



**C. U. SHAH UNIVERSITY**  
**Wadhwan City**

**FACULTY OF:** - Technology & Engineering  
**DEPARTMENT OF:** - Mechanical Engineering  
**SEMESTER:** - III  
**CODE:** - 5TE03REN1  
**NAME –** Reliability Engineering (REN)

**Teaching & Evaluation Scheme:-**

Subject Code	Name of the Subject	Teaching Scheme (Hours)				Credits	Evaluation Scheme							
		Th	Tu	Pr	Total		Theory				Practical (Marks)			Total
							Sessional Exam		University Exam		Internal		University	
							Marks	Hrs	Marks	Hrs	Pr/Viva	TW	Pr	
5TE03REN1	Reliability Engineering (REN)	4	2	0	6	5	30	1.5	70	3	---	20	30	150

**Objectives:-**

- To develop the ability to analyze any engineering problem in a simple and logical manner.
- Enabling the student to solve the operating problems in real world of manufacturing and to find their solution.

**Prerequisites:** - Basic and up to the mark knowledge of operations research, design and development of product, numerical methods and related software.

**Course outline:-**

Sr. No.	Course Contents
1	<b>Reliability Concept:</b> Introduction to reliability, Reliability definition, Failure rate, Hazard rate, Reliability function and their variation with respect to time, MTTF and its calculations for discrete data, Reliability analysis and its relation with other parameters like strength etc, Design life – A pre and posterior probabilities, Mortality of a component, Bath tub curve, Useful life.
2	<b>Data Analysis:</b> Reliability analysis for continuous data, Probability density function, failure rate and derivation of Reliability for various types of failure like constant failure rate, Logarithmic failure rate in increasing/decreasing failure rate etc. and their physical significance, Exponential, Weibull model and Markow model for reliability estimation.
3	<b>Reliability Assessment:</b> System reliability series parallel and mixed configuration, System reliability for complex systems using various techniques like successful path method, composite method etc. Redundancy, Various types, parallel operations, Cut and tie sets, Standby system.
4	<b>Strength based Reliability:</b> Safety factor, Safety margin, Stress strength interaction, Failure mode, Effects and criticality analysis and their examples, fault tree construction, analysis and evaluation techniques, Basic symbols, Reliability block diagram.
5	<b>System Reliability Analysis:</b> Reliability allocation or apportionment and techniques, Reliability availability, Reliability testing, Accelerated life testing, Sequential testing, Reliability Vs safety Engineering.
6	<b>Reliability Certification:</b> Certification based on Reliability, Statistical tools, Reliability management, Reliability Engineering Education etc.

**Learning Outcomes:** - After studying the subject the students will learn to get higher operating plant and equipment reliability that lifts efficiency and output of operating assets, stops equipment failure and creates higher plant and equipment reliability in industries.

**Books Recommended:-**

1. Introduction to Reliability Engineering **Lewis E. E.**, John Wiley and sons.
2. Reliability Engineering **Srinath L. S.**, Affiliated East-West Press Pvt. Ltd., 2005.
3. Reliability and engineering Systems **Rabiner L.**, Elsevier Publishers.
4. Practical Reliability Engineering **O' Connor P. and Kleyner A.**, Wiley Blackwell, 5<sup>th</sup> Edition.
5. An introduction to reliability to Reliability and Maintainability Engineering **Ebeling C. E.**, Tata McGraw Hill, 2000.
6. Reliability Evaluation of Engineering Systems **Billington R. and Alln R. N.**, Springer, 2007.

**Research Reference:-**

1. [www.springer.com](http://www.springer.com)
2. [www.sciencedirect.com](http://www.sciencedirect.com)



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**FACULTY OF:** - Technology & Engineering  
**DEPARTMENT OF:** - Mechanical Engineering  
**SEMESTER:** - III  
**CODE:** - 5TE03CEN1  
**NAME:** – Concurrent Engineering (CEN)

**Teaching & Evaluation Scheme:-**

Subject Code	Name of the Subject	Teaching Scheme (Hours)				Credits	Evaluation Scheme							
		Th	Tu	Pr	Total		Theory				Practical (Marks)			Total
							Sessional Exam		University Exam		Internal		University	
							Marks	Hrs	Marks	Hrs	Pr/Viva	TW	Pr	
5TE03CEN1	Concurrent Engineering (CEN)	4	0	2	6	5	30	1.5	70	3	-	20	30	150

**Objectives:-**

- To provide the current touch of real world manufacturing scenario.
- To present an integrated approach to the total systems design by providing insight in to how the various components subsystems function and interface with one another.

**Prerequisites:** - Basics and up to the mark knowledge of manufacturing design, CIM system and related softwares.

**Course outline:-**

Sr. No.	Course Contents
1	<b>Introduction:</b> Historical background of Concurrent Engineering (CE), sequential and concurrent processes, Definition and framework of CE, Decomposition of product development stages, CE team, Implementation of CE, Role of Information Technology, Examples of CE applications.
2	<b>Concurrent Engineering Tools:</b> Introduction to CE tools, Design for manufacturing and assembly (DFMA), Design for quality, Design for cost, Failure Modes Effects Analysis (FMEA), Fault Tree Analysis (FTA), Design for Experiments, Taguchi's methods, Quality function development (QFD), Simulation, etc.
3	<b>Design and Evaluation of CE:</b> Evaluation for manufacturing cost, Design process optimization for CE, Role of CAD/CAM and automation in CE, Virtual reality tools and techniques for product development and interaction modeling and visualization, Rapid Prototyping. Design for manufacturing- case studies, Design for reliability, maintainability, availability & their implication on CE, related case studies.
4	<b>CE metrics and Measures:</b> Metrics of measurement, life cycle measurement, simulation & analysis, Design for X-ability assessment, Product quality assessment.
5	<b>Total Value Management:</b> Total Quality Management (TQM), Total Value Management (TVM), Methodology, major elements, TVM in product development process. Framework & architecture. Product information management, CE architecture.

**Learning Outcomes:** - After completion of the course students will understand:

- Concurrent system Engineering and their performance indicators.
- An integrated approach to the total system design.

**Books Recommended:-**

1. Concurrent Engineering Fundamentals: Integrated Product Development, **Biren Prasad**, Vol. I & II, Prentice Hall, New Jersey.
2. Concurrent Engineering, Automation, Tools & Techniques, **Andrew Kusiak**, Interscience Publication.
3. Concurrent Engineering, **Backhouse C. J. & Brookes**, Gower Publishing House.
4. Concurrent Engineering in Product Design & Development, **Moustapha I.**, New Age International, New Delhi.
5. Integrated Product Development, **M. Anderson and L. Hein**, IFS Publications.
6. Design for Concurrent Engineering, **J. Cleetus**, CE Research Center, Morgantown.

**Research Reference:-**

1. [www.springer.com](http://www.springer.com)
2. [www.sciencedirect.com](http://www.sciencedirect.com)