

GUJARAT TECHNOLOGICAL UNIVERSITY

NAME OF COURSE : THEORY OF MACHINE AND STRENGTH OF MATERIALS

1. RATIONALE

Knowledge of this subject is essential in design, production and maintenance functions. The students learn the fundamental principles and basic concepts about various types of Machines, Mechanism of automobile components / Units.

2. SCHEME OF TEACHING :

[A] SECTION - I

TOPIC NO.	NAME OF TOPIC	NO. OF HOURS		
		LECT.	PRACT.	TOTAL
1.	Introduction to mechanics of machine	04	--	04
2.	Velocity & acceleration diagram	04	--	04
3.	Friction	06	--	06
4.	Power transmission	06	--	06
5.	Flywheel & governor	04	--	04
6.	Cam and cam-profile	04	--	04
TOTAL		28	--	28

[B] SECTION - II

TOPIC NO.	NAME OF TOPIC	NO. OF HOURS		
		LECT.	PRACT.	TOTAL
1.	Direct stress and strain	10	14	24
2.	Shear force and bending moment	04	04	08
3.	Stresses in beam	04	--	04
4.	Deflection of beam	04	--	04
5.	Torsion and spring	06	10	16
TOTAL		28	28	56

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3. TECHNOLOGY RELATED SKILLS (TRS) & ENABLING OBJECTIVES :

TRS - 1.0 : APPLY THE CONCEPTS OF VARIOUS FORCES, STRESSES AND DEFLECTIONS TO AUTOMOBILE COMPONENTS / UNITS.

- EO'S -
- 1.1 Understand the stress analysis
 - 1.2 Calculate shear force and bending moment
 - 1.3 Understand and calculate various types of stresses acting on beam
 - 1.4 Calculate deflections of beam

TRS - 2.0 : APPLY THE PRINCIPLES OF MECHANISM TO AUTOMOBILE COMPONENTS.

- EO'S -
- 2.1 Describe different mechanism
 - 2.2 Explain concepts and application of friction
 - 2.3 Know and understand torsion
 - 2.4 Calculate torsion in shaft
 - 2.5 Know and understand various types of springs
 - 2.6 Understand the various types of transmission units
 - 2.7 Select the most suitable unit
 - 2.8 Understand the flywheel
 - 2.9 Understand various types of governors
 - 2.10 Appreciate the use of governors
 - 2.11 Prepare velocity and acceleration diagram
 - 2.12 Explain the function of various types of cam & follower.
 - 2.13 Construct cam profile

4. COMMUNICATION SKILLS :-

- 1. Deliver a talk on a topic fluently and confidently.
- 2. Describe an object, process or procedure.
- 3. Write assignments (Classroom, library, home).

5. TOPICS AND SUB-TOPICS

HOURS.

[A] SECTION - I :

TOPIC :	1.0 INTRODUCTION TO MECHANICS OF MACHINE	04
	1.1 Different types of mechanism	
	1.2 Basic terminology related to machines and mechanism	

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	1.3	Development of different mechanism - Four bar mechanism - Slider crank mechanisms - Inversions	
TOPIC :	2.0	VELOCITY AND ACCELERATION DIAGRAM	04
	2.1	Basic concept used in solving velocity and acceleration problems by - Klein's Construction - Graphical Method	
TOPIC :	3.0	FRICTION	06
	3.1	Introduction and basic concepts of friction	
	3.2	Application of friction in bearing collars, brakes, clutches, considering uniform wear and uniform pressure condition.	
TOPIC :	4.0	POWER TRANSMISSION	06
	4.1	Introduction : need, modes and application	
	4.2	Rope and belt drive system, its terminology, ratio of tensions and calculation of power	
	4.3	Gear drive system, its terminology, types,application ; gear train and calculation of gear ratio	
	4.4	Chain drive system, its terminology, application and calculation of power.	
TOPIC :	5.0	FLY WHEEL AND GOVERNOR	04
	5.1	Turning moment diagram and torque determination	
	5.2	Co-efficient of fluctuation of speed and energy	
	5.3	Fly wheel, its functions, moment of inertia and weight calculation	
	5.4	Governor, its functions, types and related terminology	
TOPIC :	6.0	CAM AND CAM PROFILE	04
	6.1	Introduction, function and types of cams and cam followers	
	6.2	Types of motors and displacement of various cams and followers	
	6.3	Preparation of different types of cam profile	

