

**DIPLOMA CURRICULUM OF
AUTOMOBILE ENGINEERING
(SECOND YEAR)
(4th Semester)**

(To be implemented from 2025-26)

Prepared by;



**National Institute of Technical Teachers' Training & Research Kolkata
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Vetted by:

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PROGRAMME TITLE: AUTOMOBILE ENGINEERING

SEMESTER - IV

SL. No	Category of Course	Code No	Course Title	Teaching Scheme				Evaluation Scheme				Total Marks	Credits
				Pre-requisite	Contact Hours/ week			Theory		Practical			
						L	T	P	End Exam	Progressive Assessment	End Exam		
1	Programme Core	AEPC202 TH:1	Theory of Machines		3	0	0	70	30	-	-	100	3
2		AEPC204 TH:2	Automobile Engines - I		3	0	0	70	30	-	-	100	3
3		AEPC206 TH:3	Automotive Transmission		3	0	0	70	30	-	-	100	3
4		AEPC208 PR:1	Automobile Engines - I Lab		0	0	4			15	35	50	2
5		AEPC210 PR:2	Theory of Machines Lab		0	0	4			15	35	50	2
6		AEPC212 PR:3	Automobile Machine Shop-I		0	0	4			15	35	50	2
7	Programme Elective	AEPE202 (Any one) TH:4	(a) Refrigeration and Air conditioning (b) Automotive Air conditioning (c) Automotive Thermodynamics		3	0	0	70	30	-	-	100	3
8		AEPE204 (Any one) TH:5	(a) Automotive Pollution Control (b) Metrology and Quality Control (c) Measurements and Metrology		3	0	0	70	30	-	-	100	3
10	Minor Project	PR202 PR:4	MINOR PROJECT		0	0	4	-	-	30	70	100	2
11	Mandatory	AU202	Essence of Indian knowledge and tradition		2	0	0	-	-	0	0	0	0
TOTAL					17	0	16	350	150	75	175	750	23

The best of 2 IA conducted in a subject out of 20 marks to be considered. Assignment/ quiz etc. of 10 marks to be treated as part of IA. Besides this, Monthly Test to be conducted for each subject. Sessional Marks shall be total of the performance of individual different jobs/ experiments in a subject throughout the semester. Club/Innovation/ Idea Tinkering Activities etc. shall be encouraged to be performed by students beyond the above stipulated hours.

SEMESTER- IV

TH:1- THEORY OF MACHINES

L	T	P	Total Marks: 100	Course Code: AEPC202
3	0	0		
Total Contact Hours				Theory Assessment
Theory : 45Hrs				End Term Exam 70
				Progressive Assessment 30
Pre-Requisite : Nil				
Credit 3				Category of Course: PC

RATIONALE:

In automobiles, the chemical energy of the fuel is converted into mechanical energy in the engine from the sliding motion of the piston to the rotary motion of crankshaft. From crankshaft to the wheels the motion is transmitted through a series of mechanisms. Besides this power transmission, the automobile is operated with the help of several mechanisms, like steering, brake, clutch and Accelerator mechanisms. These mechanisms are prepared with the help of linkages, gears, belt drives, etc. As a technician, one should have the necessary knowledge and skills about these mechanisms for manufacturing, operation and mechanisms of automobiles. This subject deals with different kinds of mechanisms and their applications.

COURSE OUTCOMES:

CO1: Identify various types of mechanisms and types of links

CO2: Summarize various types of cams and followers

CO3: Classify different types of power transmission devices

CO4: Describe the functioning of brakes and dynamometers

CO5: Discuss the types and functions of clutches.

COURSE CONTENT DETAILS:

Unit No.	Content	Time Allotted (Hrs.)
I	FUNDAMENTALS: Definitions of statics, kinetics, kinematics and dynamics, Kinematics links and their types, Kinematics pairs and their types, Kinematics chains and their types, Constrained motions and their types, Mechanisms, Inversions, Machines, Structures	5
II	TYPES OF MECHANISMS: Laws of inversions, Four bar chain mechanism and its inversions like Coupling, of locomotives, Watt's Indicator mechanism, pantograph, Mechanism of two stroke I.C, Steering mechanism of automobiles.	5

III	POWER TRANSMISSION DEVICES: Belts and belt drives, types of belts, belt material, velocity ratio of belt drive, Slip and creep, Determination of tension ratio in belt drives, lengths of belts, Power transmission. Initial tension, centrifugal tension, condition for maximum power transmission. ROPE DRIVES- Their types, advantages, limitations, applications, Chain drives- Elements and composition of chain drives, their comparison with other drives, characteristics of chain drive, Gears and Gear trains- Concept of friction wheel applications, Basic gear terminology, Gear, types of gears and its applications, laws of gearing, gear trains and their types.	8
IV	CAMS AND FOLLOWERS: Definitions of cams and followers, Types and classifications of cams and followers, Different follower motions, their displacements like uniform velocity, SHM, Uniform Acceleration and retardation.	5
V	GOVERNORS AND FLYWHEEL :Function of governor , Classification of governor ,Working of Watt, Porter, Proell and Hartnell governors. Conceptual explanation of sensitivity, stability and isochronisms. Function of flywheel. Comparison between flywheel & governor. Fluctuation of energy and coefficient of fluctuation of speed. BALANCING OF MACHINE Concept of static and dynamic balancing. Static balancing of rotating parts. Principles of balancing of reciprocating parts. Causes and effect of unbalance. Difference between static and dynamic balancing	8
VI	FRICTION and CLUTCHES: Types of friction, laws of friction, uses of friction Types of bearings, simple Pivot and collar bearing, Conical pivot bearing. Relationship of torque and power by uniform pressure and wear theory.	7
VII	BRAKES and DYNAMOMETERS : Working of simple frictional brakes. Calculation of braking torque and braking force in a simple frictional brake. Working of Absorption type of dynamometer such as Prony brakes and rope brake dynamometer.	7
	TOTAL	45

REFERENCES:

1. P. L. Ballaney Theory Of Machine Khanna Publishers
2. Khurmi-Gupta Theory Of Machines Eurasia Home
3. J. E. Shigley Theory Of Machines McGraw Hill
4. Timoshenko Theory Of Machines Wiley-Eastern

TH:2- AUTOMOBILE ENGINES - I

L	T	P	Total Marks: 100	Course Code: AEPC204
3	0	0		
Total Contact Hours				Theory Assessment
Theory : 45Hrs				End Term Exam 70
				Progressive Assessment 30
Pre-Requisite : Nil				
Credit 3				Category of Course: PC

RATIONALE:

As an automobile engineer/ supervisor, he/she should have the knowledge of the various systems of the engines and the necessary skills to assemble and disassemble the various units/ assemblies/ sub-assemblies of the automobile engine. Besides, a supervisor should be able to diagnose the faults and take corrective actions. This course deals in such areas of Automobile Engines, which takes care of engine fundamentals, fuel system and exhaust system.

