

M.E. PRODUCTION ENGINEERING FIRST YEAR SECOND SEM.

EXAMINATION-2025

MAINTENANCE AND TEROTECHNOLOGY

Time: Three Hours

Full Marks: 100

Answer **any FIVE** questions.

All parts of a question (a, b, c etc) should be answered at one place.

- 1.a) What are the basic objectives of plant maintenance?
- b) What is the total productive maintenance? State its major principles.
- c) Distinguish between breakdown and preventive maintenance. Discuss their usefulness in plant maintenance.

5+10+5=20

- 2.a) State and exhibit various factors that govern the total plant life cost and profitability.
- b) Define the term terotechnology and how does total productive maintenance (TPM) practice differ from terotechnology? Discuss the procedural steps practiced in industries regarding implementation of TPM.

6+14=20

- 3.a) Describe the difference between reliability and quality.
- b) Develop the circular model related to the main function of terotechnology.
- c) Mathematically derive an expression for reliability, probability of failure and failure density function for a given system when the hazard rate follows Rayleigh distribution.

4+6+10=20

- 4.a) For general case of an n-component series system, prove that the component redundancy yields higher reliability than unit redundancy.
- b) Consider two identical independent units with $\lambda = 0.01 \text{ h}^{-1}$. Mission time $t = 24 \text{ h}$. Compare the reliability of a system made of these units if they are placed in (a) parallel configuration, (b) series configuration, (c)

[Turn over

standby configuration with perfect switching and (d) standby configuration with imperfect switching and standby failure rates of $\lambda_{ss} = 1 \times 10^{-6} \text{ h}^{-1}$ and $\lambda_1 = 1 \times 10^{-5} \text{ h}^{-1}$ respectively.

- c) The reliability of communication channel is $R = 0.40$. How many channels should be placed in parallel redundancy to achieve the reliability of receiving the information as $R_s = 0.80$?

$$8+8+4=20$$

- 5.a) What are the advantages of condition based monitoring?

- b) Exhibit the various on-load and off-load condition-monitoring techniques and explain any two of such techniques.

$$6+14=20$$

- 6.a) What is the impact of terotechnology on the maintenance management?

- b) Establish the relationship between various forms of maintenance with a neat flow diagram.

- c) Develop a bathtub curve to show how Weibull distribution can be suitably used for depicting the hazard rate of a system?

$$5+7+8=20$$

- 7.a) What are the characteristics advantages of 'decision tree' of Failure Modes & Effects Analysis (FMEA)?

- b) Describe briefly the methodology used for the construction of FMEA or FMECA.

- c) What is the importance of Health and Usage Monitoring (HUM) in industry? Explain the methodology of analysis of interlinking of Health & usage in practice.

$$5+5+10=20$$

- 8.a) Define the terms MTBF, MTTR and availability factor.

- b) Develop a decision tree to exhibit the practice of selection of effective maintenance policy for plants and equipment.

- c) What are the different indices of maintenance performance?

- d) What are the constituent elements of plant/ equipment life cycle cost?

$$8+4+4+4=20$$

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3. a)

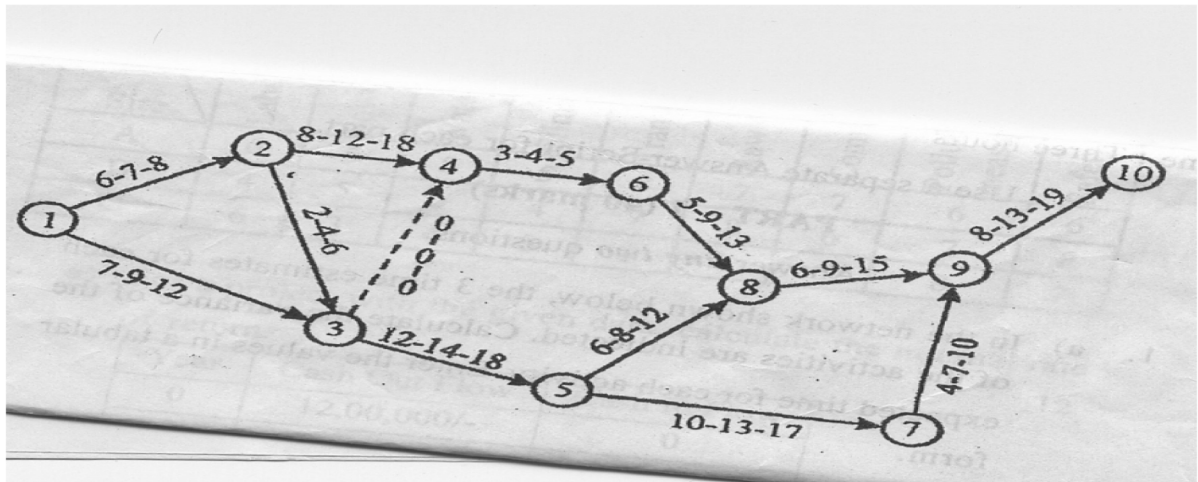


Fig. 3

The 3 time estimates are indicated along the activity arrows for the project shown above (Fig.3). Calculate (1) the expected or the avg. time t_e & the variance for each activity, (2) the earliest expected time & (3) the latest allowable occurrence time for each event. Make the entries in a tabular form. Also enter the last 2 values against the respective event circles.

