

C21_ Curriculum

DIPLOMA IN AUTOMOBILE ENGINEERING



OFFERED BY

STATE BOARD OF TECHNICAL EDUCATION & TRAINING,

TELANGANA: HYDERABAD

V Semester

Sl No	Course Code	Course Name	Teaching Scheme				Credits	Examination Scheme						
			Instruction Periods per week			Total Period per semester		Continuous internal evaluation			Semester end examination			
			L	T	P			Mid Sem 1	Mid Sem 2	Internal evaluation	Max Marks	Min Marks	Total Marks	Min marks for Passing including internal
1	ME-501	Industrial Management and Entrepreneurship	4	1	0	75	3	20	20	20	40	14	100	35
2	AU-502	Automobile Components Design	4	1	0	75	3	20	20	20	40	14	100	35
3	AU-503	Autotronics	4	1	0	75	3	20	20	20	40	14	100	35
4	AU-574	Automobile Servicing and Maintenance	4	1	0	75	3	20	20	20	40	14	100	35
	AU-584	Production Technology	4	1	0	75	3	20	20	20	40	14	100	35
	EE-594	Electric Vehicles	4	1	0	75	3	20	20	20	40	14	100	35
5	AU-575	Farm Tractors and Special Types of Vehicles	4	1	0	75	3	20	20	20	40	14	100	35
	AU-585	Motor Transport Organisation	4	1	0	75	3	20	20	20	40	14	100	35
6	AU-506	Automobile Engineering Drawing	1	0	2	45	1.5	20	20	20	40	20	100	50
7	AU-507	Fuels, Lubricants and I.C. Engines Testing Lab	1	0	2	45	1.5	20	20	20	40	20	100	50
8	AU-508	Vehicle Diagnosis & Testing Lab	1	0	2	45	1.5	20	20	20	40	20	100	50
9	AU-509	Automobile Servicing and Maintenance Lab	1	0	2	45	1.5	20	20	20	40	20	100	50
10	AU-510	Project Work	1	0	2	45	1.5	20	20	20	40	20	100	50
11	AU-511	Skill Upgradation	0	0	8	120	2.5	0	0	Rubrics			--	-
Activities: student performance is to be assessed through Rubrics														

ME-501 - INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP

Course title	Industrial Management and Entrepreneurship	Course code	ME-501
Semester	V	Course group	Core
Teaching scheme in periods (L:T:P)	4:1:0	Credits	3
Methodology	Lecture+ Tutorial	Total Contact Periods	75
CIE	60 Marks	SEE	40 Marks

Prerequisites: Knowledge of Basic Sciences.

COURSE OUTCOMES

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

Course Outcomes	
CO1	Understand the principles and functions of management and Outline Organization structure& organizational behavior
CO2	Understand the Functions of Production Management
CO3	Analyse the functions of Materials Management.
CO4	Compare Marketing, sales & Feasibility study.
CO5	Know the use of ISO 9000 & T.Q.M
CO6	Understand Industrial legislation & safety and role of entrepreneur and entrepreneurial development

Blue Print of Marks for SEE:

Units		No of periods	Questions to be set for SEE				Remarks	
			R		U	A		
Part-A	1.Principles and functions of management and organisation structure and behaviour	13	Q4	Q1	Q9(a)	Q13(a)		
	2.Production management	12						
Part-B	3.Materials management	13		Q2	Q10(a)	Q14(a)		
	4.Marketing, sales & feasibility study	12						
Part-C	5.Introduction to ISO 9000 & T.Q.M	13		Q3	Q5 Q6	Q9(b) Q11(a) Q11(b)	Q13(b) Q15(a) Q15(b)	
	6.Industrial legislation & safety and Entrepreneurial development	12			Q7 Q8	Q10(b) Q12(a) Q12(b)	Q14(b) Q16(a) Q16(b)	
TOTAL		75	08		08	08		

COURSE CONTENT

- 1. Principles and functions of management and organisation structure and behaviour**
Definitions of Industry, Commerce and Business, Evolution of management theories, Principles of Scientific Management, functions of management, Difference between administration and management, Role of industry, Types of ownership – Sole proprietorship, Partnership, Private limited, public limited company, Industrial Cooperatives, Philosophy, types of Organizations, Line and Staff and functional organizations, Advantages, limitations, departments in a large-scale industry, Effective organization, Motivation, different theories of motivation, leadership styles.
- 2. Production management**
Production, planning and control, relation with other departments, need for planning and its advantages, Routing, scheduling, dispatching, PERT and CPM, simple problems.
- 3. Materials management**
Materials in industry, inventory control model, ABC Analysis, Safety stock, re-order level, Economic ordering quantity, Stores layout, stores equipment, Stores records, purchasing procedures, purchase records, Bin card, Cardex.

4. Marketing, sales & feasibility study

Sellers and Buyers markets, Marketing, Sales, Market conditions, monopoly, oligopoly, perfect competition, Cost -Elements of Cost, Contribution, Break even analysis, Market Survey, Product and production Analysis, Materials input, Manpower, Location, Economic and Technical Evaluation, preparation of Feasibility study reports.

5. Introduction to ISO 9000 & T.Q.M

Concept of quality, Definition of the terms quality policy, quality management, quality systems, quality control and quality assurance, Elements of quality systems: Management responsibility, Quality system, contract review, design control, document control, purchasing, purchaser– supplied product, product identification and traceability, process control, Inspection and testing. Definition and Principles of quality assurance, Know the necessity of International standards –ISO- Evolution, Meaning, importance, Various standards under ISO, ISO 9000 series of standards- Features, series, Constituents, Advantages, Draw backs and beneficiaries (Whom does ISO 9000 help). **5-S** principles-concept of zero defects. TQM-Meaning, Characteristics.

6. Industrial legislation & safety and Entrepreneurial development

Employer – Employee relations, Trade, Union Settlement of disputes, collective bargaining, Welfare activities, Total Welfare concept, rights and responsibilities of Employers and employees, Salient features of Indian Factories Act, Importance of Safety at work places, Hazards, causes of accidents, Entrepreneur and entrepreneurship -Concept, definition, role, expectation, Entrepreneurship Vs Management, promotion of S.S.I. Self –employment schemes, Product selection, site selection, Institutional support needed, financial assistance programs. Start up Scheme- Importance, Features and Eligibility for startup registration, Benefits

REFERENCE BOOKS

1. Industrial engineering and management by O.P Khanna.
2. Production management by Buffa
3. Industrial Engineering & Management Science by TR Banga
4. Engineering Economics and management science by Banga & Sharma
5. Personnel management by Flippo
6. Entrepreneurship by NITTTR Chennai.

ELECTRONIC RESOURCES

1. <https://nptel.ac.in/courses/>
2. <https://www.slideshare.net/>
3. <https://en.wikipedia.org/wiki/>

4. <http://ndl.ethernet.edu.et/bitstream/>

SUGGESTED STUDENT ACTIVITIES

1. Identify any 5 industries with different types of ownerships.
2. Prepare an organizational structure of institution
3. Make a survey on marketing a product.
4. Prepare a list of ISO 9000 series as well as latest quality standards
5. Prepare sign boards representing safety measures.
6. Role play as an entrepreneur

SUGGESTED LEARNING OUTCOMES

Upon completion of the course the student shall be able to

1. Understand the principles and functions of management and Outline Organization structure& organizational behavior

- 1.1 Define industry, commerce (Trade) and business.
- 1.2 Know the need for management.
- 1.3 Understand the evolution of management
- 1.4 Explain the principles of scientific management.
- 1.5 Understand functions of Management.
- 1.6 Differentiate between management and administration.
- 1.7 Understand types of ownerships
- 1.8 Differentiate types of ownerships.
- 1.9 Understand salient features of joint stock companies.
- 1.10 Understand the philosophy and need of organization structure of an industry.
- 1.11 Understand the line, staff and Functional organizations.
- 1.12 List the advantages and limitations of line, staff and functional organizations.
- 1.13 List different departments in a large scale industry.
- 1.14 Explain the factors of effective organization.
- 1.15 Understand organizational behaviour.
- 1.16 Explain job analysis.
- 1.17 State motivation theories.
- 1.18 State Maslow 's Hierarchy of needs.
- 1.19 List out different leadership models.
- 1.20 Explain the trait theory and behavior theory of leadership

2. Understand the Functions of Production Management

- 2.1 Differentiate production, planning and control.
- 2.2 Relate the production department with other departments.
- 2.3 State the need for planning and its advantages.
- 2.4 Explain the stages of Production, planning and control.
- 2.5 Explain routing methods.
- 2.6 Explain scheduling methods.
- 2.7 Explain dispatching.
- 2.8 Draw PERT/CPM networks.

- 2.9 Identify the critical path
- 2.10 Problems on PERT & CPM.

3 Analyze the functions of Materials Management

- 3.1 State the importance of material management.
- 3.2 Objectives and functions of material management.
- 3.3 Derive expression of EOQ for inventory control.
- 3.4 Explain ABC analysis.
- 3.5 Define safety stock, Buffer stock
- 3.6 Define reorder level.
- 3.7 Functions of stores department, duties of store keeper
- 3.8 Explain stores layout,
- 3.9 Explain the stores records.
- 3.10 Describe Cardex method.
- 3.11 Objectives and functions of purchasing department
- 3.12 Explain purchasing procedures.
- 3.13 List out purchase records.
- 3.14 Describe the stores equipments

4 Compare Marketing, sales & Feasibility study.

- 4.1 Explain marketing functions.
- 4.2 Explain Sales function.
- 4.3 List out marketing conditions.
- 4.4 Differentiate Sellers and Buyers 'market.
- 4.5 Differentiate monopoly, oligopoly, and perfect competition.
- 4.6 Steps in conducting market and demand surveys.
- 4.7 Advantages and disadvantages of market and demand surveys
- 4.8 Differentiate product and production analysis.
- 4.9 Identify the input materials, i.e. Bill of materials
- 4.10 Explain the concept of cost..
- 4.11 Explain break-even analysis..
- 4.12 Evaluate Economic and Technical factors.
- 4.13 Preparation of feasibility study.
- 4.14 List out different products currently in demand with market or industry.

5 Know the use of ISO 9000 & T.Q.M

- 5.1 Understand the concept of quality.
- 5.2 Know the quality systems and elements of quality systems.
- 5.3 Know the principles of quality Assurance.
- 5.4 Know the evolution of ISO standards.
- 5.5 Discuss ISO standards and ISO 9000 series of quality systems.
- 5.6 State the constituents of ISO 9000 series of standards for quality systems.
- 5.7 Benefits and Drawbacks of ISO 9000 series of standards.

- 5.8 List out the beneficiaries of ISO 9000.
- 5.9 Understand 5-S principles and ZERO DEFECT
- 5.10 Know TQM concept and elements.

6 Understand Industrial legislation & safety and role of entrepreneur and entrepreneurial development

- 6.1 Describe employer and employee relations.
- 6.2 Objectives, functions, advantages and disadvantages of Trade Unions.
- 6.3 Explain Causes and settlements of industrial disputes..
- 6.4 List out Welfare activities..
- 6.5 List out the rights and responsibilities of employees and employers.
- 6.6 List out the salient features of Indian Factories Act.
- 6.7 Explain the importance of safety at Work place.
- 6.8 List out the important provisions related to safety.
- 6.9 Explain hazard and accident.
- 6.10 Explain the causes of accidents..
- 6.11 Define the word entrepreneur..
- 6.12 Difference between entrepreneurship and management.
- 6.13 Explain, expectations, role and qualities of an entrepreneur..
- 6.14 Determine the role of entrepreneurs in promoting Small Scale Industries.
- 6.15 Describe the details of self-employment schemes.
- 6.16 Explain the method of product selection.
- 6.17 Explain the method of site selection.
- 6.18 List the financial assistance programs.
- 6.19 List out the organizations that help an entrepreneur
- 6.20 Importance of Start-ups
- 6.21 Different Start-up schemes
- 6.22 Features and Eligibility for startup registration
- 6.23 Benefits of Start-ups

COURSE OUTCOMES		CL	Linked POs	Teaching Periods
CO1	Understand the principles and functions of management and Outline Organization structure& organizational behavior	R, U, A	5,6,7	13
CO2	Understand the Functions of Production Management	R, U, A	2,5,6	12
CO3	Analyse the functions of Materials Management.	U, A	1,6,7	13
CO4	Compare Marketing, sales & Feasibility study.	U, A	1,6,7,	12
CO5	Know the use of ISO 9000 & T.Q.M	U, A	1,6,7	13
CO6	Understand Industrial legislation & safety and role of entrepreneur and entrepreneurial development	R, U, A	1,6,7	12
			Total Periods	75

Legends: R = Remember; U= Understand; A= Apply and above levels (Bloom's revised taxonomy)

CO-PO Attainment Matrix:

COURSE OUTCOMES	PROGRAM OUTCOMES						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1					2	3	1
CO2		2			1	3	
CO3	1					2	3
CO4	1					3	2
CO5	2					3	1
CO6	1					2	3

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

MID SEM-I EXAM

S.No	Unit Name	R	U	A	Remarks
1	Principles and functions of management and organisation structure and behaviour	1, 2	5(a) 5(b)	7(a) 7(b)	
2	Production management	3, 4	6(a) 6(b)	8(a) 8(b)	
Total Questions		4	4	4	

MID SEM-I EXAM

S.No	Unit Name	R	U	A	Remarks
1	Materials management	1, 2	5(a) 5(b)	7(a) 7(b)	
2	Marketing, sales & feasibility study	3, 4	6(a) 6(b)	8(a) 8(b)	
Total Questions		4	4	4	

Legend	Remembering (R)	1 Mark
	Understanding (U)	3 Marks
	Application (A)	5 Marks

MID SEM-I Model Paper

ME-501-INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP

Time: 1 hr

Max. Marks:20

PART-A

4x1=4Marks

NOTE: 1) Answer all questions and each carries one mark.

2) Answers should be brief and straight to the point and shall not be exceed three simple sentences.

1. Define Industry.
2. Write any two qualities of a leader.
3. What do you mean by Planning?
4. What does CPM Stands for.?

PART-B

2X3M=6 Marks

NOTE: 1) Answer all questions and each carries three mark.

2) Answers should be comprehensive and the criterion for valuation is the content but not length of the answer.

5.(a) what is administration

OR

5.(b) List out theories of motivation.

6.(a) what is the need for planning.

OR

6.(b) what is routing?

PART-C

2X5M=10 Marks

NOTE: 1) Answer all questions and each carries five mark.

2) Answers should be comprehensive and the criterion for valuation is the content but not length of the answer.

7.(a) Explain the principles of scientific management

OR

7.(b) a) Compare between PERT AND CPM.

b) Explain about Scheduling and Dispatching.

8.(a) Draw the project network of the given project and identify all paths through it. Find the critical path, TL and T_E on the network.

Activity	Optimistic Time(a)	Most likely Time (m)	Pessimistic Time (b)
1-2	1	1	7
1-3	1	4	7
1-4	2	2	8
2-5	1	1	1
3-5	2	5	14
4-5	2	6	10
5-6	3	6	15

OR

8.(b) State the ERG theory of motivation.

MID SEM-II
Model Paper:: ME-501

INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP

Time: 1 hr

Max. Marks:20

PART-A

4x1=4Marks

NOTE: 1) Answer all questions and each carries **one** mark.

2) Answers should be brief and straight to the point and shall not be exceed three simple sentences.

1. Write the formula to calculate EOQ?
2. What is Buffer Stock?
3. What Is feasibility study?
4. What is Breakeven Point?

PART-B

2X3M=6 Marks

NOTE: 1) Answer all questions and each carries **three** mark.

2) Answers should be comprehensive and the criterion for valuation is the content but not length of the answer.

- 5.(a) List the advantages of ABC analysis.

OR

- 5.(b) State the functions of Material Management.

- 6.(a) List out the element of cost ?

OR

- 6.(b) what is buyer's market and seller's market.

PART-C

2X5M=10 Marks

NOTE: 1) Answer all questions and each carries **five** mark.

2) Answers should be comprehensive and the criterion for valuation is the content but not length of the answer.

- 7.(a) Explain the functions of Purchase management.

OR

- 7.(b) Explain various records used in stores.

- 8.(a) What is Break Even analysis? Illustrate graphically the concept of Break even point.

OR

- 8.(b) Differentiate product and product analysis.

BOARD DIPLOMA EXAMINATION, (C-21)
SEE-MODEL PAPER ME-501
DME– V SEMESTER EXAMINATION
INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP

Time: 2 Hours

Max. Marks: 40

PART-A

8 X 1 = 8

Instructions: 1. Answer **ALL** questions.
2. Each question carries **ONE** mark.

1. Define Trade.
2. What is a bin card
3. List two benefits of ISO 9000 certification.
4. Define a Network.
5. Define quality control.
6. What is ISO.
7. What is the purpose of Trade unions.
8. Define an entrepreneur.

PART-B

4 X 3 = 12

Instructions: 1. Answer **ALL** questions.
2. Each question carries **THREE** marks.

9. (a) State any three differences between share and debenture.
OR
9. (b) What are the 5-S principles.
10. (a) List any three advantages of ABC analysis.
OR
10. (b) Mention three qualities required for a good entrepreneur.
11. (a) List the beneficiaries of ISO 9000
OR
11. (b) State the features of ISO 9000.
12. (a) What are the expectations of an entrepreneur
OR
12. (b) Explain the significance of collective bargaining.

PART-C

4 X 5 = 20

- Instructions:** 1. Answer **ALL** questions.
2. Each question carries **FIVE** marks.

13. (a) Explain the principles of Scientific management stated by F.W. Taylor

OR

13(b) What is quality system? Explain various elements of quality systems.

14 (a) Explain ABC analysis in inventory control with graph.

OR

14(b) Explain the factors influencing the site selection for a plant location.

15 (a) What is TQM? Write the principles or elements of TQM.

OR

15(b) Explain the importance of certification of confirmation to ISO 9000 and the procedure of obtaining it ?

16(a) List out the three rights and responsibilities of Employees.

OR

16(b) State Indian electricity rules with regard to safety.

AU-502- AUTOMOBILE COMPONENTS DESIGN

Course Title	Automobile Components Design	Course Code	AU-502
Semester	V	Course Group	Core
Teaching scheme in periods (L:T:P)	4:1:0	Credits	3
Methodology	Lecture + Practicals	Total Contact Periods	75 Periods
CIE	60 Marks	SEE	40 Marks

Course Content and Blue Print of Marks for SEE

Semester End Examination							
Sl. No.	Unit No.	Questions to be set for SEE				Periods	
		R		U	A		
1	I- Bolts and Nuts	4	1		9(a)	13(a)	10
2	II- Shafts						15
3	III- Keys and couplings		2		10(a)	14(a)	12
4	IV- Cams						12
5	V- Governors and Flywheels		3	5, 6	9(b) 11(a) 11(b)	13(b) 15(a) 15(b)	14
6	VI- Bearings				7,8	10(b) 12(a) 12(b)	14(b) 16(a) 16(b)
Total Questions		8		8	8	75	

Legend:	Remembering (R)	1 Mark
	Understanding (U)	3 Marks
	Application (A)	5 Marks

Pre requisites:

Knowledge of Engineering Physics, Engineering Mechanics, Strength of Materials, Machine drawing.

Course Outcomes:**On successful completion of the course student should able to:**

CO1	Analyze the concept of Automobile Components design and demonstrate the design procedures.
CO2	Design the components like Bolts, Nuts and Shafts subjected to different stresses induced under different load conditions.
CO3	Design the keys and couplings used to transmit complete torque.
CO4	Draw the cam profile using CAD for a given follower motion.
CO5	Design the Governors and Flywheels subjected to different load conditions for various engineering applications.
CO6	Design the given automobile components with the basic concepts of sustainable development.

Course Content:**UNIT- 1: Bolts and Nuts****Duration: 10 periods (L: 6.67 – T: 2.33)**

Definition of terms related to Bolts and Nuts – Pitch, Lead and Lead angle, Thread angle, Nominal diameter, Crest, Root, Depth of thread etc. – Classification of bolts – loads acting on the bolts and the consequent failures – Calculation of various dimensions of a bolt and nut for a given diameter using empirical proportions (Hexagonal only).

UNIT-2: Shafts**Duration: 15 periods (L: 10 – T: 5)**

Introduction - function of shafts – Classification of Shafts used in Automobile Transmission System -shaft materials – Torque (torsion) equation (No Derivation) - assumptions made - Power transmitted by Solid and Hollow circular shafts – Design of Solid and Hollow shafts (i) subjected to Torsion (ii) subjected to Bending , and iii) subjected to combined Torsion and Bending-Guest's theory (max. Shear stress theory) – Rankine's theory (max. Normal stress theory) – Design of shafts based on Rigidity-Necessity of Propeller shaft application in Automobile Transmission System.

UNIT-3: Keys and Couplings**Duration: 12 periods (L: 8 – T: 4)**

Functions of Keys and Splines – Materials used – Nature of failure of key – Types of keys – Saddle, Flat, Round and Sunk keys - Design of a Rectangular sunk key – Proportions of Splines –

Function of Couplings – Classification of Couplings – Design of Muff coupling and Flange coupling

UNIT-4: Cams

Duration: 12 periods (L: 8 – T: 4)

Types of Cams and Followers – Applications – Explanation of terms Cam Profile, Base circle, Cam angle, Trace point and Lift – Explanation of displacement diagrams of 1) Uniform velocity 2) Uniform acceleration and retardation, and 3) Simple Harmonic motion. Draw Cam profiles for above three cases for Knife edge, Flat plate and Roller follower (No offset).

UNIT-5: Governors and Flywheels

Duration: 14 periods (L:9.33 – T: 4.67)

Functions of Governor – Classification of Governors – Application – Working of Porter Governor and simple problems – Flywheel types – Purpose and application – Comparison between Governors and Flywheels – Turning moment diagram – Design of Flywheel – Simple problems.

UNIT-6: Bearings

Duration: 12 periods (L: 8 – T: 4)

Functions – Types of bearings – Lubrication types – Journal bearing – Terminology – Performance-McKee's equation-Bearing Modulus, power lost in friction and heat generated. Thrust bearing – Power lost in friction, flat pivot and flat collar under conditions of uniform intensity of pressure and wear – Rolling contact bearings–advantages and disadvantages–Components of Rolling contact bearing – Ball and Roller bearings – Rating life of antifriction bearing, Static load carrying capacity, Dynamic load carrying capacity, Equivalent radial load – Load-life relationship, Market or commercial specifications of Ball and Roller bearings as per BIS standards. (No derivations required Simple numerical problems only).

Recommended Books

- | | |
|------------------------------------|------------|
| 1. Auto Design | R.B Guptha |
| 2. Machine Design | R.S Khurmi |
| 3. Design of Automobile components | Agarwal |
| 4. Auto Design | R B Gupta |

Suggested Learning Outcomes:

Upon completion of the course the student shall able to:

1.0 Bolts and Nuts

- 1.1 Define the terminology used in Bolts and Nuts.
- 1.2 Classify the Bolts.
- 1.3 Analyze the effect of forces involved when the nut is tightened.
- 1.4 Understand causes of failures of Bolts and Nuts.
- 1.5 Calculate the various dimensions of bolt and nut by using empirical formula.

2.0 Shafts

- 2.1 Know the concept of Torsion.
- 2.2 Classify various types of Shafts used in Automobile Transmission System.
- 2.3 Identify the various materials used for manufacturing of shafts.
- 2.4 Explain the Torque equation with notations.
- 2.5 Calculate the diameters of solid and hollow shafts by considering both strength and stiffness.
- 2.6 Design the shafts subjected to Torsion.
- 2.7 Describe the Power transmitted by Solid and Hollow circular shafts.
- 2.8 Design the shafts subjected to pure bending (Design of Axle).
- 2.9 Design the shafts subjected to combined Torsion and Bending (Guest's theory and Rankine's theory).
- 2.10 Design of shafts based on Rigidity.
- 2.11 Briefing of Propeller shaft used in Automobile Transmission System.

