C21_ Curriculum

DIPLOMA IN AUTOMOBILE ENGINEERING

OFFERED BY

STATE BOARD OF TECHNICAL EDUCATION & TRAINING,

TELANGANA: HYDERABAD

IV Semester

Sl No	Course Code	Course Name	Teaching Scheme				Credits	Examination Scheme						
			Instruction periods per week			Total Periods per semester		Continuous internal evaluation			Semester end examination			
			L	T	P			Mid Sem1	Mid Sem2	Internal evaluation	Max Marks	Min Marks	Total Marks	Min marks for Passing including internal
1	SC-401	Advanced Engineering Mathematics	4	1	0	75	3	20	20	20	40	14	100	35
2	AU-402	Automobile Chassis and Body Engineering	4	1	0	75	3	20	20	20	40	14	100	35
3	AU-403	Strength of Materials and Fluid Mechanics	4	1	0	75	3	20	20	20	40	14	100	35
4	AU-404	Automobile Power Train	4	1	0	75	3	20	20	20	40	14	100	35
5	AU-405	Automobile Electrical Systems	4	1	0	75	3	20	20	20	40	14	100	35
6	AU-406	Automobile Chassis and Body Engineering Lab	1	0	2	45	1.5	20	20	20	40	20	100	50
7	AU-407	Automobile Power Train Lab	1	0	2	45	1.5	20	20	20	40	20	100	50
8	AU-408	Strength of Materials and Fluid Mechanics Lab	1	0	2	45	1.5	20	20	20	40	20	100	50
9	AU-409	Automobile Electrical Lab	1	0	2	45	1.5	20	20	20	40	20	100	50
10	HU-410	Employability Skills Lab	1	0	2	45	1.5	20	20	20	40	20	100	50
11	AU-411	Skill Upgradation	0	0	8	120	2.5	0	0	Rubrics			--	-
Activities: student performance is to be assessed through Rubrics														

SC-401 - ADVANCED ENGINEERING MATHEMATICS

Course Title	Advanced Engineering Mathematics	Course Code	SC-401
SEMESTER	IV	Course Group	Foundation
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

Pre requisites:

This course requires the knowledge of Engineering Mathematics at Diploma first year level and Applied Engineering Mathematics at Diploma 3rd Semester level.

Course Outcomes:

At the end of the course, the student will have the ability to:

CO 1	Solve simple Homogeneous Linear Differential Equations
CO 2	Solve simple Non-Homogeneous Linear Differential Equations and apply them in solving engineering problems.
CO 3	Express f(x) as a Fourier series in the given interval $(c , c+2\pi)$
CO 4	Express f(x) as a Fourier Half-Range Cosine series and Sine series in $(0, \pi)$
CO 5	Find Laplace transforms of simple functions.
CO 6	Find Inverse Laplace transforms of simple functions and solve Linear Differential Equations using Laplace Transformations.

Course Contents:

Unit – I

Duration: 07 Periods (L: 5 – T: 2)

Homogeneous Linear Differential equations with constant coefficients

Homogenous linear differential equations with constant coefficients of order two and higher with emphasis on second order.

Unit – II

Duration: 16 Periods (L: 13 – T: 3)

Non-Homogeneous Linear Differential equations with constant coefficients

Non-homogenous linear differential equations with constant coefficients of the form (D)y = X, where X is in the form k(a constant) e^{ax}, sin(ax), cos(ax), x^n, (n= 1,2,3) Complimentary Function (CF), Particular Integral (PI) and General Solution (GS).

Unit-III

Duration: 14 Periods (L: 11 – T: 3)

Fourier series

Orthogonality of trigonometric functions, Representation of a function in Fourier series over the interval $(c ,\ c+2\pi)$, Euler's formulae, sufficient conditions for existence of Fourier series for a function f(x). Even, Odd functions and Fourier series over the Interval (0, 2 π) and (-π, π)

Unit – IV

Duration: 08 Periods (L: 7 – T:1)

Fourier Half-range series

  Representation of a function f(x) as a Fourier Half-range Sine series and Cosine series over the interval (0, π)

Unit – V

Duration: 14 Periods (L: 11 – T: 3)

Laplace Transformations:

  Definition, sufficient conditions for existence of Laplace Transform, Laplace Transform of elementary functions, linearity property, Change of scale property, First shifting theorem , multiplication by t^n, division by t, Laplace Transform of derivatives and integrals, unit step function, Laplace Transform of second shifting theorem

Unit – VI

Duration: 16 Periods (L: 13 – T: 3)

Inverse Laplace transforms:

  Inverse Laplace transforms- shifting theorems and change of scale property, multiplication by s^n and division by s –Inverse Laplace Transform using partial fractions – convolution theorem (no proof) – application of Laplace Transformations to solve ordinary differential equations of second order with initial conditions.

Recommended Books:

1. Higher Engineering Mathematics, B.S. Grewal.

2. Laplace Transforms - Murray R. Spigel.

3. Ordinary Differential Equations – R. S. Aggarwal.

4. Fourier Series – A.R. Vasishtha and Gupta.

Suggested Learning Outcomes

At the end of the course, the student will have the ability to:

Unit-I

1.0   Solve Homogeneous linear differential equations with constant coefficients in engineering situations

1.1 Solve Differential equations of the type $(aD^2 +bD + c)\ y = 0$ when the roots of the Auxiliary Equation (A.E) are real & different, real & repeated and complex.

1.2 Solve the higher order homogeneous linear differential equations with constant coefficients.

Unit-II

2.0   **Solve Non-Homogeneous linear differential equations with constant coefficients in engineering situations**

2.1 Apply the concept of complementary function, particular Integral to get general solution of a differential equation.

2.2 Solve n^{th} order differential equation of the type $f(D)\ y = X$ where $f(D)$ is a polynomial of second order and X is a function of the form k, e^{ax} ,Sin(ax), Cos(ax), x^n.

2.3 Solve simple problems on the above types of 2.2

Unit-III

3.0   Understand the Fourier series expansion of functions

3.1 Know the orthogonality of functions in an interval.

3.2 Identify Fourier series of a function in the interval (C, C+2π) and use the Euler's Formulae for determining the Fourier coefficients.

3.3 Write sufficient conditions for the existence of Fourier series for a function.

3.4 Expand Fourier series of simple functions in the range (0, 2π) and (-π, π).

3.5 Expand Fourier series for even and odd functions in the interval (-π, π)

3.6 Solve simple problems on even and odd functions in the interval. $(0,2\pi)\ and\ (-\pi, \pi)$

Unit- IV

4.0   Understand the Half – Range Fourier series expansion of functions

4.1 Expand Half – Range Cosine series of a function in the range $(0\ , \pi)$.

4.2 Expand Half – Range Sine series of a function in the range $(0, \pi)$.

4.3 Solve simple problems on Half – Range Cosine and Sine series over the interval $(0, \pi)$

Unit-V

5.0   Understand Laplace transforms

5.1 Apply the definition of Laplace Transform and find Laplace transform of standard functions

5.2 Identify the sufficient conditions for existence of Laplace Transform.

5.3 Use the properties of Laplace Transform – Linearity property, First shifting theorem, Change of Scale property in solving simple problems.

5.4 Apply formulae for Laplace transform of $t^n f(t)$, $\frac{f(t)}{t}$, $f^n(t)$, $\int_0^t f(u)du$ in terms of Laplace transform of f (t) to solve simple problems

5.5 Identify unit step function and write the Laplace Transform of unit step function

5.6 Apply Second shifting theorem in solving simple problems.

Unit-VI

6.0   Use Laplace transforms and Inverse Laplace transforms to solve differential equation in engineering problems

6.1 Define inverse Laplace Transform and write inverse Laplace Transforms of standard functions.

6.2 Solve simple problems on Inverse Laplace Transforms.

6.3 Write Shifting theorems and Change of scale property of inverse Laplace Transform.

6.4 Solve simple problems on 6.2

6.5 Write inverse Laplace Transforms corresponding to Laplace Transform of the functions
$$t^n f(t), \frac{f(t)}{t}, f^n(t), \int_0^t f(u)du$$

6.6 Solve simple problems on 6.5

6.7 Define convolution of two functions and state convolution theorem.

6.8 Solve simple problems on Convolution theorem.

6.9 Use Laplace and inverse Laplace Transforms to solve simple differential equations of Second order.

Suggested Student Activities:

1. Student visits Library to refer Standard Books on Mathematics and collect related material.

2. Quiz

3. Group discussion

4. Surprise tests

5. Seminars

6. Home Assignments.

7. Mathematics for preparing competitive exams and solving old question papers on Arithmetical ability.

CO-PO Mapping Matrix

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	Mapped POs
CO1	3	2					3	1,2, 7
CO2	3	2					3	1,2, 7
CO3	3	2					3	1,2, 7
CO4	3	2					3	1,2, 7
CO5	3	2					3	1,2, 7
CO6	3	2					3	1,2, 7

QUESTION PAPER PATTERN FOR MID SEMESTER EXAMS
MID SEM-I EXAM

S.No	Unit No	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 SEM-II EXAM

S.No	Unit No	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	

The length of answer for each question framed in respect of Part-A, B&C shall not exceed ¼ of a page,1page and 2 pages respectively

Unit No	Questions to be set for SEE				
	R			U	A
I	Q4	Q1		Q9(a)	Q13(a)
II					
III		Q2		Q10(a)	Q14(a)
IV					
V		Q3	Q5,Q6	Q9(b), Q11(a), Q11(b)	Q13(b), Q15(a), Q15(b)
VI			Q7,Q8	Q10(b), Q12(a), Q12(b)	Q14(b), Q16(a), Q16(b)
Total Questions	8			8	8

TIME: 1: 00 Hour   **Max. Marks: 20**

PART-A

Instructions: 1. Answer **ALL** questions   04 X 01 = 04

                       2 Each question carries **ONE** mark

1. Write the General solution of $(aD^2+bD+c)\ y = 0$, whose roots of auxiliary equation are real and distinct.

2. Find the roots of auxiliary equation of the differential equation $(D^2 + 2D + 1)y = 0$

3. Find the Particular Integral of $(D^2 - 4D + 1)y = e^{8x}$

4. Find the P.I of $(D^2 - 9)y = cos3x$

PART-B

Instructions: 1. Answer **ALL** questions   02 X 03 = 06

                       2. Each question carries **THREE** marks

5 a) Solve $(D^2 + 4D + 13)\ y = 0$

         OR

5 b) Solve $(D^2 + 16)\ y = 0$

6 a) Solve $(D^2 + 4D + 4)y = 5 + e^{-2x}$

         OR

6 b) Find P.I of $(D^3 + D)y = sin2x$

PART- C

Instructions: 1. Answer **ALL** questions   02 X 05 = 10

                       2. Each question carries **FIVE** marks

7 a) Solve $(D^3 - 2D^2 - 4D + 8)\ y = 0$

           OR

7 b) Solve $(D^3 - 6D^2 + 11\ D - 6)\ y = 0$

8 a) Solve $(D^2 + 36)y = sin^2x$

          OR

8 b) Solve : $(D^2 - 3D + 2)y = x + x^2$

TIME: 1: 00 Hour **Max. Marks: 20**

PART-A

Instructions: 1. Answer **ALL** questions 04 X 01 = 04

2 Each question carries **ONE** mark

1. Define periodic function and give one example
2. Define Fourier series of the function f(x) in the interval $(0, 2\pi)$
3. Write Half-range sine series of f(x) in the interval $(0, \pi)$
4. Find a_0 for f(x) $=e^x$ in $0 < x < \pi$

PART-B

Instructions: 1. Answer **ALL** questions 02 X 03 = 06

2. Each question carries **THREE** marks

5 a) If f(x) = x^2 in $(0, 2\pi)$, then find the value of a_n in Fourier series of f(x)

OR

5 b) If f(x) =$|x|$ in $(-\pi, \pi)$, then find the value of a_1 in Fourier series of f(x)

6 a).Find the value of a_n in half-range Cosine series for the function f(x) = e^x in $(0, \pi)$

OR

6 b) Obtain the Fourier Half – Range Sine series for f(x) = $(\pi - x) in the interval$ $(0, \pi)$

PART- C

Instructions: 1. Answer **ALL** questions 02 X 05 = 10

2. Each question carries **FIVE** marks

7 a) Obtain the Fourier series for f(x) = x in the interval $0 < x < 2\pi$

OR

7 b) Find the Fourier series for f(x) = $(x - x^2)$ in the interval $(-\pi, \pi)$. Hence show that

$$\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \ldots\ldots\ldots + = \frac{\pi^2}{12}$$

8 a) Express f(x) = π x – x^2 as a half-range Sine series in $(0, \pi)$

OR

8 b) Find the half –range cosine series for the function f(x) =x^2 in the interval $(0, \pi)$

PART-A

Instructions: 1. Answer **ALL** questions   08 X 01 = 08

2 Each question carries **ONE** mark

1. Find the roots of auxiliary equation of the differential equation $(D^2 + 4D)y = 0$.

2. Define Fourier Series for the function f(x) in the interval (c, c+2π)

3. Find the Particular Integral of $(D^2 - 4D + 1)y = e^x$

4. Find $L(e^{2t} + Cos3t)$

5. Find $L(t + 5Cosht)$

6. State the First Shifting theorem of Laplace Transforms.

7. Find $L^{-1}\left(\frac{1}{s-3} + \frac{s}{s^2+4}\right)$

8. Find $L^{-1}\left(\frac{1}{2s+5}\right)$

PART-B

Instructions: 1. Answer **ALL** questions   04 X 03 = 12

2. Each question carries **THREE** marks

9a) Solve $(D^2+D + 1)$ y = 4e^{3x}

OR

9 b) Find $L(tCos3t)$

10 a) Find Half Range Sine Series of f(x) = x in $(0, \pi)$

OR

10 b) Find $L^{-1}\left(\frac{s+1}{s^2+6s-7}\right)$

11 a) If L{f(t)} = $\frac{20-4s}{s^2-4s+20}$, find L{f(3t)}

OR

11 b) Find $\int_0^\infty t.e^{-2t}Sin3tdt$ using Laplace Transform Technique

12 a) Show that $L^{-1}\left(\frac{1}{s(s^2+a^2)}\right) = \frac{1-\cos at}{a^2}$

OR

12 b) Find $L^{-1}\left(\frac{s}{(s+2)^2+4}\right)$

PART- C

Instructions: 1. Answer **ALL** questions   04 X 05 = 20

2. Each question carries **FIVE** marks

13 a) Solve: $(D^2 + D -2)$ y = x + Sin x
                    OR
13 b) Find $L[te^t sin3t]$

14 a) Expand f(x) = x^2 as a Fourier series in the interval $(-\pi, \pi)$

OR

14 b) Find $L^{-1}\left(\frac{s}{(s+1)^2(s^2+1)}\right)$

15 a) Find $L\left(\frac{Sin3t.Cost}{t}\right)$
                    OR

15 b) Evaluate $L\left\{\int_0^t \frac{\sin t}{t} dt\right\}$

16 a) Find $L^{-1}\left(\frac{1}{(s+1)(s+2)}\right)$ using Convolution theorem.
                    OR
16 b) Solve the differential equation $y'' - 2y' - 8y$ = Sin t, when y (0) = 3, y $'$ (0) = 6 by
        Laplace Transform method.