COURSE OUTCOMES:

- CO1: Discuss various types of auto engines and their specifications
- CO2: List various types of automotive fuels.
- CO3: Explain the working principle of petrol and diesel engines
- CO4: Describe the fuel injection equipment and turbo charging of diesel engines
- CO5: Identify the issues related to automobile emission and its control

COURSE CONTENT DETAILS:

Unit No.	Content	Time Allotted (Hrs.)
I	AUTO ENGINES: Indian Automobiles, Types of Automobiles, Layout, Components and functions of the Automobile, Classification of Automobile Engines: Use of Engines, Merits and Demerits of vertical and Horizontal Engines, Basic concepts of engine- TDC, BDC, Bore, Stroke, Mean effective pressure, IP, BHP, Engine torque, weight to power ratio, fuel efficiency and specific power output. Working principle of two stroke & four stroke petrol engine. Working principle of two stroke & four stroke diesel engine. Reasons for Using Single-cylinder Two stroke Air Cooled Petrol Engine on Two Wheelers. Reasons for Using Multi- Cylinder Diesel Engine For Commercial Vehicles, Merits and Demerits of Two Stroke and Four Stroke Cycle Engines, Advantages of a Multi-cylinder Engine for the same power.	10
II	AUTOMOTIVE FUELS: Types of fuels and their origin, General properties of automotive fuel and their constituents, Specifications as per IS standards of Automotive fuels and their relevance in various structural and functional aspects of fuel systems of auto engine, Octane number, Octane rating of Automotive fuels, Unleaded petrol-necessity and identification, Vitality of conservation of convention fuels in the context of vehicular pollution and population and resource depletion, Necessity of alternate energy sources – Properties and suitability of Alcohol, Benzole and other vegetable oils, Additives in fuels & their roles, Alternative Automobile fuels	08

III	FUEL INJECTION SYSTEM IN PETROL ENGINE: Introduction, Fuel System for Petrol Engine, Gravity Feed System, Fuel Pumps, Properties of Air Fuel Mixture, Engine Requirements, Throttle valve Carburetors - Limited use of Carburetors in modern car –reason, Classification of Petrol fuel Injection System, Advantage of Port Fuel Injection or Multipoint Fuel Injection System, Advantages and Disadvantages of Fuel Injection System.	08
IV	COMBUSTION PROCESS IN DIESEL ENGINES: Introduction, Properties of Diesel Fuel, Combustion Process in C.I.Engines, Diesel Knock, Types of C.I. Combustion Chambers, Open Combustion Chamber, Pre Combustion Chamber, Turbulence Combustion Chamber, Air Cell Combustion Chamber, Energy Cell Combustion Chamber	08
V	FUEL INJECTION EQUIPMENT FOR DIESEL ENGINE: Introduction, Fuel Injection System, Fuel Injection Pump for Diesel Engine, Diesel Injector, Governor	05
VI	TURBO & SUPER CHARGING OF I.C. ENGINE: Location, Construction & working, Advantages & disadvantages, Difference between turbo changing & supercharging	06
Total		45

Reference:

1. Kirpal singh Automotive Engineering Vol I Standard publishers and distributors, New Delhi.
2. Crouse & Anglin Automotive Mechanics McGraw Hills International Pub.
3. K. K. Jain & R. B. Asthana Automobile Engineering TMH
4. Don Knowles Auto Mechanics-Understanding new technology Reston Publishers, New Jersey.
5. Mathur & Sharma Internal Combustion Engine Dhanpat Rai & Sons, New Delhi.
6. Bosch Diesel Fuel Injection SAE(distributor)
7. Anthony E. Schwaller Motor Automotive Technology Delmar Publishers, USA.
8. Harban Singh Reyat The Automobile S. Chand & Co. Ltd.
9. G. B. S. Narang Automobile Engineering Khanna Publishers.
10. R .B. Gupta Automobile Engineering Satya Prakasha

TH:3- AUTOMOTIVE TRANSMISSION

L	T	P	Total Marks: 100	Course Code: AEPC206
3	0	0		
Total Contact Hours				Theory Assessment
Theory : 45Hrs				End Term Exam 70
				Progressive Assessment 30
Pre-Requisite : Nil				
Credit 3				Category of Course: PC

RATIONALE:

Power developed by the automobile engine is transmitted to the rear axle through many parts and mechanism such as clutch gear box, propeller shaft and differential. The entire system is covered under power transmission mechanism in automobiles. Gaining knowledge of automobile transmission is of vital for the automobile engineers.

COURSE OUTCOMES:

At the end of the course, the student will be able to know:

CO1: Functions, types, requirements & adjustment of clutch. CO2:

Function, types & operation of gearbox.

CO3: Functions of propeller shaft & types of joints

CO4: Functions & types of differentials.

CO5: Types & operation of real axel. CO6:

Transmission of power in two-wheelers.

