

AU 105 AUTOMOBILE POWER POINT

Course Title	Automobile Power Plant	Course Code	AU-105
Semester	III	Course Group	Core
Teaching Scheme in Periods (L: T:P)	4:1:0	Credits	3
Methodology	Lecture + Tutorial	Total Contact Hours:	150 Periods
CIE	20+20+20 = 60 Marks	SEE	40 Marks

Pre requisites:

This course requires the basic knowledge of Basic Physics, Chemistry and Mathematics at the secondary school level.

Course Outcomes:

On successful completion of the course student should able to:

CO1	Interpret the working of various automobile engines.
CO2	Illustrate different components of an engine.
CO3	Determine the air-fuel ratios and combustion chamber for the specified conditions.
CO4	Prepare a comparative data sheet of petrol or diesel fuel systems for the given conditions.
CO5	Explain the Lubrication systems of an engine.
CO6	Describe cooling systems of an engine.

Course Content:

Unit-1: Heat engines

DURATION:13 HOURS

Introduction-Automobile Definition - Classification of an Automobile - Layout of a typical Automobile Chassis.

Heat Engines-Definition –Types of heat engines -Comparison of I.C. and I.C. Engines.

Engine Terminology-Bore–Stroke–TDC–BDC–Clearance volume -Swept volume - Total volume - Compression ratio- Mean effective pressure – Indicated power – Brake power - Friction power - Engine Speed- Engine torque.

Classification of I.C. Engines with respect to different parameters like type of fuel used, Cycle of Operations, Number of strokes per cycle, type of ignition, Number of Cylinders, Arrangement of Cylinders, Cooling system and valve arrangement etc., -L,I,F and T type valve arrangements.

Two Stroke and four stroke-S.I. engines -construction and working–I.C. Engines construction and working - Comparison of SI and CI engines - Advantages and limitations of diesel engine over petrol engine - Comparison of Two stroke and Four stroke engines-Scavenging.

Valve timing diagram of 2-stroke & 4-stroke Petrol & Diesel Engines-Firing Order-General Firing Orders of 4-, 6- and 8-cylinder engines.

Unit-2: Engine construction

DURATION 12 HOURS

Engine - Cylinder Block- Cylinder Liners- Cylinder Head-Crankcase and Oil Pan-Gaskets-Piston, Piston types- Piston Pin and Piston Rings-Connecting Rod- Connecting Rod bearings-Crankshaft- Main Bearings-Need of oil Clearance-Flywheel-Vibration dampers-Valves-Valve springs -Valve Seat -Valve guide bushing and oil seal-Cam Shaft-Valve Lifter, Pushrod and Rocker arm-mention material used and method of manufacturing of components-Types of valve actuating mechanisms-Side valve and over dead valve mechanisms.

Inlet and Exhaust System - Air Cleaners - Construction details of various types of air cleaners – Paper filter type air cleaner, Oil bath and Oil wetted type-Inlet and Exhaust Manifolds-Constructional details of Mufflers - types of Mufflers-Constructional details and working principle of various types of Mufflers.

Unit-3: Combustion and Combustion chambers:

DURATION: 8 HOURS

Combustion in I.C Engines – Stages of Combustion in S.I Engines – Phenomenon of Detonation and Pre Ignition - Stages of Combustion in C.I Engines - Diesel Knock – Factors influencing abnormal combustion in S.I Engines - Factors influencing abnormal combustion in C.I Engines – Requirements of S.I. and C.I. Engine combustion chambers - Types of S.I and C.I. engine combustion chambers

UNIT-4: Fuel system on I.C. Engines

DURATION 17 HOURS

Fuels-Definition of fuel-Classification of fuels- Calorific value of fuels - H.C.V & L.C.V - Fuels used in I.C. Engines-Rating of I.C engine fuels-Octane rating, Cetane rating- Fuel dopes or additives.

Combustion of fuels-Introduction-Combustion limits of air and fuel mixtures- Stoichiometric ratio -Homogeneous mixture -Heterogeneous Mixture-Air fuel ratios for different operating conditions.

Petrol Engine Fuel supply system-Line diagram of petrol engine fuel supply system- fuel filters-working principle with constructional details of fuel pumps-Mechanical and Electrical- constructional details of simple carburetor.

Petrol injection – Types of Petrol injection systems-Single point, Multi Point and Direct– Classification of Petrol injection - Working Principle of supercharger, intercooler and turbocharger.