AU-402- Automobile Chassis and Body Engineering

Course Title	Automobile Chassis and Body Engineering	Course Code	AU-402
Semester	IV	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:

S. No	Unit No.	Questions for SEE			Periods
		R	**U**	**A**	
1	Body Constructional Details	1	9(a)	13(a)	10
2	Body Production Methods and Aerodynamics	1	9(a)	13(a)	10
3	Basics of Automobile Air conditioning	2	10(a)	14(a)	10
4	Steering System	2	10(a)	14(a)	10
5	Braking System	3 5, 6	9(b) 11(a) 11(b)	13(b) 15(a) 15(b)	10
6	Suspension System	3 7,8	10(b) 12(a) 12(b)	14(b) 16(a) 16(b)	10
Total Questions		**8**	**8**	**8**	**60**

Note: R column shows "4" spanning rows 1-4, and "3" spanning rows 5-6.

Pre requisites:

This course requires the basic knowledge of Automobile power train.

Course Outcomes:

At the end of course student should be able to:

CO1 :	Comprehend on the contemporary issues in the field of vehicle body construction and brief the important aspects of Interior design.
CO2 :	Summarize various vehicle production methods and aerodynamic aspects.
CO3 :	Give overview of the automobile air-conditioning systems.
CO4 :	Summarize the working of Steering system of an automobile.
CO5:	Explain the need and functions of each component in a braking system.
CO6:	Outline the requirements and functions of components in suspension system of automobile.

Course Content:

1. **Body Constructional Details**

   Duration: periods 10 (L:8 T:2)

   Major dimensions of a heavy passenger vehicle - Factors to be considered for interior design – Comfort, Utility, Seating arrangement –Trimming- Interior trimming, Exterior trimming -Dust proofing –Body insulation.

   Doors, Types of doors, Door locks, Windows, Types of windows, Window Regulating Mechanism– Operation of Power windows – Central door locking mechanism– Seat– Types of seats- Seat adjusting mechanism - Seat belt - Structural members and materials used - Methods of joining them – Description and Constructional details of Roof, Bonnet, Luggage boot, Grills.

2. **Production methods and aerodynamics**

   Duration: periods 10 (L:8 T:2)

   Vehicle body drafting – Use of computers in body drafting - Manufacture of plastic body panels - Sheet metal stamping – Body painting – Paint materials and purpose of each material - Different methods of paining – Construction and working of Spray painting gun – Painting Procedure for New vehicle body and Repainting a vehicle body – Spray painting – Description of Painting booth and purpose - Body Finishing methods.

   Aerodynamic drag – Lift – Pitching – Yawing, Rolling moments and Sideway forces – Wake – Streamlining of vehicle body.

3. **Basics of Automobile Air Conditioning**

   Duration: periods 10 (L:8 T:2)

   Definition of refrigeration–Unit of refrigeration–Co-efficient of performance–Comfort Air conditioning–Classification of refrigerants- Refrigerants used in automobiles.

   Psychometric Properties –Humidity– Relative humidity–Humidity ratio–DBT–WBT– Sensible heat–Latent heat - Fans-Supply ducts– Grills for outlets–Returned ducts– Air filters and Dust collectors– Heating Coils – Cooling coils – Necessity of automobile air- conditioning – Location of air conditioning components in a car – Function of components- Compressor –Condenser-Receiver drier- Expansion valve– Evaporator– Compressor clutch - Expansion tube and Expansion valve type automobile air conditioning systems.

4. Steering system

Duration: periods 10 (L: 8 T: 2)

Requirements of the vehicle steering – Steering layout for Rigid axle and Independent systems- Types of steering gears – Construction and working of Rack and Pinion type, Re-circulating ball type and Worm and Sector type -Need of power steering – Types of Power steering systems – Hydraulic power steering –Reversible and irreversible steering, Over steering and Under steering - Steering gear ratio -Turning radius- Ackermann's & Davis steering gear mechanism - Steering geometry - Caster, Camber, King pin inclination- Steering axis inclination – Toe- in and Toe-out - Wheel wobble and Shimmy – Wheel balancing - Wheel alignment.

5. Braking system

Duration: periods 10 (L: 8 T: 2)

Functions of brakes – Working principle of braking system - Requirements of automobile brakes - Stopping time – Stopping distance – Braking efficiency- Simple numerical problems – Types of braking systems- Primary and Secondary brakes- Parking brakes – Mechanical and Hydraulic brakes – Layout of hydraulic braking system – Construction and working of Single and Tandem master cylinders- Wheel cylinder - Brake bleeding - Constructional details of Internal expanding shoe brakes and disc brakes – Advantages and limitations of disc brakes over shoe brakes- Advantages and limitations of hydraulic brakes over Mechanical brakes – Power brakes- Working of Air brakes - Construction and working of Brake valve - Power assisted brakes – Vacuum servo assisted brakes – Anti skid or Anti lock braking system – List out types of brakes used in various vehicles.

6. Suspension System

Duration: periods 10 (L: 8 T: 2)

Objectives of the suspension system – Requirements of a good suspension system – Suspension Nomenclature - Types of suspension systems – Conventional, Independent and Semi-independent suspension systems – Working principles of independent suspension system - Single arm parallel, Single arm perpendicular, Double arm parallel and Double arm perpendicular systems - Types of springs used in suspension system – Torsion bar – Need of shock absorber – Working of Telescopic shock absorber - Stabilizer bar – Working of Air suspension system.

Recommended Reference Books:

1. Automobile Engineering   Vol. I & II   by   Dr. Kirpal Singh
2. The motor vehicle   by   Newton steeds. &Garret
3. Automobile engineering   by   G.B.S.Narang
4. Automobile engineering   by   Sethi.
5. Automobile chassis   by   P.M.Heldt.
6. Body engineering   by   S.F.Page.
7. Vehicle body Engineering   by   Powlaksi
8. Refrigeration and air conditioning   by   Domukundwar
9. Automotive Mechanics   by   William H Cruise

Suggested learning outcomes:

Student will be able to:

1.0 Draw the sketch of a heavy passenger vehicle as per the dimensions**.**

1.1 Describe the construction of various types of seats.

1.2 Identify the materials for members used in body construction

1.3 Explain the constructional details of roof, bonnet, luggage boot, grills etc.,

1.4 Understand the major dimensions of vehicles.

1.5 Explain with a neat sketch about the interior design of the vehicle towards the comfort, utility, seating arrangements interior fitting, trimming, dust proofing.

2.0 Explain the understand the concept of body drafting

2.1 Explain the production methods of plastic bodies panels, sheet metal fabrication

2.2 Explain the body finishing method

2.3 Explain briefly body painting.

2.4 Understand the Aerodynamic considerations in Body profiling

2.5 Explain aerodynamic drag

2.6 Explain lift, pitching, yawing and rolling moments

3.0 Understand Automobile Air conditioning

3.1 Define Refrigeration and Air conditioning

3.2 Express unit of refrigeration in terms of ton of refrigeration

3.3 Define coefficient of performance

3.4 Identify commonly used refrigerants

3.5 Explain Air conditioning as applicable to human comfort

3.6 Define various Psychometric Properties

3.7 Explain the sensible heat and latent heat

3.8 Explain the functions various equipment such as fans, supply ducts, outlets, Return ducts, filters and dust collectors

3.9 Explain the necessity of Automobile Air – conditioning

3.10 Locate the different components of Air conditioner in a car

3.11 Working and construction of components

3.12 Explain Expansion valve type automobile Air conditioning System

3.13 Explain Expansion tube type Air conditioning System

3.14 Explain construction and working of compressor clutch

4.0 Explain the requirements of steering gear mechanisms

4.1 Explain the working of layout of steering system

4.2 Explain the types of Steering gear boxes

4.3 Identify the components of various steering gears.

4.4 Explain working of types of power steering.

4.5 Explain steering geometry.

4.6 Explain Ackermann's & Davis steering gear mechanism

5.0 Explain the functions and necessity of a brake

 5.1 Identify the types of braking system.

 5.2 Explain working of various components of hydraulic braking system.

 5.3 List and explain different types of braking systems used in various vehicles.

 5.4 Explain the working of types of master cylinder

 5.5 Explain the working of brake bleeding

 5.6 Explain the Construction and working of air brakes.

 5.7 Explain the working of vacuum servo brakes

 5.8 Explain the working of anti lock braking system

6.0 Explain the necessity of suspension system

6.1 State the requirements of a good suspension system.

6.2 Identify and explain the types of suspension systems.

6.3 Distinguish the types of springs.

6.4 Explain about Torsion bar

6.5 Explain about the Stabilizer bar

6.6 Explain the working of Telescopic shock absorber.

6.7 Explain the Working of Air suspension system.

Suggested Student Activities:

1. Student visits Library to refer to Automobile Manuals to find the various steering systems used in automobiles.

2. Student inspects the available equipment in the Laboratory to identify the different chassis components and vehicle body components.

3. Students to browse the online latest developments related to the course.

4. Student should observe the different types vehicles in respect of bodies and present a seminar or publish a paper.

5. Student should visit the service station and identify the different types steering mechanisms and present a paper.

6. Quiz

7. Group discussion

8. 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	Comprehend on the contemporary issues in the field of vehicle body construction and brief the important aspects of Interior design.	2	0	2	3	1	0	1
CO2	Summarize various vehicle production methods and aerodynamic aspects.	2	0	3	2	1	1	2
CO3	Give overview of the automobile air-conditioning systems.	2	2	2	2	3	0	0
CO4	Summarize the working of Steering system of an automobile.	3	2	3	2	1	0	2
CO5	Explain the need and functions of each component in a braking system.	3	1	2	3	2	1	0
CO6	Outline the requirements and functions of components in suspension system of automobile.	2	1	3	2	2	1	2

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	

Mid Sem -I

Subject Name: **Automobile Chassis and Body Engineering**

Subject Code: **AU-402**

Time: 1 Hour   **Total Marks: 20 M**

PART – A

Answer **ALL** questions and each question carries **ONE** Mark   4 x1 = 4 Marks

1. Name any two interior trim parts in a car?
2. Write any two major dimensions of a vehicle?
3. List the methods used for vehicle body painting?
4. Define 'Yawing moment'?

PART – B

Answer the following. **E**ach question carries **THREE** marks   2x3= 6 Marks

5. a). State the importance of seat belt in a car.

          OR

   b). Explain the term luggage boot.

6. a) Explain the term Lift.

          OR

   b) Write the importance of body drafting.

PART – C

*Answer the following. **E**ach question carries **FIVE** marks*   2x5 = 10 Marks

7. a). Explain about window regulating mechanism.

          OR

   b). Explain about seat adjusting mechanism.

8. a). Explain about manufacturing of plastic body panels.

          OR

   b). Explain about stream lining of body in aerodynamics.

(Model Question Paper)
Mid Sem -II
Subject Name: **Automobile Chassis and Body Engineering**
Subject Code: **AU-402**

<u>**Time: 1 Hour**</u>   <u>**Total Marks: 20 M**</u>

<u>PART – A</u>
Answer **ALL** questions and each question carries **ONE** mark.   4x1 = 4 Marks

1. Define the term 'refrigeration'
2. List any two types of refrigerants used in automobiles.
3. Define the term King pin inclination.
4. State reversible steering.

<u>PART – B</u>
Answer the following. **E**ach question carries **Three** marks   2x3 = 6 Marks

5. a). Define the terms (a) DBT (b) WBT
              OR
   b). Define the terms (a) Sensible Heat (b) Relative Humidity

6. a) Define Caster and Camber .
              OR
   b) Draw a neat sketch of Recirculating ball type steering gear box .

<u>PART – C</u>
Answer the following. **E**ach question carries **five** marks   2x5 = 10 Marks

7. a). Explain the working principle of compressor clutch with neat sketch?
                 OR
   b). Explain the construction of receiver drier with a neat sketch.

8. a). Explain the working of Rack and Pinion steering gear box with naet sketch
                 OR
   b). Explain Ackermann's steering gear mechanism with a neat sketch.

SEMESTER END EXAM

Subject Name: **Automobile Chassis and Body Engineering**

Subject Code: **AU-402**

<u>**Time: 2 Hour**</u>   <u>**Total Marks: 40M**</u>

PART – A

Answer **ALL** questions and each question carries **ONE** mark.   8x1 = 8Marks
and answer should not exceed ¼ page.

1. List any two materials used for Body structural members.
2. Define the term 'Unit of refrigeration'
3. List any two types of braking systems
4. List any two steering angles.
5. Write the function of brake.
6. Define 'Stopping Time'
7. List two types of springs used in automobiles.
8. Write any two objectives of suspension system.

PART – B

Answer the following. **E**ach question carries **Three** marks   4x3=12 Marks
and answer should not exceed 1 page.

9. a). Explain about dust proofing
                                                    OR
    b) Draw layout of Hydraulic braking system.

10. a) Define the terms (a) Toe-in and (b) Toe-out
                                                    OR
    b) Write a short note on Torsion bar.

11. a) What are the requirements of Braking system.
                                                    OR
    b) List any six advantages of Hydraulic Brakes.

12. a) State the importance of Coil spring.
                                                    OR
     b) Write three requirements of good suspension system.