3.0 Keys and Couplings

- 3.1 Analyze the functions of Keys, Couplings and Splines.
- 3.2 Identify the various materials used for Keys and Couplings.
- 3.3 Classify the types of Keys, Couplings and their Applications.
- 3.4 Design the Rectangular sunk key.
- 3.5 Recognize various proportions of Splines for different applications.
- 3.6 Design the Muff coupling.
- 3.7 Design the Flange coupling.

4.0 Cams

- 4.1 List out various types of Cams and Followers.
- 4.2 Interpret the applications of Cams and Followers.
- 4.3 Define the terms Cam profile, Base circle, Cam angle, Trace point and Lift.
- 4.4 Illustrate the displacement diagrams for (i) Uniform velocity (ii) Uniform acceleration, and (iii) Simple harmonic motion.
- 4.5 Design various cam profiles for a Knife edge, Flat plate and Roller follower.

5.0 Governors and Flywheel

- 5.1 Understand the function of Governor.
- 5.2 Classify the types of Governors and their applications.
- 5.3 Explain the working of Porter governor.
- 5.4 Solve the simple problems on Porter governor.
- 5.5 Identify the types of Flywheels.
- 5.6 Understand the function of Flywheel and its applications.
- 5.7 Identify the differences between the Governor and a Flywheel.

- 5.8 Illustrate the Turning moment diagram of flywheel.
- 5.9 Design the Flywheel.
- 5.10 Solve the simple problems on Flywheel.

6.0 Bearings

- 6.1 State the function of bearing.
- 6.2 Classify the bearings–Sliding and Rolling contact.
- 6.3 State the advantages and disadvantages of Sliding contact bearings.
- 6.4 Identify the types of bearing Lubrication.
- 6.5 Explain the construction and working principle of Journal bearing.
- 6.6 Explain friction in Journal bearing and give McKee's equation.
- 6.7 Write the terms in McKee's equation.
- 6.8 Design a simple Journal bearing.
- 6.9 Calculate heat generated and dissipated in Journal bearing.
- 6.10 Calculate heat generated and dissipated in Collar bearing based on uniform Pressure and uniform wear conditions.
- 6.11 Write the expressions for the load and torque carried by Thrust and Collar Bearings under uniform pressure and wear conditions (without proof).
- 6.12 Solve the numerical problems.
- 6.13 Illustrate the nomenclature of Rolling contact bearing.
- 6.14 Explain the different types of Ball and roller bearings.
- 6.15 List the Advantages and disadvantages of Anti-friction bearings.
- 6.16 Write the differences between Sliding contact and Roller bearings.
- 6.17 Identify the various bearing material.
- 6.18 Define the terms- Rating life, Bearing load, Basic load rating and equivalent radial load.
- 6.19 Explain the load – life relation for rolling contact bearings (problems omitted).

Suggested E-Learning references:

1. <http://nptel.ac.in/courses/Webcoursecontents/IIT%20Kharagpur/Machine%20design1/left/home.html>
2. www.learnengineering.org
3. www.sae.org
4. www.nptel.ac.in

Skill Upgradation Techniques:

1. Conducting an experiment to evaluate the torsion in solid and hollow shaft with sample calculations.
2. Identifying the shaft assembly with keys

CO-PO Mapping Matrix:

Course Outcome		CL	Linked PO	Teaching Periods
CO1	Analyze the concept of Automobile components design and demonstrate the design procedures.	1,2,7	R/U	10
CO2	Design the Automobile components like Bolts, Nuts and Shafts subjected to different stresses induced under different load conditions.	1,2,3,7	R/U/A	15
CO3	Design the Automobile components of keys and couplings to transmit complete torque.	1,2,3,7	U/A	12

CO4	Draw the cam profile using CAD for a given follower motion.	1,2,3,4,7	R/U/A	12
CO5	Design the Governors and Flywheels subjected to different load conditions for various engineering applications.	1,2,3,7	U/A	14
CO6	Design the given automobile components with the basic concepts of sustainable development.	1,2,3,4,5,7	R/U/A	12
		Total		75

MID SEM-I EXAM

Sl. No	Unit Name	R	U	A	Remarks
1	Unit-I	1, 2	5(a) 5(b)	7(a) 7(b)	
2	Unit-II	3, 4	6(a) 6(b)	8(a) 8(b)	
Total Questions		4	4	4	

MID SEM –II EXAM

Sl. No	Unit Name	R	U	A	Remarks
1	Unit-III	1, 2	5(a) 5(b)	7(a) 7(b)	
2	Unit-IV	3, 4	6(a) 6(b)	8(a) 8(b)	
Total Questions		4	4	4	

MID SEM –I
MODEL QUESTION PAPER
C-21AU, DIPLOMA IN AUTOMOBILE ENGINEERING
Subject Name: Automobile Components Design
Subject Code: AU-502

Time: 1hr

Max Marks: 20

PART – A

Answer all Questions. Each question carries 1 marks

4 X 1M = 04 marks

- 1) Define the term 'Lead' of a Screw thread.
- 2) What is the use of Eye-bolt? Where it is used?
- 3) Write any four requirements while selecting the Shaft materials?
- 4) Define the term 'Spindle'.

PART – B

Answer any two Questions. Each question carries 3 marks

2 X 3M = 06 Marks

5. a) How a Screw thread is designated? Give an example.
(OR)

b) Draw any three forms (types) of Screw threads and name it.

6. a) What are the assumptions made for deriving the Torsion equation?
(OR)

b) A solid shaft is required to transmit a torque of 20 kNm. Find the necessary diameter of the shaft, if the allowable shear stress is 70 N/mm^2 .

PART – C

Answer any two Questions. Each question carries 5 marks

5 X 2M = 10 Marks

7. a) List out different forms of screw threads and explain any two with sketches.
(OR)

b) Compute the safe tensile load for a M36 bolt, if the safe tensile stress is 90 N/mm^2 .

8. a) A solid circular shaft is used to transmit a torque of 9.6 Nm. The angle of twist over a length of 2 m is 2 degrees. Estimate the required diameter of the shaft and shear stress induced in the material. Take $G = 0.8 \times 10^5 \text{ N/mm}^2$.

(OR)

b) Calculate the power that can be transmitted through a solid shaft 380 mm diameter when driven by a reciprocating engine at 110 rpm if the stress is not to exceed 40 MN/m^2 and the ratio of maximum to mean torque is 1.4.

MID SEM –II
MODEL QUESTION PAPER
C-21AU, DIPLOMA IN AUTOMOBILE ENGINEERING
Subject Name: Automobile Components Design
Subject Code: AU-502

Time: 1hr

Max Marks: 20

PART – A

Answer all Questions. Each question carries 1 marks

4 X 1M = 04 marks

1. What is a 'Key'.
2. Write any two types of Couplings.
3. Define the term 'Cam profile'.
4. Write the different types of Cams?

PART – B

Answer any two Questions. Each question carries 3 marks

2 X 3M = 06 Marks

5. a) State any three advantages and disadvantages of Flexible couplings over a Rigid couplings.
(OR)
b) What is the use of coupling? Write any three applications of couplings.
6. a) Draw a neat sketch of Radial cam and write their application.
(OR)
b) List any three types of Cam follower and write their specific use.

PART – C

Answer any two Questions. Each question carries 5 marks

5 X 2M = 10 Marks

7. a) Draw a neat sketch of a Gib-head key showing all proportionate dimensions.
(OR)
b) Briefly explain about Flexible coupling and write any four advantages of Flexible couplings over Rigid couplings.
8. a) Explain the terms relating to cam a) Base circle, and b) Cam profile.
(OR)
b) A cam of minimum radius of 30 mm drives a follower with a stroke of 35 mm. The out stroke and the return stroke are performed with S.H.M. The follower has flat surface. The follower moves out stroke during 120° of the cam rotation followed by a dwell for 30° . The return stroke during next 120° with dwell for the remaining part of a evolution. Draw time Vs displacement curve.

BOARD DIPLOMA EXAMINATION, (C-21)
SEMESTER END EXAMINATION
DAE - FIFTH SEMESTER EXAMINATION
AUTOMOBILE COMPONENTS DESIGN

Time :2 Hours]

[Total Marks: 40

PART-A

Answer all Questions. Each question carries 1 marks

8 x 1M = 08 Marks

1. Write any four characteristics of Shaft materials.
2. What is 'Rigid coupling'?
3. Define the term 'Effort' of governor.
4. Write any four applications of Couplings.
5. Define the term Co-efficient of Fluctuation of energy of Flywheel.
6. State the function of Governor?
7. Write any four important properties of bearing materials.
8. State the function of Bearing.

PART-B

Answer any Four Questions. Each question carries 5 marks

4 x 3M = 12 Marks

9. a) Compute safe tensile load for a bolt of M20 if the safe tensile stress is 80 N/mm^2 .
(OR)
b) Define the terms i) Isochronism and ii) Hunting of governor.
10. a) Draw a neat sketch of Wedge cam and write their application.
(OR)
b) Briefly explain about Sliding contact bearing.
11. a) Illustrate the Turning moment diagram of Flywheel.
(OR)
b) Write any six differences between Flywheel and Governor.

12. a) State the McKnee's equation and elaborate the terms.

(OR)

b) List any five advantages of anti-friction bearing and where it is used?

PART-C

Answer any four Questions. Each question carries 10 marks

4 x 5M = 20

Marks

13. a) Explain the following forms of screw threads with neat sketches:

i) Indian Standard thread (ISO metric thread) and ii) Square thread.

(OR)

b) Describe the working of Porter governor with neat sketch.

14. a) A cam of minimum radius of 30 mm drives a follower with a stroke of 35 mm. The out stroke and the return stroke are performed with S.H.M. The follower has flat surface. The follower moves out stroke during 120° of the cam rotation followed by a dwell for 30° . The return stroke during next 120° with dwell for the remaining part of a revolution. Draw time Vs displacement curve.

(OR)

b) Explain the construction and working of Journal bearing.

15. a) Briefly explain the i) Sensitiveness and ii) Stability of governor.

(OR)

b) In a porter governor two balls of weight 26 N each are joined by four equal links of length 300 mm each. A dead weight of 320 N is used on the sleeve at the centre. If the radius of rotation is 240 mm, find the equilibrium speed.

16. a) Explain about the Thrust and Collar bearing with neat sketch.

(OR)

b) Explain about the Rolling contact bearing with neat sketch and state its advantages.

AU-503- AUTOTRONICS

Course Title	Autotronics	Course Code	AU-503
Semester	V	Course Group	Core
Teaching Scheme in Hrs(L:T:P)	4:1:0	Credits	3
Methodology	Lecture + Assignments	Total Contact periods	75
CIE	60 Marks	SEE	40 Marks

Course Content and Blue Print of Marks for SEE

Semester End Examination

Sl No	Unit No.	Questions to be set for SEE				Periods	
		R		U	A		
1	I- Autotronics	4	1	9(a)	13(a)	10	
2	II- Sensors					10	
3	III- Actuators		2	10(a)	14(a)	08	
4	IV- Electronically controlled fuel supply system					12	
5	V- Electronically controlled steering, Brakes and suspension systems		3	5, 6	9(b)	13(b)	10
						11(a)	
				11(b)	15(b)		
6	VI- Safety systems and Instrumentation		7,8	10(b)	14(b)	10	
				12(a)	16(a)		
				12(b)	16(b)		
Total Questions		8		8	8		

Legend:	Remembering (R)	1 Mark
	Understanding (U)	3 Marks
	Application (A)	5 Marks

Pre requisites

This course requires the basic knowledge of Automobile Chassis at fourth semester level

Course outcomes

At the end of course student should be

CO1 :	Identify the various sensors suitable for efficient vehicle operation and control.
CO2 :	Explain the applications of various actuators in vehicle systems.
CO3 :	Interpret impact of engineering solution for economic, environmental context.
CO4 :	Explain the applications of electronics in vehicle safety systems
CO5 :	Demonstrate/submit presentation on assigned topics related to course
CO6:	Relate and respond regarding contemporary issues in the field of autotronics.

COURSE CONTENT:

1.0 Fundamentals of Autotronics :

Duration : Periods 10(L: 6 – T: 4)

Use of electronics in Automobiles- Electronic systems-types-block diagrams-analog system-digital system-components of electronic system-sensor-actuator-display-signal processing-digital signal processing-sampling-sample time-quantization-semiconductor devices-diodes-diode in rectifier circuit-transistors-types-use of transistor as switch and amplifier-binary number system-decimal number system-numerical problems on number system conversion-logic circuits-NOT gate-AND gate-OR gate- Define combinational circuit, sequential circuit, micro controller, microprocessor -integrated circuits-types-block diagram of micro controller (8051)- types of micro controllers-applications- CAN bus-types-applications-Multiplexing-MUX-DEMUX.

2.0 Sensors :

Duration: Periods 10(L: 6 – T: 4)

Vehicle electronic control system description with block diagram-Engine control unit description with block diagram-Sensors- definition-classification of sensors-construction and working of throttle position sensor-types-crankshaft sensor-types-combustion knock sensor-temperature sensor-MAP sensor-MAF sensor-types-ride height sensor-types-EGO sensor.

3.0 Actuators :

Duration: Periods 8 (L:4.8 – T:3.2)

Actuators used in engine control system-pulse width modulation and duty cycle-applications-solenoid-ON/OFF solenoid-applications-proportional solenoid-applications-stepper motor – types-working –advantages and disadvantages-servo motor-working principle of D.C. servo motor-servo motor control-servo mechanism-applications-Relay-construction and working.

4.0 Electronically controlled fuel supply system:

Duration: Periods 12(L: 7.2 – T: 4.8)

Advantages of electronic petrol injection system–classification of fuel injection systems–MPFI system description with block diagram- operation-types of MPFI system-petrol injectors-construction and working- petrol direct injection system-types-working.

Need for electronic diesel injection system – advantages and disadvantages –Diesel electronic control injection description with block diagram-operation-CRDI description with block diagram-electronic CRDI injector-working-electronic distributor pump-working-description with block diagram.

5.0 Electronically controlled steering, braking and suspension systems :

Duration: Periods 10 (L: 6 – T: 4)

Draw backs of conventional steering- merits of electronic power steering-components of electronic power steering-sensor-motor- working of electronic rack and pinion power steering- purpose of Antilock braking system -classification of ABS- working of ABS components-working of ABS description with block diagram- advantages of ABS-components of electronically controlled suspension system-working of electronically controlled suspension system description with block diagram-advantages-electronic solenoid controlled shock absorber-working-types.

6.0 Safety systems and Instrumentation :

Duration: Periods 10 (L: 6 – T: 4)

Airbag system-components-principle of operation of airbag system-low tyre pressure warning system description with a block diagram-cruise control system- need and operation with a block diagram- traction control system-operation-electronic stability program-operation-description with a block diagram.

Recommended Books

1. Automotive Electrical systems equipment by N.R. Khatawate
2. Electrical Equipment of Automobiles by Parker Smith
3. Automobile Electrical Equipment by P.L. Kohli
4. Automobile Electrical Engineering by Arora&Dass
5. Microcontroller & application (8051) by Mazdi&Mazdi
6. Digital Electronics by Morris Mano
7. Instrumentation by A.K.Sawhaney
8. Automotive Mechanics by S.Srinivasan

Suggested Learning Outcomes

Student will be able to

- 1.0 Distinguish between analog and digital signals
 - 1.1 Perform conversion of decimal to binary and binary to decimal number systems
 - 1.2 List types of Analog & Digital IC's
 - 1.3 Define combinational circuit, sequential circuit, micro controller, micro processor
 - 1.4 Draw the block diagram of Micro controller 8051 & explain each component
 - 1.5 List types of microcontroller IC's
 - 1.6 State the function of CAN in Automobile application
-
- 2.0 Draw the block diagram of and explain the function of ECU.
 - 2.1 Classify sensors.
 - 2.2 Mention various sensors used in automobile systems.
 - 2.3 List out the sensors used in Automobiles.
 - 2.4 Explain in brief the working of sensors used in Automobiles.
-
- 3.0 List out the different actuators used in Automobiles.
 - 3.1 Explain the working of Actuators used in Automobiles.
 - 3.2 List out the applications of various Actuators.
-
- 4.0 List the advantages of electronic petrol injection system over carburetor
 - 4.1 Classify electronic petrol injection system
 - 4.2 State the need for electronic diesel injection system
 - 4.3 Explain working of electronic controlled diesel supply system with a block diagram.
-
- 5.0 List the drawbacks of conventional steering system.
 - 5.1 List the advantages of electronic power steering
 - 5.2 Describe the construction & working of electronic rack and pinion Power steering
 - 5.3 State the need for Anti lock braking System (ABS)
 - 5.4 Explain the components and working of ABS with block diagram.
 - 5.5 List the advantages of ABS
 - 5.6 Describe electronic suspension control system

- 6.0 Explain working principle of air bags
- 6.1 Draw the block diagram of low tyre pressure warning system
- 6.2 Describe operation of traction control system.
- 6.3 Describe cruise control system.

Suggested Student Activities

1. Student visits Library to refer to Manual of Automobile components to find the various electronic Components used in automobile for efficient operation.
2. Student inspects the available equipment in the Laboratory to identify sensors and actuators used in Engines.
3. Visit nearby workshop / service station to familiarize with type of sensors used in vehicles.
4. Prepare a presentation on latest trends in automobile electronics.
5. Record data / specifications of various components of vehicle safety systems.
6. Prepare a report by visiting the service stations on electronic fuel supply system for petrol / diesel Vehicles.
7. Prepare working models of various sensors and actuators.
8. Visit electronic shops and collect various fundamental electronic components such as relay, diode Etc.,.
9. Prepare small electronic circuits to demonstrate function of various electronic components.
10. Quiz
11. Group discussion on role of electronics in automobiles.
12. Surprise test

Suggested E-Learning references

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

CO PO Mapping Matrix:

Course Outcome		CL	Linked PO	Teaching periods
CO1	Identify the various sensors suitable for efficient vehicle operation and control.	R/U	1,2,6	7.2
CO2	Explain the applications of various actuators in vehicle systems.	R	1,2,10	4.8
CO3	Interpret impact of engineering solution for economic, environmental context.	A	1,2,5,6	6.0
CO4	Explain the applications of electronics in vehicle safety systems	R/U	1,2,5	6.0
CO5	Demonstrate/submit presentation on assigned topics related to course	A	1,2,6,8,9	7.2
CO6	Relate and respond regarding contemporary issues in the field of autotronics.	A	1,2,6,10	6.0

Mid Semester Examination Blueprint of Questions and Marks:

MID SEM-I EXAM

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

MID SEM –II EXAM

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

R-Remembering, U-Understanding, A- Application type questions each carrying 1, 3 and 5 Marks respectively

Max Marks: 20

4 x1 =

7. a). Explain the CAN bus system used in automobiles?
OR
b). Explain the applications of microcontrollers?
8. a). Explain working of any one type of sensors used in engine?
OR
b). Explain working of any one type of sensor used in vehicle safety systems?

Total Marks: 20 M

4 x1 =

2 x 3 = 6Marks

2 x 5 = 10 Marks

7. a). Explain the working of solenoid with a diagram?
OR
b). Explain working principle of stepper motor?
8. a). Explain the working of MPFI system with a diagram?
OR
b). Explain the working of electronic diesel injection system with a diagram?

SEMESTER END EXAMINATION
MODEL QUESTION PAPER
C-21, DIPLOMA IN AUTOMOBILE ENGINEERING
Subject Name: AUTOTRONICS
Subject Code: AU-503

Time: 2hrs

Max Marks: 40

PART-A

08X01=08

- Instructions :**
1. Answer **ALL** questions.
 2. Each question carries **ONE** mark.
1. List out two sensors used in control system of vehicle?
 2. Mention two advantages of electronic petrol injection system over carburetor?
 3. Mention two drawbacks of conventional steering?
 4. Mention two applications of Microcontrollers in automobile industry?
 5. List two advantages of ABS?
 6. State the need for Anti lock braking System?
 7. Write the advantages of airbags?
 8. State the need of cruise control system?

PART-B

04X03=12

- Instructions :**
1. Answer any **FOUR** questions.
 2. Each question carries **THREE** marks.
9. (a) Explain CAN bus system ?
(or)
 9. (b) Explain the components of ABS ?
-
10. (a) Draw the block diagram of electronic diesel injection system ?
(or)
 10. (b) Draw the block diagram of computer based instrumentation system ?
-
11. (a) Draw the block diagram of electronic rack and pinion power steering ?
(Or)
 11. (b) List out five advantages of electronic power steering ?
-
12. (a) Explain traction control system used in Automobiles ?
(or)
 12. (b) Explain electronic stability program ?

PART-C

04X5=20

- Instructions :**
1. Answer any **FOUR** questions.
 2. Each question carries **FIVE** marks.

13. (a) Draw the block diagram of Electronic Control Unit (ECU) and explain the function of ECU ?

(or)

13. (b) Describe electronic suspension control system e ?

14. (a) State the need for Stepper motor & list the types of motors?

(or)

14. (b) Draw the block diagram of electronic speed measurement system and explain?

15. (a) Classify the Antilock braking System (ABS)?

(or)

15. (b) Explain electronic rack and pinion power steering system with a diagram ?

16. (a) Explain working of low tyre pressure warning system with a diagram ?

(or)

16. (b) Explain working of air bag system with a diagram ?

AU-574- AUTOMOBILE SERVICING AND MAINTENANCE

Course Title	Automobile Servicing and Maintenance	Course Code	AU-574
Semester:	V	Course Group	Core
Teaching Scheme in Periods (L:T:P)	4:1:0	Credits	3
Methodology:	Lecture + Practical	Contact Periods:	75
CIE	60 Marks	SEE	40 Marks

Pre requisites

This course requires the basic knowledge of Basic Automobile Engineering and Automobile Power Train at second and third semester levels.

Course Content and Blue Print of Marks for SEE

Course Content and Blue Print of Marks for SEE							
S.No	Unit No.	Questions for SEE					Periods
		R		U	A		
1	Service station & Equipment	4	1		9(a)	13(a)	08
2	Maintenance of motor vehicles & servicing of two wheelers						12
3	Hierarchy of Operations in Service Station		2		10(a)	14(a)	08
4	Automobile Pollution and control						10
5	Servicing & Maintenance of four wheelers		3	5, 6	9(b)	13(b)	10
					11(a)	15(a)	
				11(b)	15(b)		
6	Automobile Reconditioning Equipment		7,8	10(b)	14(b)	12	
				12(a)	16(a)		
				12(b)	16(b)		
Total Questions		8		8	8	60	

Course outcomes

CO1 :	Identify the various tools and equipment required in a service station
CO2 :	Understand the General procedure of servicing and Maintenance
CO3 :	Describe the working of various automobile reconditioning equipment.
CO4 :	Determine the sources of pollution; identify the common troubles and remedies for four wheelers.
CO5 :	Demonstrate/ submit presentation on assigned topics related to the course

Course content:

Unit 1: Automobile Service Station & Equipment.

Duration: Periods: 6 (L: 5 T: 1)

Garage, Service Station, Specialist repair Shop -Tools and equipment for a garage and service station –Factors to be considered while locating service station - Layout of a typical garage and service station -

Car Washing Equipment - Vehicle Hoist - Air Compressor - Lubrication equipment: A grease gun, High pressure lubrication - Fire safety- Fire extinguishers and types A, B and C

Unit 2: Types of Maintenance & Servicing of 2- Wheelers Duration: Periods 12 (L:8 ,T:4)

Types of maintenance–Periodic maintenance–Preventive maintenance – Breakdown maintenance–Operation maintenance – Servicing and its necessity – Degreasing plant- Decarbonizing methods.–overhauling-necessity. Periodic checkup (Maintenance schedule) and the trouble shooting of motorcycle and scooter (Without clutch and gear shift).

