

PROGRAMME: B.E.
AUTOMOBILE ENGINEERING
CURRICULUM

SEMESTER 1										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SMTA1101	Engineering Mathematics - I	3	*	0	3	50	50	1
2	Theory	SPHA1101	Physics for Engineers	4	0	0	4	50	50	2
3	Theory	SBTA1101	Environmental Science and Engineering	2	0	0	0	-	-	4
4	Theory	SCSA1103	Programming in C	3	*	0	3	50	50	5
5	Theory	SMEA1101	Engineering Graphics	1	0	4	3	50	50	6
6	Theory	SMEA1203	Fundamentals of Mechanical Engineering	3	0	0	3	50	50	7
7	Practical	SPHA2101	Physics Lab	0	0	2	1	25	25	8
8	Practical	SCSA2104	Programming in C Lab	0	0	4	2	50	50	9
9	Practical	SMEA2101	Computer Aided Design Lab	0	0	4	2	50	50	10
Total Credits for Semester 1 - 21										
Total Marks for Semester 1 - 750										

SEMESTER 2										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SHSA1101	Technical English	3	0	0	3	50	50	11
	Theory	SMTA1201	Engineering Mathematics - II	3	*	0	3	50	50	14
2	Theory	SEEA1101	Basic Electrical and Electronics Engineering	3	*	0	3	50	50	15
3	Theory	SCYA1101	Engineering Chemistry	3	1	0	4	50	50	16
4	Theory	SMEA1202	Engineering Mechanics	3	*	0	3	50	50	17
5	Theory	SAUA1201	Materials and Measurements	3	0	0	3	50	50	18
6	Practical	SCYA2101	Engineering Chemistry Lab	0	0	2	1	25	25	20
7	Practical	SMEA2201	Workshop Practice	0	0	4	2	50	50	21
Total Credits for Semester 2 - 22										
Total Marks for Semester 2 - 750										

L - LECTURE HOURS, T - TUTORIAL HOURS, P - PRACTICAL HOURS, C - CREDITS

CAE - CONTINUOUS ASSESSMENT EXAMINATION,

ESE - END SEMESTER EXAMINATION

SEMESTER 3										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SMTA1301	Engineering Mathematics - III	3	*	0	3	50	50	22
2	Theory	SAUA1301	Applied Thermodynamics	3	*	0	3	50	50	23
3	Theory	SAUA1302	Automotive Petrol Engines	3	0	0	3	50	50	24
4	Theory	SAUA1303	Fuels and Lubricants	3	0	0	3	50	50	25
5	Theory	SMEA1304	Machine Drawing	1	0	4	3	50	50	26
6	Theory	SAUA1304	Solid and Fluid Mechanics	3	*	0	3	50	50	28
7	Practical	SAUA2301	Fuels and Lubricants Lab	0	0	4	2	50	50	29
8	Practical	SMEA2302	Material Testing and Metallurgy Lab	0	0	4	2	50	50	30
Total Credits for Semester 3 - 22										
Total Marks for Semester 3 - 800										

SEMESTER 4										
Sl. No.	Course type	Course code	Course title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SMTA1401	Engineering Mathematics - IV	3	*	0	3	50	50	31
2	Theory	SAUA1401	Automotive Diesel Engines	3	0	0	3	50	50	32
3	Theory	SAIC4001	Industry 4.0	2	0	0	2	50	50	33
4	Theory	SAUA1402	Manufacturing Processes	3	0	0	3	50	50	34
5	Theory	SMEA1402	Mechanics of Machines	3	*	0	3	50	50	35
6	Theory	SAUA1403	Automotive Chassis	3	0	0	3	50	50	36
7	Practical	SAUA2401	Thermal Engineering Lab	0	0	4	2	50	50	37
8	Practical	SMEA2402	Manufacturing Processes Lab	0	0	4	2	50	50	38
Total Credits for Semester 4 - 21										
Total Marks for Semester 4 - 800										

L - LECTURE HOURS, T - TUTORIAL HOURS, P - PRACTICAL HOURS, C - CREDITS

CAE - CONTINUOUS ASSESSMENT EXAMINATION

ESE - END SEMESTER EXAMINATION

SEMESTER 5										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SAUA1501	Automotive Engine Component Design	3	0	0	3	50	50	39
2	Theory	SAUA1502	Automotive Transmission	3	0	0	3	50	50	40
3	Theory	SMEA1503	Finite Element Analysis	3	*	0	3	50	50	41
4	Theory	SAUA1503	Heat Transfer Applied to I.C Engines	3	*	0	3	50	50	42
5	Theory	SAUA1504	Vehicle Body Engineering	3	0	0	3	50	50	43
6	Theory		Open Elective - I (Humanities)	3	0	0	3	50	50	-
7	Practical	S86APT1	Professional Training	0	0	4	2	50	50	-
8	Practical	SAUA2501	Automotive Engine and Chassis Components Lab	0	0	4	2	50	50	44
9	Practical	SAUA2502	Two and Three Wheeler Lab	0	0	4	2	50	50	45
Total Credits for Semester 5 - 24										
Total Marks for Semester 5 - 900										

SEMESTER 6										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SAUA1601	Automotive Electrical and Electronics	3	0	0	3	50	50	46
2	Theory	SAUA1602	Vehicle Dynamics	3	0	0	3	50	50	47
3	Theory		Elective - I	3	0	0	3	50	50	-
4	Theory		Elective - II	3	0	0	3	50	50	-
5	Theory		Open Elective - II	3	0	0	3	50	50	-
6	Practical	SAUA2601	Automotive Electrical and Electronics Lab	0	0	4	2	50	50	48
7	Practical	SAUA2602	Automotive Components Design Lab	0	0	4	2	50	50	49
8	Practical	S86APT2	Interdisciplinary Mini project	0	0	6	3	-	100	-
Total Credits for Semester 6 - 22										
Total Marks for Semester 6 - 800										

L - LECTURE HOURS, T - TUTORIAL HOURS, P - PRACTICAL HOURS, C - CREDITS

CAE - CONTINUOUS ASSESSMENT EXAMINATION

ESE - END SEMESTER EXAMINATION

SEMESTER 7										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SAUA1701	Hybrid and Electric Vehicles	3	0	0	3	50	50	50
2	Theory	SAUA1702	Vehicle Maintenance	3	0	0	3	50	50	51
3	Theory		Elective - III	3	0	0	3	50	50	-
4	Theory		Elective - IV	3	0	0	3	50	50	-
5	Theory		Open Elective - III	3	0	0	3	50	50	-
6	Practical	SAUA2701	Vehicle Maintenance and Reconditioning Lab	0	0	4	2	50	50	52
7	Project	S86APROJ1	Project Work (Phase - I)	0	0	6	3	50	50	-
Total Credits for Semester 7 - 20										
Total Marks for Semester 7 - 700										

SEMESTER 8										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory		Elective - V	3	0	0	3	50	50	-
2	Theory		Elective - VI	3	0	0	3	50	50	-
3	Project	S86APROJ2	Project Work (Phase - II)	0	0	14	7	50	50	-
Total Credits for Semester 8 - 13										
Total Marks for Semester 8 - 300										

L - LECTURE HOURS, T - TUTORIAL HOURS, P - PRACTICAL HOURS, C - CREDITS

CAE - CONTINUOUS ASSESSMENT EXAMINATION

ESE - END SEMESTER EXAMINATION

LIST OF ELECTIVES

PROFESSIONAL ELECTIVE COURSES									
Sl. No.	Course code	Course title	L	T	P	C	Marks		Page No.
							CAE	ESE	
1	SAUA3001	Automotive Air Conditioning	3	0	0	3	50	50	53
2	SAUA3002	Automotive Pollution Control	3	0	0	3	50	50	54
3	SAUA3003	Automotive Aerodynamics	3	0	0	3	50	50	55
4	SAUA3004	Vehicle Design Characteristics	3	0	0	3	50	50	56
5	SAUA3005	Automotive Safety	3	0	0	3	50	50	57
6	SAUA3006	Off Road Vehicles	3	0	0	3	50	50	58
7	SAUA3007	Modern Automobile Accessories	3	0	0	3	50	50	59
8	SAUA3008	Two and Three Wheeled Vehicles	3	0	0	3	50	50	60
9	SAUA3009	Vibration and Noise Control in Automobiles	3	0	0	3	50	50	61
10	SAUA3010	Styling and Modeling of Vehicles	3	0	0	3	50	50	63
11	SMEA3003	Computational Fluid Dynamics	3	0	0	3	50	50	64
12	SMEA3005	Non Destructive Testing and Techniques	3	0	0	3	50	50	65
13	SMEA3009	Product Design and Development	3	0	0	3	50	50	66
14	SMEA3012	Industrial Robotics and Expert Systems	3	0	0	3	50	50	67
15	SAUA3011	Computer Simulation of I.C Engines	3	0	0	3	50	50	68
16	SAUA3012	Fuel Cell and Applications	3	0	0	3	50	50	69
17	SAUA3013	Alternate Fuels and Energy Systems	3	0	0	3	50	50	70
18	SAUA3014	Transport Management	3	0	0	3	50	50	71
19	SMRA3003	Artificial Intelligence	3	0	0	3	50	50	72
20	SMEA1702	Industrial Mechatronics	3	0	0	3	50	50	73

OPEN ELECTIVE COURSES									
Sl. No.	Course Code	Course Title	L	T	P	C	Marks		Page No.
							CAE	ESE	
1	SALA4001	Intellectual Property Law	3	0	0	3	50	50	A1
2	SAEA4001	Fundamentals of Aerospace Technology	3	0	0	3	50	50	A2
3	SBAA4001	Fundamentals of Management	3	0	0	3	50	50	A3
4	SBAA4002	Principles of Management and Professional Ethics	3	0	0	3	50	50	A4
5	SBTA4001	Biology for Engineers	3	0	0	3	50	50	A5
6	SBMA4001	Neurology	3	0	0	3	50	50	A6
7	SBMA4002	Modelling of Physiological Systems	3	0	0	3	50	50	A7
8	SBMA4003	Drug Delivery System	3	0	0	3	50	50	A8
9	SBMA4004	Fundamentals of Mechatronics	3	0	0	3	50	50	A9
10	SBMA4005	Virtuality and Augmented Reality	3	0	0	3	50	50	A10
11	SBMA4006	Medical Optics and Laser Applications	3	0	0	3	50	50	A11
12	SBMA4007	Forensic Science	3	0	0	3	50	50	A12
13	SBMA4008	Artificial Intelligence and Expert Systems	3	0	0	3	50	50	A13
14	SBMA4009	Human Factors in Engineering and Design	3	0	0	3	50	50	A14
15	SCHA4001	Corrosion Engineering	3	0	0	3	50	50	A15
16	SCHA4002	Energy Engineering	3	0	0	3	50	50	A16
17	SCHA4003	Environmental Impact Assessment	3	0	0	3	50	50	A17
18	SCHA4004	Environmental Pollution and Control	3	0	0	3	50	50	A18
19	SCIA4001	Disaster Management	3	0	0	3	50	50	A19
20	SCSA4001	R Programming	3	0	0	3	50	50	A20
21	SCSA4002	5 G Networks	3	0	0	3	50	50	A21
22	SECA4001	Software Tools for Engineering Applications	3	0	0	3	50	50	A22
23	SMEA4001	Resource Management Techniques	3	0	0	3	50	50	A23
24	SMEA4002	Wind and Solar Energy	3	0	0	3	50	50	A24

Semester	Theory courses (including elective courses)			Practical Courses (including PT and project)		
	Total no.	Total Credits	Total Marks	Total no.	Total Credits	Total Marks
1	6	16	500	3	5	250
2	6	19	600	2	3	150
3	6	18	600	2	4	200
4	6	17	600	2	4	200
5	6	18	600	3	6	300
6	5	15	500	3	7	300
7	5	15	500	2	5	200
8	2	6	200	1	7	100
Overall Total	42	124	4100	17	41	1700

Overall total credits for B.E Automobile Engineering	165
Overall total marks for B.E Automobile Engineering	5800

SCSA1103	PROGRAMMING IN C	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- Learn the organization of a digital computer.
- Be exposed to the number systems.
- Learn to think logically and write pseudo code or draw flow charts for problems.
- Be exposed to the syntax of C.
- Be familiar with programming in C.
- Learn to use arrays, strings, functions, pointers, structures and unions in C.

UNIT 1 INTRODUCTION OF C

9 Hrs.

Introduction: Generation and Classification of Computers- Basic Organization of a Computer Algorithms & flowcharts - Overview of C - Features of C - Structure of C program - Compilation & execution of C program - Identifiers, variables, expression, keywords, data types, constants, scope and life of variables, and local and global variables - Operators: arithmetic, logical, relational, conditional and bitwise operators- Special operators: size of () & comma (,) operator - Precedence and associativity of operators & Type conversion in expressions - Input and output statements- solving simple scientific and statistical problems.

UNIT 2 CONTROLS STRUCTURES AND FUNCTIONS

9 Hrs.

Control structures: Conditional statements - Looping statements - Functions: Library Functions - User Defined- Function Prototype - Function Definition - Types of Functions - Functions with and without Arguments-Functions with no return and with Return Values - solving simple scientific and statistical problems- Nested Functions - Recursion.

UNIT 3 ARRAYS AND STRINGS

9 Hrs.

Arrays: Single and Multidimensional Arrays - Array Declaration and Initialization of Arrays Array as Function Arguments. Strings: Declaration - Initialization and String Handling Functions- Simple programs- sorting- searching - matrix operations. Structure and Union: Definition and Declaration - Nested Structures - Array of Structures - Structure as Function Argument - Function that Returns Structure - Union.

UNIT 4 STORAGE CLASS AND POINTERS

9 Hrs.

Storage Class Specifier: Auto, Extern, Static, & Register. Pointers: The '&' and '*' Operators - Pointers Expressions - Pointers arithmetic- Example Problems. Arrays Using Pointers - Structures Using Pointers- Functions Using Pointer - Function as Arguments - Command Line Arguments.

UNIT 5 MEMORY MANAGEMENT AND FILES

9 Hrs.

DMA functions: malloc (), calloc (), sizeof (), free () and realloc (). Pre-processor directives. File management: File operations - opening & closing a file, Read and write binary files ,input and output statements, Control statements.

Max.45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Design C Programs for problems.
- CO2 - Write and execute C programs for simple applications.
- CO3 - To develop programs using the basic elements like control statements, Arrays and Strings.
- CO4 - To solve the memory access problems by using pointers.
- CO5 - To understand about the dynamic memory allocation using pointers which is essential for utilizing memory.
- CO6 - To understand the uses of pre-processors and various header file directives.

TEXT BOOKS/REFERENCE BOOKS

1. Byron S Gottfried, "Programming with C", Schaums Outlines, 2nd Edition, Tata McGraw Hill, 2006.
2. Dromey R.G., "How to Solve it by Computer", Pearson Education, 4th Reprint, 2007.
3. Kernighan B.W. and Ritchie D.M., "The C Programming language", 2nd Edition, Pearson Education, 2006.
4. Balaguruswami. E., 'Programming in C', TMH Publications, 2003.
5. Yashavant P. Kanetkar, 'LET US C', 5th Edition, 2005.
6. Stevens, 'Graphics programming in C', BPB Publication, 2006.
7. Subburaj R., 'Programming in C', Vikas Publishing, 1st Edition, 2000.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

Part A: 10 Question of 2 marks each - No choice

20 Marks

Part B: 2 Questions from each unit of internal choice, each carrying 16 marks

80 Marks

SMEA1101	ENGINEERING GRAPHICS	L	T	P	Credits	Total Marks
		1	0	4	3	100

COURSE OBJECTIVES

- To know the basics of Engineering Graphics.
- To make the student to visualize and read the drawings.
- To make the students to understand the importance of sectioning and concept of development.
- To learn about the orthographic and pictorial projections.

