Government of Karnataka
Department of Collegiate and Technical Education
Board of Technical Examinations, Bangalore

Course Code	20AT21P	**Semester**	II
Course Title	**AUTOMOTIVE ENGINES**	**Course Group**	Core
No. of Credits	4	**Type of Course**	Tutorial & Practice
Course Category	PC	**Total Contact Hours**	6 Hrs Per Week
			78 Hrs Per Semester
Prerequisites	Drawing/Creativity	**Teaching Scheme**	(L:T:P)-1:0:2
CIE Marks	60	**SEE Marks**	40

1. COURSE SKILL SET

The aim of the course is to help the student to attain the following industry identified competency through various teaching –learning experiences.
Perform Service & Repair Work of an IC engine in the Automobile Engineering Workshops/Service stations

2. INSTRUCTIONAL STRATEGY

1. The training methods to be used should be appropriate to the development of competencies. It should be individual centered to make each person a competent one.
2. Demonstrations using different models, audio visual aids and equipment be used intensively.
3. Instructor should expose to different tools used in Automobile service stations, Operational safety and Procedure to be followed for service & repair of different IC engines. Emphasis should be given on technical aspects as per manufacturer's standards& use of service manuals.
4. Focus should be on proper selection& use of measuring tools, service tools& equipment's and their proper use.

3.COURSE OUTCOMES

On successful completion of the course, the students will be able to demonstrate industry-oriented Cos associated with the above-mentioned competency:

CO1	Classify various types of automobile, its nomenclature & explain the constructional &working principle of IC engine components with their functions.
CO2	Select & use different types of conventional and special tools, equipment, data & information for servicing & overhauling of an IC engine.
CO3	Ascertain and select measuring instrument and measure dimension of components and compare them with standard values.
CO4	Perform machining operations such as reboring, honing, valve refacing& lapping applying safe working practices.

CO5	Perform engine disassembly / assembly, repair and maintenance of SI& CI engines as per workshop manual, identify and rectify errors and repair/replace components.

4. COURSE CONTENT

The following topics/sub topics are to be taught and assessed in order to develop Unit Skill sets for achieving CO to attain identified skill sets.

SHOP	Topics/Sub topics	Unit skill set (In cognitive domain)	Hours L-T-P
UNIT-1: GENERAL STRUCTURE OF AUTOMOBILE	1. Identify major systems of Automobile with their functions. 2. Identify major components of a 2-3 & 4-wheeler with their functions. 3. Measure the wheel base - wheel track - overall length - front overhung - rear overhung - height of CG point - ground clearance - gross weight and kerb weight of different vehicles. 4. Know the different manufacturing concerns of two-wheeler, three-wheeler, LMV and HTV – their products and plants location	Automobile - Classification of Automobile, Major systems of an Automobile - their functions, Chassis – chassis layout of two, three & four-wheeler with major components - their functions, engine mounts, definition of: wheel base - wheel track - overall length - front overhung - rear overhung - height of CG point - ground clearance - gross weight and kerb weight. Automobile manufacturing concerns of two & three-wheeler, LMV and HTV – their products and plants location	04-00-08
UNIT-2: CYLINDER BLOCK	1. Remove the cylinder head, gasket & crankcase using suitable tools. 2. Compare the cylinder block, cylinder head & gaskets of different materials with their advantages and disadvantages. 3. Explain & compare wet & dry liners with their merits & demerits. 4. Measure the ovality and taperness of cylinder bore using bore gauge. 5. Perform reboring & honing operations.	Cylinder block – types - Constructional details - materials used, Cylinder head - constructional details - materials used – Gasket- purpose- types, crank case, oil pan, cylinder liners – types – construction –comparison- merits and demerits.	04-00-08
UNIT-3: PISTON & PISTON RINGS	1. Remove piston-connecting rod assembly and piston rings using special tools. 2. Identify the different methods adopted to control piston expansion. 3. Describe the necessity of compression & oil ring with their constructional features	Piston - functions - requirements - constructional details - materials, piston clearance – importance – piston slap-expansion controlling methods in piston- heat dam- slots in piston- cam grounded, Piston rings – functions - types - constructional details – materials, Piston pin -construction – materials	04-00-06