Unit 3: Hierarchy of Operations in Service Station

Duration: Periods 8 (L: 4.8 T: 3.2)

Roles and Responsibilities of service department staff: Service manager, Assistant service manager, Floor supervisor, Body shop supervisor, P.D.I supervisor, Service advisor, Technician, Spare parts in charge -Customer relationship executive. Procedure of P.D.I – Job card opening- Job card closing after repairs-Warranty claiming- Procedure of accident vehicle repairs involving Insurance claims.

Unit 4: Automobile Pollution and control

Duration: periods 10 (L: 6 T: 4)

Various sources from vehicles, effects of pollutants on human and environment.SI Engine emissions – CO_x, NO_x, HC- Control measures: Exhaust Gas Recirculation, Catalytic Converter, Evaporative Loss Control Device, Positive Crankcase Ventilation etc,. C.I Engine Emissions: Particulate emissions, Smoke control measures: Particulate trap. Vehicle emission norms – B.S (Bharat) and Euro, Exhaust gas Analyzer / Smoke meter.

Unit 5: Servicing & Maintenance of four wheelers

Duration: Periods 10 (L: 6 T: 4)

Servicing- Maintenance- Periodic checkup and Trouble shooting (Diagnosis and fault rectification) of following systems of four wheelers:

(a) Engine systems: Engine Overhaul- Engine tune-up Procedure - Trouble shooting of different -types of Fuel systems - Lubrication system- Cooling system- Ignition system

(b) Transmission system: Clutch: Clutch overhaul, Trouble shooting – Gearbox: Gear box overhaul -overhaul Trouble shooting – Differential: Differential overhaul, Trouble shooting

(c) Braking system: Servicing of brake shoe assembly- Overhauling of Master cylinder, Wheel cylinder-Brake bleeding- Adjustment of brakes- Trouble shooting

(d) Suspension system: Repair, Lubrication and maintenance of leaf spring

(e) Steering system: Servicing of steering system and trouble shooting

Unit 6: Automobile re-conditioning Equipment

Duration: Periods 14 (L: 10 T: 4)

Degreasing plant – Procedure of degreasing – De-carbonizing methods –Description and working of re-conditioning equipment: Cylinder re-boring machine, Honing machine, Line boring machine, Valve seat cutting and grinding machine, Valve re-facing machine, Valve lapping equipment, Crank shaft grinding machine, Brake drum lathe machine, Brake shoe riveting machine. Fuel injection pump Test Bench-Phasing and Calibration of F.I.P -Servicing and Testing of Fuel injector - Trouble shooting of fuel injection system

Recommended books

- | | |
|--------------------------------|--------------------------|
| 1. Automobile Engineering | by G.B.S.Narang |
| 2. Automobile Engineering | by Harbanth singh Rayath |
| 3. Manual on Depot maintenance | by T.S.R.T.C manuals. |
| 4. Transmission overhaul | by Station Abbey |
| 5. The modern motor Engineer | by Arten Judge |
| 6. Practical Auto Engineering | by Odamis |

Suggested Learning Outcomes

Student will be able to

- 1.0 Describe the Details of garage-service station and servicing equipment
- 1.1 List the various tools and equipments used in service station.
- 1.2 Draw and explain layout of service station
- 1.3 Differentiate between garage, service station and specialist service station
- 1.4 Explain the working of various servicing equipment.
- 1.5 List and state uses of various fire extinguishers.

- 2.0 Explain the necessity and general procedure of servicing and maintenance of motor vehicle.
- 2.1 List the types of maintenance.
- 2.2 Explain the various types of maintenance.
- 2.3 State servicing and its necessity
- 2.4 Explain the periodic checkup and the troubleshooting of moped and motorcycle.

- 3.0 Mention the various Automobile Service department staff
- 3.1 State the role and responsibility of service department staff
- 3.2 Explain the procedure of PDI
- 3.3 Explain the procedure of job card opening and closing
- 3.4 Explain the procedure of warranty claims and insurance claims.

- 4.0 Identify sources of pollutants from vehicles
- 4.1 Recite the ill effects of pollutants
- 4.2 List the S.I and C.I Engine pollutants like CO_x, HC and NO_x
- 4.3 Mention the control measures of automotive pollution

- 5.0 Explain Engine tune up procedure.
- 5.1 Able to find fault and rectification of various systems of four wheeler.

- 6.0 List the various automobile reconditioning equipment.
- 6.1 State working of various automobile reconditioning equipment.
- 6.2 Describe the components of Fuel injection pump Test Bench.
- 6.3 Explain the procedure of Phasing and Calibration of F.I.P.

Suggested Student Activities

1. Student visits Library to refer to Manual of Automobile to find their maintenance schedules.
2. Student inspects the available reconditioning equipment in the Laboratory to identify the components.
3. Student inspects the available tools and equipments in the Laboratory and familiarize.
4. Quiz
5. Group discussion

6. Surprise test

Suggested E-Learning references

- www.learnengineering.org
- www.sae.org
- www.nptel.ac.in

CO PO Mapping Matrix

Course Outcome		CL	Linked PO
CO1	Identify the various various tools and equipment required in a service station	R/A	1,4,5,7
CO2	Identify the general troubles and remedies of two wheeler	R/U/A	1,2,5
CO3	Describe the working of various automobile reconditioning equipment.	R	1,4
CO4	Determine the sources of pollution; identify the common troubles and remedies for four wheelers.	R/U/A	1,3,4,5
CO5	Demonstrate/ submit presentation on assigned topics related to the course	U/A	1,4,6

OVER VIEW OF STUDENT EVALUATION

Mid Semester Examination-1

Max.Marks: 20

S.No	Unit	R	U	A	Remarks
1	Unit-I	1, 2	5(a)	7(a)	
			5(b)	7(b)	
2	Unit-II	3, 4	6(a)	8(a)	
			6(b)	8(b)	
Total Questions		4	4	4	

Mid Semester Examination-2

Max.Marks: 20

S.No	Unit	R	U	A	Remarks
1	Unit-III	1, 2	5(a)	7(a)	
			5(b)	7(b)	
2	Unit-IV	3, 4	6(a)	8(a)	
			6(b)	8(b)	
Total Questions		4	4	4	

(Model Question Paper)
Mid Sem -I

Subject Name: **Automobile Servicing and Maintenance**

Subject Code: **AU-574**

Time: 1 Hour

Total Marks: 20 Marks

PART – A

Answer **ALL** questions

4x1 = 4Marks

Each question carries **Onemark** and answer should not exceed ¼ page.

1. List any two factors to be considered for locating Service station?
2. What is overhauling?
3. List any two tools used in service station?
4. Define the term “maintenance”?

PART – B

Answer the following.

2x3 = 6Marks

Each question carries **Threemarks** and answer should not exceed 1 page.

5. a). Draw a neat sketch of grease gun and label the parts?
OR
b).List any six difference between garage and service stations?
6. a) Draw a neat sketch of degreasing plant and label the parts ?
OR
b) Write a short notes on decarbonizing ?

PART – C

Answer the following.

2x5 = 10 Marks

Each question carries **Fivemarks** and answer should not exceed 2 pages.

7. a).Draw a layout of service station and explain?
OR
b) list the construction and working principle of car washing machine with a neat sketch?
8. a). Write the trouble shooting of motor cycle?
OR
b). write the maintenance schedule of motor cycle?

(Model Question Paper)

Mid Sem -II

Subject Name: **Automobile Servicing and Maintenance**

Subject Code: **AU-574**

Time: 1 Hour

Total Marks: 20 Marks

PART – A

Answer **ALL** questions and each question carries **ONE** mark. Marks: 4 X 1M = 4M
and answer should not exceed ¼ page.

1. List any two checkups of four wheelers in daily maintenance?
2. List any two regular checkups of four wheelers in periodic maintenance?
3. What is valve re-facing?
4. List the methods of decarbonizing

PART – B

Answer the following.

Each question carries **Three**marks and answer should not exceed one page.

2x3= 6 Marks

5. a). Write a short notes on engine time up procedure?

OR

b). Write a short notes on “ brake bleeding”?

6. a) Write a short notes an “cylinder reboring?

OR

b) Write a short notes on valve seat cutting?.

PART – C

Answer the following.

Each question carries five marks and answer should not exceed two pages.

2x5 = 10 Marks

7. a). Explain the maintenance procedure of leaf spring?

OR

b). Write any three defects, cause and their remedies of a clutch?

8. a). Explain the working principle of brake drum lathe with a neat sketch

OR

b). Explain the working principle of Crankshaft grinding machine with a neat sketch?

(Model Question Paper)
SEMESTER END EXAM

Subject Name: **Automobile Servicing and Maintenance**

Subject Code: **AU-574**

Time: 2 Hour

Total Marks: 40M

PART – A

Answer **ALL** questions.

8x1 = 8 Marks

Each question carries **ONE** mark and answer should not exceed ¼ page.

1. Define “Garage”?
2. List any two engine reconditioning equipment
3. Write the full form of P.D.I?
4. Write the full form of E.G.R?
5. Write any two duties of floor supervisor?
6. Write any two duties of body shop supervisor?
7. List any two emission of S.I engine?
8. Write two ill effects of automobile pollutants?

PART – B

Answer the following.

4x3 = 12 Marks

Each question carries **THREE** marks and answer should not exceed ONE page.

9. a) Define the term “fire extinguisher”?
OR
b) Write the duties of assistant service manager?
10. a) Explain the procedure of “degreasing”?
OR
b) Write the necessity of catalytic convertor in automobile ?
11. a) What is the rule of service advisor in service station?
OR
b) What are the rules and responsibilities of technician in a service station ?
12. a) List various BS (Bharat) emission norms?
OR
b) Write a short note on “particulate emission”?

PART – C

Answer the following.

4x5 = 20 Marks

Each question carries **FIVE** marks and answer should not exceed two pages.

13. a) Explain any two types of fire extinguishers with neat sketch?
OR
b) Explain the detailed procedure of opening job card?
14. a) What are the various defects, causes and their remedies of a lubrication system of a

fourwheels?

OR

b) Explain the EGR system with a neat sketch?

15. a) Explain about the warranty calming procedure in a service station?

OR

b) Explain about the job card closing after repair in service station?

16. a) Explain the catalytic convertor with a neat sketch?

OR

b) Explain about positive crankcase ventilation with a neat sketch?

AU-584-PRODUCTION TECHNOLOGY

Course Title	Production Technology	Course Code	AU-584
Semester	V	Course Group	Elective
Teaching Scheme in Hrs(L:T:P)	4:1:0	Credits	3
Methodology	Lecture + Assignments	Total Contact Periods :	75
CIE	60 Marks	SEE	40 Marks

PREREQUISITES

Basic knowledge in Work shop technology, Engineering materials and Manufacturing Processes

COURSE OUTCOMES:

CO1	Illustrate the Working of Grinding Process and apply for engineering applications.
CO 2	Define various surface finishing processes and apply for various applications
CO 3	Explain Plastic Processing methods
CO 4	Perform Milling and Grinding operations as per industrial requirements.
CO 5	Identify Special tools for Work holding and guiding for different machining processes
CO 6	Student should able to learn different Modern machining process such as USM, EDM,NC & CNC

Course Content and Blue Print of Marks for SEE

COURSE CONTENT:

1.0 Grinding

Duration: 12 periods (L: 6.8 – T:

Introduction – Principles of Metal Removal by Grinding – Abrasives: Natural & Artificial – Bonds and binding processes: Vitrified, Silicate, Shellac, Rubber, Bakelite – Factors effecting the selection of grind wheels – Size and Shape of wheel – Types of abrasive materials– Grain size – Grade and strength of bond – Structure of grain – Spacing – Types of binding materials – Standard marking systems – Meaning of letters & numbers – Sequence of marking – Grades of letters.

Grinding machines – Classification: Cylindrical, Surface, Tool & Cutter grinding machine – Construction details – Relative merits – Principle of Centreless grinding, Advantages & limitations of Centreless grinding – Work holding devices – Wheel maintenance – Balancing of wheels – Dressing and trimming of grind wheels – Coolants used.

2.0 Surface Finishing processes

Duration: 08 periods (L: 4.8 – T:

Surface finishing by grinding: Honing, Lapping, Super finishing, Electroplating – Basic principles – Plating metals – applications – Hot dipping: Galvanizing, Tin coating, Parkerising, Anodizing – Metal spraying: Wire process, Powder process and applications – Organic coatings: Oil base Paint, Lacquer base, Enamels, Bituminous paints, Rubber base coating.

3.0 Plastics Processing

Duration: 08 periods (L: 4.8 – T:

Processing of Plastics – Injection moulding – Compression moulding - Transfer moulding – Extruding – Casting – Calendaring – Applications of Plastics.

4.0 Milling and Gear Making

Duration: 12 periods (L: 6.8 – T:

Types of Milling machines: Plain, Universal, And Vertical milling machines – Constructional details and Specifications – Milling operations– Indexing: Direct and Simple indexing.

Gear Making.

Manufacture of Gears by Casting, Moulding, Stamping, Coining, Extruding, Rolling – Gear shaping – Description of Gear shaper – Gear hobbing – Description of Gear hob – Operation of gear hobbing Machine – Gear finishing processes.

5.0 Jigs and Fixtures

Duration: 08 periods (L: 4.8 – T:

Advantages of using Jigs and Fixtures in mass production – Design principle of jigs and fixtures – Principle of Location and Clamping – Work location – Types of Locators and Clamps – Drill jigs – Welding and Milling fixtures.

6.0 Modern machining Processes

Duration: 12 periods (L: 6.8 – T:

Introduction – Comparison of modern machining processes with traditional machining process – Ultrasonic machining (USM): Principles, Description of equipment, applications, advantages and limitations.

Electrical Discharge Machining (EDM): Principle, description of equipment, applications, advantages and limitations – Chemical machining: Basic concepts of NC machines – Comparison with operator controlled Machine – Types of NC system: open loop and closed loop servo drives – Elements of NC machines: Control system, machine tools, drive – unit feed back or servo components – Classification of NC systems: Point to point positioning control system, straight cut positioning system, continuous path or contouring system – Functions carried out by NC machines and types of controls – Programming for NC machines – Absolute programming, Incremental programming – Advantages and limitations of NC system over the conventional system – Basic concept of CNC and DNC systems – Definition of CAM – Applications of CAM: Application of CAM on Manufacturing planning, Application of CAM in manufacturing control –high speed machining and micro machining process.

REFERENCE BOOKS:

- | | | |
|----|---|---------------------------|
| 1. | A course on workshop Technology (Vol. II) | - Raghuvamshi. |
| 2. | Elements of workshop Technology (vol. II) | - Hazra Chowdhary. |
| 3. | Production Technology | - R.K.Jain and S.C.Gupta. |
| 4. | Workshop Technology (Vol. III) | - Chapman |
| 5. | Manufacturing Process | - B.M.L. Begeman |
| 6. | Workshop Technology (Vol. II) | - Gupta and Kaushik |
| 7. | Production Technology | - H.M.T. |
| 8. | Automation, production system and | - Micelle Groover |
| 9. | CAD / CAM | - Mikell P. Groover |
| 10 | Computer aided design and manufacturing | - W.Zimmer |

SUGGESTED LEARNING OUTCOMES:

1.0 Understand the concept of Grinding

- 1.1 Explain the principle of metal removal by grinding.
- 1.2 List the different abrasives.
- 1.3 Explain the bonds and binding processes in grinding wheel manufacturing
- 1.4 Identify the grinding wheel from the standard code (Marking system or designation of wheel).
- 1.5 State the factors for selecting the grinding wheels.
- 1.6 State the methods of grinding.
- 1.7 Classify the grinding machines.
- 1.8 Illustrate the cylindrical, surface, tool and cutter grinders.
- 1.9 Write the principle for centre less grinding.
- 1.10 State the Advantages and limitations of centreless grinding.
- 1.11 List the different work holding devices.
- 1.12 State the methods of wheel maintenance.

2.0 Understand the concept of Surface Finishing Processes

- 2.1 State different finishing processes by grinding (Honing, Lapping, Super finishing).
- 2.2 Explain the principle of electro-plating with a legible sketch.
- 2.3 Explain the principle of hot dipping processes namely Galvanising, Tin coating, Parkerizing and Anodising.
- 2.4 List the various Organic coatings.
- 2.5 Describe the processes of various Organic coatings.
- 2.6 State the principles of Metal Spraying.
- 2.7 State the features of wire process and powder process.
- 2.8 Select the appropriate process for surface roughness of a given application.

3. 0.Understand the principle of manufacturing plastic products.

- 3.1 Explain the methods of injection moulding, compression moulding, transfer moulding with legible sketches.
- 3.2 Explain the principle of extruding, casting and calendaring with legible sketches.
- 3.3 State the principle of machining and welding plastics.
- 3.4 Explain the different fabrication methods – Sheet forming, Blow moulding, Laminating and Reinforcing.
- 3.5 List Engineering applications of plastics.

4 .0 Understand the concept of Milling, Gear making

- 4.1 Explain the principle of working of a Milling machine.
- 4.2 Classify the milling machines.
- 4.3 Illustrate the constructional details of milling machine
- 4.4 Explain the functions of each part of the milling machine.
- 4.5 Explain the various milling operations.
- 4.6 List the different milling cutters.
- 4.7 Explain selection of tool and work holding devices.
- 4.8 Explain the different indexing methods.
- 4.9 Explain the specifications of milling machines.
- 4.10 List the different methods of producing gears.
- 4.11 Illustrate gear shaping.
- 4.12 Draw the gear hob and label its components.
- 4.13. Describe the working of the above machines.
- 4.14. List the sequence of operations in generating gear by gear hobbing m/c.
- 4.15. Explain the different methods of finishing & checking gear teeth dimensions.
- 4.16. Specify the gear.
- 4.17. List the various gear materials.
- 4.18. State the different heat treatment processes applied to gears.

5.0. Understand the concept of Jigs and Fixtures

- 5.1 State the function of drill bush.
- 5.2 List different types of fixtures and explain their constructional details with the help of legible sketches.
- 5.3 Differentiate between jigs and fixtures.
- 5.4 List the advantages of Jigs and Fixtures
- 5.5 Explain basic principle of location.
- 5.6 Identify different locating methods and devices.
- 5.7 Explain the basic principle of clamping.
- 5.8 Identify different types of clamps and their constructional details with the help of legible sketches.

6. 0. Understand the modern machining processes

- 6.1 Compare non-conventional machining with traditional (conventional) machining.
- 6.2 State the relative advantages and limitations of non-conventional Machining.
- 6.3 State the equipment used in USM process.

- 6.4 Explain the principle of USM with a neat sketch.
- 6.5 Explain Electric Discharge Machining (EDM) with sketch.
- 6.6 Explain the principle of open loop NC machine and closed loop NC Machine.
- 6.7 List the elements of NC machine.
- 6.8 Explain the NC system-point to point positioning control system, Straight cut positioning system-Continuous path system.
- 6.9 List the operations carried out on NC machine.
- 6.10 Explain the procedure of preparing NC programming for a simple component involving only turning operation.
- 6.11 State the advantages and limitations of NC machining system over the conventional machining system.
- 6.12 Explain the principle of computerized numerical control (CNC)
- 6.13 State the difference between NC and CNC machines.
- 6.14 Explain direct numerical control (DNC) system.
- 6.15 State the application of computers in design like geometric modeling, Engineering analysis, design reviews and evaluation and automated Drafting.
- 6.16 State Definition, applications, advantages and procedure of CAD.
- 6.17 State Definition, applications, advantages and limitations of CAM in manufacturing.
- 6.18 Explain the role of CAM in manufacturing planning and control.
- 6.19 What is High speed machining and micro machining process?

SUGGESTED STUDENT ACTIVITIES:

1. Student visits Library to refer to manual of Engineering Materials to find their properties.
2. Student inspects the available equipment in the Laboratory to identify the components.
3. The students can visit nearby workshops/Industries and collect information like which type of machines are used for particular purpose and their design features of various machine components.
4. The students can visit nearby workshops/Industries and collect information about various manufacturing processes by using different machine tools, observe their specifications and the recent developments.
5. Student should write the program for particular task to perform the particular operation by using CNC machines.
6. The student should Download and present various presentations related to CNC, DNC systems and modern machining methods
7. The student should prepare the different products as mini-project.

SUGGESTED E-LEARNING REFERENCES:

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

CO PO MAPPING MATRIX:

Course Outcome		CL	Linked PO
CO1	Illustrate the Working of Grinding Process and apply for engineering applications.	R/U/A	1,2
CO2	Define various surface finishing processes and apply for various applications	R/U/A	1,2
CO3	Explain Plastic Processing methods	R/U/A	2,4
CO4	Perform Milling and Grinding operations as per industrial requirements.	R/U/A	1,3
CO5	Identify Special tools for Work holding and guiding for different machining processes	R/U/A	2,3,4
CO6	Student should able to learn different Modern machining process	R/U/A	2,6,7

MID SEM-I EXAM				
Unit Name	R	U	A	Remarks
Unit-I	1, 2	5(a) 5(b)	7(a) 7(b)	
Unit-II	3, 4	6(a) 6(b)	8(a) 8(b)	
Total Questions	4	4	4	
MID SEM –II EXAM				
Unit Name	R	U	A	Remarks
Unit-III	1, 2	5(a) 5(b)	7(a) 7(b)	
Unit-IV	3, 4	6(a) 6(b)	8(a) 8(b)	
Total Questions	4	4	4	

(Model Question Paper)
Mid Sem -I
Subject Name: **Production Technology**
Subject Code: **AU-584**

Time : 1:00 hours

Max

Marks : 20

PART – A

Remembering type questions

Answer all Questions. Each question carries 1 mark

4 X 1M = 04 marks

- 5) State any two factors to be considered for the selection of grinding wheel.
- 6) List any two work holding grinding.
- 7) What is 'Anodizing'?
- 8) List out any four methods of surface coating.

PART – B

Understanding type questions

Answer any two Questions. Each question carries 3 marks

2 X 3M = 06 Marks

5. a) List out the various methods of grinding.

(OR)

- b) State the terms a) GRIT, and b) GRADE.

6. a) What is 'Galvanizing'?

(OR)

- b) What is the necessity of Organic coating? Write any two advantages.

PART – C

Application type questions

Answer any two Questions. Each question carries 5 marks

5 X 2M = 10 Marks

7. a) Draw a neat sketch of Tool and cutter grinding machine , label the parts and explain its working.

(OR)

- b) Explain about the Centre less grinding with neat sketch.

8. a) Explain the working of Electro plating with a neat sketch.

(OR)

- b) Describe the Hot dipping process and write any three advantages of it.

(Model Question Paper)
Mid Sem-II
Subject Name: **Production Technology**
Subject Code: **AU-584**

Time : 1:00 hours

Max

Marks : 20

PART – A

Remembering type questions

Answer all Questions. Each question carries 1 mark

4 X 1M = 04 marks

1. Define the term 'Thermo setting plastics'.
2. State any four limitation of plastics.
3. What is 'Indexing'?
4. List any four work and tool holding devices in milling.

PART – B

Understanding type questions

Answer any two Questions. Each question carries 3 marks

2 X 3M = 06 Marks

5. a) Write short notes on Blow moulding process.
(OR)
b) Briefly explain about 'Calendaring' in plastics?

6. a) State the function of 'Arbor' in milling.

(OR)

- b) Write any three specifications of Milling machine.

PART – C

Application type questions

Answer any two Questions. Each question carries 5 marks

5 X 2M = 10

Marks

7. a) Explain the Injection moulding process in plastics.
(OR)

- b) Describe the Extrusion process with neat sketch.

8. a) Draw a neat sketch of vertical milling machine and explain its working.

(OR)

- b) Explain about Gear Hobbing process in neat sketch.