COURSE CONTENT DETAILS:

Unit No.	Content	Time Allotted (Hrs.)
I	Clutch: Introduction, requirement of clutch, types of clutch, Clutch operation, Clutch components, clutch facing, Clutch problem and adjustment, Fluids fly wheel & coupling.	6
II	Gear Box: Introduction, functions & types of transmission, Sliding mesh & constant mesh gearbox, Epicyclic gear box overdrive, Free-wheel drive, selector mechanism, Fluid torque converter.	6
III	Propeller shaft: Introduction, definition and types of propeller shaft, Universal joints & its types, Sliding joint.	6
IV	Differential: Function of differential gear box, Types of differential, Constructional details of a differential, Study and inspection of differential.	6

V	Rear Axle: Definition of rear axle, supporting of rear axle, Rear axle drives such as Hotchkiss drive, torque tube drive etc., Types of rear axle. Rear axle casing.	6
VI	Two wheeler: Power transmission system of moped, Power transmission system of scooter, Power transmission system of motorcycle, Power transmission system of bullet.	6
VII	Performance of Automobile: Power for propulsion resistances for vehicle, Traction & tractive effort, road performance curves, Acceleration gradient ability & draw-bar pull, Calculation of equivalent weight, Calculation of maximum traffic effort.	9
Total		45

Reference :

1. Automotive mechanics by Heitner. CBS publishers.
2. The automobile by Harbans Singh Rayat, S. Chand and Co.
3. Automobile Engineering by G.B.S. Narang, Khanna publishers.
4. Automobile Engineering Volume-1 by Dr. Kipal Singh, std Publisher.
5. Automobile Engineering & power Yrain by W.H. Crouse. Mc GrawHills.
6. Motor manual (Transmission) by A.N. Judge.
7. Motor manual (Car mechanism) by A. N. Judge.

PR:1- AUTOMOBILE ENGINE-I LAB

L	T	P	Total Marks: 50	Course Code: AEPC208	
0	0	4		Practical Assessment	
Total Contact Hours				End Exam 15	
Practical : 60Hrs				Progressive Assessment 35	
Pre-Requisite : Nil					
Credit 2				Category of Course: PC	

RATIONALE:

As an automobile engineer/ supervisor, should have the necessary skills to assemble and disassemble the various units/ assemblies/ sub- assemblies of the automobile engine. Besides, a supervisor should be able to diagnose the faults and take corrective actions. Automobile Engine I Lab takes care of engine fundamentals, fuel system and exhaust system

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1: Determine the fire point and flash point of given fuel

CO2: Identify the components of fuel systems of petrol and diesel engine

CO3: Perform activity on decarbonizing the cylinder head

CO4: Modify fuel filter of a given vehicle

CO5: Test the emission of diesel and petrol vehicles

COURSE CONTENT DETAILS:

Unit No.	Content	Time Allotted (Hrs.)
I	Determination of fire point & flash point of given fuel	4
II	Open fuel system of given vehicle (Petrol), identify and check the components, draw the block diagram	4
III	Open fuel system of given vehicle (Diesel), identify and check the components, draw the block diagram	4
IV	Dismantle various fuel pumps like – mechanical and electrical, identify and check the components Dismantle diesel fuel injection pumps and injectors, identify the components, sketch and reassemble	8
V	Remove the cylinder head, observe the combustion chamber, location of valves, fuel injector, decarbonize combustion chamber, clean and refit	8
VI	Performance of fuel filters change activity of a given vehicle.	8
VII	Diagnose engine condition by exhaust gas analyzer.	8
VIII	Testing of emission of diesel vehicle and petrol vehicle	8
IX	Calibration of diesel fuel pumps and nozzles	8
	Total	60

REFERENCE BOOKS:

1. Kirpalsingh Automotive Engineering Vol I Standard publishers and distributors, New Delhi.
2. Crouse & Anglin Automotive Mechanics McGraw Hills International Pub.
3. K. K. Jain & R. B. Asthana Automobile Engineering TMH
4. Don Knowles Auto Mechanics-Understanding new technology Reston Publishers, New Jersey.
5. Mathur & Sharma Internal Combustion Engine Dhanpat Rai & Sons, New Delhi.
6. Bosch Diesel Fuel Injection SAE(distributor)
7. Anthony E. Schwaller Motor Automotive Technology Delmar Publishers, USA.
8. Harban Singh Reyat The Automobile S. Chand & Co. Ltd.
9. G. B. S. Narang Automobile Engineering Khanna Publishers.
10. R .B. Gupta Automobile Engineering Satya Prakashan

PR:2- THEORY OF MACHINES LAB

L	T	P	Total Marks: 50	Course Code: AEPC210
0	0	4		
Total Contact Hours				Practical Assessment
Practical : 60Hrs				End Exam 15
				Progressive Assessment 35
Pre-Requisite : Nil				
Credit 2				Category of Course: PC

RATIONALE:

In automobiles, conversion of chemical energy of the fuel into mechanical energy is done with the help of a series of mechanisms. Practical approach of such machines and mechanism is required for the budding engineers. These mechanisms are prepared with the help of linkages, gears, belt drives, etc. As an engineer, one should have the necessary knowledge and skills about these mechanisms for manufacturing, operation and mechanisms of automobiles. This course deals with the practical approach to different kinds of mechanisms and their applications.

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1: Demonstrate various mechanisms, their inversions and brake and clutches in Automobiles

CO2: Apply cam- follower mechanism to get desired motion of follower.

CO3: Apply the concepts of gears and gear train to get desired velocity ratio for power transmission.

CO4: Apply the concept of governors to control the fuel supply in engine.