Line diagram of Diesel engine fuel system–Types of diesel fuel feed pumps- Types of Diesel filter – primary and secondary filters -- Types of diesel fuel injection systems – Air injection and solid injection systems – Unit injection system, individual pump systems- distributor type pump system – CRDI system and TDI system - Injectors- Types of injectors – Constructional details and working of fuel injection pump–Types of Nozzles– Single hole, Multi hole, Pintle and Pintaux– Governing system for diesel engines – Mechanical and Pneumatic types of governors.

UNIT - 5: Lubrication systems

DURATION 12 HOURS

Types of lubricants–Properties required for a lubricating oil- viscosity-Fire and Flashpoint etc., - Grades of Lubricating oils -S.A. E and API systems – Grades of Lubricants used for Engine, Gear Box, Differential

Types of lubrication systems used in Automobiles - Petroil type-Splash type-force feed lubrication system-Dry Sump and Wet sump Lubrication-Types of oil filters-Full flow and By-pass filter arrangements –Additives used for synthetic Lubricants.

UNIT- 6: Cooling systems

DURATION :13 HOURS

Necessity of cooling-Disadvantages of over cooling and under cooling-Types of cooling systems – Air cooling, Water Cooling-Liquid Cooling-Constructional details of an Air-cooled engine-Thermo siphon system-Force feed type cooling systems-Radiator pressure cap– Constructional details and working principle of water pump - Radiator -core- Different types and their constructional details -Thermostat- Wax pellet type and Bellows type - Anti freezing additives – Anti rusting additives.

Recommended Reference Books

1.	Automobile Engineering Vol. I & II	by	Dr. Kirpal Singh
2.	Automotive Mechanics	by	Joseph Heitner
3.	Automobile Engineering	by	G.B.S. Narang
4.	Automobile Engineering	by	R.B. Gupta
5.	Automobile Engineering	by	Banga and Nathun Singh
6.	Automobile mechanics	by	William Crouse
7.	Internal Combustion Engines	by	Mathur & Sharma
8.	Automobile Engineering Vol. I	by	Anil Chikara

Suggested Learning Outcomes:

1.Heat Engines

- 1.1 Define Automobile.
- 1.2 Classify the Automobile.
- 1.3 Draw the layout of a four-wheeler chassis.
- 1.4 State the function of an engine.
- 1.5 Classify the heat engine.
- 1.6 Compare I.C engine and E.C engine.
- 1.7 Identify the terminology of an I.C. Engines.
- 1.8 Define the terms like stroke, stroke volume, clearance volume, total volume, compression ratio, Mean effective pressure, etc.,
- 1.9 Classify I.C engines based on different parameters.
- 1.10 Describe the arrangement of cylinders in multi cylinder engines.
- 1.11 Identify the type of valve arrangement in an engine.
- 1.12 State the firing order in case of a multi cylinder engine.
- 1.13 Explain the construction and working of 2-Stroke and 4-Stroke petrol engines.
- 1.14 Explain the construction and working of 2-Stroke and 4-Stroke diesel engines.
- 1.15 Compare 2-Stroke and 4-Stroke cycle engines.
- 1.16 Compare between S.I and C.I engines.
- 1.17 State the advantages and limitation of diesel engine over a petrol engine.
- 1.18 State the need of scavenging process.
- 1.19 Draw and explain the valve timing diagram of 2-Stroke and 4-Stroke petrol engines.
- 1.20 Draw and explain the valve timing diagram of 2-Stroke and 4-Stroke diesel engines.
- 1.21 State the requirements of Firing order.
- 1.22 Explain the firing order arrangement for 4-, 6- and 8-cylinder Engines (Inline & V type).
- 1.23 Explain the valve arrangements in L, I, F & T type Engines.

2. Engine construction

- 2.1 State the constructional details, materials used and functions of various engine components.
- 2.2 List various types of Gaskets used in Engines.
- 2.3 Explain the function of valve, Valve springs, valve seat, valve guides.
- 2.4 Draw and explain side valve and overhead valve arrangements.
- 2.5 Explain overhead cam shaft and side cam shaft mechanism.
- 2.6 Explain the use of vibration dampers.
- 2.7 Explain valve clearance and its importance.
- 2.8 Identify the need of Inlet and Exhaust systems of an engine
- 2.9 Need of an air cleaner
- 2.10 List the types of air cleaners
- 2.11 List the types of manifolds
- 2.12 Classify the types of mufflers
- 2.13 Explain the construction and working of various types of mufflers
- 2.14 Explain construction details of different types of air cleaners

