool.

END OF PAPER