

**Khulna University of Engineering & Technology**  
**Department of Industrial Engineering and Management**  
 B.Sc. Engineering 4<sup>th</sup> Year 2<sup>nd</sup> Term Regular Examination, 2015  
**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) What is meant by automated manufacturing system? Briefly discuss the components of a manufacturing system. 15
- (b) Classify manufacturing system based on level of automation. 08
- (c) The CNC grinding section has a large number of machines devoted to grinding of shafts for the automated industry. The grinding machine cycle takes 3.6 min. At the end of the cycle, an operation must be present to unload and load parts, which takes 40 sec. Determine i) how many grinding machines the worker can service if it takes 20 sec to walk between the machines and no machine idle time is allowed. ii) How many seconds during the work cycle is the worker idle? iii) What is the hourly production rate of this machine cluster? 12
2. (a) Define group technology and cellular manufacturing. Discuss the benefits of group technology. 08
- (b) What is meant by part family? Briefly discuss the Opitz classification system with suitable example. 12
- (c) Apply the rank order clustering technique to the part machine incidence matrix in the following table to identify logical part families and machine groups. 15

Machine	Parts					
	A	B	C	D	E	F
1	1				1	
2				1		1
3	1	1				
4			1	1		
5		1			1	
6			1	1		1

3. (a) What is meant by material handling? Discuss the design consideration in material handling system. 12
- (b) What are guidance technologies used for AGV? Briefly discuss them. 13
- (c) Four forklift trucks are used to deliver pallet loads of parts between work cell in a factory. Average travel distance loaded is 350 ft and the travel distance empty is estimated to be the same. The trucks are driven at an average speed of 3 mile/hr when loaded and 4 mile/hr when empty. Terminal time per delivery average 1.0 min (load=0.5 min and unload =0.5 min). If the traffic factor is assumed to be 0.90, availability=1.0 and worker efficiency=0.95, what is the maximum hourly delivery rate of four trucks? 10
4. (a) Define inspection accuracy. What are type-I and type-II errors? Discuss with example. 10
- (b) What is ADC? Write down the names of different technologies used in ADC. 05
- (c) Briefly describe the on-line and off-line inspection. 08
- (d) Four machine used to produce a family of parts are to be arranged into a GT sell. An analysis of 50 parts processed on these machines has been summarized in the Form To chart of the following table. Additional information is that 50 parts enter the machine grouping at machine 3, 20 parts leave after processing at machine 1, and 30 parts leave after processing at machine 4. i) Determine the most logical sequence of machines for this data using Hollior method 1. ii) Construct the flow diagram for the data, 12



4. (d) iii) Compute the percentage of sequence moves, by-pass and backtracking moves in the solution.

From-To chart

To	1	2	3	4
From				
1	0	5	0	25
2	30	0	0	15
3	10	40	0	0
4	10	0	0	0

**SECTION-B**

5. (a) What makes a system flexible? Write down the different types of flexibility in manufacturing. 10  
 (b) Why is computer control required in FMS? Write down the importance of FMS in material handling system. 10  
 (c) A FMC consist of two machining workstations plus load/unload station having one carrier for each and connected by a part handling system having one work carrier. The mean transportation time is 2.5 min. The operation frequency  $f_{ijk} = 1.0$  for all operations and others information are presented in the following table. 15

Part J	Part Mix $P_j$	Operation K	Description	Station i	Process Time $t_{ijk}$ (min)
A	0.2	1	Load	1	3
		2	Mill	2	20
		3	Drill	3	12
		4	Unload	1	2
B	0.3	1	Load	1	3
		2	Mill	2	15
		3	Drill	3	30
		4	Unload	1	2
C	0.5	1	Load	1	3
		2	Drill	3	14
		3	Mill	2	22
		4	Unload	1	2

Determine: i) maximum production rate of FMC, ii) corresponding production rate of each product, iii) utilization of each machine in the system.

6. (a) What are meant by line pacing and line balancing? 05  
 (b) The table below defines the precedence relationships and element time for a new model toy. 15  
 i) if the ideal cycle time= 1.1 min, repositioning time=0.1 min, and uptime proportion=1.0, what is the theoretical minimum number of workstations (assume one worker per station)?  
 ii) use the largest candidate rule to assign work elements to stations.