(Model Question Paper)
Semester End examination (SEE)
Subject Name: **Production Technology**
Subject Code: **AU-584**

Time : 2 hours

Max Marks : 40

PART-A

Remembering type questions

Answer all Questions. Each question carries 1 mark

8 x 1M = 08 Marks

1. List any four abrasives used in grinding wheels.
2. Define the term 'Thermo plastics'.
3. Write any four advantages of Non-Conventional machining process.
4. State the need of 'Wheel dressing' in grinding.
5. List any two advantages of Jigs.
6. What is 'Fixture'?
7. List any two applications of CAM.
8. Write any four advantages of CAD.

PART-B

Understanding type questions

Answer any four Questions. Each question carries 3 marks

4 x 3M = 12 Marks

9. a) Explain the procedure of Electro plating with a neat sketch.

(OR)

- b) Differentiate between jigs and fixtures.

10. a) Briefly write about Transfer moulding process in plastics.

(OR)

- b) State the difference between Conventional and Non-conventional machining.

11. a) Describe the general considerations in design of Drill jigs.

(OR)

- b) State the basic principle if 'Location' in Jigs and Fixtures.

12. a) State the principle of open loop Numerical Control(NC) system.

(OR)

- b) Briefly explain about Chemical machining process.

PART-C

Application type questions

Answer any four Questions. Each question carries 5 marks

4 x 5M = 20 Marks

13. a) Explain about Cylindrical grinding process with neat sketch.

(OR)

b) State the need of 'Drilling fixture' and explain with neat sketch.

14. a) Explain about the Universal milling machine with neat sketch.

(OR)

b) Describe the process of Electric Discharge Machining (EDM) with neat sketch.

15. a) State the basic principle of 'Clamping' and explain about any one clamp with neat sketch.

(OR)

b) Explain about Milling fixture with the help of legible sketch.

16. a) Describe the working of Direct Numerical Control (DNC) system with neat sketch.

(OR)

b) Explain the working of Ultrasonic machining (USM) with neat sketch.

EE-594-ELECTRIC VEHICLES

Course Title :	Electric Vehicles	Course Code	EE-594
Semester	V	Course Group	Core
Teaching Scheme in periods (L:T:P)	4:1:0	Credits	3
Methodology	Lecture + Assignments	Total Contact Periods :	75
CIE	60 Marks	SEE	40 Marks

Prerequisites

Basic knowledge of electrical machines, electric circuit analysis, power electronic converters
Battery technology, drive train, engines working principles of automobiles.

Course outcomes

On Successful completion of the course, the student will be able to

CO1 :	Analyze the architecture of electric vehicle
CO2 :	Explain the working concept of different components of EV and charging station
CO3 :	Design/size the drive train for EV, Battery, and charging station
CO4 :	Analyze and troubleshoot basic faults in different EV components and charging system
CO5 :	Repair and retrofit different components of EV and the charging station
CO6	Analyze the impact of EV integration on distribution system

Blue Print of Marks for SEE

Unit no	Unit name	Questions to be set for SEE (Q No)				Remarks	
		R		U	A		
1	Introduction to Electric Vehicles	4	1		9(a)	13(a)	
2	EV components						
3	Drive train in EV & HEV		2		10(a)	14(a)	
4	Battery charging Technologies and EV Charging Infrastructure						
5	Electric vehicle grid integration	3	5,6		9(b) 11(a) 11(b)	13(b) 15(a) 15(b)	
6	EVs and renewable energy (RE) integration, Troubleshooting		7,8		10(b) 12(a) 12(b)	14(b) 16(a) 16(b)	
Total questions		8		8	8		

Legend: R; Remembering, U: Understanding A: Applying

COURSE CONTENT

UNIT-1

Periods 10 (L: 08 – T: 02)

Introduction to Electric Vehicles

Introduction to Electric Vehicle(EV) – Hybrid Electric vehicle(HEV) – Plug-in Hybrid Electric vehicle (PHEV) - Types of Electric vehicles based on with and without differential – Types of HEV series, parallel, series-parallel and Complex - Fuel cell vehicles -Differences between EV and conventional vehicles - Differences between complete EV and Hybrid vehicles - Benefits of EV including environmental impacts – Single speed transmission - Government Schemes and Progress: FAME-1, FAME-2; Transformative -mobility and Energy Storage Mission, and other latest central level policies - State Policies, subsidies, and incentives - Global experiences and success stories on EV production

UNIT-2

Periods 15 (L: 12 – T: 03)

EV Components

Main components of EV sub-systems and configuration – an introduction - **Motor drive Technologies** - Electric Propulsion unit - Configuration and control of DC Motor drives - Induction Motor drives - Permanent Magnet Motor drives - Switched reluctance motor - **Energy**

storage technologies – speed variation in EV - Introduction to energy storage devices in EV and HEV- Definition of different battery parameters - Lead Acid Battery – Nickel based batteries – Lithium based batteries - Fuel Cell - Super Capacitor - Super Flywheel based energy storage and its analysis - Hybridization of different energy storage devices.

UNIT-3

Periods 10 (L: 08 – T: 02)

Drive train in EV and HEV:

Basic Architecture of Electric Drive Trains: General configuration of an electric vehicle, Alternatives Based on Drive train Configuration, Alternatives Based on Power Source Configuration, Single and Multi-motor Drives - In Wheel Drives.

Energy saving potential of Hybrid drive trains - Various HEV configurations and their operation modes - Power Flow in HEVs: Power Flow Control in Series Hybrid -Power Flow Control in Parallel Hybrid - Power Flow Control in Series-Parallel Hybrid - Power Flow Control in complex Hybrid - Torque Coupling and Analysis of Parallel Drive Train - Braking in EV – Regenerative braking – Hybrid braking.

UNIT-4

Periods 15 (L: 12 – T: 03)

Battery charging Technologies and EV Charging Infrastructure

Methods of charging - Domestic Charging Infrastructure - Public Charging Infrastructure – Fast Charging Station - Battery Swapping Station - Move-and-charge zone - Battery Management System - Power electronics related to power conversion related to charging, drive and control - Control systems for EV - Sizing the drive system - Sizing the propulsion motor, sizing the power electronics - Selecting the energy storage technology - Communications - supporting subsystems

EV Charging Infrastructure - EV Charging Fundamentals - Onboard and off board charger - Electric Vehicle Supply Equipment (EVSE) Types Characteristics - EVSE Standards and Communication Protocols - Next Generation Technologies: Super Chargers - Wireless Chargers - EVSE Management and Settlement Solutions - Effect of EV charging on generation and load profile - Smart charging technologies - EV charging facility planning - Centralized charging schemes - Decentralized charging schemes - Energy storage integration into Microgrid

UNIT-5

Periods 10 (L: 08 – T: 02)

Electric vehicle grid integration

Introduction - Impact of EV charging on distribution system (congestion, power quality issues etc.) – Smart charging - Vehicle to anything (V2X) technology (V2G, V2V, V2H, V2B etc.) - Grid up gradation for fast charging stations - Cost estimate of an EV charging station - Demand response from EVs - Voltage/reactive power support from EVs - Frequency support (inertial, primary, and secondary) from EVs - Fleet aggregation approaches for grid support services

UNIT-6

Periods 15(L: 12 – T: 03)

EVs and renewable energy (RE) integration, Troubleshooting

Scheduling of EVs for increased RE generation uptake - RE based EV charging stations - Correlation between EV charging and RE integration - Coordinated operation of EVs and distributed generation - Cost comparison of RE based EV charging with other alternatives Maintenance, repairing and services Troubleshooting faults in different EV components (Motor, drive train, battery etc.) - Repairing and rectifying faults in EV motor and components - EV battery and battery management systems - EV charging device repairing - Battery disposal & recycling

REFERENCE BOOKS

- 1 ATB on Modern EV, HEV and Fuel cell vehicles by Mehرداد Eshani, Yimin Gao
- 2 Hand book on EV charging Infrastructure Implementation by NITI Ayog, Govt Of India
- 3 NEPTel Notes on Introduction to EV & HEV
- 4 [Electric Vehicle trends - Electrical Installation Guide \(electrical-installation.org\)](http://electrical-installation.org/)
- 5 Electric Vehicles Integrated with Renewable Energy Sources for Sustainable Mobility <https://www.intechopen.com>
- 6 [\(PDF\) A REVIEW ON RENEWABLE ENERGY INTEGRATION FOR ELECTRIC VEHICLES \(researchgate.net\)](https://www.researchgate.net/publication/317111111)

Suggested E-Learning references

1. <https://nptel.ac.in/courses/108/106/108106170/>
2. https://en.wikipedia.org/wiki/Category:Heavy_equipment
3. How does an Electric Car work? | Tesla Model S <https://www.youtube.com/watch?v=3SAxXUIre28>
4. Tesla Model 3's motor - The Brilliant Engineering behind it <https://www.youtube.com/watch?v=esUb7Zy5Oio>
5. Toyota Hybrid System <https://www.youtube.com/watch?v=jNuixuVhc5E>
6. How Does It Work? Honda's 2 Motor Hybrid System Explained! https://www.youtube.com/watch?v=-P_VChMGK8
7. Understanding the Honda Hybrid E-Drive <https://www.youtube.com/watch?v=QLUIExAnNcE>
8. Electric Engine PRODUCTION - Audi e-tron MOTOR <https://www.youtube.com/watch?v=uWBEPespbWI>

9. BMW Electric Drive HOW IT'S MADE - Interior BATTERY CELLS Production Assembly Line
<https://www.youtube.com/watch?v=xvaQMTcckSg>
10. How Tesla Builds Cars So Fast <https://www.youtube.com/watch?v=KqXi6EkCdpQ>

SUGGESTED LEARNING OUTCOMES

Up on completion of the course the student shall be able to

1. Introduction to Electric Vehicles

- 1.1 Introduce to Electric vehicle and latest technology.
- 1.2 Know BEV, HEV and PHEV
- 1.3 List the advantages of BEV, HEV and PHEV
- 1.4 List disadvantages and limitations
- 1.5 Classify an EV based on Drive train Configuration (In wheel drives)
- 1.6 Know the effect of EV on environment
- 1.7 Summarise the concept of 'In Wheel Drives' in EV
- 1.8 Compare BEV and ICE
- 1.9 Compare BEV and HEV

2. EV components

- 2.1 List the various components of EV like
 - 2.1.1 Traction battery pack.
 - 2.1.2 DC-DC Converter.
 - 2.1.3 Electric motor.
 - 2.1.4 Power inverter.
 - 2.1.5 Charge Port.
 - 2.1.6 Onboard charger.
 - 2.1.7 Controller.
- 2.2 Know the purpose of each component
- 2.3 Introduce Electric motor as Propulsion unit
- 2.4 Know the types of Electric motors AC/DC
- 2.5 List the advantages of DC motors over AC
- 2.6 Know the construction and working of Induction motor
- 2.7 Explain the construction and working of Permanent magnet motor
- 2.8 Understand the construction and working of Switched reluctance motor
- 2.9 Know the various energy storage devices like Battery, Fuel cell, Super capacitor and super fly wheel
- 2.10 Know battery terminology like
 - 2.10.1 Depth of Discharge

- 2.10.2 Daily Depth of Discharge
- 2.10.3 Battery State of Charge (BSOC)
- 2.10.4 self discharge rate
- 2.10.5 Charge equalization
- 2.11 Know the effect of Temperature on battery performance
- 2.12 Understand the C- Rate parameter
- 2.13 Understand the Chemistry of Lead acid battery
- 2.14 Explain the construction and chemistry of Nickel based Battery
- 2.15 Know the complete details about Lithium based battery like Li-P and Lithium ion battery
- 2.16 Know the advantages/ Merits of Lithium battery as a energy source for EV
- 2.17 Know the need and concept of Hybridisation of various energy sources

3. Drive train in EV and HEV.

- 3.1 Explain General configuration of an electric vehicle.
- 3.2 Classify an EV based on Drive train Configuration.
- 3.3 Contrast the Alternatives in EV Based on Power Source Configuration.
- 3.4 Explain the concepts of Single and Multi-motor Drives in EV.
- 3.5 Summarise the concept of 'In Wheel Drives' in EV.
- 3.6 List the conceptual advantages and limitations of HEV's in terms of overall energy efficiency.
- 3.7 Explain the conceptual advantages and limitations of HEV's in terms of overall energy efficiency.
- 3.8 List the various possible ways of combining the power flow to meet the driving requirements in HEV.
- 3.9 Name the various drivetrain configurations in HEVs.
- 3.10 Outline the various drivetrain configurations in HEVs.
- 3.11 Spell the goals in power flow control in HEV's.
- 3.12 Infer four operating modes of power flow control in a Series HEV.
- 3.13 Explain the operating modes of power flow control in a Parallel HEV.
- 3.14 Interpret the ICE dominated power flow control modes in a Series Parallel HEV.
- 3.15 Summarize the EM dominated power flow control modes in a Series Parallel HEV.
- 3.16 Explain the basic concepts of mechanical coupling in Parallel HEV.
- 3.17 Outline concept of torque coupling in Parallel HEV.
- 3.18 Summarize the concept of speed coupling in Parallel HEV.
- 3.19 Illustrate two-shaft configuration or Dual transmission of parallel HEV using torque

coupler.

3.20 Rephrase the pre-transmission configuration of a parallel HEV with torque coupling

3.21 Summarise the pre-transmission configuration of a parallel HEV with speed coupling

4. Battery charging Technologies and EV Charging Infrastructure

4.1 Definition and purpose of charging station

4.2 Understand AC and DC Charging

4.3 Know methods of AC charging

4.4 Summarise the domestic and Public charging equipment

4.5 Understand Method-1, 2 & 3 charging techniques

4.6 Types of connectors to plug the charging cable to the vehicle inlet like Type-1, type-2 and type-3 connector

4.7 Understand CHAdeMO connector, Combined charging system(CCS) Combo-1 and combo-2 connectors

4.8 Know the DC Method-4 charging

4.9 List advantages of DC fast charging

4.10 Understand the draw backs of Method- 1 &2 charging

4.11 Know onboard and off board charging

4.12 Understand Manual and automated battery swapping

4.13 List merits and demerits of battery swapping

4.14 Know the Indian standards IS17017 for AC charging

4.15 Know the difference between charging station and charging point

4.16 Understand the Wireless charging

4.17 Identify the various parts and working of Electric Vehicle Supply Equipment (EVSE)

5. Electric Vehicle Grid Integration

5.1 Know AC and DC Charging station and their specificness

5.2 Know the load calculation of a charging station

5.3 Analyse the effect of charging station on the local grid

5.4 Understand the requirements for locating a charging station

5.5 Know the International Electro technical Commission (IEC) standards for establishing EV charging station

5.6 Understand charging station output, single and multiple output

5.7 Identify various modes of charging communication Like Ethernet, Wi-Fi, 3G/4G, Bluetooth, NFC and even dry contact.

5.8 Know wall and floor charging installation

- 5.9 Explain charging station with and without cable
- 5.10 Explain fast charging station along with advantages and disadvantages
- 5.11 Understand the functions of Residual current devices and Over current protective devices
- 5.12 Understand the impact of EV charging on maximum power demand
- 5.13 Explain different types of power management for EV charging station
- 5.14 Define smart charging and various options V2X tech (V1G ,V2G, V2V, V2H, V2B)
- 5.15 Identify various elements of a EV charging station

6. EVs and renewable energy (RE) integration, Troubleshooting

- 6.1 List and understand various types of renewable energy sources
- 6.2 Know the term smart grid
- 6.3 Know the need of EV integration with renewable energy
- 6.4 Know advantages of EV integration with renewable energy
- 6.5 Know the safety aspects of EV
- 6.6 Understand the service and maintenance schedules of EV
- 6.7 Identify the challenges in EV integration with renewable energy
- 6.8 Explain EV integration with Wind energy
- 6.9 Explain EV integration with Solar energy
- 6.10 Know EV coordination
- 6.11 Identification of battery faults like
 - 6.11.1 Over charge and Over discharge
 - 6.11.2 Overheating and under cooling
 - 6.11.3 Short circuit or open circuit of inner cell
- 6.12 Know how to identify dead battery
- 6.13 Understand dead battery disposal and recycling
- 6.14 Identification of Motor faults
- 6.15 Identification of software problems
- 6.16 Know using OBD (On-board diagnostics) scanning tools
- 6.17 Understand Remote diagnostics
- 6.18 Identify the Power electronics faults

CO-PO Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Mapping Pos
CO1	3	2	1	-	-	-	2	1,2,3,7
CO2	2	1	-	-	-	-	2	1,2,7
CO3	3	2	-	-	1	1	2	1,2,5, 6,7
CO4	3	2	1	-	-	1	3	1,2,3,6,7
CO5	3	2	1	-	-	1	2	1,2,3,6,7
CO6	1	1	1	-	-	-	2	1,2,3,7

QUESTION PAPER PATTERN FOR MID SEMESTER EXAMS

Sl.No	Description	Level	No.of Questions	Marks for each question	Questions to be attempted	Total Marks
01	Part-A	Remembering(R)	4	1	Nil	4 Marks
02	Part-B	Understanding(U)	4	3	2	6 Marks
03	Part-C	Application(A)	4	5	2	10 Marks
Total Marks						20 Marks

Question Paper Blue Print for CIE (MID I)

Unit no	Unit name	Questions to be set for MID-I			Remarks
		R	U	A	
1	Introduction to Electric Vehicles	1,2	5(a) 5(b)	7(a) 7(b)	
2	EV components	3,4	6(a) 6(b)	8(a) 8(b)	
Total questions		4	4	4	

Question Paper Blue Print for CIE (MID II)

Unit no	Unit name	Questions to be set for MID-II			Remarks
		R	U	A	
3	Drive trains in EV & HEV	1,2	5(a) 5(b)	7(a) 7(b)	
4	Battery charging Technologies and EV Charging Infrastructure	3,4	6(a) 6(b)	8(a) 8(b)	
Total questions		4	4	4	

AU- 575- FARM TRACTORS AND SPECIAL TYPES OF VEHICLES

Course Title	Farm Tractors and Special Types of Vehicles	Course Code	AU-575
Semester	V	Course Group	Elective
Teaching Scheme in periods (L:T:P)	4:1:0	Credits	3
Methodology	Lecture + Tutorials	Total Contact Periods	75
CIE	60 Marks	SEE	40 Marks

Pre requisites:

This course requires the basic knowledge of Basic Automobile engineering and servicing and maintenance of automobiles.

Course Content and Blue Print of Questions for SEE							
Unit	Unit Title	Questions to be set for SEE				Periods	
		R		U	A		
1	Introduction to Earth moving machinery and Construction equipment	4	1	9(a)	13(a)	15	
2	Basics of Hydraulic Systems					10	
3	Components of Hydraulic control systems		2	10(a)	14(a)	15	
4	Farm Tractors					10	
5	Hydraulic systems and maintenance of Special purpose Vehicles.	3	5,6	9(b)	13(b)	15	
				11(a)	15(a)		
				11(b)	15(b)		
6	Chassis and Steering in Crawler tractors		7,8	10(b)	14(b)	10	
				12(a)	16(a)		
				12(b)	16(b)		
Total Questions		8		8	8	8	75

Legend	Remembering (R)	1 Mark
	Understanding (U)	3 Marks
	Application (A)	5 Marks

Course Outcomes:

On successful completion of the course student should be able to

CO1 :	Recognize an earth moving machine or a crane and state the application.
CO2 :	Comprehend the basics of a hydraulic system.
CO3 :	State the components a hydraulic control system.
CO4 :	Comprehend the working of general mechanisms in a Farm tractor.
CO5 :	Draw the general layout of hydraulic system in an earth moving machinery
CO6 :	Outline the working of steering in a crawler tractor.

COURSE CONTENT:**1. Introduction to Earth moving Machinery and Construction Equipment:****(15 Periods)**

Types of Earth movers: Farm tractors – Excavators - Shovel: - Types of shovels – Operation – Applications and Limitations – Backhoe: Types of backhoes – Constructional details of backhoe- Applications- Advantages and limitations – Dragline: Types of dragline – Operation – Applications – Factors affecting dragline production – Advantages and Limitations – Scrapers: Types of scrapers- Operation – Applications – Motor Graders: Applications – Operations of Grader – Wheel Loader: Types, Operations - Bull Dozers: Types- Operation – Comparison between wheel dozer and Crawler dozer – Types of dozer blades. - Mobile cranes: Types of mobile cranes – Dumpers: Types of dumpers.

2. Basics of Hydraulic Systems :**(10 Periods)**

Introduction to hydraulic system – Pascal's law – Merits and Limitations of hydraulic control systems – Essential Components of a hydraulic circuit and their functions – Accumulators - Types of pumps – Constructional details of pumps – Hydraulic pumps: External gear pump, Vane pump, Radial piston pump, Axial piston pump —Actuators: Linear and Rotary actuators – Oil Reservoir and its elements - Oil Filters: Edge, Surface and Depth filters.

3. Components of Hydraulic Control Systems:**(15 Periods)**

Valves: Functions, Classification – Types of pressure control valves - Classification of hydraulic controls - Open loop control and Closed loop control - Control valves: Types of control valves – Pressure Control Valves: Relief valves, Pressure reducing valves, Speed control valves – Direction Control valves: Designation of D.C Valves, Sliding spool valve, Pilot Check valve, Solenoid Control valve – Flow control valves: Pressure compensated flow control valve, Gate valve, Plug valve, Butterfly valve, Non-return valve, Needle valves.

4. Farm Tractors:

(10 Periods)

Farm Tractors - Classification - types of tractors with their application – Features of a tyre tractor and track or crawler tractor –Advantages and limitations of tyre tractors - Advantages and limitations of crawler tractors - Power take off shaft – purpose of P.T.O. shaft – Classification of PTO shafts - Types of drive for P.T.O. shafts – Belt pulley drive -Precautions to be taken while using belt pulley and P.T.O. shaft - Draw bar- Types of drawbar: Regular Drawbar, Three point linkage drawbar – Types of hitching systems: Two point linkages & Three point linkages.

5. Hydraulic systems & Maintenance of Special purpose vehicles:

(10 Periods)

Purpose of hydraulic system in a tractor - General layout of hydraulic system of a tractor– Position or Depth control system – Draft control system - Automatic depth and draft control in tractors - Hydraulic system of a tipper or dump truck - Hydraulic operation of a bulldozer blade – Maintenance of Farm Tractors, Excavators, Backhoes, Forklifts etc.,.

6. Chassis and Steering in Crawler tractors:

(15 Periods)

Track Mechanism in Crawlers: Parts of under carriage like Track frame, Track rollers, Track chain and Sprocket, Types of track chains, Track shoes, Types of track shoes.

Principle of steering mechanism in tracked vehicles – Design considerations for steering of tracked vehicles - Types of steering systems used in tracked vehicles: Dual drive system, Twin transmission or Geared steering system, Clutch-Brake system, Differential braking system, Controlled differential system, Double differential system, Triple differential system.

