Ex/ME(M2)/HS/B/T/322/2024

B.E. Mechanical Engineering - Third Year (Second Semester), 2024

INDUSTRIAL MANAGEMENT

Time: Three hours **Full Marks: 100**

Answer ***any five*** **(05)** questions.
Assume suitable data, if needed.
Use graph papers for the solution of graphical problems.

Answer all the parts of a question together.

1. (a) What is 'THERBLIGS'? Discuss its importance in the time study method.
   (b) Discuss in brief about camera study methods.
   (c) Times (in appropriate time units) of different operations in the shipping department of a company are furnished below:

Work element	Cycle				Performance Rating
	1st	2nd	3rd	4th	
Obtain the case	0.15	0.25	0.20	0.17	90%
Place 3-dozens bottles in the case	1.56	29.35	1.80	1.75	105%
Set case aside	0.20	0.10	0.10	0.15	95%

The operator takes 0.50 minutes for personal requirements. Find out the standard time of the task. [6+4+10]

2. (a) Discuss about (i) quality control inspection and testing (ii) quality assurance.
   (b) Drawing explanatory figure and defining Type – I & Type – II errors, discuss about operating characteristics curve (OC-curve).
   (c) A manufacturer produces 10000 flow valves in 10 days. He draws random samples of 50 flow valves twice a day. The numbers of defective items are as follows:

Sample no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14
No. of defectives:	9	6	13	3	9	2	11	9	14	5	8	9	13	20
Sample no.:	15	16	17	18	19	20								
No. of defectives:	15	7	12	8	3	4								

Using graph paper construct a fraction defective chart and conclude accordingly. [4+6+10]

3. (a) Defining the terms reliability, maintainability and availability discuss about 'bathtub curve'.
   (b) Discuss, in brief, different maintenance strategies followed in the industry. (6+4+10]

4. (a) The machining sequence and the corresponding machining times of two jobs are given below. Using graph paper solve the scheduling problem:

Job I:	A	B	C	D	E
	1	2	3	5	1
Job II:	C	A	D	E	B
	3	4	2	1	5

(b) State the general assumptions of Johnson's algorithm of n-job, 2 machines problem. What is modified Johnson's algorithm? [10+10]

5. Historical demand for a product is:

Month	April	May	June	July	August	September
Actual	60	55	75	60	80	75

(a) Using a four-month simple moving average, calculate a forecast for October.
(b) Using a four-month weighted moving average with weights of 0.4, 0.3, 0.2, and 0.1, calculate a forecast for October.
(c) Using single exponential smoothing with alpha = 0.3, and April forecast = 65, forecast for each month including September and calculate the MAPE and the tracking signal. [4+4+12]

6. (a) The company XYZ has an annual demand of 4000 units of an item. The cost of each item is Rs. 90. The cost of placing an order is Rs. 25 and the inventory carrying cost is Rs. 9. Assume 250 working days per year. Determine (i) EOQ, (ii) the Optimal number of orders per year, (iii) The optimal order cycle time, and (iv) the total cost comprising the total annual ordering cost and the carrying cost if the EOQ is used. (b) Derive the formula of the EOQ you use in (a).
(c) What is the purpose of the ABC classification system? [8+6+6]

7. (a) Show graphically the angle of incidence and margin of safety in case of linear break-even analysis and state their importance.
(b) A project is broken down into the following activities along with their times (days) and precedence relationships. Develop the network based on AOA.

Activity	A	B	C	D	E	F	G	H	I	J	K
Immediate predecessor(s)	----	A	A	B	D	C	E, F	G	G	H, I	J
Normal time (days)	4	6	3	6	14	5	2	2	3	4	2

(c) Determine the critical path with the corresponding project duration.
(d) Determine the total float and free float of each activity. [6+6+3+5]

8. (a) Determine the initial basic feasible solution of the following transportation problem using the North-West Corner rule and VAM and check for optimality.

		Destination				Supply
Source		D1	D2	D3	D4	
	S1	1	2	1	4	30
	S2	3	3	2	1	30
	S3	4	2	5	9	40
Demand		20	40	30	10	

(b) A department has six employees with six jobs to be performed. The time (in hours) each person will take to perform each job is given in the following matrix.

			Employees				
		1	2	3	4	5	6
	A	21	5	21	15	15	38
Jobs	B	30	11	16	8	16	4
	C	28	10	11	11	15	11
	D	19	16	17	15	19	8
	E	26	21	22	28	29	14
	F	3	21	21	11	26	11

How should the jobs be allocated, one per employee, to minimize the total time? [10+10]

9. (a) What is linear programming? Define feasible solutions and optimal solutions in linear programming.

(b) An oil refinery manager must decide on the optimal mix of two possible blending processes of which the inputs and outputs run are as follows.

Process (units)	Input (units)		Output (units0	
	Grade A	Grade B	Gasoline X	Gasoline Y
1	5	3	5	8
2	4	5	4	4

The maximum amounts available of crudes A and B are 200 units and 150 units respectively. Market requirements show that at least 100 units of gasoline X and 80 units of gasoline Y must be produced. The profits per production run for process 1 and process 2 are Rs. 300 and Rs. 400 respectively. Formulate the LP model and solve using a graphical method. [6+14]

END