

**BACHELOR OF ENGINEERING IN MECHANICAL****ENGINEERING EXAMINATION – 2023****(3<sup>rd</sup> Year, 2<sup>nd</sup> Semester)****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.

1. (a) What are the roles of Managers as suggested by F. W. Taylor?  
 (b) Drawing an explanatory diagram discuss about a Matrix Organization Structure.  
 (c) State the importance of different factors, both tangible and intangible, to select an ideal site for of a thermal power plant.  
 (d) Write a brief note on lean manufacturing. [5x4]

2. (a) State the general assumptions in Johnson's algorithm for scheduling-n-sequencing problem. What is modified Johnson's algorithm and how the algorithm is applied? Discuss clearly without considering any numerical value.

- (b) Find out the sequence and corresponding schedule in the following case:

Job (j):	A	B	C	D	E	F	G
M1	1	3	7	9	4	5	2
M2:	1	3	8	2	8	6	1
M3:	8	10	9	11	9	14	12

[M1→M2→M3]

[(4+4) + 12]

3. (a) Define the terms reliability, availability and maintainability. What is a 'bath tub curve' and how is it related with maintenance practice of industrial machineries?

- (b) The values of sample mean and the range for ten samples of size 5 each are given in the following table. Draw the corresponding charts from the data and comment on the state of control of the process. If the process is out of control, then, what to be done?

Sample No.	1	2	3	4	5	6	7	8	9	10
Mean	43	49	37	44	45	37	51	46	43	47
Range	5	6	5	7	7	4	8	6	4	6

Control limit factors for sample size 5 are as follows:

 $A_2 = 0.58$ ,  $D_3 = 0$  and  $D_4 = 2.115$ .

[(2+2+2+4) + 10]

[ Turn over

4. (a) Historical demand for a product is:

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

- i. Using a three-month simple moving average, calculate a forecast for October.
  - ii. Using a three-month weighted moving average with weights 0.5, 0.3, and 0.2, calculate a forecast for October.
  - iii. Using a single exponential smoothing with  $\alpha = 0.6$  and August forecast = 65, calculate a forecast for October.
- (b) What is the purpose of a tracking signal in the context of forecasting practice?
- (c) How regression analysis is helpful in demand forecasting? Develop two normal equations based on linear regression analysis and hence find out the values of the constants.
- (d) Discuss ABC analysis in inventory control. [6+4+6+4]

5. (a) Each year XYZ Company purchases 18,000 of an item that costs Rs. 16 per unit. The cost of placing an order is Rs. 12, and the cost to hold the item for a year is 30 percent of the unit cost. Determine

- i. the economic order quantity
  - ii. optimal number of orders per year
  - iii. the optimal order cycle time
  - iv. average inventory level assuming that the minimum inventory level is zero.
- (b) Derive the formula of the EOQ you use in part (a). Mention the assumptions.
- (c) With the help of a quantity – cost curve, explain the significance of EOQ.
- (d) Describe the difference between a fixed-quantity (Q) and a fixed-period (P) inventory system. [8+4+4+4]

6. (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.

Activity	A	B	C	D	E	F	G	H	I
Immediate predecessor(s)	-	A	A	A	B	C,D	D,F	D	E,G,H
Time (days)	3	2	4	4	6	6	2	3	3

- i. Draw the network based on AOA.
- ii. Find the critical path and project duration based on forward pass and backward pass computation.
- iii. Which would you shorten, if you have the option of shortening any or all of B, C, D, and G each of two days to reduce the project duration as much as possible?
- iv. What is the new critical path and earliest completion time? [6+4+4+4+2]

7. (a) A work operation consisting of three elements has been subjected to a stopwatch time study. The recorded observations are shown in the following table. The allowances for tasks are personal 5%, fatigue 7%, and delay 2%. Determine the normal time and the standard time for the work operation.

[ 3 ]

Task element	Observations (minutes)					Performance rating (%)
	1	2	3	4	5	
1	0.8	0.6	3.1	0.7	0.8	90
2	0.4	0.5	1.2	0.3	0.6	110
3	1.0	2.1	0.9	1.0	0.9	80

(b) What is 'THERBLIGS'? Discuss its importance in time study.

(c) Five men are available to do five different jobs. The time in hours each man takes to do each job is given in the following table. Determine the assignment of men to jobs that minimizes the total time required to perform the five jobs, when each man has to be assigned at one job.

		Job				
		1	2	3	4	5
Man	A	2	9	2	7	1
	B	6	8	7	6	1
	C	4	6	5	3	1
	D	4	2	7	3	1
	E	5	3	9	5	1

OR

The unit costs of transportation along different paths are shown in the following table. Solve the problem using Vogel's Approximation Method (VAM) and also check for optimality:

Destination \ Source	A	B	C	D	Supply
X	3	1	7	4	300
Y	2	6	5	9	400
Z	8	3	3	2	500
Demand	250	350	400	200	

[8+4+8]

8. (a) What is linear programming? Give some applications of linear programming.

(b) Define feasible solution, basic feasible solution and optimal solution in linear programming.

(c) Solve the following LPP using graphical method.

$$\text{Minimize } Z = 2500x + 3000y$$

$$\text{Subject to: } x \geq 30$$

$$y \geq 20$$

$$x + y \geq 30$$

$$\text{and } x, y \geq 0$$

(d) Explain degeneracy in transportation problem.

[4+4+8+4]