3. Combustion and Combustion chambers:

- 3.01 Define combustion in IC engine
- 3.02 Explain the different stages of combustion in SI engine with sketch
- 3.03 Describe the phenomenon of detonation and pre-ignition
- 3.04 Explain the different stages of combustion in CI engine with sketch
- 3.05 Describe about diesel knock
- 3.06 State the factors influencing abnormal combustion in SI engine
- 3.07 State the factors influencing abnormal combustion in CI engine
- 3.08 Mention requirements of a good combustion chamber in SI engine
- 3.09 Mention requirements of a good combustion chamber in CI engine

4. Fuel system on I.C. Engines

- 4.0 Define the term fuel.
- 4.1 Classify the different types of fuels.
- 4.2 Identify the fuels used in I.C. Engine.
- 4.3 State their merits and limitations of liquid fuels over solid fuels.
- 4.4 State their merits and limitations of gaseous fuels over liquid fuels.
- 4.5 Define calorific value of a fuel.
- 4.6 Differentiate between Gross calorific value and Net calorific value.
- 4.7 Describe the process of assigning Octane number and Cetane number to the fuel sample.
- 4.8 Infer the need of fuel additives or fuel dopes.
- 4.9 Define Combustion.
- 4.10 Identify the Combustion limits of air and fuel mixtures.

- 4.11 State the concept of Stoichiometric ratio.
- 4.12 Apprise the types of air fuel mixtures used in I.C. Engines.
- 4.13 Understand the working of Petrol Engine Fuel Supply System.
- 4.14 Draw a line diagram of petrol engine fuel supply system.
- 4.15 Classify the types of Fuel pumps.
- 4.16 Explain the working of mechanical and electrical fuel pumps with the help of legible sketches.
- 4.17 List the Air fuel ratios for different conditions. State the importance of the petrol injection system
- 4.18 Identify the different types of petrol injection systems
- 4.19 Explain the construction and working of the MPFI system
- 4.20 State the importance of the supercharger, intercooler, and turbocharger
- 4.21 Explain the working Principle of the supercharger with a sketch
- 4.22 Explain the working Principle of the intercooler with a sketch
- 4.23 Explain the working Principle of the turbocharger with a sketch
- 4.24 Draw a line diagram for the diesel fuel system
- 4.25 Describe the function of the diesel fuel feed pump
- 4.26 Identify and explain the types of diesel fuel feed pumps with the sketches
- 4.27
- 4.28 State the necessity of diesel Filters
- 4.29 Identify the types of diesel filters
- 4.30 Explain the working Principle of diesel filter with a sketch
- 4.31 State the requirements for the fuel injection system
- 4.32 State the function of the diesel fuel supply system
- 4.33 Identify the types of diesel fuel injection systems
- 4.34 Explain the working Principle of the air injection system with a sketch
- 4.35 Identify the types of solid diesel fuel injection systems
- 4.36 State the function of the diesel fuel injection pump
- 4.37 Explain the working Principle of the common-rail diesel injection system with a sketch
- 4.38 Explain the working Principle of the unit-injector type diesel fuel injection system with a sketch
- 4.39 Explain the working Principle of the individual pump type diesel fuel injection system with a sketch
- 4.40 Explain the working Principle of the Distributor pump type Diesel engine's pump fuel injection system with a sketch
- 4.41 Explain the working Principle of the CRDI type diesel injection system with a sketch
- 4.42 Explain the working Principle of the TDI type diesel injection system with a sketch
- 4.43 Explain the construction and working of the diesel fuel injection pump with a sketch
- 4.44 State the function of a diesel fuel injector
- 4.45 Classify the different types of diesel fuel injection nozzles with the sketches
- 4.46 Explain the construction and working of the mechanical fuel injector with a sketch

- 4.47 Explain the construction and working of the electronic fuel injector with a sketch
- 4.48 State the function of a governor in the diesel fuel system
- 4.49 Identify the types of governors in the diesel fuel system
- 4.50 Explain the construction and working of the mechanical governor with a sketch
- 4.51 Explain the construction and working of the pneumatic governor with a sketch

5. Lubrication systems

- 5.1 Classify the various lubricants used in I.C. Engines.
- 5.2 State the properties of lubricants.
- 5.3 Explain the properties of lubricants, SAE number of lubricant and state its necessity.
- 5.4 State the requirements of engine lubrication.
- 5.5 Explain clearly the constructional details and working of Petroil, Splash type, Forced feed type lubrication systems.
- 5.6 Explain the dry sump and wet sump systems.
- 5.7 State the difference between By-pass filter and Full-flow filter.
- 5.8 List the various additives of lubricants.

