

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

Course Curriculum

AUTOMOBILE COMPONENT DESIGN (Code: 3330206)

Diploma Programme in which this course is offered	Semester in which offered
Automobile	3rd Semester

1. RATIONALE

The day to day functions carried out in the design and drawing department of automobile Industries are multifarious. Some of these functions are planning, selecting materials, deciding specification, determining design factors, computing and providing dimensions, coordinating with production, designing job fixtures and tools, specifying materials, evaluating design etc.

The technicians should possess some cognitive skill to assist the designers in performing the above referred job function. This course therefore provides such experiences to the students where they can apply their knowledge from various courses. This course also aims at developing the ability to analyze the given problem, weight alternatives and find the suitable solution. This course would also reinforce the understanding of the basic features of different automobile components since designing would help them in better appreciation of relations between different parameters of components.

2. COMPETENCY (Programme Outcomes (POs) According to NBA terminology)

The course content should be taught and with the aim to develop different types of skills so that students are able to acquire following competencies:

- **Design (basic design) various automobile components including selection of proper material for them.**

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	150
4	0	2	6	70	30	20	30	

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit; ESE - End Semester Examination; PA - Progressive Assessment

4. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
Unit – I Introduction to design.	1a. Explain general considerations and factors affecting the design of automobile components. 1b. Describe factors affecting the selection of materials. 1c. Explain basic terminologies used in design of automobile parts.	1.1 Design and its types, General consideration, factors affecting the design. 1.2 General procedure in Machine Design. 1.3 Material Selection for manufacturing various components of automobile. 1.4 Standardisation and its Importance, Various Standards and I.S codes. 1.5 S. I. units and definitions of various fundamental and derived quantities 1.6 Mass, Weight, Inertia, Force, Couple, Moment of Inertia, Torque, Power, Work, Energy, Stress, Strain, Young Modulus, Shear Modulus, Bearing Stress, Factor of Safety, Limit, Fit and Tolerances. 1.7 Types of loads, stress and strain. 1.8 Column and Strut, different end conditions, Rankin's and Euler's Formulae. 1.9 Stress concentration and how it can be reduced, Concept of fluctuating load and endurance limit.
Unit– II Design of piston.	2a. Explain nomenclature of piston. 2b. Select proper material of piston. 2c. Design different parts of piston.	2.1 Piston nomenclature. 2.2 Function of Piston. 2.3 Design considerations for Piston. 2.4 Materials for Piston. 2.5 Design of Piston head, rings, pin, skirt and barrel.
Unit– III Design of connecting rod.	3a. State nomenclature of connecting rod. 3b. Select proper material of connecting rod. 3c. Design different parts of connecting rod.	3.1 Connecting rod nomenclature. 3.2 Function of Connecting rod. 3.3 Shape of Connecting rod. 3.4 Length of Connecting rod. 3.5 Forces on Connecting rod. 3.6 Material for Connecting rod. 3.7 Design considerations for Connecting rod. 3.8 Design of cross-section of Connecting rod: I-section & Circular. 3.9 Design of Crank pin. 3.10 Design of Big end cap & bolts.
Unit–IV Design consideration for crank shaft and valve.	4a. State nomenclature of crank shaft and valve. 4b. Select proper material of crank shaft. 4c. Describe the factors affecting design of crank shaft and valve.	Crankshaft nomenclature. 4.1. Function of crankshaft. 4.2. Types of crankshaft. 4.3. Materials and manufacturing processes for crankshaft. 4.4. Bearing pressure and stresses in

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
		crankshaft. 4.5. Design considerations for crankshaft. 4.6. Design consideration for valve.
Unit– V Design of flywheel.	5a. Explain terminology related to flywheel. 5b. Describe design considerations for flywheel. 5c. Design of flywheel rim.	5.1 Function of flywheel. 5.2 Turning Moment Diagram. 5.3 Fluctuation of speed. 5.4 Fluctuation of energy. 5.5 Energy stored in flywheel. 5.6 Weight of the flywheel. 5.7 Design of flywheel Rim.
Unit– VI Design of clutch.	6a. Explain material selection for friction lining of clutch. 6b. Describe design considerations for friction clutch. 6c. Design Single plate and Multiplate clutch.	6.1 Function of clutch. 6.2 Types of clutch. 6.3 Materials for friction surfaces. 6.4 Design considerations for friction clutch. 6.5 Design of disc clutch: (i) Single plate; (ii) Multiplate.
Unit– VII Design of propeller shafts and axles.	7a. Describe design considerations for shaft and axle.	7.1 Calculation for finding diameter of Propeller shaft and Section of Dead Axle. 7.2 Bearing load on front axle. 7.3 Bearing load on rear axle.
Unit– VIII Design considerations for gear.	8a. State terminology related to gears, 8b. Describe design considerations for gear drive. 8c. Compute the gear teeth, speed and torque.	8.1 Gear terminology. 8.2 Types of gears. 8.3 Design consideration for gear drive. 8.4 Relation between number of teeth, speed and torque in meshing gears. 8.5 Calculation of number of teeth and torque transmitted.