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

- (c) What is storage buffer? Why are storage buffers required in automated production line? 10  
 (d) What are the factors needed to be considered in manual assembly lines? 05
7. (a) Discuss the control function of an automatic transfer machine. 10  
 (b) A 20 station transfer line has an idle cycle time  $T_c = 1.2$  min. The probability of station breakdowns per cycle is equal for all stations, and  $p=0.005$  breakdown/cycle. For each of upper-bound and lower bound approaches, determine i) frequency of line stops per cycle, ii) average actual production rate, and iii) line efficiency. 12  
 (c) Write down the conditions for which automated assembly systems should be considered. 05  
 (d) Write short notes on: i) selector and/or orientor, ii) escapement and placement device. 08
8. (a) Define lean production and agile manufacturing. Write down the basic principles of lean production. 10  
 (b) What is retrieval CAPP systems? Show the general procedure of the retrieval CAPP system. 10  
 (c) Explain how concurrent engineering is more beneficial over traditional product development system. 10  
 (d) Differentiate between lean production and agile manufacturing. 05

**Khulna University of Engineering & Technology**  
**Department of Industrial Engineering and Management**  
 B.Sc. Engineering 4<sup>th</sup> Year 2<sup>nd</sup> Term Regular Examination, 2015  
**IPE 4059**  
 Project Management

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 project. List down the differences between general management and project management. 12
- (b) Describe different types of project life cycle with necessary figures. 13
- (c) Briefly explain the constrained weighted factors scoring model of project selection. 10
2. (a) Briefly discuss the distinction between risk and uncertainty in management. 10
- (b) "The project managers must never allow serious management to be surprised." Justify it. 10
- (c) Discuss about the qualities that must be possessed by a successful project manager. 15
3. (a) What is meant by physical asset control of project management? Explain. 10
- (b) Define critical ratio in terms of project controlling. Describe project controlling procedure by using critical ratio method. 13
- (c) Do you think that sometimes creative activities are needed to be controlled for the success of project? Justify your opinion. 12
4. (a) What are the essential conditions of a credible audit? 07
- (b) "Evaluation of a project is another means of project control" Justify the statement. 09
- (c) What are the primary duties of a termination manager? 10
- (d) What factors are considered most important in the decision to terminate a project? Why might a failing project not be terminated? 09

**SECTION-B**

5. (a) What is meant by project planning? List down the nine key elements necessary for project success and briefly describe the composition of each element. 13
- (b) Why linear responsibility chart is used? What are the basic steps to design and use the work breakdown structure? 12
- (c) Define monitoring. Describe different types of reports used in Project monitoring. 10
6. (a) Draw the "Earned value chart." Assume that operations on a work package were expected to cost \$1500 to complete the package. They were originally schedule to have been finished today. At this point, \$1350 has actually been expended. It is estimated that two-thirds of the work have been completed. Calculate CV, SV, CSI, ETC, and EAC. 16
- (b) What is meant by project communication management? How can a conflict management strategy be developed? 12
- (c) What are the tools and techniques of source selection process? 07
7. (a) What characteristics of the critical path times make them critical? 06
- (b) Briefly summarize how Gantt chart is drawn. 11



7. (c) Given the following information, draw the AOA network.

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Activity	a	m	b	Activity	a	m	b
AB	3	6	9	BD	0	0	6
AC	1	4	7	BE	2	5	8
CB	0	3	6	DF	4	4	10
CD	3	3	3	DE	1	1	1
CE	2	2	8	EF	1	4	7

Also find: i) the critical path, ii) all event slacks, iii) critical path to event D, iv) critical path Probability of completion in 14 days, v) the effect if CD slips to 6 days; to 7 days; to 8 days.

8. (a) Show the "Time –cost relationship" during the crashing of an activity.

07

- (b) Consider the following data of project

28

Activity	Normal Time (Week)	Normal cost (Rs)	Crash Time (Week)	Crash cost (Rs)
1-2	6	700	4	840
1-3	12	300	10	Week 1, Rs 60 Week 2, Rs 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 Rs 150, find the optimal crashed project completion time and cost.