6. Cooling systems

- 6.0 What is the necessity of Cooling System.
- 6.1 State the disadvantages of over cooling and under cooling.
- 6.2 Classify the cooling systems.
- 6.4 Explain the constructional details and state the working principle of Air cooling, Liquid Cooling systems with the help of line diagrams.
- 6.5 Explain the constructional details of water pump and thermostat.
- 6.6 Explain the types of Thermostats, Radiator and Pressure cap.
- 6,7 List out various Anti-freeze and anti-rusting liquids.

Suggested E-Learning references:

1. www.learnengineering.org
2. www.sae.org
3. www.nptel.ac.in

1. HEAT ENGINES:

<https://www.youtube.com/watch?v=e5h4sIZlmUo>
<https://www.youtube.com/watch?v=IHnTKsHuJQw>
<https://www.youtube.com/watch?v=ASJmVNcJqk4>
<https://www.youtube.com/watch?v=vIJ50aUiBgM>

2. ENGINE CONSTRUCTION:

<https://www.youtube.com/watch?v=BJYSyA-u61U>
https://www.youtube.com/watch?v=zA_19bHxEYg
<https://www.youtube.com/watch?v=dfFvtpbjdow>

3. COMBUSTION AND COMBUSTION CHAMBERS:

<https://www.youtube.com/shorts/5ug7clGN0Rw>
https://www.youtube.com/shorts/FZfSkTJ0R_Y
<https://www.youtube.com/shorts/NeDKfmt9Bdc>
<https://www.youtube.com/watch?v=tHazG3EuG2U>

4. FUEL SYSTEM ON I.C. ENGINES:

https://www.youtube.com/watch?v=4O3nC9l_1F0
https://www.youtube.com/watch?v=Z5_vfZhMWOg
<https://www.youtube.com/watch?v=m6-KZS19HDU>
<https://www.youtube.com/watch?v=l6qMhwyLUHA>
<https://www.youtube.com/watch?v=mhPP6pnisL4>
<https://www.youtube.com/watch?v=6YzIki62ga8>
<https://www.youtube.com/watch?v=U6XGjYuX8ys>

5. LUBRICATING SYSTEMS:

https://www.youtube.com/watch?v=y5p31F_dVJU
<https://www.youtube.com/watch?v=V7inC4lOpGs>
<https://www.youtube.com/watch?v=D9dYx9lF5uw>
<https://www.youtube.com/watch?v=mmmej53TNic>

6. COOLING SYSTEMS:

https://www.youtube.com/watch?v=Rt_AWy4tsN0
<https://www.youtube.com/watch?v=1oY8-tgl8q4>
<https://www.youtube.com/watch?v=V6x19pFplJw>

CO-PO& PSO Mapping Matrix

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1
CO1	Interpret the working of various automobile engines.	2	1			2		2	2
CO2	Illustrate different components of an engine.	2		1		1	2	1	3
CO3	Determine the air-fuel ratios and combustion chamber for the specified conditions.	3	3			3	3	3	3
CO4	Prepare a comparative data sheet of petrol or diesel fuel systems for the given conditions.	2	3			1	2	3	3
CO5	Explain Lubrication systems of an engine.	2	1	1		2	1	2	3
CO6	Describe cooling systems of an engine.	2	1	1		2	1	2	3

Guidelines for Continuous Internal Evaluation

MID SEM-I EXAM					
S.No	Unit Name	R	U	A	Remarks
1	Unit-I	1, 2	5(a) 5(b)	7(a) 7(b)	
2	Unit-II	3, 4	6(a) 6(b)	8(a) 8(b)	
Total Questions		4	4	4	
MID SEM –II EXAM					
S.No	Unit Name	R	U	A	Remarks
1	Unit-III	1, 2	5(a) 5(b)	7(a) 7(b)	
2	Unit-IV	3, 4	6(a) 6(b)	8(a) 8(b)	
Total Questions		4	4	4	

Internal Assessment**Max.Marks: 20**

Model Question Paper for Mid Term –I
C-26, Diploma in Automobile Engineering
Course Title: Automobile Power Plant
Course Code: AU-105

Time: 1 Hr

Max Marks: 20

PART-A

Short answers questions

Answer All Questions. Each question carries ONE mark 4 x 1 = 4 Marks

1. Define Automobile?
2. State the function of an engine?
3. Draw diagram of connecting rod and label the parts?
4. List the materials used for manufacturing of any four Engine components?

