

Khulna University of Engineering & Technology
Department of Industrial Engineering and Management

B.Sc. Engineering 4th Year 2nd Term Examination, 2016

IPE 4027

Computer Integrated Manufacturing

Full Marks: 210

Time: 3 hrs

- N.B:** i) Answer any *THREE* questions from each section in separate scripts.
 ii) Figures in the right margin indicate full marks.
 iii) Assume reasonable data if missing any.

SECTION-A

1. (a) Define manufacturing system. Briefly discuss the component of a manufacturing system. 15
 (b) How can you determine the automation and manning level of a manufacturing system? 07
 (c) The CNC grinding section has a large number of machines devoted to grinding of shaft for the automotive industry. The grinding machine cycle takes 3.6 min. the worker service time 40 sec. worker takes 20 sec to walk between the machines. If no machine idle time is allowed, determine 13
 i) How many machines the worker can service?
 ii) Worker idle time
 iii) Hourly production rate of this machine cluster.
2. (a) Define Group Technology and Cellular manufacturing. Discuss the three basic types coding systems in the group technology. 13
 (b) Differentiate between single station manned cell and single station automated cell. 08
 (c) Apply the rank order clustering technique to the following part- machine incidence matrix to identify logical part families and machine groups. Parts are identified by numerically and machines are identified by letter. 14

Machine ID	Part number						
	1	2	3	4	5	6	7
A		1		1			1
B			1		1		
C	1	1		1			1
D	1		1			1	
E			1	1	1	1	

3. (a) Define material handling. Discuss the design considerations in material handling system. 12
 (b) Write short notes on i) AGV ii) Vehicle Management 13
 (c) An automated guided vehicle system has an average travel distance per delivery =200m and an average empty travel distance= 150m. Load and unload times are each 24 sec and speed of the AVG =1.2 m/s. Traffic factor =0.9. How many vehicles are needed to satisfy a delivery requirement of 45 del/hr? Assume A=0.95. 10
4. (a) What is ADC? What are the basic components of ADC? 05
 (b) Discuss the code 39 bar code standard. 08
 (c) Define inspection accuracy. Briefly describe the on-line and off-line inspection. 10
 (d) Four machines used to produce a family of parts are to be arranged into a GT cell. The From-To data for the parts processed by the machines are shown in the table below. (i) Determine the most logical sequence of machines using Hollier method 1 ii) Construct the flow diagram for the data, showing where and how many part enter and exit the system. iii) Compute the percentage of in-sequence movies. 12

From	To			
	1	2	3	4
1	0	10	0	40
2	0	0	0	0
3	50	0	0	20
4	0	50	0	0

SECTION-B

5. (a) What is FMS? Why FAMS more appropriately used than FMS? 05
 (b) Describe the various types of FMS based on the number of machines. 12

5. (c) An FMS consists of three stations plus a load/unload station. Station 1 loads and unloads part from the FMS using two servers. Station 2 performs horizontal milling operations with two servers. Station 3 performs vertical milling operation with three servers. Station 4 performs drilling operations with two servers. The machines are connected by a part handling system that has three work carriers and a mean transport time 3.5 min. The FMS produces four parts A, B, C and D whose part mix fractions and process routings are presented in the table below. The operation frequency is $f_{ijk}=1.0$ for all operations. Determine i) Maximum production rate of the FMS ii) Corresponding production rate for each product iii) Utilization of each machine in the system and iv) Number of busy serves at each station. 18

Part j	Part mix Pj	Operation k	Description	Station i	Process time t_{ijk} (min)
A	0.2	1	Load	1	4
		2	H. mill	2	15
		3	V. mill	3	14
		4	Drill	4	13
		5	Unload	1	3
B	0.2	1	Load	1	4
		2	Drill	4	12
		3	H. mill	2	16
		4	V. mill	3	11
		5	Drill	4	17
		6	Unload	1	3
C	0.25	1	Load	1	4
		2	H. mill	2	10
		3	Drill	4	9
		4	Unload	1	3
D	0.35	1	Load	1	4
		2	V. mill	3	18
		3	Drill	4	8
		4	Unload	1	3

6. (a) What is storage buffer? Why are storage buffers required in automated production line? 07
 (b) Briefly describe the walking beam transfer line. 07
 (c) Discuss the control function of an automatic transfer machine. 07
 (d) A 22- station in-line transfer machine has an ideal cycle time of 0.35 min. Station break-downs occur with a probability $p=0.01$. Assume that station breakdowns are the only reason for line stops. Average downtime=8.0 min per line stop. Use the upper-bound approach to determine i) Ideal production rate R_c ii) Frequency of line stops F iii) Average actual production rate R_p and iv) line efficiency E . 14

