GUJARAT TECHNOLOGICAL UNIVERSITY

MECHANICAL (PRODUCTION ENGINEERING) (28)

RELIABILITY & FAILURE ANALYSIS

SUBJECT CODE: 3712809

SEMESTER: I

Type of course: Program Elective II

Prerequisite:

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.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE(E)	PA (M)	PA (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Topics	Teaching Hrs.	% 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 Cut Set and Tie Set, 'stardelta' method, matrix method etc.	6	15
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.	6	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	22
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	22
5	**Reliability Management** Reliability testing - Reliability growth monitoring - Non parametric methods - Reliability and life cycle costs - Reliability allocation - Replacement model	4	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.	8	16
	Total	42	100

Reference 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
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

Course Outcome:

After learning the course the students would be able to:

(1) the failure phenomena of product available
(2) understand concept of Reliability of individual product.
(3) Design a Reliability for Different Product available in Market

List of Experiments:

Students are required to perform experiments based on following topics:

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

<u>Major Equipments</u>:

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