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 B.Sc. Engineering 4<sup>th</sup> Year 2<sup>nd</sup> Term Regular Examination, 2015  
**IPE 4219**

Human Factors Engineering and Safety Management

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) What is meant by Ergonomics? What are the differences between human factors engineering and ergonomics? 12
- (b) Classify Man-Machine system with proper examples. What are the functions that a component of a man-machine system serves? Explain. 13
- (c) Write down the classification of body movement in order of increasing difficulty. 10
2. (a) What is meant by anthropometry? Discuss the classification of sitting posture. According to your opinion which one is best and why? 12
- (b) Write down the ergonomic rules for optimal working height in an industrial assembly work under different type of tasks. 10
- (c) Why do we need to change the working posture through the day? 05
- (d) Explain with diagram the dimension of normal and maximum working area in horizontal plane proposed by Barnes and Squares. 08
3. (a) What is meant by good working posture? What are the differences between posture and motion? 07
- (b) Write down some guidelines for computer workstation design from ergonomic perspective. 12
- (c) Discuss under what working conditions the standing posture is preferred. 10
- (d) Write short note on first class, second class and third class lever found in human body. 06
4. (a) Explain the location of Video Display Terminal (VDT) at greater viewing distance with necessary sketches. 12
- (b) Discuss the ergonomic criteria of hand tool design with repetitive tasks. 10
- (c) Why should the centre of gravity of the heavy tool be far away from wrist? 06
- (d) What are the advantages and disadvantages of using gloves in repair work? 07

SECTION-B

5. (a) Explain in brief the safety management system. Also write down the purposes of safety management. 11
- (b) How can the quality circle be differentiated from safety circle? Prepare a safety circle for a garment industry. 12
- (c) Define injury. Describe the types of injury with the reasons and remedies. 12
6. (a) Define risk. Explain risk matrix and risk calculator for determining the types of risks with proper examples. 15
- (b) Write down the generic strategies for risk mitigation. 10
- (c) How can the safety environment be established in any industry by applying general safety rules? Explain. 10
7. (a) "Investigation is done after an accident"-Do you agree? How can an accident investigation be effectively done to identify the root cause behind it? 13
- (b) How can you improve safety training program in a company? Explain. 10
- (c) Write short notes on: i) safety hazard, and ii) general equipment safety rules. 12
8. (a) Why is safety sign necessary? How can the different types of safety signs are understood by their appearances. 11
- (b) How can the interview of the witness of a road accident be conducted and evaluated? Describe with practical scenario. 13
- (c) What are the parameters to think for an effective safety budget? 11



**Khulna University of Engineering & Technology**  
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 B.Sc. Engineering 4<sup>th</sup> Year 2<sup>nd</sup> Term Regular Examination, 2015  
**IPE 4225**  
**Tool Engineering**

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) | Describe the degrees of freedom of a workpiece located in space. How many degrees of freedom are restrained in a cylindrical locator? Explain. | 13 |
| (b)    | What are the three basic principles applied to the use of locating pins? Explain.  | 12 |
| (c)    | What are the differences between primary and secondary locator?  | 10 |
| 2. (a) | Define clamp and clamping. What are the important factors to be considered for selecting a clamp?  | 12 |
| (b)    | What are the methods used to speed up the clamping action of a screw clamp? Explain any one of them with suitable sketches.                    | 13 |
| (c)    | Discuss the effects of taper angle of wedge clamp on clamping action. Mention suitable range of taper angle of wedge clamp.                    | 10 |
| 3. (a) | How can the drill bushing be classified by AISI? Discuss the application of each type of bushing.  | 15 |
| (b)    | What are the advantages and disadvantages of plate jig and a leaf jig?   | 10 |
| (c)    | Explain the working principle of a simple latch clamp.   | 10 |
| 4. (a) | Why is the collar of knock-off expanding mandrel made of left hand thread?   | 10 |
| (b)    | Discuss the design principles of lathe fixtures.   | 10 |
| (c)    | Sketches the different vice fixtures with their uses.  | 15 |

**SECTION-B**

- |        |   |    |
|--------|---|----|
| 5. (a) | Discuss in short the various die cutting operations.  | 12 |
| (b)    | What is meant by die clearance? Discuss the effects of insufficient and excessive die clearance.                    | 10 |
| (c)    | Sketch the progressive die and discuss its functions.   | 13 |
| 6. (a) | Discuss the methods of reducing cutting force in die cutting operation.   | 12 |
| (b)    | Explain how to determine the drawing force and blank size.  | 13 |
| (c)    | Draw an OBI press and discuss about its major components.   | 10 |
| 7. (a) | Discuss the factors that influence the clearance between punch and die.   | 10 |
| (b)    | Do you think that sheet metal working process is different from metal forming process? Justify your answer.         | 13 |
| (c)    | Differentiate between: i) piercing, punching and blanking, ii) perforating and slitting, iii) flanging and bending. | 12 |
| 8. (a) | Explain how gauge tolerance and wear are allocated in the design of limit gauge.                                    | 10 |
| (b)    | Name the different types of limit gauges that are commonly used in the industry and mention their applications.     | 09 |
| (c)    | Discuss the effect of excessive and insufficient draw radius in drawing operation.                                  | 10 |
| (d)    | Explain why it is important not to stop drawing operation once started.   | 06 |