7. (a) Define line pacing and line balancing. The table below defines the precedence relationships and element times for a new model toy. 25
 i) Construct the precedence diagram for this job.
 ii) If the ideal cycle time is 1.1 min, representing time 0.1min and uptime proportion is assume to be 1.0. What is the theoretical minimum number of workstations required to minimize the balance delay under the assumption that there will be one worker per station?
 iii) Use the largest candidate rule to assign work elements to stations.
 iv) Compute the balance delay for your solution.

Work Element	T_e (min)	Immediate predecessors
1	0.5	-
2	0.3	1
3	0.8	1
4	0.2	2
5	0.1	2
6	0.6	3
7	0.4	4,5
8	0.5	3,5
9	0.3	7,8
10	0.6	6,9

- (b) Describe the various possible layouts of the segmented in-line configuration of an automated production line with proper applications. 10
8. (a) What is CAPP? How is generative CAPP different from retrieval CAPP system? 10
 (b) Explain that, concurrent Engineering shortens the product development time. 10
 (c) Differentiate between lean manufacturing and agile manufacturing. Also describe briefly the basic principles of agile manufacturing. 15

Khulna University of Engineering & Technology
Department of Industrial Engineering and Management
 B.Sc. Engineering 4th Year 2nd Term Examination, 2016
IPE4059
Project Management

Full Marks: 210

Time: 03 hrs

N.B: i) Answer any **THREE** questions from each section in separate scripts.
 ii) Figures in the right margin indicate full marks.
 iii) Assume reasonable data if missing any.

SECTION-A

1. (a) How do projects, programs, tasks and work packages differ? 10
- (b) A project consists of a series of task labeled A, B,.....H, I, J with the following 08
 relationships ($W > X, Y$ means X and Y cannot start until W is completed; $X, Y < W$
 means W cannot start until both X and Y are completed). With the notation construction the
 network diagram having the following constraints: $A < D, E; B, D < F; E < C; C < G; B <$
 $H; F, G < I$ and $H, I < J$.
- (c) A project consists of the following activities, where time estimates are given against each as 17
 under:

Activity	Estimated duration (weeks)		
	Optimistic	Most likely	Pessimistic
1-2	3	6	15
1-3	2	5	14
1-4	6	12	30
2-5	2	5	8
2-6	5	11	17
3-6	3	6	15
4-7	3	9	27
5-7	1	4	7
6-7	4	19	28

Required:

- i) What is the probability that the project will be completed in 38 weeks?
- ii) What project duration will have 95% chance of completion?

2. (a) Define crash time? Demonstrate the concept of resource allocation with a suitable example. 10
- (b) How resource leveling does differ from resource allocation? 05
- (c) Consider the data of a project as shown below: 20

Activity	Normal time (weeks)	Normal cost Tk.	Crash time weeks	Crash cost Tk.
1-2	6	700	4	840
1-3	12	300	10	1 st week 60 2 nd week 90
1-4	4	200	2	360
2-3	8	900	6	1000
2-4	4	600	2	760
2-5	15	100	8	380
3-5	8	500	3	960
4-5	6	400	4	500

If the indirect cost per week is Tk. 150, find the optimal crashed project completion time.

3. (a) Why conflict arises? Is negotiation a tool for solving conflict? Give your opinion. 10
- (b) Construct win-lose negotiation and win-win negotiation and explain why latter is so 10
 important in project management.
- (c) Consider the network scheduling problem as shown below: 15

Activity	Duration (Month)	Manpower Required
1-2	5	12
1-3	6	4
2-3	8	6
2-4	7	3
3-4	4	8

Schedule the activities of the project with a maximum limit on the manpower requirement as 12.

