KL UNIVERISTY
FIRST SEMESTER 2010-11
Course Handout
Academic Division

Dated: 07-07-2010

Course No. : **ME C201**
Course Title : **Applied Mechanics**
Course Structure : **3-1-0**
Course coordinator : **G Durga Prasad**
Instructors : **Dr Sambasiva Rao, Prof B Raghu Kumar, Prof K Meera Saheb**

1. Course Description:

The course has been planed to known about Principle of Virtual Work, Equilibrium of ideal systems, Stable and un stable equilibrium systems – potential energy theory. Kinematics of rectilinear and curvilinear motion, principles of dynamics, differential equation of rectilinear and curvilinear motion – D'Alembert's Principle. Kinematics of rotation, equation of motion of a rigid body rotating about a fixed axis. Types of stresses and strains, stress - strain diagram, Hooke's law. **D**eflection of a axially loaded member, statically indeterminate structures (Stiffness method), Temperature effects. plane stress and strains, principle stress and maximum shear stress, Mohr's circle for plane stress. Torsion of a circular bars, Non uniform torsion, Transmission of power by circular shafts, Strain energy in pure shear and torsion.

2. Scope and Objective of the Course:

The main objective of this course in Applied mechanics should be to build a strong foundation, to acquaint the student with as many general methods t attack as possible and to illustrate the application of these methods to practical engineering problems. The student shall be in a position to solve problems on Kinematics and Dynamic analysis of rigid bodies in translation as well as rotation about a fixed axis. Later he shall use the Information in the analysis of Mechanics.

The concepts of stress and strains for isometric materials for one dimensions and for two dimension problems will be learnt. The concept of principle stress and graphical solution for principle stresses and maximum shear stress at a point will be learnt. Circular shafts subjected to torsion and show for analysis of stresses and deformation. Power transmission shafts and simple concepts of strain energy will be understood.

At the end of the course, the students feel confident of learning next higher courses on strength of materials and Kinematics and Dynamics of Machinery.

3. Books:

(i) Textbook:

a. Engineering Mechanics: Revised Fourth Edition (in Si Units) (special Indian Edition) by Stephen Timoshenko, D. Young, J Rao, Tata McGraw Hill,
b. Mechanics of Materials by Gere and Timoshenko, Second edition, CBS publishers.

(ii) Reference Book:

a. Engineering Mechanics by K.L.Kumar, Tata McGraw Hill, 2nd Edition
b. Strength of Materials – S.S.Rattan. Tata McGraw Hill,

4. Syllabus:

UNIT-I

Principle of Virtual Work: Equilibrium of ideal systems, Stable and un stable equilibrium systems – potential energy theory. Rectilinear translation: - **Kinematics of rectilinear motion, principles of dynamics, differential equation of rectilinear motion – D'Alembert's Principle**

UNIT-II

Curvilinear translation – Kinematics of curvilinear motion, differential equation of curvilinear motion – D'Alembert's Principle

Rotation of a rigid body about a fixed axis – Kinematics of rotation, equation of motion of a rigid body rotating about a fixed axis - Problems, Rotation under the action of a constant moment.

UNIT-III

Simple Stresses and Strains: Introduction, Types of stress, stress - strain diagram, Hookes law, types of strains,

Axially loaded members: Deflection of a axially loaded member, statically indeterminate structures (Stiffness method), Temperature effects,

UNIT-IV

Analysis of Stress and Strain: Introduction, plane stress and strains, principle stress and maximum shear stress, Mohr's circle for plane stress.

UNIT-V

Torsion: Introduction, Torsion of a circular bars, Non uniform torsion, Transmission of power by circular shafts, Strain energy in pure shear and torsion

5.Course Plan:

Course plan is meant as a guideline. There may probably be changes.

Lec No.	Learning Objective	Topics to be covered	Reference
1	Concepts of statics, displacement, work and virtual work. Physical sense of virtual work	Introduction	Refer lecture notes
2 3	Finding displacements and unknown reactions of system of all kinds under equilibrium	Equilibrium of ideal systems	T1-P 357-369
4	Understand the concept of stability and states of equilibrium with illustrative examples	Stable and unstable equilibrium systems	T1-P377-378
5	Concepts of stability	Potential energy theory	T1-P379
6	Concepts of dynamics, understand the concepts of Newton's laws	Principles of dynamics	T1-P404-406
7 8	Describe the motion of a particle on an axis in terms of its position, velocity and acceleration. Specialize the general kinematic equation for the case of rigid body.	Differential equation of rectilinear motion	T1-P407-420
9	Concept of resultant and real forces. Newton's	D'Alembert's	T1-P440-448