PART – C

Answer the following. **E**ach question carries **five** marks   4x5 = 20
Marks
and answer should not exceed TWO pages.

13. a) Draw the major Dimensions of a Bus
                                                    OR
    b). Explain the working of Vacuum Brakes with help of block diagram.

14. a).Explain with a block diagram the working of Expansion Valve type automobile air conditioning
     system.

<div align="center">OR</div>

  b). Explain the working of Air suspension system with the help of a block diagram.

15. a). Explain the constructional caliper type disc brake system with the help of a block diagram.

<div align="center">OR</div>

  b). Explain the Brake bleeding operation.

16. a). Explain the necessity of 'Stabilizer bar' in vehicle.

<div align="center">OR</div>

  b) . Explain the construction and working of Mac Pherson Strut type suspension system

AU-403-Strength of Materials and Fluid Mechanics

Course Title	Strength of Materials and Fluid Mechanics	Course Code	AU-403
Semester:	IV	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:

S.No	Unit No.	Questions for SEE					Periods
		R		U		A	
1	Simple stresses and strains	4	1	9(a)		13(a)	10
2	Properties of Fluids						10
3	Geometric properties of Sections		2	10(a)		14(a)	10
4	Flow of Fluids						10
5	S.F and B.M.		3	5, 6	9(b) 11(a) 11(b)	13(b) 15(a) 15(b)	10
6	Pneumatics			7,8	10(b) 12(a) 12(b)	14(b) 16(a) 16(b)	10
Total		8		8		8	60

Pre requisites:

This course requires the basic knowledge of geometry at Secondary school level

Course outcomes:

At the end of course student should be able to

CO1 :	Calculate the stress and strain acting on the given material under different axial load conditions and to understand the elastic behavior of metals.
CO2 :	Understand the concepts of fluid pressure and other properties.
CO3 :	Assess the geometrical properties like C.G and M.I of symmetrical and non symmetrical laminas.
CO4 :	Comprehend the basic types of fluid flows and energy possessed in a fluid flow.
CO5 :	Draw the shear force and bending moment diagrams for the Point and Uniformly Distributed Load system on Cantilever, Simply supported and Over hanging beams.
CO6:	Detail about the governing functions of pneumatic components.

COURSE CONTENT:

UNIT-1: Simple stresses and strains   **Periods 10 (L: 7.0 –T: 3.0)**

Introduction–Load- Force - Difference between load and force- Types of loads - Mechanical properties: Strength, Stiffness, Elasticity, Plasticity, Ductility, Malleability, Toughness, Hardness, Brittleness, Creep and Fatigue - Stress, Strain - Various types of Stresses and Strains: Tensile, Compressive, Shear, Bending – Hooke's law-Modulus of elasticity- Stress v/s Strain diagram- Problems on total elongation, Stress induced, Strain in bars of varying cross sections- Ultimate Stress - Factor of Safety- Design or Allowable stress -Young's Modulus- Rigidity Modulus - Bulk Modulus - Poisons' ratio - Relation among three elastic constants- Problems related to three elastic constants-Thermal stresses and strains-Related problems.

UNIT-2: Properties of fluids   **Periods 10 (L: 7.0 – T: 3.0)**

Definition of fluid – Types of fluids: Compressible and In-compressible fluids – Properties of fluids: Density, Specific weight, Specific gravity, Viscosity, Capillarity, Surface Tension and Pressure - Pascal's law – Intensity of pressure – Gauge Pressure and Absolute Pressure – Measurement of pressure by Piezometer, U- tube and Differential manometers – Problems on pressure measurement - Working of Bourdon's tube pressure gauge.

UNIT-3: Geometrical properties of sections   **Periods 10 (L: 6.0 – T: 4.0)**

Centre of gravity of regular laminas: Square, Rectangle, Triangle and Circle – Centroid- Neutral axis-Inertia -Types of Moment of Inertias: Mass moment of Inertia, Area moment of Inertia and Polar Moment of Inertia – Application of these Moment of Inertias and formulae – Definition of area Moment of Inertia or 2nd Moment of Inertia - Radius of gyration-Section modulus of Square, Rectangle, Triangle and Circle- Parallel and perpendicular axis theorems- Calculation of moment of inertia of L, I and T- sections.

UNIT-4: Flow of Fluids   **Periods 10(L: 6.0– T: 4.0)**

Types of fluid flows: Steady and Unsteady, Uniform and Non-uniform, Laminar and Turbulent flows -Concept of Reynolds number –Continuity Equation –Assumptions made for Bernoulli's theorem – Statement of Bernoulli's theorem, Equation and its Practical applications – Problems on Bernoulli's Equation – Flow of fluid through pipes and orifice – Hydraulic coefficients - Loss of head in pipes due to friction: Darcy's and Chezy's formula (without proof) – Hydraulic gradient – Total energy line – Power transmitted through pipes, efficiency and condition for maximum power transmission (without derivation)- Simple problems.

UNIT-5: S.F. and B .M.   **Periods 10(L: 6.0– T: 4.0)**

Definition of Beam, types of beams: Cantilever, Simply supported, Overhanging beam, Fixed beam and Continuous beams -Cantilever, Simply supported and Overhanging beams subjected to Point load and U.D.L - S.F. and B.M. calculations and diagrams for these beams – Assumptions made for bending equation and Derivation of Bending Equation.

UNIT-6: Pneumatics   **Periods 10 (L: 6.8 – T: 3.2)**

Definition of the term 'Pneumatics' –Applications of pneumatic systems - Basic components of a pneumatic circuit – Basic symbols of a pneumatic circuit - Function of power source, control elements and actuator – Major components of power source – Types of Compressors - Constructional and working details of single acting reciprocating compressor – Types of control elements – Types of actuators – Single acting, double acting, Piston type and Diaphragm type actuators - Advantages and limitations of Pneumatic controls.

REFERENCE BOOKS:

1.	Strength of Materials	-by	R.S.Khurmi
2.	Solid Mechanics	-by	Pakirappa
3.	Strength of Materials	-by	Ramamrutham
4.	Hydraulics	- by	R.S. Khurmi
5.	Hydraulics &Hydraulics Machines Vol- I&II	- by	Jagadish Lal
6.	Hydraulics	- by	Reya and Rao
7.	Fluid Power Pneumatics	-by	ALAN H. JOHN
8.	Fluid Power & Pneumatics	-by	AUDEL

Suggested learning outcomes:

1.0 Simple stresses and strains

1.1 Differentiate between load, force

1.2 Meaning of point load and distributed load

1.3 Difference between stress and strain

1.4 Principal constituents of stress-strain diagram of mild steel.

1.5 Meaning of various elastic constants

1.6 Simple problems on thermal stresses and strains.

2.0 Properties of fluids

2.1 Define fluid, differentiate between the fluid flows.

2.2 Define various properties of fluids.

2.3 State Pascal law and its applications

2.4 Explain the atmospheric pressure, absolute pressure and pressure head of fluid

2.5 Explain the working principle of pressure Gauges.

2.6 Problems on manometers.

3.0 Geometrical properties of sections

3.1 Define centroid, centre of gravity, Moment of inertia, and radius of gyration.

3.2 State the necessity of finding the centroid and centre of gravity for various engineering applications.

3.3 Calculate positions of centroid for simple plane laminas.

3.4 Explain the method of determining the centroid by 'Method of moments'.

3.5 Define moment of inertia, radius of gyration.

3.6 State the necessity of finding moment of inertia for various engineering applications.

3.7 Determine M.I. of standard sections L, I and T by applying parallel axes and perpendicular axes theorems.

4.0 Types of Fluid flows

4.1 Explain the fluid flow of steady, unsteady, uniform, non-uniform, laminar and turbulent flows.

4.2 Write the Equation of continuity of flow

4.3 Write the total energy equation of fluid in motion. Bernoulli's theorem (proof not necessary) and its practical applications in venturi meter. Simple problems.

4.4 Explain the phenomenon of flow through orifices under constant heads. Know the coefficient of velocity, coefficient of contraction and coefficient of discharge and the relation among the three coefficients – simple problems.

4.5 State the laws of fluid friction, Reynolds number, change of stream lined flow into Turbulent flow and critical velocity.

4.6 Illustrate various losses in a fluid flow. Loss of friction – Darcy's and Chezy's expressions (Without proof) - Simple problems.

5.0 S.F. and B .M. diagrams

5.1 Types of beams

5.2 Define different types of loads: Point load, Uniformly distributed load etc.,

5.3 Define and explain the terms (a) Shear force and (b) Bending moment.

5.4 Determine shear force and bending moments on cantilever, simply supported beam and overhanging beam for simple cases of loading (Point load, uniformly distributed load).

5.5 Describe the procedures for sketching the shear force diagrams (SFD) and Bending Moment diagrams (BMD).

5.6 Define Point of contra flexure.

5.7 Definition of Bending

5.8 Derivation of Bending equation and assumptions.

6.0 Define the term 'Pneumatics'

6.1 State the applications of pneumatic systems

6.2 List the basic components of a pneumatic circuit

6.3 Draw the symbols of components in a pneumatic circuit

6.4 Sketch and explain a pneumatic circuit

6.5 State the function of power source

6.6 State the function of control elements in pneumatic circuit

6.7 State the function of an actuator

6.8 List the major components of power source

6.9 List the types of Compressors

6.10 Explain the Constructional and working details of single acting reciprocating compressor.

6.11 List the types of control elements

6.12 List the types of actuators

6.13 Explain the constructional details of Single acting actuator

6.14 Explain the constructional details of actuator double acting actuator

6.15 Explain the constructional details of Piston type actuator

6.16 Explain the constructional details of Diaphragm type actuator

6.17 State the Advantages and limitations of Pneumatic controls

Suggested Student Activities:

✓ Draw Stress/Strain diagrams for different types of materials and analyze the performance of these metals.
✓ Demonstrate the measurement of pressure head using Pitot tube.
✓ Sketch the bending and deflection diagrams under single point load on a cantilever, simply supported beam and overhanging beam.
✓ Visit any hydraulic power plant and submit a study report.
✓ Verify Bernoulli's using a Pitot tube in a pipe flow and submit a report.
✓ Debate on the applications of Strength of materials in the respective field of engineering.
✓ Seminar on hydraulic circuit.

Suggested E-Learning Resources:

✓ Simple Stresses and Strains:
https://www.toppr.com/guides/physics/mechanical-properties-of-solids/stress-and-strain/
✓ Fundamental Concepts of Fluid mechanics
https://nptel.ac.in/courses/112105171/1
✓ Fundamental Concepts of Fluid mechanics
https://nptel.ac.in/courses/112105171/2
✓ Fundamental Concepts of Fluid mechanics
https://nptel.ac.in/courses/112105171/3
✓ Geometrical Properties of sections
https://nptel.ac.in/courses/112103108/15
✓ Flow of Fluids
https://nptel.ac.in/courses/112105171/1#
https://nptel.ac.in/courses/112105171/2#
https://nptel.ac.in/courses/112105171/3#
✓ Shear Force and Bending Moment Diagrams
https://nptel.ac.in/courses/105106172/53 to
https://nptel.ac.in/courses/105106172/77
✓ www.nptel.ac.in
✓ www.wikipedia.org

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	

CO/PO Mapping Matrix:

	Course Outcome	Cognitive Level	Linked PO'S	Periods
CO1	Calculate the stress and strain acting on the given material under different axial load conditions and to understand the elastic behavior of metals.	R/U/A	1,3,4,5,8	10
CO2	Understand the concepts of fluid pressure and other properties.	R/U/A	1,3,5,10	10
CO3	Assess the geometrical properties like C.G and M.I of symmetrical and non symmetrical laminas.	R/U/A	1,2,3,10	10
CO4	Comprehend the basic types of fluid flows and energy possessed in a fluid flow.	R/U/A	1,2,3,6	10
CO5	Draw the shear force and bending moment diagrams for the given simple load system on Cantilever, Simply supported and Over hanging beams.	R/U/A	1,2,8,9	10
CO6	Detail about the governing functions of hydraulic operated machines.	R/U/A	1,3,4,5	10
TOTAL				60

Instructions:

1.AnswerFOUR questions from Part A.Each question carries ONE mark.

2.Answer any TWO questions from Part B.Each question carries THREE marks.

3.Answer any TWO questions from Part C.Each question carries FIVE marks.

PART-A   4 X 1= 4

1.Define the term "stress".

2.State Newton's law of viscosity.

3.Define the term poison's ratio.

4. Define the term surface tension.

PART-B   2 X 3 = 6

5(a) A bar of 16mm diameter is subjected to a pull of 27 k N. The measured extension over gauge length of 80 mm is 0.12 mm.Find the modulus of elasticity.

(or)

5(b) A steel rod of 25 mm diameter and 6000mm length is subjected to an axial pull of 40 kN.Find the tensile stress induced in the rod.

6(a) Write a short notes on (a) Surface Tension (b) Capillarity

(or)

6(b) Write a short notes on Manometers.

PART-C   2 X 5 = 10

7(a) A bar of 18 mm diameter is subjected to a pull of 40 k N. The measured extension over gauge length of 800 mm is 0.15 mm and the change in diameter is 0.007mm. Find the poison's ratio and modulus of elasticity.

(or)

7(b) A steel rod 4m long and 20 mm diameter is subjected to an axial tensile load of 45 kN. Find the change in (a) length (b) diameter and (c)volume Take, $E = 200$ kN/mm^2, $1/m = 0.3$

8(a) Find the kinematic viscosity of oil whose specific gravity is 0.96 and viscosity is 0.00109 Ns/m^2.

(or)

8(b)Explain the constructional details of U-tube manometer.

IV SEMESTER MID 2
COURSE CODE: AU-403
COURSE TITLE: STRENGTH OF MATERIALS AND FLUID MECHANICS
(Time   : 1 hour)   Max marks:20)

Instructions:

      1. Answer <u>FOUR</u> questions from Part A. Each question carries <u>ONE</u> mark.

      2. Answer any <u>TWO</u> questions from Part B. Each question carries <u>THREE</u> marks.

      3. Answer any <u>TWO</u> questions from Part C. Each question carries <u>FIVE</u> marks.

           PART-A   **4 X 1= 4**
1. Define the term "centre of gravity".
2. State Bernoulli's theorem.
3. Define the term moment of inertia.
4. Write an expression of Darcy's equation
           PART-B   **2 X 3 = 6**
5(a) Find the M.I. of a rectangle of width 50 mm and depth 80 mm about its centroidal axes.
                    (or)
5(b) Find the M.I. of a rectangle of 80 mm wide and depth 120 mm about its base.