4. (a) Differentiate between risk and uncertainty. Write down a project proposal for “making a pen”. 15
- (b) What do you mean by “project life cycle”? what are the major sources of conflict during various stages of the project life cycle? 10
- (c) What is “Work Breakdown Structure (WBS)”? What are the basic steps to design and use the WBS? 10

SECTION-B

5. (a) “Rewards and punishments in project monitoring system can meet with minimal risks and efforts”. Explain this statement. 10
- (b) For the following test marketing project at weeks 6, calculate the cost, schedule and time variances. Also calculate the CPI, SPI, and ETC and EAC. 15

Activity	Predecessors	Duration weeks	Budget, \$	Actual cost, \$	% complete
a	--	2	300	400	100
b	--	3	200	180	100
c	a	2	250	300	100
d	a	5	600	400	20
e	b,c	4	400	200	20

- (c) Why is it important to use outside auditors rather than inside auditors who would be more familiar with the company and the project? 10
6. (a) When a project is terminated? “Evaluation of a project is another means of project control”- Comment. 11
- (b) What are the responsibilities of a project auditor? Describe the life cycle of a project audit. 12
- (c) Identify the reasons of project termination. What are the characteristics of a good termination manager? 12
7. (a) Why are R&D projects in a Company’s aggregate project plan significantly different in type from the firm’s derivative, breakthrough and platform projects? 12
- (b) What problems may occur if the project manager does not have a follow-on project when the current project nears termination? 11
- (c) Discuss the uses of a PMIS in the different system of the project life cycle. 12
8. (a) What is balanced control system and what are the characteristics of a balanced control system? 10
- (b) Define risk management. What are the guidelines can be integrated to manage the risk in a project? 13
- (c) What is project evaluation? What are the dimensions of project success? Describe in brief about of them. 12

Khulna University of Engineering & Technology
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B.Sc. Engineering 4th Year 2nd Term Examination, 2016

IPE 4219

Human Factors Engineering and Safety Management

Full Marks: 210

Time: 03 hrs

N.B: i) Answer any **THREE** questions from each section in separate scripts.

ii) Figures in the right margin indicate full marks.

iii) Assume reasonable data if missing any.

SECTION-A

1. (a) What is meant by Ergonomics? Discuss the importance of Ergonomics in industrial engineering. 13
- (b) Explain why ergonomics is called a subset of human factor engineering. 10
- (c) Explain the characteristics and various aspects of man-machine system. 12
2. (a) What is meant by office ergonomics? Discuss the different key elements of office ergonomics. 10
- (b) What are the essential features of well-designed chair that can be adjusted to suit a range of people? 13
- (c) Write down the signs and symptoms of MSDs. 12
3. (a) Define Anthropometry. Discuss the general principles of work design. 12
- (b) What is manual material handling? Write down the characteristics of handle material of hand tools. 10
- (c) Describe five ergonomic principles of optimizing tasks in the workplace. 13
4. (a) Give six features to be considered in VDT work station design. 10
- (b) Define biomechanics. What are the five components of biomechanics? 10
- (c) Discuss the ergonomic considerations for working with laptop. 15

SECTION-B

5. (a) Define SMS. For a company which is important-SMS or QMS? Why? 08
- (b) Write the process of risk management with key points. Also mention risk management principles. 10
- (c) Which is best-source analysis or problem analysis? Why? 07
- (d) Differentiate between safety circle and safety culture. Draw a system model of safety. 10
6. (a) Describe the different types of work based injuries with their compensations. 10
- (b) Suppose, an accident occurred in your computer lab. How you can investigate that accident? 12
- (c) What is less important-safety training of safety sign? Why? Write down different types of safety signs with their distinguishing characteristics and applications. 13
7. (a) Differentiating among risk, accident and hazard. How can you improve safety culture in your industry? 12
- (b) Differentiate risk mitigate option and potential risk treatment. Also mention OSHA medical safety guidelines. 10
- (c) How can the safety environment be established to a company by applying general safety rules? 13
8. (a) What are the importances's of safety management in a manufacturing industry? 05
- (b) Define and draw: Sagittal line; Asymmetry line. Also define LI with respect to RWL. 10
- (c) In a paint processing industry, a worker is assigned to a job of placing 15Kg paint jar from the conveyor to rack. The height of the conveyor is 30 cm and the included angle with sagittal plane is 0°. The height of the rack is 100 cm and included angle is 30°. The diameter of the paint jar is 25 cm and height is 28 cm. The frequency of the job is 3 lifts/min. The duration of work is 8 hours which result a multiplier of 0.55. Assuming the coupling as fair, calculate the RWL and LI at the origin and destination. Also mention the limitations of revised NIOSH lifting equation. 20

Khulna University of Engineering & Technology
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 B.Sc. Engineering 4th Year 2nd Term Examination, 2016
IPE4225
Tool Engineering

Full Marks: 210

Time: 03 hrs

N.B: i) Answer any **THREE** questions from each section in separate scripts.
 ii) Figures in the right margin indicate full marks.
 iii) Assume reasonable data if missing any.