	4. Perform measurement of piston ring gap, piston ring to groove clearance, piston OD, cylinder to piston clearance & compare them with standard values in service manual.		
UNIT-4 : CONNECTING ROD, CRANKSHAFT & CAMSHAFT	1. Remove crankshaft, camshaft & flywheel from the engine. 2. Know different methods of connecting piston with connecting rod and compare them. 3. Explain & compare the different camshaft drive mechanisms. 4. Checking of connecting rod, crankshaft, camshaft & flywheel as per service manual. 5. Measurement of crank pin diameter using vernier caliper & compare them with standard data.	Connecting rod and crank shaft– Constructional details, material - functions, List different methods of connecting piston with connecting rod – Explain fully floating type. Camshaft-functions– construction-materials, explain different types of camshaft drives. Flywheel-need-construction and materials.	04-00-06
UNIT - 5: VALVES & VALVE MECHANISM	1. Explain & compare the different types of valve mechanisms. 2. Dismantle the valve assembly and check them as per service manual. 3. Perform Re-conditioning of valve mechanism, measuring valve face angle, valve re-facing & honing. 4. Interpret the Valve timing diagram for four stroke petrol & diesel engines. 5. Set and adjust the valve clearance & know the importance of hydraulic valve lifter.	Poppet valve, valve materials, valve cooling - sodium cooled valve-overhead & side valve operating mechanism, overhead camshaft valve mechanism- valve seat- valve guide-valve spring, valve tappet, push rod, rocker arm & rocker shaft - hydraulic valve lifter, variable valve timing Valve timing diagram for four stroke petrol engines & diesel engines- valve clearance- its importance.	05-00-10
UNIT-6: MANIFOLDS & MUFFLERS	1. Explain the need of firing order, firing order in multi cylinder engines 2. Remove inlet & exhaust manifold, differentiate them & identify the materials used. 3. Identify different types of mufflers with their working principle. 4. Service the inlet & exhaust manifold of different types 5. Assemble all the engine parts using appropriate tools and equipment's. Tighten the bolts to the specified torques as per service manual.	Multi cylinder engine- arrangement of multi cylinder engine cylinders- Meaning and need of firing order, firing order of three, four six- & eight-cylinder engines. Inlet and exhaust manifold, mufflers-purpose - constructional details of absorber type, baffle plate type, wave cancellation type and resonance type mufflers.	05-00-14

SL. No	Practical Outcomes/Practice Sessions	Unit No	PO	CO	L:T:P
1	Practice Health & Safety-%S technique (Sort, set in order, **S**hine/Sweep, **S**tandardize &**S**ustain). Identifying and practice on use of conventional tools, special tools & equipment's, pneumatic tools, used for dismantling and assembling the engine.	1	1-6	2	0:0:2
2	Practice on use of measuring instruments such as vernier caliper, screw gauge, dial gauge, bore gauge, combination set square.	1	1-6	3-4	0:0:2
3	Identify the major systems & components of a 2-3 & 4-wheeler and do their comparative study	1	1-6	1	0:0:2
4	Measure the wheel base - wheel track - overall length - front overhung - rear overhung - height of CG point - ground clearance - gross weight and kerb weight of different vehicles and compare them with their manuals	1	1-6	1	0:0:2
5	Conduct compression test & vacuum test on SI & CI engine and check with the standard values	2	1-6	2-3	0:0:2
6	Remove any single cylinder engine from vehicle, drain engine oil and coolant, Water wash engine / degrease. Dismantle the engine parts, clean, inspect the parts. Check engine bore, cylinder, cylinder head, fins for warpage, cracks & rust.	2	1-6	3-5	0:0:2
7	Measure the ovality and taperness of cylinder bore & compare with standard values.	3	1-6	3	0:0:2
8	Practice on Re-boring of cylinder of single cylinder engine	3	1-6	3-4	0:0:4
9	Practice on Honing of cylinder of single cylinder engine	3	1-6	3-4	0:0:2
10	Practice on cleaning of piston & piston rings	3	1-6	5	0:0:2
11	Measure the piston ring end gap, piston ring to groove clearance, piston OD, cylinder to piston clearance, compare the measurements with service manual	3	1-6	3-4	0:0:2
12	Clean & check connecting rod, crankshaft, camshaft & flywheel	4	1-6	5	0:0:2
13	Study the camshaft drive mechanism – remove, clean, check & overhaul its components	4	1-6	5	0:0:2
14	Measure the crank pin/Journal diameters & compare them with service manual data	4	1-6	3-4	0:0:2
15	Remove, clean, check & overhaul the valve mechanism Remove valve seats and valve guides-	5	1-6	5	0:0:2
16	Check for valve stem bend, Check the condition of valve spring, Measure the valve face angle and compare with service manual data.	5	1-6	3-4	0:0:2
17	Practice on Valve refacing /lapping by using valve refacing machine.	5	1-6	3-4	0:0:4

