

Subject Code: 01ME0711
Subject Name: Advanced Machine Design
B.Tech. IV Year – (Sem-7) Mechanical Engineering
Type of course: PE
Prerequisite: Machine Design, Strength of Materials

Rationale:- The course is intended to strengthen fundamentals of applied mechanics of solids and help understanding design and analysis of machine components under variable loading. The course explains design procedure and analysis of machine components at elevated temperature. The course teaches fundamentals and application of fracture mechanics and surface failures in mechanical component design.

Teaching and Examination Scheme:

Teaching Scheme (Hours)			Credits	Evaluation Scheme					Total Marks
				Theory Marks			Practical Marks		
Theory	Tutorial	Practical		ESE (E)	IA	CSE	Viva (V)	Term Work (TW)	
4	2	--	5	50	30	20	25	25	150

COURSE OUTCOME

Students will be able to

1. Students will be able to design mechanical components subjected to static loading.
2. Students will be able to design and analyze mechanical components subjected to dynamic loading.
3. For the design and analysis of components students will be able to incorporate effect of crack and creep.

SR No	CONTENTS	TOTAL HOURS	WEIGHTAGE
1	Review of stresses, Strains and Theories of Failures : Introduction, Plane Stress, Rotation of Coordinate Axes, Generalized Plane Stress, Principal Stresses and Maximum Shear Stress, Three Dimensional state of stress, Stresses on Octahedral plane, Plane strain, Strain gage rosettes. Introduction to basic Constitutive Relations and Rheological Models: Elastic model-Generalized Hooke's Law, Plastic model Rigid-Perfectly Plastic, Elastic-Perfectly, Elastic-Linear Hardening, Anisotropic and Orthotropic Hooke's Law, Different	09	21%

	Theories of Failures: Distortion Energy, Maximum-Shear Stress, Maximum Normal Stress, Modified Coulomb-Mohr Theory, Comparison of theories of failures.		
2	Fracture Mechanics: Introduction to fracture mechanics, Increase in stresses due to crack, displacement due to Crack tip opening, Effect of crack on strength of ductile and brittle material, Crack opening modes and Griffith theory, Concept of <i>Stress Intensity Factor</i> , <i>Plasticity at Crack Tip</i> , Use of <i>Stress Intensity Factor</i> in design and analysis, Determination of plastic zone, size and shape.	09	21%
3	Fatigue: Introduction, factors affecting fatigue behavior, 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. Fatigue considering Strain : Strain Vs Life Curve, Strain-Life Equation, effect of Mean stress , Life estimate for structural components.	10	24%
4	Surface Failures: Rolling Friction, Effect of surface roughness, velocity and lubrication on friction, Wear: Adhesive, Abrasive and Corrosive, Lubrication: Hydrodynamic, hydrostatic and elasto-hydrodynamic lubrication, Surface Fatigue, Contact Stresses in Spherical, Cylindrical under General and Dynamic condition, Surface Fatigue Strength, Methods to avoid surface fatigue.	07	17%
5	Creep : Creep phenomenon, Creep Curve, concept of True stress and true strain, Creep parameters, time-temperature parameters and life estimate under creep. Stress relaxation. Stress-Strain-Time relation, Creep deformation under varying stress, Component stress-strain analysis,	07	17%

Distribution of Theory Marks

Remembrance	Understanding	Application	Analyze	Evaluate	Create
10	10	20	15	25	20

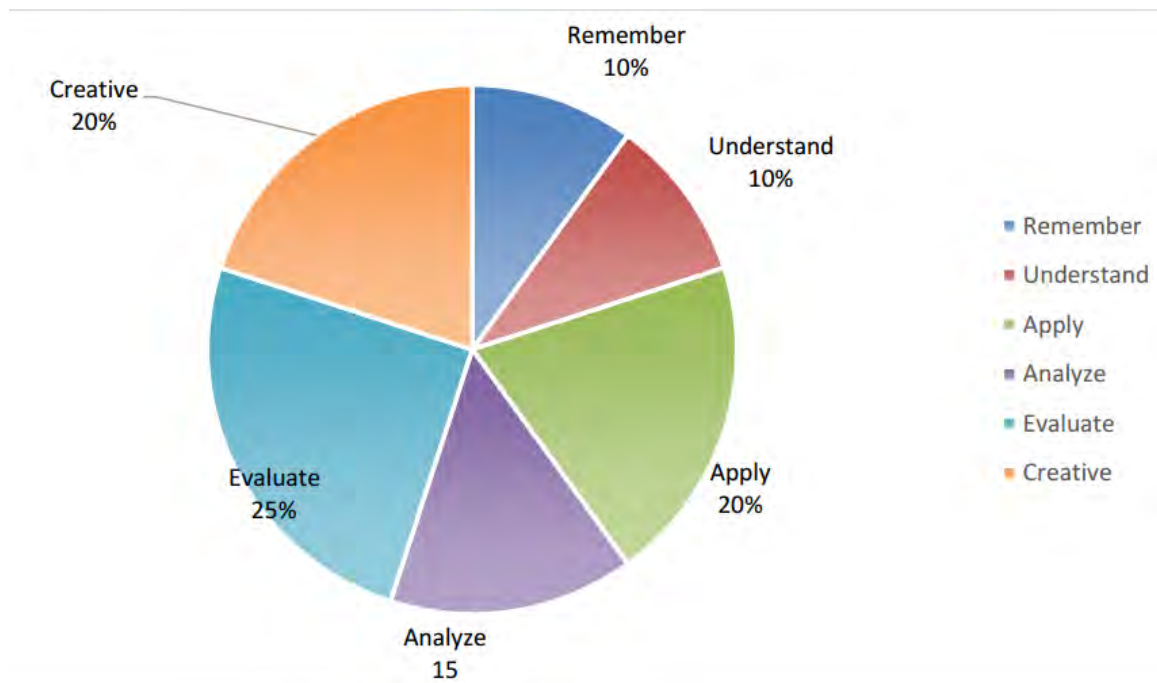
Syllabus for Bachelor of Technology

Reference Books:

1. Machine Design: An Integrated Approach Third addition Norton Pearson Education.
2. Fundamentals of Machine Design 5th Edition R C Juvinall & K M Marshek Wiley India.
3. Mechanical Design of Machine Elements and Machines: H Busby and G Stabb Wiley India.
4. Dislocations and Mechanical Behaviour of Materials M. N. Shetty PHI.
5. Mechanical Behaviour of Materials, 2nd Edition T H Courtney McGraw-Hill / Overseas Press India.
6. Metal Fatigue in Engineering R I Stephens, A Fatemi, R R Stephens and H O Fuchs. John-Wiley.
7. Elements of Fracture Mechanics Prashant Kumar McGraw-Hill.
8. Engineering Design Dieter, G McGraw-Hill
9. Mechanical Behavior of Materials: Engineering Methods for Deformation Fracture and Fatigue Fourth edition Dowling Pearson Education.

List of Experiments:

1. Students should be assigned at least five different case studies related to design of mechanical components which covers all kind of stresses. Students must use design data books and various design standards for design and selection of the components. Students must prepare detail design reports including necessary drawings.



Blooms level distribution