

## GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

### course curriculum

### AUTOMOBILE ENGINES (Code:3330201)

Diploma Programme in which this course is offered	Semester in which offered
Automobile Engineering	3 <sup>rd</sup> Semester

#### 1. RATIONALE

All automotive vehicles are powered by automobile engines. Hence the fundamental knowledge of automobile engine is most essential for an auto technician. This course will help the students in manufacturing, inspection, operation, servicing and maintenance of various types of engines, and their different associative systems like lubricating systems, cooling systems, fuel systems, etc. Knowledge of this course will also be helpful to the polytechnic pass outs in diagnosis and testing of engine and other associative systems

#### 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 competency:

- **Maintain petrol and diesel automotive engines**

#### 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	
3	0	2	5	70	30	20	30	150

**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
<b>Unit – I Introduction to I.C. Engine.</b>	1a. Describe automotive systems. 1b. Describe Engines types. 1c. Differentiate Petrol v/s 1d. Diesel Engine. 1e. Explain Otto and Diesel Cycle. 1f. Compare single & multi cylinder engines.	1.1 Automobile Vehicles-history, arrangement & different systems. 1.2 Types of Engines. 1.3 Principles of I.C. engines for automobiles 1.4 Mechanism of piston type engine and related terms 1.5 Two and four stroke Otto cycle, Two stroke and four stroke diesel cycle 1.6 Merits and demerits of single and multi cylinder engines.
<b>Unit – II Constructional and functional details of components of I.C. Engines</b>	2a. Describe construction & working of different components, systems, subassemblies, of IC engines. 2b. Differentiate components of petrol and diesel engine. 2c. Explain Engine ignition timing, firing order balancing	2.1 Construction of I.C. Engines- Major, minor components, sub-assemblies, systems, etc. 2.2 Functions of I.C. Engine- Major, minor components, subassemblies. 2.3 Engine ignition timing, firing order balancing.
<b>Unit– III Types of combustion chamber</b>	3a. Identify constructional difference between combustion chambers of S. I. Engines. 3b. Identify constructional difference between combustion chambers Of C.I. Engines.	3.1 Different types of combustion chamber used in S.I. engine with their relative advantages. 3.2 Different types of combustion chamber used in C.I. engine with their relative advantages.
<b>Unit– IV Fuel systems for petrol engine</b>	4a. Describe petrol fuel systems with advantages of each system. 4b. Explain construction & working of fuel carburetion system. 4c. Explain construction & working of fuel injection systems. 4d. Explain working of various modern fuel	4.1 Fuel systems of petrol engines.- Description & advantages. 4.2 Carburetion and mixture quality for engine. 4.2 Construction and function of simple Carburetor. 4.3 Types of inlet manifolds and methods of Vaporization. 4.4 Working of air cleaner. 4.5 Gasoline Fuel Injection System. 4.6 Classification of Fuel Injection System. 4.7 Fuel Injection Requirements. Throttle

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
	injection systems for Petrol engine.	Body Injection (TBI) System. Port Fuel Injection (PFI) System. 4.8 Construction & Functions of electronic Injectors.
<b>Unit– V Fuel systems for diesel engine</b>	5a. Describe various diesel fuel injection systems. 5b. Explain construction and working of various fuel systems. 5c. Explain working of various modern fuel injection systems for diesel engine. 5d. Describe construction & working of Common Rail Direct Injection .	5.1 Fuel flow diagram.- brief descriptions. 5.2 Construction and working of Different diesel fuel injection system- Unitary type, of mechanically operated fuel injection system, mechanically operated & electronically controlled fuel injection system. 5.3 Construction & Functions of Common Rail Direct Injection (CRDI). 5.4 Details of different types of injectors. 5.5 Various types of governors. 5.6 Types of diesel filters. 5.7 Working of fuel feed pump for diesel engine. 5.8 Diesel electronic control system (DECS).
<b>Unit– VI Cooling system of I. C. Engines</b>	6a. Explain need of Cooling system. 6b. Explain construction & working of various cooling Systems. 6c. Describe attributes & effects of coolants.	6.1 Necessity of cooling system in I.C. engines. 6.2 Types of cooling system. 6.3 Construction & working of cooling system. 6.4 Types & Characteristics of a Coolant , and their effect on performance of cooling and engine
<b>Unit– VII Lubricating system of I.C. engines</b>	7a. Explain need of lubricating system. 7b. Explain elements & working of lubricating systems. 7c. Describe properties of engine oils and their effects.	7.1 Necessity of lubricating system in Engine. 7.2 Properties of engine oils, & effect on performance of lubricating of engines. 7.3 Types of a lubricating system, 7.4 Elements & working of lubricating system.
<b>Unit– VIII Super charging of I.C. engine</b>	8a. Explain purpose of supercharger with its merits and demerits. 8b. Describe various types of superchargers 8c. Explain construction & working of superchargers, Turbocharger, Intercoolers.	8.1 The purpose of super charging, 8.2 Merits & limitations of super charger, 8.3 Types & construction of super charger, 8.4 Principle & Construction of Turbocharger, Intercoolers.

## 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
1.	Introduction to I.C. Engine.	08	03	07	04	14
2.	Constructional and functional details of components of I.C. engines	11	04	07	03	14
3.	Types of combustion chamber	04	00	03	04	07
4.	Fuel systems for petrol engine	04	03	04	00	07
5.	Fuel systems for diesel engine	04	03	04	00	07
6.	Cooling system of I.C. Engine	04	03	04	00	07
7.	Lubricating system of I.C. engines	04	03	04	00	07
8.	Super charging of I.C. engine	03	00	03	04	07
	Total	42	19	36	15	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 PRACTICAL/EXERCISES

The practical/exercises should be properly designed and implemented with an attempt to develop different types of practical skills (**Course Outcomes in psychomotor and affective domain**) so that students are able to acquire the competencies (Programme Outcomes). Following is the list of practical exercises for guidance.

