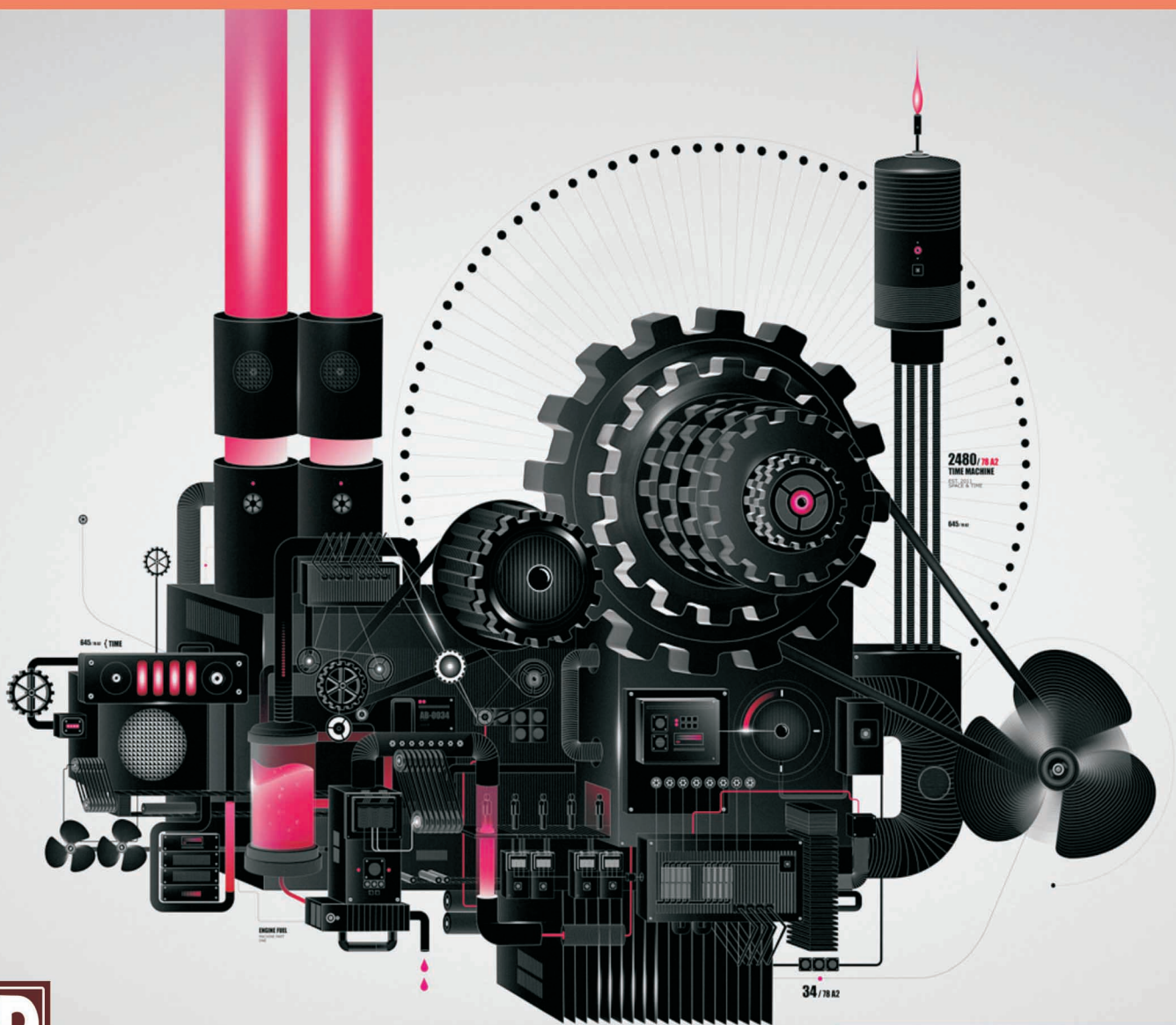


# THEORY OF MACHINES-I

(Kinematics of Machines)

(SI Units)

(Strictly as per the latest syllabus prescribed by U.P.T.U., U.P.)



Dr. R.K. Bansal

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## **(Kinematics of Machines)**

(In SI Units)

*For*

**BE/B.Tech. 3rd YEAR**

*(Strictly as per the latest syllabus prescribed  
by U.P.T.U., U.P.)*

*By*

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# SYLLABUS

B. Tech. V Semester

(EME 502 : THEORY OF MACHINES – I)

L	T	P
3	1	0

## UNIT I

### Introduction 5

Links – types, Kinematics pairs – classification, Constraints – types. Degrees of freedom of planar mechanism, Grubler's equation linkage mechanisms, inversions of four bar chain, slider crank chain and double slider crank chain.

### Velocity in Mechanisms 3

Velocity of point in mechanism, relative velocity method; Velocities in four bar mechanism, slider crank mechanism and quick return motion mechanism, Rubbing velocity at a pin joint, Instantaneous center method. Types and location of instantaneous centers, Kennedy's theorem, Velocities in four bar mechanism and slider crank mechanism.

## UNIT II

### Acceleration in Mechanisms 4

Acceleration of a point on a link, Acceleration diagram, Coriolis component of acceleration, Crank and slotted lever mechanism, Klein's construction for Slider Crank mechanism and Four Bar mechanism, Analytical method for slider crank mechanism.

### Mechanisms with Lower Pairs 5

Pantograph, Exact straight line motion mechanisms – Peaucellier's, Hart and Scott Russell mechanisms, Approximate straight line motion mechanisms – Grass-Hopper, Watt and Tchebicheff mechanisms, Analysis of Hooke's joint, Davis and Ackermann steering gear mechanisms.

