



### End Term Examination (December 2019)

School: School of Engineering

Program: M.Tech Automotive Product Engineering

Course: System Reliability

Course Code: APE606

Semester: III

Max Marks: 40

Duration (mins): 90

**Q 1. Answer the following questions (ANY TWO).**

(Each question carries 8 marks)

[16]

- a) The components in the system below are exponentially distributed with the indicated failure rates. Develop an expression for the reliability of the system. What is the system reliability at time = 100 hours?



- b) Explain in detail integration of reliability engineering into the Product Life Cycle at various stages with diagram.
- c) Describe the bath tub curve and how is it useful to improve reliability of a system?

**Q 2. Answer the following questions (ANY ONE).**

[04]

- a) Explain the terms:  
i. Maintenance ii. Logistic support iii. Product liability iv. Cost effectiveness
- b) What is MTTF, MTBF, MTTR? And how availability of the system depends on these parameters?

**Q.3 Answer the following questions. (ANY TWO)**

(Each question carries 10 marks)

[20]

- a) What is Reliability Design? Explain in detail the design for Six Sigma.
- b) Develop a reliability program for a product manufacturing company considering reliability planning, specifications, customer expectations & satisfaction and reliability requirements.

- c) A home computer has two 3.5 inch disk drives. What is the probability of the computer operating successfully (with at least one disk drive) for 1000 hours? Assume the following estimated reliability values of the components

Component	Failure Rate	Reliability (1000 hours)
3.5 inch Disk Drive	$39/10^6$ hr	0.962
Hard Disk	$34/10^6$ hr	0.967
CPU Board	$4/10^6$ hr	0.966
KEY Board	$10/10^6$ hr	0.990
Monitor	$10/10^6$ hr	0.990

- d) Time failure of a system is exponentially distributed as 25, 75, 125, 125, 250, 100 (hours)
- Calculate the reliability of an item for an operating time of 100 hours.
  - If the failure probability is below 45% then find optimum operating time to achieve 60 % reliability without improving design.
  - For the same component, if design is allowed to improved, then how frequently the component could fail to achieve 60% to operate it for 100 hours?

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