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

Course Title: Engine Maintenance and Estimation		
Scheme (L:T:P) : 4:0:0	**Engine Maintenance and Estimation:52**	**Course Code:15AT63T**
CIE:25 marks		**SEE: 100 Marks**

Prerequisites: Knowledge of all one to four semester automobile core subjects.

Course Objectives:

Prepare the maintenance schedule, estimations and diagnosis of engine troubles.

COURSE OUT COMES

On successful completion of the course, the students will be able to:

	Course Outcome	CL	Linked PO	Teaching Hrs
CO1	Interpret the maintenance schedule and inspection reports of vehicle.	R/U/A	2,5,6,	**06**
CO2	Utilize different Diagnostic tools to diagnose the engine problems.	R/U/A	2,3,4	**10**
CO3	Apply the knowledge of dismantling, Inspection, cleaning and servicing of Engine parts and engine tune-up.	R/U/A	2,3,4	**09**
CO4	Determine different pollutants from engine and their controlling methods.	R/U/A	2,5,6	08
CO5	Prepare cost estimation of mechanical and Automobile parts.	R/U/A/An	2,3	**10**
CO6	Calculate Depreciation and prepare repair Estimate of various automobile components/ systems.	R/U/A/An	2,3	**09**
			Total Sessions	**52**

Legend: R; Remember, U: Understand A: Application

COURSE-PO ATTAINMENT MATRIX

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
Engine Maintenance And Estimation.	0	3	3	2	2	2	0	0	0	0

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.
If >40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

COURSE CONTENT AND BLUE PRINT OF MARKS FOR SEE

Unit No	Unit Name	Hour	Questions to be set for SEE/MARKS			Marks Weightage	Weightage (%)
			R	U	A		
1	Maintenance Schedule	06	05	05	10	20	13.79
2	Diagnostic Techniques	10	05	05	20	30	20.68
3	Repair And Overhauling Of Engine	09	05	10	20	35	24.17
4	Engine emissions & their Control	08	05	05	10	20	13.79
5	Estimation & Costing	10	05	05	10	20	13.79
6	Depreciation & Repair Estimate	09	05	05	10	20	13.79
	Total	52	30	35	80	145	100

Legend: R; Remember, U: Understand, A: Application, An: Analyze.

Course Contents:

UNIT I : MAINTENANCE SCHEDULE 06Hrs

Introduction, Necessity of maintenance, maintenance systems, vehicle inspection check lists, vehicle inspection reports, log books, Job Card, Workshop activities, Maintenance Schedule of LMVs, HMVs (general maintenance schedule) daily, weekly, monthly & periodic maintenance.

UNIT II : DIAGNOSTIC TECHNIQUES 10Hrs

Introduction, Diagnostic process-six stage process, diagnostics flow chart, Mechanical diagnostic techniques- Noise conditions-Vibration conditions-Road test, Diagnosing Engine problems before repair- causes and remedies for : excess oil consumption- fuel consumption- Lack of power output- Engine noises description (Crank noises-Piston noises-Valve train noises- Pre-ignition - Detonation-Broken Engine Mount) – overheating of engine –Loss of coolant- Oil pressure problems- Engine will not crank- Engine cranks slowly but does not start- Engine back fires- Excess smoke- on board diagnostic- Need- Benefits- different methods of accessing DTCs(

Diagnostic Trouble Codes), OBD II DTCs, OBD II Drive Cycle, Introduction to Engine Analyzer & scan tools.

UNIT III : REPAIR AND OVERHAULING OF ENGINE **09Hrs**

Overhauling of multi-cylinder engine : Procedure- Engine Removal from vehicle- Engine Cleaning methods- Engine dismantle - Engine parts inspection and cleaning - servicing of Manifolds- Cylinder Head- Valve mechanism- cam shaft – hydraulic valve lifter- Fly wheel- Crank shaft- Bearings - Connecting rods – Piston assembly- cylinder block-liners, Assembly of engine - Valve clearance setting- engine tune-up.

UNIT IV: ENGINE EMISSIONS AND THEIR CONTROL **08 Hrs**

Air pollution –Introduction - Pollutants from S.I Engine – main sources , SI engine emission control methods by – Engine modification – Treatment of exhaust gases – Fuel modification, Positive crankcase ventilation, Evaporative loss control device, Exhaust gas recirculation. Pollutants from C.I engines –types of smoke – causes of smoke - smoke meters – filter darkening type – Light extinction type, smoke control methods.

UNIT V: ESTIMATION & COSTING 10 Hrs

Definition of Estimating, Importance of Estimating, Aims of Estimating, Functions of Estimator, Qualities of Estimator, procedure of Estimating, Sources of Errors in Estimating, constituents of Estimation.

Costing -Definition- Objectives & aims of Costing, elements of cost, components of cost, methods of Cost allocation, Difference between Estimating and Costing.

