# M.E. PRODUCTION ENGINEERING 1ST YEAR 2ND SEMESTER EXAMINATION, 2017

## MAINTENANCE ENGINEERING AND TEROTECHNOLOGY

Time: **Three hours**                                               Full marks: **100**

*Answer any THREE questions from GROUP A and any TWO questions from GROUP B.*

## GROUP A

1. (a) Why is 'Terotechnology' needed in plants? Highlighting the major goals of Terotechnology, exhibit the chronological mix of various engineering, technological and management concepts and principles over the years to lead to the development of the present era of Terotechnology. (10)

(b) State and exhibit various factors that govern the total plant life cycle cost and profitability. (6)

(c) What are the basic objectives of plant maintenance? (4)

2. (a) Describe how the spare parts can be classified in various categories. (4)

(b) Derive the expressions for optimal scheduling period, prescribed order level and optimal total inventory cost for spares with stochastic demand pattern. (8)

(c) Derive the optimal inspection frequency for a system so as to enhance the profitability criteria. (8)

3. (a) It costs $3,000 to perform preventive maintenance (PM) on a group of four machines. The cost of downtime and repairs, if a machine malfunctions between PM inspections, is $9,000. How often should PM be performed to minimize the expected cost of malfunction and the cost of PM? (12)

Machine breakdown history

| Weeks between PM | Probability that a machine will malfunction |
|---|---|
| 1 | 0.10 |
| 2 | 0.15 |
| 3 | 0.35 |
| 4 | 0.40 |

(b) Developing a bath-tub curve, show how Weibull distribution can be suitably used for depicting the hazard rate of a system. (8)

4. (a) Determine the techno-economic life of a plant taking into consideration the reliability effort function. Assume that the failure mechanism is governed by Rayleigh's distribution. (10)

(b) State the basic principles of total productive maintenance. (10)

5. (a) Assume that there are three components having individual reliabilities of 0.85, 0.75 and 0.95 respectively. For this, what is the best redundant configuration? (10)

(b) Using Poison Process, derive the expressions for probability of survival of a system containing (i) one and (ii) n stand-by components. Also show the effect of the number of spare parts in the reliability expression for a system containing N components connected in series. (10)

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# MASTER OF PRODUCTION ENGG. 2$^{ND}$ SEMESTER EXAMINATION, 2017

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**Full Marks: 100**

### GROUP B (40 marks)

*Answer any **TWO** questions*

6. (a) What are the characteristics advantages of 'decision tree' of Failure Modes & Effects Analysis (FMEA)?    5

  (b) Identify the probable causes of failure of engineering equipment and its auxiliaries, resulting in the total failure of the systems.    5

  (c) Discuss the various types of replacement strategies required to reduce the total maintenance cost of a plant.    10

7. (a) What are the advantages of condition based monitoring?    6

  (b) Exhibit the various on-load and off-load condition-monitoring techniques and explain any two of such techniques.    14

8. (a) Detect the common vibration problems, which are noticed on a rotating system and suggest some probable remedial actions for it.    10

  (b) What is the importance of Health and Usage Monitoring (HUM) in industry? Explain the methodology of analysis of interlinking of Health & usage in practice.    10