UNIT 1 LETTERING, DIMENSIONING AND GEOMETRICAL CONSTRUCTION**9 Hrs.**

BIS - Lettering - Two systems of dimensioning - Dividing a straight line into any number of equal parts - Bisecting an angle and right angled triangle - Drawing a regular pentagon and hexagon given one side - Conic sections - ellipse, parabola, hyperbola by eccentricity method.

UNIT 2 ORTHOGRAPHIC PROJECTION**9 Hrs.**

Projection - Types of projection - Projection of points lying in four quadrants - Projection of lines (First angle projection only) - Projection of lines parallel and inclined to one or both the planes - Projection of simple solids like prisms, pyramids, cylinder, cone with its axis perpendicular to HP, axis perpendicular to VP, axis inclined to HP, axis inclined to VP.

UNIT 3 SECTION OF SOLIDS**9 Hrs.**

Purpose of sectioning - Sectional views - Hatching - Section plane perpendicular to one plane and parallel to other plane - Section plane inclined to HP - Section plane inclined to VP - True shape of the section

UNIT 4 DEVELOPMENT OF SURFACES**9 Hrs.**

Need for development of surfaces - Types of development of surfaces - Development of pentagonal and hexagonal prisms - Development of cylinders - Development of pentagonal and hexagonal pyramids - Development of cones.

UNIT 5 ISOMETRIC PROJECTION**9 Hrs.**

Isometric view and isometric projection - Isometric scale - Isometric view of circle, cube, square, pentagonal and hexagonal prisms, Isometric view of square, pentagonal and hexagonal pyramids - Combination of two solids - Drawing of orthographic views of objects from their isometric views.

Max.45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1 - Identify the national standards related to the Engineering drawing based on BIS and construct conic sections and polygons.
- CO2 - Draw orthographic projections of points, lines and solids.
- CO3 - Draw section of solids and to know the importance of sectioning.
- CO4 - Draw the development of surfaces and its applications in manufacturing industry.
- CO5 - Draw the isometric view of solids and to learn to convert pictorial into orthographic projection.
- CO6 - Visualize and read the Engineering Drawing.

TEXT/REFERENCE BOOKS

1. Engineering drawing practice for schools and colleges, SP 46 - 1988.
(http://web.iitd.ac.in/~achawla/public_html/201/lectures/sp46.pdf).
2. Natarajan, K.V., A Text Book of Engineering Graphics, Dhanalakshmi Publishers, 21st Edition, 2012.
3. Bhatt, N.D., Engineering Drawing Drawing, Charotar Publishing House, 53rd Edition, 2014.
4. Venugopal, K., Prabhu Raja, V., Engineering Graphics, New Age International Publishers, 15th Edition, 2018.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****Part A:** 10 Questions of 2 marks each - No choice**20 Marks****Part B:** 2 Questions from each unit of internal choice, each carrying 16 marks**80 Marks**

SMEA2101	COMPUTER AIDED DESIGN LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To gain practical experience in engineering modeling through computer aided systems.
- To understand the functioning of 2D drafting and 3D modeling software systems.

INTRODUCTION TO CAD

Basics, Fundamentals of feature-based modeling

TWO DIMENSIONAL OBJECTS

Create basic drawing objects: Points, Lines, Circles, Arcs, Planes and their combinations.

Layout and sketching

Setup a drawing with correct scales. Draw with precision using Coordinate input and object Snaps, Isometric drawings, Orthographic projections, Auxiliary views.

Dimensioning, Dimension styles

Various other AutoCAD commands and relevant keyboard shortcuts

THREE DIMENSIONAL OBJECTS

Creating and editing 3D solid objects.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand the fundamentals of computer aided design.
- CO2 - Implement their knowledge in designing a model.
- CO3 - Understand the various limits and tolerances.
- CO4 - Understand various dimensioning styles.
- CO5 - Implement their knowledge to model various 2D and 3D models.
- CO6 - Understand various commands and keyboard shortcuts for faster modelling skills.

SAUA1201	MATERIALS AND MESEAUUREMENTS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the design, selection and processing of materials for a wide range of applications in engineering and other applications
- To understand how and why the properties of materials are controlled by structure and bonding at the atomic scale and by features at the microscopic and macroscopic levels.
- To understand how and why the structure and properties of a material may be controlled by processing.
- To understand the basic principles of measurements
- To learn the various linear and angular measuring equipments, their principle of operation and applications.

UNIT 1 INTRODUCTION TO MATERIALS**9 Hrs.**

Basic Principles: Crystal structure: BCC -FCC -HCP -Methods to determine crystal structure - Atomic radius - Atomic Packing Factor - Allotropy -Solid solutions, Intermetallic compounds, Atomic Diffusion - Laws of diffusion -Factors affecting diffusion. Phase diagrams: Solidification of metals, phase rules, construction of phase diagram, Isomorphous diagram, Eutectic diagram showing partial solid solubility, Peritectic system.

UNIT 2 FERROUS AND NON – FERROUS ALLOYS**9 Hrs.**

Iron - Iron carbide equilibrium diagram, Cooling curves of pure Fe, Critical points in Fe - Fe₃C equilibrium diagrams, Steels – types of plain carbon steels, stainless steels - their typical compositions, properties and applications, effects of alloying elements on steel, IS designation of steels - Cast iron and its types - their typical compositions, properties and applications. Aluminium and its alloys, Ti & its alloys, Nickel & its alloys - Composition, Properties & applications.

UNIT 3 HEAT TREATMENT OF STEEL**9 Hrs.**

Annealing - Full annealing - Stress relief - Recrystallization - Spheroidizing, Normalizing, Hardening, Tempering, Austempering, Martempering - Hardenability and its determination, TTT diagram and CCT diagram. Case hardening techniques - Carburizing, Nitriding, Cyaniding, Carbonitriding, Flame and Induction hardening, Agehardening, Precipitation hardening

UNIT 4 INTRODUCTION TO METROLOGY AND LINEAR MEASUREMENT**9 Hrs.**

Accuracy, precision, resolution and sensitivity of measuring instruments, classification of errors in measurements, alignment errors. Linear Measuring Instruments - Evolution - Types - Classification - gauge design - concepts of interchangeability and selective assembly - Comparators, slip gauges - Types - Angular measuring instruments - Sine bar, angle gauges, autocollimator, angle dekkor, tool maker's microscope, Bevel protractor, clinometers, spirit levels- Alignment telescope - Applications, Surface roughness measurement.

UNIT 5 TEMPERATURE, FLOW AND ADVANCED MEASUREMENT TECHNIQUES**9 Hrs.**

Temperature - thermo couple, RTD, thermistor-electrical resistance thermometer- pyrometers. Flow - Turbine type flow meter, magnetic flow meter, ultra sonic flow meter, thermalflow meter and hot wire anemometer. : Venturimeter, Orifice meter, Rotameter, Pitot tube - Temperature: bimetallic strip. Interferometry - laser interferometers - types - applications - Computer Aided Inspection-Basic concept of Coordinate Measuring Machines(CMM)- Types of CMM - Constructional features-Probes- laser interferometer, working principle, applications, alignment and errors; Machine Vision, elements of vision system, applications in manufacturing.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1 - Acquire knowledge of physical and mechanical properties of materials including heat treatment, destructive and non-destructive testing of materials.
- CO2 - Recognize and state the Iron-Carbide phase diagram and TTT Diagrams sufficiently to visualize them in discussions of heat treatment of steels and cast irons.
- CO3 - Select appropriate materials for specific engineering applications considering manufacturing and working conditions
- CO4 - Describe structures of metallic materials and their effects on mechanical properties
- CO5 - Understand the significance of measurement system, errors.
- CO6 - Check alignment of various components in various mechanisms using advanced measurement tools.

TEXT / REFERENCE BOOKS

1. Avener S.H, "Introduction to Physical Metallurgy", 2nd Edition, McGraw Hill, Indian Edition, 2017.
2. Raghavan V, "Material Science and Engineering", 5th Edition, Prentice Hall, 2005.
3. William D Callister "Material Science and Engineering", John Wiley and Sons 2007.
4. Khurmi.R.S, Sedha R.S, "Material Science", 4th Edition, S.Chand & Co., 2009
5. Dieter.G.E, "Mechanical Metallurgy", 3rd Edition, McGraw Hill, 1988.
6. Beckwith T.G. and Marangoni, "Mechanical Measurements", Addison Wesley, 2000.
7. Gupta I C, "Text Book of Engineering Metrology", Dhanpat Rai Publishers, 2003.
8. Jain R.K., "Engineering Metrology", Khanna Publishers, 2009.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each - No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SMEA2201	WORKSHOP PRACTICE	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVE

- To provide the students with hands on experience on different trades of engineering like Plumbing work, fitting, carpentry, Foundry, welding and sheet metal.

PLUMBING WORKS:

- Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, and elbows in household fittings.
- Study of pipe connections requirements for pumps and turbines.
- Preparation of plumbing line sketches for water supply and sewage works.
- Hands-on-exercise: Basic pipe connections - Mixed pipe material connection - Pipe connections with different joining components.
- Demonstration of plumbing requirements of high-rise buildings.

CARPENTRY

Handling of carpentry tools, A practice in marking, sawing planning and chiseling to size. Making simple joints such as half-lap, dove-tail and mortise and tenon joints.

Use of modern materials such as plywood, chip board, novapan, laminated sheet (Demonstration only)

FITTING

Use of fitting tools-practice in marketing, fitting to size and drilling-making of simple mating and profiles such as V, Square, Dove-tail, Half-round joints.

WELDING

- Electric Arc Welding
 - Study on Edge preparation techniques for Arc welding
 - List of Welding Exercises
 - Lap Joint 2. Butt Joint 3. Fillet Joint 4. Tee Joint 5. V Joint 6. Corner Joint
- Study on gas welding and gas cutting
- Study on TIG & MIG welding

FOUNDRY

- Sand testing - Grain fineness - Permeability test.
- Study on Pattern Allowances
- Preparation of green sand moulding
 - Flanges 2. Glands 3. Bush 4. Dumbbell
- Metal casting technique (Demonstration only)

SHEET METAL

Tools and equipments- practice.

Making rectangular tray, hopper, scoop, etc.

Mini project - Fabrication of a small cabinet, dust bin, etc.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - To work with various components used in fluid flow pipelines and to make connections for various applications suitably.
- CO2 - To handle carpentry tools for wood working.
- CO3 - To perform various fitting operations
- CO4 - To make precise weld joints using arc and gas welding processes
- CO5 - To make mould precisely and to place runner, riser at suitable places also they understand how to provide various allowances.
- CO6 - To handle sheet metal tools for making various sheet metal components.

SAUA1302	AUTOMOTIVE PETROL ENGINES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To learn the fundamental principles and operation of Engine.
- Understand SI engine fuel feed system.
- Understand the ignition system in SI Engine
- Gain knowledge on cooling and lubrication system in SI Engine
- Understand the combustion system in SI Engines.
- Understand the abnormal combustion in SI engine

UNIT 1 ENGINE CONSTRUCTION AND OPERATION**9 Hrs.**

Constructional details of four stroke petrol engine, working principle, air standard Otto cycle, actual indicator diagram, fuel air analysis, two stroke engine construction and operation, comparison of four stroke and two stroke engines operation, firing order and its significance. Theoretical and actual Port Timing, Valve Timing of petrol engines.

UNIT 2 SI ENGINE FUEL SYSTEM**9 Hrs.**

Carburetor working principle, requirements of an automotive carburetor, Solex, S.U, Carter carburetor. starting, idling, acceleration and normal circuits of carburetors. Compensation, maximum power devices, constant choke and constant vacuum carburetors, fuel feed systems; mechanical and electrical fuel feed pumps. Petrol injection, GDI, MPFI.

UNIT 3 IGNITION SYSTEM**9 Hrs.**

Types and working of battery coil and magneto ignition systems, relative merits and demerits, centrifugal and vacuum advance mechanisms. Types and construction of spark plugs, electronic ignition systems- Transistorized coil ignition system Capacitive discharge ignition system.

UNIT 3 COOLING AND LUBRICATION SYSTEM**9 Hrs.**

Need for cooling system, Types of cooling system: air cooling system, liquid cooling system, Comparison, forced circulation system, pressure cooling system. Lubrication system- Requirements, mist, wet sump lubrication system, properties of lubricants.

UNIT 4 COMBUSTION AND COMBUSTION CHAMBERS**9 Hrs.**

Combustion in SI engine; stages of combustion, flame propagation, rate of pressure rises, abnormal combustion, detonation, effect of engine variables on knock, knock rating. Combustion chambers; different types, factors controlling combustion chamber design.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand the operational principle of two stroke & four stroke engine and recall the Otto cycle process in details
- CO2 - Explain the SI engine fuel feed system.
- CO3 - Explain the battery, magneto & electronic ignition system in SI engine.
- CO4 - Explain the principle of cooling & various lubrication system in SI engine.
- CO5 - Analyse the combustion phenomena in SI engine & explain types of SI engine combustion chamber.
- CO6 - Analyse the effect of engine variables on knocking in SI engine.

TEXT / REFERENCE BOOKS

1. Ganesan V, "Internal Combustion Engines", 4th Edition, Tata McGraw Hill Publication, 2017.
2. Rajput R. K, "A textbook of Internal Combustion Engines", 3rd Edition Laxmi Publications, 2016.
3. Mathur and Sharma "Internal Combustion Engines" "Dhanpat Rai and Sons Publication, 2012.
4. John B. Heywood, "Fundamentals of Internal Combustion Engine, 2nd Edition, McGraw Hill Education; 2018.
5. Heinz Heisler, "Advanced Engine Technology", 2nd Edition SAE Publication, 2010.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 2 Questions from each unit, each carrying 2 marks**20 Marks****PART B:** 2 Questions from each unit with internal choice, each carrying 16 marks**80 Marks**

SMEA1304	MACHINE DRAWING	L	T	P	Credits	Total Marks
		1	0	4	3	100

COURSE OBJECTIVES

- To understand and apply national standards while drawing machine components based on BIS.
- To understand the conventions, abbreviations and symbols to be followed by Engineers for making assembly drawings.
- To make the students to understand sectioning and concept of limits, fits and tolerances used for component design.
- To understand surface texture, riveted joints, welded joints, keys.
- To know various thread forms and its engineering applications.
- To make the students learn to draw the assembly, orthographic and sectional views of various machine components and to interpret the assembly drawing.

DETAILED CONTENTS**1. Conventions, Abbreviations and Symbols**

Conventional representation of shaft, hollow shaft, bar - Conventional representation of common machine elements such as threads, slotted head, bearings, straight and diamond knurling, holes on a linear and circular pitch, helical spring, leaf spring – Conventional representation of metals, glass, packing and insulating materials, liquids, concrete and wood - Conventional representation of screw, rivet and pin in section. Abbreviations for iron, carbon steel, alloy steel - Abbreviations for across corners, across flats, assembly, bearing, center of gravity, counterbore, countersunk, insulation, left hand, right hand, nominal, pitch circle diameter, tolerance, undercut.