10

b) The following project is to be represented by a bar chart. The duration for each activity is in days. These are the actual work days. The proj. commences on Wed., Nov. 15, with 5 work days a week. Draw the bar chart with the horizontal scale denoting calendar dates. Activities 1 & 2 can occur concurrently. Activity 3 can take place after activity 2 is completed. Activities 4, 6 & 3 can occur concurrently. Activity 8 can start 4 days after the commencement of activity 6. Activity 7 should follow activity 5. Activity 5 can begin concurrently with activity 8.

Activity 1	8 days
Activity 2	4 days
Activity 3	7 days
Activity 4	9 days
Activity 5	3 days
Activity 6	3 days
Activity 7	14 days
Activity 8	17 days

5

c) Draw the network for the following project and number the events according to Fulkerson's rule:

5

Event No.	Preceded by
A	Start event

B	A
C	B
D	B
E	D
F	B
G	E
H	G,E
J	D,F,H
K	C,J
L	K

The relevant portion of the
Normal Distribution Function

Normal deviate (+)	Probability (%)	Normal deviate (+)	Probability (%)
0	50.0	0	50.0
-0.1	46.0	+0.1	54.0
-0.2	42.1	+0.2	57.9
-0.3	38.2	+0.3	51.8
-0.4	34.5	+0.4	65.5
-0.5	30.8	+0.5	69.2
-0.6	27.4	+0.6	72.6
-0.7	24.2	+0.7	75.8
-0.8	21.2	+0.8	78.8
-0.9	18.4	+0.9	81.6
-1.0	15.9	+1.0	84.1
-1.1	13.6	+1.1	86.4
-1.2	11.5	+1.2	88.5
-1.3	9.7	+1.3	90.3
-1.4	8.1	+1.4	91.9
-1.5	6.7	+1.5	93.3
-1.6	5.5	+1.6	94.5
-1.7	4.5	+1.7	95.5
-1.8	3.6	+1.8	96.4
-1.9	2.9	+1.9	97.1
-2.0	2.3	+2.0	97.7
-2.1	1.8	+2.1	98.2
-2.2	1.4	+2.2	98.6
-2.3	1.1	+2.3	98.9
-2.4	0.8	+2.4	99.2
-2.5	0.6	+2.5	99.4
-2.6	0.5	+2.6	99.5
-2.7	0.3	+2.7	99.7
-2.8	0.3	+2.8	99.7
-2.9	0.2	+2.9	99.8

M. E. Production Engg. 1st Year, 2nd Semester EXAMINATION, 2025**SUBJECT: MANAGEMENT AND CONTROL OF PROJECTS****Time : Three hours****Full Marks 100****Use a Separate Answer Script For Each Part****PART II****(Answer any Three Question)**

4. Identify suitable location in India, stating various deciding factors to be considered for the evaluation of the plant site of the following type of industries. 10

- i) Cement Manufacturing Plant;
- ii) Food Processing Industries;
- iii) Plywood Industries;
- iv) Precision Engineering Industries;

- b) A Hydral Power plant location has to be selected from three probable sites as listed below. The comparative rating of major factors influencing the site selection process are as shown in table below: 10

Rating Site	Labour	Power	Water	Climatic Condition	Transport- ation	Zoning Regulation	Community Facility	Pollution Control measure
A	5	5	8	5	5	4	3	5
B	6	7	5	3	7	3	5	4
C	5	3	4	8	6	5	4	5

5. Compare projects 'A' and 'B' using NPV method of evaluation and IRR method utilising the given data. Is there any difference between the two results? If yes explain why? Assuming a discount rate of 11% per year. 17+3

Year	Project A (Cash Flow)	Project B (Cash Flow)
0	- 12,00,000/- (Cash Out Flow)	- 12,00,000/- (Cash Out Flow)
1	8,00,000/-	4,00,000/-
2	7,00,000/-	3,00,000/-
3	-----	3,00,000/-
4	-----	2,00,000/-
5	-----	2,00,000/-

6. a) Write a short notes on (*any three*): 3×5
- i) Annuities
 - ii) Means of Finance for Project
 - iii) Matrix Organisation
 - iv) Hierarchy of Plans
- b) How the Performance Analysis helps to controls Projects 5
7. a) How to construct activity relationship chart? 5
- b) Describe the advantages and disadvantage of Process, Product and Group layout. 15