COURSE CONTENT DETAILS:

Sl. No	Topics for practice	Time Allotted (Hrs.)
I	To study various types of kinematics links, pairs, chains & Mechanisms.	4
II	To Study of Inversions of Four bar linkage.	4
III	Draw the velocity and acceleration diagram for the given mechanism.	4
IV	To study of inversions of single/double slider crank mechanisms.	4
V	To study of inversions of single/double slider crank mechanisms.	4
VI	To perform experiment on spring controlled governor to prepare Performance characteristic Curves, and to find stability & sensitivity.	16
VII	To study gyroscopic effects through models.	8
VIII	To determine whirling speed of shaft theoretically and experimentally.	8
IX	To perform experiment on brake.	8
	Total	60

REFERENCES:

1. Theory of Machines by S.S. Rattan., Tata McGraw Hill.
2. Dynamics of Machinery by Farazdak Haideri, Nirali Publication.
3. Theory of Machines by Sadhu Singh Pearson Education.
4. Theory of Machines and Mechanisms by J.Uicker, Gordon R Penstock & J.E. Shigley Oxford International Edition
5. Kinematics, Dynamics and Design of Machinery by Kenneth J Waldron, Gary L Kinzel Wiley Edition.
6. Theory or Mechanisms and Machines by Amitabh Ghosh and A. Kumar Mallik.
7. Theory of Machines – P. L. Ballaney, Khanna Publishers

PR:3- AUTOMOBILE MACHINE SHOP-I

L	T	P	Total Marks: 50	Course Code: AEPC212
0	0	4		
Total Contact Hours				Practical Assessment
Practical : 60Hrs				End Exam 15
				Progressive Assessment 35
Pre-Requisite : Nil				
Credit 2				Category of Course: PC

RATIONALE:

Automobile engineers should know the use of measuring tools for automobile parts, they should also know about intricate machining and finishing of automobile parts. They should be able to operate different machine tools required in an automobile machine shop and use relevant measuring instruments.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1: Identify the given specimen by viewing the micro structure using metallurgical microscope

CO2: Identify the cracks in the specimen using different techniques

CO3: Determine the various types of stress and plot the stress strain diagram for mild steel.

CO4: Determine the torsion, bending, impact and shear values of given materials

CO5: Determine the modulus of rigidity, strain energy, shear stress and stiffness of coil spring

COURSE CONTENT DETAILS:

Expt No.	Content	Time Allotted (Hrs.)
I	Checking flatness and squareness using a try square and filling the same if not levelled.	4
II	Sharpening of cutting tools like chisels, twist drill bit and punch through double ended grinder.	4
III	Internal threading of hole/ blind holes using hand taps.	4
IV	Measurement of hole and slots using telescopic gauges and inside micrometer	4
V	Measurement of size / depth and roundness of an object with a Vernier caliper.	4
VI	Measurement of crank pins, main journal of crank shaft.	8
VII	Measurement of cylinder bore by inside micrometer	8
VIII	Determination of ovality and taper by using dial gauge.	8
IX	Measurement of fillet radius.	8
X	Operating various Workshop equipment such as: Valve refacing M/C, Cylinder Honing M/C, Twin head M/C, Horizontal Boring bar, Surface grinding M/C, Crank shaft Grinding M/C.	8
Total		60

REFERENCES BOOKS:

1. Principles of Engineering Metrology – Rega Rajendra, Jaico publishers, 2008.
Metrology & Measurement – Anand K Bewoor, Vinay Kulakarni, Tata McGraw Hill, New Delhi, 2009.
2. Engineering Metrology – R.K. Jain, Khanna Publishers, New Delhi, 2005.
3. A text book of Engineering Metrology – I.C. Gupta, Dhanpat Rai and Sons, New Delhi, 2005.
4. Metrology for Engineers – J.F.W. Galyer and C. R. Shotbolt, ELBS.
5. Engineering Metrology – K. J. Hume, Kalyani publishers.

TH:4(A)- REFRIGERATION AND AIR CONDITIONING

L	T	P	Total Marks: 100	Course Code: AEPE202A
3	0	0		
Total Contact Hours				Theory Assessment
Theory : 45Hrs				End Term Exam 70
				Progressive Assessment 30
Pre-Requisite : Nil				
Credit 3			Category of Course: PE	

RATIONALE: Main objective of the course in refrigeration and air conditioning is to make the students understand the basics of Refrigeration cycles. The basics of vapor compression and vapor absorption systems, components and refrigerants and lubricants of a refrigeration system, control strategies for refrigeration system and air conditioning systems are elaborated in this course.

LEARNING OUTCOMES:

After completion of the course, the students will be able to

- Define refrigeration and types of Refrigeration cycles
- Explain Vapor Compression and Vapor Absorption System working principles
- Identify the components required for refrigeration system.
- Identify the controlling components for a refrigeration system.
- Explain the working principles of Air-conditioning.

DETAILED COURSE CONTENTS

Unit No.	Topic/Sub-Topic	Allotted Time (Hours)
I	Introduction to Refrigeration: Definition of Refrigeration; Refrigerating effect- unit of refrigeration- Coefficient of performance; Types of Refrigeration-Ice, dry ice, Steam jet, Throttling, Liquid nitrogen refrigeration; Carnot refrigeration Cycle; Air refrigeration- Bell - Coleman cycle, PV& TS diagram; Advantage and disadvantages in air refrigeration; Simple problems	10
II	Refrigeration systems: Basic Components, Flow diagram of working of Vapour compression cycle; Representation of the vapour compression cycle on P-H, T-S & P-V Diagram; Expression for Refrigerating effect, work done and power required; Types of Vapour Compression cycle; Effects of super heating and under cooling, its advantages and disadvantages; Simple Vapour absorptions cycle and its flow diagram; Simple Electrolux system for domestic units; Comparison of Vapour absorption and vapour compression system; Simple problems on vapour compression cycle.	10
III	Refrigeration equipment: Compressor - types of compressors; Hermetically sealed and semi hermetically sealed compressor; Condensers - Air Cooled, water cooled, natural and forced draught cooling system; Advantages and disadvantages of air cooled and water-cooled condensers; Evaporators -natural, convection, forced convection types.	8

IV	Refrigerant flow controls: Capillary tube; Automatic Expansion valve; Thermo- static expansion valve; High side and low side float valve; Solenoid valve; Evaporator pressure regulator. Application of refrigeration: Slow and quick freezing; Cold storage and Frozen storage; Dairy refrigeration; Ice making industry; Water coolers.	8
V	Air conditioning: Introduction to Air conditioning; Factors affecting Air conditioning; Psychometric chart and its use; Psychometric process- sensible heating and cooling, Humidifying and dehumidifying; Adiabatic saturation process; Equipment used in air conditioning cycle; Air conditioning units and plants. Refrigeration and Air-conditioning tools: Tools used in refrigeration and Air conditioner installation; Installation procedure; Faults in refrigeration and air conditioning system; Servicing procedure.	9

REFERENCES:

1. Refrigeration and Air Conditioning – Sadhu Singh, Khanna Book Publishing Co., New Delhi
2. Refrigeration and Air Conditioning – S. Domakundawar, Dhanpat Rai publications.
3. Refrigeration and Air Conditioning – A.S.Sarao & G.S. Gabi, 6th edition, Satya Prakashan publications, New Delhi, 2004.
4. Principles of Refrigeration – Roy J.Dossat, 5th edition, Pearson Publications, 2001.
5. Refrigeration and Air Conditioning – M.Zakria Baig, Premier/ Radiant Publishing House.

