Printed Pages : 2 **Roll No.** | | | | | | | | | | | **EME014**

B. TECH.

THEORY EXAMINATION (SEM–VI) 2016-17

RELIABILITY ENGINEERING

Time : 3 Hours ***Max. Marks : 100***

Note : *Be precise in your answer. In case of numerical problem assume data wherever not provided.*

SECTION – A

1. Attempt all of the following questions: **10 x 2 = 20**

(a) What is Reliability?

(b) Represent a reliability graph using probability density function.

(c) How is the testing done for the goodness of a fit of data to distribution?

(d) Explain the terms 'Availability' and 'Maintainability' of system.

(e) Define MTTF and MTBF?

(f) Write the differences between a k-out-of-n redundant system and n unit parallel system.

(g) Define Minimal cut-set.

(h) What is the system reliability, if the subsystem reliability is 0.80 in a system comprising of three identical subsystems in parallel redundancy?

(i) What is Weibull distribution used in probability calculations?

(j) State the objectives of Life Tests?

SECTION – B

2. Attempt any five of the following questions: **5 x 10 = 50**

(a) Explain with a neat sketch

(i) Series configuration

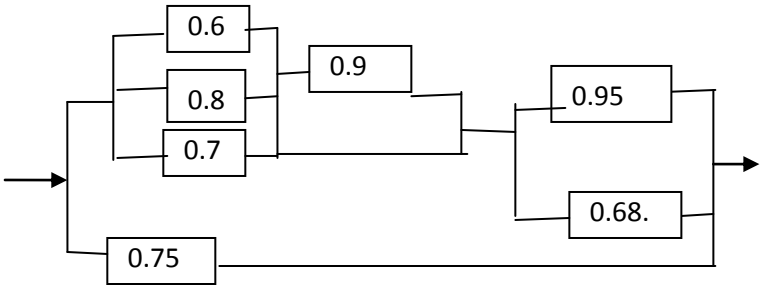
(ii) General Series- parallel System

(b) Differentiate between Design FMEA and Process FMEA. Also, explain methodology of system analysis.

(c) Write a brief note on 'Reliability Testing'.

(d) Explain the steps involved in Chi-Square goodness fit test.

(e) Estimate the Reliability of the system shown below: The numerals indicate the reliability of each element.



(f) Derive an equation $\mathbf{MTTF} = \frac{1}{N} \Sigma\, \mathbf{n_k}\ \mathbf{k}\ \Delta\mathbf{t}$

(g) The following data have been collected at the plant:

Mean time before failure = 30 hrs

Mean time to repair = 15 hrs

Administrative logistic time is 30% of Mean down time.

Calculate the operational availability and inherent availability of this plant.

(h) Explain the reliability analysis of complex systems using minimal cut-set method.

SECTION – C

Attempt any two of the following questions: **2 x 15 = 30**

3. Test conducted on a sample of 100 automobile brakes have yielded a mean value of 56,669.5 and a standard deviation of 12393.64 miles for the life of the brakes. Assuming normal distribution find the probability of realizing the life of the brakes less than 50,000 miles. Table below shows $\Phi(z)$ values

Z	**0.53**	**0.54**
$\Phi(z)$	**0.7019**	**0.7054**

4. **(a)** What is the minimum reliability required for each component if overall system reliability must be at least 0.9 for a series system having 10 identical components?

(b) (i) Hazard rate (ii) Probability density functions of failure.

5. If two components having failure rates λ_1, λ_2 respectively are connected in parallel, show that the reliability of this parallel configuration at time t is given as

$$R_p(t) = e^{-\lambda_1 t} - e^{-\lambda_2 t} - e^{-(\lambda_2 + \lambda_1) t}$$