GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering
Level: Diploma
Branch: Automobile Engineering
Subject Code : DI04002011
Subject Name : Maintenance & Service - I

w. e. f. Academic Year:	2024-25
Semester:	4th
Category of the Course:	PCC

Prerequisite:	-
Rationale:	The automotive industry heavily relies on skilled professionals who can effectively maintain and service automobile engines. There is a high demand for technicians who possess the necessary knowledge and practical skills to diagnose, troubleshoot, and repair engine-related issues. Engine malfunctions or failures can lead to hazardous situations, accidents, or breakdowns on the road. By emphasizing maintenance and service, students learn how to identify and rectify problems in automobile engines components, fuel supply system & cooling and lubricating system.

Course Outcome:
After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Apply appropriate diagnostic tools and techniques to evaluate engine condition.	R, U & A
02	Service engine components to identify wear, damage, or malfunction.	R, U & A
03	Diagnose faults in the fuel supply system to identify root causes.	U & A
04	Maintain engine cooling and lubricating systems for effective functioning.	U & A
05	Overhaul engines to restore optimal performance and reliability.	U & A

**Revised Bloom's Taxonomy (RBT)*

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE (E)	PA(M)	PA(I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	**Engine condition diagnosis** 1.1 Primary assessment of engine condition involves employing the following techniques: • Evaluating engine smoke to determine potential issues. • Conducting a visual inspection to identify potential sources of engine oil and coolant leakage. • Analyzing engine noise to diagnose possible problems. 1.2 Various engine test methods mentioned below: • Engine compression test • Cylinder leakage test • Vacuum test • Oil pressure testing • Cylinder Power Balance Test	05	16%
2.	**Engine components maintenance** 2.1 Service procedure, inspection, causes and remedies of following engine components: • Piston and piston ring • Connecting rod, piston pin and half -split bearings • Crankshaft and main bearing journal • Flywheel • Inlet and exhaust valve • Inlet- exhaust valve and spring assembly • Camshafts, Lifters, Timing Belts, and Chains • Combustion chamber • Engine head • Engine cylinder liners • Engine cylinder block 2.2 Describe engine repowering and reconditioning method as mentioned in the following. • Engine cylinder boring & honing. • Engine cylinder head resurfacing. • Engine valve face and seat grinding.	10	21%
3.	**Maintenance and servicing of Fuel supply system** 3.1 Common problems related to fuel supply system and its remedies (Petrol/diesel/CNG/LPG/PFI/GDI).	10	21%

	3.2 Inspection, problems, causes and its remedies & repair/replacement of following components of fuel supply system. • Fuel tank • Fuel line and fittings • Fuel filters • Fuel pumps • Fuel Injectors • Intake manifold 3.3 Servicing and replacement procedure of air filter. 3.4 Testing methods and techniques of fuel injectors. (Petrol & Diesel fuel) 3.5 Calibration and phasing of fuel injection pump		
4.	**Maintenance and servicing of engine Cooling & Lubricating system** 4.1 Low temperature & high temperature engine problems and its remedies Types of cooling system use in engine. 4.2 Inspection and testing of coolant. 4.3 Inspection/service/Testing and repair/replacement of following components of engine cooling system. • Water pump • Thermostat valve • Hoses and gasket • Radiator & pressure cap • Cooling fan 4.4.Engine radiator flushing and cleaning technique. 4.5.Common problems related to engine lubrication system and its remedies. 4.6.Inspection, problems, causes and remedies of lubricating system and its components. 4.7.Factors affecting the oil pressure 4.8.Service and repair/replacement of Engine Oil Pump. 4.9.Procedure for changing engine oil.	15	26%
5.	**Engine rebuilding and Overhauling** 5.1 Reason for engine failure and need for rebuilding. 5.2 Dismantling of engine components and cleaning, visual and dimensional inspection. 5.3 Engine removal procedure. 5.4 Overhauling of engine with safety precautions. 5.5 Procedure of Engine decarbonizing.	5	16%

	5.6 Procedure of Engine major and minor tune up. 5.7 Diagnostic equipment scans tools.		
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
20	**40**	**40**	**-**	**-**	**-**

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:
(a) Books:

Sr. No.	Title of Book	Author	Publication with place, year and ISBN
1	Automobile Mechanics	William Crouse	Tata Mc-Graw Hill Publication ISBN-13:978-0-07-063435-0
2	Automotive Technology	James Halderman and Curt Ward	Pearson Publication (7th edition) ISBN-10: 0-13-785490-0 ISBN-13: 978-0-13-785490-5
3	Advanced Automotive fault diagnosis	Tom Denton	Elsevier publication ISBN 13:978-0-75-066991-7
4	Automotive Service: Inspection, Maintenance, Repair.	Tim Gills	Cengage Learning, 2015. ISBN 13: 9781305445932
5	Vehicle Maintenance and Garage practice	Jigar A. Doshi Dhruv U. Panchal Jayesh P. Maniar	Prentice Hall India Learning Private Limited ISBN-10 : 8120349822 ISBN-13 8120349827-978 :
6	Automotive maintenance and trouble shooting.	Ernest A. Venk, Edward Dale Spicer & Irving Augustus Frazee	American Technical Society ASIN B000U7AB7A :

(b) Open source software and website:

1. https://nptel.ac.in
2. https://swayam.gov.in
3. https://vlab.co.in
4. https://www.howacarworks.com

Suggested Course Practical List:

Sr. No	Practical Outcomes (PrOs)		Unit No.	Approx. Hrs. required
1	Conduct engine smoke analysis, visual inspections, and noise diagnostics to ascertain the condition of the engine.	Any one	1	4
2	Conduct engine compression and vacuum testing.		1	4
3	Perform replacement procedure of engine piston, connecting rod, crankshaft and main journal bearings.	Any one	2	4
4	Conduct an inspection and reconditioning of valves and valve seats.		2	4
5	Perform service and testing of fuel injector.	Any one	3	4
6	Trouble shooting and service procedure of fuel supply system of Petrol engine/Diesel engine.		3	4
7	Describe replacement procedure of components of cooling system.	Any Three	4	4
8	Trouble shooting and service procedure of cooling system.		4	4
9	Perform oil changing procedure in a given vehicle.		4	4
10	Describe replacement procedure of components of lubricating system.		4	4
11	Trouble shooting and service procedure of lubricating system.		4	4
12	Perform engine tune up.	Any one	5	6
13	Perform diagnosis of engine by scan tool.		5	6
	Total Hrs.			**30**

List of Laboratory/Learning Resources Required:

Sr. No.	Equipment Name with Broad Specifications
1	Light motor vehicle: A modern car or jeep of any make and model along with all relevant accessories and systems
2	Digital Compression Test Kit.

	– Max. pressure: 300 psi (20.5 bar) (2,070 kPa) – Digital compression tester comprising of test gauge with rubber boot, 10 in. (250 mm) high-pressure hose and female quick-change coupler – 14 mm standard reach thread x 6.5 in. (165 mm) hose adapter. – 14 mm standard reach thread x 12 in. (305 mm) hose adapter – 14 mm reach thread x 12 in. (305 mm) hose adapter – 18 mm standard reach thread x 12 in. (305 mm) hose adapter – 18 mm reach male thread x 14 mm standard reach female thread plug adapter – 16 mm male thread x 14 mm standard reach female thread plug adapter – 10 mm male thread x 14 mm standard reach female thread plug adapter – 12 mm male thread x 14 mm standard reach female thread plug adapter – Air hold adapter
3	Digital Diesel Compression Test Kit – Max. pressure: 1000 psi (6890 kPa) (68.9 bar) – Digital compression tester comprising of test gauge with rubber boot, 15 in. (380 mm) long, high-pressure hose, quick-change coupler – Injector adapter – Glow plug adapter – Right-angle adapter – Field service kit – Displays values in psi, bar and kPa
4	Air Compressor: – Horse Power : 7.5 HP – Compressor Technology : Reciprocating Compressor – Model Name/Number : TS07 – Discharge Pressure : 30 BAR – Maximum Flow Rate : 11.51 CFM – Weight : 248 Kg – Product Dimension : 1490 x 600 x 695 mm
5	Fuel Injector Tester – Voltage 220 V – Frequency 50 Hz – Phase Phase Single Phase – Rotation Speed 10000 RPM – Tube Volume 120ml – Tank Volume 4 Liter – Fuel Flow 4.5L/min – Automation Type Automatic – Display Digital – Injection Time 0-600 sec – Oil Pump Pressure 0-6.5kg/cmA

6	Ultrasonic Cleaner: – Capacity (L): 2 Ltr Ultrasonic – Frequency: 40 Khz – Digital Timer: 5-60 minutes – Heating: 0-80°C – Power: 50 W – Basket Dimension (mm): 175x165x250 mm
7	Scan Tool: – Screen 8" diagonal, daylight readable color LCD screen; 1280*800 pixel – Touch with Gloves Supported – Operating System Android system – CPU Quad-Core, 1. 3GHz – Memory 2GB DDR3L – SSD Hard drive 32GB – Communication Interface Built-in WIFI 802.11 b/g Wireless LAN micro USB 2.0 OTG, USB 2.0 HOST standard Bluetooth 4.0 (10-20 m) – HDMI Yes – Camera 5 megapixels rear-facing – Battery 8000mAh, lithium-polymer battery. Chargeable via 5V AC/DC power supply – Protocols ISO 9141-2, ISO 14230-2(KWP2000), SAE J1850-PWM, SAE J1850-VPW, SAE J2740(GM UART), UART Echo Byte Protocol(SAE J2809、SAE J2818), Honda Diag-H Protocol, SAE J2610(SCI), ISO 11898, ISO 15765-4, KW81, KW82, GWM 3089 (Single Wire CAN), SAE J2819(TP2.0), SAE J3054(TP1.6), ISO 11898-3(Low Speed Fault-Tolerant CAN), SAE J2284 (High Speed CAN) – OBD2 Compatible with Indian cars
8	Radiator pressure tester kit – Allows Radiator Cap Relief Pressure and Seal Condition to Be Tested – Shaft Diameter: 0.47 inch – Maximum Pressure: 30 PSI – Used For: Most Vehicle Radiators – Vehicle Make: Universal

Suggested Project List:

1) Prepare a checklist for primary assessment of engine condition.
2) Develop a training module on how to identify and diagnose engine problems based on smoke color and opacity.
3) Conduct a study on the effectiveness of different engine oil and coolant leak detection methods.
4) Develop a training module on how to perform an engine compression test, cylinder leakage test, vacuum test, oil pressure test.
5) Conduct a study on the common causes of piston and piston ring failure.

6) Develop a training module on how to service and inspect connecting rods, piston pins, and half-split bearings.
7) Conduct a study on the common causes of crankshaft and main bearing journal failure.
8) Develop a training module on how to service and inspect inlet and exhaust valve spring assemblies.
9) Conduct a study on the common causes of camshaft, lifter, timing belt, and chain failure.
10) Conduct a study on the common causes of engine head gasket failure and cracking.
11) Conduct a study on the common causes of combustion chamber carbon buildup and detonation.

Suggested Activities for Students: If any

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of each activity. They should also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a) Charts can be prepared.
b) Small report on any topic given by concern faculty.
c) Small groups of students can be formed for assigned work. Assigned work should be such that it covers market survey, team work, presentation, time management, quality development.

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