Recommended Books for Reference:

1. Farm Machines and Equipment - C.P.Nakra
2. Farm Tractor Maintenance and Repair - S.C.Jain and C.R. Rai
3. Truck Cranes - A. Astakhov (MIR Publishers, Moscow)
4. Motor Graders - E.G.Ronioson (MIR Publishers, Moscow)
5. Construction equipment operation & maintenance - Y.Pokras & M.Tushnyakov
(MIR Publishers, Moscow)
6. Hand book of Earth moving Machinery - Central water and Power Commission
7. Tractors and Automobiles – V.Rodichev, G.Rodicheya (MIR Publishers, Moscow)
8. A Text book of Hydraulic machines – R.K.Rajput – S.Chand
9. Fluid power engineering – Venkatesh Naik – Sunstar publishers
10. Hydraulic Control Systems - Noah D. Manring, Roger C. Fales - Wiley

Suggested Learning Outcomes:

- 1.1 Definition of a 'Tractor'
- 1.2 Definition of a 'Farm Tractor'
- 1.3 List the types of Earthmovers
- 1.4 Name the types of Shovels
- 1.5 Explain the Operation of a Shovel
- 1.6 State the applications and Limitations of Shovels
- 1.7 List the types of Backhoes
- 1.8 Outline the constructional details of Backhoe
- 1.9 Select the applications of a Backhoe
- 1.10 List the advantages and Limitations of a Backhoe
- 1.11 Name the types of Draglines
- 1.12 List the four operations performed by a dragline
- 1.13 Outline the operations of a dragline
- 1.14 State the factors affecting dragline production
- 1.15 List the advantages and limitations of a dragline
- 1.16 Name the types of Scrapers
- 1.17 State the basic parts of bowl of a scraper
- 1.18 Explain Scraping operation and Spreading operations of a Scraper
- 1.19 Define the cycle time of a scraper
- 1.20 State the applications of a Scraper
- 1.21 Name the types of Bulldozers
- 1.22 List the advantages of Wheel type Bulldozer
- 1.23 State the advantages of Crawler type Bulldozer
- 1.24 Outline the operation of a Bulldozer
- 1.25 Compare a Wheel dozer and a Crawler dozer
- 1.26 List the types of blades of a Bulldozer
- 1.27 State the various applications of a Bulldozer
- 1.28 Name different types of mobile cranes
- 1.29 Outline a Truck mounted crane
- 1.30 Explain the use of a Rough terrain crane
- 1.31 Summarize the use of Pick and Carry crane
- 1.32 Infer the use of Crawler crane.

1.33 State the use of a dumper or Dump truck

1.34 Name the types of Dump trucks

2.1 Define a hydraulic system.

2.2 State the merits and limitations of hydraulic control systems.

2.3 State 'Pascal's Law'.

2.4 List the essential components of a hydraulic circuit.

2.5 State the functions of each component in a typical hydraulic circuit.

2.6 Draw the symbols used for a hydraulic circuit.

2.7 Define an 'Accumulator'

2.8 List the types of pumps used in an hydraulic circuit.

2.9 Explain the working of a Gear pump

2.10 Summarise the working of a vane pump

2.11 Explain the working of a Radial piston pump

2.12 Summarise the working of an Axial piston pump

2.13 List the types of actuators

2.14 Explain the working of linear actuator

2.15 Explain the working of Rotary actuator

2.16 State the function of Oil Reservoir and its elements

2.17 Justify the need of Oil Filter in an hydraulic circuit

2.18 Explain the Edge type oil filter

2.19 Summarise the working of Surface oil filter

2.20 Explain the working of Depth filters

3.1 State the functions of a valve in a hydraulic circuit.

3.2 Classify the valves used in a hydraulic circuit.

3.3 Classify the hydraulic control systems.

3.4 Enumerate the types of control valves.

3.5 Explain open loop control system.

3.6 Explain closed loop control system.

3.7 Summarise the working of various pressure control valves.

3.8 Explain the working of direction control valves.

3.9 Summarise the working of flow control valves.

- 4.1 Classification of Tractors
- 4.2 List the applications of different types of tractors
- 4.3 Describe the features of a tyre tractor and track or crawler tractor
- 4.4 State the advantages and limitations of tyre tractors
- 4.5 List the advantages and limitations of crawler tractors
- 4.6 Outline the purpose of Belt Pulley Drive
- 4.7 Infer the precautions to be taken while using Belt Pulley drive of a tractor
- 4.8 State the purpose of power take off shaft
- 4.9 Classification of PTO shafts
- 4.10 List the types of drives for PTO shaft
- 4.11 Explain the different types of drives for PTO shafts
- 4.12 State the function of a Draw bar in a tractor
- 4.13 List the types of drawbars used in Farm tractors
- 4.14 Name the types of hitching systems used in Farm Tractors
- 4.15 Explain two point linkage type of hitching system used in farm tractors
- 4.16 Outline Three point linkage hitching system used in farm tractors

- 5.1 State the difference between a tractor and farm tractor.
- 5.2 Draw the general Layout of a Farm tractor and label the parts.
- 5.3 State the purpose of hydraulic system in a tractor.
- 5.4 Interpret the necessity of Depth or Position control of implement in a tractor.
- 5.5 State the necessity of Draft control of an implement in a tractor.
- 5.6 Explain the automatic depth and draft control system in a farm tractor.
- 5.7 Summarise the blade operation in a bulldozer and uses.
- 5.8 Draw the outline on the maintenance of Tractors
- 5.9 Explain the maintenance of Excavators
- 5.10 Enumerate the salient features in the maintenance of fork lifts
- 5.11 Explain the working of Hydraulic system for tipper and its functions

- 6.1 Enumerate the parts of track mechanism in crawler.
- 6.2 Describe the construction of under carriage of a crawler.
- 6.3 Summarise the constructional features of track frame in a crawler
- 6.4 Contrast the arrangement of track on rollers in a tracked vehicle.

- 6.5 Explain the constructional details of track chain and sprocket system in a crawler.
- 6.6 Name the types of track shoes used in a crawler.
- 6.7 Summarise the constructional details of Inter-locking and Non Inter-locking type track shoes of a crawler.
- 6.8 List the popular designs in the track shoes or grouser plates.
- 6.9 State the general requirements of steering system in tracked vehicles.
- 6.10 Draw the introduction to steering mechanism in a tracked vehicle.
- 6.11 Explain Dual drive steering system in a tracked vehicle
- 6.12 Summarise the working of Twin transmission or Geared steering system.
- 6.13 Explain the Clutch-Brake steering system used in crawlers
- 6.14 Outline the Differential braking type steering system in a tracked vehicle.
- 6.15 Write a summary of Controlled differential steering system
- 6.16 Summarise Double differential system and Triple differential systems used in crawlers.

Suggested Student Activities:

- 1. Visit the Library to refer various reference books on this course.
- 2. Debate on importance of developing earth moving machinery in the country.
- 3. Visit the nearby workshops/Industries/Market to submit a brief report on available farm tractors.
- 4. Visit the nearby workshops/Industries/Market to submit a brief report on available earth moving machines.
- 5. Give seminar on special features arrangement in farm tractors.
- 6. Fabricate a proto type model of any one special purpose vehicle as mini-project.
- 7. Prepare and submit a report on contemporary issues in the field of Earth moving machinery or construction equipment.
- 8. Participate in Quiz.
- 9. Group discussion.

Suggested E-Learning references

- 11. <https://nptel.ac.in/courses/108/106/108106170/>
- 12. <https://www.equipmentandcontracting.com/a-complete-guide-to-earthmoving-equipment/>
- 13. <https://www.youtube.com/watch?v=bUUBHg7bpO4&t=4s>

14. https://lkdfacility.org/wp-content/uploads/2016-06-30-BASIC-MECHANICS6_EM-Equipments-FINAL-WEB.pdf
15. https://en.wikipedia.org/wiki/Category:Heavy_equipment
16. <https://careertrend.com/about-5583871-types-construction-vehicles.html>
17. <https://www.fueloyal.com/14-popular-types-construction-vehicles/3/>
18. https://en.wikipedia.org/wiki/Power_shovel
19. <https://www.explainthatstuff.com/tractors.html>
20. <https://www.tractoragriculture.com/types-of-tractors/>
21. <https://www.hobbyfarms.com/4-tractor-types-to-consider-for-your-farm/>
22. <http://ecoursesonline.iasri.res.in/mod/page/view.php?id=2274>
23. <https://lib.dr.iastate.edu/cgi/viewcontent.cgi?article=17335&context=rtd>
24. <https://www.youtube.com/watch?v=FA-bJGTqtvI&t=119s>
25. <https://www.youtube.com/watch?v=W8oNTcsA6c4>
26. <https://www.youtube.com/watch?v=FCU2t3fTv-k>
27. Automatic Draft and Depth Control System in Tractors
<https://youtu.be/ufs6TtuEjJU>
28. P.T.O Technology in Tractors
<https://www.youtube.com/watch?v=bkKEHbtFWHg&t=226s>

CO- PO Mapping Matrix:

S.No	Course Outcome	List of PO or PSO Mapping	Number of periods
CO1 :	Recognize an earth moving machine or a crane and state the application.	PO 1,5,7 & PSO 1 and 2	15
CO2 :	Comprehend the basics of a hydraulic system.	PO 1,5,7 & PSO 1 and 2	10
CO3 :	State the components a hydraulic control system.	PO 1,5,7 & PSO 1 and 2	15
CO4 :	Comprehend the working of general mechanisms in a farm tractor.	PO 1,5,7 & PSO 1 and 2	10
CO5 :	Draw the general layout of hydraulic system in an earth moving machinery	PO 1,5,7 & PSO 1 and 2	10
CO6 :	Outline the working of steering in a crawler tractor.	PO 1,5,7 & PSO 1 and 2	15

Mid Semester Examination Blueprint of Questions and Marks:

MID SEM –I EXAM					
S.No	Unit Name	R	U	A	Marks
1	Unit-I	1, 2	5(a) 5(b)	7(a) 7(b)	10
2	Unit-II	3, 4	6(a) 6(b)	8(a) 8(b)	10
Total Questions		4	4	4	20
MID SEM –II EXAM					
S.No	Unit Name	R	U	A	Marks
1	Unit-III	1, 2	5(a) 5(b)	7(a) 7(b)	10
2	Unit-IV	3, 4	6(a) 6(b)	8(a) 8(b)	10
Total Questions		4	4	4	20

Blue Print of Questions for Semester End Examination							
Unit	Unit Title	Questions to be set for SEE				Periods	
		R		U	A		
1	Introduction to Earth moving machinery and Construction equipment	4	1		9(a)	13(a)	15
2	Basics of Hydraulic Systems						10
3	Components of Hydraulic control systems		2		10(a)	14(a)	15
4	Farm Tractors						10
5	Hydraulic systems and maintenance of Special purpose Vehicles.	3	5,6	9(b)	13(b)	15	
				11(a)	15(a)		
				11(b)	15(b)		
6	Chassis and Steering in Crawler tractors			7,8	10(b)	14(b)	10
					12(a)	16(a)	
					12(b)	16(b)	
Total Questions		8		8	8	75	

AU-585- MOTOR TRANSPORT ORGANISATION

Course Title	Motor Transport Organisation	Course Code	AU-585
Semester	V	Course Group	Elective
Teaching Scheme in Periods (L:T:P)	4:1:0	Credits	3
Methodology	Lecture	Total Contact Periods :	75
CIE	60 Marks	SEE	40 Marks

Pre requisites

This course requires the basic knowledge of Automobile Engineering.

Course Content and Blue Print of Marks for SEE

Unit Sl No	Unit Name	Questions to be set for SEE				Periods	
		R		U	A		
1	Organizational structure	4	1		9(a)	13(a)	12
2	Operations						12
3	Bus and crew scheduling		2		10(a)	14(a)	12
4	Services and Fares						12
5	Transport Economics		3	5, 6	9(b) 11(a) 11(b)	13(b) 15(a) 15(b)	12
6	Legal aspects and Loss assessment				7,8	10(b) 12(a) 12(b)	14(b) 16(a) 16(b)
Total Questions		8		8	8	70	
Legend:		Remembering (R)		1 Mark			
		Understanding (U)		3 Marks			
		Application (A)		5 Marks			

Course Outcomes:

CO1 :	Identify the various types of motor transport systems.
CO2 :	Explain different types of operations.
CO3 :	Explain bus and crew scheduling
CO4 :	Describe various services and fare collections
CO5 :	Explain transport Economics
CO6:	Infer the legal aspects and loss assessment

Course Content:

UNIT I: Organizational structure

Duration: Periods 8 (L: 8.0 – T:4.0)

Importance of motor transport in present day transport system – types of motor transport – Passenger transport and Goods transport – public transport and private transport – classification of carriers – common carriers, contract carriers – Highway carriers , High way passenger carriers – freight carriers – Types of ownership – state, municipality , public and private undertaking, principal functions of transport organisation – administrative, traffic, secretarial and engineering functions – organisational structure – organisation of various departments – staffing – chain of responsibilities – Training Programmes.

UNIT II: Operations

Duration : Periods 10 (L:8 – T:4)

Types of operations – city operation – city – suburban operation – inter-city (short distance and long distance) operation – other specific operations for goods carriers –operating characteristics – utility – capacity , Dependability – safety , distance, speed – road condition- fuel economy , Traffic interference , flexibility – Trip generation – Trip distribution – traffic data – published data – field survey –preparation of time tables for - vehicles and operational staff –duty rosters – Trip sheet – way bill.

UNIT III: Bus and Crew Scheduling

Duration: Periods 12 (L: 8– T:4)

Basic factors to be considered in bus scheduling – Traffic demand, running time, maintenance time – vehicle utilization - Basic factors to be considered in crew scheduling – hours of work – Daily and weekly intervals of rest – spread over, spell of duty, overtime allowance – Handling over and taking over time – use of computer in scheduling.

UNIT IV: Services and Fares

Duration : Periods 8 (L: 8 – T:4)

Elementary treatment of traffic investigation to improve services – peak hours demand, express limited stop services relief services – fare structure – Requirements of a good fare system – different fares for hilly areas – different routes – Express services luxury services – different rates relating to distance – fare methods – straight line scale method, tapered scale method, flat rate , concessional fare, luggage fare – structure and method of drawing of fare stages – Examples for different type of fare structures - stage – fare stage – Designing a stage – Fare collection system . Ticketing system – types – Hand written ticket, card ticket and pre – printed denomination ticket – advance booking and reservation voucher – Ticketing machine.

UNIT V: Transport Economics

Duration : Periods 10 (L: 8– T:4)

Costs – Capital costs – Maintenance costs- miscellaneous costs – components of vehicle operational costs – fuel, lubricants, tyres, license- operational staff – vehicle taxes – depreciation

UNIT VI: Legal aspects and Loss assessment

Duration : Periods 12 (L: 6 – T:4)

Salient features of Motor Vehicle act of India 1989 –Traffic signs –pollution norms –Penalties for violation of traffic rules-registration requirements –Necessity of permits for commercial vehicles – motor vehicle insurance, necessity and types – Driving license –requirements & renewals –Driving competence test.

Types of accidents – Probable damage to the vehicles. Role of insurance companies and surveyors in the loss assessment – Procedure of loss assessment- Types of surveys – Types of losses –Documents required for the settlement of insurance claim.

RECOMMENDED BOOKS:

Sl.No	Title of Books	Author	Publication
1.	Industrial Organization and Engineering Economics	T.R.Banga & S C Sharma	Khanna Publishers
2.	Industrial Management and Engineering Economics	O.P.Khanna	Khanna publishers
3.	Safety Management in Industry	Krishnan's V	Jaico Publishing House, Bombay, 1997
4.	Vehicle Transport Management	S.L.Bhandarkar	Dhanapath Rai & Co
5.	The central Motor Vehicles Rules 1989 (2001 Edition)	Edited By: SathpalPuliani	Karnataka Law Journal Publications Bangalore
6.	The central Motor Vehicles Rules 1989 (2005 Edition)	Edited By: SathpalPuliani	Karnataka Law Journal Publications Bangalore

Suggested learning outcomes

Student will be

1.0 Understand the organization structure of Motor Transport Organization

1.1 Outline the importance of Motor Transport Organization.

1.2 Classify the Motor Transport Organization.

1.3 Comparison between passenger transport and goods transport.

1.4 Comparison between Public transport and private transport.

1.5 Classify transport carriers.

- 1.6 Explain the different types of ownership of motor transport organization.
- 1.7 List the functional wings of a transport system.
- 1.8 Construct the Organizational charts for the transport organization, its regional and district branches.
- 1.9 Explain the criteria and mode of staffing.
- 1.10 Interpret the chain of responsibilities.
- 1.11 Outline the need and type of staff training Programs.

2.0 Understand the fundamentals of Operations

- 2.1 List the types of operation.
- 2.2 Compare – city; city-suburban and inter –city operation.
- 2.3 Illustrate the operating characteristics.
- 2.4 Explain the factors such as utility, capacity, dependability, safety, distance, flexibility, speed, road condition, fuel economy, traffic interference.
- 2.5 Explain the terms – trip generation, factors to be considered for trip generation.
- 2.6 Explain about traffic data – published data - field survey.
- 2.7 Model time table for– vehicles- operational staff.
- 2.8 Explain the following terms – duty rosters – trip sheet, way bill.
- 2.9 Basic concept of of trip generation and explain the factors to be considered for trip generation
- 2.10 Explain the trip distribution
- 2.11 Classify the collection methods of traffic data.
- 2.12 Explain the method of preparation of Time – Table for operational staff.

3.0 Understand the bus and crew scheduling

- 3.1 Infer the factors to be considered in bus scheduling.
- 3.2 Identify number of buses required.
- 3.3 Outline the factors to be considered in crew scheduling..
- 3.4 Explain how the productivity can be increased by scheduling.
- 3.5 Applications of computer in scheduling.

4.0 Understand the services and Fares

4.1 Demonstrate the different types of fares

4.2 Explain the fare structure.

4.3 Interpret the requirements of good fare system.

4.4 Outline different services, fares relating to distances.

4.5 List the different fare methods.

4.6 Explain straight line scale method, tapered scale method, flat fare, concessional fare and luggage fare.

4.7 Explain the method of drawing fare tables with suitable examples

4.8 Explain the term fare stage.

4.9 Explain how to design a fare stage.

4.10 Summarize the fare collection system.

4.11 List the types of ticketing system.

4.12 Know about hand written ticket, card ticket, pre printed denomination ticket, advance booking and reservation voucher and ticketing machine.

5.0 Understand the Transport Economics

5.1 Outline the different types of costs involved in a transport organization.

5.2 Explain the components of vehicle operational cost.

5.3 Compute the total cost for specific type of operation.

5.4 Explain Vehicles taxes and depreciation

6.0 Understand the Legal aspects and loss assessment

6.1 Explain the procedure of vehicle registration

6.2 Explain the necessity of permit

6.3 Explain Insurance coverage.

6.4 Explain pollution norms

6.5 Interpret the driving competence test

6.6 List Nature of accidents

6.7 List the various types of accidents

6.8 Enumerate the probable damages to the vehicles due to different type of accidents.

6.9 Interpret the role of insurance companies and surveyors.

6.10 Explain the procedure of loss assessment.

Suggested Student Activities

1. Visit library to refer TSRTC, APSRTC, NAVATA and other transport organisation manuals.
2. Collect the data about various ticketing methods to collect the fares.
3. Visit nearby bus depots to familiarize with field survey.
4. Assignment on how production planning and control takes place in the industry.
5. Group discussion on Marketing, Sales.
6. Visit the manufacturing industry to know materials management techniques.
7. Quiz.
8. Surprise test.

Suggested E-Learning references

1. www.learnengineering.org
2. www.sae.org
3. www.nptel.ac.in
4. <http://transport.telangana.gov.in/>
5. <https://www.youtube.com/watch?v=OqmRZXfVoE4>
6. <https://www.toolshero.com/management/five-functions-of-management/>
7. <https://www.mooc-list.com/course/sales-marketing-alignment-coursera>
8. <https://www.investopedia.com/terms/o/organizational-structure.asp>
9. <https://www.youtube.com/watch?v=wO-MtWejRM>
10. <https://wricitieshub.org/online-publications/71-costs-and-revenues-understanding-bus-operations>
11. <http://bca.transportationeconomics.org/setup/project-schedule>
12. <https://www.westminster.ac.uk/courses/professional-and-short-courses/air-transport/introduction-to-air-transport-economics-and-planning>
13. <https://kalyan-city.blogspot.com/2011/12/what-is-production-management-meaning.html>
14. <https://www.britannica.com/technology/production-management>
15. <https://www.purchasing-procurement-center.com/materials-management-system.html>
16. <https://www.class-central.com/subject/>
17. <https://www.communionmarketing.com/index.php/marketing/market-research-and-feasibility-studies>

CO- PO Mapping Matrix:

Course Outcome		CL	Linked PO	Teaching Periods
CO1	Identify the various types of motor transport	R/U	1,2,6	12
CO2	Explain the types of operations.	R	1,2,	12
CO3	Bus and crew scheduling	A	1,2,6	12
CO4	Services and Fares	A	1,2,5	12
CO5	Transport Economics	R/U	1,2,	12
CO6	Legal aspects and Loss assessment	R	1,7	10

R-Remembering, U-Understanding, A- Application type questions each carrying 1, 3 and 5 Marks respectively.

Guidelines for Continuous Evaluation:

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

Internal Assessment**Max.Marks: 20**

Type of test	Unit	Marks allotted	Remarks
Slip Test 1	1 and 2	5	2 Essay Questions out of 3 Questions
Slip Test 2	3 and 4	5	2 Essay Questions out of 3 Questions/ Objective type
Assignment	Any one Unit / Course	5	Different group assignments of Higher order Questions that develop problem solving skills, critical thinking and that promote lifelong learning should be given.
Seminar		5	Any topic approved by the faculty

MID SEM –I
MODEL QUESTION PAPER
DIPLOMA IN AUTOMOBILE ENGINEERING
Subject Name: Motor Transport Organisation
Subject Code: AU-585

Time: 1hr

Max Marks: 20

PART – A

Answer **ALL** questions and each question carries **ONE** mark.
and answer should not exceed $\frac{1}{4}$ page.

Marks: 4 X 1M = 4M

1. State the importance of Motor Transport Organization.
2. List the types of owner ships.
3. What is meant by Trip.
4. State the factors of dependability.

PART – B

i. Answer the following.

ii. Each question carries Three marks and answer should not exceed 1 page. 2x3= 6 Marks

5. a) Explain the term bus staff ratio.

OR

- b). State the need of staff training Programs.

6. a) Define ‘trip sheet’

OR

- b) What the factors to be considered in bus scheduling.

PART – C

i. Answer the following.

ii. Each question carries Three marks and answer should not exceed 2 pages. 2x5= 10 Marks

7. a). Explain about types of carriers.

OR

- b). Draw the Organizational charts for the transport organization

8. a). Explain the factors to be considered for trip generation.

OR

- b). Explain the trip distribution.

MID SEM –II
MODEL QUESTION PAPER
DIPLOMA IN AUTOMOBILE ENGINEERING
Subject Name: Motor Transport Organisation
Subject Code: AU-585

Time: 1hr

Max Marks: 20

PART – A

**Answer ALL questions and each question carries ONE mark.
and answer should not exceed ¼ page.**

4x1 = 4Marks

1. Define the term “Bus scheduling”
2. Define the term “Fleet utilisation”
3. What are the types of services you observed in A.P.S.R.T.C?
4. What is the meaning of fare?

PART – B

i. Answer the following.

ii. Each question carries Three marks and answer should not exceed 1 page. 2x3= 6 Marks

5. a). What are the factors for making for crew scheduling.

OR

- b). Write the applications of computer in scheduling.

6. a) What is the reason for different fares for hilly areas?

OR

- b) List the different fare methods.

PART – C

ii. Answer the following.

iii. Each question carries Three marks and answer should not exceed 2 pages. 2x5= 10 Marks

7. a). Explain the productivity can be increased by scheduling.

OR

- b).How do you make a bus scheduling.

- 8.a). What are the requirements of good fare system.

OR

- b). Explain about fare differentials for services.

**SEMESTER END EXAMINATION
MODEL QUESTION PAPER
DIPLOMA IN AUTOMOBILE ENGINEERING
Subject Name: Motor Transport Organisation
Subject Code: AU-585**

Time: 2hrs

Max Marks: 40

PART-A

- Instructions :**
1. Answer **ALL** questions.
 2. Each question carries **ONE** mark.

1. State the importance of Motor Transport Organization.
2. State the factors to be considered in crew scheduling.
3. What is meant by fare stage.
4. State the types of operation.
5. List the types costs involved in transport organisation.
6. What is cost per kilometre.
7. Explain the term insurance.
8. Define “transport accident” .

PART-B

- Instructions :**
1. Answer any **FOUR** questions.
 2. Each question carries **THREE** marks.