2. Sectional Views

Full section, half section, partial or local section, revolved or superimposed section, removed section, successive section, parts that are not sectioned.

3. Limits, Fits and Tolerances

Definitions: Limits, Fits and Tolerances - Upper limit, lower limit, tolerance, deviation, upper deviation, lower deviation, tolerance zone - Standard tolerance grades - Computation of IT tolerance using formulae and tables - Fundamental deviation - Computation of fundamental deviation - System of fits - Clearance fit - Interference fit - Transition fit - Problems on clearance and interference fit on shaft and hole basis system.

4. Surface Texture

Nominal surface - Roughness - Waviness - Lay - Sampling length - Indication of surface roughness by roughness values, roughness grade number, roughness symbols - Indication of surface roughness by surface texture symbol with all the characteristics.

5. Threaded Fasteners and Its Applications

Screw thread terminology - Basic forms of screw threads - Standard forms of V threads - Basic form of square threads - Modified forms of square threads - Basic knuckle thread - Standard form of knuckle thread - Conventional representation of internal V thread and external V thread - Square thread - Designation of threads - Empirical proportions of hexagon and square head bolt and nut.

6. Riveted Joints, Welded Joints and Keys

Application of riveted joints - Difference between a bolt and a rivet - Disadvantages of riveted joints - Types of riveted joints - Empirical proportions of riveted joints - Types of welded joints - Symbolic representation of weld - Elementary weld symbols - Keys - Application of keys.

7. Assembly Drawing (using mini-drafter) for the following with part drawings given

Preparation of assembled views from exploded views for the following components: Cotter joint with sleeve, screw jack, snug type pedestal bearing, swivel bearing, tail stock.

Max.45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Identify the national standards related to the machine drawing based on BIS and applying the standards.
- CO2 - Analyze limits and tolerances for assembly and evaluate to choose appropriate fits for the assembly.
- CO3 - Understand and apply surface finish and welding symbols.
- CO4 - Assemble machine components through drawings.
- CO5 - Interpret the machine components and conventions used in the drawing.
- CO6 - Interpret the components such as fasteners, riveted joints, welded joints and keys

TEXT/REFERENCE BOOKS

1. Engineering drawing practice for schools and colleges, SP 46 - 1988 (http://web.iitd.ac.in/~achawla/public_html/201/lectures/sp46.pdf).
2. Gopalakrishnan, K.R., Machine Drawing, Subhas Publications, 16th Edition, 2008.
3. Bhatt, N.D., Machine Drawing, Charotar Publishing House, 48th Edition, 2013.
4. Brian Griffiths, "Engineering Drawing for Manufacture", Kogan Page Science, 2003.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****Part A:** Questions from sections 1 - 6 (Each section 10 marks)**60 Marks****Part B:** One question from section 7 with no choice (Assembly Drawing)**40 Marks**

SAUA2301	FUELS AND LUBRICANTS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To gain in depth knowledge of properties of fuels and lubricants
- To impart the skill of testing fuels and lubricants for their properties using various testing equipments.

SUGGESTED LIST OF EXPERIMENTS

1. Study of International and National standards for fuels and lubricants.
2. Study of Octane and Cetane Number of fuels.
3. ASTM distillation test of liquid fuels
4. Aniline point test of diesel.
5. Calorific value of liquid fuel.
6. Calorific value of gaseous fuel.
7. Reid vapour pressure test.
8. Flash and fire points of petrol and diesel.
9. Copper strip corrosion Test
10. Cloud & pour point Test.
11. Temperature dependence of viscosity of lubricants & fuels by Redwood Viscometer.
12. Viscosity Index of lubricants & fuels by Saybolt Viscometer.
13. Ash content and carbon residue Test.
14. Drop point of grease and mechanical penetration in grease.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand the International and National standards for fuels and lubricants.
- CO2 - Understand distillation of liquid fuels.
- CO3 - Understand the different properties of fuels and lubricants.
- CO4 - Determine the properties of fuels and lubricants using various testing equipments.
- CO5 - Analyze important fuel and lubricant properties for the application in specific conditions.
- CO6 - Compare the values of important physical properties of fuels and lubricants.

SMEA2302	METALLURGY AND MATERIAL TESTING LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To understand the fundamental practices of material testing, such as specimen preparation, micro structural analysis and hardenability.
- To test and evaluate the mechanical properties, such as hardness, stiffness, impact strength, shear strength, torsion strength, tensile strength.

METALLURGY LAB

1. Studying the preparation of a specimen for metallographic examination
2. To study the microstructure of plain carbon steel (Low carbon steel, medium carbon steel and high speed steel).
3. To study the effect of heat treatment on plain carbon steel (Annealing, Normalizing and Hardening)
4. To study the microstructure of alloy steels (Stainless steels, Tool steels)
5. To study the microstructure of cast iron (Grey cast iron, white cast iron, malleable cast iron and spheroidal graphite cast iron)
6. To study the microstructure of light alloys (Aluminium alloy and Magnesium alloy)
7. To study the microstructure of heavy alloys (Copper alloy, Nickel alloy)
8. Determine the Hardenability of steel by Jominy end quench testing.

MATERIAL TESTING LAB

1. Hardness test on metals- Brinell, Vicker and Rockwell Hardness tests.
2. Impact test on metals-Charpy, Izod impact tests.
3. Shear test on metals-direct shear strength, single shear, double shear.
4. Deflection test on beams-load deformation characteristics, Young's modulus, Maxwell's reciprocal law verification.
5. Torsion test on beams-torque and angle of twist characteristics, shear stress, modulus of rigidity, energy.
6. Tests on helical springs-compression, tension springs-load deformation characteristics, stiffness, shear stress, modulus of rigidity, energy.
7. Tension test on metals-stress strain characteristics, ductility, resilience, toughness.

SAUA1401	AUTOMOTIVE DIESEL ENGINES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- Understand the diesel engine construction and its operation.
- Understand the fuel injection system in CI Engine.
- Gain knowledge on air motion & combustion phenomena in CI Engine.
- Understand turbo charging and engine management system in IC Engines.
- Understand CI engine performance.
- Understand the principle of modern engine technology.

UNIT 1 BASIC THEORY**9 Hrs.**

Diesel engine construction and operation, two stroke and four stroke diesel dual cycle engines, diesel cycle, fuel-air and actual cycle analysis, diesel fuel, ignition quality, cetane number, laboratory tests for diesel fuels, standards and specifications.

UNIT 2 FUEL INJECTION SYSTEM**9 Hrs.**

Requirements, air and solid injection, functions of components, jerk and distributor type pumps common rail system, PTFI system pressure waves, injection lag, unit injector, mechanical and pneumatic governors, fuel injector, types of injection nozzle, nozzle tests, spray characteristics, injection timing, pump calibration.

UNIT 3 AIR MOTION, COMBUSTION AND COMBUSTION CHAMBER**9 Hrs.**

Importance of air motion, swirl, squish and turbulence, swirl ratio, fuel air mixing, stages of combustion, delay period, factors affecting delay period, knock in CI engines. Combustion chamber: design requirements, direct and indirect injection combustion chambers, M type combustion chamber.

UNIT 4 AUXILIARY SYSTEM**9 Hrs.**

Necessity and limitations, types of supercharging and turbocharging, relative merits, matching of turbocharger, exhaust gas recirculation, charge cooling. Introduction to engine electronics, Engine Management systems, Types of Sensors- piezoelectric, thermistor, hot wire, vortex, Exhaust oxygen, knocking sensor

UNIT 5 PERFORMANCE TESTING AND MODERN ENGINE TECHNOLOGY**9 Hrs.**

Necessity and limitations, charge cooling, basic performance parameters, performance characteristics, factors affecting performance characteristics, performance maps - CI engines, heat balance test, morse test, introduction to modern engine technologies - lean burn engines, stratified charged engines, low heat rejection engines, homogeneously charged compression ignition engines engine management systems.

Max.45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1 - Understand the operational principle of CI engine and recall the Diesel cycle & Dual cycle in detail.
- CO2 - Explain the working principle of fuel injection pump, governor in CI engine.
- CO3 - Analyse the combustion phenomena in CI engine & explain types of CI engine combustion chamber.
- CO4 - Explain the principle of turbocharging, Engine management systems.
- CO5 - Analyse the performance characteristic of IC engine.
- CO6 - Familiarize with modern engine technologies.

TEXT / REFERENCE BOOKS

1. Ganesan V, "Internal Combustion Engines" 4th edition, Tata McGraw Hill publication 2017.
2. Rajput R. K, "A textbook of Internal Combustion Engines", Third edition Laxmi Publications, 2016.
3. Mathur and Sharma "Internal Combustion Engines" "Dhanpat Rai and Sons Publication, 2012
4. John B. Heywood, "Fundamentals of Internal Combustion Engine, 2nd edition, McGraw-Hill Education; 2018.
5. Heinz Heisler "Advanced Engine Technology", 2nd edition SAE Publication, 2010.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each- No choice**20 Marks****PART B:** 2 Questions from each unit with internal choice, each carrying 16 marks**80 Marks**

SAIC4001	INDUSTRY 4.0	L	T	P	Credits	Total Marks
		2	-	2	2	100

UNIT 1 ADVANCED TECHNOLOGY AND ADVANCED MATERIALS**7 Hrs.**

Advanced electro-optical sensing technology-active, passive multi-spectral and hyper spectral imaging; electronic beam steering; vacuum technology, surface and coating technology, health care technology, Nanotechnology- Nanomechanics, Nano optoelectronics; energy storage technology-next generation Li-based Batteries, Hydrogen storage, solar photovoltaic's, Flexible electronics. Intellectual Property Rights - case studies governing/pertaining to Materials/Technology.

UNIT 2 TRANSFORMING TECHNOLOGIES IN BIOENGINEERING**7 Hrs.**

Establishment of smart biotechnology factory, Artificial intelligence in Bioprocess technology, Omics - Big data analysis through automation, 3D bio printing for tissue engineering. Simulation tools, RSM and Box model. Cyber physical system based telemedicine, diagnosis and therapeutics through real time biosensors. Bionanotechnology. Intellectual Property rights (IPR): Case Studies.

UNIT 3 ADVANCEMENTS IN SUSTAINABLE BUILT ENVIRONMENT**7 Hrs.**

Introduction - Technological developments in Architectural, Engineering and Construction (AEC) - Building Information Modelling (BIM) using Cloud computing technology and Internet of things (IoT) - Unmanned Aerial Vehicles, sensors - Additive manufacturing in construction - Concrete 3D printing - Materials used - Lightweight and functionally graded structures - Net Zero Energy buildings, Bioswales, Biofiltration pond, Ecosan systems- Recent developments in Waste water Management, Air pollution control, waste disposal - Integration of energy, water and environmental systems for a sustainable development- Emerging Technologies: Robot Highway- Vertical farming - Intellectual Property rights: Case studies.

UNIT 4 SMART MANUFACTURING**8 Hrs.**

Smart factories and interconnection, Smart Manufacturing - automation systems, Additive Manufacturing, Smart grids, Micro Electro Mechanical Systems (MEMS), Stealth technology, Metal Finishing, Self propelled vehicles, e mobility, Green fuels, drones - unmanned aerial vehicles(UAVs), aerodynamics. Robotic Automation and Collaborative Robots - Augmented reality and haptics, engineering cybernetics and artificial intelligence (AI), Disruptive Technologies - Frugal Innovations - Emerging Technologies - Autonomous Robots, Swam Robot, Modular Robotics, Space craft, Intellectual Property Rights (IPR): Case Studies

UNIT 5 SMART WORLD**8 Hrs.**

Smart Sensors and IIOT, Smart grid, Hybrid renewable energy systems, Electronics in Smart city, Integration of Sensors in Robots and Artificial Intelligence, 5G Technology, Communication protocols, Human-Machine Interaction, Virtual Reality, Quantum Computing: Changing trends in transistor technology: Processor, Emerging Trends: Deep Space, Swarm Robots, Cyborg, Geofencing, Pervasive Computing, Intellectual Property Rights- Case Studies.

UNIT 6 CYBER PHYSICAL SYSTEMS**8 Hrs.**

Introduction to Cyber Physical Systems (CPS), Architecture of CPS, Data science and technology for CPS, Prototypes of CPS, Emerging applications in CPS including social space, crowd sourcing, healthcare and human computer interactions, Industrial Artificial Intelligence, Networking systems for CPS applications, Wearable cyber physical systems and applications, Domain applications of CPS: Agriculture, Infrastructure, Disaster management, Energy, Transportation, Intellectual Property Rights (IPR) : Case Studies

Max.45 Hrs.**TEXT / REFERENCE BOOKS**

1. William D. Callister, "Materials Science and Engineering, An Introduction, John Wiley and Sons Inc. Singapore, 2001.
2. V. Raghavan, "Physical Metallurgy: Principle and Practice, Prentice Hall India Pvt Ltd, 2006.
3. Flavio Craveiro, Jose Pinto Duarte, Helena Bartolo and Paulo Jorge Bartolo, "Additive manufacturing as an enabling technology for digital construction: A perspective on Construction 4.0", Automation in Construction, Vol. 103, pp. 251-267, 2019.
3. Klaus Schwab, "Fourth Industrial Revolution", Random House USA Inc, New York, USA, 2017.
4. Oliver Grunow, "SMART FACTORY AND INDUSTRY 4.0. The current state of Application Technologies", StudyLab Publications, 2016.
5. Alasdair Gilchrist, "INDUSTRY 4.0: Industrial Internet of Things", Apress, 2016.
6. Sang C. Suh, U. John Tanik, John N Carbone, Abdullah Eroglu, "Applied Cyber-Physical Systems", Springer Publications, New York, 2013.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 11 Questions of 2 marks each-No choice**22 Marks****PART B:** 2 Questions from each unit with internal choice, each carrying 13 marks**78 Marks**

SAUA1402	MANUFACTURING PROCESSES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To learn the basic operation of various manufacturing process.
- This course is designed to provide students with an overview of a wide variety of manufacturing process.
- Introduce the student to processes and equipment utilized in the manufacturing environment.
- To learn the various methods and types of castings, welding, and Processing of plastics.
- To understand the basic concept of non-traditional machining process.
- To impart knowledge on selection of suitable manufacturing process for the typical component.

UNIT 1 CASTING, JOINING AND FORMING PROCESSES**9 Hrs.**

Types of Moulding Methods - Gating Design. Special Casting processes, Defects in Castings-Inspection Methods. Principle and applications of submerged arc welding- Electro slag welding - TIG welding -MIG welding special welding processes - Plasma arc welding- Thermit welding - Friction welding - Diffusion welding - Welding defects Processing of plastics - Types, Applications, Advantages and Limitations - Injection Moulding, Blow moulding.

UNIT 2 MACHINE TOOLS**9 Hrs.**

Working principle, Applications, Advantages and Limitations of Centre lathe, Capstan and turret lathes - automats -single spindle, Swiss type, automatic screw type, multi spindle - Turret Indexing mechanism, bar feed mechanism. shaper, planer, slotter, Milling, Gear cutting, forming, generation, shaping, hobbing.

UNIT 3 SURFACE FINISHING & MICRO-MANUFACTURING**9 Hrs.**

Abrasive processes: grinding wheel - specifications and selection, types of grinding process - cylindrical grinding, Surface grinding, centreless grinding - honing, lapping, super finishing, polishing and buffing. Introduction and Scaling Laws for micro-manufacturing, Silicon Layer Processes, LIGA process Other Micro-fabrication Processes.