SECTION-A

1. (a) What do you mean by 'locating'? What are the major factors that determine how a workpiece will be located? 10
- (b) Explain how nine degrees of freedom can be arrested by 3 – 2 – 1 locating principle. 15
- (c) What is tumble jig? Write down the differences between a drill jig and a fixture. 10

2. (a) What is cam clamp? Write down the limitations of cam clamp and the basic rules for applying clamping forces. 12
- (b) What are the important factors to be considered when selecting a clamp? 10
- (c) Describe the advantages and disadvantages of clamping action of a screw clamp with necessary figures. 13

3. (a) Define fixture. What are the economic aspects of the use of a fixture? 10
- (b) What are the classifications of milling fixtures? How is a faceplate fixture located on the lathe fixture? 13
- (c) Describe the design principles of lathe fixtures. 12

4. (a) How can the drill bushing be classified by ANSI? Discuss which type bushing are used for what purpose. 15
- (b) Why is the collar of knock-off expanding mandrel made of left hand thread? 10
- (c) What is nesting? Narrate the advantages of partial nesting and disadvantages of full nesting. 10

SECTION-B

5. (a) What is meant by die clearance? Discuss the effects of insufficient and excessive die clearance. 10
- (b) Sketch the progressive die and discuss its features. 13
- (c) Discuss the methods of reducing cutting force in die cutting operation. 12

6. (a) What are the seven basic elements of workpiece geometry that gages is design to check? 10
- (b) Why is drawing complicated compared to bending and forming? 10
- (c) How can you manufacturing the box as shown in the following figure: 6(c) from a sheet of metal? Make list sequentially and briefly explain the involved operations. All dimensions are in mm. 15

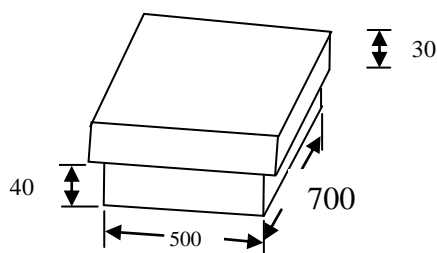


Figure: 6(c)

7. (a) Design a flush pin gage and a length gage to check the depth of the slot and length of the 13

workpiece in following figure: 7(a).

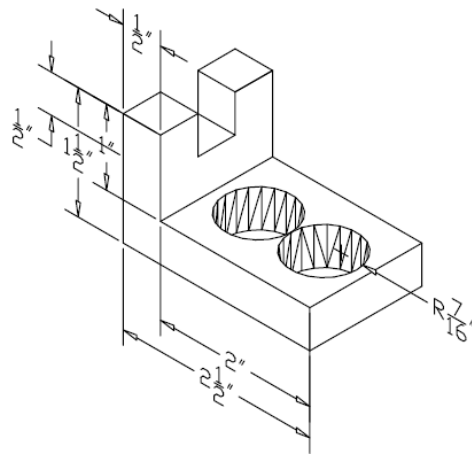


Figure: 7(a)

- (b) Design a draw die for the following workpiece. Calculate the followings in the early stages of the design procedure. 15
- i) Percent deduction
 - ii) Number of draw required
 - iii) Relationship of punch-nose radius and die radius.

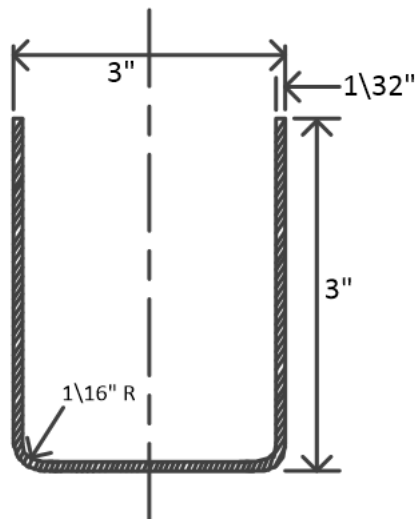


Figure: 7(b)

- (c) What is the basic difference between embossing and coining? 07
8. (a) Discuss the effects of excessive and insufficient draw radius in drawing operation. 12
- (b) Explain why it is important, not to stop a drawing operation once started. 08
- (c) Discuss the following with the help of neat sketch- 15
- i) Wire drawing
 - ii) Tube drawing

Khulna University of Engineering & Technology
Department of Industrial Engineering and Management

B.Sc. Engineering 4th Year 2nd Term Examination, 2016

IPE4227
CAM and Robotics

Full Marks: 210

Time: 03 hrs

N.B: i) Answer any *THREE* questions from each section in separate scripts.
 ii) Figures in the right margin indicate full marks.
 iii) Assume reasonable data if missing any.