4x3 = 12

9. (a) Explain the different types of ownership of motor transport organization.
(or)
9. (b) Explain fixed cost in transport economics.
10. (a) What are the factors making for crew scheduling.
(or)
10. (b) What is the importance of M.V act?
11. (a) Explain the term traffic revenue.
(or)
11. (b) Explain lubrication cost in transport economics.
12. (a) Write down a short notes on informatory signs.
(or)
12. (b) Draw any three traffic signs

PART-C

04X5=20

- Instructions :**
1. Answer any **FOUR** questions.
 2. Each question carries **FIVE** marks.

13. (a) Differentiate between passenger transport and goods transport.
(or)
13. (b) Write short notes on depreciation.
14. (a) Explain the factors to be considered for trip generation.
(or)
14. (b) Write the procedure of motor claim settlement
15. (a) Explain various components of vehicle operational cost.
(or)
15. (b) Explain tyre cost in transport economics.
16. (a) Explain the Registration procedure for the vehicles
(or)
16. (b) Write the procedure to get driving license of a heavy vehicle

AU-506- AUTOMOBILE ENGINEERING DRAWING

Course Title :	Automobile Engineering Drawing	Course Code	AU-506
Semester:	V	Course Group	Core
Teaching Scheme in Periods(L:T:P):	1:0:2	Credits	1.5
Methodology:	Lecturer+ Practical	Total Contact periods:	45
CIE:	60 Marks	SEE	40 Marks

Pre requisites

This course requires the basic knowledge of Engineering Drawing. And also have the idea about physical shape of various engine and transmission parts.

Course Content and Blue Print of Marks for SEE

Unit No	Unit Name	Periods	Marks Weight age				Total Marks	Remarks
			Q.No	5M	10M	20M		
1	Automobile Engine Components	15	1,2,3,4	2	-	-	10	Answer any two
2	Chassis and Transmission Components	15	5,6	-	1	-	10	Answer any one
3	Automobile Parts assembly drawings	15	7,8	-	-	1	20	Answer any one
	Total	45	08	10	10	20	40	-

Course Outcomes:

At the end of the course the student should be able to

Course Outcomes	
CO1	Apply the drawing methods to various automobile engine components
CO2	Identify the need of chassis and transmission components
CO3	Able to draw the transmission components and their views
CO4	Acquire the knowledge and draw assembly of different engineering components

Course Contents:

I. Draw to scale, the following Automobile parts including different views of Automobile Engine Components.

1. Pistons for petrol engine.
2. Pistons for diesel engine.
3. Connecting rod for petrol engine.
4. Connecting rod for diesel engine.
5. Cylinder head for 2 stroke petrol engine.
6. Cylinder Block for 2 stroke petrol engine.
7. Crank shaft.
8. Cam shaft.
9. Valves.
10. Rocker Arms
11. Spark plugs.

II. Chassis and Transmission Components.

1. Linkage Bracket
2. Rear hub
3. Chassis Bracket
4. Gear box selector fork
5. Engine Mount
6. Bell crank
7. Steering arm
8. Track Arm

III. Automobile Parts Assembly Drawing

1. Piston assembly.
2. Connecting rod assembly.
3. Master Cylinder assembly
4. Wheel Cylinder assembly

REFERENCE BOOKS

- | | | | |
|----|--------------------------------|----|-----------|
| 1. | Automobile Engineering Drawing | by | R.B Gupta |
| 2. | Machine Drawing | by | N.D Bhat |

Suggested Learning Outcomes

The key competencies to be achieved by the student:

Unit NO	Topic	Key competency
1	Automobile Engine Components.	<ul style="list-style-type: none">• Able to identify the various parts of the IC engine.• Visualize physical shape of the engine parts.• Study the dimensions of the given views.• Able to draw proportionate free hand sketches and two dimensional views of the engine parts.• Able alter the given views from one form to other form.
2	Chassis and Transmission Components.	<ul style="list-style-type: none">• Identify the various parts of the chassis and transmission components.• Able get acquaint with the physical shape of the chassis and transmission components.• Able to draw the different two dimensional views to the given isometric views.
3	Automobile Parts Assembly drawings.	<ul style="list-style-type: none">• Understand function, working principle and field of application for the automobile parts assembly.• Study the external and internal features of each part along with dimensions.• Put the overall dimensions.• Prepare the table of parts giving part number, its name, material and quantity.• Able to draw the assembled views by matching respective parts.

CO-PO MATRIX:

Course Outcome		CL	Linked PO
CO1	Apply the drawing methods to various automobile engine components	U/A	1,2,3,6,7
CO2	Identify the need of chassis and transmission components	R/U	1,2,3,6,7
CO3	Able to draw the transmission components and their views	U	1,2,3,6
CO4	Acquire the knowledge and draw assembly of different engineering components	U	1,2,3,6

Suggested Student Activities

1. www.learnengineering.org
2. www.sae.org
3. www.nptel.ac.in
4. <https://www.google.com/>
5. <https://en.wikipedia.org/wiki/Piston>

Suggested E-Learning references:

1. Visit automobile laboratory available in the institute to study the features of automobile components.
2. Prepare the images of automobile engine, chassis, transmission hydraulic brakes components by visiting nearby garages and service stations.
3. Watch the video lessons related to the course.
4. Participate in Quiz
5. Participate in Group discussion
6. Surprise test

Mid Semester Examination Blueprint of Questions and Marks:**MID SEM-I EXAM**

S.No	Unit Name	R	U	A	Remarks
1	Unit-I	-	4		Answer any two questions each carries four marks
2		-		2	Answer any one question each carries six marks

MID SEM-II EXAM

S.No	Unit Name	R	U	A	Remarks
1	Unit-II	-		4	Answer any two questions each carries 10 marks

MID SEM –I
MODEL QUESTION PAPER
C-21, DIPLOMA IN AUTOMOBILE ENGINEERING
Subject Name: AUTOMOBILE ENGINEERING DRAWING
Subject Code: AU-506

TIME: 1 HOUR

Max.Marks:20

PART-A

Instructions: Answer any TWO questions .Each question carries FOUR Marks

2x4=8 Marks

1. (a) Draw free hand sketch of a Petrol engine piston with symmetry.
(OR)
(b) Draw free hand sketch of crankshaft with symmetry.
2. (a) Draw free hand sketch of camshaft with symmetry.
(OR)
(b) Draw free hand sketch of I.C engine valve with symmetry.

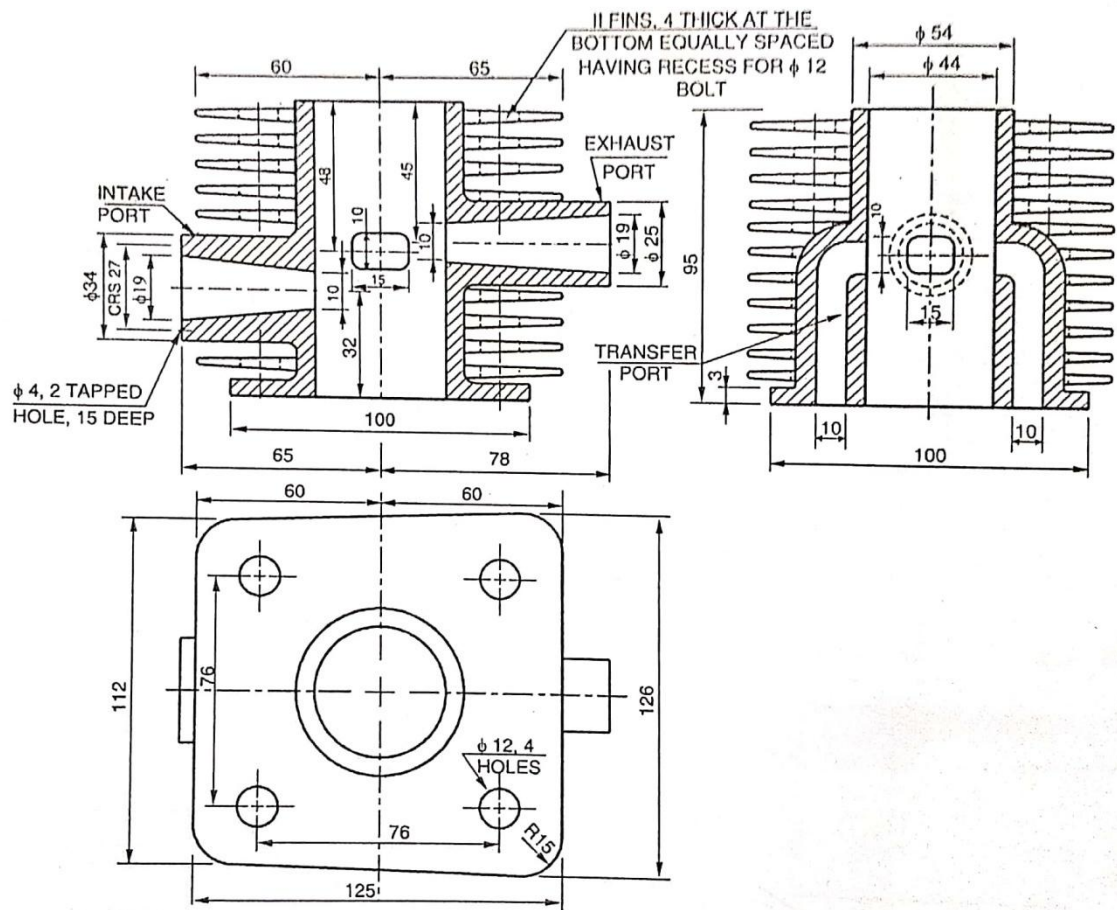
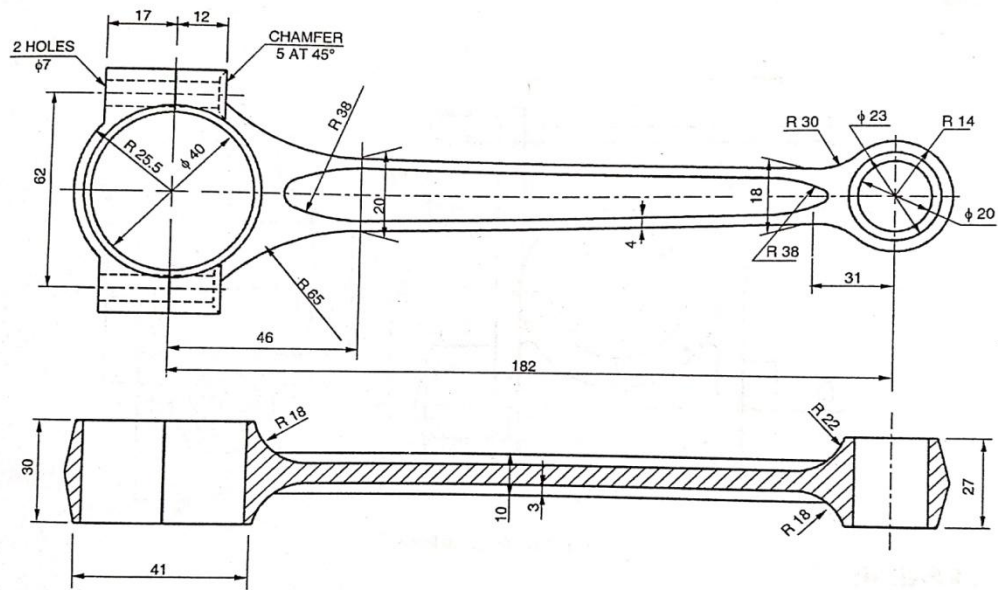
PART-B

Instructions: Answer any ONE choosing (a) or (b) question.
Each question carries TWELVE Marks

12 Marks

- 3 (a) Reproduce the following two views of the following connecting rod
2x6 = 12 Marks

(OR)
(b) Reproduce any two views of the following two stroke engine cylinder
2x6 = 12 Marks



MID SEM –II
MODEL QUESTION PAPER
C-21, DIPLOMA IN AUTOMOBILE ENGINEERING
Subject Name: AUTOMOBILE ENGINEERING DRAWING
Subject Code: AU-506

TIME: 1 HOUR

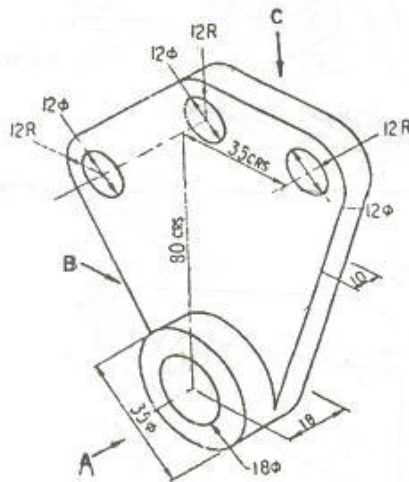
Max.Marks:20

Instructions: Answer **two** questions.

Each question carries **TEN** Marks

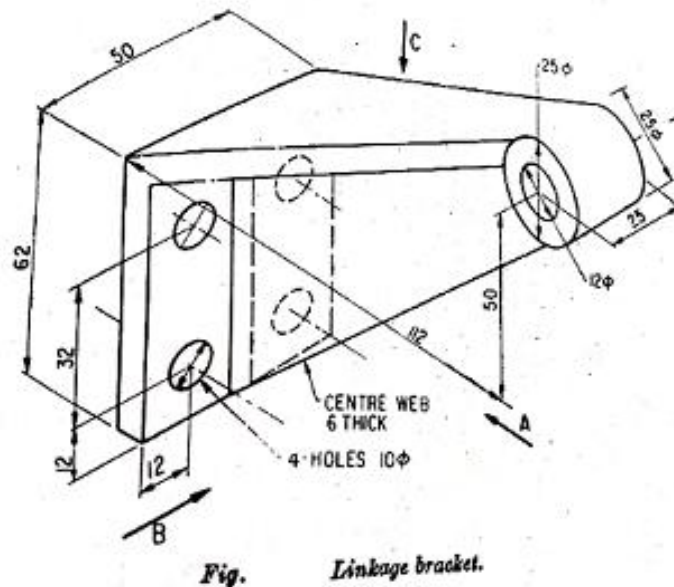
2x10 = 20 Marks

1. (a) Draw (i) front view (ii) Left side view for the chassis bracket shown in figure below.



OR

1. (b) Figure below shows the isometric view of 'Linkage bracket'. Draw the views directions of 'A' and 'B'.



2.(a) Draw the front view and right side view of the Engine mount given below.

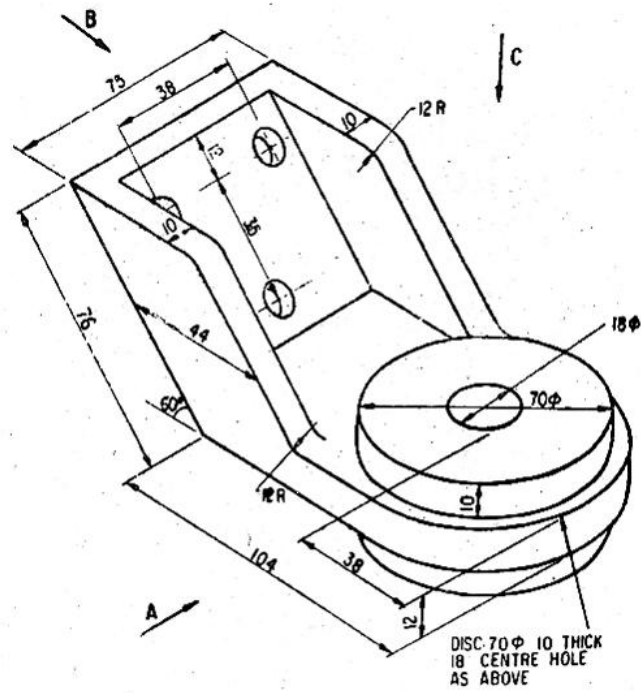


Fig. Engine mount.

OR

2(b) Draw the two orthographic views of the following selector fork in the given directions.

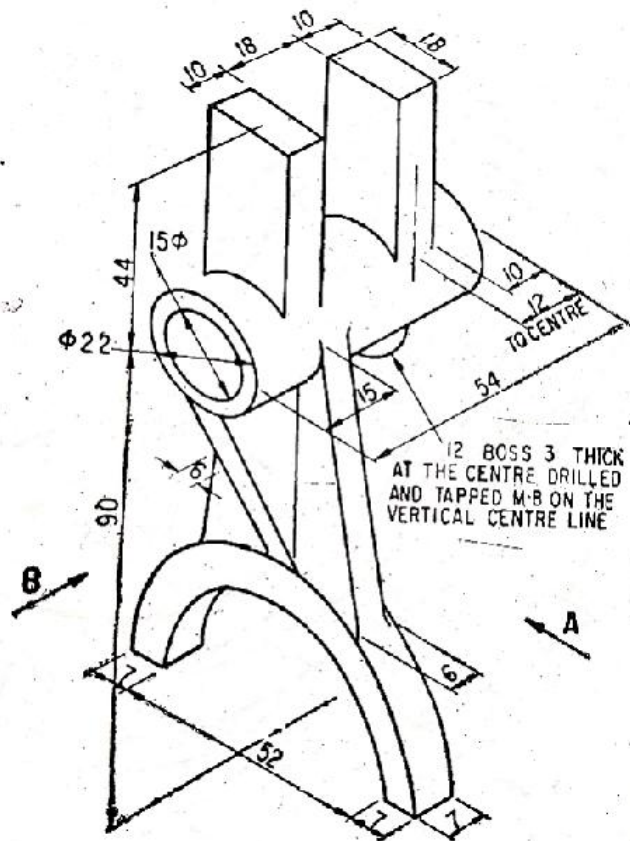


Fig. Gearbox selector fork.

SEMESTER END EXAMINATION
MODEL QUESTION PAPER
C-21, DIPLOMA IN AUTOMOBILE ENGINEERING
Subject Name: Automobile Engineering Drawing
Subject Code: AU-506

Time: 2hrs

Max Marks: 40

PART -A

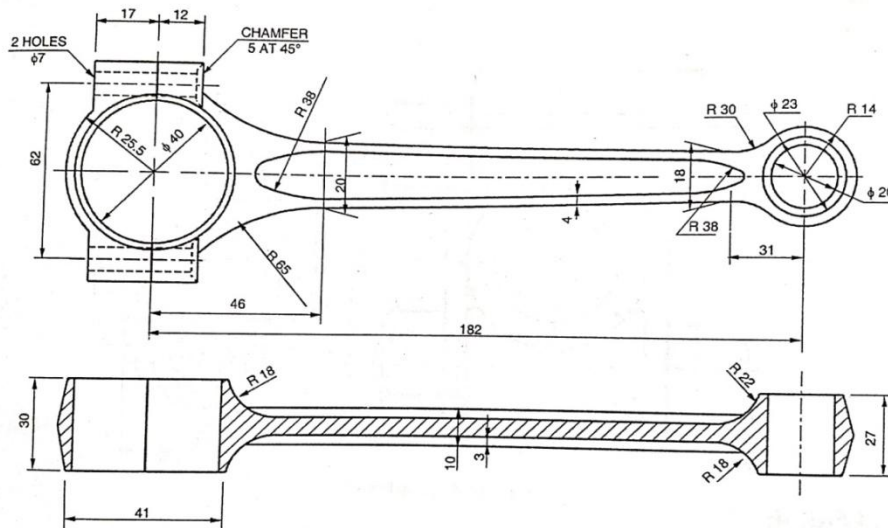
16 Marks

INSTRUCTIONS: (1) Answer any **TWO** question.

(2) Each question carries **Eight** Marks.

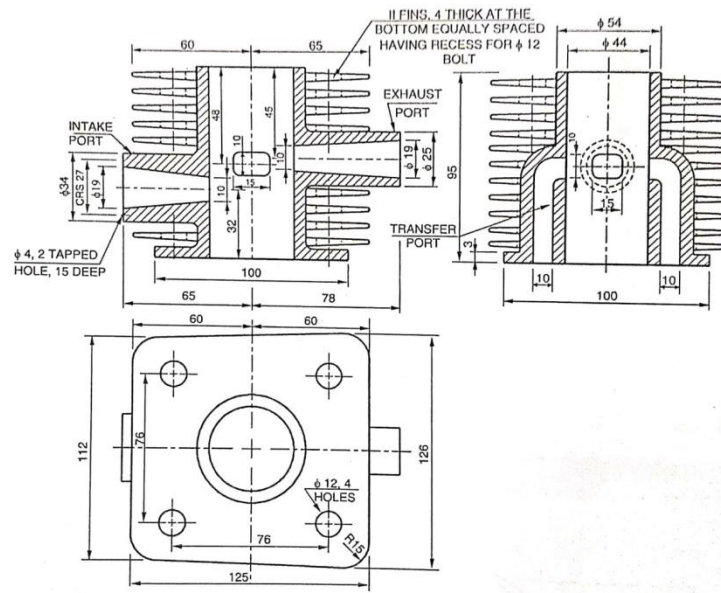
(3) All Dimensions are in mm and assume missing dimensions if any and choose suitable scale.

1 (a) Reproduce the following two views of the following connecting rod



OR

(b) Reproduce any two views of the following two stroke engine cylinder



2. (a) Figure below shows the isometric view of 'Track arm'. Draw its front view in the direction of 'A'

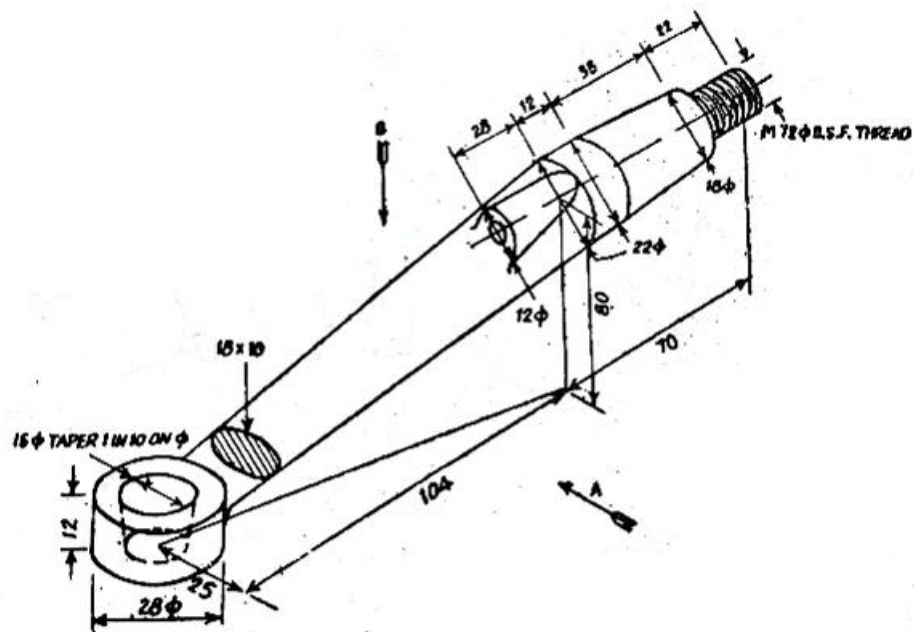
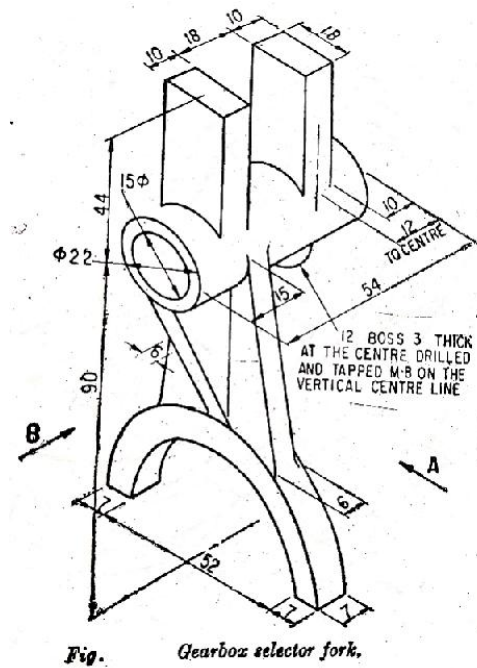


Fig. Track arm.