Refrigeration and Air Conditioning – C.P Arora, Tata McGraw Hill

TH:4(B)- AUTOMOTIVE AIR CONDITIONING

L	T	P	Total Marks: 100	Course Code: AEPE202B
3	0	0		
Total Contact Hours				Theory Assessment
Theory : 45Hrs				End Term Exam 70
				Progressive Assessment 30
Pre-Requisite : Nil				
Credit 3				Category of Course: PC

RATIONALE:

The automotive users want comfortable atmosphere inside the automobiles. The ambient temperatures in winter and summer needs to be controlled by heating or cooling processes of air conditioning, as well as maintenance of fresh and healthy air inside the automobiles. As an automobile person, he/she has to install, maintain or operate such air conditioning systems in automobiles. This subject focuses these needs and addresses the issues of this area.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1: Identify the basics of Automobile air conditioning.

CO2: Describe the components of heating system and their working.

CO3: Discuss the different types of automotive air conditioning.

CO4: Explain the concept of retrofitting and alteration in auto air conditioning system.

CO5: analyze the environmental aspects related to air conditioning.

COURSE CONTENT DETAILS:

Unit no.	Content	Time allotted (hrs.)
I	Introduction: Need of ventilation, heating & Air conditioning of cars, multi utility vehicles, vans, safari, heavy passenger vehicle – coaches, cargo vehicle cabin, special application vehicle viz. vehicle used for transportation of perishable commodities & cryogenic substances (general requirements & broad comparison), Ventilation – Needs for various applications under different circumstances, Types of ventilation – uncontrolled and controlled ventilation, Uncontrolled ventilation – meaning, application & comparison, Controlled ventilation – meaning, types, applications and comparison, Heating –Needs for various applications under different circumstances, Air Conditioning -Needs for various applications under different circumstances.	9
II	Heating System: Layouts for various applications, Various components – function, construction, working, maintenance, general faults and their remedies, Various positions of heating control knob & relevant mechanism and body respective air flow patterns in car, Blower motor electrical circuit& concerned important electrical component.	9

III	AIR CONDITIONING SYSTEM: Manual, semi-automatic and Automatic Air conditioning system (Details & comparison), Layouts for various applications, Various components, their function, construction, working, maintenance and recurring faults & their remedies, Control panel (Any two varieties – push button and knob type)- Control system for manual. Air Conditioning System. Parameters to be controlled. Electro-mechanical circuit- Major components of control circuit and their function, Control System for Automatic Air Conditioning System. Parameters to be controlled. Electro-mechanical circuit- Major components of control circuit & their function, Refrigerant, Popularly used refrigerants & their comparison.	9
IV	RETROFITTING AND ALTERATION IN AUTO AIR CONDITIONING SYSTEM: Compatibility of vehicle for retrofitting, Selection of capacity & outlets for Air Conditioning system, Preparatory work for retrofitting & Air Conditioning System, Tools, fitting procedure & precautions, Altering existing Air Conditioning C system.	9
V	ENVIRONMENTAL ASPECTS RELATED TO AIR CONDITIONING: Ozone Depletion, Green Home Effect, Global Warming, Assignment- Prepare project report repairing & retrofitting Auto A/C system – economics (fixed, running, charger, profit) equipment, consumable & lay-out, Compare the specification of HVAC systems of various categories of vehicles.	9
	Total	45

REFERENCES BOOKS:

1. Kirpal Singh, Automotive Engineering Vol I, Standard Publishers And Distributors, New Delhi
2. Crouse & Anglin Automotive Mechanics Mcgraw Hill International Pub.
3. K. K. Jain & R. B. Asthana Automobile Engineering Tata Mcgraw Hill.
4. Don Knowles Auto Mechanics- Understanding New Technology Reston Publishers, New Jersey.
5. Mathur & Sharma Internal Combustion Engine Dhanpat Rai & Sons, New Delhi.
6. Bosch Diesel Fuel Injection SAE (distributor)
7. Anthony E. Schwaller Motor Automotive Technology Delmar Publishers, USA.
8. T.W. Birch Automotive Chassis System Delmark Thompson learning Inc. New York.
9. Bosch Automotive Handbook SAE (distributor).1, 2000.

TH:4(C)- AUTOMOTIVE THERMODYNAMICS

L	T	P	Total Marks: 100	Course Code: AEPE202C
3	0	0		
Total Contact Hours				Theory Assessment
Theory : 45Hrs				End Term Exam 70
				Progressive Assessment 30
Pre-Requisite : Nil				
Credit 3				Category of Course: PE

RATIONALE:

The course "Automotive Thermodynamics" is designed to build a foundational and advanced understanding of thermodynamic principles with direct application to automotive systems. It provides a comprehensive review of the first and second laws of thermodynamics, energy analysis, and thermodynamic cycles essential for internal combustion engines, jet propulsion, and power generation systems. The course further explores fuels and combustion processes, refrigeration and air-conditioning systems, and air compressors, all of which play crucial roles in automotive and transport applications. By covering modern advancements such as cogeneration, alternative fuels, and high-efficiency cycles, this course prepares students to innovate and optimize energy systems in the automotive sector.

COURSE OUTCOMES:

CO1: Analyze thermodynamic systems using the first and second laws, including concepts of entropy, availability, irreversibility, and reversible work.

CO2: Evaluate the performance of gas and vapor power cycles including Otto, Diesel, Dual Combustion, Brayton, Rankine, and their modifications for enhanced efficiency.

