052 ME 33 Theory of Machines

Introduction

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About the Course …

- Delivery Form/practicalities …
- Content/Coverage …
- Assessment (Tests, Exam & Assignments …)

About the course …

Theory of Machines

Machine …

- Is a tool
- Usually contains one or more parts or mechanisms
- Uses energy to perform the intended action(s)/provide force and transmit power

- … is defined as the branch of engineering science, which deals with the study of relative motion between the various parts of a machine, and forces which acts on them….
- Knowledge acquired is essential for an engineer in designing various parts of a machine ..

Delivery Form

Semester III							
Module Code	Module Name	Hour Distribution					Credits
		IS	A	L	T	P	
052 MA 31	Engineering Mathematics III	3	1	5	1	-	15
052 ME 32	Engineering Thermodynamics	2	1	4	1	-	12
052 ME 33	Theory of Machines	2	1	4	1	-	12
052 ME 34	Design and Drawing of Machine Element	2	1	4	1	-	12
052 ME 35	Fluid Mechanics and Machinery	2	1	4	1	-	12
052 ME 36	Engineering Materials and Metallurgy	2	1	4	1	-	12
052 CE 37	Fluid Mechanics and Machinery Laboratory	2	2	-	-	2	9
052 CE 38	Computer Aided Machine Drawing	2	2	-	-	2	9
052 IP 01	Industrial Practical Training I (4 weeks)	-	-	-	-	-	10
Total Contact Hours=(35hrs/week*15week)=525hrs+405hrs		**17**	**10**	**25**	**6**	**4**	
Total Credits							**103**

Delivery Form

How the course is structured and how it will be run ...

- Theoretical lectures (4 hrs./week)
- Labs & demonstrations (1 hrs./week
- Independent Study (IS) + Assignments/Home works (A) (3 hrs./week)

November, 2020 — Weekly classes — January 2021

Delivery Form

Labs & demonstrations ….

Some common mechanisms

Contents ..

Unit I: Basics of Mechanisms

- Terminology and definitions - degree of freedom/ mobility (Kutzbach criterion & Grashoff's Law) Kinematic Inversions of 4-bar chain and slider crank chains – Mechanical advantage – Transmission angle – Description of common mechanisms – single, double and offset slider mechanism – quick return mechanism – snap-action mechanism – Linear actuators – motion adjustment mechanism, clamping mechanisms – ratchets and escapements – Indexing mechanisms, rocking mechanisms – straight linear generators – design of crank – rocker mechanisms.

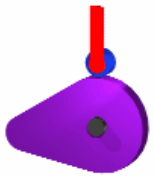
Contents ..

Unit II: Kinematics

- Displacement, velocity, and acceleration and analysis in simple mechanisms – graphical methods, velocity and acceleration polygons – Instantaneous center of velocity – angular velocity ratio theorem – Kinematics analysis by algebraic methods – complex algebra methods – vector approach, computer applications in the kinematics analysis of simple mechanisms – Coincident points – Coriolis acceleration

- Kinematics … branch of mechanics concern with motion of objects without consideration of masses (of these objects) or forces that causes motion

Contents ..



Unit III: Kinematics of Cam

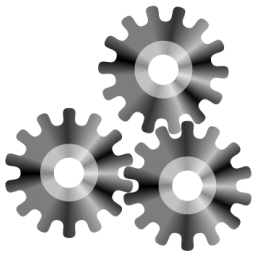
- Classifications – Displacement diagrams – parabolic simple harmonic and cycloidal motions – Layout of plate cam profile – Derivatives of Follower motion – High speed cams – circular arc and tangent cams – Standard cam motion – Pressure angle and undercutting

- Cam …a (rotating or sliding) piece of mechanical linkage
- Typically used to transform rotary motion into linear motion or vice versa
- Can be an eccentric wheel or disc, a cylinder with irregular shape that strikes a lever (cam follower)

Contents ..

Unit IV: Gears

- Spur gear: terminology and definitions – fundamental law of toothed gearing and involute gearing – interchangeable gears – gear tooth action – terminology – interference and undercutting - non standard gear teeth – helical, bevel, worm, rack and pinion gears (basics only) – gear trains – parallel axis gear train – epicyclic gear trains – differentials – automotive transmissions gear trains



- Gear…a rotating machine part having cut teeth
- Usually meshes with another toothed part...
- Work together to alter the relation between speed of a driving mechanism (such as the engine or crank shaft)) and the speed of the driven parts (such as the wheel)

Contents ..

Unit V: Friction

- Surface contacts – sliding and rolling friction – friction angle – friction in screws with square thread – Friction in V threads – Friction drives – Belt and rope drives, friction aspects in Brakes – Friction in the propulsion and braking of vehicles – Tractive resistance.

- Friction …
- Is the force resisting the relative motion of solid surfaces (.. also fluid layers & other materials).

Learning Objectives...

After completion of this course, students should be able to:

- Identify mechanical mechanisms used in machines.
- Perform basic analyses of common mechanical mechanisms.
- Explain basic kinematics concepts (displacement, velocity & acceleration); perform kinematic analysis in simple mechanisms.
- Identify types of cams; describe/develop various cam motion profiles & follower mechanisms.
- Identify types of gears; explain the importance and practical applications of gear trains.
- Name types of friction, distinguish friction based drives such as belt and rope drives, explain effects of friction in machine elements such as screws with square thread, V threads, and brakes.
- Analyze dynamic (position, velocity, acceleration, force and torque) characteristics of mechanisms such as linkages and cams.
- Design and optimize mechanism to perform a specified task.

References ...

- **Books**
  - Shigley J. E. and Uicker J., 2007 Theory of Machines and Mechanisms", McGrawHill Inc., New Delhi
  - Thomas Bevan, 2008, "Theory of Machines", CBS Publishers & Distributors, New Delhi
  - Ghosh A. and Mallick A. K., 2008 "Theory of Mechanisms and Machines", Affiliated East-West Pvt. Ltd., New Delhi
  - Rattan S. S., 2000, "Theory of Machines", Tata McGraw Hill Publishing Company Ltd, New Delhi.
  - Rao J. S. and Dukkipati R. V. 2008, "Mechanisms and Machines Theory", Wiley-Eastern Limited, New Delhi
  - John Hannah and Stephens R. C., 2009 "Mechanics of Machines", Viva Low-Prices Students Edition, Chennai.

Assessment ..

Continuous Assessment Tests (CAT)

- 1st Test – 6th Week
- 2nd Test – 12th Week

Final Examination

- End of Semester Exam – 14th Week

Assignments

- Submission: 6th & 14th Week

Lesson 1 Revision Problems

1. Define the following terms:
   a) Machine,
   b) Kinematics
   c) Cam
   d) Gear
   e) Friction

Finally...

Visit ...

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End...