6(a) List the limitations of Bernoulli's Theorem.
                    (or)
6(b) Write a short notes on Venturimeter.

           PART-C   **2 X 5 = 10**

7(a) A bar of T section has a flange 50 mm wide and 10 mm thick. The web is 80 mm deep and 10 mm thick. Find the M.I of the section about a line parallel to its flange and about a line passing through the centroids of flange and web.
                    (or)
7(b) Find the moment of inertia about centroidal axes of a channel 200mm X 100 mm with flange thickness 5 mm and web thickness 10 mm.

8(a) A horizontal Venturimeter has a main diameter of 300 mm and a throat diameter of 200 mm. If discharge of 10,000 litres of water per minute when the difference of pressure heads between the inlet and the throat is 1.5 m of water find the coefficient of meter.

                    (or)
8(b).The head of water over the centre of an orifice of diameter 30 mm is 2 m. The actual discharge through the orifice is 3 lit/s. Find the coefficient of discharge.

<u>**Time: 2Hours**</u>   **Max.Marks:40**

PART-A

Answer all the questions.
Each question carries one mark   **8 x 1 = 8 Marks**

1. Define the term 'Elasticity'.
2. State the Pascal's law.
3. What is 'Point of contra flexure'?
4. State the equation of continuity of flow.
5. Define the term 'Beam'.
6. What is Bending moment?
7. Define the term 'Pneumatics'.
8. List any four components of Pneumatic control circuit.

PART-B

Answer any FOUR questions.
Each question carries Three marks   **4 X 3 = 12**

9(a) The specific gravity of water at 20^oC is 0.998 and it's Dynamic viscosity is 0.001008 Pa-S. Find it's kinematic viscosity.

(Or)

9(b) List various types of beams

10(a) Find the M.I of a triangle whose base is 180mm and height is 120 mm about its base.

(Or)

10(b) List the functions of control valve

11(a) List the assumptions made in bending equation.

(Or)

11(b) Write an expression of bending equation and relate the terms.

12(a) List any three advantages and disadvantages of Pneumatic control system.

(Or)

12(b) What are the industrial applications of actuators?

PART-C

Answer any FOUR questions.
Each question carries five marks.   **4 X 5 = 20**

13(a) A piece of steel 200 mm long and 20 mm X 20 mm cross section is subjected to a tensile force of 40kN in the direction of its length. Calculate the change in its volume. Take, E = $2X10^5$N/mm ^{2},1/m = 0.3

(Or)

13(b)A cantilever 2 m long carries point loads of 6kN,5kN,2kN and 3kN at the free end, at 1.5m,0.9 m and 0.4 m from fixed end. Sketch the SFD and BMD showing SF and BM values.

14(a) Explain the constructional details of Bourdon's tube pressure gauge with a neat sketch?

(Or)

14(b) Explain the construction of External gear pump and label the parts?

15(a) A cantilever of 3m long carries point loads of 8kN, 4kN, 6kN and 5kN at free end, 2.5m, 1.6 m and 1m from fixed end. Sketch the SFD and BMD showing the values?

(Or)

15(b) A Simply supported beam of 10m length at its end, carries an UDL of 2kN/m over the left half of the span and a point load of 3kN at the mid span. Find the maximum bending moment and draw SF and BM diagrams?

16(a) Describe the construction and explain the working of a Singe acting Reciprocating Compressor with the aid of a sketch.

(Or)

16(b) With the aid of a diagram explain the constructional details and working of Diaphragm type actuator.

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AU-404: Automobile Power Train

Course Title	Automobile Power Train	Course Code	AU-404
Semester	IV	Course Group	Core
Teaching Scheme in Periods (L:T:P)	4:1:0	Credits	3
Methodology	Lecture + Practical	Total Contact Periods :	75
CIE	60 Marks	SEE	40 Marks

Pre requisite:

This course requires the basic knowledge of Basic Automobile Engineering

Course Content and Blue Print of Marks for SEE

S.No	Unit Name	Questions to be set for SEE				Periods
		R		U	A	
1	Combustion and Combustion Chambers	1		9(a)	13(a)	12
2	Fuel Supply System					12
3	Transmission	2		10(a)	14(a)	12
4	Propeller shaft and Differential					08
5	Wheels and Tyres	4	5, 6	9(b) 11(a) 11(b)	13(b) 15(a) 15(b)	08
6	Front axle &Rear axle		7,8	10(b) 12(a) 12(b)	14(b) 16(a) 16(b)	08
Total Questions		8		8	8	60 Periods
Legend:	Remembering (R)	1 Mark				
	Understanding (U)	3 Marks				
	Application (A)	5 Marks				

Course Outcomes

At the end of the course the student should be:

CO1 :	Describe the construction of S.I and C.Iengine combustion chambers.
CO2 :	Identify the fuel system components.
CO3 :	Describe various types of gear box for power transmission.
CO4 :	Determine the air-fuel ratios and combustion limits.
CO5 :	Procure knowledge on contemporary issues.
CO6 :	Make presentation on assigned topics related to Automobile Power Train.

Course Contents:

1. Combustion and Combustion chambers: **Duration: Periods 12 (L: 7.2 T: 4.8)**

Combustion in I.C Engines – Stages of Combustion in S.I Engines – Phenomenon of Detonation and Pre Ignition - Stages of Combustion in C.I Engines - Diesel Knock – Factors influencing abnormal combustion in S.I Engines - Factors influencing abnormal combustion in C.I Engines – Requirements of S.I. and C.I. Engine combustion chambers - Types of S.I and C.I. engine combustion chambers – S.I. Engine Combustion chambers – Ricardo turbulent, Bath tub, Wedge head, Spheroidal and Hemispherical. C.I Engine Combustion chambers - Direct injection type, pre-combustion chambers and Turbulence chambers and types – Air cell combustion chamber - Relative advantages and disadvantages.

2. Fuel Supply System :

Duration : Periods 12(L:7.8 T:4.2)

Various types of Carburetor circuits –Types of carburetors: Construction and working of S.U Carburetor, Solex Carburetor. Petrol injection – Types of Petrol injection systems – Classification of Petrol injection - Working Principle of supercharger, inters cooler and turbocharger.

Line diagram of Diesel engine fuel system–Types of diesel fuel feed pumps- Types of Diesel filter – primary and secondary filters - Requirements of fuel injection system – types of fuel injection systems – air injection and solid injection systems – common rail system, unit injection system, individual pump systems- distributor type pump system – CRDI system - Injectors- Types of injectors – Constructional details and working of fuel injection pump–Types of Nozzles– Single hole, Multi hole, Pintle and Pintaux– Governing system for diesel engines – Mechanical and Pneumatic types of governors.

3. Transmission:

Duration: Periods 12 (L: 7.2 T: 4.8)

Dynamics of moving vehicles-Types of resistances encountered by a vehicle-Road resistance, Gradient resistance, Air resistance-Traction-Tractive effort–Simple related problems.

Need of a gear box in the transmission system– Types of gear boxes– Principles and operation of sliding mesh-constant mesh-synchromesh gearbox- Floor Gear shifting mechanism -Working principle of simple Epi-cyclic gear train- Principle and working of freewheel unit– Overdrive mechanism– Transfer case - Fluid coupling - Construction and working - Advantages and disadvantages -percentage slip in fluid coupling -Torque converter its Principle and working -

Principle of automatic transmission system and advantages-CVT-Principle of operation in two wheeler-advantages and disadvantages - Working Principle of Automated Manual Transmission (A.M.T) with block diagram.

4. Propeller shaft and Differential

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

Propeller shaft – Function of propeller shaft - slip joint or sliding joint – universal joint -.Types of universal joints– cross type or spider and two yoke type–ball and trunnion type– constant velocity type– Different types of Constant velocity joints.

Differential gear–Final drive–purpose of final drive, types of final drive– Bevel, worm and worm wheel, Hypoid gear and Palloid gear-single and double reduction final drives – Four wheel drive – differential lock – self-locking differential – Transaxle.

5. Wheels and Tyres:

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

Wheel assembly–functions of the wheels–Types of wheels, types of rims–Types of tyres–Construction of tyres-cross ply tyre–radial tyre –belted bias ply–merits of radial tyre over cross ply tyre- tube tyre-tubeless tyre –tyre tread patterns – tyre inflation pressure & wear – Desirable tyre properties – causes of tyre wear – Tyre rotation–procedure for Puncture repair of tubeless tyre–Retreading- Advantages of nitrogen for tyre inflation.

6. Front Axle and Rear Axle:

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

Live and dead axles – Components of Front axle –stub axle–types of stub axles–Elliot–Reversed Elliot–Lamoine–Reversed Lamoine. Loads on the rear axle–Types of rear axles-semi floating–Three quarter floating–fully floating axles–Axle Housings and types–Split, Banjo and Salisbury types-Types of drives–Hotchkiss drive, Torque tube drive.

Recommended Books for Reference:

1. Automobile Engineering Vol. I & II   by   Dr. Kirpal Singh
2. Automotive Mechanics   by   Heitner
3. Automobile Engineering   by   G.B.S. Narang
4. Automobile Engineering   by   R.B.Gupta
5. Automobile Engineering   by   Banga and Nathun Singh
6. Automobile mechanics   by   William Crouse
7. Internal Combustion Engines   by   Mathur&Sharma
8. Automobile Engineering Vol. I   by   Anil Chikara

Suggested Learning outcomes:

After completion of the course Student will be able to

1.0   Define combustion in IC engine

1.1   Explain the different stages of combustion in SI engine with sketch

1.2   Describe the phenomenon of detonation and pre-ignition

1.3   Explain the different stages of combustion in CI engine with sketch

1.4   Describe about diesel knock

1.5   State the factors influencing abnormal combustion in SI engine

1.6   State the factors influencing abnormal combustion in CI engine

1.7   Mention requirements of a good combustion chamber in SI engine

1.8   Mention requirements of a good combustion chamber in CI engine

1.9   Explain the constructional details of Ricardo's turbulent combustion chamber in SI engine with sketch

1.10   Explain the constructional details of Bath tub type combustion chamber in SI engine with sketch

1.11   Explain the constructional details of Wedge heat type combustion chamber in SI engine with sketch

1.12   Explain the constructional details of Spheroidal type combustion chamber in SI engine with sketch

1.13   Explain the constructional details of Hemi-spherical type combustion chamber in SI engine with sketch

1.14   Explain the constructional details of Direct injection type combustion chamber in CI engine with sketch

1.15 Explain the constructional details of Pre-combustion type combustion chamber in CI engine with sketch

1.16 Explain the constructional details of Turbulence (swirl) type combustion chamber in CI engine with sketch

1.17 Explain the constructional details of Air-cell combustion chamber in CI engine with sketch

1.18 Describe homogeneous and heterogeneous mixture

1.19 Differentiate homogeneous and heterogeneous mixture

1.20 State the advantages and disadvantages of Ricardo combustion chamber in SI engine

1.21 State the advantages and disadvantages of Ricardo combustion chamber in CI engine

1.22 State the advantages and disadvantages of Pre-combustion chamber in CI engine

2.0 Identify the various types of carburetor circuits

2.1 Explain the construction and working of S.U Carburetor with a sketch

2.2 Explain the construction and working of Solex Carburetor with a sketch

2.3 State the importance of the petrol injection system

2.4 Identify the different types of petrol injection systems

2.5 Explain the construction and working of the MPFI system

2.6 State the importance of the supercharger, intercooler, and turbocharger

2.7 Explain the working Principle of the supercharger with a sketch

2.8 Explain the working Principle of the intercooler with a sketch

2.9 Explain the working Principle of the turbocharger with a sketch

2.10 Draw a line diagram for the diesel fuel system

2.11 Describe the function of the diesel fuel feed pump

2.12 Identify and explain the types of diesel fuel feed pumps with the sketches

2.13 State the necessity of diesel Filters

2.14 Identify the types of diesel filters

2.15 Explain the working Principle of diesel filterwith a sketch

2.16 State the requirements for the diesel fuel injection system

2.17 State the function of the diesel fuel supply system

2.18 Identify the types of diesel fuel injection systems

2.19 Explain the working Principle of the air injection systemwith a sketch

2.20 Identify the types of solid diesel fuel injection systems

2.21 State the function of the diesel fuel injection pump

2.22 Explain the working Principle of the common-rail diesel injection systemwith a sketch

2.23   Explain the working Principle of the unit-injector type diesel fuel injection system with a sketch

2.24   Explain the working Principle of the individualpump type diesel fuel injection system with a sketch

2.25   Explain the working Principle of the Distributor pump type Diesel engine's pump fuel injection system with a sketch

2.26   Explain the working Principle of the CRDI type diesel injection system with a sketch

2.27   Explain the construction and working of the diesel fuel injection pump with a sketch

2.28   State the function of a diesel fuel injector

2.29   Classify the different types of diesel fuel injection nozzles with the sketches

2.30   Explain the construction and working of the mechanical fuel injector with a sketch

2.31   Explain the construction and working of the electronic fuel injector with a sketch

2.32   State the function of a governor in the diesel fuel system

2.33   Identify the types of governors in the diesel fuel system

2.34   Explain the construction and working of the mechanical governor with a sketch

2.35   Explain the construction and working of the pneumatic governor with a sketch

3.0   List various resistance encountered by vehicle.

3.1   Explain the types of different resistance encountered by a vehicle

3.2   Solve simple problems relating to the vehicle resistances

3.3   Define the terms Traction and tractive effort

3.4   Describe the function of a gearbox's transmission system

3.5   Explain the construction and working of a sliding-mesh gearbox, constant-mesh gearbox, and synchromesh gearbox with the sketches

