Roll No .....

# MMCM - 205

## M.E./M.Tech., II Semester

Examination, June 2016

## Reliability And Total Productive Maintenance

*Time : Three Hours*

*Maximum Marks : 70*

*Note :* Attempt any five questions. All questions carry equal marks.

1. a) Discuss different distribution functions used for the estimation of reliability in the performance of the maintenance functions. 7

   b) How terms Reliability, Availability and Maintainability (RAM) are associated with maintenance engineering? Explain. 7

2. a) Explain terms MTTR, MTBF, MTTF and Failure Rate. 7

   b) In order to test the strength of a new glue, ten similar structures constructed using the glue were subjected to a continuous vibratory load, and the duration of survival of each structure was noted, the values obtained being the following:

| Specimen No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Hours of Survival | 60 | 62 | 58 | 50 | 61 | 55 | 59 | 62 | 54 | 55 |

   Calculate the Mean Time To Failure (MTTF) from this data. 7

3. a) Explain the significance of gamma distribution in relation to Normal and Weibull distribution. 7

   b) Explain Weibull distribution, write expression of its probability density function and explain the influence of shape factor $\beta$ on Weibull distribution. Why is it very important distribution in maintenance engineering? 7

4. a) Consider a three component standby system in which two units are normally online. Both online units must fail before the stand by unit is placed online. Compute the system reliability function and the MTTF. Assume no failures in standby and a constant failure rate when units is online. 7

   b) Prove that for series systems with components having constant hazard rates, the system mean life (T) and mean life of components ($T_i$) are related by

$$\frac{1}{T}=\frac{1}{T_1}+\frac{1}{T_2}+\frac{1}{T_3}.....+\frac{1}{T_n}$$ 7

5. a) Explain method of decomposition for solving systems which are not reducible to mixed configurations. 7

   b) A test fix test reliability growth program conducted growth testing in 100-hr increments with following results:

| Hours of Test | No.of Failures |
|---|---|
| 0-100 | 23 |
| 100-200 | 15 |
| 200-300 | 9 |
| 300-400 | 5 |
| 400-500 | 2 |
| 500-600 | 2 |
| 600-700 | 1 |
| 700-800 | 1 |

   Fit a Duane growth curve and estimate the additional time necessary to achieve an MTTF of 50 hours. 7









6. a) Explain the concept of TPM and describe pillars of TPM. Also write a comment on "TPM is answer to all maintenance related woes". 7

   b) Compare Reactive, Preventive, Predictive and Proactive maintenance. 7

7. a) Explain "Reliability Demonstration Testing". 7

   b) In an automobile plant producing heavy and light commercial vehicles and which predominantly employs breakdown and preventive maintenance techniques. Systematically bring out a model showing step by step activities whereby total productive maintenance can be brought forth. 7

8. Write short notes on: 14

   a) Life history curve

   b) Fault Tree Analysis

   c) Replacement models

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