CO3: Understand the types, properties, and combustion characteristics of different fuels, and assess the efficiency and limitations of combustion processes in automotive applications.

CO4: Explain the principles and performance of refrigeration and air conditioning systems, and analyze their role in vehicle climate control.

CO5: Examine the principles and applications of gas dynamics in nozzles and analyze the working of various types of air compressors including reciprocating, centrifugal, and axial flow types.

CO6: Apply thermodynamic principles in designing and optimizing automotive systems, including compressors, propulsion systems, and alternative energy systems.

COURSE CONTENT DETAILS:

Unit No.	Content	Time Allotted (Hrs.)
I	Review of First and Second laws: First law analysis of unsteady flow control volumes, Entropy generation, Reversible work, Availability, and Irreversibility.	7
II	Gas and Vapour Power cycle: Air standard cycles- Otto, Diesel, Dual Combustion and Brayton cycles, The Brayton cycle with non-isentropic flow in compressors and turbines, The Brayton cycle with regeneration, reheating and intercooling, ideal jet propulsion cycle. The Carnot vapor cycle and its limitations, The Rankine cycle, means of increasing the Rankine cycle efficiency, In brief concepts of the binary vapour cycle, the gas-vapor coupled cycles, Cogeneration (Back pressure and Pass-out turbines).	10

III	Fuels and Combustion: Fuels: solid, liquid and gaseous, Chemical equations – conservation of mass, 1 st law applied to combustion process, calorific value of the fuel, calorific value of fuels, efficiency of combustion processes, limitations of thermodynamic analysis. Alternative fuels for automobiles	8
IV	Refrigeration and air conditioning: Principles of refrigeration, Vapour compression and vapour absorption system, COP, properties of refrigeration, Psychometric, Type of air conditioning system.	8
V	Basics of Gas dynamics and Isentropic flow through Nozzles Air Compressors: Introduction (Uses of compressed air), The reciprocating cycle neglecting and considering clearance volume, Volumetric efficiency and its effect on compressor performance, Limitations of single stage compression, Multistage compression and intercooling, Optimum intercooler pressure, Performance and design calculations of reciprocating compressors, Air motors. Centrifugal and axial flow compressor, blowers and fans: Components, working principles and applications.	12
TOTAL		45

REFERENCES:

1. Basic and Applied thermodynamics, P.k.Nag, TMH publications
2. Fundamentals of Engineering Thermodynamics, E. Rathakrishnan (PHI)
3. A course in Thermodynamic and Heat Engine: Kothandaraman and Domkundwar, Dhanpat Rai publication
4. Applied Thermodynamics: P.L.Balany, Khanna publications
5. Engineering Thermodynamics: R.K.Rajput, S. Chand and Co

TH:5(A)- AUTOMOTIVE POLLUTION CONTROL

L	T	P	Total Marks: 100	Course Code: AEPE204A
3	0	0		
Total Contact Hours				Theory Assessment
Theory : 45Hrs				End Term Exam 70
				Progressive Assessment 30
Pre-Requisite : Nil				
Credit 3				Category of Course: PE

RATIONALE:

The increasing global emphasis on environmental sustainability and public health has made emission and noise control in internal combustion engines a critical area of study. This course is designed to provide a comprehensive understanding of the formation, measurement, and control of emissions, noise, and vibrations associated with spark ignition (SI) and compression ignition (CI) engines. The rationale is to equip students with in-depth knowledge of the scientific principles, technological innovations, and regulatory frameworks related to automotive emissions and noise pollution. Through this course, students will gain insights into contemporary emission norms (Euro and Bharat), alternate fuel behavior, advanced testing techniques, and modern control strategies. This knowledge is crucial for designing cleaner, quieter, and more efficient engine systems aligned with global environmental standards.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1 Understand emission formation mechanism.

CO2 Interpret emission standards and fuel effect.

CO3 Apply emission testing method

CO4 Implement emission control technologies.

CO5: Analyze and control noise pollution.

CO6: Measure and control vibrations.

COURSE CONTENT DETAILS:

Unit No.	Topics for practice	Time Allotted (Hrs.)
I	Emissions from SI and CI Engines: Emission formation in SI and CI engines – factors influencing emission, effect of pollution on environment and human health. Emission norms - Euro & Bharat norms, effect of fuel properties and additives, emissions from alternate fuels.	9
II	Emission Testing: Emission test cycles, constant volume sampling method, non-dispersive infrared (NDIR) analyzer, flame ionization detectors (FID), chemiluminescence analyzer, smoke meters, gas chromatograph.	9
III	Emission Control Techniques: Air fuel ratio (A/F) control, crank case emission control, fuel evaporation & control, EGR, SCR, catalytic converters, Particulate traps, LNT, DOC. Effect of engine combustion modification and control technologies.	9

IV	Noise and Noise Control: Introduction to sound, noise measurements, control of air borne and structure borne noise- use of absorber, criteria for the selection of materials. Engine noise and control, Brake noise and control, tyre noise and control, gear noise and control, clutch noise and control, resonators, reactive and absorptive silencers, anechoic chamber.	9
V	Vibration Measurement and Control: Introduction, elements of vibration, source of vibration, types of vibration, measurement of vibration- FFT analyzer, quarter car model analysis. Methods of vibration control – passive, active, semi active control, vibration isolation, engine and drive train vibrations.	9
	Total	45

REFERENCES:

1. Engine Emission, B.P Pundir, Narosa Publication.
2. Automotive Pollution & Control, A. K. Babu, AKB Publishers
3. Internal Combustion Engines, V .Ganesan, Tata McGraw Hill.
4. Automotive Emission Control, Crouse, W.M. and. Anglin, A.L, McGraw Hill.
5. IC Engines, Dr. S. S. Thipse, Jaico publications.
5. Engine Emissions, pollutant formation, G.S .Springer and D.J. Patterson, Plenum Press.
6. ARAI vehicle emission test manual.