3.6   Explain the floor shifting gear mechanism with a sketch

3.7   Explain the working principle of a simple epi-cyclic gear train with a sketch

3.8   Explain the working principle of a simple freewheel unit with a sketch

3.9   Explain the constructional details of the overdrive mechanism with a sketch

3.10   Explain the construction and working of a fluid coupling with a sketch

3.11   State the advantages and disadvantages of the fluid coupling

3.12   Describe the percentage slip in a fluid coupling

3.13   Explain the constructional details and working of a torque converter with a sketch

3.14   Explain the working principle of the automatic transmission system with a sketch

3.15   State the advantages of the automatic transmission system

3.16   Explain the working principle of the CVT in a two-wheeler with a sketch

3.17   State the advantages and disadvantages of the CVT in a two-wheeler

3.18   Explain the working principle of the AMT with a block diagram

4.0   State the function of the propeller shaft.

4.1   State the function of slip joint and Universal joint

4.2   Explain the types of universal joints: cross-type or spider and two yoke type–ball and trunnion type– constant velocity types with sketches

4.3   Explain the working of final drive and its types: Bevel, worm and worm wheel, Hypoid gear and Palloid gear-single and double reduction final drives – Four wheel drive – differential lock – self-locking differential with sketches

4.4   State the purpose of the four wheel drive.

4.5   Explain the working Principle of a four wheel drive.

4.6   Explain the working Principle of differential gear, differential lock, Self-lockingdifferential

4.7   Explain the working of a Transaxle with sketch.

5.0   State the function of a wheel

5.1   Identify the parts of a wheel

5.2   Know the types of wheels and explain their constructional details with sketch

5.3   Describe the types of rims

5.4   Identify and explain the constructional details and types of tires based on the carcass

5.5   Describe advantages of radial tire over cross-ply tire

5.6   Explain the constructional details of a tubed tire and tubeless tire with sketch

5.7   Identify the different types of thread patterns on a tire

5.8   Describe different tire inflation pressure and wear

5.9   Explain the desirable tire properties

5.10   Explain the uses of tire wear

5.11   Describe the need of tire rotation and explain the procedure in a four wheeler with sketch

5.12   Explain the procedure for repairing of a tubeless tire puncture

5.13   Explain the retreading procedure of a tire

5.14   State the advantages of using nitrogen gas as a tire inflator

6.0   State the function of live and dead axles.

6.1   Differentiate live and dead axle

6.2   Identify components of live axle

6.3   State the function of stub axle and explain its types with sketch

6.4   Describe the various loads acting on rear axle

6.5   Explain the constructional details and types of rear axles with sketch

6.6   Explain the constructional details and types of rear axle hub housing

6.7   Explain the Constructional details of a Hotch kiss rear axle drive with sketch

6.8   Explain the Constructional details of a Torque tube rear axle drive with sketch

Suggested Student Activities:

1. Student visits Library to refer to Manual of Automobile components to find the various combustion chambers used in Engines.

2. Student inspects the available equipment in the Laboratory to identify the components of transmission system.

3. Visit nearby workshop / service station to familiarize with type of gear box used in four wheeler and two wheeler.

4. Quiz

5. Group discussion

6. 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	Describe the construction of S.I and C.I Engine combustion chambers.	2	0	2	0	0	0	2
CO2	Identify the fuel system components.	2	0	2	2	0	0	1
CO3	Describe various types of gear box for power transmission.	3	2	3	2	0	0	2
CO4	Determine the air-fuel ratios and combustion limits.	3	2	2	2	2	2	2
CO5	Procure knowledge on contemporary issues	2	0	2	3	0	0	0
CO6	Make presentation on assigned topics related to Automobile Power Train.	3	0	2	0	0	3	2

OVER VIEW OF CONTINUOUS INTERNAL 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	

<p style="text-align:center">AU-405- Automobile Electrical Systems</p>

Course Title :	Automobile Electrical Systems	Course Code	AU-405
Semester	IV	Course Group	Core
Teaching Scheme in Hrs(L:T:P)	4:1:0	Credits	3
Methodology	Lecture + Assignments	Total Contact Hours	75
CIE	60 Marks	SEE	40 Marks

Pre requisites:

This course requires the basic knowledge of Physics and chemistry at Secondary school level

Course Content and Blue Print of Marks for SEE

S.No	Unit No.	Questions for SEE					Periods
		R		U	A		
1	Fundamentals of Electrical Engineering	4	1	9(a)	13(a)		12
2	Batteries						10
3	Electric and Hybrid Vehicles		2	10(a)	14(a)		08
4	Lighting and Accessories						06
5	Starting and Charging systems		3	5, 6	9(b)	13(b)	14
					11(a)	15(a)	
					11(b)	15(b)	
6	Ignition System			7,8	10(b)	14(b)	08
					12(a)	16(a)	
					12(b)	16(b)	
Total Questions		**8**		**8**	**8**		**60**

Course outcomes:

At the end of course student should be able to

CO1 :	Summarize the fundamentals of electrical engineering.
CO2 :	Comprehend the working, care and maintenance of automobile batteries.
CO3 :	Explain the function of each component in Electrical and Hybrid vehicles
CO4 :	Interpret the components of lighting and accessories of an automobile.
CO5 :	Elaborate the working of starting and charging systems used in a vehicle.
CO6:	Illustrate the working of automobile Ignition system

COURSE CONTENT:

UNIT-1: Fundamentals of Electrical Engineering   Duration: Periods 12(L:10 – T:2)
Electrical Units of Current, Voltage, Resistance, Power, Energy- Concept of Potential difference,-
Define AC & DC –Ohm's Law – Series and parallel circuits – Determination of total resistance of
a given series circuit, parallel circuit, Series and Parallel circuits - Kirchhoff's Laws, Simple and
elementary problems on Kirchhoff's laws - Magnetic Field-Magnetic Flux-Magnetic Flux density-
Comparison between Magnetic circuit and Electrical circuit - Magnetism and Electromagnetism-
Electromagnetic Induction - Definitions of Inductance, Impedance, Capacitance,– Self-induction –
Mutual induction-Basic principle of flux production due to electric current- Maxwell's cork screw
rule - Fleming's Right hand and Left hand rules - Lenz's law.

UNIT-2: Batteries   Duration: Periods 10 (L: 7 – T: 3)

Introduction - Definition of a Cell – Primary and secondary cells – Types of batteries -
Constructional features of a lead acid battery – Constructional details of Li-ion battery – Typical
Chemical reaction during charging and discharging in a lead acid battery and Li-ion battery –
Battery parameters: Cell and Battery Voltage, Charge Capacity, Energy stored, Specific energy,
Energy density, Specific power, Ampere-hour efficiency, Energy Efficiency (Watt-hour
efficiency), Self discharge rates, Battery temperature, heating and cooling needs, Battery life and
number of deep cycles – Charging of Lead acid battery and Li-ion batteries – Different methods
used including trickle charging - Battery tests: Voltage test, Specific gravity test, High discharge
test, Cadmium cells test - Care and maintenance of Lead acid battery and Li-ion battery-
Advantages and Limitations of Li-ion battery over lead acid cell battery- Introduction to Fuel cell –
Factors considered for selection of a battery for a vehicle.

UNIT-3: Electric Vehicles   Duration: Periods 08 (L: 7 – T: 1)
Need of Non polluting or Zero Emission Vehicles – Introduction to Electric drive Vehicles -
Layout of a typical Electric Vehicle - Types of Electric vehicles based on the types of drive motors
used- AC Motors and DC Motors and their types – Hybrid Vehicles and Types of hybrid drives-
Advantages of Electrical vehicles over Conventional vehicles.

UNIT-4: Lighting and Accessories   Duration: Periods 06 (L: 5 – T: 1)
Define Wire-Harness and need of wiring harness – Earth return systems used in Automobiles –
Advantages of earth return systems **-** Define Relay-Types of Relays - Define Fuses – Need of a
fuse in automobile electric circuits –Types of fuses used in automobiles.
 Need of Automobile Illumination - Head lamps – Construction of sealed beam lamps – Halogen
screen wiper circuit – Projector headlights - Traffic Indicators –Instrument panel – Electronic
engine Speed measurement - Fuel quantity measuring system - Oil pressure gauge – Coolant
temperature measuring system - Automatic wiper - Automatic Head lamps – Electronic vehicle
speed measurement- Trip information- Navigation systems- Block diagram of modern automobile
computer based instrumentation system.

UNIT-5: Starting and Charging Systems　　　**Duration:　Periods 14 (L: 10 – T: 4)**

Need of a D.C machine in an automobile - Constructional details of D.C Motor -Types of DC Motor– Characteristics of a D.C series motor –Need for self starter - Conditions of self starter during starting of an engine - Need for series motor as self starter – Need of a Solenoid switch - Constructional details of solenoid switch - Starter Drive mechanisms: Bendix, Folo through, Lucas drive and Over running clutch drive – Constructional details of over running clutch.

Working Principle of an Alternator - Construction details of an Alternator– Define the terms Cycle, Time period& Frequency-Limitations of D.C. Generator and Advantages of using alternator-Types of D.C Generators -Define Diode-Operation-VI Characteristics- Zener Diode – VI Characteristics of Zener diode- Transistor-Types NPN, PNP -Operation-Applications - Rectification of AC to DC – Half –wave rectifier and Full-wave rectifier – Basic Principles of charging- Need of voltage regulation and working of an electronic voltage regulator.

UNIT-6:　Ignition system　　　　　　　　**Duration: Periods 8 (L: 5 – T: 3)**

Requirements of ignition system - Types of ignition system- Coil ignition and magneto ignition systems - Constructional details and working principle of coil ignition systems with circuit diagrams – Function of each component and their constructional details - Ignition Timing – Advancing and Retarding of ignition timing- Automatic advance mechanisms - Specifications of a spark plug – Types of spark plugs-Working of Electronic ignition and Transistorized (CDI) ignition systems-Advantages over conventional ignition system.

Suggested Reference Books:

1.	Automotive Electrical systems equipment	by	N.R. Khatawate - (S.Chand& Co.)
2.	Basic Electrical Engineering.	by	M.L. Gupta
3.	Electrical Technology	by	Theraja
4.	Electrical Equipment of Automobiles	by	Parker Smith
5.	Automobile Electrical Equipment	by	P.L. Kohli
6.	Basic Automobile Electricity	by	C.P. Nakra
7.	Automobile Electrical Engineering	by	Arora&Dass
8.	Automobile Engineering	by	K.K. Ramalingam
9.	Microcontroller & application (8051)	by	Mazdi&Mazdi
10.	Digital Electronics	by	Morris Mano
11.	Instrumentation	by	A.K.Sawhaney
12.	Automotive Mechanics	by	S.Srinivasan
13.	Automotive Electrical and Electronic systems	by	Tom Denton

Suggested E Learning References:

1. Fundamentals of Electrical Engineering
   https://www.youtube.com/watch?v=3TR_DS_7z2w&list=PLbRMhDVUMngfdEXVcdf_ijj2Eub-UHs_y
2. Ohm's Law etc,.
   https://www.youtube.com/watch?v=bT1Ko-1_1nY
3. Types of batteries
   https://www.youtube.com/watch?v=EfgDShcgKvM
4. Li Ion Battery
   https://www.youtube.com/watch?v=5X2YYNQWm_k
   https://www.youtube.com/watch?v=Jiyrw1zUQlA
   https://www.youtube.com/watch?v=kqR7MihP5k4
   https://www.youtube.com/watch?v=4ONdsVs6yS0
5. Charging and Starting Circuits of a vehicle
   https://www.youtube.com/watch?v=EthVIixON4o
   https://www.youtube.com/watch?v=k7LYOC_AXI4
6. Working of charging system
   https://www.youtube.com/watch?v=VOGu2Fft7WQ
7. Modern vehicle charging system
   https://www.youtube.com/watch?v=oxUbXtsY7cA
8. How does an Ignition system of a car work
   https://www.youtube.com/watch?v=W94iksaQwUo
9. Magneto Ignition system
   https://www.youtube.com/watch?v=z4xkPyQn_ZU
10. Spark Plug
    https://www.youtube.com/watch?v=742Ml4oD3s4

SUGGESTED STUDENT ACTIVITIES:

1. Quiz on the fundamentals of electrical engineering.
2. Visit a substation and submit a report.
3. Give a seminar on the working of any one component of Automobile Electrical Systems.
4. Submit a report on the electrical systems data of an automobile.
5. Visit a service center near to you and submit a report on your observations on the servicing of a specific automobile electrical system.
6. Write a Slip test (Objective type)
7. The faculty is advised to conduct an identification parade of auto electrical components and conduct a viva-voice examination.
8. Study a specific model of electric vehicle and submit a report.
9. Procure the components of a lead acid battery and share your knowledge with your classmates.
10. Prepare a wiring circuit of a functionary system of a four wheeler as a micro project.

SUGGESTED LEARNING OUTCOMES:

On completion of the course of instruction the student shall be able to

1.0 Comprehend the basic Electrical units of current, voltage, power, energy and Electromagnetic induction

1.1 State and explain Ohm's Law

1.2 Define AC & DC.

1.3 Differentiate between series and parallel electrical circuits

1.4 Compute the resistance of a conductor for a given length, area and resistivity.

1.5 Define Magnetic Field, Magnetic Flux, and Magnetic Flux Density.

1.6 Comparison between Magnetic circuit and Electrical circuit.

1.7 State the Faraday's laws of electromagnetic induction.

1.8 State Fleming's Right hand rule

1.9 State Lenz's law

1.10 Distinguish between self and mutual inductance.

1.11 Calculate inductance of a given coil.

1.12 State the Energy stored in a magnetic field (only formula)

1.13 Describe the Lifting power of a magnet (no derivation)

2.0 Explain the need of a battery in an automobile

2.1 Classify the batteries

2.2 List different types of batteries used in automobile

2.3 Explain the Constructional features of a lead acid battery

2.4 Narrate the Constructional details of a Li-ion battery

2.5 Write the Chemical reaction during charging and discharging in a lead acid battery

2.6 Write the specifications of a battery based on Ampere-hour efficiency and Watt-Hour efficiency.

2.7 Explain the procedure for Charging of Lead acid and Li-ion batteries, including trickle charging.

2.8 Narrate the Battery tests – Voltage test, Specific gravity test, High discharge test, Cadmium cells test

2.9 Outline the Care and maintenance of Lead acid battery and Li-ion battery.

2.10 Explain the working of a Fuel cell.

2.11 Advantages and Limitations of Li-ion battery over lead acid cell battery

3.0 Narrate the Need of Non polluting or Zero Emission Vehicles

3.1 Give the Introduction to Electric drive Vehicles

3.2   Draw the Layout of a typical Electric Vehicle

3.3   List of classify the types of Electric vehicles based on the types of drive motors used

3.4   Enumerate the types of drive motors used for Electric vehicles

3.5   Explain the procedure for Electronic control of the drive motors

3.6   Write the need of Hybrid Vehicles and Types of hybrid drives.

3.7   Advantages and Limitations of EV's over Conventional vehicles.

4.0   Comprehend the Automobile Electrical wiring systems, Lighting and Accessories

4.1   Wire-Harness and need of a wiring harness.

4.2   Explain the constructional details of sealed beam head light.

4.3   Describe the adjustment of head lights.

4.4   Draw neat sketch of wind screen wiper and explain in brief

4.5   Explain in brief the working of horn

4.6   Explain the working principles horn, wind screen wiper, Traffic indicator, Flash type directional signals, fuel and oil and water gauge circuits.