UNIT 4 NON TRADITIONAL MACHINING PROCESS**9 Hrs.**

Non-Traditional machining: Working principle, Applications, Advantages and Limitations- AJM-WJM-USM-ECM-ECG-EDM-EBM-EDG-LBM-PAM.

UNIT 5 CNC MACHINE TOOLS AND FUNDAMENTALS OF CAD/CAM**9 Hrs.**

Numerical control: Brief principles and description of numerical control application to M/c tools. DNC, CNC and adaptive control. Programming of CNC M/C tools, CNC programming based on CAD. Fundamentals of CAD/CAM, Computer integrated manufacturing, Compute Aided Process Planning, Computer Integrated, Production Planning system.

Max. 45 Hrs**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1 - Recognize the different types of manufacturing process.
- CO2 - Learning various machine tools operations and applications.
- CO3 - Understanding the concept of Surface finishing operation and Micro manufacturing concepts.
- CO4 - Understand and Develop various Non Traditional Machining process.
- CO5 - Explain the operations and capabilities of CNC machines used in manufacturing.
- CO6 - Select the suitable manufacturing process in order to produce the various components.

TEXT / REFERENCE BOOKS

- Ghosh, A., Mallik, A.K., Manufacturing Science, 2nd Edition, East West Press, 2010.
- Hajra Choudhury, "Elements of Workshop Technology", Vol. I and II, Media Promoters and Publishers Pvt.Ltd., Mumbai, 2005.
- Jain R.K., Production Technology, Khanna Publishers, 2001.
- Tata McGraw-Hill, Production Technology by HMT, 2002.
- Kalpakjian .S and Schmid S R, Manufacturing Processes for Engineering Materials, Pearson Education, 2009.
- Roy. A. Linberg, "Process and Materials of Manufacture", PHI, 2000.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****PART A:** 10 Questions of 2 marks each- No choice**PART B:** 2 Questions from each unit with internal choice, each carrying 16 marks**Exam Duration: 3 Hrs.****20 Marks****80 Marks**

SAUA1403	AUTOMOTIVE CHASSIS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To gain in depth knowledge of fundamentals of chassis lay out with reference to power plant locations and drives.
- To discuss front wheel geometry and steering geometry.
- To understand drive line, suspension system and braking system

UNIT 1 INTRODUCTION**9 Hrs.**

Types of chassis lay out with reference to power plant locations and drives, vehicle frames, various types of frames, passenger car frames, x member type frame, box section type frame, load acting on frames, constructional details, materials, sub frame, testing of vehicle frames, checking of frame alignment.

UNIT 2 FRONT AXLE AND STEERING SYSTEM**9 Hrs.**

Types of front axles, construction details, materials, front wheel geometry: castor, camber, king pin inclination, toe-in and toe-out, condition for true rolling motion of wheels during steering, steering geometry, Ackermann and Davis steering system, constructional details of steering linkages, different types of steering gear boxes, slip angle, over-steer and under-steer, turning radius, wheel wobble, power assisted steering, steering ratio - power steering - centre point steering.

UNIT 3 DRIVE LINE**9 Hrs.**

Effect of driving thrust and torque reactions, Hotchkiss drive, torque tube drive and radius rods, propeller shaft, universal joints, front wheel drive, different types of final drive, double reduction and twin speed final drives, differential principle, construction details of differential unit, non-slip differential locks, differential housings, construction of rear axles, types of loads acting on rear axle, fully floating, three quarter floating and semi floating rear axles, construction of different types of axle housings, final drive differential: worm and worm wheel, straight bevel gear, spiral bevel gear and hypoid gear final drives, fifth wheel coupling.

UNIT 4 SUSPENSION SYSTEM**9 Hrs.**

Need of suspension system, type of suspension, suspension springs, constructional details and characteristics of leaf spring, variable rate leaf suspension, coil and torsion bar springs, anti-roll bar, front wheel & rear wheel independent suspension, rubber suspension, pneumatics suspensions, shock absorbers, torque reaction, air suspension system-electronically controlled, hydro-gas suspension.

UNIT 5 BRAKING SYSTEM**9 Hrs.**

Classification of brakes, drum brakes and disc brakes, constructional details, theory of braking, determination of braking torque, concept of dual brake system, parking brake, material, hydraulic brake system, vacuum assisted system, air brake system- hydro mechanical, anti-lock braking, regenerative braking system, retarded engine brakes, eddy retarders, master cylinder, slave cylinder, servo action and self - energizing brakes.

Max.45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1 - Understand the construction details of various types of automotive Frames and basic Chassis layouts
- CO2 - Understand the basic function steering system and steering components
- CO3 - Select the appropriate transmission system for various automobiles
- CO4 - Comprehend the final drive system of a vehicle.
- CO5 - Apply the knowledge for selection of suitable axles, wheels and tyres for a vehicle.
- CO6 - Distinguish various types of suspension system, brake system.

TEXT / REFERENCE BOOKS

1. Kirpal Singh, "Automobile Engineering Vol.I", 12th Edition Standard Publishers, 2011.
2. Banga T.R. & Nathu Singh, "Automobile Engineering", 3rd Edition Khanna Publications, 2012.
3. Rajput R.K., "A Text-Book of Automobile Engineering", Laxmi Publications Private Limited, 2007.
4. Heldt.P.M. "Automotive Chassis", 3rd edition Chilton Co. Publications, New York, 1990.
5. Heinz heisler "Advanced vehicle technology", 2nd Editions Edward Arnold publication 2002.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****PART A:** 10 Questions of 2 marks each - No choice**PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**Exam Duration: 3 Hrs.****20 Marks****80 Marks**

SAUA2401	THERMAL ENGINEERING LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To conduct experiments and report result on I.C. Engine performance.
- To understand the importance of heat balance sheet in I.C. Engines.
- To study the performance of Refrigeration cycle

SUGGESTED LIST OF EXPERIMENTS

1. Valve timing diagram of a four stroke engine, Port timing diagram of a two stroke engine.
2. Performance test on a four stroke diesel engine.
3. Heat balance test on a four stroke diesel engine.
4. Performance test on a multi cylinder diesel engine
5. Performance characteristics of a two stroke petrol engine.
6. Performance characteristics of a four stroke multi -cylinder petrol engine.
7. Determination of mechanical efficiency using retardation test.
8. Determination of indicated power of multi cylinder petrol engine - Morse test.
9. Determination of mechanical efficiency using negative horse power method
10. Performance test on refrigeration test rig
11. Performance test on air-conditioning test rig

COURSE OUTCOMES

On completion of the course, students will be able to

- CO1 - Demonstrate the significance of valve timing and port timing in I.C. Engine working.
- CO2 - Calculate performance parameters I.C. Engines by conducting experiments.
- CO3 - Develop heat balance sheet for I.C.Engine.
- CO4 - Determine the friction power of I.C Engine.
- CO5 - Determine indicated power of multi cylinder petrol engine.
- CO6 - Estimate the COP of vapour compression refrigeration cycle.

SMEA2402	MANUFACTURING PROCESSES LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVE

- To Study and practice the various operations that can be performed in lathe, shaper, drilling, milling machines etc. and to equip with the practical knowledge required in the core industries.

SUGGESTED LIST OF EXPERIMENTS

1. Lathe Operations: Turning, Taper Turning, Boring, Thread cutting - Internal and External.
2. Shaping Machines: Machine of plane and inclined surfaces, grooving - V grooving, dovetail cutting.
2. Planning: Exercise involving plane and inclined surfaces.
3. Grinding: Exercise involving cylindrical grinding - Surface grinding - single point tool grinding in tool and cutter grinder.
4. Milling: Cutting of spur, helical, bevel gear, milling of polygon surface.
5. Boring: Simple exercise in boring machine.
6. Hobbing: Making of spur and helical gear.
7. Slotting: Key way cutting (internal & external).
8. Measurement of cutting forces in turning, milling and drilling (tool dynamometer).
9. Practices in Capstan and Turret lathes (at least one exercise)
10. CNC Lathe - Simple Turning, Step Turning, Thread Turning
11. Machining Center - A typical job production-Milling, Drilling, Reaming.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Demonstrate the safety precautions exercised in the mechanical workshop.
- CO2 - Use different machine tools to manufacture gears and other components.
- CO3 - Use different machine tools for finishing operations.
- CO4 - Manufacture tools using cutter grinder.
- CO5 - Understand the basics of the CNC part programming.
- CO6 - Make the workpiece as per the given shape and size using lathe.

SAUA1501	AUTOMOTIVE ENGINE COMPONENTS DESIGN	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To familiarize the various steps involved in the Design Process.
- To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
- To learn to use standard practices and standard data.
- To learn to use catalogues and standard machine component.

UNIT 1 INTRODUCTION**9 Hrs.**

Engineering material and their physical properties applied to design, selection of materials. Stress and strain, theory of failures, factor of safety, endurance limit, notch sensitivity, stress concentration, Limits, Fits and Tolerances, design considerations for interference fits, surface finish, surface roughness, Rankine's formula - Tetmajer's formula - Johnson formula- design of pushrods

UNIT 2 CYLINDER AND PISTON – MATERIALS AND DESIGN**9 Hrs.**

Choice of materials of cylindrical piston, piston friction, piston slap, design of piston, piston pin (Gudgeon pin), piston ring, piston failures, lubrication and piston assembly. Design of cylinder. Ceramic coating - Engine performance, Emission.

UNIT 3 DESIGN OF CONNECTING ROD, CRANKSHAFT**9 Hrs.**

Material for connecting rod, determining minimum length of connecting rod, small end and big end design, shaft design, design of big end cap bolts, connecting rod failures, balancing of I.C. Engines, significance of firing order, material for crankshaft, design of crankshaft under bending and twisting, balancing weight calculations.

UNIT 3 DESIGN OF VALVES, VALVE TRAIN AND FLYWHEEL**9 Hrs.**

Design aspects of intake and exhaust manifolds, inlet and Exhaust valves, valve springs, tappets, valve train. Design of cam & camshaft, Design of rocker arm, Cam profile generation. Materials and design of flywheel.

UNIT 5 DESIGN OF TRANSMISSION SHAFTS, BEARINGS AND SPRINGS**9 Hrs.**

Design of transmission shafts, materials used for bearings, classification of bearings. Viscosity of lubricants, theory of hydrostatic and hydrodynamic lubrication, design of sliding contact bearings and design of helical springs

Max.45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1 - Understand and implement Engineering Design process.
- CO2 - Apply engineering principles and analytical techniques in the design process.
- CO3 - Develop knowledge on design procedure of various engine components.
- CO4 - Design the Machine Components like Shafts and Springs Gear, Design Flywheels and Bearings.
- CO5 - Acquire knowledge on geometrical dimensioning.
- CO6 - Acquire the knowledge about the lubrication.

TEXT / REFERENCE BOOKS

1. Jain.R.K, "Machine Design", Khanna Publishers, New Delhi, 1997.
2. "Design Data Book", PSG College of Technology, Coimbatore, 2012.
3. Heldt.P.M "High Speed Combustion Engines", Oxford-IBH Publishing Co., Calcutta, 1965.
4. Kolchin.A and Demidov.V, "Design of Automotive Engines", MIR Publishers, Moscow, 1984.
5. Sundararaja Murthy T.V "Machine Design", Khanna Publishers, New Delhi, 1991.
6. John L Lumley, "Engine - An Introduction", Cambridge University Press, 1999.
7. Giri.N.K, "Automobile Mechanics", Khanna Publishers, New Delhi, 2007

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each - No choice**20 Marks****PART B:** 2 Questions from each unit with internal choice, each carrying 12 marks**80 Marks**

SMEA1503	FINITE ELEMENT ANALYSIS	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To introduce the concepts of Mathematical Modeling of Engineering Problems.
- To appreciate the use of FEM to a range of Engineering Problems.
- Learn how to implement the finite element method efficiently in order to solve a particular equation for simple problems.
- Solve simple and complicated 2D structural problems for stress analysis under impact loads from general engineering aspects.

UNIT 1 INTRODUCTION**9 Hrs.**

Historical Background- Basic Concepts of FEM - Mathematical Modeling of field problems in Engineering - Governing Equations - Discrete and continuous models - Boundary, Initial and Eigen Value problems-Residual Methods- Variational Formulation of Boundary Value Problems - Ritz Method.

UNIT 2 ONE-DIMENSIONAL PROBLEMS**9 Hrs.**

One Dimensional Second Order Equations - Discretization - Element types- Linear and Higher order Elements - Derivation of Shape functions and Stiffness matrices and force vectors- Assembly of Matrices- Solution of problems from solid mechanics and heat transfer-Bar, Beam Elements - Applications to Heat Transfer.

UNIT 3 TWO DIMENSIONAL PROBLEMS**9 Hrs.**

Basic Boundary Value Problems in Two Dimensions - Triangular, quadrilateral, higher order elements - Triangular elements - Shape functions and element matrices and vectors. Application to Field Problems - Thermal problems - Torsion of Non circular shafts -Quadrilateral elements - Higher Order Elements.

UNIT 4 SOLUTION TO PLANE ELASTICITY PROBLEMS**9 Hrs.**

Introduction to Theory of Elasticity - Plane Stress - Plane Strain and Axisymmetric Formulation - Body forces and temperature effects - Stress calculations - Plate and shell elements.

UNIT 5 ISO PARAMETRIC FORMULATION**9 Hrs.**

Natural Co-ordinate System - Lagrangian Interpolation Polynomials - Iso-parametric Elements - Formulation -Numerical Intergration - 1D -2D Triangular elements - rectangular elements - Introduction to Analysis Software-- h & p elements- Errors and Types.

Max.45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1 - Understand the basics of matrix manipulations required for Finite Element Analysis
- CO2 - Apply finite element formulations to solve one dimensional Problems.
- CO3 - Apply finite element formulations to solve two dimensional scalar Problems.
- CO4 - Apply finite element method to solve two dimensional Vector problems.
- CO5 - Apply finite element method to solve problems on iso parametric element
- CO6 - Appreciate the importance of ethical issues pertaining to the effective utilization of FEA in Mechanical engineering.

TEXT / REFERENCE BOOKS

1. Reddy. J.N., "An Introduction to the Finite Element Method", 3rd Edition, Tata McGraw-Hill, 2010.
2. Seshu, P., "Text Book of Finite Element Analysis", Prentice-Hall of India Pvt. Ltd., New Delhi, 2007.
3. Chandrupatla & Belagundu, "Introduction to Finite Elements in Engineering", 4th Edition, Prentice Hall College Div, 1997.
4. Rao, S.S., "The Finite Element Method in Engineering", 4th Edition, Butterworth Heinemann, 2005.
5. Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, "Concepts and Applications of Finite Element Analysis", 4th Edition, Wiley Student Edition, 2002.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each - No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SAUA1503	HEAT TRANSFER APPLIED TO I.C ENGINES	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- Impart the knowledge of fundamentals of heat transfer
- Deep understanding on the governing equations for convection heat transfer and the dimensionless parameters
- Understand the temperature distribution and heat transfer rate in engine components
- Familiarize with cooling system and measurement of heat transfer rate in IC engines

UNIT1 CONDUCTION**9 Hrs.**

Fourier law of conduction, general equation in Cartesian, cylindrical, spherical co-ordinates - 1 Dimensional steady state conduction in solids across plane wall - composite wall - composite cylinder - composite sphere with convection boundaries, overall heat transfer co-efficient, critical thickness of insulation, conduction with generation, thermal contact resistance, variable conductivity.