TH:5(B)- METROLOGY AND QUALITY CONTROL

L	T	P	Total Marks: 100	Course Code: AEPE202B
3	0	0		
Total Contact Hours				Theory Assessment
Theory : 45Hrs				End Term Exam 70
				Progressive Assessment 30
Pre-Requisite : Nil				
Credit 3				Category of Course: PE

RATIONALE:

Diploma engineers often come across varied types of measuring instruments and quality control processes in the actual practice. Diploma engineer should be proficient in making the measurements and follow various control processes to maintain the quality in engineering manufacturing areas. He should be able to understand and analyze the practical measurement systems. In this context, the course Metrology and quality control makes the students to understand the process of measurement and quality control processes required in any industry.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1: Identify different metrology concepts and standards

CO2: List various limits, fits, gauges and angular measuring instruments

CO3: Describe various comparators, surface finish measurement principles and statistical concepts

CO4: Identify the use of basic precision measuring instruments

CO5: Prepare P-chart and C-chart for variables.

COURSE CONTENT DETAILS:

Unit No.	Topics for practice	Time Allotted (Hrs.)
I	METROLOGY CONCEPTS AND STANDARDS: Definition of Metrology common terminology used such as Accuracy, Precision, Sensitivity, Magnification, Errors, Sources of errors, Line standard, Wavelength standard	06
II	LIMITS, FITS & GAUGES: Definitions -Tolerance, Allowance, Types of fits, Hole basic system & shaft, Basic system of fits, Types of gauges - Plug gauges, snap gauges, Ring gauges and relation Gauges, Taylor's Principle of gauge design. Problems of Tolerance calculations Gauge design	09
III	ANGULAR MEASUREMENTS: Concept of Angular measurement, Construction & working of bevel protractor, sine bar angle gauges, clinometers, Autocollimator, angle dekkor	06
IV	COMPARATORS: Principle of comparators, operation of various comparators, dial Indicators as mechanical comparator, Pneumatic comparators - Solex type & thigh pressure dial type. Electrical comparators, Relative advantages of disadvantages of various comparators & characteristics of good comparator	09

V	SURFACE FINISH MEASUREMENT: Terminology, Importance of surface finish, Concept of primary texture, secondary texture, CLA, RMS & RA Value, Principle and operation of stylus probe instruments	06
VI	FUNDAMENTAL OF STATISTICAL CONCEPTS: Classification of data, use and construction of frequency plot, frequency distribution, Measures of central tendency- mean, mode, median and variability and application, measures of dispersion-range, mean deviations, standard deviations, Areas under standard deviation, areas under normal distribution curve	09
	Total	45

REFERENCE BOOKS:

1. R. K. Jain Engineering Metrology Khanna Publishers
2. ASTM Hand book of Industrial Metrology
3. M. Mahajan Statistical quality control Dhanpat Rai & sons
4. Tapan. P. Bagchi, ISO 9000 Concepts, Methods and Implementations Wheeler
5. Codes of Practices by BIS IS 919 - 1963 limits, fits & tolerances IS 2029 - 1962 dial gauges.

TH:5(C)- MEASUREMENTS AND METROLOGY

L	T	P	Total Marks: 100	Course Code: AEPE202C
3	0	0		
Total Contact Hours				Theory Assessment
Theory : 45Hrs				End Term Exam 70
				Progressive Assessment 30
Pre-Requisite : Nil				
Credit 3				Category of Course: PE

RATIONALE:

The Mechanical measurement is primarily concerned with methods of measurement based on agreed units and standards. The practice of mechanical measurement involves precise measurements requiring the use of apparatus and equipment to permit the degree of accuracy required to be obtained. In the broader sense the subject is not limited to length measurement but is also concerned with the metrology, inspection and its various techniques. Thus technicians working in inspection, production and maintenance units need to be thorough in this subject.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1: Identify the principles of measurements and the working of measuring instruments.

CO2: Distinguish between various types of transducers and strain gauges.

CO3: Identify the aspect of limits, fits, tolerances, angular and screw thread measurements.

CO4: Interpret the data obtained from different measurement processes.

CO5: Measure the geometrical dimensions of drill angles, threads, gears and slip gauges

COURSE CONTENT DETAILS:

Unit No.	Topics for practice	Time Allotted (Hrs.)
I	Introduction to measurements: Definition of measurement; Significance of measurement; Methods of measurements: Direct & Indirect; Generalized measuring system; Standards of measurements: Primary & Secondary; Factors influencing selection of measuring instruments; Terms applicable to measuring instruments: Precision and Accuracy, Sensitivity and Repeatability, Range, Threshold, Hysteresis, calibration; Errors in Measurements: Classification of errors, Systematic and Random error. Measuring instruments: Introduction; Thread measurements: Thread gauge micrometer; Angle measurements: Bevel protractor, Sine Bar; Gauges: plain plug gauge, ring Gauge, snap gauge, limit gauge; Comparators: Characteristics of comparators, Types of comparators; Surface finish: Definition, Terminology of surface finish, Talysurf surface roughness tester;	9

II	Transducers and Strain gauges: Introduction; Transducers: Characteristics, classification of transducers, two coil self-inductance transducer, Piezoelectric transducer; Strain Measurements: Strain gauge, Classification, mounting of strain gauges, Strain gauge rosettes-two and three elements. Measurement of force, torque, and pressure: Introduction; Force measurement: Spring Balance; Torque measurement: Prony brake, Eddy current, Pressure measurement: Mcloed gauge.	9
III	Applied mechanical measurements: Speed measurement: Classification of tachometers, Revolution counters, Eddy current tachometers; Displacement measurement: Linear variable Differential transformers (LVDT); Flow measurement: Rotometers, Turbine meter; Temperature measurement: Resistance thermometers, Optical Pyrometer. Miscellaneous measurements: Humidity measurement: hair hygrometer; Density measurement: hydrometer; Liquid level measurement: sight glass, Float gauge; .	9
IV	Limits, Fits & Tolerances: Concept of Limits, Fits, and Tolerances; Selective Assembly; Interchangeability; Hole And Shaft Basis System; Taylor's Principle; Design of Plug; Ring Gauges; concept of multi gauging and inspection. Angular Measurement: Concept; Instruments For Angular Measurements; Working and Use of Universal Bevel Protractor, Sine Bar, Spirit Level; Principle of Working of Clinometers; Angle Gauges. Screw thread Measurements: ISO grade and fits of thread; Errors in threads; Pitch errors; Measurement of different elements such as major diameter, minor diameter, effective diameter, pitch; Two wire method; Thread gauge micrometer;	9
V	Gear Measurement and Testing: Analytical and functional inspection; Rolling test; Measurement of tooth thickness (constant chord method); Gear tooth vernier; Errors in gears such as backlash, runout, composite. Machine tool testing: Parallelism, Straightness, Squareness, Co-axiality, roundness, run out, alignment testing of machine tools as per IS standard procedure.	9
	Total	45