Calculate the material cost of simple component like- step pully- rivets- flywheel-crankshaft- Connecting rod- Valve- Gibb headed key, simple problems on components of cost & on cost allocation.

UNIT VI : DEPRICIATION & REPAIR ESTIMATE 09 Hrs

Depreciation- Definition- depreciation fund, causes of depreciation, methods of calculating depreciation, simple problems on straight line method, diminishing balance method, sinking fund method, sum of the year's digit method, machine hour basis method.

Estimate the cost of repairing of auto components- Starter- Alternator- Fuel Injection pump- Injector- Fuel pump- Clutch, Estimate the cost of overhauling of Major assemblies of- Engine - top overall hauling - major overhauling- Gearbox- Differential unit- Steering system - Brake system- Hub greasing - Suspension system (Independent and Rigid)

REFERENCE BOOKS:

Sl.No.	Title of Books	Author	Publication
1	Vehicle Maintenance and Garage Practice	Doshi . Panchal . Maniar	PHI Learning Private Limited.
2	Maintenance of Automotive Engines	Tim Gilles	Cengage Learning.
3	Advanced Automotive Fault Diagnosis: Automotive Technology: Vehicle Maintenance and Repair	Tom Denton	Cengage Learning.
4	Automotive Computer Controlled Systems- Diagnostic tools and techniques	Allan W. M. Bonnick	Butterworth-Heinemann
5	Mechanical Estimating and Costing	S.C. Sharma & T.R.Banga	KHANNA PUBLISHERS.
6	Automotive Engineering-Fuels & Emissions, Classroom Manual	Ken Pickerill	Cengage Learning.
7	Automotive Engineering –Engine Performance Classroom Manual	Barry Hollembeak	A Butterworth-Heinemann Title; 3 edition
8	Internal Combustion Engines	M.L.Mathur & R.P.Sharma	Dhanpath rai & Sons.
9	IC Engines	V Ganesan	McGraw Hill Education(India) Private Limited, NEW DELHI.
10	Internal Combustion Engines	M.L.Mathur & R.P.Sharma	Dhanpat Rai & Sons.
11	Automobile Engineering	Kamaraju Ramakrishna	PHI Publication.

LIST OF SOFTWARES/ WEBSITES:

1 http://www.tidyforms.com/download/automotive-maintenance-log.html
2. http://slsi.net/downloads/Monthly_Vehicle_Checklist.doc.pdf
3. http://www.tidyforms.com/download/vehicle-maintenance-schedule-template/page-8.html
4. http://www.kohlerengines.com/maintenance/basicTroubleshooting.htm#troubleshooting1
5. http://www.auto-facts.org/engine-diagnosis.html
6. http://slideplayer.com/slide/726802/

SPECIAL INSTRUCTIONAL STRATEGIES

UNIT	UNIT NAME	STARATEGIES
1	Maintenance Schedule	Teaching , Showing charts, presentations, Video movies
2	Diagnostic Techniques	Teaching ,Presentations, charts, Video movies, Expose to real life transport organizations
3	Repair And Overhauling Of Engine	Teaching, Presentations, charts. Expose to practiced procedures
4	Engine Emissions And Their Control	Teaching, Presentations &Seminar
5	Estimation & Costing	Teaching, Expose to practiced procedures, Presentations &Seminar
6	Depreciation & Repair Estimate	Discussions, real life industries situation, industrial visits.

SUGGESTED LIST OF STUDENT ACTIVITIES

Note: the following activities or similar activities for assessing CIE (IA) for 5 marks (Any one)

Student should do any following type activity or similar activities related to the course and before take it up, get it approved from concerned Teacher and HOD.

Each student should conduct activity individually and should not copy from others.

1	Visit service station to prepare job card and maintenance schedule of different vehicles.
2	Prepare Diagnosis chart and information about OBD II Scanners.
3	Visit local service station, garages to prepare document on servicing of engine.
4	Collecting of emission standard norms for different makes and models of the vehicles.
5	Prepare repair estimate of MPFI, CRDI repair, etc.

Course Assessment and Evaluation Scheme:

Course Assessment and Evaluation Scheme:

Method	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
Direct Assessment	CIE (Continuous Internal Evaluation)	IA	Students	Three IA Tests; (Average of three Tests)	20	Blue books	1,2,3,4,5,6
				Activity	05	Activity Reports	1,2,3,4,5,6
	SEE (Semester End Examination)	End Exam		End of the course	100	Answer scripts at BTE	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	Middle of the course		Feedback forms	1,2&3 Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3,4,5&6 Effectiveness of Delivery of instructions & Assessment Methods

Note: I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off to the next higher digit.