UNIT 2 CONVECTION**9 Hrs.**

Forced convection - external flow over a plate; cylinder, sphere & non circular ducts- internal flow through pipes- annular spaces & non circular conducts. Natural convection from vertical inclined & horizontal surfaces.

UNIT 3 RADIATION**9 Hrs.**

Electromagnetic spectrum, black body emission, emissive power, laws of radiation, radiation shape factor, electrical analogy, radiation shields gas radiation.

UNIT 4 HEAT TRANSFER AND COOLING IN IC ENGINES**9 Hrs.**

Temperature distribution in cylinder, piston - engine heat transfer and energy balance - parameters- Extended Surfaces- Fins- Heat Exchanger Types - Overall Heat Transfer Coefficient - Fouling Factors - Analysis - LMTD method, - NTU method - Classification - cooling system-need for cooling system-power required to cool the engine-characteristics of efficient cooling system-types of cooling system.

UNIT 5 MEASUREMENT OF HEAT TRANSFER RATES IN IC ENGINES**9 Hrs.**

Measurement methods-SI engine measurement-CI engine measurement -evaluation of heat transfer correlations-boundary layer behavior-components temperature distribution - effect of engine variables-temperature measurement.

Max.45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1 - Understand the basic modes of heat transfer
- CO2 - Compute temperature distribution in steady-state heat conduction.
- CO3 - Understand principles of forced and free convection heat transfer processes.
- CO4 - Understand the principles of radiation heat transfer.
- CO5 - Understand the cooling systems in IC engines.
- CO6 - Estimate the temperature distribution and heat transfer rate in IC engine.

TEXT / REFERENCE BOOK

1. Heywood J.B "Internal Combustion Engine Fundamentals", McGraw-Hill Book CO., USA - 1995.
2. Rajput.R.K, Heat and Mass transfer - S.Chand & Co, 2016.
3. Kothandaraman C.P. Fundamentals of Heat and Mass Transfer - New Age International (P) Ltd., 1998.
4. Sachdeva R.C. Fundamentals of Heat and Mass Transfer - New Age International (P) Ltd.
5. Ozisik N.M., Heat Transfer - McGraw Hill Book Company, 1988.
6. Holman J.P. Heat Transfer - McGraw Hill Book Company, 1989.
7. Incropera and Dewite, Heat Transfer - John Wiley.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each - No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SAUA1504	VEHICLE BODY ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To develop knowledge in design of vehicle body to give maximum comfort for the passengers
- To develop skills in the areas of car body design, bus body design, active and passive safety.
- To understand different types of bodies and ergonomics of the vehicle

UNIT 1 CAR BODY DETAILS**9 Hrs.**

Types of car bodies, visibility: regulations, driver's visibility, tests for visibility, methods of improving visibility and space in cars safety: safety design, safety equipment for cars, car body construction - front assembly, roof assembly, under floor, bonnet; design criteria, prototype making, initial tests, crash tests on full scale model

UNIT 2 VEHICLE AERODYNAMICS**9 Hrs.**

Objectives, vehicle drag and its types; various types of forces and moments, effects of forces and moments, side wind effects on forces and moments, various body optimization techniques for minimum drag, wind tunnel testing: flow visualization techniques, scale model testing, component balance to measure forces and moments, aerodynamic study for heavy vehicles, effects of different cabin to trailer body, pressure distribution, effects of a cab to trailer body roof height.

UNIT 3 BUS BODY AND COMMERCIAL VEHICLE DETAILS**9 Hrs.**

Types: mini bus, single decker, double-decker, two level and articulated bus. Bus body layout; floor height, engine location, entrance and exit location, seating dimensions, constructional details: frame construction, double skin construction, types of metal sections used, regulations, conventional and integral type construction. commercial vehicle: types of body; flat platform, drop side, fixed side, tipper body, tanker body, light commercial vehicle body types, dimensions of driver's seat relation to controls, drivers cab design.

UNIT 4 INTERIOR ERGONOMICS**9 Hrs.**

Introduction, seating dimensions, interior ergonomics, seat comfort, driver seat design, dash board instruments, electronic displays, commercial vehicle cabin ergonomics, mechanical package layout, goods vehicle layout. Vehicle stability: Introduction, longitudinal, lateral stability, vehicle on a curvilinear path, critical speed for toppling and skidding, effect of operating factors on lateral stability, steering geometry and stabilization of steerable wheels, mass distribution and engine location on stability.

UNIT 5 BODY MATERIALS, TRIM AND MECHANISMS**9 Hrs.**

Steel sheet, timber, plastic, glass, GRP, properties of materials; corrosion, anticorrosion methods, selection of paint and painting process, adhesives, insulation, body trim items, body mechanisms.

Max.45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1 - Discuss the different types of car body design and its safety features.
- CO2 - Select a suitable body optimization techniques to minimize drag and able to describe the wind tunnel testing procedure.
- CO3 - Classify the various types of bus body construction and able to identify the body layout.
- CO4 - Describe the different types of commercial vehicles and its design.
- CO5 - Explain the various types of materials and painting techniques used in automobiles.
- CO6 - Acquire knowledge about the corrosion coating methods

TEXT / REFERENCE BOOKS

1. Powloski J, "Vehicle Body Engineering", Business Books Ltd., London 1989.
2. John Fenton, "Vehicle body layout and analysis", Mechanical Engg. Publication Ltd, London, 1982.
3. Kohli P. L, "Automotive Chassis & Body", Papyrus Publishing House, New Delhi, 2010.
4. Wolf-Heinrich Hucho, "Aerodynamics of Road Vehicles" SAE International, USA, 1998.
5. Robinson A., Livesey W. A, "The Repair of Vehicle Bodies", Butterworth - Heinemann Ltd, 1989
6. John Fenton, "Vehicle Body Layout & Analysis", Hutchinson, London, 1998

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each - No choice**20 Marks****PART B:** 2 Questions from each unit with internal choice, each carrying 12 marks**80 Marks**

SAUA2501	AUTOMOTIVE ENGINE AND CHASSIS COMPONENTS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To study, dismantling and assembling of various chassis components of the vehicle.
- To study, dismantling and assembling of various Engine components of the vehicle.

SUGGESTED LIST OF EXPERIMENTS - AUTOMOTIVE CHASSIS COMPONENTS LAB**Study and measurement of the following chassis frames**

1. Heavy duty vehicle frame (Leyland, Tata etc.)
2. Light duty vehicle frame (Ambassador, Maruti Van etc.)

Study, Dismantling and Assembling of

3. Front Axle
4. Rear Axle
5. Differential Unit.
6. Steering systems along with any two steering gear boxes.
7. Braking systems- Hydraulic, Servo, Vacuum, Compressed air power Brakes.
8. Leaf spring, Coil Spring, Torsion Bar, Hydraulic shock Absorber.
9. Clutch assembly of different types
10. Gear box
11. Transfer Case
12. Propeller shaft.

SUGGESTED LIST OF EXPERIMENTS - AUTOMOTIVE ENGINE COMPONENTS LAB

1. Dismantling, study and Assembling of 4 strokes four-cylinder petrol engine.
2. Dismantling, study and Assembling of 4 strokes six-cylinder Diesel engine.
3. Study of oil filter, fuel filter, fuel injection system, carburetor, MPFI system.
4. Study of ignition system components- coil, magneto and electric ignition system.
5. Study of engine cooling system components.
6. Study of engine lubrication system components.
7. Ovality and taper measurement of cylinder bore and comparison with standard specification.
8. Ovality and taper measurement of engine crank shaft and comparison with standard specification

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Gain extensive knowledge about heavy duty and light duty vehicle frame
- CO2 - Know the dismantling and assembling procedure of front and rear axle system
- CO3 - Understand the dismantling and assembling procedure of different brake system.
- CO4 - Know the dismantling and assembling procedure of six-cylinder diesel engine
- CO5 - Gain knowledge about fuel injection system and ignition system.
- CO6 - Study the Ovality and taper measurement of cylinder bore

SAUA2502	TWO AND THREE WHEELER LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To gain knowledge on the standards of measurement and calibration.
- To analyze faults in the vehicles.
- To learn the service and maintenance.

SUGGESTED LIST OF EXPERIEMENTS - TWO WHEELER LAB

1. Road performance test of a two wheeler using chassis dynamometer.
2. Dismantling and assembling of two wheeler engine.
3. Performance test on a shock absorber. and coil springs
4. Two wheeler chain tension test.
5. Brake and clutch adjustment as per specification.
6. Dismantling and assembling of two wheeler gear box and finding gear ratio.

SUGGESTED LIST OF EXPERIEMENTS - THREE WHEELER LAB

1. Dismantling and assembling of three wheeler engine.
2. Dismantling and assembling of three wheeler gear box and finding gear ratios.
3. Three wheeler brake and clutch play adjustment.
4. Study of three wheeler steering systems.
5. Study of three wheeler chassis frame and power transmission systems.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Gain knowledge about the engines employed for two and three wheelers.
- CO2 - Understand about the Chassis and its sub-systems.
- CO3 - Perceive the functionality of Brakes and wheels.
- CO4 - Gain knowledge through specific case studies of major Indian models.
- CO5 - Gather information about servicing, maintenance and trouble shooting of two and three wheelers.
- CO6 - Understand the Clutch and brake adjustment.

SAUA1601	AUTOMOTIVE ELECTRICAL AND ELECTRONICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand construction and working of batteries, starting system and charging system.
- To familiarize with lighting, ignition and injection system.
- To understand the electronics and infotronics in automobiles.

UNIT 1 BATTERIES, STARTING SYSTEM AND CHARGING SYSTEM**9 Hrs.**

Types of batteries - principle, construction and electrochemical action of lead - acid battery, electrolyte, efficiency, rating, charging, testing and maintenance, condition at starting and behaviour of starter during starting, Starter motors - characteristics, capacity requirements, drive mechanisms, starter switches. D.C generators and Alternators their characteristics, cut out, regulators, regulations for charging, charging circuits for D.C generators and A.C generators.

UNIT 2 LIGHTING, IGNITION AND INJECTION SYSTEM**9 Hrs.**

Wiring requirements, insulated and earth return system, details of head light and side light, head light dazzling and preventive methods, vehicle interior lighting system, vehicle exterior lighting system, lighting design, dashboard instruments, horn, wiper mechanism, speedometer, and odometer. Types, construction & working of battery coil and magneto ignition, electronic ignition systems - spark plugs, variable ignition timing, distributor less ignition, CDI electronic spark timing control, TBI, MPFI, GDI systems, engine mapping.

UNIT 3 AUTOMOTIVE ELECTRONICS & DIGITAL ENGINE CONTROL SYSTEM**9 Hrs.**

Components for electronic engine management and electronic chassis management system, vehicle motion control, open loop and closed loop control systems-engine cranking and warm up control-acceleration enrichment deceleration leaning and idle speed control, distributor less ignition-integrated engine control systems, exhaust emission control engineering, electronic dashboard instruments-on board diagnosis system.

UNIT 4 SENSORS AND MICROPROCESSOR**9 Hrs.**

Basic sensor arrangement, types of sensors such as exhaust oxygen level sensor, crankshaft position sensor fuel metering, vehicle speed sensor and detonation sensor, altitude sensor, flow sensor, throttle position sensors, mass flow sensor, camshaft position sensor, steering position sensor, tire pressure sensor, engine temperature sensor. Microprocessor and microcomputer controlled devices in automobiles such as voice warning system, travel information system, keyless entry system, automatic transmission system, electronic steering system.

UNIT 5 AUTOMOTIVE INFOTRONICS**9 Hrs.**

Telematics: global positioning system, geographical information systems, navigation system, architecture, automotive vision system and road recognition. Safety systems: active and passive safety, airbags, seat belt tightening system, forward collision warning systems, anti-lock braking systems, traction control system and lane Departure warning system, anti-theft technologies, security and warning system.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1 - Understand the construction details of various types of batteries and generators.
- CO2 - Understand the basic function of lighting, ignition and injection system.
- CO3 - Understand the automotive electronics & digital engine control system.
- CO4 - Understand the sensors and microprocessor.
- CO5 - Understand the automotive infotronics.
- CO6 - Understand the Safety systems.

TEXT / REFERENCE BOOKS

1. Robert Bosch, "Automotive Electrics Automotive Electronics", Professional Engineering publishing, 2004.
2. Willis Santini AI, "Automotive Electricity and Electronics", Cengage Learning, 2012.
3. Tom Denton, "Automotive Electrical and Electronic System", SAE International, 2004.
4. BOSCH, "Automotive Handbook", 8 th Edition, BENTLEY ROBERT Incorporated, 2011.
5. Norm Chapman, "Principles of Electricity and electronics for the Automotive Technician", Delmar Cengage Learning, 2008.
6. AI Santini, "Automotive Technology (Electricity and Electronics)", Cengage Learning Yes Dee Publishing Pvt.Ltd, 2011

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each - No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SAUA1602	VEHICLE DYNAMICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To familiarize with dynamic analysis of vehicles.
- To demonstrate the ability to design a system, component or process to meet the desired needs within realistic constraints.
- To acquire the capability to identify, formulate and solve complex engineering problems related to Automobile Engineering.

UNIT 1 CONCEPT OF VIBRATION**9 Hrs.**

Definitions, Modeling and Simulation, Global and Vehicle Coordinate System, Free, Forced, Undamped and Damped Vibration, Response Analysis of Single DOF, Two DOF, Multi DOF, Magnification factor, Transmissibility, Vibration absorber, Vibration measuring instruments, Torsional vibration, Critical speed.

UNIT 2 VERTICAL DYNAMICS**9 Hrs.**

Human response to vibration, Sources of Vibration. Design and analysis of Passive, Semi-active and Active suspension using Quarter car, half car and full car model. Influence of suspension stiffness, suspension damping, and tire stiffness. Control law for LQR, H-Infinite, Skyhook damping. Air suspension system and their properties.

UNIT 3 TIRES**9 Hrs.**

Tire forces and moments, Tire structure, Longitudinal and Lateral force at various slip angles, rolling resistance, Tractive and cornering property of tire. Performance of tire on wet surface. Ride property of tires. Magic formulae tire model, Estimation of tire-road friction. Test on Various road surfaces. Tire vibration.

UNIT 4 LATERAL DYNAMICS**9 Hrs.**

Steady-state handling characteristics. Steady state response to steering input. Testing of handling characteristics. Transient response characteristics, Direction control of vehicles. Roll center, Roll axis, Vehicle underside forces. Stability of vehicle on banked road, during turn. Effect of suspension on cornering.

UNIT 5 LONGITUDINAL DYNAMICS AND CONTROL**9 Hrs.**

Aerodynamic forces and moments. Equation of motion. Tire forces, rolling resistance, Load distribution for three wheeler and four wheeler. Calculation of Maximum acceleration, Reaction forces for Different drives. Braking and Driving torque. Prediction of Vehicle performance. ABS, stability control, Traction control.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, students will be able to

- CO1 - Understand vibration modes and its problems related to Automobile Engineering.
- CO2 - Able to understand how passenger comfort is achieved along with vehicle stability.
- CO3 - Ability to design and conduct experiments on tires on different road conditions.
- CO4 - Demonstrate the ability to design a system, component or process to meet the stability needs of vehicles
- CO5 - Understand the concepts in lateral and longitudinal dynamics of automobiles.
- CO6 - Understand the methods of predicting vehicle performance.