**Note:** Here only Course Outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in a common list at the beginning of curriculum document for this programme. Faculty should refer to that common list and should ensure that students also acquire those Programme Outcomes/Course Outcomes related to affective domain.

S. No.	Unit No.	Practical Exercise (Any Seven) (Course Outcomes in Psychomotor Domain according to NBA terminology)	Apprx. Hrs. Required
1	I	Demonstrate working of two & four stroke S.I. engines.	04
2	I	Demonstrate working of two & four stroke C.I. engines.	04
3	II	Demonstrate constructional details of piston, connecting rod & crank shaft.	04
4	II	Demonstrate construction & working of valve gear mechanism (Camshaft, Timing gear).	04
5	IV	Demonstrate construction & function of carburetor.	04
6	IV	Demonstrate construction of Gasoline Fuel Injection System.	04
7	VII	Observe construction & operation of fuel injector, its nozzle & fuel filters.	04
8	V	Demonstrate construction of fuel injection pump and governors.	04
9	VI	Demonstrate construction & function of cooling system and its components.	04
10	X	Observe construction & function of various lubricating system & its components.	04
11	XI	Observe construction & working of Turbocharger and Supercharger.	04
<b>Total</b>			<b>28</b>

## 7. SUGGESTED LIST OF PROPOSED STUDENT ACTIVITIES

Following is the list of proposed student activities such as:

- a. Seminar by Students on construction & operation of various components of engine, associate systems like cooling system, lubricating system etc.
- b. Prepare Display Board such as fuel injection system etc., & Chart like 2 & 4 Stroke engine, various cycles.
- c. Prepare Cut section model of S.I & C.I engine.
- d. Assembly and disassembly of Engine components, fuel, cooling and lubricating systems, turbochargers, superchargers, water pump, etc.
- e. Teacher guided self learning activities to prepare report as an assignment from industrial survey/internet/library/or group discussion on any of the automobile transmission mechanisms.

## 8. SPECIAL INSTRUCTIONAL STRATEGIES (If Any)

- a. Lectures cum Discussion using Chart (such as fuel injection system for Petrol & Diesel engine), Cut Section Model (such as 2 & 4 stroke S.I & C.I. engine, super charger), Display board (such as cooling system, lubricating system).
- b. Visit of authorized workshop of two wheeler and four wheeler.
- c. Use of animation or video clips.

## 9. SUGGESTED LEARNING RESOURCES

### (A) List of Books

S. No.	Author	Title of Books	Publication
1	R. B. Gupta	Automobile Engineering	Satya Prakashan, New Delhi
2	Anil Chhikara	Automobile Engineering vol-I	Satya Prakashan, New Delhi
3	K. M. Gupta	Automobile Engineering	Umesh Publication
4	W.H.Crouse & D.L. Anglin	Automotive Mechanics	Tata Mc-Graw Hill Publishing Co. Ltd.
5	Jain K.K., Asthana R.B.	Automobile Engineering	Tata Mc-Graw Hill Publishing Co. Ltd.
6	Ganeshan V.	Internal Combustion Engines	Tata Mc-Graw Hill Publishing Co. Ltd.
7	Mathur M.L. Sharma R.P.	Course in Internal Combustion Engines	Dhanpat Rai & Co. (P) Ltd
8	R. K. Rajput	A Textbook of Internal Combustion Engines	Laxmi Publication Ltd.
9	H.N.Gupta	Fundamentals of Internal Combustion Engines	Prentice Hall of India Pvt. Ltd. New Delhi
10	S. Srinivasan	Automotive Mechanics	Tata McGraw-Hill Education
11	C.P. Nakra	Basic Automobile Engineering	Dhanpat Rai Publication Co. (P) Ltd.
12	Singh Kirpal	Automobile Engineering: In a nutshell (Part-I)	Standard Publishers Distributors

### (B) List of Major Equipment/ Instruments

- a. Charts for Otto & Diesel Cycles, Components of I.C Engines, Fuel Systems (Circuits) of Petrol/ Diesel/ LPG/ CNG powered Engines, Lubricating System and Cooling Systems.
- b. Models of various components of I.C. Engine.
  - Cut Section model showing Two Stroke Petrol/ Diesel Engine.
  - Cut Section model showing Four Stroke Petrol/ Diesel Engine.
  - Cut Section model showing Fuel Systems (Circuits) for various fuels.
  - Cut Section model showing Lubricating System.
  - Cut Section model showing cooling System.

**(C)List of Software/Learning Websites**

1. <http://auto.indiamart.com/auto-technology/auto-tech-engine.html>
2. <http://inventors.about.com/library/weekly/aacarsgasa.htm>
3. Howstuffworks.com
4. <http://www.nextgreencar.com/lpg-cng.php>
5. <http://www.air-quality.org.uk/26.php>
6. <http://www.engineering.com/Videos/VideoPlayer/tabid/4627/VideoId/573/Internal-Combustion-Engine.aspx>
7. <http://www.youtube.com/watch?v=uB2cmkWbCMI>
8. <http://www.animatedengines.com>
9. [http://en.wikipedia.org/wiki/Internal\\_combustion\\_engine](http://en.wikipedia.org/wiki/Internal_combustion_engine)

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

- **Prof. D.A.Dave**, Head Automobile Engineering Department, Sir Bhavsinhji Polytechnic Inst., Bhavnagar
- **Prof. 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. K.K. Jain**, Professor, Department of Mechanical Engineering
- **Dr. C.K. Chugh**, Professor, Department of Electronic Media