Note to IA verifier*: *The following documents to be verified by CIE verifier at the end of semester

1. Blue books (20 marks)
2. Student suggested activities report for 5 marks evaluated through appropriate rubrics.
3. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods

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MODEL OF RUBRICS /CRITERIA FOR ASSESSING STUDENT ACTIVITY

RUBRICS MODEL

RUBRICS FOR ACTIVITY(5 Marks)						
Dimension	**Unsatisfactory**	**Developing**	**Satisfactory**	**Good**	**Exemplary**	**Student Score**
	1	**2**	**3**	**4**	**5**	
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	Ex: 4
Full fill 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	5
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.	3
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	2
Average / Total marks=(4+5+3+2)/4=14/4=3.5=4						

Note: This is only an example. Appropriate rubrics/criteria may be devised by the concerned faculty (Course Coordinator) for assessing the given activity.

MODEL QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
	VI SEM	**ENGINE MAINTENANCE AND ESTIMATION.**	20
	Year: 2016-17	Course code: **15AT63T**	
Name of Course coordinator :		Topic: Units:1,2	**CO: 1,2**

Note: Answer all questions

Q No	Question	Marks	CL	CO	PO
1	Explain the importance of Preventive maintenance of a vehicle OR List out the importance of maintenance.	5	R	1	2,5,6
2	List out the different types of vehicle maintenance and explain them along with its merits and demerits.	5	A	1	2,5,6
3	Explain the need of OBD II. OR Express causes for excess smoke from engine.	5	U	2	2,3,4
4	Explain the OBD II Diagnostic trouble codes.	5	A	2	2,3,4

MODEL QUESTION PAPER ((SEE)

V Semester Diploma
Examination

ENGINE MAINTENANCE AND ESTIMATION.

Time: **3 Hours**] [Max Marks**: 100**

Note: Answer any **SIX** from Part A and any **SEVEN** from Part B

Part A 6x5=30 marks

1. Appraise the importance of predictive maintenance of a vehicle
2. List the six stages of diagnosis process.
3. List the engine cleaning methods.
4. List the engine emission control methods
5. List the qualities of estimator
6. List the causes of depreciation.
7. Write a note on obsolescence.
8. List and explain the elements of costing.
9. Describe hot soak type of ELCD

Part B

1. List and explain the workshop activities.
2. a) Illustrate the procedure for valve lapping.
   b) Diagnosis for overheating of engine.
3. Write a note on OBD II Drive cycle
4. Explain the procedure to conduct road test diagnostic technique.
5. Write a procedure to valve face reconditioning
6. Explain valve seat recondition methods in details.
7. Sketch and explain exhaust gas recirculation device.
8. Estimate the weight of C.I used in manufacturing stepped pully having dimensions Pully A- diameter 12mm, pully B- 9 mm & pully C-6 mm all pulleys having a width of 4 mm and having a through-hole diameter of 3 mm. assume the density of the C.I as 7.2 gm/cc.

9. Explain the causes of depreciation
10. a) Explain the procedure for cylinder liner fitting.
    b) Discus the Difference between Preventive and brake down maintenance.

MODEL QUESTION BANK

VI- Semester Diploma Examination

ENGINE MAINTENANCE AND ESTIMATION.

Note: *The paper setter is of liberty to set the questions on his/her desecration based on cognitive levels notified for that unit. They have to follow only blue print of SEE question paper format. The model question bank is only for reference to students/course coordinator to initiate the process of teaching-learning only.*

CO-1: Interpret the maintenance, schedule and inspection reports of vehicle.

Remember **05Marks**

1. Describe why daily maintenance is required for a vehicle?
2. List the types of maintenance systems.
3. Explain the importance of Preventive maintenance of a vehicle
4. Explain the importance of predictive maintenance of a vehicle
5. List out the importance of maintenance.
6. List the importance of job card.

Understanding **05Marks**

1. Illustrate a typical trip sheet of vehicle.
2. Discus the Difference between Preventive and brake down maintenance.
3. Illustrate a typical maintenance log sheet of an automobile.
4. Explain Why scheduled maintenance is preferred?
5. Explain description of job card.

Application **10Marks**

1. List out the different types of vehicle maintenance and explain them along with its merits and demerits.
2. Discuss about the preparation of maintenance check list and explain the various forms used for vehicle maintenance.
3. Explain about the preparation of check list for the complete overhauling of a petrol engine.
4. Explain maintenance schedule of LMV on monthly maintenance.
5. Explain maintenance schedule of HMV for periodic maintenance.
6. Illustrate the specimen job card for estimate purpose.
7. List and explain the workshop activities.

CO-2: Utilize different Diagnostic tools to diagnose the engine problems.

Remember **05Marks**

1 List the six stages of diagnosis process.
2 List the sources to causes Crank Noise.
3. List the sources to causes Piston Noise.
4. List the sources to causes Valve train noise.
5. List the causes for excess oil consumption.
6. List the causes and remedies for the lack of power output.