	second law, inertia force. Conversion of dynamic problem into static problem. Effect of external forces and acceleration. F B D of dynamic problem.	principle	
10	Derive the geometric properties of a plane curve in terms of the equation of the curve.	Kinematics of curvilinear motion	T1-P476-488
11 12	Concept of tangential, normal, acceleration and forces. Derive the geometric properties of a plane curve in terms of the equation of the curve.	Differential equation of curvilinear motion	T2-P488-493
13	Concept of inertia force and effect of external forces in curvilinear motion.	D'Alembert's principle	T1-P501-508
14 15	Describe the motion of a rigid body in terms of an angular velocity and angular acceleration associated with uniform and non uniform motion, tangential and normal acceleration.	Kinematics of rotation	T1-P523-528
16 17	Determine absolute and apparent displacements of a rigid body in terms of a rotation about a fixed axis as a result of external forces, tangential component of its inertia force, moments of inertia forces and resultant forces.	Equation of motion of a rigid body rotating about a fixed axis	T1-P528-533
18	Governing the equation for rotation of a rigid body rotating about a fixed axis, angular velocity, angular acceleration, Inertia couples.	Rotation under the action of a constant moment	T1-P534-541
19	State and illustrate examples about rigid body and deformable body, general meaning of stress and strain	Introduction	T2-P1
20 21	Compute stress intensities caused by applied loads in simple and compound sections	Types of stresses	T2-P3-8
22 23	Define and describe the elastic properties of materials	Stress-strain diagrams for different materials	T2-P9-18
24	State and apply Hooke's law, derive and state the relations between elastic constants	Hooke's law	T2-P19-23
25	Compute different strain expressions and their effect, relation between them	Types of strains	T2-P24-28
26 27	Explain the terms static determinancy, calculate the degree of indeterminancy and calculate the reactive forces in simple indeterminate systems	Statically intermediate structure	T2-P64-69
28	Compute stresses and strains due to temperature changes	Temperature effects	T2-P70-79
29	Concept of one dimensional and two dimensional stresses and strains.	Introduction to analysis of stress-strains	T2-P279
30 31	Determine the magnitude and nature of stresses on an oblique plane, derive the transformation equations for stresses in a plane stress system	Plane stress and strains	T2-P280-286
32 33 34	Derive the equations for principal stresses and the maximum plane shear stress and calculate their magnitudes and directions	Principal stresses and maximum shear stress	T2-P287-294
	Draw the Mohr circle for a plane stress system	Mohr's circle for	T2-P295-302

35 36 37	and interpret this circle, determine the principal stresses and strains analytically and graphically for a given set of plain stresses and determine the principal stresses	plane stress	
38 39	Draw the torque diagram for a shaft, explain the structural behaviour of members subjected to torque	Introduction	T2-P131
40 41	Derive and explain the torsion equation for axisymmetric sections, design shafts subjected to torque and calculate the stresses in composite shafts and design such shafts	Torsion of circular bars	T2-P131-137
42	For varying bar effect of torque and angle of twist	Non-uniform torsion	T2-P138-140
43 44	Derive an expression for power transmission, maximum power of tensions, effect of centrifugal tension	Transmission of power by circular shafts	T2-P148-151
45	Obtain expressions for strain energy stored in an element in pure shear and calculate the amount of strain energy stored in a bar	Strain energy in pure shear and torsion	T2-P155-160

6.Self learning material:

Unit	Topic	Source
I	Virtual work : Potential energy and stability	A text book of Engineering mechanics by J. L Meriam & L. G . Kraige third edition , Statics John wiley & Sons Inc Page No. 428 - 433
	Rectilinear Motion	A text book of Engineering mechanics by J. L Meriam & L. G . Kraige third edition , Dynamics John wiley & Sons Inc Page No. 17 – 26
II	Moment of Inertia of masses	A text book of Vector mechanics by Beer-Jhonston Seventh edition Mc. Graw Hill Page No. 507 – 514
	Moment of Inertia of some laminas	A text book of Vector mechanics by Beer-Jhonston Seventh edition Mc. Graw Hill Page No. 507 – 514
III	Mechanical Properties of Materials	A text book of Strength of Materials by R. Subramaniam Oxford Page No. 133 – 139
	Mechanical Properties of Materials	A text book of Strength of Materials by R. Subramaniam Oxford Page No. 133 – 139
IV	Relation between Elastic Constants	A text book of Strength of Materials by R. Subramaniam Oxford Page No. 113 – 114
	Relation between Elastic Constants of isotropic materials	A text book of Strength of Materials by R. Subramaniam Oxford Page No. 113 – 114
V	Statically Indeterminate Torsion Problems	A text book of Strength of Materials by L. S . Srinad MaC Millam India Ltd Page No126 -129
	Statically Indeterminate Torsion Problems	A text book of Strength of Materials by L. S . Srinad MaC Millam India Ltd Page No126 -129

7.Evaluation Scheme:

Component	Duration (minutes)	% Weightage	Marks	Date & Time	Venue
Test-1	50 Min	10	10	09-08-2010 9.30 to 10.20 A.M	CSE005,101,104 105,106,201,202 204,205,209,301 309,502,509
Test-2	50 Min	10	10	13-09-2010 9.30 to 10.20 A.M	CSE005,101,104 105,106,201,202 204,205,209,301 309,502,509
Assignement submission		5	5	Continuous	
Assignment Test	50 Min	5	5	25-10-2010 9.30 to 10.20 A.M	CSE005,101,104 105,106,201,202 204,205,209,301 309,502,509
Quiz	30 Min	5	5	25-10-2010 9.30 to 10.20 A.M	CSE005,101,104 105,106,201,202 204,205,209,301 309,502,509
Regular Lab Evaluation	Continuous	0	0		
Comprehensive Lab Exam	3 Hrs	0	0		
Comprehensive Exam	3 Hrs	60	60		
Attendance for Theory & Tutorial		5	5	Continuous	
Attendance for Lab		0	0	Continuous	

8. Chamber consultation hour: Informed in the class in first week.

9. Notices: All notices regarding the course will be put in E-learning website.

10.Tutorial: Tutorial will be conducted by the respective in charge faculty. The tutorials are planned to supplement the material taught in the lectures and clear doubts. Student must attend registered section for tutorial in the respective classroom. Class assignment, class tests and other evaluation components will also be conducted during tutorials. Students must actively participate in the tutorial and come prepared for it.

Course Coordinator