5.0   Explain the need of a D.C Motor and Generator in an automobile.

5.1   Explain the Constructional details of D.C Machine.

5.2   Comprehend the procedure for Conversion of D.C Motor into Generator and Vice-versa

5.3   Explain the Characteristics of a D.C series motor

5.4   Explain need for self starter in an automobile.

5.5   Recite the Conditions required for self starter during starting of an engine

5.6   Explain why a series motor is used as self starter

5.7   Describe the Constructional details of self starter and solenoid switch

5.8   Explain the working of Bendix drive mechanism

5.9   Outline the working of Folo- through drive

5.10 Summarize the working of Lucas drive

5.11 Comprehend the working of over running clutch drive.

5.12 Explain the Working Principle and constructional details of an Alternator

5.13 Recite the Limitations of D.C. Generator and Advantages of using alternator

5.14 Identify the Need Rectification of AC to DC

5.15 Explain the working of Half –wave rectifier and Full-wave rectifier

5.16 Narrate Basic Principles of charging using block or line diagram

5.17 Explain the Needof voltage regulation and working of an electronic voltage regulator.

5.18 List the types of D.C Motors.

5.19 Name the types of D.C Generators.

5.20 Transistor -Types -NPN, PNP –Operation -Applications.

5.21 Define the terms Cycle, Time period & Frequency

5.22 Working of Cut-Out.

5.23 Define Diode-Operation-VI Characteristics.

6.0 List the Requirements of ignition system

6.1 Write Types of ignition system

6.2 Constructional details and working of coil ignition systems with circuit diagram.

6.3 Know the Function of each component and their constructional details of a coil ignition system.

6.4 Identify the importance of Ignition Timing on the performance of the engine.

6.5 Explain Advance and Retarding of ignition timing- Automatic advance mechanisms

6.6 Specify a spark plug

6.7 List Types of spark plugs

6.8 Explain the Working of Electronic ignition and Transistorized (CDI) ignition systems

6.9 List the Advantages over conventional ignition system.

6.10 Define Relay &Types.

6.11 Define Fuses &Types.

CO and PO Mapping Matrix:

	Course Outcome	CL	Linked PO	Teaching periods
CO1	Summarize the fundamentals of Electrical Engineering	R/U	1,2	14
CO2	Comprehend the working, care and maintenance of an automobile battery.	R/U/A	1,2	08
CO3	Explain the function of each component in charging system of a vehicle	R/U/A	1,2	12
CO4	Illustrate the working of automobile Ignition system	R/U/A	1,2	08
CO5	Elaborate the working of starting system used in a vehicle.	R/U/A	1,2	10
CO6	Interpret the components of lighting and accessories of an automobile.	R/U/A	1,2	08

OVER VIEW OF CONTINUOUS INTERNAL 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	

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
Assignment	Any one Unit	5	Different group assignments of Higher order Questions that develop problem solving skills and critical thinking should be given
Seminar		5	Any topic approved by the faculty

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

Time: 1hr _____   **Max Marks: 20**

PART-A   Short answers questions

Answer All Questions. Each question carries ONE mark   **4 x1 = 4 Marks**

1. Define a) Voltage   b) Resistance?
2. State ohm's law?
3. What is the necessity of Battery in an Automobile?
4. List the types of Batteries?

PART-B ___ _____   Essay type questions

Answer any TWO Questions by choosing either (a) or (b) from each question.
Each question carries THREE marks   **2 x 3 = 6 Marks**

5. (a) State the Faraday's laws of electromagnetic Induction?
5. (b) State Fleming's Right hand rule?

6. (a) State the ampere hour and watt-hour efficiency of the battery?
6. (b) List and explain different methods of charging of battery?

PART-C   Application type questions

Answer any TWO Questions by choosing either (a) or (b) from each question.
Each question carries THREE marks   **2 x 5 = 10 Marks**

7. (a) Describe the working of PNP Transistor?
7. (b) State the use of Transistor as an amplifier?
8. (a) Explain any one method of testing of a lead acid battery for fully charged and discharged condition?

8. (b) Explain the care and maintenance of an automobile battery ?

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

Time: 1hr _____ **Max Marks: 20**

PART-A   Short answers questions

Answer All Questions. Each question carries ONE marks   **4 x 1 = 4 Marks**

1. What is the need of non polluting vehicles?
2. List types of electric vehicles?
3. What is the purpose of headlights?
4. What is navigation system?

PART-B ___   _____   Essay type questions

Answer any TWO Questions choosing either (a) or (b) from each question.
Each question carries FIVE Marks   **2 x 3 = 6 Marks**

5. (a) Draw layout of electric vehicle?
5. (b) Explain the need of hybrid vehicle?
6. (a) Explain construction of sealed beam headlight?
6. (b) Explain electronic engine speed measurement?

PART-C   Application type questions

Answer any TWO Questions choosing either (a) or (b) from each question.
Each question carries FIVE Marks   **2 x 10 = 20 Marks**

7. (a) Explain any one type of electric vehicle?
7. (b) Explain hybrid vehicle?
8. (a) Explain oil pressure measurement?
8. (b) Explain electronic vehicle speed measurement?

Time: 2hrs   **Max Marks: 40**

PART-A

Answer all Questions. Each question carries One mark   **8 x 1 = 8 Marks**

1. Define power?
2. What is the need of non polluting vehicles?
3. State the need of a D.C machine in an automobile?
4. What is the function of condenser in ignition system?
5. State the need for series motor as self starter?
6. Mention the advantages of using alternator?
7. State the specifications of a spark plug?
8. List the types of spark plugs?

PART-B

Answer any FOUR questions choosing either (a) or (b) from each question. 4x3 =12 Marks

9. (a) Explain about care and maintenance of Lead acid battery?
9. (b) Explain the need for self starter?
10. (a) Explain about fuel quantity measuring system?
10. (b) Mention the requirements of ignition system?
11. (a) Explain any one type of starter drive mechanism?
11. (b) Explain the need of voltage regulation?
12. (a) Explain ignition timing?
12. (b) Mention the advantages of electronic ignition system?

PART-C

Answer any FOUR questions choosing either (a) or (b) from each question. 4x5=20 Marks

13. (a) Explain the constructional features of a lead acid battery?
13. (b) Explain the Constructional details of self starter?
14. (a) Explain any one type of electric vehicle?
14. (b) Explain working principle of coil ignition systems with circuit diagram?
15. (a) Explain working Principle of an Alternator?
15. (b) Explain constructional details of D.C Machine?
16. (a) Explain Working of Electronic ignition?
16.(b) Explain constructional details of ignition coil ?

AU-406- Automobile Chassis and Body Engineering Lab

Course Title	Automobile Chassis and Body Engineering Lab	Course Code	AU-406
Semester:	IV	Course Group	Core
Teaching Scheme in Periods (L:T:P)	1:0:2	Credits	1.5
Methodology	Lecture + Assignments	Total Contact periods	45
Continuous Internal Evaluation (CIE)	20+20+20 = 60 Marks	SEE	40 Marks

Course Content and Blue Print of Marks for SEE:

Unit No	Experiment title	Periods	Handling	Manipulation	Precision	Marks weightage	% of Weightage
			Criteria for SEE				
1.	Automobile steering system	3	10	10	20	40	100
2.	Braking system	3	10	10	20	40	100
3.	Independent suspension system	3	10	10	20	40	100
4.	Air suspension system	3	15	15	10	40	100
5.	Rigid axle suspension system	3	15	15	10	40	100
6.	Anti skid braking system	3	15	15	10	40	100
7.	Body denting practice	3	10	10	20	40	100
8.	Body panel riveting.	3	10	10	20	40	100
9.	Manual &Power window mechanism.	3	10	10	20	40	100
10.	Door locking system	3	10	10	20	40	100
11.	Wheel Balancing	3	10	10	20	40	100
12.	Computerised wheel aligner	3	10	10	20	40	100
13.	Painting of automobiles	6	10	10	20	40	100
14.	Tests	3 Periods					
	Total	45 Periods					

Prerequisites:

This course requires the basic knowledge of Basic Automobile Engineering Laboratory

Course Outcomes:

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

CO1	Perform sequential dismantling and assembling of steering system and study the parts.
CO2	Perform sequential dismantling and assembling of , braking system and study the parts.
CO3	Perform sequential dismantling and assembling of suspension system and study the parts.
CO4	Understand sequential procedure of denting practice of a car body.
CO5	Comprehend the painting operation of a car body.
CO6	Perform the procedures for wheel alignment and wheel balancing.

Course Contents:
LIST OF EXPERIMENTS

1. Dismantle the given steering system of an automobile and study the working of the system.
2. Study the Braking system of the given automobile and report the type and its working.
3. Identify the given Independent suspension system of an automobile and report the type of suspension system and its working.
4. Study the given Air suspension system in automobile and report on its working.
5. Identify the given Rigid axle suspension system of the automobile and report on its working and lubrication.
6. Study the working of anti skid braking system of the given automobile and submit a report on its constructional details and working.
7. Identify the special tools used for body dent removal and practice removal of dent on a vehicle body.
8. Practice riveting of vehicle body panels and study the tools and equipment used.
9. Study the Manual and Power window regulating mechanisms of given vehicles and submit your observations on construction and working.
10. Comprehend the door locking system used in the given automobile and submit your report.
11. Dismantle the wheels from the vehicle and balance all the wheels of the vehicle.
12. Conduct wheel alignment for the given automobile on the given computerised wheel aligner.
13. Study the given spray painting gun and report on its construction and working.
14. Practice spray painting process and report on the techniques required for proper painting.

The key competencies to be achieved by the student:

S. No	Title of the Experiment	Key competencies expected	Competencies expected
1	Automobile steering systems	(a) Identify the tools and gauges required (b) Dismantling and assembling (c) Servicing and adjustments.	(a) Understand the construction and working (b) Understand the steering systems used in different types of vehicles (c) Understand the grades of oils used in automobile steering systems.
2	Braking systems of automobiles	(a) Identify the tools and gauges required (b) dismantling and assembling (c) Servicing and adjustments (d) Brake bleeding.	(a) Understand the construction and working (b) Understand the braking systems used in different types of vehicles (c) Understand the grades of oils used in automobile brake systems.
3	Independent suspension systems of automobiles	(a) Identify the tools and gauges required (b) Dismantling and assembling (c) Servicing and adjustments	(a) Understand the construction and working (b) Understand the independent Suspension systems used in different types of vehicles.
4	Air suspension system in automobile	(a) Identify the tools and gauges required. (b) Dismantling and assembling. (c) Servicing and adjustments.	(a) Understand the construction and working (b) Understand the air suspension systems used in different types of vehicles.
5	Rigid axle suspension system of automobiles	(a) Identify the tools and gauges required (b) Dismantling and assembling (c) Servicing and adjustments.	(a) Understand the construction and working (b) Understand the rigid axle suspension systems used in different types of vehicles.
6	Anti skid braking system	(a) Identify the tools and gauges required (b) Dismantling and assembling (c) Servicing and adjustments.	(a) Understand the construction And working.
7	Body denting practice	(a) Identify the tool required for body denting repairs (b) Able to repair body repairs.	(a) Able to inspect the body defects
8	Body components riveting and welding.	(a) Identify the tool required For body riveting. (b) Able to riveting the Body panels.	(a) Able to inspect the body riveted joints.

9	Manual &power window mechanism and door locks.	(a) Identify the tools and gauges required (b) Dismantling and assembling (c) Servicing and adjustments.	(a) Understand the construction and working.
10	Computerised wheel aligner and wheel balancer	(a) Identify the equipments, tools and gauges required (b) Able to carry out the wheel balancing and wheel alignment methods on the vehicle with the help of equipment.	(a) Understand the various parameters used in wheel alignment and balance (b) Able to understand the effects of miss alignment and Imbalance of wheel.
11	Paint booth and painting of automobiles.	(a) Identify the equipments, tools and different paints required (b) Able to carry out the painting work in the paint booth. (c) Able to carry out the complete body painting work including spray painting work.	(a) Understand the advantage of paint booth (b) Understand the uses of different kinds of paints and painting materials.