OR

- (b) Figure below shows the isometric view of 'Gear box selector fork'. Draw its view in the direction of 'A'



PART –B

1 X 24 = 24

Marks

INSTRUCTIONS: (1) Answer any **ONE** question.

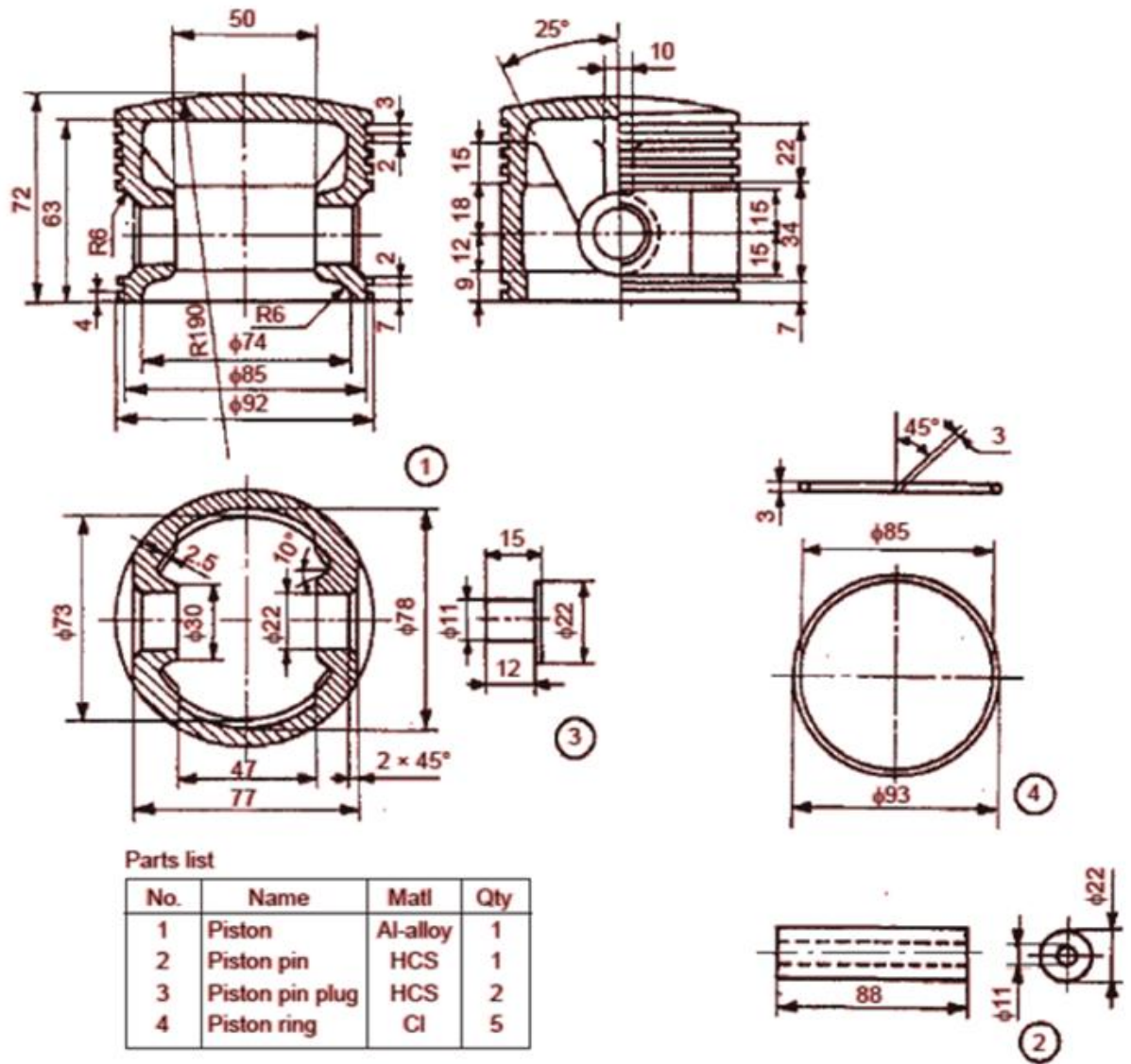
(2) Each question carries **TWENTY FOUR** Marks.

(3) All Dimensions are in mm and assume missing dimensions if any and choose

suitable scale.

3(a).Figure below shows the components of the Piston. Draw its assembled Left half sectional front view and top view.

14+10



OR

3 (b) .Following figure shows the components of the wheel cylinder. Draw its assembled half sectional front view and side view.

14+10

AU-507- FUELS, LUBRICANTS AND I.C.ENGINES TESTING LAB

Course Title :	Fuels, Lubricants and I.C. Engines Testing Lab	Course Code	AU-507
Semester	V	Course Group	Core
Teaching Scheme in Periods(L:T:P)	1:0:2	Credits	1.5
Methodology	Lecture + Practical	Total Contact periods	45
CIE	60 Marks	SEE	40 Marks

Course Content and Blue Print of Marks for SEE

Unit No	Experiment using	Hours/ Periods	Marks for SEE			Marks	% of Weight age
			Handl ing	Manip ulation	Preci sion		
1.	Cleveland Apparatus (Open cup)	03	10	10	20	40	100
2.	Pensky Martins Apparatus (Closed cup)	03	10	10	20	40	100
3.	Able's Apparatus(Closed cup)	03	10	10	20	40	100
4.	Red wood Viscometer	03	15	15	10	40	100
5.	Copper strip test	03	15	15	10	40	100
6.	Grease penetration test	03	10	10	20	40	100
7.	Carbon residue test	03	10	10	20	40	100
8.	Say bolt Viscometer	03	15	15	10	40	100
9.	Bomb Calorimeter	03	15	15	10	40	100
10.	Junkers Gas Calorimeter	03	15	15	10	40	100
11.	Morse Test	03	15	15	10	40	100
12.	Load Test on Petrol Engine	03	15	15	10	40	100
13.	Load Test on Diesel Engine	03	15	15	10	40	100

14.	Heat balance sheet of a petrol engine	03	15	15	10	40	100
15.	Heat balance sheet of a diesel engine	03	15	15	10	40	100
Total Periods		45					

Pre requisites

This course requires the basic knowledge of physics, chemistry, fuels and lubricants.

Course outcomes

At the end of course student should be able to

CO1	Measure the Flash and Fire points of different fuels.
CO2	Evaluate the Kinematic and Absolute viscosities of the fuel and lubricating oils.
CO3	Determine the percentage of carbon in the given sample of fuel or lubricant.
CO4	Conduct the penetration test for semi solid lubricant.
CO5	Determine the Calorific values of solid and liquid fuels and gaseous fuels.
CO6	Find the degree of corrosivity of the given fuel or lubricant
CO7	Apprise the performance of the given petrol or diesel engine and to prepare heat balance sheet

Course Content:

- Determination of flash and fire points of various fuels and lubricants using Abel's apparatus by open cup method.
- Determination of flash and fire points of various fuels and lubricants using Pesky Martin's, apparatus by closed cup method.
- Determination of flash and fire points of various fuels and lubricants using Cleveland's apparatus by closed cup method.
- Determination of Kinematic and Absolute viscosities of the fuels and lubricating Oils using Redwood viscometer/Say bolt viscometer.
- Conduct corrosion test on the given fuel or lubricant and assess the degree of corrosivity.
- Find out the percentage of carbon in the given sample of fuel or lubricating oil.

- Determination of Calorific values of Solid and liquid fuels using Bomb calorimeter.
- Determination of Calorific value of gaseous fuel by using Junker's calorimeter.
- Find the frictional power of the given multi cylinder petrol engine and calculate the mechanical efficiency at various loads.
- Conduct load test on the given petrol engine.
- Perform Load test on the given diesel engine.
- Draw up Heat balance sheet for the given petrol engine.
- Prepare Heat balance sheet for the given diesel engine.

Suggested E-Learning references

- www.learnengineering.org
- www.sae.org
- www.nptel.ac.in

Suggested Student Activities

- Case study of major liquid Lubricants in Automobiles with their specifications.
- Conduct an identification parade of instruments and equipments available in the Laboratory.
- Visit nearby workshop / service station to familiarize the various types of fuels and lubricants used in automobiles.
- Collect the information regarding modern measuring instruments used for various parameters of an Engine. Compare the valve timing diagrams of different petrol and diesel engines and submit a report as a case study.
- Visit nearby workshop / service station to identify opening and closing of I.C.engine valves.
- List the various parameters that are recorded while conducting tests in the I.C engines Lab and their effect on performance.
- Group discussion on selection of an engine for an automobile.
- Group discussion on the pollution effects of I.C.Engines.
- Quiz on fuels and lubricants.
- Surprise test.

CO-PO MAPPING MATRIX:

COURSE OUTCOME	Linked to	Teaching
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		PO	periods
CO1	Measure the Flash and Fire points of different fuels.	1,2,3,4,5,7	09
CO2	Evaluate the Kinematic and Absolute viscosities of the fuel and lubricating oils.	1,2,3,4,5,7	06
CO3	Determine the percentage of carbon in the given sample of fuel or Lubricant.	1,2,3,4,5,7	03
CO4	Conduct the penetration test for semi solid lubricant.	1,2,3,4,5,7	03
CO5	Determine the Calorific values of solid and liquid fuels and gaseous fuels.	1,2,3,4,5,7	06
CO6	Find the degree of corrosivity of the given fuel or lubricant	1,2,3,5,7	03
CO7	Apprise the performance of the given petrol or diesel engine and to prepare heat balance sheet	1,2,3,4,5,7	15

**MID SEM –I & II
MODEL QUESTION PAPER**

**C-21, DIPLOMA IN AUTOMOBILE ENGINEERING
Subject Name: FUELS, LUBRICANTS AND I.C.ENGINE
TESTING LAB.**

Subject Code:

AU-507

Time: 1 hr

Max Marks: 40

Instructions: Answer **any one** question and each question carries **twenty** marks.

1. Determination of flash and fire points of various fuels and lubricants using Abel's apparatus by open cup method.
2. Determination of flash and fire points of various fuels and lubricants using Pesky Martin's, apparatus by closed cup method.
3. Determination of flash and fire points of various fuels and lubricants using Cleveland's apparatus by closed cup method.
4. Determination of Kinematic and Absolute viscosities of the fuels and lubricating Oils using Redwood viscometer/Say bolt viscometer.
5. Conduct corrosion test on the given fuel or lubricant and assess the degree of corrosivity.
6. Find out the percentage of carbon in the given sample of fuel or lubricating oil.
7. Determination of Calorific values of Solid and liquid fuels using Bomb calorimeter.
8. Determination of Calorific value of gaseous fuel by using Junker's calorimeter.
9. Find the frictional power of the given multi cylinder petrol engine and calculate the mechanical efficiency at various loads.
10. Conduct load test on the given petrol engine.
11. Perform Load test on the given diesel engine.
12. Draw up Heat balance sheet for the given petrol engine.
13. Prepare Heat balance sheet for the given diesel engine.

**MID SEM –I & II
MODEL QUESTION PAPER**

**C-21, DIPLOMA IN AUTOMOBILE ENGINEERING Subject
Name: FUELS, LUBRICANTS AND I.C.ENGINE TESTING LAB.**

Subject Code:

AU-507

Time: 1 hr

Max Marks: 40

Instructions: Answer **any one** question and each question carries **twenty** marks.

1. Determination of flash and fire points of various fuels and lubricants using Abel's apparatus by open cup method.
2. Determination of flash and fire points of various fuels and lubricants using Pesky Martin's, apparatus by closed cup method.
3. Determination of flash and fire points of various fuels and lubricants using Cleveland's apparatus by closed cup method.
4. Determination of Kinematic and Absolute viscosities of the fuels and lubricating Oils using Redwood viscometer/Say bolt viscometer.
5. Conduct corrosion test on the given fuel or lubricant and assess the degree of corrosivity.
6. Find out the percentage of carbon in the given sample of fuel or lubricating oil.
7. Determination of Calorific values of Solid and liquid fuels using Bomb calorimeter.
8. Determination of Calorific value of gaseous fuel by using Junker's calorimeter.
9. Find the frictional power of the given multi cylinder petrol engine and calculate the mechanical efficiency at various loads.
10. Conduct load test on the given petrol engine.
11. Perform Load test on the given diesel engine.
12. Draw up Heat balance sheet for the given petrol engine.
13. Prepare Heat balance sheet for the given diesel engine.

AU-508- VEHICLE DIAGNOSIS & TESTING LAB

Course Title :	Vehicle Diagnosis & Testing Lab	Course Code:	AU-508
Semester:	V	Course Group:	Core
Teaching Scheme in Periods (L:T:P):	1:0:2	Credits:	1.5
Methodology:	Lecture + Assignments	Total Contact Periods :	45 Periods
CIE:	60 Marks	SEE:	40 Marks

Course Content and Blue Print of Marks for SEE

Unit No	Unit name	Hours/ Periods	Questions for SEE			Marks weight age	% Weig htage
			Hand ling	Manip ulation	Preci sion		
1.	Trouble diagnosis of engine	03	10	15	15	40	100
2.	Trouble diagnosis of starting system	03	10	15	15	40	100
3.	Trouble diagnosis of fuel system	03	10	15	15	40	100
4.	Trouble diagnosis of steering system	03	10	15	15	40	100
5.	Trouble diagnosis of suspension system	03	10	10	20	40	100
6.	Trouble diagnosis of clutch	03	10	10	20	40	100
7.	Trouble diagnosis of Gear box	03	10	10	20	40	100
8.	Trouble diagnosis of differential	03	10	10	20	40	100
9.	Trouble diagnosis of wheels and tyres	03	10	15	15	40	100
10.	Trouble diagnosis of brakes	03	10	10	20	40	100
11.	Trouble diagnosis of Charging system	03	10	10	20	40	100
12.	Trouble diagnosis of Lighting system	03	10	10	20	40	100
13.	Exhaust gas analysis of Petrol engine	03	10	10	20	40	100
14.	Exhaust gas analysis of Diesel engine	03	10	10	20	40	100
15.	Test/Revision	03	-	-	-	-	-
Total		45 Periods					

Pre requisites

This course requires the basic knowledge of automobile servicing and maintenance

Course Outcomes

At the end of the course student should be able to:

CO1 :	Trouble diagnosis of the vehicle
CO2 :	Practice the usage Exhaust gas Analyzer and Smoke meter
CO3	Measure the percentage of pollutants from petrol and diesel engines using exhaust gas analyser.

Course Content:

1. Study and Practice trouble diagnosis of various vehicle systems like:

- a. Engine
- b. Starting system
- c. Fuel system
- d. Steering system
- e. Suspension system
- f. Clutch
- g. Gear box
- h. Differential
- i. Wheel and tyres
- j. Braking system
- k. Charging system
- l. Lighting system

2. Conduct exhaust gas analysis for the given petrol engine

3. Conduct exhaust gas analysis for the given diesel engine

Suggested E-Learning references:

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

Suggested Student Activities:

1. Collect the information on the various vehicle functionary systems and submit a report.
2. Visit nearby workshop / service station to familiarize the operation of exhaust gas analyser.
3. Get acquainted with checking of various engine parameters using latest engine analyser.
4. Quiz.
5. Group discussion.

CO-PO Mapping Matrix:

Course Outcome		CL	Linked PO	Teaching Hours
CO1 :	Trouble diagnosis of the vehicle	U/A	1,2,3,8,10	10
CO2 :	Practice the usage Exhaust gas Analyzer.	R/U	1,2,3,8,10	5
CO3	Measure the pollutants from petrol and diesel engines using exhaust gas analyser.	U/A	1,2,3,8,10	10

MODEL QUESTION PAPER

MID SEM –I

C-21AU, DIPLOMA IN AUTOMOBILE ENGINEERING

Subject Name: Vehicle Diagnosis & Testing Lab;

Subject Code: AU-508

Time: 1Hr

Max Marks: 20

Note:

- i. Answer any one Question by adopting lottery for allotment.
- ii. All questions carries equal marks

1. Conduct Trouble diagnosis for the engine of the given vehicle, report on the condition and suggest the remedial measures and also write the Trouble diagnosis chart for the engine.
2. Conduct Trouble diagnosis for the starting system of the given vehicle, report on the condition and suggest the remedial measures and also write the Trouble diagnosis chart for starting system.
3. Conduct Trouble diagnosis for the fuel system of the given vehicle, report on the condition and suggest the remedial measures and also write the Trouble diagnosis chart for the fuel system.
4. Conduct Trouble diagnosis for the steering system of the given vehicle, report on the condition and suggest the remedial measures and also write the Trouble diagnosis chart for the steering system.
5. Conduct Trouble diagnosis for the suspension system of the given vehicle, report on the condition and suggest the remedial measures and also write the Trouble diagnosis chart for the suspension system.
6. Conduct Trouble diagnosis for the clutch of the given vehicle, report on the condition and suggest the remedial measures and also write the Trouble diagnosis chart for the clutch.
7. Conduct Trouble diagnosis for the gear box of the given vehicle, report on the condition and suggest the remedial measures and also write the Trouble diagnosis chart for the gear box.
8. Conduct Trouble diagnosis for the differential of the given vehicle, report on the condition and suggest the remedial measures and also write the Trouble diagnosis chart for the differential unit.
9. Conduct Trouble diagnosis for the wheels and tyres of the given vehicle, report on the condition and suggest the remedial measures and also write the Trouble diagnosis chart for wheels and tyres of the vehicle.
10. Conduct Trouble diagnosis for the braking system of the given vehicle, report on the condition and suggest the remedial measures and also write the Trouble diagnosis chart for the braking system of the vehicle.

11. Conduct Trouble diagnosis for the charging system of the given vehicle, report on the condition and suggest the remedial measures and also write the Trouble diagnosis chart for the vehicle charging system.
12. Conduct Trouble diagnosis for the lighting system of the given vehicle, report on the condition and suggest the remedial measures and also write the Trouble diagnosis chart for the lighting system of the vehicle.
13. Write the procedure for analysis of exhaust gases from a diesel engine using a smoke meter and conduct the procedure also report for the given vehicle.
14. Write the procedure for analysis of exhaust gases from a petrol engine using an exhaust gas analyzer and conduct the procedure also report for the given vehicle.

MODEL QUESTION PAPER
MID SEM –II
C-21AU, DIPLOMA IN AUTOMOBILE ENGINEERING

Subject Name: Vehicle Diagnosis & Testing Lab; Subject Code: AU-508

Time: 1Hr

Max Marks: 20

Note:

- iii. Answer any one Question by adopting lottery for allotment.
- iv. All questions carries Equal marks

1. Conduct Trouble diagnosis for the engine of the given vehicle, report on the condition and suggest the remedial measures and also write the Trouble diagnosis chart for the engine.
2. Conduct Trouble diagnosis for the starting system of the given vehicle, report on the condition and suggest the remedial measures and also write the Trouble diagnosis chart for starting system.
3. Conduct Trouble diagnosis for the fuel system of the given vehicle, report on the condition and suggest the remedial measures and also write the Trouble diagnosis chart for the fuel system.
4. Conduct Trouble diagnosis for the steering system of the given vehicle, report on the condition and suggest the remedial measures and also write the Trouble diagnosis chart for the steering system.
5. Conduct Trouble diagnosis for the suspension system of the given vehicle, report on the condition and suggest the remedial measures and also write the Trouble diagnosis chart for the suspension system.
6. Conduct Trouble diagnosis for the clutch of the given vehicle, report on the condition and suggest the remedial measures and also write the Trouble diagnosis chart for the clutch.
7. Conduct Trouble diagnosis for the gear box of the given vehicle, report on the condition and suggest the remedial measures and also write the Trouble diagnosis chart for the gear box.
8. Conduct Trouble diagnosis for the differential of the given vehicle, report on the condition and suggest the remedial measures and also write the Trouble diagnosis chart for the differential unit.
9. Conduct Trouble diagnosis for the wheels and tyres of the given vehicle, report on the condition and suggest the remedial measures and also write the Trouble diagnosis chart for wheels and tyres of the vehicle.

10. Conduct Trouble diagnosis for the braking system of the given vehicle, report on the condition and suggest the remedial measures and also write the Trouble diagnosis chart for the braking system of the vehicle.

11. Conduct Trouble diagnosis for the charging system of the given vehicle, report on the condition and suggest the remedial measures and also write the Trouble diagnosis chart for the vehicle charging system.

12. Conduct Trouble diagnosis for the lighting system of the given vehicle, report on the condition and suggest the remedial measures and also write the Trouble diagnosis chart for the lighting system of the vehicle.

13. Write the procedure for analysis of exhaust gases from a diesel engine using a smoke meter and conduct the procedure also report for the given vehicle.

14. Write the procedure for analysis of exhaust gases from a petrol engine using an exhaust gas analyzer and conduct the procedure also report for the given vehicle.

MODEL QUESTION PAPER
SEMESTER END EXAMINATION
C-21AU, DIPLOMA IN AUTOMOBILE ENGINEERING

Subject Name: Vehicle Diagnosis & Testing Lab; Subject Code: AU-508

Time: 2Hr

Max Marks: 40

Note:

- i. Answer any one Question by adopting lottery for allotment.
- ii. All questions carry equal marks

1. Conduct Trouble diagnosis for the engine of the given vehicle, report on the condition and suggest the remedial measures and also write the Trouble diagnosis chart for the engine.
2. Conduct Trouble diagnosis for the starting system of the given vehicle, report on the condition and suggest the remedial measures and also write the Trouble diagnosis chart for starting system.
3. Conduct Trouble diagnosis for the fuel system of the given vehicle, report on the condition and suggest the remedial measures and also write the Trouble diagnosis chart for the fuel system.
4. Conduct Trouble diagnosis for the steering system of the given vehicle, report on the condition and suggest the remedial measures and also write the Trouble diagnosis chart for the steering system.
5. Conduct Trouble diagnosis for the suspension system of the given vehicle, report on the condition and suggest the remedial measures and also write the Trouble diagnosis chart for the suspension system.
6. Conduct Trouble diagnosis for the clutch of the given vehicle, report on the condition and suggest the remedial measures and also write the Trouble diagnosis chart for the clutch.
7. Conduct Trouble diagnosis for the gear box of the given vehicle, report on the condition and suggest the remedial measures and also write the Trouble diagnosis chart for the gear box.
8. Conduct Trouble diagnosis for the differential of the given vehicle, report on the condition and suggest the remedial measures and also write the Trouble diagnosis chart for the differential unit.
9. Conduct Trouble diagnosis for the wheels and tyres of the given vehicle, report on the condition and suggest the remedial measures and also write the Trouble diagnosis chart for wheels and tyres of the vehicle.

10. Conduct Trouble diagnosis for the braking system of the given vehicle, report on the condition and suggest the remedial measures and also write the Trouble diagnosis chart for the braking system of the vehicle.
11. Conduct Trouble diagnosis for the charging system of the given vehicle, report on the condition and suggest the remedial measures and also write the Trouble diagnosis chart for the vehicle charging system.
12. Conduct Trouble diagnosis for the lighting system of the given vehicle, report on the condition and suggest the remedial measures and also write the Trouble diagnosis chart for the lighting system of the vehicle.
13. Write the procedure for analysis of exhaust gases from a diesel engine using a smoke meter and conduct the procedure also report for the given vehicle.
14. Write the procedure for analysis of exhaust gases from a petrol engine using an exhaust gas analyzer and conduct the procedure also report for the given vehicle.