TEXTBOOKS/ REFERENCES

1. Singiresu S. Rao, "Mechanical Vibrations", 6th Edition, Prentice Hall, 2017.
2. Dieter Schramm, " Vehicle Dynamics- Modeling and Simulation", Springer, 2016.
3. Wong. J. Y., "Theory of Ground Vehicles", 5th Edition, Wiley-Interscience, 2013.
4. Hans B Pacejka, "Tire and Vehicle Dynamics", 3rd Edition, SAE International, 2012.
5. John C. Dixon, "Tires, Suspension, and Handling", 4th Edition, Society of Automotive Engineers Inc, 2013.
6. Jan Zuijdijk, "Vehicle dynamics and damping", Author House, 2013.
7. Michael Blundell & Damian Harty, "The Multibody Systems Approach to Vehicle Dynamics", 2nd Edition, Elsevier Limited, 2014
8. NakhaieJazar. G., "Vehicle Dynamics: Theory and Application", 2nd edition, Springer, 2014.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****PART A:** 10 Questions of 2 marks each - No choice**PART B:** 2 Questions from each unit with internal choice, each carrying 16 marks**Exam Duration: 3 Hrs.****20 Marks****80 Marks**

SAUA2601	AUTOMOTIVE ELECTRICAL AND ELECTRONICS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- Recognize and understand the different wiring diagrams used in automobile Manuals
- Understand basic electrical and electronic circuits used in automobile systems and also understand the basic programming with the 8085 microprocessor

SUGGESTED LIST OF EXPERIMENTS - AUTO ELECTRICAL LAB

1. Testing of batteries and battery maintenance.
2. Testing of starting motors, generators and alternators.
3. Testing of regulators and cut outs.
4. Diagnosis of ignition system faults.
5. Study of Automobile electrical wiring.
6. Identification of fault on Multipoint Fuel Injection System (MPFI).
7. Identification of fault on Common Rail Direct Injection (CRDI) system.
8. Tuning of horns and sound level measurement.
9. Making of starting and Ignition circuits.
10. Making of generating and lighting circuits.
11. Study of electronic control module.
12. Study of electronic fuel feed system.

SUGGESTED LIST OF EXPERIMENTS - AUTO ELECTRONICS LAB

1. Study of rectifiers and filters.
2. Study of logic gates, adder and flip-flops.
3. Study of SCR and IC timer.
4. Micro controller programming and interfacing.
5. Interfacing ADC and DAC for Data Acquisition and Control Application.
6. Interfacing Actuators.
7. Fault Diagnosis of various sensors.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand battery Testing and maintenance.
- CO2 - Understand Testing of starting motors, generators and alternators.
- CO3 - Understand the Diagnosis of ignition system faults.
- CO4 - Identification of fault on Multipoint Fuel Injection System (MPFI).
- CO5 - Identification of fault on Common Rail Direct Injection (CRDI) system.
- CO6 - Understand the micro controller programming and interfacing.

SAUA2602	AUTOMOTIVE COMPONENTS DESIGN LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To make the students understand the design concept and principles of various engine components, their materials and manufacturing techniques.
- To familiarize with concepts and principles in design of components.
- Designing of the clutch, gear box, front axle and drive line systems of automobiles.

SUGGESTED LIST OF EXPERIMENTS - COMPUTER AIDED ENGINE DESIGN LAB

1. Design and drawing of piston, Piston pin and piston rings.
2. Design of connecting rod small end and big end, shank design, design of big end cap, bolts and drawing of the connecting rod assembly
3. Design of crankshaft, balancing weight calculations, Development of short and long crank arms, front end and rear end details, drawing of the crankshaft assembly.
4. Design and drawing of flywheel, Ring gear design, drawing of the flywheel including the development of ring gear teeth.
5. Design and drawing of the inlet and exhaust valves.
6. Design of cam and camshaft, cam profile generation, drawing of cam and camshaft.

SUGGESTED LIST OF EXPERIMENTS - COMPUTER AIDED CHASSIS DESIGN LAB

1. Design of light and heavy duty vehicle frame
2. Design of front axle and rear axle.
3. Design of clutch (Complete design of clutch components, Assembly drawing of clutch)
4. Design of gear Box (Gear train calculation, Layout of gear box, Calculation of bearing loads, Selection of bearings, Assembly of gear box)

Computer aided design of the above components.

(Use of these packages are recommended - Pro E, CATIA, ANSYS and other CAD packages)

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Can understand the design concept and principles of various engine components.
- CO2 - Understand the concepts and principles are familiarized for design of components.
- CO3 - Can apply the fits, tolerance and drawing standards.
- CO4 - Can obtain knowledge about load distribution in vehicle frame
- CO5 - Can understand the design concept and principles of various chassis components.
- CO6 - Familiarized with the design of chassis components.

TEXT / REFERENCE BOOKS

1. Heldt, P.M., "High speed combustion Engine", Chilton Books co., 1952
2. Giles. J.G., "Engine Design" Illiffe Books Ltd., London, 1962
3. Khovak, " Motor Vehicle Engines", MIR publishers
4. Kolchin, A. and Demidov, V., "Design of Automotive Engines".

SAUA1701	HYBRID AND ELECTRIC VEHICLES	L	T	P	Credits	Total Marks
		3	0	4	2	100

COURSE OBJECTIVES

- To introduce the fundamentals concepts, principles of hybrid, electric and fuel cells
- To understand the analysis and design of hybrid, electric and fuel cells
- To understand the basics of battery and its types

UNIT 1 INTRODUCTION TO ELECTRIC VEHICLE**9 Hrs.**

Layout of an electric vehicle, performance of electric vehicles - traction motor characteristics, tractive effort, transmission requirements, vehicle performance, energy consumption, advantages and limitations, specifications, system components, electronic control system.

UNIT 2 HYBRID VEHICLES**9 Hrs.**

Concepts of hybrid electric drive train, types, architecture of series and parallel hybrid electric drive train, merits and demerits, series and parallel hybrid electric drive train design.

UNIT 3 ELECTRIC PROPULSION SYSTEMS**9 Hrs.**

DC motors, AC motors, permanent magnet motors, brushless DC and reluctance motors, Characteristics, regenerative braking. DC generators, AC generators, voltage and frequency regulations. Control system principles, speed and torque control - DC motors and AC motors.

UNIT 4 ENERGY STORAGEES**9 Hrs.**

Electrochemical batteries - types of batteries - lead acid batteries, nickel based batteries, and lithium based batteries, electrochemical reactions, thermodynamic voltage, specific energy, specific power energy efficiency. Ultra capacitors.

UNIT 5 FUEL CELLS AND SOLAR CARS**9 Hrs.**

Fuel cell, construction, working equations, possible fuel sources, fuel reformer, design of solar cars - photovoltaic cells, tracking efficiency and cost comparisons.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1 - Understand the working of different configuration of electric vehicles.
- CO2 - Understand the hybrid vehicle configuration.
- CO3 - Differentiate electric and hybrid vehicles.
- CO4 - Understand the properties of batteries and its types.
- CO5 - Understand the electric vehicle drive systems and hybrid electric vehicles.
- CO6 - Design of solar cell and fuel cell.

TEXT / REFERENCE BOOKS

1. Iqbal Hussain, "Electric and Hybrid vehicles Design fundamentals", CRC press, second edition 2013.
2. James Larmine, John Lowry, "Electric vehicle technology explained" second edition, John & Wiley sons 2012.
3. Mehrdad Ehsani, Yimin Gao, Ali Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals", CRC press, 2010.
4. Sandeep Dhameja, "Electric Vehicle Battery Systems", Butterworth - Heinemann, 2002.
5. Ronald K Jurgan. "Electric and Hybrid Vehicle - Electric Vehicles", SAE, 2011.
6. Ron Hodkinson and John Fenton, "Light Weight Electric/Hybrid Vehicle Design", Butterworth-Heinemann, 1st Edition 2001.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each - No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SAUA2701	VEHICLE MAINTENANCE AND RECONDITIONING LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- List down the various maintenance procedures.
- Ensure the maximum availability of vehicle without any major problem.
- Prepare the Workshop layout and statements.

STUDY EXPERIMENTS

1. Tools and instruments required for maintenance.
2. Safety aspects with respect to man, machine and tools.
3. General procedures for servicing, maintenance schedule and record maintenance.

SUGGESTED LIST OF EXPERIMENTS

1. Cylinder reboring-checking the cylinder bore and setting the tool and reboring.
2. Valve grinding, valve lapping.
3. Setting the valve angle and checking for valve leakage
4. Calibration of fuel injection pump
5. Wheel alignment - testing of camber, caster.
6. Testing kingpin inclination, toe-in and toe-out.
7. Chassis alignment testing
8. Brake adjustment and brake bleeding.
9. Head light adjustment.
10. Tyre changing.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand about the tools and Equipment's used in automotive workshop.
- CO2 - Troubleshoot and service various sub systems in the vehicle
- CO3 - Demonstrate the cylinder re-boring
- CO4 - Perform the valve grinding and lapping
- CO5 - Demonstrate the Wheel alignment for a vehicle
- CO6 - Demonstrate the removal of tyre and tube

SAUA3001	AUTOMOTIVE AIRCONDITIONING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- Identify various components of Vehicle Air conditioning and heating system
- Understand the principle of maintenance and service procedure of Air conditioner
- Study the working of Air conditioning system and its components
- Understand the working of various types of refrigerants and their properties.

UNIT 1 AIRCONDITIONING FUNDAMENTALS**9 Hrs.**

Basic air conditioning system - location components, layout of air conditioning system, Components - compressor, condenser and high pressure service valve, thermostatic expansion valve, evaporator, controlling evaporator temperature

UNIT 2 AIR CONDITIONER – HEATING SYSTEM**9 Hrs.**

Automotive heaters, manually controlled air conditioner and heater system, automatically controlled air conditioner and heater systems, automatic temperature control, safety devices - air conditioning protection & engine protection.

UNIT 3 REFRIGERANT**9 Hrs.**

Classification of refrigerants - Coding of Refrigerants - Desirable properties of refrigerants-Substitute for CFC refrigerants - Containers - Handling refrigerants, air conditioning lubricants. Thermodynamic Cycle of Air conditioner-Vapour Compression cycle, Coefficient of Performance.

UNIT 4 AUTOMATIC TEMPERATURE CONTROL**9 Hrs.**

Different Types Of Sensors And Actuators Used In Automatic Temperature Control- Fixed And Variable Displacement Temperature Control- Semi Automatic- Controller Design For Fixed And Variable Displacement Type Air Conditioning System

UNIT 5 AIR CONDITIONING SERVICE**9 hrs.**

Air conditioner maintenance and service, inspection using manifold gauge, servicing heater system, removing and replacing components, evacuation and refilling of refrigerant, trouble shooting of air controlling system, servicing of compressor

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1 - Understand various types of refrigerants and their properties
- CO2 - Diagnose various faults in air conditioning system by using suitable tools and instruments.
- CO3 - Explain the thermodynamic cycle of refrigeration, Compute C.O.P and classify refrigerants.
- CO4 - Distinguish manually controlled and automatic controlled air conditioner.
- CO5 - Justify evacuation and refilling of refrigerants. Carryout servicing of components in refrigeration system.
- CO6 - Follow safety rules while servicing of Air conditioning and heating system.

TEXT / REFERENCE BOOKS

1. William H. Crouse and Donald I. Anglin - "Automotive Air conditioning" - McGraw Hill Inc. - 1990.
2. Boyce H.D Wiggins - "Automotive Air Conditioning" - Delmar - 2002
3. Mitchell information Services, Inc - "Mitchell Automatic Heating and Air Conditioning Systems" - Prentice Hall Ind.-1989.
4. Paul Weiser - "Automotive Air Conditioning" - Reston Publishing Co., Inc., - 1990.
5. MacDonald, K.I., - "Automotive Air Conditioning" - Theodore Audel series - 1978.
6. Goings.L.F. - "Automotive Air Conditioning" - American Technical services -1974.
7. Warren Farnell And James D.Halderman, "Automotive Heating, Ventilation, And Air Conditioning Systems", Classroom Manual, Pearson Prentice Hall, 2004.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each - No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SAUA3002	AUTOMOTIVE POLLUTION CONTROL	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- Understand the sources of Automobile Emissions and their effects on environment.
- Gain knowledge about the formation of Emissions from SI Engines.
- Gain knowledge about the formation of Emissions from CI Engines.
- Understand Emission and control Techniques in SI and CI Engines.
- Understand measuring techniques of Emission and test procedure.

UNIT 1 INTRODUCTION**9 Hrs.**

History back ground, exhaust gas pollutants, vehicle population assessment in metropolitan cities and contribution to pollution, effect on human health and environment, global warming, acid rain, type of emission-exhaust & non-exhaust emission, transient operational effect on pollution

UNIT 2 POLLUTANT FORMATION IN S.I ENGINES**9 Hrs.**

Pollutant formation in SI engines, mechanism of HC and CO formation in four stroke and two stroke SI engines, NOx formation in SI engine, effects of design and operating variables on emission formation, control of evaporative emission, modern evaporative emission control device, charcoal canister, two stroke engine pollution.

UNIT 3 POLLUTANT FORMATION IN C.I ENGINES**9 Hrs.**

Pollutant formation in CI engines, smoke and particulate emissions in CI engines, effects of design and operating variables on CI engines emissions, NOx formation and control, noise pollution from automobiles, vehicle body noise, measurement standards, smoke & smoke measurements, particulate emission and control, diesel pollution control methods - CO - UBHC – low heat rejection engine.

UNIT 4 CONTROL OF EMISSION FROM SI AND CI ENGINES**9 Hrs.**

Design of engine, optimum selection of operating variables for control of emissions, EGR, thermal reactors, secondary air injection, catalytic converters, catalyst, fuel modifications, post combustion treatments, fuel cells, two stroke engine pollution controls, supply of fuel - establishment of national test centres, construction of road networks, estimation of petroleum reserve - need for alternate fuels - merits & demerits and uses of CNG, LPG, alcohols, hydrogen, bio-fuels, electric energy, solar energy, noise control, noise control devices and noise proof materials & vibration control - muffler.

UNIT 5 MEASUREMENT TECHNIQUES, EMISSION STANDARDS AND TEST PROCEDURE**9 Hrs.**

NDIR, FID, chemiluminescent analysers, gas chromatograph, smoke meters, emission standards, driving cycles - USA, JAPAN, EURO and INDIA, test procedures - ECE, FTP tests. SHED test - chassis dynamometers, dilution tunnels, measurements of invisible emissions -ORSAT sat apparatus, evaluation of emission standards - mandatory tests for emission measurement type approval & production conformity tests - driving cycles, Bharat stages & Euro emission standards.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1 - Understand the sources of formation of engine emissions and its effect on human health and environment.
- CO2 - Explain the effects of design and operating variables on emission formation and working principle of modern evaporative emission control device.
- CO3 - Explain the effects of design and operating variables on CI engines emissions and various sources of noise pollution from automobiles
- CO4 - Understand various emission control technique for both SI and CI engines.
- CO5 - Understand the importance of various alternative fuels for reducing emission.
- CO6 - Explain the test procedure of different emission measurement technique and recall various emission standards.