Suggested Student Activities:

i. Visit service station/browse on internet and Collect the information about type of steering systems, brakes, suspension of four wheelers.
ii. Case study of different car bodies.
iii. Student inspects the available equipment in the Laboratory to identify the chassis components.
iv. Visit nearby workshop / service station to familiarize the denting of different parts of vehicle bodies and painting procedure.
v. Student should watch video lessons related to the latest trends in the course.
vi. Student should participate in Quiz
vii. Student should participate in Group discussion
viii. 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	Perform sequential dismantling and assembling of steering system and study the parts.	3	0	0	3	0	1	1	1	0	3
CO2	Perform sequential dismantling and assembling of , braking system and study the parts.	3	0	0	3	0	1	1	1	0	3
CO3	Perform sequential dismantling and assembling of suspension system and study the parts.	3	0	0	3	0	1	1	1	0	3
CO4	Understand sequential procedure of denting practice of a car body.	3	0	0	0	0	0	1	0	0	3
CO5	Comprehend the painting operation of a car body.	3	0	0	0	1	0	0	0	0	3
CO6	Perform the procedures for wheel alignment and wheel balancing.	3	2	0	3	0	0	0	0	0	3

AU-407- AUTOMOBILE POWER TRAIN LAB

Course Title	Automobile Power Train Lab	Course Code	AU-407
Semester	IV	Course Group	Core
Teaching Scheme in Periods (L:T:P)	1:0:2	Credits	1.5
Methodology	Lecture + Practical	Total Contact Periods:	45 Periods
CIE	60 Marks	SEE	40 Marks

Pre requisites

This course requires the basic knowledge of Basic Automobile Engineering 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.	Engine Dismantling and assembling	6	10	10	20	40	100
2.	Lubrication System of a Multi Cylinder Engine	3	10	10	20	40	100
3.	Cooling System of a Multi Cylinder Engine	3	10	10	20	40	100
4.	Gear box dismantling and assembling	6	15	15	10	40	100
5.	Differential dismantling and assembling	6	15	15	10	40	100
6.	Practice on adjusting/changing the different control cables and drive chain of two wheelers	6	15	15	10	40	100
7.	Wheel removal and refitting	3	10	10	20	40	100
8.	Identification of major components in Two-wheeler	3	10	10	20	40	100
9.	Driving Practice Two wheeler	9	10	10	20	40	100
	Total	**45**					

Course Outcomes

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

CO1 :	Perform sequential dismantling and assembling of Engine and inspect the parts.
CO2 :	Identify the components of gear box after dismantling inspect and assemble.
CO3 :	Adjust the control cables and drive chain of two wheeler.
CO4 :	Perform driving of two wheeler.

Course Content

LIST OF EXPERIMENTS

1. Dismantle a given I.C. Engine and identify various basic components such as Cylinder, Cylinder block, Cylinder heads, Piston, Piston rings, Connecting rod, Crank shaft, Valves and various Valve actuating mechanisms, Timing gears, Crankcase, Spark plug, Fuel pump, Carburetor, Fuel Injector, Fuel Injection pump.
2. Demonstrate the lubrication system of a multi cylinder engine with the aid of a chart or simulator.
3. Demonstrate the cooling system of a multi cylinder engine with the aid of a chart or simulator.
4. Dismantling and Assembling of a gear box (synchromesh)
5. Dismantling and Assembling of a Differential
6. Practice on adjusting/changing the different control cables and drive chain of two wheelers.
7. Practice on removing and refitting of wheel from vehicle and identify tyre and disc specifications.
8. Identification of major components in Two-wheeler.
9. Practice driving on the given two wheeler.

The competencies and key competencies to be achieved by the student :

S NO	Title of the Experiment	Key Competencies	Competencies
1	Engine Dismantling and assembling	1. Dismantle the Engine 2. Assembling the Engine 3. Check the Running Condition Of the engine.	1. Identify the tools required for Dismantling. 2. Use Of appropriate tools dismantle the engine parts and keep the parts without damage in order. 3. Clean all the parts with appropriate tool / medium. 4. Assemble all the parts in order. 5. Check the running condition of the engine.
2	Lubrication System of a Multi Cylinder Engine	Identify the major components of Lubrication system of a multi cylinder engine.	1. Draw a line diagram of a Lubrication System of a given Multi Cylinder Engine
3	Cooling System of a Multi Cylinder Engine	Identify the major components of Cooling system of a multi cylinder engine.	1. Draw a line diagram of a Cooling System of a given Multi Cylinder Engine
4	Gear box dismantling and assembling	Identifying proper meshing of gears	1. Identify the tools required for dismantling the component. 2. Use of appropriate tools dismantle the component 3. Keep the dismantled parts without any damage in order 4. Clean all the parts with appropriate tool / medium 5. Assemble the component 6. Check and bring to the operating condition
5	Differential dismantling and assembling	Identify the components of differential	

6	Practice on adjusting/changing the different control cables and	Dismantle the components	Identify the tools required for dismantling the component.
7	Wheel removal and refitting	Practice to loosen and fasten the wheel nuts in correct order	Identify the proper jack locating points for lifting the vehicle. Identify the specifications of tyre and disc.
8	Identification of major components in Two-wheeler	Identify the various 2-wheelers	Identify the various components of 2-wheelers
9	Practice driving on the given two wheeler	Operate Controls Driving Controls Operate all the above Controls Simultaneously	1. Identify the Controls of a two Wheeler i.e, accelerator, brake and clutch 2. State the Purpose of controls. 3. Operate the controls efficiently 4. Operate the steering efficiently 5. Operate to change of gear by gear Shift lever 6. Identify the various accessories like Horn, lights and Indicators. 7. Operate all the above Controls Simultaneously.

Suggested Student Activities:

1. Visit service station and Collect the information about type of gear box and gear ratios used in four wheelers.
2. Case study of major Indian models of motorcycles and scooters.
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:

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

CO PO Mapping Matrix

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	Perform sequential dismantling and assembling of Engine and inspect the parts.	3	0	0	3	0	0	0
CO2	Identify the components of gear box after dismantling inspect and assemble.	3	0	0	3	0	0	0
CO3	Adjust the control cables and drive chain of two wheeler.	3	0	0	3	0	0	0
CO4	Driving the given two wheeler.	3	0	0	1	2	0	2

AU-408- STRENGTH OF MATERIALS AND FLUID MECHANICS LAB

Course Title	Strength of Materials and Fluid Mechanics Lab	Course Code	AU-408
Semester	IV	Course Group	Core
Teaching Scheme in Periods (L:T:P)	1:0:2	Credits	1.5
Methodology	Lecture + Practical	Total Contact Periods:	45 Periods
CIE	60 Marks	SEE	40 Marks

TIME SCHEDULE

Sl. No.	Major Topics	Periods
(i)	Strength of Materials Lab practice	27
(ii)	Fluid Mechanics Lab practice	18
	Total	45

Unit No	Unit name	Hours/ Periods	Questions for SEE			Marks weightage	%Weightage
			Handling	Manipulation	Precision		
1.	Conduct test on ductile material for finding yield points and Young's modulus.	6	10	10	20	40	100
2.	Torsion Test on Mild steel	6	10	10	20	40	100
3.	Bending and deflection Test for steel	6	10	10	20	40	100
4.	Determine Rockwell hardness number for materials like Mild steel, Aluminum	3	10	10	20	40	100
5.	Determine the resistance of materials to impact loads by conducting IZOD's Test.	6	10	10	20	40	100
6.	Bernoulli's Theorem-Proof verification.	6	10	10	20	40	100
7.	Application of Venturi meter.	6	10	10	20	40	100
8.	Study of reciprocating/Rotary Pump available and conduct load test on it.	6	10	10	20	40	100

NOTE:

1.   **Sessional Marks will be 20 in each laboratory**

2. **The End Examination will be conducted separately in both laboratories.**

3. **Internal assessment marks will be awarded based on the performance of the candidate in each laboratory**

4. **Both labs has to be passed at a time otherwise they have to appear for both exam even though they passed in any one of them**

(A) (I) List of Experiments in S.M. LAB.

1. Test on ductile material and finding Young's Modulus ,Yield Points ,Percentage Elongation and percentage reduction in area. Draw stress–strain diagram using Mechanical Extensometers and Universal Testing Machine

2. Torsion Test on Mild steel-Determination of relation between Torque and Angle of twist. Determination of Shear Modulus.

3. Bending and Deflection Test for steel – Determination of Young's Modulus for steel.

4. To determine Rockwell hardness number for materials like Mild steel, Aluminum etc.

5. To determine the resistance of materials to impact loads by conducting IZOD's Test.

The competencies and key competencies to be achieved by the student

S. No	Title of the experiment	Competencies expected	Key competencies
1.	Conduct test on ductile material for finding yield points and Young's modulus.	1. To understand Young's modulus 2. To understand yield point 3. To understand percentage elongation 4. To understand stress-strain diagram	1. To use UTM by fixing specimen between the jaws. 2. Must be able to measure the elongation and load.
2.	Torsion Test on Mild steel	1. To understand about torsion 2. To measure angle of twist 3. To understand shear Modulus	1. Able to measure load and angle of twist on the torsion machine
3.	Bending and deflection Test for steel	1. To understand bending and deflection. 2. Able to fix the specimen on Bend test machine. 3. Able to draw the graph between load vs deflection 4. Able to draw the graph vs different spans and deflections for a given load	1. Able to measure and apply different loads on the specimen and concerned deflections on the machine.
4.	Determine Rockwell hardness number for materials like Mild steel, Aluminum	1. To understand hardness 2. Able to measure the load on specimen and depth of indentation	1. Able to fix the specimen and operate the machine. 2. Able to use the formula for finding Rockwell hardness number
5.	Determine the resistance of materials to impact loads by conducting IZOD's Test.	1. Understand the resistance of material 2. Able to fix the specimen on the machine and apply different loads.	1. Able to read the impact load reading after the arm is released on the specimen from a specific height.

(II)   List of Experiments in F.M. LAB.

1. Bernoulli's Theorem-Proof verification.

2. Applications of Venturimeter.

3. Study of Reciprocating/Rotary Pump available and load test on it.

S. No	Title of the experiment	Competencies expected	Key competencies
1	Bernoulli's Theorem-Proof verification.	To understand the Bernoulli's Theorem	(a) Able to write Bernoulli's equation. (b) Able to substitute the values in the Bernoulli's equation
2	Application of Venturi meter.	(a) Able to measure inlet, thought and out let section areas. (b) Calculate the value of discharge in a given time.	(c) Able to measure the volume of the measuring tank. (d) Must calculate potential, kinetic and pressure energy at inlet
3	Study of reciprocating/Rotary Pump available and conduct load test on it.	(a) Able to measure the energy meter reading. (b) Able to calculate the input given to the motor and output delivered by the pump	(a) Able to measure the various readings like pressure, speed, vacuum gauge reading. (b) Able to find out efficiency of the pump.

AU-409- AUTOMOBILE ELECTRICAL LAB

Course Title :	Automobile Electrical Lab	Course Code	AU-409

Semester	IV			Course Group	Core
Teaching Scheme in Periods(L:T:P)	1:0:2			Credits	1.5
Methodology	Lecture + Practical			Total Contact Hours :	45Periods
CIE	60 Marks			SEE	40 Marks

Pre requisites:

This course requires the basic knowledge of Electrical Engineering.

Course Content and Blue Print of Marks for SEE:

Unit No	Unit name	Periods	Criteria and weightage for SEE			Max. Marks	%Weightage
			Handling	Manipulation	Precision		
1	Identification of different Wires, cables, conductors, semiconductors and harnesses used in Automobiles.	3	10	10	20	40	100
2	Identification of different connectors, removing and providing insulation for circuits.	3	10	10	20	40	100
3	Testing of Power cords for Continuity.	3	15	15	10	40	100
4	Identifying A.C. and D.C.Power supply.	3	15	15	10	40	100
5	Preparation of Simple switch Control Circuit	3	10	10	20	40	100
6	Measurement of Current, Voltage and Resistance.	3	10	10	20	40	100
7	Calculation of Resistance of the given cable.	3	10	10	20	40	100
8	Identification of different switches,fuses and relays	3	10	10	20	40	100
9	Soldering Practice.	3	10	10	20	40	100
10	Perform different tests on a given battery and reporting on the condition.	3	10	10	20	40	100
11	Identify various components of Automobile electrical system.	3	10	10	20	40	100
Test-1		3 Periods					
Test-2		3 Periods					

Revision of Experiments	6 Periods
Total	**45 Periods**

Course Outcomes

CO1 :	Remove and Provide insulation of cables.
CO2 :	Measure the voltage, current and resistance of the given circuit.
CO3 :	Prepare Simple switch Control of Circuits.
CO4 :	Identify the various automobile electrical components
CO5:	Calculate the resistance using Ohms Law
CO6:	Prepare and Solder the given wires

Course Contents:

1.0 Practice the Identification different materials in Electrical Laboratory

1.1   Identify Conductors.

1.2   Identify Insulators.

1.3   Identify Magnetic materials.

1.4   Identify different types of Wires and Cable.

1.5   Identify Wiring Harness.

2.0 Identification of different connectors, removing and providing insulation for circuits.

2.1   Remove the insulation for a given circuit.

2.2   Provide new insulation for a given circuit

3.0 Testing of Power cords for Continuity.

3.1   Identify different wiring (including colours) Connection of main wiring harness of

an automobile and test its continuity.

4.0 Practice Identification A.C and D.C Power supply

4.1   Identify A.C or D.C power supply for a given machine.

5.0 Prepare Simple switch Control Circuit

5.1   Prepare a Simple switch Control Circuit.

6.0 Measure Voltage, Current, Resistance

6.1   Practice to Measure Voltage by using Voltmeter.

6.2   Practice to Measure Current by using Ammeter.

6.3   Practice to Measure Voltage, Current and Resistance by using Multimeter.

7.0 Calculate the Resistance of a cable

7.1   Practice to measuring Current, Voltage and calculate resistance using Ohms Law.

8.0 Practice the Identification of different switches and relays

    8.1   Identify different fuses in a fuse box of an automobile.

    8.2   Identify various types of relays of automobile electrical circuits.

    8.3   Identify and test various types of sensors in an automobile by using Multi meter.

9.0 Perform Soldering Practice

    9.1   Practice soldering for a given wires/ components.

10.0   Identify and Perform different tests on battery

    10.1   Identify battery in the given automobile

    10.2   Inspect the condition of battery.

    10.3   Perform Specific gravity test of battery.

    10.4   Perform Voltage test on battery.

    10.5   Report on the condition of the battery

    10.6   Charge the battery if necessary

11.0   Identify various components of Auto electrical system

    11.1   Identify various components of a starter motor.

    11.2   Identify various components of a dynamo/alternator.

    11.3   Identify various components of a wiper motor.

    11.4   Identify various components of a combination switch.

    11.5   Identify various components of an ignition system.

    11.6   Identify various components and their connections of instrument panel.

Suggested Student Activities:

   i.   Visit service station and Collect the information about type of electrical components used in four wheelers.

  ii.   Case study of major electrical components in Automobile.

 iii.   Student inspects the available electrical components used in the Laboratory.

 iv.   Visit nearby workshop / service station to familiarize the specifications of Automobile electrical components.

  v.   Quiz

 vi.   Group discussion

vii.   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		Linked PO	Teaching Hrs
CO1 :	Remove and Provide insulation of cables.	1,2,3,10	03
CO2 :	Measure the voltage, current and resistance of the given circuit.	1,2,3,10	03
CO3 :	Prepare Simple switch Control of Circuits.	1,2,3,10	03
CO4 :	Identify the various automobile electrical components	1,2,3,10	03
CO5:	Calculate the resistance using Ohms Law	1,2,3,10	03
CO6:	Prepare and Solder the given wires	1,2,3,10	03

(**Model Question Paper**)

Mid Sem –I&II

Subject Name: **Automobile Electrical Lab**

Subject Code: **AU-409**

Time: 3 Hour   **Total Marks: 20 M**

Instructions:

   I.   *The examiner is instructed to test the performance of the candidate by adopting lottery system for allocation of the experiment in the list of experiments performed in the laboratory.*

****

1) Identification of different Wires, cables and harnesses used in Automobiles.

