



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: PG

Branch: Mechanical Engineering

Course / Subject Code : ME01079011

Course / Subject Name : RELIABILITY & FAILURE ANALYSIS

w. e. f. Academic Year:	2024-25
Semester:	1 st Semester
Category of the Course:	PEC

Prerequisite:	Nil
Rationale:	This course provides the knowledge and practice regarding different Product Failure Theory, Reliability Prediction Models and Reliability evaluation. This course gives hands on practice regarding Reliability of Engineering Design and Reliability Management. This course gives knowledge of Diagnostic maintenance through ferrography, Vibration Signature, SOAP and other programme.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Understand the failure phenomena of product available	Understanding
2	Reliability analysis of individual product.	Analyze
3	Design a Reliability for Different Product available in Market	Analyze
4	Evaluate Reliability	Evaluate
5	Demonstrate Reliability testing	Analyze

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Introduction: Basic Probability-concept and various distributions, Concept of Reliability and analysis of various configurations of assemblies and sub-assemblies. Series, Parallel and other grouping. System reliability, Set theory, optimal	6	15



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	Cut Set and Tie Set, 'stardelta' method, matrix method etc.		
2.	Product Failure Theory System reliability determination through 'Event Tree' analysis and Fault Tree Analysis (FTA), Failure Modes and Effects Analysis (FMEA), Failure Modes, Effects and Criticality Analysis (FMECA). R.P.N, Graph theory, etc	7	15
3.	Reliability Prediction Models Series and parallel systems - RBD approach - Standby systems - m/n configuration -Application of Baye's theorem - cut and tie set method - Markov analysis. Optimal allocation of component reliability to achieve maximum system reliability - various techniques and methods such as Proportional, Conditional, Agree, Arinc, etc.	9	20
4.	Reliability evaluation Concept of loading roughness, probability in design including evaluation of safety margin. Reliability of Engineering Design; Mean, Median & K statistics for Reliability evaluation (non parametric, Short Sample).	9	20
5.	Reliability Management Reliability testing - Reliability growth monitoring - Non parametric methods - Reliability and life cycle costs - Reliability allocation - Replacement model	5	10
6.	Case Studies Diagnostic maintenance through ferrography, Vibration Signature, SOAP and other programme. Case studies done in Indian perspectives using Short Sample, nonparametric reliability.	9	20
	Total	45	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	15	15	25	25	10

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. Gupta AK, "Reliability engineering and tero-technology", Macmillan India Ltd, Delhi
2. Srinath LS, "Reliability Engineering", Affiliated East-West Press Pvt Ltd, Delhi



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3. O'Connor PDT, "Practical Reliability Engineering", John Wiley & Sons Ltd, Singapore
4. Modarres, "Reliability and Risk analysis ", Mara Dekker Inc., 1993.
5. John Davidson, "The Reliability of Mechanical system", The Institution of Mechanical Engineers, London, 1988.
6. Smith C.O." Introduction to Reliability in Design", McGraw Hill, London

Suggested Course Practical List:

1. Life Distributions
2. Complex System Models & Reliability Block Diagrams
3. Design by Reliability & Probabilistic Approach
4. Relationship between reliability and Safety Factor
5. Failure Modes, Effect and Criticality Analysis [FMECA]
6. Fault Tree Analysis [FTA]
7. Reliability Estimation – Binomial Distribution
8. Reliability Estimation – Exponential Distribution
9. Reliability Estimation – Weibull Distribution
10. Management of Reliability Programs

List of Laboratory/Learning Resources Required:

Suggested Project List:

- All the students must perform at least one Industrial Case Study Report

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