GUJARAT TECHNOLOGICAL UNIVERSITY
DIPLOMA ENGINEERING (INTERDISCIPLINARY)

Semester - I

SUBJECT CODE : 310030   (w.e.f. 4th August,2011)

SUBJECT NAME : ENGINEERING MECHANICS

RATIONALE :

Engineering Mechanics is a branch of Applied Science where laws of physics are applied to solve engineering problems. Broadly speaking Engineering Mechanics can be classified in two categories-Static and Dynamics.

In this course, an attempt has been made to apply different laws of science to solve Static and Kinematic problems. An attempt is also made to strengthen the knowledge of students, so as to make the path for applied technologyl subjects smoother and logical.

3. OBJECTIVES:

1. Explain the term: vector and scalar, giving examples of each.
2. Explain different system of Units.
3. Explain various system of forces and transmissibility and superposition of forces.
4. Develop the concept of Resultant and equilibrant using parallelogram of forces
5. Develop the concept of composition and Resolution of force.
6. Explain graphical methods, Lami's theorem.
7. Develop the concept of Moment and Couple
8. Explain statically determinate beams and reactions.
9. Distinguish between Centroid and Centre of Gravity.
10. Develop the concept of moment of area.
11. Develop the concept & phenomenon of friction & various terms related to it.
12. Develop the concept of rectilinear motion & V-T diagram.
13. Explain the principles related to motion of projectile & engineering problems related to trajectory of projectile.
14. Explain the concepts & principles related to Curvilinear motion.
15. Explain importance of centripetal & centrifugal force,superelevation, wheel reactions, skidding, overturning of vehicle moving on a level path.
16. Explain the concept of Work, Power & Energy.
17. Explain the method of computing work, power of typical engines, K.E. and P.E.

18. Explain & develop the concept of working of various simple machines & different terms related to it.

19. Explain law of machines & develop the concept of reversibility of machines, reversible & non-reversible machines.

Sr. No.	Subject Content	Hrs.

1.	**INTRODUCTION**
	    1.1 Scalar and Vector quantities.
	    1.2 Scope of Engg. Mechanics.
	         - Static
	         - Dynamics (a) Kinetics (b) Kinematics
	    1.3 Different systems of units-Conversions-, Abbreviations.
		1

2.	**COPLANAR CONCURRENT FORCES :**
	    2.1 Forces, Units of Force, elements, Principles of superposition, Principle of transmissibility.
	    2.2 Composition and resolution of forces, Resultant conditions of equilibrium, Analytical and graphical method, Law of parallelogram of forces, law of triangle of forces, law of polygon of forces, Lami's theorem-problems.
		8

3.	COPLANER, PARALLEL AND NON-CONCURRENT FORCES
	3.1 Moment, Couple, Principal of moment, application, properties of couple, numerical problems
	3.2 Conditions of Equilibrium
	3.3 Reaction of beams by **analytical method only**
	    - Statically determinate beams
	    - Types of supports
	    - Types of loading
	    - Problems
		6

4.	CENTROID & CENTRE OF GRAVITY
	4.1 Centroid
	    - Axis of symmetry
	    - Centroid of standard shapes
	    - Sections like I, L, T, Channel etc.
		4

	- State formula to find centroid of plane sections
	- Problems
	4.2 Centre of Gravity (C.G)
	  - Axis of symmetry
	  - C.G. standard solids
	  - State formula to find C.G. of solid sections
	  - Problems	

5.	**FRICTION** 5.1 Friction, law of friction, coefficient of friction, angle of friction, angle of repose - Types of friction 5.2 Application of Lami's theorem and theory of resolution of forces - Problems on Friction for a block resting on horizontal plane & inclined plane.	4

6.	**RECTILINEAR MOTION :**
	6.1 Kinetics, Kinematics.
	  - Velocity, Average Velocity, Uniform Velocity, Speed, Displacement, Acceleration, Retardation.
	  - $v = u + at,\ v^2 = u^2 + 2as,\ s = ut + 1/2\ at^2$
	6.2 Draw V-T diagram.
	  - Problems, motion under gravity.
		4

7.	**MOTION OF PROJECTILES :** 7.1 Trajectory range, maximum range, angle of projection, time of flight, Maximum height different equations of projectile. 7.2 Engineering problems.	2

8.	CURVILINEAR MOTION 8.1 Angular displacement, angular velocity, angular acceleration and retardation, tangential velocity, equations. 8.2 Problems 8.3 Explain Centrifugal and centripetal forces - Explain skidding, over turning, thrust on rails - Explain super-elevation and its importance, state expression for super-elevation	5

9.	**WORK-POWER- ENERGY**
	
	    9.1 Work
	
	        - Workdone, force-displacement diagram Workdone in stretching the compound spring Torque, workdone by torque.
	
	    9.2 Power
	
	        - I.H.P., B.H.P. of engine
	
	        - Equation of H.P. in terms of torque and R.P.M.
	
	        - Engineering Problems on it.
	
	    9 . 3 E- nergyKinetic and potential energy & Engg. problems on it
		4

10.	**SIMPLE MACHINES :**
	
	    10.1 Mechanical Advantage, V.R., Efficiency, line sketch of different systems of pulley blocks, simple and compound levers, simple machines, problems.
	
	    10.2 Laws of Machines.
	
	    10.3 Reversible, Non-reversible machines.
		4

	Total	42

LABORATORY EXPERIENCES

Sr. No.   **Name of Experiments**

    1.   Law of parallelogram of forces.

    2.   Law of Triangle of forces (Lamy's theorem, Unknown weight)

    3.   Law of polygon of forces.

4. Law of parallel Forces. (Reactions of Beam-couple)
5. Centroid of given laminar
6. Law of machine of given machine. Simple screw

   jack. (Analytically, graphically)
7. Verify velocity ratio for different simple

   machine. (1) Wheel - Axle (2) Simple

   purchase crab.

   (3) Simple screw jack.
8. Determine M.A., efficiency, Ef, F, for double purchase crab.
9. Draw and study of graph for wheel and different axle.

   (a) W - P   (b) W - n (c) W - Pf   (d) W - F.
10. Draw V - T diagrams for different combinations of (a) Velocities

   (b) Uniform accelerations as well as (c) Uniform retardations
11. Demonstration of Non - concurrent Non parallel forces. (Funicular diagram.)

REFERENCES :

1. Applied Mechanics   - by R.S.Khurmi.
2. Applied Mechanics   - by Dadhe, Jamdar & Walavalkar.
3. Engineering Mechanics   - by S.B.Junarkar.
   For Diploma Students
4. Applied Mechanics   - by I.B.Prasad.
5. Applied Mechanics   - by Ramamrutham.