2) Identification of different connectors, removing and providing insulation for circuits.

3) Testing of Power cords for Continuity.

4) Identifying A.C. and D.C.Power supply.

5) Preparation of Simple switch Control Circuit

6) Measurement of Current, Voltage and Resistance.

7) Calculation of Resistance of the given cable.

8) Identification of different switches and relays

9) Soldering Practice.

10) Perform different tests on a given battery and reporting on the condition.

11) Identify various components of Automobile electrical system.

(Model Question Paper)

SEMESTER END EXAMINATION

Subject Name: **Automobile Electrical Lab**

Subject Code: **AU-409**

Time: 3 Hour   **Total Marks: 40 M**

Instructions:

I. *The examiner is instructed to test the performance of the candidate by adopting lottery system for allocation of the experiment in the list of experiments performed in the laboratory.*

II. *Answer any One of the following*

III. *All questions carry equal marks*

****

1) Identification of different Wires, cables and harnesses used in Automobiles.

2) Identification of different connectors, removing and providing insulation for circuits.

3) Testing of Power cords for Continuity.

4) Identifying A.C. and D.C.Power supply.

5) Preparation of Simple switch Control Circuit

6) Measurement of Current, Voltage and Resistance.

7) Calculation of Resistance of the given cable.

8) Identification of different switches and relays

9) Soldering Practice.

10) Perform different tests on a given battery and reporting on the condition.

11) Identify various components of Automobile electrical system.

HU -410 – Employability Skills Lab

Course Title	Employability Skills Lab	Course Code	HU-410
Semester	IV	Course Group	Core
Teaching Scheme in Hrs (L:T:P)	1:0:2	Credits	1.5
Methodology	Pair Work, Group Work, Activities, Lecture, Self-Learning	Total Contact Hours	45 (3 contact hours per week)
CIE	60 Marks	SEE	40 Marks

Rationale:

The course is designed to impart employability skills to make the students of diploma get the initial employment, maintain the employment and get better employment, if they wish.

Prerequisites:

The course requires the basic knowledge of vocabulary, grammar, four language learning skills, viz. listening, speaking, reading and writing and life skills.

Course Outcomes

CO1	Comprehend the importance of employability skills and strategies to survive in a job.
CO2	Converse fluently and accurately accordingly in JAM sessions. Group Discussions will enhance the willingness to take the Initiative, accept adaptability in turn developing leadership qualities and Communication Skills.
CO3	Understand purpose and process of interview in turn knowing how to prepare and succeed in interview.
CO4	Making effective presentation, Develop Public speaking skills and learn to make visually attractive PPTs.
CO5	Learn various writing formats useful at workplace and to develop an ability to apply technical information in documentation.
CO6	Build strong workplace relationships by learning workplace etiquette, professional ethics and importance of gender sensitization.

Course Contents

Module 1: Introduction to Employability Skills

Duration: 6 Periods (L 2   P 4)

a. Filling the Curriculum gaps
   i. Attributes and values
   ii. Specific and general skills
   iii. Academic Knowledge and Aptitude Skills
   iv. Analytical skills / Data Analysis
b. How to get into a job?
   i. Good personal presentation and attitude
   ii. Core generic skills
   iii. Technical / Professional skills

iv. Good Communication skills
c. How to survive in a job?
    i. Learning skills needed for self-advocacy and networking
    ii. Adaptability to cope with the changing circumstances.
    iii. Reliability and Integrity
    iv. Continuous Learning and Consistency in performance.

Module 2: JAM & Group Discussion

Duration: 9 Periods   (L 3   P- 6)

    i. What is JAM?
    ii. Significance of JAM
    iii. Enhancing Speaking skills, fluency, usage, coherence, spontaneity, voice modulation, eye contact, body language, Creativity, Sense of humor, Confidence and Time management.
    iv. Learn avoiding hesitation, deviation and repetition
    v. Purpose of Group Discussion
    vi. Types of Group Discussion
    vii. Different expressions and phases and their effective usage
      a. Opinion expression agrees and disagrees, partially agree or disagree, interrupt politely, add new information and conclusion
    viii. Dos and Don'ts of a Group Discussion
    ix. Importance of body language, Etiquettes and awareness of group dynamics
    x. Practice.

Module 3: Interview Skills

Duration: 9 Periods   (L 3 P 6)

    i. Importance of interview skills
    ii. Types of interviews
      a) Face to Face / One to One, Telephonic / Video, Panel Interview.
    iii. Understanding the process of interview.
      a) Before the interview
      b) On the day of the interview
      c) After the interview
    iv. FAQs, Common expressions of an interviewer and interviewee
    v. Acceptable and unacceptable gestures. Body language, and Attire,
    vi. Do's and Don'ts of an interview
    vii. Mock Interviews

Module 4: Presentation Skills:

Duration: 9 Periods (L-3 P-6)

    a) Significance of presentation
    b) Types of presentations.
      i. Informative, Instructional, Arousing, Persuasive and Decision-Making
    c) . What makes a good presentation?
      i. Understand, Collect, Organize, Use presentational aids and Practice

d) Tips for an effective presentation
  i. Good Beginning – Greeting, Confidence, Body Language, Opening Ideas (Funny Videos, Ridicule. Asking Questions, Quote someone/Proverb or telling a story/referring an historical event)
  ii. Unveiling – Develop systematically, usage of appropriate linkers or discourse markers. Eye contact and Effective usage of PPTs
  iii. Conclusion – Summarize - Giving time to the audience for queries and Time management
e) Guidelines for PPTs
f) Public Speaking Skills
  i. Benefits – Personal and Professionals.
  ii. Strategies to improve public speaking skills.
  iii. Obstacles to effective public speaking.
  iv. Overcoming the barriers of public speaking.
g) Prepare presentation template.

Module 5: Writing Skills at Workplace:

Duration: 6 Periods   (L – 2 P – 4)

a) Various writing formats useful at workplace
b) Skills involved in writing at workplace
c) Different templates for different purposes
d) Useful technical information in documentation

Module 6: Workplace Awareness

Duration 6 Periods   (L – 2 P – 4)

a) Workplace etiquette
b) Knowledge, skills and attributes useful at workplace
c) Workplace Relationships
d) Professional ethics
e) Importance of gender sensitization
f) Sense of responsibility towards the society

Suggested Student Activities:

- Paper Presentations
- Seminars
- Mock Interviews
- Telephonic Interviews
- Group Discussions
- Role Plays
- Creating advertisements
- Five-minute activities
- Creating a model of workplace

Course Outcomes

CO1	Comprehend the importance of employability skills and strategies to survive in a job.
CO2	Converse fluently and accurately accordingly in JAM sessions. Group Discussions will enhance the willingness to take the Initiative, accept adaptability in turn developing leadership qualities and Communication Skills
CO3	Understand purpose and process of interview in turn knowing how to prepare and succeed in interview.
CO4	Making effective presentation, develop public speaking skills and learn to make visually attractive PPTs.
CO5	Learn various writing formats useful at workplace and to develop an ability to apply technical information in documentation.
CO6	Build strong workplace relationships by learning workplace etiquette, professional ethics and importance of gender sensitization.

CO-PO Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Mapping POs
410.1	-	-	-	-	3		3	5,7
410.2	-	-	-	-	3	2	3	5,6,7
410.3	-	-	-	-	3	3	3	5,6,7
410.4	-	-	-	-	2	2	3	5,6,7
410.5	-	-	-	-	2	2	3	5,6,7
410.6		-	--	--	2		3	5,7

Evaluation Pattern:

I. Continuous Internal Examination: **60 Marks**

    a. **Mid Sem - I**   20 marks
        Syllabus:
            i. Introduction to Employability skills
           ii. JAM & Group Discussion
    b. **Mid – II**   20 Marks
        Syllabus:
            i. Interview Skills
           ii. Presentation skills

    c. **Internal assessment**   20 marks

        i. Seminars: 10 marks
        ii. Assignments: 5 marks
        iii. Lab record submission: 5 marks

II. Semester End Examination: **40 Marks**

    a. Write an essay on a given topic or participate in an activity: 15 Marks
    b. Interview or Group Discussion: 15 Marks
    c. *Viva Voce*   10 marks

References:

Adair, John. *Effective Communication*. London: Pan Macmillan Ltd., 2003.

Ajmani, J. C. *Good English: Getting it Right*. New Delhi: Rupa Publications, 2012.

Amos, Julie-Ann. *Handling Tough Job Interviews*. Mumbai: Jaico Publishing, 2004.

Collins, Patrick. *Speak with Power and Confidence*. New York: Sterling, 2009.

Fensterheim, Herbert and Jean Baer. *Don't Say Yes When You Want To Say No*. New York: D

Raman, Meenakshi & Sangeeta Sharma. *Technical Communication: Principles and Practice*. Second Edition. New Delhi: Oxford University Press, 2011

E-Learning Resources:

http://www.dailywritingtips.com/
http://www.englishdaily626.com/c-errors.php
http://www.owlnet.rice.edu/~cainproj/
http://www.thehumorsource.com/
http://www.indiabix.com/group-discussion/topics-with-answers/
http://networketiquette.net/
https://public.wsu.edu/~brians/errors
http://www.bbc.co.uk/worldservice/learningenglish/radio/specials/15

Unit No	Unit name	Periods	Questions for SEE			Marks weightage	%Weightage
			R	U	A		
1.	Introduction to Employability Skills	6			2	2	
2	JAM/ Group Discussions	9			2	2	
3	Interview Skills	9			2	2	
4.	Presentation Skills	9			2	2	
5.	Writing skills at work place	6			1	1	
6.	Workplace awareness	6			1	1	
	Total	**45**			**10**		**100**

Time: 1 Hour _____ **Total Marks: 20**

Part – A   **10 marks**

Instruction: Answer any one of the following questions.

1. Write a paragraph on the importance of employability skills.
2. List out the important employability skills.
3. Mention the different strategies to enhance the employability skills.

Part – B   **10 marks**

Instruction: Answer any one of the following questions.

4. What are the rules to be implemented in a JAM session?
5. What are the do's and don'ts of a group discussion.
6. List out the steps involved in a group discussion and mention some phrases and expressions commonly used.

BOARD DIPLOMA EXAMINATION (C-21)
MID SEMESTER EXAMINATION - II
HU-410- EMPLOYABILITY SKILLS LAB

Time : 1 Hour _____ **Total Marks: 20**

Part – A   **10 marks**

Instruction: Answer any one of the following questions.

1. Write a list of frequently asked questions in an interview. Write the answers for the questions.
2. Mention the instructions to attend a telephonic interview.
3. What are the do's and don'ts for a formal interview?

Part – B   **10 marks**

Instruction: Answer any one of the following questions.

4. Write the various steps involved in making presentations effectively.
5. What are the do's don'ts of body language during a presentation?
6. List out a few audio-visual aids and explain their role in making an effective presentation.

<u>**Time: 3 Hours**</u>   <u>**Total Marks: 40**</u>

Part – A   **10 marks**

Instruction: *Pick any one question from the given lot.*

1. How are employability skills helpful to secure a good job?
2. Describe the steps involved in JAM and group discussion.
3. Write the guidelines involved in making a good presentation.
4. List few professional ethics useful at workplace.
5. Mention few skills involved in writing at workplace.

Part – B   **15 marks**

6. Interview / Group Discussion

Part – C   **15 marks**

7. *Viva Voce*

AU-411 SKILL UPGRADATION

Course Title	Skill Upgradation	Course Code	AU-411
Semester	III	Course Group	Core
Teaching Scheme in Hrs(L:T:P)	0:0:8	Credits	2.5
Methodology	Lecture + Practice	Total Contact Hours	120

AU-402

1. Student visits Library to refer to Automobile Manuals to find the various steering systems used in automobiles.

2. Student inspects the available equipment in the Laboratory to identify the different chassis components and vehicle body components.

3. Students to browse the online latest developments related to the course.

4. Student should observe the different types vehicles in respect of bodies and present a seminar or publish a paper.

5. Student should visit the service station and identify the different types steering mechanisms and present a paper.

6. Quiz

7. Group discussion

8. Surprise test

AU-403

✓ Draw Stress/Strain diagrams for different types of materials and analyze the performance of these metals.
✓ Demonstrate the measurement of pressure head using Pitot tube.
✓ Sketch the bending and deflection diagrams under single point load on a cantilever, simply supported beam and overhanging beam.
✓ Visit any hydraulic power plant and submit a study report.
✓ Verify Bernoulli's using a Pitot tube in a pipe flow and submit a report.
✓ Debate on the applications of Strength of materials in the respective field of engineering.
✓ Seminar on hydraulic circuit.

1. Quiz on the fundamentals of electrical engineering.
2. Visit a substation and submit a report.
3. Give a seminar on the working of any one component of Automobile Electrical Systems.
4. Submit a report on the electrical systems data of an automobile.
5. Visit a service center near to you and submit a report on your observations on the servicing of a specific automobile electrical system.
6. Write a Slip test (Objective type)
7. The faculty is advised to conduct an identification parade of auto electrical components and conduct a viva-voice examination.
8. Study a specific model of electric vehicle and submit a report.
9. Procure the components of a lead acid battery and share your knowledge with your classmates.
10. Prepare a wiring circuit of a functionary system of a four wheeler as a micro project.