**ADDIS ABABA UNIVERSITY**

**ADDIS ABABA INSTITUTE OF TECHNOLOGY**

**SCHOOL OF MECHANICAL & INDUSTRIAL ENGINEERING**

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**Course Title :** Mechanisms of Machinery **Course No. :** Meng 3071

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**Course Objective**

The course enables students to understand:

* The different types of linkage mechanisms used in mechanical design
* The kinematic and kinetic analysis and design of machinery
* Computer method for kinematic and kinetic analysis of mechanisms;
* Design and analysis of cams, universal joints, governors, gear trains, flywheels and gyroscopes; and
* Balancing of rotating and reciprocating machines

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**Course outline**

1. **Introduction**
2. **Linkages**
   1. Four bar linkage
   2. Slider-crank mechanism
   3. Scotch Yoke mechanism
   4. Quick-Return mechanism
   5. Toggle mechanisms
   6. Straight line mechanisms
   7. Parallel mechanisms
   8. Intermittent motion mechanisms
   9. Steering Gear mechanisms
3. **Velocity analysis of linkages**
   1. Velocity analysis by vector Mathematics
   2. Velocity analysis by using Equations of Relative motion
   3. Velocity Analysis by complex numbers
   4. Analysis of velocity vectors by instant-center method
4. **Acceleration analysis of linkages**
   1. Acceleration analysis by vector Mathematics
   2. Acceleration analysis by using Equations of Relative motion
   3. Acceleration Analysis by complex numbers
5. ***Introduction to computer methods for kinematic analysis of linkages***
6. **Cam design**
   1. classification of followers
   2. classification of cams
   3. graphical design of cam curves
   4. nomenclature
   5. displacement diagram
   6. types of follower motion
   7. analytical cam design
   8. tangent cam with reciprocating roller follower
7. **Universal Joints**
   1. velocity ratio of shaft
   2. polar angular velocity diagram
   3. coefficient of speed fluctuation
   4. angular acceleration of driven shaft
   5. double hooke’s joint
8. **Governors**
   1. classification of governors
   2. Centrifugal governor
   3. The porter governor
   4. Hartnel governor
   5. The centrifugal Shaft governor
   6. Inertia governor
9. **Gear trains**
   1. angular velocity ratio
   2. types of gear trains
   3. reverted gear train
   4. planetary gear train
   5. methods of analysis of planetary gear trains
   6. automotive differential
   7. planetary gear trains with two inputs
10. **Introduction to synthesis of machinery**

10.1 Dimensional synthesis of mechanism; motion, path and function generation, precision point approach, Chebyshev spacing

10.2 Three position synthesis, graphical approach for four link mechanisms.

10.3 Advanced synthesis solutions, branch and order defects

10.4 Analytical methods, straight line mechanisms

1. **Force analysis of machinery**

11.1 Superposition method

11.2 Use of Transverse and Radial component method

11.3 Virtual work method

1. **Flywheels**

12.1 fly wheel size

12.2 engine output torque

1. **Balancing of rotating and reciprocating masses**
2. **Gyroscopes**

**References:**

Alem Bazezew, Mechanisms of Machinery, Addis Ababa University Press, 2001(Text Book)

1. Norton, Robert L., “Design of machinery”, WCB/McGraw-Hill, 1999
2. Meriam, J.L., Kraige, L.G., “Engineering Mechanics Dynamics”, John Wiley, 1992
3. Shigley, J.E., Uicker, J.J., “Theory of Machines & Mechanisms”, McGraw-Hill, 1995
4. Kurmi, R.S, Gupta, J.K., “Theory of Machines”, Eurasia Publishing House, 1983

**Evaluation:**

* + Assignment 15%
  + Mid Examinations 30%
  + Projects and Seminars 20 %
  + Final Examination 35%