18	Draw the Valve timing diagram for four stroke petrol engines & diesel engines.	5	1-6	3-5	0:0:2
19	Assemble the engine by using appropriate tools with specified torques.	2,3, 4,5	1-6	2-5	0:0:6
20	Set the valve tappet clearance for inlet and exhaust valves as specified in the manual	5	1-6	3-5	0:0:2
21	Service the inlet & exhaust manifold of different types	6	1-6	5	0:0:2
22	Observe and compare the arrangement of cylinders in a multi cylinder engine	6	1-6	5	0:0:2
Total Hours					**0:0:52=52**

MAPPING OF CO WITH PO

CO	Course Outcome	PO Mapped	Experiment Linked	R/U/A	Tutorial& PracticalSessions in Hrs	
CO1	Classify various types of automobile, its nomenclature & explain the constructional & working principle of IC engine components with their functions.	**PO1**	**1-6**	**A**	**12**	
CO2	Select & use different types of conventional and special tools, equipment, data & information for servicing & overhauling of an IC engine.	**PO1, PO4**	**1-6**	**A**	**12**	
CO3	Ascertain and select measuring instrument and measure dimension of components and compare them with standard values.	**PO1, PO4**	**1-6**	**A**	**10**	
CO4	Perform machining operations such as reboring, honing, valve refacing& lapping applying safe working practices.	**PO1, PO4**	**1-6**	**A**	**10**	
CO5	Perform engine disassembly / assembly, repair and maintenance of SI& CI engines as per workshop manual, identify and rectify errors and repair/replace components.	**PO1, PO2, PO4**	**1-6**	**A**	**15**	

Course	CO's	Programme Outcomes (PO's)						
		1	2	3	4	5	6	7
Automotive Engines	CO1	3	0	0	0	0	0	0
	CO2	3	1	0	2	0	0	0
	CO3	3	0	0	2	0	0	0
	CO4	3	1	0	2	0	0	0
	CO5	3	2	0	2	0	0	0
Level 3- Highly Mapped, Level 2-Moderately Mapped, Level 1-Low Mapped, Level 0- Not Mapped								

7. SUGGESTED LEARNING RESOURCES

Sl.No.	Title of Book	Author	Publication
1	A course in Internal Combustion Engines	M. L. Mathur, R. P. Sharma	Dhanpat Rai and sons.
2	Automobile Engineering	G. B. S. Narang.	Khanna Publication
3	Automobile Engineering	R. B. Gupta.	S. Chand
4	Automobile Engineering (Vol II)	Dr. Kripal Singh.	Standard Publication
5	Automotive Engineering	G. B. S. Narang.	Tata McGraw Hill
6	Automobile Mechanics	S. Shrinivasan	Tata McGraw Hill
7	The Automobile	Harbans Singth Royat.	S. Chand Publication
8	Internal Combustion Engine	V. Ganeshan	Tata McGraw Hill
9	Automobile Engineering	Ramlingam K. K.	Saitech Publication
10	Automotive engines	James D. Halderman	Pearson

Websites:

1. How stuff works.com.
2. http://en.wikipedia.org/wiki/Car
3. http://en.wikipedia.org/wiki/History_of_the_automobile
4. http://www.history.com/topics/automobiles.
5. http://en.wikipedia.org/wiki/History_of_the_automobile.
6. https://www.youtube.com/watch?v=fTAUq6G9apg.
7. https://www.youtube.com/watch?v=rWmR9UIz5iA.
8. https://www.youtube.com/watch?v=nAKTVBRNsmI.
9. https://www.youtube.com/watch?v=hV3LImCslpo.
10. https://www.youtube.com/watch?v=PYje-4D76kc.