Note: - All Equation /Units/ mathematically derivation and Examples based on SI system only.

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total
I.	Introduction to Design.	14	4	6	4	14
II.	Design of Piston.	06	2	2	3	07
III.	Design of Connecting Rod	06	3	3	5	11
IV.	Design Consideration for Crank Shaft and Valve.	06	3	3	4	10
V.	Design of Flywheel.	06	2	2	3	07
VI.	Design of Clutch.	06	2	2	3	07
VII.	Design of Propeller Shafts and Axles.	06	2	2	3	07
VIII.	Design Considerations for Gear.	06	2	2	3	07
	Total	56	20	22	28	70

Legends: R = Remember; U= Understand; A= Apply and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

6. SUGGESTED LIST OF TUTORIAL WORK:

Sr. No.	Unit No.	TUTORIAL WORK	Apprx. Hrs. Required
1.	I	Report writing on general considerations of design.	02
2.	II	Basic Design of Piston.	04
3.	III	Basic Design of Connecting rod.	04
4.	IV	Basic Design considerations for crank shaft and valve.	04
5.	V	Basic Design of Flywheel rim.	02
6.	VI	Basic Design of propeller shafts and axles.	04
7.	VII	Basic Design of clutches.	04
8.	VIII	Basic Design considerations for gear drive to compute the gear teeth, speed and torque.	04
		Total	28

7. SUGGESTED LIST OF PROPOSED STUDENT ACTIVITIES

Following is the list of proposed student activities such as:

- Seminars using power point presentations to get understanding of different phenomenon of design such as stress concentration, endurance limit, limit, fit, tolerances, various I.S. codes etc.
- Group discussion on severity of forces responsible for designing various components of automobile to design dimensions for effective area. Internet based assignments, teacher guided self learning activities, course/library/internet/lab based mini-projects etc. These could be individual or group-based.
- Case studies from real life problems of failure for piston, connecting rod, crank shaft, clutch plate etc.

8. SPECIAL INSTRUCTIONAL STRATEGIES (If Any)

- Power point presentation showing various nomenclature of different components of engine and transmission system to design various dimensions.
- Chart showing various nomenclatures of different components of engine and transmission system.
- Assignments during tutorials for basic design of different components of engine and transmission system (individual attention to be provided to students so solve their difficulties and clear their doubts)

9. SUGGESTED LEARNING RESOURCES

A. List of Books (with SI system)

S.No	Author	Title of Books	Publication
1	B.C.Punamia, Arun Kr. Jain	Strength (Mechanics) of Materials	Firewall Media, 2002
2	S. Ramamurtham	Strength of Materials	Dhanpat Rai Publishing Co., New Delhi.
3	R.S.Khurmi	Strength of Materials	S. Chand Limited, 2007
4	P.C. Sharma; D.K. Aggrawal	Machine Design: Mechanical Engineering Design	S. K. Kataria and Sons
5	R. K. Jain	Machine Design	Khanna Publishers, Delhi
6	R S Khurmi J K Gupta	A Text Book of Machine Design	S Chand & Co., Delhi
7	Dr Sadhu Singh	Machine Design	Khanna Publishers, Delhi
8	Pandya & Shah	Machine Design	Charotar Publishing House
9	K. M. Agrawal	Automobile Design Problems	Satya Prakashan, New Delhi

B. List of Major Equipment/ Instrument:

- a. Charts of Pistons, Connecting Rods, Crank shafts, Clutch Plates, Different types of Flywheels, Gears and Gear Boxes for better understanding of various terminologies related to automobile components.
- b. Models of Pistons, Connecting Rods, Crank shafts, Clutch Plates of different vehicles, different types of gears etc.

C. List of Software/Learning Websites

- a. http://courses.washington.edu/engr100/Section_Wei/engine/UofWindsorManual/Piston%20Design.htm
- b. http://confident-instruments.com/Piston_Study.htm
- c. <http://www.youtube.com/watch?v=gfNR4kGhChs>
- d. http://en.wikipedia.org/wiki/Connecting_rod
- e. <http://www.youtube.com/watch?v=M8TF11Y2T-4>
- f. <http://en.wikipedia.org/wiki/Crankshaft>
- g. <http://en.wikipedia.org/wiki/Flywheel>
- h. <http://www.youtube.com/watch?v=1wDmsevZsRY>

10. COURSE CURRICULUM DEVELOPMENT**COMMITTEE Faculty Members from Polytechnics**

- **Prof. M. J. Pathak**, H.O.D., Automobile Engineering Department, Sir Bhavsinhji Polytechnic Institute, Bhavnagar.
- **Prof. (Mrs) M. N. Vibhakar**, Lecturer, Automobile Engineering Department, Dr. S. & S. S. Ghandhy College of Engineering and Technology, Surat.
- **Prof. S.V. Trivedi**, Lecturer, Automobile Engineering Department, Parul Institute of Engineering & Technology, Vadodara.

Coordinator and Faculty Members from NITTTR Bhopal

- **Dr. C.K. Chugh**, Professor, Department of Electronic Media
- **Dr. K. K. Jain**, Professor, Department of Mechanical Engineering