4039 - THEORY OF MACHINES

Teaching Schedule Per Week			Progressive Assessment		Examination Schedule (Marks)			
Lectures	Practical	Credits			Theory		Practical Ex.	Total
4	2	6	25	25	3 Hrs.	100	-	150
Pre-requisite		Source						
2006		MEC						

Semester	Theory	Test	Total	TW	PR	Gr Total
	75	25	100	25	–	125

Rationale:- In this machine age it is necessary to know the mechanism of machines. The number of links transmitting forces and motion comprise mechanisms. The subject shall deal with geometry of the mechanism as well as with the forces that are acting and transmitting. This shall involve the knowledge of velocity and acceleration of links, inversion of mechanism, different power drives and power transmission equipment. The scope of the course shall be to deal with kinematics and dynamics of machines, role of friction, power transmission and application of cams in machines and engines.

Objectives: to understand machines and mechanisms and their applications in practice, to study power transmission system, friction brakes and dynamometers. Mathematics is to be linked to understand the mechanisms only.

COURSE CONTENTS	Hrs.	Mks
1. KINEMATICS OF MACHINES Definition-kinetics, kinematics of machines, scope, purpose and application of machines. Kinematic link or element, kinematic pairs and their classification, degrees of freedom. Kinematic chain, mechanism, inversion of mechanism inversion of four bar chain, inversion of single slider crank chain, inversion of double slider crank chain, practical application of quick return mechanisms.	6	10
2. VELOCITY AND ACCELERATION 2.1 Displacement, velocity and acceleration - time curves. 2.2 Relative velocity and relative acceleration of a point in the link, angular velocity and angular acceleration. 2.3 Drawing of velocity and acceleration diagram when configuration diagram of a mechanism is given. 2.4 Determination of velocity and acceleration of points on the links in mechanisms with the help of velocity and acceleration diagrams. Analytical method and Klien's construction for determining velocity and acceleration of piston in reciprocating engine mechanism. (Coriolis component of acceleration is excluded)	9	16
3. FLY WHEEL 1 Piston effort, Crank effort diagram. 2 Turning moment on crank-shaft, fluctuation of speed and fluctuation of energy, moment of inertia and weight of fly wheel. (No numerical problems to be asked)	3	4
4. GOVERNORS 1 Function of Governor, its comparison with flywheel. 2 Types of Governors - centrifugal and inertia types. (No mathematical treatment) Definitions: 1. Sensitiveness, 2. Stability 3. Isochronism, 4. Hunting, 5. Governor effort and power	4	8
5. FRICTION 1. Friction of a screw and nut 2 Friction in flat collared and pivot-bearings, uniform pressure and uniform wear assumptions, power, loss due to friction. Types of thrust bearings and power loss due to friction in thrust bearings and power transmitted by single plate disc clutch.	6	8
6. ROPE & BELT DRIVE 1. Law of belts & belt materials 2. Determination of belt length, velocity ratio. 3. Ratio of tensions on tight and slack sides for flat, V belts and ropes, Belt slip and creep. 4. Effect of centrifugal tension on power transmission. Condition for maximum power to be transmitted, initial tension. 5. Determination of cross-sectional dimensions of belt.	10	12

7. GEAR & GEAR TRAIN	6	8
1. Introduction, Law of gears.		
2. Types of tooth gears and their selections for different applications. Gear terminology and construction of involute gear tooth-profile.		
3. Gear trains, simple and compound, train value.		
8. BRAKES & DYNAMOMETERS	7	12
1. Definition, classification and comparison of brakes and dynamometers.		
2. Construction and working of following brakes:		
i) Block brakes (numerical problems) – single shoe, double shoe.		
ii) Band brakes (numerical problems), iii) Band and block brake		
iv) Internal expanding shoe brake, v) Hydraulic and vacuum brakes.		
3. Construction and working of following dynamometers: Prony-brake dynamometers, Rope brake dynamometers, Transmission type dynamometers, Hydraulic dynamometers.		
9. CAMS AND FOLLOWERS	7	12
1. Types of cams and followers.		
2. Drawing of profile of plate cams, with following types of reciprocating followers and motion. Followers: i) Knife edge, ii) Roller follower (with offset also)		
3. Motion: i) Uniform velocity, ii) (SHM) Simple harmonic motion, iii) Uniform acceleration and retardation		
10. GYROSCOPE	2	4
Its function and application		
11. BALANCING & VIBRATION	4	6
Balancing of revolving masses in a plane and masses in two parallel planes		
Vibration: Introduction, definition & types of vibration.		
Total	64	100

TERM WORK

The term work shall be presented in the form of a journal based on study experiments and three Drawing sheets of the following study experiments:

1. Study of inversion of four bar, single slider crank and double slider crank mechanisms.
2. Study of cams and followers.
3. Study of clutches.
4. Study of gearbox of an automobile.
5. Study of different types of brakes and dynamometers.
6. Study of different types of Governors.
7. Comparative study of following power drives. i) Belt, ii) Rope, iii) Chain, iv) Gear.
8. Drawing sheets i) Construction of velocity and acceleration diagrams (three problems)
   ii) Construction of profiles of the cam with different followers and motions (three problems)
   iii) Drawing of involute gear tooth profile of a pinion and spur wheel in mesh or rack and pinion in mesh

REFERENCE BOOK

1. Theory of Machines, by R. S. Khurmi
2. Theory of Machines, by P. L. Ballaney (Khanna publishers)
3. Theory of Machines, by S.K.Shah and Dr.Jagdishlal, Metropolitan Book Co. Pvt.Ltd, Faiz Bazaar, Delhi 6
4. Theory of Machines, by Pandya and Shah
5. Theory of Machines, by Beevan