PART-B

Essay type questions

Answer any TWO Questions by choosing either (a) or (b) from each question.

Each question carries THREE marks

2 x 3 = 6 Marks

5. (a) Name the types of valve arrangements in I.C Engines?
5. (b) Sketch and explain theoretical valve timing diagram of a 4-stroke diesel engine?
6. (a) Explain the constructional details of camshaft with a diagram?
6. (b) Explain valve clearance and its importance.

PART-C

Application type questions

Answer any TWO Questions by choosing either (a) or (b) from each question.

Each question carries FIVE marks

2 x 5 = 10 Marks

7. (a) Explain the construction and working of 4-Stroke diesel engine.
7. (b) Draw and explain theoretical and actual valve timing diagrams of a four stroke petrol Engine?
8. (a) Sketch and explain the constructional details including materials used and manufacturing method of Crankshaft for a four-cylinder Engine?
8. (b) With the aid of a sketch explain the constructional details including materials used and manufacturing method of a piston?

Model Question Paper for Mid Term –II
C-26, Diploma in Automobile Engineering
Course Title: Automobile Power Plant
Course Code: AU-105

Time: 1 Hr

Max Marks : 20

PART-A

Short answers questions

Answer All Questions. Each question carries ONE mark 4 x 1 = 4 Marks

1. Define combustion in IC engine
2. List any two types of SI engine combustion chambers?
3. Define fuel?
4. Define calorific value?

PART-B

Essay type questions

Answer any TWO Questions by choosing either (a) or (b) from each question.

Each question carries THREE marks

2 x 3 = 6 Marks

- 5.(a) Define the term diesel knock?
- 6.(b) Write three requirements of SI engine combustion chamber?
- 7.(c) Draw a line diagram of petrol engine fuel supply system.
- 8.(d) Identify the types of diesel filter?

PART-C

Application type questions

Answer any TWO Questions by choosing either (a) or (b) from each question.

Each question carries FIVE marks

2 x 5 = 10 Marks

- 9.(a) State the factors influencing abnormal combustion in SI engine
10. (b) Describe the phenomenon of detonation and pre-ignition
11. (a) Explain the working of mechanical fuel pump with the help of legible sketch?
12. (b) Explain the working Principle of the CRDI type diesel injection system
with a sketch

SEMESTER END EXAMINATION
MODEL QUESTION PAPER
C-26, DIPLOMA IN AUTOMOBILE ENGINEERING

Course Title: Automobile Power Plant

Course Code: AU-105

Time: 2hrs

Max Marks: 40

PART-A

Answer all Questions. Each question carries One mark

8 x 1 = 8Marks

1. Define 'Compression ratio'?
2. List various types of Gaskets used in Engines.
3. Expand S.A.E and A.P.I?
4. What is the function of a 'Flywheel'?
5. Identify the fuels used in I.C. Engine
6. Identify the types of diesel filters
7. Name the types of additives used for synthetic lubricants?
8. What is the necessity of Cooling System.

PART-B

i. Choose either (a) or (b) from each question.

ii. Answer any FOUR questions

4 x 3 = 12 Marks

- 9.(a) What is 'firing order'? Mention the firing order of six cylinders 'In-line engine'?
- 10.(b) State the use of 'Break down service vehicle'?
- 11, (a) Explain how 'Octane rating' is given to a sample of gasoline fuel?
- 12, (b) Mention requirements of a good combustion chamber in SI engine
- 13.(a) State the concept of Stoichiometric ratio.?
- 14(b) State the function of the diesel fuel injection pump?
- 15(a) Which grade of lubricating oil is used for a gear box and narrate the process of lubrication in a gear box?
- 16, (b) Classify the cooling systems.?

PART-C

i. Choose either (a) or (b) from each question.

ii. Answer any FOUR questions

4 x 5 =20 Marks

- 18.(a) Sketch and explain the valve timing diagrams of a four-stroke diesel engine?
- 19.(b) Identify the need of Inlet and Exhaust systems of an engine
20. (a) Describe the phenomenon of detonation and pre-ignition
- 21.(b) Explain the different stages of combustion in CI engine with sketch
- 22.(a) Explain the construction and working of the MPFI system
- 23.(b) Explain the construction and working of the mechanical governor with a sketch

24.(a) Draw a neat diagram of dry sump system of lubrication system, state where this system is used and compare with the wet sump system of lubrication?

25.(b) Sketch the forced feed cooling system and explain its constructional details and working?