**Khulna University of Engineering & Technology**  
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 B.Sc. Engineering 4<sup>th</sup> Year 2<sup>nd</sup> Term Regular Examination, 2015  
**IPE 4227**  
 CAM and Robotics

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) What is meant by CAM? Briefly explain the relation between Automation and CAM. 10  
 (b) Define "Numerical Control". Briefly explain the working principle of an NC system with neat sketch. 13  
 (c) What are the basic types of motion control systems in NC machines? Describe them with necessary figures. 12
2. (a) What are floating zone and incremental positioning? Explain. 10  
 (b) Define part programming. Explain the part programmer's job and computer's job. 13  
 (c) What is CAPP? Describe the benefits of CAPP. 12
3. (a) Mention the types of statements in APT languages with examples. 10  
 (b) Explain drive surface, part surface and check surface. 10  
 (c) In the following figure, the part requires milling on the periphery for smoothing. Make a part program on a machine centre equipped with the ISO controller. Clearly show the set point and axes on the sketch of the part. All dimensions are in mm. 15

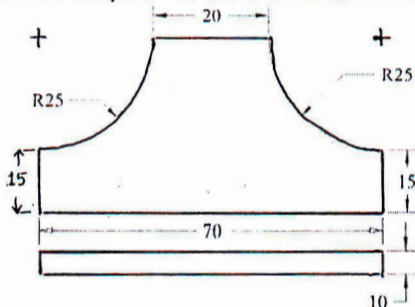


figure 3(c)

4. (a) What are the basic components of a DNC system? Describe the two alternative configurations of DNC systems with schematic diagrams. 12  
 (b) Write short notes on: i) Hybrid CNC, and ii) Straight CNC. 10  
 (c) Write a part program in APT language to make the part ABCDEFG from sheet IJKL by a CNC machine considering, i) program is in absolute mode, ii) program begins from reference point at the bottom left edge of sheet iii) program is counterclockwise (points A-B-C-D-E-F-G-A) iv) material is aluminum. All dimensions are in mm. Assume relevant data if required. Sheet is 5 mm thick. 13

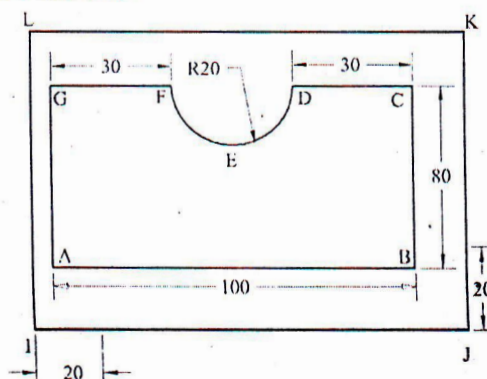


figure 4(c)

SECTION-B

- |    |     |   |    |
|----|-----|---|----|
| 5. | (a) | Define robot, robotics, and automation with examples.   | 10 |
|    | (b) | Describe the basic components of a robotic system.  | 15 |
|    | (c) | Write some specific applications of industrial robot.   | 10 |
| 6. | (a) | What are meant by robot work space and work envelope? Draw and explain the work envelope of a cylindrical body and arm robot configuration. | 12 |
|    | (b) | Write short notes on: i) SCARA robot, and ii) Wrist configuration.  | 12 |
|    | (c) | What is a robot manipulator? Discuss the different types of manipulator joints with neat sketches.  | 11 |
| 7. | (a) | What is actuator? Compare the hydraulic actuator with electric actuator.  | 12 |
|    | (b) | Describe about robot reference frame briefly.   | 12 |
|    | (c) | Explain the functions of vacuum gripper and magnetic gripper.   | 11 |
| 8. | (a) | What is sensor? Classify robotic sensors with their applications.   | 11 |
|    | (b) | What is Teach Pendant? Why is it used in robotic system?  | 12 |
|    | (c) | What is meant by robot kinematics? Describe how a position is fixed with kinematics.  | 12 |