[B] SECTION - II :

TOPIC :	1.0	DIRECT STRESS AND STRAIN	10
	1.1	Types of stress and strain - Direct stress : tensile, compressive, shear - Linear strain - Lateral strain - Shear strain	
	1.2	Relation between stress and strain	
	1.3	Hook's law and modulus of elasticity	
	1.4	Effect of temperature on material	
	1.5	Stresses in a thin cylinder	
TOPIC :	2.0	SHEAR FORCE AND BENDING MOMENT	04
	2.1	Terms related with SF & BM	
	2.2	Shear force and bending moment diagram for	

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	- Cantilever - Simply supported - Over hung beam	
TOPIC :	3.0 STRESSES IN BEAM	04
	3.1 Bending equation	
	3.2 Stress distribution	
TOPIC :	4.0 DEFLECTION OF BEAM	04
	4.1 Concepts of slope and deflection	
	4.2 Slope and deflection for : - Simply supported beam - Cantilever	
TOPIC :	5.0 TORSION AND SPRING	06
	5.1 Theory associated with torsion	
	5.2 Various terms related to torsion	
	5.3 Effect of torsion	
	5.4 Relationship of Horsepower, torque and RPM	
	5.5 Stiffness of spring	
	5.6 Types of spring	
	5.7 Effect of Load on spring	
TUTORIALS :		
1.	SF and BM calculation and diagram	
2.	Calculation of deflection of beam	
3.	Problems of four bar chain mechanism :velocity& acceleration diagram	
4.	Problems on velocity and acceleration by Klein's construction and graphical method	
5.	Problems of friction.	
6.	Problems of torsion and calculation of stiffness of spring	
7.	Exercise on power transmission of different drive	
8.	Exercise on flywheel and governor	
9.	Preparation of cam profile for various types of follower	
Note :-	The teachers are requested to cover as many tutorials as possible during theory periods.	

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6. LABORATORY EXPERIENCES

SR. NO.	NAME OF TOPICS	HOURS
1.	Tensile test on mild steel	04
2.	Impact test	04
3.	Shear test (Single / double)	02
4.	Compression test	04
5.	Torsion test	04
6.	Stiffness test	04
7.	Study of gear train & calculation of gear ratio	04
8.	Calculation of mass moment of inertia	02
TOTAL		28

7. SUGGESTIVE INSTRUCTIONAL STRATEGIES :

EO'S NO.	INSTRUCTIONAL STRATEGIES	KEY RESOURCES NEEDED
1.1	Lecture	
1.2 to 1.4	Lecture, assignment	
2.1 to 2.3	Lecture, charts, model, assignment	
2.4	Lecture & assignment	
2.5 to 2.10	Lecture, demonstration, model, charts, industrial visit, assignment	
2.11 to 2.13	Lecture, assignment , charts	

8. REFERENCES :

Sr. No.	Name of Book	Author
1.	Strength of Materials	R.S.Khurmi
2.	Strength of Materials	Ramamruthm
3.	Mechanics of Structure	Junnarkar
4.	Strength of Materials	B.C.Punamia
5.	Theory of Machine	R.S.Khurmi
6.	Theory of Machine	J.M.Shah & Jagdishlal
7.	Theory of Machine	P.L.Ballaney
8.	Theory of Machine	Joseph Sighle
9.	Theory of Machine	R.C.Patel, B.M.Shah & L.B.Shah