Understanding **05Marks**

1. Demonstrate diagnostic flow chart.
2. Diagnosis for overheating of engine.
3. Express causes for excess smoke from engine.
4. Explain the need of OBD II.
5. Explain different methods of accessing DTCs.

Application **10 Marks**

1. Explain the mechanical diagnostic techniques.
2. List the causes and remedies for excess oil consumption and lack of power out-put.
3. List the causes for low and high oil pressure in the engine.
4. Write a note on OBD II Drive cycle.
5. Explain the OBD II Diagnostic trouble codes.
6. Write a note on engine back fire.
7. Explain the procedure to conduct road test diagnostic technique.

CO-3: Apply the knowledge of dismantling, Inspection, cleaning and servicing of Engine parts and engine tune-up.

Remember **05Marks**

1. List the engine cleaning methods.
2. List the steps to servicing of manifolds.
3. Explain the procedure for piston assembly.
4. Explain the procedure for valve clearance setting.
5. Explain the procedure to service the connecting rod.

Understanding **05Marks**

1. Explain step by step procedure for resurfacing of the cylinder.
2. Express the cylinder boring and cylinder honing.
3. Illustrate the procedure for valve lapping.
4. Describe procedure to check the flatness of cylinder head surface.
5. Explain the procedure for cylinder liner fitting.

Application **10Marks**

1. Explain engine disassembly procedure in detail.
2. Mention the methods used for cleaning of the engine, explain them in detail.
3. Explain valve seat recondition methods in details.
4. Write the procedure for valve tappet clearance.
5. Write a procedure to valve face reconditioning.

CO-4: Determine different pollutants from engine and their controlling methods.

Remember **05Marks**

1 List the types of pollutants from petrol engine.
2. List the pollutants from exhaust gas of petrol engine.
3. List the engine emission control methods.
4. List the evaporative loss control devices.
5. List the pollutants from CI Engines.
6. List the CI smoke meters.
7. List the smoke control methods.

Understanding **05Marks**

1. Describe hot soak type of ELCD.
2. Identify the methods to control of oxides of nitrogen.
3. Identify the causes of smoke in diesel engine.
4. Differentiate the Blue-white smoke and Black smoke.
5. Explain control of smoke in CIE.

Application **10Marks**

1. Explain engine emission control methods.
2. Sketch and explain positive crankcase ventilation.
3. Sketch and explain catalytic converter.
4. Sketch and explain exhaust gas recirculation device.
5. Mention the causes of smoke in diesel engine and explain them.

CO-5: Prepare Estimation, cost estimation of Automobile and mechanical components.

Remember **05Marks**

1. Define Estimation.
2. Mention the importance of estimation.
3. List the functions of estimator.
4. List the qualities of estimator.
5. List the sources of errors in estimating.
6. Define costing.
7. List objectives and aims of costing.
8. Define standard cost and mention the advantages of standard cost.
9. Explain the advantages of efficient costing.

Understanding **05Marks**

1. Explain the aim of estimation.
2. Explain the procedure of estimating.
3. List and explain the elements of costing.
4. Differentiate between the estimating and costing.
5. Write the procedure to for calculating the material cost of the product.
6. Draw the Block diagram to show the relationship between elements and Components of cost.

Application / Analyze **10Marks**

1. Explain constituents of estimation.
2. Estimate the weight of C.I used in manufacturing stepped pully having dimensions Pully A- diameter 12mm, pully B- 9 mm & pully C-6 mm all pulleys having a width of 4 mm and having a through-hole diameter of 3 mm. assume the density of the C.I as 7.2 gm/cc.

CO-6: Calculate Depreciation and prepare repair Estimate of various automobile components/ systems.

Remember **05Marks**

1. Define depreciation.
2. List the causes of depreciation.
3. List the various methods of calculating depreciation.

Understanding **05Marks**

1. Explain depreciation due to physical condition.
2. Explain deprecation due to functional condition.
3. Explain the sinking fund method of calculating depreciation.
4. Write a note on obsolescence.

Application / analyze **10Marks**

1. Explain the causes of depreciation.
2. (a) A boiler was purchased in Rs. 45000 on 1st January 1946, the erection and installation cost was Rs.7000. the boiler was to be replaced by a new one on 31 st December 1965. If the scrap value was estimated as Rs. 15000 what should be the rate of depreciation and depreciation fund on 15th June, 1955.

   (b) If after 12 years of running, some boiler tubes are replaced and the replacement cost is Rs.15000, what will be the rate of depreciation?
3. Prepaid estimate for Starter.
4. Prepaid estimate for alternator.
5. Prepaid estimate for FIP.
6. Prepaid estimate for Injector
7. Prepaid estimate for fuel pump.
8. Prepaid estimate for gear box
9. Prepaid estimate for top overhauling.
10. Prepaid estimate for differential unit.