G.R. No.	

DECEMBER 2021 - ENDSEM EXAM
FINAL YEAR B. TECH. (MECHANICAL) (SEMESTER - I)
COURSE NAME: RELIABILITY ENGINEERING
COURSE CODE: MEUA40181C
(PATTERN 2018)

Time: [1Hr]   [Max. Marks: 30]

Instructions to candidates:
1) Answer Q.1 OR Q.2, Q.3 OR Q.4, Q.5 OR Q.6.
2) Figures to the right indicate full marks.
3) Use of scientific calculator is allowed
4) Use suitable data where ever required

Q. No.	Question Description	Marks
Q.1 a	Comment on the technology aspects in reliability management.	4
Q.1 b	A material handling system has to be designed with a reliability value of 0.93 for 1050 hours. Operational availability is required to be 95% of the probability of survival over the same period of time. Consider the mean administrative and logistic time as 20% of mean time to repair. Assuming a constant hazard rate for failure and ignoring the preventive maintenance downtime find the mean time to repair (MTTR), mean down time (MDT) and inherent availability.	6

OR

| Q2 a | Comment on design for maintainability and its considerations. | 4 |
| Q2 b | In private enterprise, cost of unreliability must be concerned from a financial view point, i.e., monetary measures over a period of time. Justify the statement. | 6 |

| Q.3 a | Carry out the failure mode and effect analysis of a cotter pin of a cotter joint. Tabulate probable failure modes, causes and effects for a cotter pin. | 4 |
| Q.3 b | Figure shown below is a fault tree diagram. The failure modes of A, C and D have failure rates 0.002, 0.001 and 0.004 per hour respectively. The failure modes of B, E and F have failure rates 0.001, 0.003 and 0.002 per hour respectively. Find out the failure rate of the system. Also, draw the block diagram of the system. | 6 |
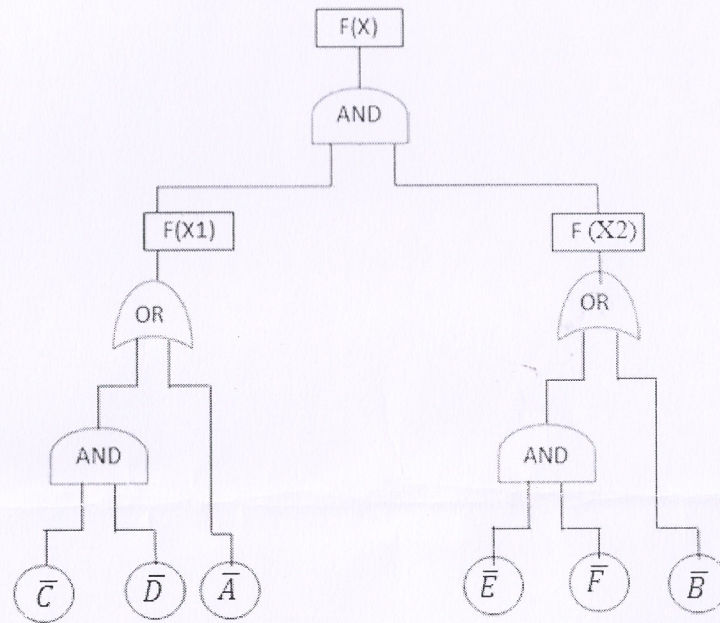
<div align="center">OR</div>

Q.4 a   Carry out the failure mode and effect analysis of a bolt used for clamping an I.C.   4
engine cylinder and head together. Tabulate probable failure modes, causes and
effects for bolt.

Q.4 b   Comment on the statement that a well-designed experiment assists in determining   6
the key factors in a process and in selecting the process parameters at which the
process would give better performance.

Q.5 a   Comment on reliability in manufacturing   4

Q.5 b   The stress developed in journal housing is known to be normally distributed with a   6
mean a value of stress is 281 N/mm^2 and standard deviation of 24 N/mm^2. The
mean material strength of journal housing is 384 N/mm^2 and standard deviation is
33 N/mm^2. Assuming that the material strength of journal housing and induced
stresses are independent, determine the probability of survival of journal housing,
average, minimum and maximum values of factor of safety.
Extract the data from following table which shows the normal variant (Z) and Ø(Z).

Z	2.1	2.2	2.3	2.4	2.5	2.6
Ø(Z)	0.9642	0.9722	0.9786	0.9836	0.9876	0.9906

<div align="center">OR</div>

Q.6 a   Accelerated life testing (ALT) and highly accelerated stress screening (HASS)   4
techniques are helpful to minimize warranty claims, reduce field failures, and
minimize time to market while increasing customer confidence in the reputation of
products. Justify the statement.

Q.6 b   FRACAS is a process that gives organizations a way to report, classify and analyze   6
failures, as well as plan corrective reactions in response to those failures. Comment
on the statement.