## UNIT III

### Friction 6

Laws of friction, Friction on inclined plane, Efficiency on inclined plane, Friction in journal bearing – friction circle, Pivots and collar friction – uniform pressure and uniform wear, Belt and pulley drive, Length of open and cross-belt drive, Ratio of driving tensions for flat belt drive, centrifugal tension, condition for maximum power transmission, V belt drive.

### Brakes and Dynamometers 3

Shoe brake, Band brake, Band and Block brake, Absorption and transmission type dynamometers.



#### **UNIT IV**

##### **Cams**

**7**

Cams and Followers – Classification and terminology, Cam profile by graphical methods with knife edge and radial roller follower for uniform velocity, simple harmonic and parabolic motion of followers, Analytical methods of cam design – tangent cam with roller follower and circular cams with flat faced follower.

#### **UNIT V**

##### **Gears and Gear Trains**

**7**

Classification and terminology, law of gearing, tooth forms and comparisons, Systems of gear teeth, Length of path of contact, contact ratio, interference and under cutting in involute gear teeth, minimum number of teeth on gear and pinion to avoid interference, simple, compound, reverted and planetary gear trains, Sun and planet gear.

**1.1. DEFINITION**

Theory of Machine is that branch of science which deals with the study of relative motion between the various parts of a machine, and forces which act on them. Theory of machine may be divided into *kinematics* and *dynamics*.

**Kinematics** is that branch of theory of machine which deals with the study of relative motion between the various parts of the machines. Here the various forces involved in the motion, are not considered. Thus kinematics is the study to know the displacement, velocity and acceleration of a part of the machine.

**Dynamics** is that branch of theory of machine which deals with the study of various forces involved in the various parts of the machine. The forces may be either static or dynamic.

Dynamics is further divided into *kinetics* and *statics*. Kinetics is that branch of theory of machine which deals with various forces when the body is moving whereas statics is that branch of theory of machine which deals with various forces when the body is stationary as shown in Fig. 1.1.

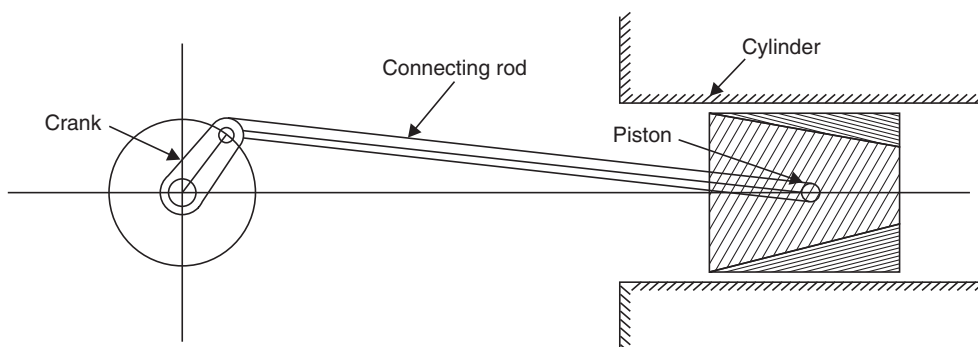
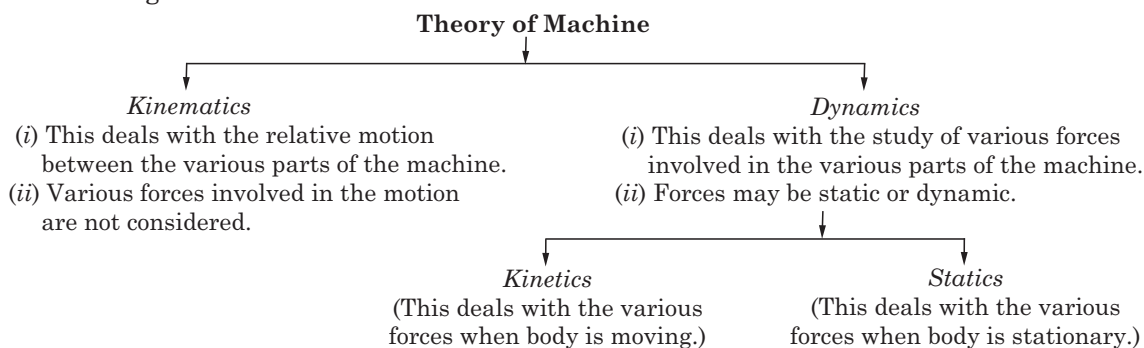
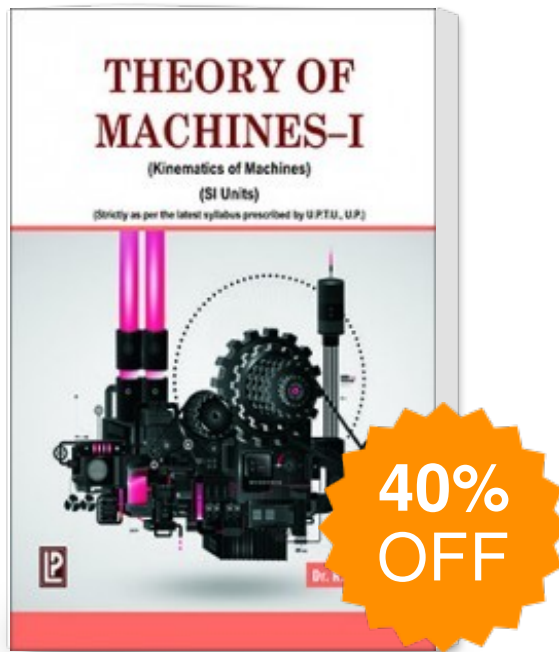


Fig. 1.1 (a)

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