REFERENCES BOOKS:

1. Mechanical measurements – Beckwith Marangoni and Lienhard, Pearson Education, 6th Ed., 2006.
2. Metrology & Measurement – Anand K Bewoor, Vinay Kulakarni, Tata McGraw Hill, New Delhi, 2009.
3. Principles of Industrial instrumentation and control systems – Channakesava. R. Alavala, DELMAR Cenage learning, 2009.
4. Principles of Engineering Metrology – Rega Rajendra, Jaico publishers, 2008.
5. Dimensional Metrology – Connie Dotson, DELMAR, Cenage learning, 2007.
6. Instrumentation measurement and analysis – B.C. Nakara, K.K. Chaudary, second edition, Tata McGraw Hill, 2005.
7. Engineering Metrology – R.K. Jain, Khanna Publishers, New Delhi, 2005.
8. A text book of Engineering Metrology – I.C. Gupta, Dhanpat Rai and Sons, New Delhi, 2005.
9. Metrology for Engineers – J.F.W. Galyer and C. R. Shotbolt, ELBS.
10. Engineering Metrology – K. J. Hume, Kalyani publishers.

PR:4- MINOR PROJECT

L	T	P	Total Marks: 100	Course Code: PR 202
0	0	4		
Total Contact Hours				Assessment
Theory : 60Hrs				End Exam 30
				Progressive Assessment 70
Pre-Requisite : Nil				
Credit 2				Category of Course : Project

RATIONALE:

A Minor project is generally requires a larger amount of effort and more independent work than that involved in a normal assignment. It requires students to undertake their own fact-finding and analysis. The students will select the topic, perform and design work. Minor project is as preparation for the students to take on more responsibilities and bigger project in the future. It is a learning experience, which aims to provide students with the opportunity to synthesize knowledge from different areas of learning, and critically and creatively apply it to real life situations. The leadership quality, co-ordination of job and maintaining good communal harmony is an important factor of this type of activity.

LEARNING OUTCOMES:

After completion of the course, the students will be able to

- Plan a Minor Project
- Execute a Minor Project with team.
- Implement hardware/software/analytical/numerical techniques, etc. based on project requirements.
- Optimize time related works through sharing of work responsibility
- Develop cost awareness and utilization of fund.
- Prepare a technical report on the project.

GUIDELINES FOR MINOR PROJECT

Unit No.	Topic/Sub-Topic
I	● Minimum three and maximum five students can form a group for the minor project.

II	○ Project type can include ● Development of a simple prototype system/product. ● Investigation of performance of some systems using experimental method ● Analysis of components/systems/devices using suitable software ● Investigation of optimum process/material for product development using market survey. ● Solution for society/industry problems
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III	○ Project domain may not be limited to the specific area / discipline.
IV	○ Project report to be prepared and submitted by the students with following components: 1. Title 2. Objectives 3. Relevance and significance 4. Methodology 5. Analysis-Simulation/experimentation/survey/testing etc. 6. Result and Discussion 7. Conclusion

ESSENCE OF INDIAN KNOWLEDGE AND TRADITION

L	T	P	Total Marks: NIL	Course Code: AU 202
2	0	0		
Total Contact Hours				Theory Assessment
Theory : 30Hrs				End Term Exam 0
				Progressive Assessment 0
Pre-Requisite : Nil				
Credit 0				Category of Course : AU

RATIONALE:

Considering the need of protecting Indian knowledge and tradition, the diploma level students of Automobile Engineering should be facilitated the concepts Indian traditional knowledge and to make them understand the importance of roots of knowledge system and methods of application in today's life and how to protect traditional knowledge system. Interpretation of the concepts of Intellectual property to protect the traditional knowledge as well as importance of Traditional knowledge in Agriculture and Medicine must be known.

LEARNING OUTCOMES:

After completion of the course, the students will be able to:

- Understand the foundational principles of Indian knowledge systems by exploring the Vedas, Upavedas, Vedangas, and their interrelation with ancient and modern disciplines.
- Develop an appreciation for the integration of traditional Indian practices with modern science, focusing on holistic health care, yoga, and sustainable living practices.
- Analyze case studies to evaluate the practical applications of Indian knowledge systems in modern technological and scientific domains, including AI and ML.
- Foster interdisciplinary thinking by bridging ancient wisdom with contemporary educational and technological frameworks.

DETAILED COURSE CONTENTS:

Unit No.	Topic/Sub-Topic	Allotted Time (Hours)
I	Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge (Unani / Siddha/ Ayurveda), Indigenous Knowledge (IK), characteristics, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge of Odisha	7
II	Protection of traditional knowledge (TK): The need for protecting traditional knowledge, Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.	7

III	Legal framework and TK: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act); The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016.	6
IV	Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, Geographical Indications (GI).	4
V	Traditional Knowledge in Different Sectors: Traditional knowledge and engineering, Traditional medicine system, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK	6

REFERENCES:

1. Cultural Heritage of India- Course Material by V. Sivaramakrishna Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014.
2. Modern Physics and Vedant by Swami Jitatmanand, Bharatiya Vidya Bhavan.
3. The wave of Life by Fritzof Capra
4. Tao of Physics by Fritzof Capra
5. Tarkasangraha of Annam Bhatta, International by V N Jha Chinmay Foundation, Velliarnd, Amaku,am
6. Science of Consciousness Psychotherapy and Yoga Practices by RN Jha Vidyanidhi Prakasham, Delhi, 2016.