Course code	Course Name	L-T-P -Credits	Year of Introduction
ME211	MECHANICS OF SOLIDS AND MECHANICS OF MACHINES	3-1-0-4	2016

Prerequisite: Nil

Course Objectives

- To introduce various behavior of structural components under various loading conditions
- To impart the basics of machines and mechanisms.

Syllabus

Definition of stress, strain and their relations -Mechanisms –Cam -Spur gear –Gear trains- Sliding and Rolling Friction –friction drives - Applied and Constrained Forces - Dynamic force analysis – Balancing - Vibration

Expected outcome.

The student will be able to

   i.   understand the principles in the formation of mechanisms and their kinematics.

  ii.   understand the effect of friction in different machine elements.

 iii.   analyse the forces and toques acting on simple mechanical systems

 iv.   understand the importance of balancing and vibration.

Text Books:

1. Ambekar A.G., "Mechanism and Machine Theory" Prentice Hall of India, New Delhi, 2007
2. Shigley J.E., Pennock G.R and Uicker J.J., "Theory of Machines and Mechanisms", Oxford University Press, 2003
3. 4. R.S.Khurmi, J.K.Gupta, "Theory of Machines" S.Chand Publications.

References:

1. Martin, J.W., "Engineering Materials, Their properties and Applications", Wykedham Publications (London) Ltd., 1987.
2. Van Vlack.L.H., "Materials Science for Engineers", Addison Wesley, 1985.
3. Thomas Bevan, "Theory of Machines", CBS Publishers and Distributors, 1984.
4. Ghosh.A, and A.K.Mallick, "Theory and Machine", Affiliated East-West Pvt. Ltd., New Delhi, 1988.
5. Rao.J.S. and Dukkipatti R.V. "Mechanisms and Machines", Wiley-Eastern Ltd., New Delhi, 1992.
6. Ramamurthi. V, "Mechanisms of Machine", Narosa Publishing House, 2002
7. Robert L. Norton, "Design of Machinery", McGraw-Hill, 2004.
8. Titterton.G.,"Aircraft Materials and Processes", V Edition, Pitman Publishing Co., 1995.

Course Plan			
Module	Contents	Hours	Sem.ExamMarks
I	Definition of stress, strain and their relations relations between material constants – axial loading	4	15%
	statically determinate and indeterminate problems in tension & compression -plane truss analysis	4	
	Method of joints – method of sections – 3-D trusses – thermal stresses – impact loading.	4	

	Mechanisms – Terminology and definitions	2	
II	kinematics inversions of 4 bar and slider crank chain – kinematics analysis in simple mechanisms – velocity and acceleration polygons	4	
	Analytical methods– computer approach.	2	15%

| **FIRST INTERNAL EXAMINATION** |||||

III	Cams – classifications – displacement diagrams - layout of plate cam profiles– derivatives of follower motion – circular arc and tangent cams.	3	
	Spur gear – law of toothed gearing – involute gearing – Interchangeable gears	3	15%
	Gear tooth action interference and undercutting – nonstandard teeth	2	
IV	Gear trains – parallel axis gears trains – epicyclic gear trains – automotive transmission gear trains.	2	15%
	Sliding and Rolling Friction angle – friction in threads	2	
	Friction Drives – Friction clutches – Belt and rope drives – brakes – Tractive resistance.	3	

| **SECOND INTERNAL EXAMINATION** |||||

V	Applied and Constrained Forces – Free body diagrams – static Equilibrium conditions – Two, Three and four members - Static Force analysis in simple machine members	4	20%
	Dynamic Force Analysis –Inertia Forces and Inertia Torque	3	
	D'Alembert's principle – superposition principle – dynamic Force Analysis in simple machine members.	3	
VI	Static and Dynamic balancing – Balancing of revolving and reciprocating masses- Balancing machines	4	20%
	Free vibrations – Equations of motion – natural Frequency	3	
	Damped Vibration – critical speed of simple shaft – Torsional vibration – Forced vibration – harmonic Forcing – Vibration isolation.	4	

| **END SEMESTER EXAM** |||||

Question Paper Pattern

Maximum marks: 100,   Exam duration: 3 hrs

The question paper shall consist of three parts

Part A

4 questions uniformly covering modules I and II. Each question carries 10 marks
Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

Part B

4 questions uniformly covering modules III and IV. Each question carries 10 marks
Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

Part C

6 questions uniformly covering modules V and VI. Each question carries 10 marks
Students will have to answer any four questions out of 6 (4X10 marks =40 marks)

Note: In all parts, each question can have a maximum of four sub questions, if needed.