TEXT / REFERENCE BOOKS

1. Pundir.B. P, "Engine Emissions: Pollutant Formation and Advances in Control Technology", 2nd edition, Narosa publication, 2012.
2. Ganesan V, "Internal Combustion Engines"4th edition, Tata McGraw Hill publication 2017.
3. Rajput R. K, "A textbook of Internal Combustion Engines", Third edition Laxmi Publications,2016.
4. John B. Heywood, "Fundamentals of Internal Combustion Engine, Second edition, McGraw-Hill Education; 2018
5. Mathur and Sharma "Internal Combustion Engines" "Dhanpat Rai and Sons Publication, 2012.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each - No choice**20 Marks****PART B:** 2 Questions from each unit with internal choice, each carrying 16 marks**80 Marks**

SAUA3003	AUTOMOTIVE AERODYNAMICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To apply basic principles of aerodynamics for the design of vehicle body.
- To become familiar with modern engineering tools and analyze the problems within the domains of Automobile Engineering as members of multidisciplinary teams.
- To demonstrate the ability to use the techniques, skills and modern engineering tools necessary for engineering practice in the field of Automobile Engineering.

UNIT 1 INTRODUCTION**9 Hrs.**

Scope, historical developments, fundamentals of fluid mechanics, flow phenomenon related to vehicles, external and internal flow problem, resistance to vehicle motion, performance, fuel consumption and performance potential of vehicle aerodynamics.

UNIT 2 AERODYNAMIC DRAG OF CARS**9 Hrs.**

Cars as a bluff body, flow field around car, drag force, types of drag force, analysis of aerodynamic drag, drag coefficient of cars, strategies for aerodynamic development, low drag profiles.

UNIT 3 SHAPE OPTIMIZATION OF CARS**9 Hrs.**

Front end modification, front and rear windshield angle, boat tailing, hatchback, fastback and square back, dust flow patterns at the rear, effects of gap configuration, effect of fasteners. Case studies on modern vehicles.

UNIT 4 WIND TUNNELS FOR AUTOMOTIVE AERODYNAMICS**9 Hrs.**

Introduction, principle of wind tunnel technology, limitation of simulation, stress with scale models, full-scale wind tunnels, measurement techniques, equipment and transducers, road testing methods, numerical methods. CFD analysis.

UNIT 5 VEHICLE HANDLING**9 Hrs.**

The origin of forces and moments on a vehicle, lateral stability problems, methods to calculate forces and moments - vehicle dynamics underside winds, the effects of forces and moments, characteristics of forces and moments, dirt accumulation on the vehicle, wind noise, drag reduction in commercial vehicles and racing cars.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, students will be able to

- CO1 - Acquire strong basics in motion of the vehicle in all aspects of the constraints.
- CO2 - Understand the fundamentals of aerodynamics, vehicle body optimization, measuring aerodynamics forces.
- CO3 - Predict component or process to meet the desired needs within realistic constraints such as comfort, environmental and safety,
- CO4 - Analyze, interpret data and simulate the structures in automobiles.
- CO5 - Choose the appropriate characteristics of forces and moments in vehicle for multi-disciplinary areas.
- CO6 - Design, formulate and optimistically solve problems related to Automobile Engineering.

TEXTBOOK / REFERENCES

1. Hucho .W.H., "Aerodynamic of Road Vehicles", SAE International, 2015.
2. A. Pope, "Wind Tunnel Testing", 5th Edition, John Wiley & Sons New York, 2015.
3. "Automotive Aerodynamic", ISBN:978-1-119-18572-7, Wiley, 2016.
4. Thomas Schwartz, "Aerodynamics of Road Vehicles", R-430, Society of Automotive Engineers Inc, 2015.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each - No choice**20 Marks****PART B:** 2 Questions from each unit with internal choice, each carrying 16 mark**80 Marks**

SAUA3008	TWO AND THREE WHEELED VEHICLES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- Understand the various systems and subsystems of two and three wheeled vehicles
- understand the constructional details operating characteristics and vehicle design aspects
- Address the underlying concepts and methods behind two and three wheeler technology.
- Extant a problem oriented in depth knowledge of two and three wheeler technology.

UNIT 1 THE POWER UNIT**9 Hrs.**

Two stroke and four stroke SI & CI engine construction and working, merits and demerits, symmetrical and unsymmetrical valve & port timing diagrams, scavenging process, scavenging efficiency, types of scavenging, unif low and cross flow.

UNIT 2 FUEL AND IGNITION SYSTEM**9 Hrs.**

Fuel system - different circuits in two wheeler fuel systems, fuel injection system, lubrication system, ignition systems - magneto coil and battery coil spark ignition system, electronic ignition system, starting system - kick starter system - self-starter system, recent technologies.

UNIT 3 CHASSIS AND SUB-SYSTEM**9 Hrs.**

Main frame for two and three wheelers, its types, chassis and different drive systems for two wheelers, single, multiple plates and centrifugal clutches, gear box and its and various gear controls in two wheelers front and rear suspension systems shock absorbers, panel meters and controls on handle bar, freewheeling devices.

UNIT 4 BRAKES AND WHEELS**9 Hrs.**

Drum brakes & disc brakes, construction and working and its types, front and rear brake links lay-outs, brake actuation mechanism, spoked wheel, cast wheel, disc wheel & its merits and demerits, tires and tubes, construction & its types, steering geometry.

UNIT 5 TWO AND THREE WHEELERS – CASE STUDIES**9 Hrs.**

Case studies - sports bike, motor cycles, scooters and mopeds - auto rickshaws, pick up van, delivery van and trailer, servicing and maintenance, recent developments.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1 - Gain knowledge about the Engines employed for two and three wheelers.
- CO2 - Understand about the Chassis and its sub-systems.
- CO3 - Distinguish about the functionality of Brakes and wheels.
- CO4 - Gain knowledge on specific Case studies of major Indian models.
- CO5 - Develop the information about Servicing, maintenance and trouble shooting of two and three wheelers.
- CO6 - Acquire knowledge about recent developments in two and three wheelers.

TEXT / REFERENCES BOOKS

1. Irving,P.E., Motor cycle Engineering, Temple Press Book, London, 1992.
2. The Cycle Motor Manual, Temple Press Ltd., London, 1990.
3. K. K. Ramalingam, Two Wheelers, Scitech publications, Chennai, 2005.
4. Encyclopedia of Motor cycling, 20 volumes, Marshall Cavensih, New York and London,1989.
5. Bryaut,R.V., Vespa Maintenance and Repair series.
6. Raymond Broad, Lam bretta - A practical guide to maintenance and repair, 1987.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each - No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SAUA3010	STYLING AND MODELLING OF VEHICLES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To understand the basics and familiarize with the concepts on the styling of automobiles.
- To design the structure and surfaces of vehicles.
- To visualize the interior and exterior of vehicles.

UNIT 1 INTRODUCTION TO**9 Hrs.**

Introduction to product design, drawing by hand, drawing using CAD softwares, geometric versus naturalistic drawing, modernist design. Basic drawing skills - Perspectives, metric projections, spherical projections, orthographic projections, sections and scrap views. Tools and materials. Car Design,, Automotive Sketching, Styling process, Car proportions, Aerodynamics, Crashworthiness and its influence on body design, Designing of Interior

UNIT 2 FORM STUDIES**9 Hrs.**

Technical production documentation, the general arrangement drawing, drafting standards, computer aided drafting, geometric constructions, controlling curves, Form studies, Speed Forms, Clay Modeling, 2D systems, 3D systems, parametric design, CAD data - Exchange standards and all change in the CAD market. From watercolor washes to markers, painting by numbers, the art of design, visual tricks, making marker drawing, 2D computer programs: paint and vector, 3D computer aided styling (CAS), creating virtual reality, shading a computer model, ray tracing and radiosity, adding texture, fractals and commercial modelers.

UNIT 3 COMPUTER SYSTEMS**9 Hrs.**

The computer processor, system software, the central processing unit, memory, frame buffers, display, input devices, hardcopy output, 3D output devices, networking, healthy and safety. Concept design - Satisfying the client, sketch, schematic, evaluating the design, 3D modeling concepts, hybrid approach, commercial computer solutions, drawing in space, creating organic forms. Art of technical illustration, techniques of technical illustration, thick and thin lines, sections, cutaways and ghosting, photo-tracing, annotation and labeling, computer aided illustration, interactive technical illustration and commercial solutions.

UNIT 4 VEHICLE ERGONOMICS**9 Hrs.**

Dimension Determination, Anthropometry - Need, Data collection methodology, Different postural considerations, Measuring Procedures Subject and Sampling size selection, Measurement of Hands/Feet/Full posture, Applying Anthropometry data, Application of percentile curves. Passenger Compartment, Floor Pan, Technical requirements, Dash board equipments arrangement, Positioning of operational controls, Force Analysis, Seating and position(ECE Regulations), Human Factors, Navigation systems, pedal positioning

UNIT 5 VEHICLE PACKAGING**9 Hrs.**

R-Point, AHP, Manikin positioning of 2-D pattern, car entry/exit, Sight - All round visibility, View of Instruments, Mirror design, Logical formation of cockpit, Boot lid packaging, Loading/Unloading analysis.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1 - Familiarize on sketching in various automotive exterior parts
- CO2 - Acquire the knowledge on design and styling of cars.
- CO3 - Acquire the concepts of benchmarking for quality improvement
- CO4 - Gain knowledge on the systematic methods of creative designing.
- CO5 - Expertise in the various steps involved in automotive product design
- CO6 - Expertise in the various processes involved in automotive product development

TEXT / REFERENCE BOOKS

1. Vivek D Bhise, "Ergonomics in the Automotive Design Process", 2013, ISBN- 10: 1439842108
2. Tony Lewin, "How to Draw Cars like a Pro", Motorbooks International, 2003.
3. Thom Taylor, Lisa Hallett, "How to Draw Cars like a Pro", Motorbooks International; 2Rev Ed edition, 2006.
4. Julian Happian-Smith, "An introduction to modern vehicle design", Butterworth Heinmann, 2001.
5. Fenton John, "Handbook of automotive body and system design", Wiley-Blackwell, 1998.
6. J. Brian Peacock, Waldemar Karwowski, "Automotive ergonomics", Taylor & Francis Ltd, 1993.
7. Alan Pipes, "Drawing for Designers", Laurence King Publishing, 2007.
8. Erik Olofsson, Klara Sjölen, "Design Sketching", Keeos Design Books AB, 2005.
9. Stuart Macey, Geoff Wardle, Ralph Gilles, Freeman Thomas, Gordon Murray , "H-Point: The Fundamentals of Car Design & Packaging", Design Studio Press, 2009.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each - No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SMEA3012	INDUSTRIAL ROBOTICS AND EXPERT SYSTEMS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To teach students the basics of robotics and Automation Systems.
- To teach students robot cell design , Robot Configuration and robot programming.
- To teach students application of artificial intelligence and expert systems in robotics.

UNIT 1 INTRODUCTION AND ROBOTIC KINEMATICS**9 Hrs.**

Definition need and scope of industrial robots- Coordinate Systems Classification of Robot- Robot anatomy - work volume - Precision movement - End effectors - sensors. Robot kinematics - Basics about plane rotation - rotation matrix - Direct and inverse kinematics - Robot trajectories-Control of robot manipulators - Robot dynamics - Methods for orientation and location of objects. Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load.

UNIT 2 ROBOT DRIVES AND CONTROL**9 Hrs.**

Controlling the robot motion - Position and velocity sensing devices - Design of drive systems - Hydraulic and Pneumatic drives - D.C. Servo Motors, Stepper Motors, A.C. Servo Motors Linear and rotary actuators and control valves -Electro hydraulic servo valves, electric drives - Motors -Selection of Drives- designing of end effectors - Vacuum, magnetic and air operated grippers

UNIT 3 ROBOT PATH PLANNING & IMAGE PROCESSING**9 Hrs.**

Introduction-Path planning overview- Road map path planning- Cell decomposition path planning-Potential field path planning-Obstacle avoidance- Robotic vision system - Image Greeting - Image processing and analysis - Image segmentation - Pattern recognition - Training of vision system

UNIT 4 ROBOT CELL DESIGN AND FIELD ROBOTS**9 Hrs.**

Robot work cell design and control - Safety in Robotics - Robot cell layouts - Multiple robots and machine interference - Robot cycle time analysis - Ariel robots- Collision avoidance-Robots for agriculture, mining, exploration, underwater, civilian and military applications, nuclear applications, Space applications

UNIT 5 ROBOT PROGRAMMING, ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS**9 Hrs.**

Methods of robot programming - characteristics of task level languages lead through programming methods-Motion interpolation. Artificial intelligence - Basics - Goals of artificial Intelligence - AI techniques - problems representation in AI- Problem reduction and solution techniques - Application of AI. Elements of Knowledge Representation -Logic, Production Systems, Semantic Networks, Expert Systems Knowledge Building Environment Systems (KBES)-Humanoids.

Max.45 Hrs.**COURSE OUTCOMES**

- On completion of the course, student will be able to
- CO1 - Describe Fundamental Concepts of Robots and Kinematics.
 - CO2 - Implement Drives concepts in End effectors.
 - CO3 - Analyze and design Path planning and Image processing.
 - CO4 - Design robot work cell for automation industries.
 - CO5 - Understand the robot programming methods
 - CO6 - Understand the concepts of AI and expert systems

TEXT / REFERENCE BOOKS

1. K.S.Fu, R.CGonzalez and C.S.G. Lee, Robotics control, Sensing, Vision and intelligence", McGraw Hill,1994.
2. Kozyrey, Yu, "Industrial Robotics", MIR Publishers Moscow, 1998.
3. Richard.D.,Klafter, Thomas.A, Chmielewski, Machine Negin "Robotics Engineering-An Integrated Approach", PrenticeHall of India, 1984.
4. Deb, S.R. "Robotics Technology and Flexible Automation", Tata McGraw Hill, 1994.
5. Mikell,P.Groover, Mitchell Weis, Roger N.Nagel, Nicholas Odrey "Industrial Robotics Technology, Programming and Applications", McGraw Hill, Int., 1986.
6. Timothy Jordonidesetal,"Expert Systems and Robotics", Springer-Verlag, New York, May 1991.
7. Ashitave Ghosal "Robotics - Fundamental concepts and Analysis" Oxford University Press, 2006.
8. Koren Y., "Robotics for Engineers", McGraw Hill Book Co., 1992.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each - No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SAUA3013	ALTERNATE FUELS AND ENERGY SYSTEMS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To gain in depth knowledge of alternate fuels used in automobile applications.
- To understand the alternate energy systems used in automobile applications.

UNIT 1 ALCOHOLS AS FUELS**9 Hrs.**

Introduction to alternative Fuels. - Need for alternative Fuels - Availability of different alternative fuels for SI and CI Engines. Alcohols as fuels. Production methods of alcohols. Properties of alcohols as fuels. Methods of using Alcohols in CI and SI Engines. Blending, Dual Fuel Operation, Surface Ignition and oxygenated Additives. Performance Emission and Combustion Characteristics in CI and SI Engines.

UNIT 2 VEGETABLE OILS AS FUELS**9 Hrs.**

Various vegetable oils and their important properties, Different methods of using vegetable oils in engines - Blending, Preheating, transesterification and emulsification of vegetable oils - Performance in engines - Performance, Emission and combustion characteristics in diesel engines

UNIT 3 HYDROGEN AS ENGINE FUEL**9 Hrs.**

Production methods of hydrogen. Combustive properties of hydrogen. Problems associated with hydrogen as fuel and solutions. Different methods of using Hydrogen In SI And CI Engines. Performance, emission and combustion analysis in engines. Hydrogen storage – Safety aspects of hydrogen.

