FACULTY OF ENGINEERING & TECHNOLOGY

First Year Master of Engineering

Semester I

Course Code: 102320101

Course Title: Advanced Machine Design

Type of Course:Core Course I

Course Objectives:The course is intended to build understanding of design and analysis of machine components under dynamic loading by using Failure theories.The course includes Fatigue failure analysis of machine components at elevated temperature under variable loading. It includes fundamentals and application of fracture mechanics and surface failures in machine component design.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Internal		External		Total
Lecture	Tutorial	Practical		Theory	J/V/P*	Theory	J/V/P*	
3	0	2	4	40 / 16	20 /08	60 /24	30 / 12	150 /60

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	Introduction: design concepts, General design procedure, product design and development, Product life cycle, Protection of intellectual property, Bench marking, Brainstorming, Ethics in Engineering design, Whistle blowing. Quality Function Deployment – Concurrent approach . Design for Strength and rigidity	07
2	Review of Stresses, Strains and Theories of Failures: Introduction, Plane Stress, Rotation of Coordinate Axes, Generalized Plane Stress, Principal Stresses and Maximum Shear Stress, Plane strain, Theories of Failures: Distortion Energy, Maximum-Shear Stress, Maximum Normal Stress, Modified Coulomb-Mohr Theory, Comparison of theories of failures.	08
3	Design for Variable Loading: Introduction, factorsaffecting fatiguebehaviour, Theoretical stress concentration factor and notch sensitivity factor, Fatigue under complex stresses, cumulative fatigue design, Linear damage (Miner's Rule), Manson's method, Fatigue crack propagation and life estimation for constant and variable amplitude stress. Strain Based Approach to Fatigue: Strain Vs Life Curve, Mean stress effect, Strain-Life Equation, Life estimate for structural components.	12

Opp. Shastri Maidan, Beside BVM College, Vallabh Vidyanagar, Dist: Anand, Gujarat - 388120
(O): 02692-238001 | Email: adminoffice@cvmu.edu.in | www.cvmu.edu.in

4	Surface Failures: Friction: Rolling, Effect of roughness, velocity and lubrication on friction, Wear: Adhesive, Abrasive and Corrosive, Lubrication: Hydrodynamic, hydrostatic and elsato hydrodynamic lubrication, Surface Fatigue, Contact Stresses: Spherical, Cylindrical, Surface Fatigue Strength, design to avoid surface fatigue.	**07**
5	Design for Creep: Creep phenomenon, Creep Curve, Creep parameters, time-temperature parameters and life estimate: Sherby-Darn parameters, Larson-Miller parameters, Manson-Haferd parameter, comparison of parameters for these three methods, Stress-Strain-Time relation, Creep deformation under varying stress,	**05**
6	Click or tap here to enter text.	Click
7	Click or tap here to enter text.	Click
8	Click or tap here to enter text.	Click
9	Click or tap here to enter text.	Click
10	Click or tap here to enter text.	Click
11	Click or tap here to enter text.	Click
12	Click or tap here to enter text.	Click
13	Click or tap here to enter text.	Click
14	Click or tap here to enter text.	Click
15	Click or tap here to enter text.	Click

Opp. Shastri Maidan, Beside BVM College, Vallabh Vidyanagar, Dist: Anand, Gujarat - 388120
(O): 02692-238001 | Email: adminoffice@cvmu.edu.in | www.cvmu.edu.in

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks						**R**: Remembering; **U**: Understanding; **A**: Application, **N**: Analyze; **E**: Evaluate; **C**: Create
R	**U**	**A**	**N**	**E**	**C**	
15%	25%	20%	20%	10%	10%	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1	Mechanical Behaviour of Materials: Engineering Methods for Deformation Fracture and Fatigue, N E Dowling, Pearson Publication.
2	Machine Design: An Integrated Approach , R L Norton , Pearson Education.
3	Fundamentals of Machine Design , R C Juvinall& K M Marshek , Wiley India.
4	Mechanical System Design , FarazdakHaidery.
5	Elements of Fracture Mechanics, Prashant Kumar, Tata McGraw-Hill Publication.
6	Engineering Design, George E. Dieter, Tata McGraw-Hill Publication.
7	Design of Machine Elements, V B Bhandari, Tata McGraw-Hill Publication
8	Design data book, V B Bhandari.
9	Machine Design, P.C.Sharma& D.K. Agrawal, S.K.Kataria& Sons.
10	Machine Design: Fundamentals and Applications, P C Gope, PHI Publication.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Predict failure of engineering components using failure theories	**15%**
CO-2	Identify and explain the types of fractures of engineered materials and their characteristic features	**15%**
CO-3	Understand LEFM approach	**10%**

Opp. Shastri Maidan, Beside BVM College, Vallabh Vidyanagar, Dist: Anand, Gujarat - 388120
(O): 02692-238001 | Email: adminoffice@cvmu.edu.in | www.cvmu.edu.in

CO-4	Estimate life of components using stress life and strain life	**20%**
CO-5	Categorize different types of surface failure	**20%**
CO-6	For the design and analysis of components students will be able to incorporate effect of crack and creep.	**20%**
CO-7	Click or tap here to enter text.	Click
CO-8	Click or tap here to enter text.	Click
CO-9	Click or tap here to enter text.	Click
CO-10	Click or tap here to enter text.	Click

Opp. Shastri Maidan, Beside BVM College, Vallabh Vidyanagar, Dist: Anand, Gujarat - 388120
(O): 02692-238001 | Email: adminoffice@cvmu.edu.in | www.cvmu.edu.in

List of Practicals / Tutorials:

Click or tap here to enter text.

1	To understand various factors to be considered affecting design process and understand material selection procedure through case studies.
2	Problems related to calculation of stresses and strain along with transformations of basis and Theories of Failures.
3	Study various materials depicting different constitutive relations and understand behaviour of anisotropic and orthotropic materials of composites.
4	Case Studies related to plastic zone and validation of LEFM.
5	Case studies of Mechanical Components subjected to fluctuating load.
6	Case studies related to complex loading, cumulative damage and strain life approach.
7	Case studies of surface failures in Bearings, Cams and Gears.
8	Study effects of various types of wear mechanisms and effectiveness and suitability of lubrication methods.
9	Study creep mechanism and related parameters
10	Problems related to life estimation theories and design considerations for creep.
11	Click or tap here to enter text.
12	Click or tap here to enter text.
13	Click or tap here to enter text.
14	Click or tap here to enter text.
15	Click or tap here to enter text.

Supplementary learning Material:	
1	Click or tap here to enter text.
2	Click or tap here to enter text.
3	Click or tap here to enter text.
4	Click or tap here to enter text.
5	Click or tap here to enter text.

Opp. Shastri Maidan, Beside BVM College, Vallabh Vidyanagar, Dist: Anand, Gujarat - 388120
(O): 02692-238001 | Email: adminoffice@cvmu.edu.in | www.cvmu.edu.in

Curriculum Revision:	
Version:	**1**
Drafted on (Month-Year):	Apr-20
Last Reviewed on (Month-Year):	Jul-20
Next Review on (Month-Year):	Apr-22

Opp. Shastri Maidan, Beside BVM College, Vallabh Vidyanagar, Dist: Anand, Gujarat - 388120
(O): 02692-238001 | Email: adminoffice@cvmu.edu.in | www.cvmu.edu.in