AU-509- AUTOMOBILE SERVICING AND MAINTENANCE LAB

Course Title :	Automobile Servicing and Maintenance Lab	Course Code	AU-509
Semester	V	Course Group	Core
Teaching Scheme in Periods (L:T:P)	1:0:2	Credits	1.5
Methodology	Lecture + Assignments	Total Contact periods	45 periods
CIE	60 Marks	SEE	40 Marks

Pre requisites:

This course requires the basic knowledge of Automobile Servicing and Maintenance Laboratory

Course Content and Blue Print of Marks for SEE:

Unit No	Unit name	Hours/ Periods	Questions for SEE			Marks Weightage	% Weightage
			Handling	Manipulation	Precision		
1.	Decarburization	3	10	10	20	40	100
2.	Cylinder Reboring	3	10	10	20	40	100
3.	Cylinder Honing.	3	10	10	20	40	100
4.	Valve seat cutting, grinding and refacing.	3	15	15	10	40	100
5.	Line boring	3	15	15	10	40	100
6.	Crank shaft grinding	3	15	15	10	40	100
7.	Brake drum turning	3	10	10	20	40	100

8.	Brake shoe riveting	3	10	10	20	40	100
9.	Fuel injection pump testing - phasing and calibration	3	10	10	20	40	100
10.	Review of Experiments	9 Periods					
11	Test I	3 Periods					
12	Test II	3 Periods					
13	Revision test	3 Periods					
Total		45 Periods					

Course Outcomes:

At the end of the course student should be able to:

CO1 :	Obtain awareness about inspection, reporting on the condition, servicing, repair, reconditioning of various engine components.
CO2 :	Understand the sequential operations in brake servicing, repair and reconditioning.
CO3 :	Perform Phasing and Calibration operations of FIP.

The competencies and key competencies to be achieved by the student

S.No.	Name Of The Experiment	Key Competencies	Competencies
1	Decarbonisation	<ul style="list-style-type: none"> Scrape Engine components with hand scraper 	<ul style="list-style-type: none"> State various decarbonising methods. Identify suitable tools Wet the components with kerosene / diesel Scrape Engine components with hand scraper Use hand scraper unidirectionally Wipe the components with cotton cloth.
2	Cylinder Reboring	<ul style="list-style-type: none"> Measure ovality and taper using dial bore gauge Align the cylinder block with cylinder reboring machine. Check roundness of cylinder 	<ul style="list-style-type: none"> Identify the tools required for dismantling Engine. measure ovality and taper using dial bore gauge Calculate depth of cut. Align the cylinder block with cylinder reboring machine. Select suitable speed , feed and depth of cut.
3	Cylinder Honing.	<ul style="list-style-type: none"> Align the cylinder block with honing machine. Obtain smooth and criss cross hatch pattern. 	<ul style="list-style-type: none"> Identify the tools required. Select the required hone. Select suitable speed , feed and depth of cut Align the cylinder block with honing machine. Obtain smooth and criss cross hatch pattern.
4	Valve seat cutting, grinding and refacing	<ul style="list-style-type: none"> Check the condition of valve face and seat. Align valve with grinding wheel. Check concentricity for valve face and seat. 	<ul style="list-style-type: none"> State different grades of emery paste. Check the condition of valve face and seat. Apply lapping compound on valve seat and valve face. Align valve with grinding wheel. Check concentricity for valve face and seat.
5	Line – boring	<ul style="list-style-type: none"> Align Main journal with line boring machine. Check for correctness of bearing journals. 	<ul style="list-style-type: none"> Measure diameter of journal using micrometer. Align Main journal with line boring machine.

			<ul style="list-style-type: none"> • Select suitable speed , feed and depth of cut • Check for correctness of bearing journals.
6	Crank shaft grinding	<ul style="list-style-type: none"> • Align crank pin with grinding wheel. • Check roundness of crank pin. 	<ul style="list-style-type: none"> • Measure diameter of crank pin using micrometer • Calculate depth of cut. • Align crank pin with grinding wheel. • Select suitable speed , feed and depth of cut • Check correctness.
7	Brake drum turning	<ul style="list-style-type: none"> • Check ovality and taper. • Mount brake drum with suitable cones. • Check roundness of brake drum 	<ul style="list-style-type: none"> • Identify tools required for removing brake drum. • Measure diameter of brake drum for ovality and taper • Calculate depth of cut. • Mount brake drum with suitable cones • Select suitable speed , feed and depth of cut
8	Brake shoe riveting	<ul style="list-style-type: none"> • Align new brake liner on brake shoe • Fix brake liner to brake shoe using rivets • Check the thickness of liner. 	<ul style="list-style-type: none"> • Identify the tools required for removing lining from brake shoe. • State the procedure of riveting. • Remove the old rivets • Align new brake liner on brake shoe • Fix brake liner to brake shoe using rivets.
9	Fuel injection pump testing - phasing and calibration.	<ul style="list-style-type: none"> • Mount F.I.P. on test bench. • Adjust controls of test bench. • Compare fuel output with manufacturer specifications. • Check fuel injection timing 	<ul style="list-style-type: none"> • State various specialized tools required. • Identify controls of F.I.P. test bench. • Mount F.I.P. on test bench. • Adjust controls of test bench. • Compare fuel output with manufacturer specifications. • Check fuel injection timing.

Suggested E-Learning references:

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

CO PO Mapping Matrix:

Course Outcome		CL	Linked PO
CO1	Obtain awareness about inspection, reporting on the condition, servicing, repair, reconditioning of various engine components.	R/U/A	1,2,3,8,10
CO2	Understand the sequential operations in brake servicing, repair and reconditioning.	U/A	1,2,3,8,10
CO3	Perform Phasing and Calibration operations of FIP.	U/A	1,2,3,8

Suggested Student Activities:

- 1) Visit service station and collect the information about different engine reconditioning equipment and submit a report with diagram.
- 2) Visit service station and collect the information about the brakes and FIP reconditioning equipment and submit a report with diagram.
- 3) Student inspects the available equipment in the Laboratory to identify the components.
- 4) Student should watch video lessons related to the latest trends in the course.
- 5) Student should participate in Quiz
- 6) Student should participate in Group discussion
- 7) Surprise test

(Model Question Paper)

Mid Sem –I&II

Subject Name: **Automobile Servicing and Maintenance Lab**

Subject Code: **AU-509**

Time: 3 Hour

Total Marks: 20 M

1. Perform decarburization operation on a given multi cylinder engine?
2. Dismantle a given multi cylinder engine, inspect cylinder ovality, taper with the help of bore dial gauge and perform and re-boring operation on all cylinder and assemble the engine?
3. Perform cylinder honing operation with honing tool to the specifications?
4. Perform valve seat cutting, grinding and refacing operations on a given cylinder head and engine valves?
5. Perform line boring operation for a given multi cylinder engine on line boring machine with the help of special tools?
6. Perform crank shaft grinding operation for a given multi cylinder crank shaft on a crank shaft grinding machine with the help of special tools?
7. Perform brake drum truing operation for a given brake drum on brake drum lathe with the help of special tools?
8. Perform brake shoe riveting operation for a given brake shoe on brake shoe riveting machine?
9. Perform phasing and calibration operations for a given FIP on FIP Test bench and note the readings?

(Model Question Paper)

SEMESTER END EXAMINATION

Subject Name: **Automobile Servicing and Maintenance Lab**

Subject Code: **AU-509**

Time: 3 Hour

Total Marks: 40 M

1. Perform decarburization operation on a given multi cylinder engine?
2. Dismantle a given multi cylinder engine, inspect cylinder ovality, taper with the help of bore dial gauge and perform and re-boring operation on all cylinder and assemble the engine?
3. Perform cylinder honing operation with honing tool to the specifications?
4. Perform valve seat cutting, grinding and refacing operations on a given cylinder head and engine valves?
5. Perform line boring operation for a given multi cylinder engine on line boring machine with the help of special tools?
6. Perform crank shaft grinding operation for a given multi cylinder crank shaft on a crank shaft grinding machine with the help of special tools?
7. Perform brake drum truing operation for a given brake drum on brake drum lathe with the help of special tools?
8. Perform brake shoe riveting operation for a given brake shoe on brake shoe riveting machine?
9. Perform phasing and calibration operations for a given FIP on FIP Test bench and note the readings?

AU-510- PROJECT WORK

Course Title	Project Work	Course Code	AU-510
Semester	V	Course Group	Core
Teaching Scheme in Periods (L:T:P)	1:0:2	Credits	1.5
Methodology	Lecture+ Tutorial+ Practical	Total Contact Hours :	45
CIE	40 Marks	SEE	60 Marks

Course Content and Blue Print of Marks for SEE

S.No	Subject	Items	Max. Marks	Remarks
1	MINI PROJEC T	1.Project Work Evaluation Spell-I	25	
		2. Project Work Evaluation Spell-II	25	
		3. a) Maintenance of Log Book	15	
		b) Record work	15	
		4. a) Seminar	10	
		b) Viva-Voce	10	
Total: 100				

Note:

The pass marks are 50%, i.e the candidate has to obtain 50 Marks, failing to secure the minimum marks has to reappear for the project work with a new topic.

At the end of course student should be able to

CO1 :	Apply basic and discipline knowledge for the development of project.
CO2 :	Apply the knowledge of identifying the materials.
CO3 :	Design the components required and to solve the engineering problems.
CO4 :	Use the engineering tools, where ever required.
CO5 :	Demonstrate social and ethical responsibilities in engineering practices and to exhibit environment concerns and to obtain sustainable solutions in the respective field of engineering.
CO6	Work individually and effectively in a team
CO7	Expose themselves to the recent trends, involve in lifelong learning and Present the work effectively

Guidelines for a Project Work:

Project Work helps the student to explore and strengthen the understanding of fundamentals through practical application of theoretical concepts. Project work can help to boost the skills and widen the horizon of thinking. It acts like a beginners guide to do larger projects later in their career. Here are some tips, which help a student to come out with a successful Project.

1. Selection of Topic:

Selection of topic is an important task in a Project work. One should have a clear idea about one's subject strengths and the selected topic should be relevant to it. Always select the project that has value addition. Always select a project which is either advantageous to a lot of people or enhance your technical and managerial skills. The project must play its role towards a positive growth/development in that specific field.

2. Research about the selected topic online:

Do some online search about the selected topic. Go through the research papers from different researchers around the world on the topics related to Project. Find some websites containing the information about the materials used for Project.

3. Suggestions from subject experts:

Consults the subject experts in the Institution and interact with them about the Mini Project topic. The student can also meet many subject experts from various parts of India through social media and some discussion forums. This helps the student in getting suggestions in different possible ways, through which gives a clear idea on the topic selected for Project.

4. Planning:

After getting a clear idea about the topic, prepare a rough plan about procurement of resources, experimentation and fabrication along with the teammates. Make a rough schedule, adapt to it and distribute the work among the teammates. This will keep your Mini Project on track and individuals will come to know about their part in the Project rather than any individual (leader) taking full responsibilities.

5. Execution of plans:

Make sure that the materials will be ready for the experimentation/fabrication by the scheduled time. Follow the schedule during experimentation/fabrication to get accurate and efficient results.

6. Presentation:

Experimentation/Fabrication does not make a Project successful; one should be able to present the results in proper way. So it should be prepared in such a way that, it reflects the exact objective of the Project.

Guidelines for Preparation of Report:

The mini project report should follow the following format:

I. Abstract:

Give a brief overview of the project in not more than one page.

II. Introduction:

- Discuss briefly an overview of the sector/industry/background to the topic/problem.
- State the objectives of the research.
- Summary of the project/case scenario.

III. Literature Review (one and half pages)

Give the brief outline of the findings given in the Technical Papers/Books, journals etc related

to the topic i.e. what other scholars have written about the topic (citations).

IV. Search/Research Methodology

The plan/methodology of carrying out the project-interviews/questionnaires/secondary data.

V. Discussion of the findings

The use of graphs, tables, pictures etc., is essential.

VI. Conclusions and Recommendations

Give the conclusions/ Remarks/ Recommendations.

VII. References

Minimum requirements: A minimum number of references should be at least five (5)

The project should have a maximum of 50 pages of 12 font size in Times New Roman format.

Seminar / Presentation (20 Marks):

Criteria for evaluating presentation.

Structure: Is the structure evident, understandable, and appropriate? Is transition from point to point smooth?

Slides / transparencies: Are slides well designed (not too busy, right font)? Are graphic and visual appropriate? Any spelling, grammar, word use slips?

Timing: Is presentation timed properly, rehearsed?

Style: Is the level of treatment appropriate (not too detailed or too general)? Is the presentation energetic, enthusiastic, and clear? Is the volume good?

Appearance: Students are expected to present in formal attire.

Handling of Questions: How the students respond to the question and answer session.

Viva Voice: (20 Marks)

The lecturer/Head of section/External Examiner will ask students individual questions one – one based on the report and the presentation submitted. All the questions should be related to the courses covered and the project work done by the students.

Important Points:

The Project work has to be done in groups and the suggested group size is 6 to 10 students in each group.

Students are needed to visit companies and interact with the employees there and gather information the various aspects of Operations Management.

The students should have to submit the progress report on the project work and present a seminar during Mid Semester assessments I and II for evaluation.

The Viva Voice marks will awarded to the students on their individual performance, while the Report and the Presentation will be common.

AU-511- SKILL UPGRADATION

Course Title :	Skill Up gradation	Course Code	AU-511
Semester:	V	Course Group	Core
Teaching Scheme in Hrs:	0:0:8	Credits	2.5
Methodology:	Seminar+ G.D+ Activity	Total Contact Periods:	120
CIE:	By Rubrics	SEE	Rubrics

The performance of the candidate is ascertained using rubrics in every skill development activity, No marks are awarded only the Pass or Fail is indicated in the final evaluation.

Pre requisites:

This course requires basic communication skills in English and general awareness of all the courses of the discipline.

Course Outcomes

At the end of course student should be able to:

CO1 :	Ability to apply basic and discipline specific knowledge to solve core and/or applied engineering problems.
CO2 :	Understand the impact of the engineering solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development.
CO3 :	Demonstrate knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to engineering practice.
CO4:	Understand the impact of the engineering solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development.
CO5:	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
CO6:	An ability to communicate effectively.
CO7:	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the context of technological changes.
CO8:	Function effectively as an individual, and as a member or leader in diverse/multidisciplinary teams.

Suggested Student Activities in Industrial Management and Entrepreneurship (ME-501):

1. Identify any 5 industries with different types of ownerships.
2. Prepare an organizational structure of institution
3. Make a survey on marketing a product.
4. Prepare a list of ISO 9000 series as well as latest quality standards
5. Prepare sign boards representing safety measures.
6. Role play as an entrepreneur

Suggested Student Activities in Automobile Components Design (AU-502):

1. The students should identify at least five machine components. He should select the materials for identified machine components by using design data hand book. List the mechanical properties of material selected.
2. Observe the mechanisms where transmission of power takes place through Shaft, Keys and coupling. Get the required information regarding power transmitted (power output by motor engine etc.).
3. The students can visit nearby workshops/garages and collect information like material, design features etc on different fasteners and machine components.
4. Assignments on design of Shafts, Keys and couplings, Cams and Governors and Flywheels with neat sketches.
5. The student should download and present various presentations related to stresses in Machine elements.
6. The student should download and present various presentations related to failure of Machine elements.
7. The student should download and present various presentations related to design of machine elements.
8. The student should design the small machine elements as mini-project.

Suggested Student Activities in Autotronics (AU-503):

1. Student visits Library to refer to Manual of Automobile components to find the various electronic components used in automobile for efficient operation.
2. Student inspects the available equipment in the Laboratory to identify sensors and actuators used in engines.
3. Visit nearby workshop / service station to familiarize with type of sensors used in vehicles.
4. Prepare a presentation on latest trends in automobile electronics.
5. Record data / specifications of various components of vehicle safety systems.
6. Prepare a report by visiting the service stations on electronic fuel supply system for petrol / diesel vehicles.
7. Prepare working models of various sensors and actuators.
8. Visit electronic shops and collect various fundamental electronic components such as relay, diode etc.,.
9. Prepare small electronic circuits to demonstrate function of various electronic components.
10. Quiz.
11. Group discussion on role of electronics in automobiles.

12. Surprise test/

Suggested Student Activities in AU-575:

1. Visit the Library to refer various reference books on this course.
2. Debate on importance of developing EV/EHV/SPV in the country.
3. Visit the nearby workshops/Industries/Market to submit a brief report on available EV/SPV.
4. Visit the nearby workshops/Industries/Market to submit a brief report on available SPV.
5. Give seminar on special features arrangement in farm tractors.
6. Fabricate a proto type model of any one special purpose vehicle as mini-project.
7. Prepare and submit a report on contemporary issues in the field of SPV/EV.
8. Participate in Quiz.
9. Group discussion.

Suggested Student activities in MTO (AU-585):

1. Visit library to refer TSRTC, APSRTC, NAVATA and other transport organisation manuals.
2. Collect the data about various ticketing methods to collect the fares.
3. Visit nearby bus depots to familiarize with field survey.
4. Assignment on how production planning and control takes place in the industry.
5. Group discussion on Marketing, Sales.
6. Visit the manufacturing industry to know materials management techniques.
7. Quiz.
8. Surprise test.

Suggested Student Activities in ASM (AU-574):

1. Student visits Library to refer to Manual of Automobile to find their maintenance schedules.
2. Student inspects the available reconditioning equipment in the Laboratory to identify the components.
3. Student inspects the available tools and equipments in the Laboratory and familiarize.
4. Quiz
5. Group discussion
6. Surprise test

Suggested Student Activities in PT (AU-584):

1. Student visits Library to refer to manual of Engineering Materials to find their properties.
2. Student inspects the available equipment in the Laboratory to identify the components.
3. The students can visit nearby workshops/Industries and collect information like which type

of machines are used for particular purpose and their design features of various machine components.

4. The students can visit nearby workshops/Industries and collect information about various manufacturing processes by using different machine tools, observe their specifications and the recent developments.
5. Student should write the program for particular task to perform the particular operation by using CNC machines.
6. The student should Download and present various presentations related to CNC, DNC systems and modern machining methods.
7. The student should prepare the different products as mini-project.

Suggested Student Activities in Automobile Engineering Drawing (AU-506):

1. Visit automobile laboratory available in the institute to study the features of automobile components.
2. Prepare the images of automobile engine, chassis, transmission hydraulic brakes components by visiting nearby garages and service stations.
3. Watch the video lessons related to the course.
4. Participate in Quiz
5. Participate in Group discussion
6. Surprise test

Suggested Student Activities in Fuels, Lubricant and I.C.Engines Testing Laboratory (AU-507):

1. Collect the properties and their purpose of various alternate fuels.
2. Case study of major liquid Lubricants in Automobiles with their specifications.
3. Student inspects the available equipment in the Laboratory to identify the equipment and its purpose.
4. Visit nearby workshop / service station to familiarize the various types of fuels and lubricants used in Automobiles.
5. Quiz on fuels and lubricants.
6. Group discussion on the pollution effects of fuels or lubricants.
7. Collect the information regarding modern measuring instruments used for various parameters of an Engine. Compare the valve timing diagrams of different petrol and diesel engines and submit a report as a case study.
8. An identification parade of instruments and equipments available in the Laboratory.
9. Visit nearby workshop / service station to identify opening and closing of I.C.engine valves.
10. List the various parameters that are recorded while conducting tests in the I.C engines Lab and their effect on performance.

11. Quiz on I.C. Engines
12. Group discussion on selection of an engine for an automobile.
13. Surprise test

Suggested Student Activities in Vehicle Diagnosis Laboratory (AU-508):

1. Collect the information on the various vehicle functionary systems and submit a report.
2. Visit nearby workshop / service station to familiarize the operation of exhaust gas analyser.
3. Get acquainted with checking of various engine parameters using latest engine analyser.
4. Quiz.
5. Group discussion.
6. Surprise test.

Suggested E-Learning references in ASM Laboratory (AU-509):

- 1) Visit service station and collect the information about different engine reconditioning equipment and submit a report with diagram.
- 2) Visit service station and collect the information about the brakes and FIP reconditioning equipment and submit a report with diagram.
- 3) Student inspects the available equipment in the Laboratory to identify the components.
- 4) Student should watch video lessons related to the latest trends in the course.
- 5) Student should participate in Quiz
- 6) Student should participate in Group discussion
- 7) Surprise test

Suggested E-Learning references for Project ideas in Automobile Engineering (AU-510):

(Note: The following are only some of the project ideas from the websites, but the students are advised to refer the national and International journals for better and innovated ideas and get the approval of the guide and Head of section)

1. <http://www.mechanicalengineeringprojects.net/category/automobiles-2/>
2. <https://mechanicalstudents.com/automobile-engineering-projects/>
3. <https://www.seminaronly.com/Engineering-Projects/Mechanical/Automobile-Engineering-Project-Ideas.php>
4. <http://www.technofist.com/automobiles-projects.html>
5. https://www.projecttopics.info/Mechanical/Mechanical_Projects.php
6. <https://www.projecttopics.info/automobile/simple-automobile-projects-for-diploma-students.php>
7. <https://projectabstracts.com/tag/automobiles>

RUBRICS FOR EVALUATION OF THE STUDENT:

CATEGORY	Excellent	Very Good	Good	Satisfactory
Contributions	Routinely provides useful ideas when participating in the group and in classroom discussion. A definite leader who contributes a lot of effort.	Usually provides useful ideas when participating in the group and in classroom discussion. A strong group member who tries hard!	Sometimes provides useful ideas when participating in the group and in classroom discussion. A satisfactory group member who does what is required.	Rarely provides useful ideas when participating in the group and in classroom discussion. May refuse to participate.
Quality of Work	Provides work of the highest quality.	Provides high quality work.	Provides work that occasionally needs to be checked / redone by other group members to ensure quality.	Provides work that usually needs to be checked / redone by others to ensure quality.
Time-management	Routinely uses time well throughout the project to ensure things get done on time. Group does not have to adjust deadlines or work responsibilities because of this person's procrastination.	Usually uses time well throughout the project, but may have procrastinated on one thing. Group does not have to adjust deadlines or work responsibilities because of this person's procrastination.	Tends to procrastinate, but always gets things done by the deadlines. Group does not have to adjust deadlines or work responsibilities because of this person's procrastination.	Rarely gets things done by the deadlines AND group has to adjust deadlines or work responsibilities because of this person's inadequate time management.
Problem-solving	Actively looks for and suggests solutions to problems.	Refines solutions suggested by others.	Does not suggest or refine solutions, but is willing to try out solutions suggested by others.	Does not try to solve problems or help others solve problems. Lets others do the work.
Attitude	Never is publicly critical of the project or the work of others. Always has a positive attitude about the task(s).	Rarely is publicly critical of the project or the work of others. Often has a positive attitude about the task(s).	Occasionally is publicly critical of the project or the work of other members of the group. Usually has a positive	Often is publicly critical of the project or the work of other members of the group. Often has a negative

			attitude about the task(s).	attitude about the task(s).
Focus on the task	Consistently stays focused on the task and what needs to be done. Very self-directed.	Focuses on the task and what needs to be done most of the time. Other group members can count on this person.	Focuses on the task and what needs to be done some of the time. Other group members must sometimes nag, prod, and remind to keep this person on-task.	Rarely focuses on the task and what needs to be done. Lets others do the work.
Preparedness	Brings needed materials to class and is always ready to work.	Almost always brings needed materials to class and is ready to work.	Almost always brings needed materials but sometimes needs to settle down and get to work	Often forgets needed materials or is rarely ready to get to work.
Pride	Work reflects this student\'s best efforts.	Work reflects a strong effort from this student.	Work reflects some effort from this student.	Work reflects very little effort on the part of this student.
Monitors Group Effectiveness	Routinely monitors the effectiveness of the group, and makes suggestions to make it more effective.	Routinely monitors the effectiveness of the group and works to make the group more effective.	Occasionally monitors the effectiveness of the group and works to make the group more effective.	Rarely monitors the effectiveness of the group and does not work to make it more effective.
Working with Others	Almost always listens to, shares with, and supports the efforts of others. Tries to keep people working well together.	Usually listens to, shares, with, and supports the efforts of others. Does not cause \\'waves\' in the group.	Often listens to, shares with, and supports the efforts of others, but sometimes is not a good team member.	Rarely listens to, shares with, and supports the efforts of others. Often is not a good team player.