SECTION-A

1. (a) Define CAD and CAM. Discuss the benefits of CAD/CAM to engineering design as compared to conventional methods. 10
- (b) What CAD tools are required to support the design process? How you can implement a typical CAM process on a CAD/CAM system? 13
- (c) What is meant by Numerical Control? Briefly describe the working principle of an NC system with neat sketch. 12

2. (a) Explain Floating zero and incremental positioning. 10
- (b) “Contouring NC is the most complex and the most flexible type of machine tool”- explain. 10
- (c) The workpiece is a low-carbon steel plate, which has previously been cut out in the rough shape of the part outline. The tool is ½" -diameter side-milling cutter, cutting speed=573 rpm and feed=2.29"/min. Now smooth the periphery. Assume reasonable data and use ATP. 15

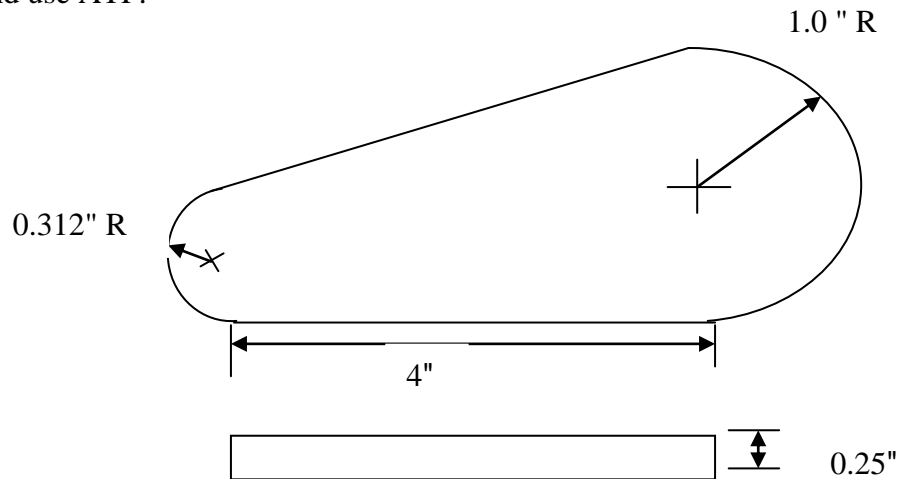


Figure 2(c)

3. (a) What is ATP language? Explain the role of 3 surfaces in ATP language. 11
- (b) Define route sheet. Discuss the problems with conventional NC. 10
- (c) What is word address format? CNC machining centre equipped with the ISO controller. Produce the following part (sheet) from the inside of a large sheet. Assume reasonable data. 14

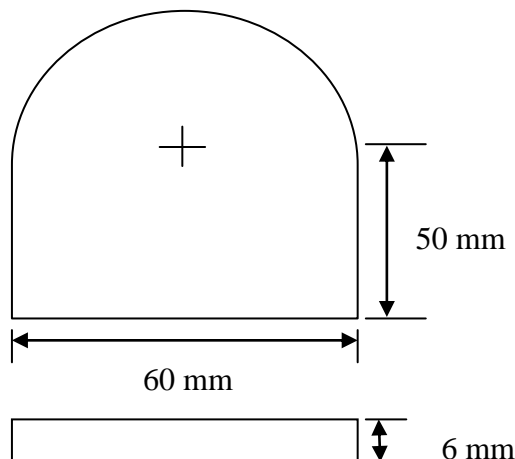


Figure 3(c)

4. (a) Discuss hybrid CNC and straight CNC. 12
 (b) Explain the requirements of in-process compensation. 11
 (c) Discuss the sources of variability in machining. 12