8. SUGGESTED LIST OF STUDENT ACTIVITIES

Note: the following activities or similar activities for assessing CIE (IA) for 10 marks (Any one)

Each student should conduct different activity and no repeating should occur

1	Visit to an Automobile service station; observe the safety practices followed and service procedures followed. Make hand written report
2	Collect the vehicle specifications of different vehicles & prepare a comparison study report.
3	Collect different parts of automobile engine parts and write material, function of those parts
4	Prepare trouble shooting chart for SI and CI engines (symptoms, causes and remedies).
5	Visit to an Automobile service station; observe the different machining operations (cylinder reboring, honing, valve refacing) ,safety practices and service procedures followed. Make hand written report

Course Assessment and Evaluation Chart

Method	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
DIRECT ASSESSMENT	CIE (Continuous Internal Evaluation)	Models	Students	Two Tests - Theory	20	Blue Book	1,2,3,4,5
				Three Skill tests	20	Log of Records	1,2,3,4,5
				Student Activity	20		1,2,3,4,5
				TOTAL CIE	60	-	-
	SEE (Semester End Examination)	End Exam		End of the course-SEE	40	BTE Answer Scripts	1,2,3,4,5
INDIRECT ASSESSMENT	Student Feedback on course		Students	Middle of the course		Feedback forms	1,2,3,4,5 Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3,4,5 Effectiveness of Demonstrations & Assessment Methods

Assessment Methodology

Sl.No	Assessment	Mode of Assessment	Schedule of Assessment	Duration	Max marks	Conversion after taking Average
1	CIE Assessment 1	Written Test-1 (At the end of 3rd week)	End of 3rd week	1 Hr	20	Average of two written tests 20
2	CIE Assessment 2	Written Test-2 (At the end of 13th week)	End of 13th week	1 Hr	20	
3	CIE Assessment 3	Skill Test-1 (At the end of 7th week)	End of 5th week	3 Hrs	20	Average of three skill tests 20
4	CIE Assessment 4	Skill Test-2 (At the end of 9th week)	End of 7th week	3 Hrs	20	
5	CIE Assessment 5	Skill Test-3 (At the end of 11th week)	End of 9th week	3 Hrs	20	
6	CIE Assessment 6	Student Activity	End of 11th week	-	20	20
Total Continuous Internal Assessment (CIE) Marks						60
7	SEE- Semester End Examination	Skill Test	As per BTE	3 Hrs	100	40
Total Marks						**100**

Note:

1. Assessment of student activity is evaluated through appropriate rubrics by the respective course coordinator.
2. CIE Skill tests to be conducted as per SEE scheme of evaluation.

10. RUBRICS for Skill Test Evaluation

Sl No	Parameter to be Observed	Marks Allotted
1	Knowledge on Measuring Instruments	20
2	Tools Identification	20
3	Application Knowledge	20
4	Application of skill	20
5	Viva-voce	20
Total		100

RUBRICS FOR ACTIVITY (10marks)						
Dimension	**Unsatisfactory**	**Developing**	**Satisfactory**	**Good**	**Exemplary**	**Student Score**
	2	**4**	**6**	**8**	**10**	
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collect much information; but very limited relate to the topic	Collects some basic information; most refer to the topic	Collects a great deal of information; all refer to the topic	8
Fulfil team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties but unreliable.	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team roles	6
Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Normally does the assigned work	Always does the assigned work without having to be reminded.	8
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Talks good; but never show interest in listening others	Listens, but sometimes talk too much	Listens and speaks a fair amount	8
Average / Total Marks: (8+6+8+8)/4						**7.5 = 8 marks**