SECTION-B

5. (a) Define the term “Robot”. Write down some specific applications of robot in different industrial sectors. 10
 (b) What is robot autonomy? Sketch a robotic system with basic main components. 12
 (c) Define work envelop of a robot. Explain the work envelop of Cartesian coordinate robot and SCARA robot. 13
6. (a) Differentiate between cylindrical and jointed body and arm configuration robot. 10
 (b) What are the different types of end effectors? Also describe the various types of grippers. 12
 (c) Define sensors and transducers. Also write down their distinguish characteristics and differentiate them. 13
7. (a) How do sensors sense proximity and temperature? Explain. 10
 (b) How could you design a control process? Differentiate between intermittent transfer and non-synchronous transfer. 10
 (c) A unity feedback system has the open loop transfer function $G(s) = \frac{s+1}{s^3+s^2}$; find the error constant K_p , K_v and K_a for this system. 15
8. (a) Figure 8(a) shown a block diagram with two feedback loops for which the transfer functions are $G_1(s) = \frac{1+4s}{4+4s}$; $G_2(s) = \frac{1}{1+0.5s}$; $G_3(s) = \frac{1}{1+s+s^2}$; $G_4(s) = \frac{1}{s}$; $H_1(s) = \frac{1}{1+0.1s}$ and $H_2(s) = \frac{s}{1+0.2s}$. Find the transfer functions from R and disturbance D to the output C. 10

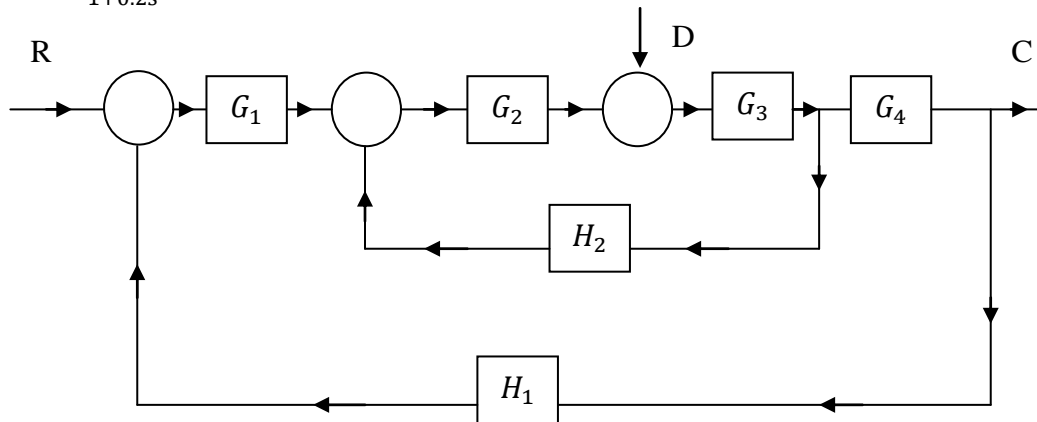


Figure 8(a)

- (b) With the help of neat sketch, discuss Denavit-Hartenberg parameters. What are the values of θ_2 and θ_1 in figure 8(b). 15

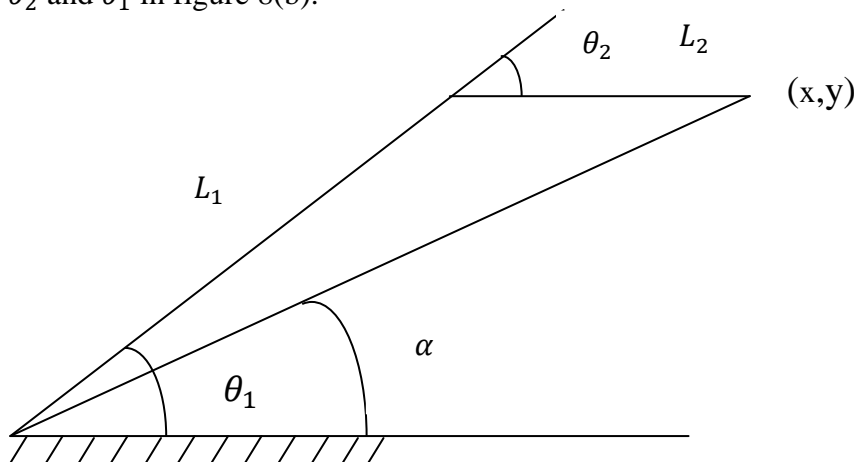


Figure 8(b)

- (c) Given the world coordinates for a TRL:R robot as $x = 300 \text{ mm}$, $y = 350 \text{ mm}$, $z = 400 \text{ mm}$ and $\alpha = 45^\circ$; and given that the links have values $L_0 = 0$, $L_1 = 325 \text{ mm}$, L_3 has a range from 300 to 500 mm, and $L_4 = 25 \text{ mm}$. Determine the joint angles θ_1 , θ_2 , λ_3 and θ_4 . 10