UNIT 4 BIOGAS, NATURAL GAS AND LPG AS FUELS**9 Hrs**

Production methods of biogas, Natural gas and LPG. Property studies. CO₂ and H₂S scrubbing in biogas. Modification required to use in SI And CI Engines- Performance and emission characteristics of biogas, CNG and LPG in SI And CI engines.

UNIT 5 ELECTRIC, HYBRID AND FUEL CELL VEHICLES**9 Hrs.**

Layout of electric vehicle and hybrid vehicles - Advantages and drawbacks of electric and hybrid vehicles. System components, Electronic control system - Different configurations of hybrid vehicles. Power split device. High energy and power density batteries – Basics of fuel cell vehicles.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1 - Understand the need of alternate fuels and energy systems.
- CO2 - Understand the production method of various alternate fuels.
- CO3 - Understand the different methods of using alternate fuels in engines.
- CO4 - Understand the properties of different alternate fuels.
- CO5 - Analyse the performance, emission and combustion characteristics of engines using alternate fuels.
- CO6 - Understand the basics of electric, hybrid and fuel cell vehicles.

TEXT / REFERENCE BOOKS

1. S.S. Thipse, "Alternative Fuels", Jaico Publishing House; First edition, 2010.
2. Erjavec Jack Et.Al, "Alternative Fuel Technology: Electric, Hybrid, and Fuel-Cell Vehicles", Cengage Learning, 2007.
3. Ganesan. V. "Internal Combustion Engines", Tata McGraw-Hill Publishing Co, 2012.
4. Mathur D.S., Sharma. R.P. "A course in internal combustion engines", Dhanpatrai publication, 2014.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each - No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**80 Marks**



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JEPPIAAR NAGAR, RAJIV GANDHI SALAI, 600 119.



ACADEMIC REGULATIONS

Choice Based Credit System (CBCS)

(Applicable for students admitted from 2015)

PROGRAMME: B.E

AUTOMOBILE ENGINEERING

CURRICULUM

SEMESTER 1

Sl. No.	COURSE CODE	COURSE TITLE	L	T	P	Total Hrs.	Credits
THEORY							
1	SCH1101	Environmental Science and Engineering					
	SHS1101	English for Science and Technology	3	0	0	45	3
2	SMT1101	Engineering Mathematics - I	3	1	0	60	4
3	SPH1101	Physics of Engineering Materials	3	0	0	45	3
4	SCY1101	Engineering Chemistry	3	0	0	45	3
5	SME1101	Engineering Mechanics	3	1	0	60	4
6	SME1102	Fundamentals of Mechanical Engineering	3	0	0	45	3
PRACTICAL							
7	SPH4051	Engineering Physics Lab	0	0	2	15	1
8	SCY4051	Engineering Chemistry Lab	0	0	2	15	1
9	SME4051	Engineering Graphics - I	1	0	2	30	2
TOTAL CREDITS						24	

SEMESTER 2

Sl.No	COURSE CODE	COURSE TITLE	L	T	P	Total Hrs.	Credits
THEORY							
1	SHS1101	English for Science and Technology					
	SCH1101	Environmental Science and Engineering	3	0	0	45	3
2	SMT1105	Engineering Mathematics - II	3	1	0	60	4
3	SCH1101	Environmental Science and Engineering	3	0	0	45	3
4	SPH1102/ SPH1103/ SPH1104	Physics for Electronic Devices / Engineering Physics / Applied Biophysics	3	0	0	45	3
5	SCY1102/ SCY1103/ SCY1104/ SCY1105	Chemistry of Electronic Materials / Chemistry of Industrial Materials / Bio-organic Chemistry / Physical Chemistry	3	0	0	45	3
6	SCS1102	Fundamentals of Programming	3	0	0	45	3
7	SEE1103	Electrical Engineering	3	0	0	45	3
PRACTICAL							
8	SCS4101	Programming in C Lab	0	0	4	30	2
9	SME4052	Engineering Graphics - II	1	0	2	30	2
TOTAL CREDITS						23	

L - LECTURE HOURS, T - TUTORIAL HOURS, P - PRACTICAL HOURS, C - CREDITS

SEMESTER 3

Sl.No.	COURSE CODE	COURSE TITLE	L	T	P	Total Hrs	Credits
THEORY							
1	SMT1201	Engineering Mathematics - III	3	1	0	60	4
	SME1203	Kinematics of Machines	3	1	0	60	4
	SME1204	Strength of Materials	3	1	0	60	4
	SPR1201	Material Technology	3	0	0	45	3
2	SPR1202	Engineering Metrology	3	0	0	45	3
3	SAU1201	Fuels and Lubricants	3	0	0	60	3
PRACTICAL							
7	SME4056	Material Testing Lab	0	0	4	30	2
8	SPR4051	Manufacturing Process Lab - I	0	0	4	30	2
TOTAL CREDITS						25	

SEMESTER 4

Sl.No.	COURSE CODE	COURSE TITLE	L	T	P	Total Hrs	Credits
THEORY							
1	SMT1204/ SMT1206/ SMT1207/ SMT1208/ SMT1209	Engineering Mathematics - IV / Number Theory and Linear Algebra / Graph Theory / Applied Statistics / Foundations of Mathematics	3	1	0	60	4
2	SME1201	Engineering Thermodynamics	2	1	0	45	3
3	SME1202	Fluid Mechanics and Machinery	3	1	0	60	4
4	SME1206	Dynamics of Machinery	3	1	0	60	4
5	SPR1206	Manufacturing Process	3	0	0	45	3
6	SAU1202	Automotive Engines	3	0	0	45	3
PRACTICAL							
7	SME4055	Machine Drawing Practice	1	0	2	30	2
8	SAU4051	Fuels Lubricants and Engine Testing Lab	0	0	4	30	2
9	S86PT1	Professional Training - 1	0	0	10	30	5
TOTAL CREDITS						30	

SEMESTER 5

SI.No.	COURSE CODE	COURSE TITLE	L	T	P	Total Hrs	Credits
THEORY							
1	SME1207	Thermal Engineering	3	1	0	60	4
2	SPR1304	Industrial Mechatronics	3	0	0	45	3
3	SAU1302	Automotive Electrical and Electronics	3	0	0	45	3
4	SAU1303	Automotive Engine Component Design	3	1	0	45	4
5	SAU1301	Automotive Chassis	3	0	0	45	3
6	SAU1304	Vehicle Dynamics	3	1	0	45	4
PRACTICAL							
7	SAU4052	Automotive Electrical and Electronics Lab	0	0	4	30	2
8	SAU4053	Automotive Engine Components and Chassis Components Lab	0	0	4	30	2
TOTAL CREDITS						25	

SEMESTER 6

SI.No.	COURSE CODE	COURSE TITLE	L	T	P	Total Hrs.	Credits
THEORY							
1	SME1309	Heat and Mass Transfer	3	1	0	60	4
2	SPR1307	Resource Management Techniques	2	1	0	60	3
3	SAU1305	Automotive Chassis Design	3	0	0	45	3
4	SAU1306	Automotive Pollution and Control	3	0	0	45	3
5	SAU1307	Vehicle Maintenance and Reconditioning	3	0	0	45	3
6		Elective - 1	3	0	0	45	3
PRACTICAL							
7	SAU4054	Two Wheeler and Three Wheeler Lab	0	0	4	30	2
8	SAU4055	Computer Aided Engine Design and Chassis Design Lab	0	0	4	30	2
9	S86 PT2	Professional Training - 2	0	0	10	30	5
TOTAL CREDITS						28	

SEMESTER 7

Sl.No.	COURSE CODE	COURSE TITLE	L	T	P	Total Hrs	Credits
THEORY							
1	SAU1402	Automotive Transmission	3	0	0	45	3
2	SAU1403	Vehicle Body Engineering	3	0	0	45	3
3		Elective - 2	3	0	0	45	3
4		Elective - 3	3	0	0	45	3
PRACTICAL							
7	SPR4054	CAD / CAM Lab	0	0	4	30	2
8	SAU4056	Vehicle Maintenance and Reconditioning Lab	0	0	4	30	2
		Project Work (Phase - 1)					
TOTAL CREDITS							16

SEMESTER 8

Sl.No.	COURSE CODE	COURSE TITLE	L	T	P	Total Hrs	Credits
THEORY							
1	SBA1101	Principles of Management and Professional Ethics	3	0	0	45	3
2	SAU1404	Vehicle Design Characteristics	3	0	0	45	3
3		Elective - 4	3	0	0	45	3
4	S86 PROJ	Project Work (Phase - 1 & 2)	0	0	30		15
TOTAL CREDITS							24
TOTAL CREDITS FOR THE PROGRAMME							195

ELECTIVE COURSES (GROUP A)

Sl. No.	COURSE CODE	COURSE TITLE	L	T	P	Total Hrs.	Credits
1	SME1601	Advanced Internal Combustion Engineering	3	0	0	45	3
2	SME1603	Alternative Fuels and Energy Systems	3	0	0	45	3
3	SME1615	Fuel Cell and Applications	3	0	0	45	3
4	SAU1601	Automotive Aerodynamics	3	0	0	45	3
5	SAU1602	Automotive Air Conditioning	3	0	0	45	3
6	SAU1603	Automotive Safety	3	0	0	45	3
7	SAU1604	Hybrid and Electric Vehicles	3	0	0	45	3
8	SAU1605	Modern Automobile Accessories	3	0	0	45	3
9	SAU1606	Vibration and Noise control in Automobiles	3	0	0	45	3
10	SAU1607	Off Road Vehicles	3	0	0	45	3
11	SAU1608	Styling and Modelling of Vehicles	3	0	0	45	3
12	SAU1610	Two and Three Wheeled Vehicles	3	0	0	45	3

ELECTIVE COURSES (GROUP B)

Sl.No.	COURSE CODE	COURSE TITLE	L	T	P	Total Hrs.	Credits
1	SPR1602	Artificial Intelligence and Expert Systems	3	0	0	45	3
2	SPR1604	Design for Manufacture and Assembly	3	0	0	45	3
3	SPR1605	Flexible Manufacturing Systems	3	0	0	45	3
4	SPR1606	Industrial Robotics and Expert systems	3	0	0	45	3
5	SPR1607	Industrial Safety Engineering	3	0	0	45	3
6	SPR1609	Material handling and Storage systems	3	0	0	45	3
7	SPR1611	Non Destructive Testing and Techniques	3	0	0	45	3
8	SPR1612	Six Sigma Methods and Applications	3	0	0	45	3
9	SPR1615	Production and operations Management	3	0	0	45	3
10	SPR1616	Rapid Prototyping	3	0	0	45	3
11	SPR1617	Supply Chain Management	3	0	0	45	3
12	SPR1619	Precision Engineering	3	0	0	45	3

SME4051	ENGINEERING GRAPHICS I (Common to Mech, M&P, Aero & Auto)	L	T	P	Credits	Total Marks
		1	0	3	2	100

COURSE OUTCOMES:

On completion of the course, student will be able to

- CO1 - Adapt the drawing standards, conventions and practices in engineering drawing.
- CO2 - Draw the conic sections for the given real world example using the eccentricity method.
- CO3 - Interpret the orthographic projections for the straight lines lying in the first quadrant using the change of position method.
- CO4 - Interpret the orthographic projections for the solids lying in the first quadrant using the change of position method.
- CO5 - Use the two dimensional features of a CAD package to sketch the required engineering drawing.
- CO6 - Sketch the two dimensional engineering drawing in a CAD package with layout selection, dimensioning, annotations, symbols and tolerances.

UNIT 1 FUNDAMENTALS**6 Hrs.**

Use of drafting instruments - Bureau of Indian Standards (BIS) - Lettering - Vertical and Inclined - Dimensioning - Aligned and Unidirectional systems - Scaling - Importance of graphics in engineering applications.

UNIT 2 GEOMETRICAL CONSTRUCTIONS**6 Hrs.**

Dividing a given straight line into any number of equal parts - Bisecting a given angle - Trisecting a right angle - Drawing a regular pentagon and hexagon given one side.

UNIT 3 PROJECTION OF POINTS AND LINES**6 Hrs.**

Types of projection - Introduction to orthographic projection - Orthographic projection of points lying in four quadrants - Orthographic projection of lines in first quadrant - Parallel to both the planes - Perpendicular to one plane - Parallel to one plane and inclined to other plane - Inclined to both the planes.

UNIT 4 PROJECTION OF SOLIDS**6 Hrs.**

Orthographic projection of prisms, pyramids, cone and cylinder in first quadrant - Axis perpendicular to HP - Axis perpendicular to VP - Axis inclined to only one plane of projection - Change of position method only.

UNIT 5 COMPUTER AIDED DRAFTING**6 Hrs.**

Introduction to AutoCAD2015 - Basic commands - Simple part modeling - Combination of basic geometric entities like cone, cylinder, prism, pyramids and cube - Indian standard angles - Indian standard tees - Indian standard beams - Preparation of GAD (General Arrangement Drawing) development of plot plan - Preparation of P & ID (Piping and Instrumentation Diagram) - Preparation of equipment drawing like storage tank, pressure vessel, heat exchanger, distillation column, pump and motor.

Max.45 Hrs.**TEXT / REFERENCE BOOKS**

- Natarajan, K.V., A text book of Engineering Graphics, Dhanalakshmi Publishers, 2006
- Bhatt, N.D. and Panchal, V.M., Engineering Drawing, Charotar Publishing House, 2010
- Ibrahim Zeid., CAD / CAM Theory and Practice, McGraw Hill, 1991
- Venugopal, K. and Prabhu Raja, V., Engineering Drawing and Graphics + AutoCAD, New Age International, 2009.
- Trymbaka Murthy, S., Computer Aided Engineering Drawing, I.K. International Publishing House, 2009.
- SP 46: Engineering Drawing Practice for schools and colleges, Bureau of Indian Standards.
- AutoCAD - 2D CAD Reference Guide.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 2 Questions each from CO1-CO4, 1 question each from CO5 and CO6 - No choice**20 Marks****PART B:** 4 Questions each with internal choice from CO1-CO4, 1 question from CO5 and CO6 with internal choice, each carrying 16 marks**80 Marks**

SCS1102	FUNDAMENTALS OF PROGRAMMING (Common to ALL Branches of B.E/ B. Tech.)	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Comprehend the basic structure, compilation and execution of C program
- CO2 - Develop the C program using conditional statements and function.
- CO3 - Appraise the concept of array and structure.
- CO4 - Develop C program using storage classes and pointers
- CO5 - Apply preprocessor directives for memory management
- CO6 - Create the programs using file concept for different applications.

UNIT 1 INTRODUCTION**9 Hrs.**

Introduction: Algorithms, Pseudocodes & flowcharts, Overview of C, features of C, Structure of C program, Compilation & execution of C program. Identifiers, variables, expression, keywords, data types, constants, scope and life of variables, and local and global variables. Operators: arithmetic, logical, relational, conditional and bitwise operators. Special operators: size of () & comma (,) operator. Precedence and associativity of operators & Type conversion in expressions. Basic input/output and library functions: Single character input/output i.e. getch(), getchar(), getche() & putchar(). Formatted input/output: printf() and scanf().

UNIT 2 CONTROL STRUCTURES AND FUNCTIONS**9 Hrs.**

Control structures: Conditional control (if, nested if, switch case), Loop control (for, while, do while) and Unconditional control structures (goto) Functions: The Need of a function, user defined and library function, prototype of a function, calling of a function, function argument, passing arguments to function, return values, nesting of function, recursion. Library Functions: Concepts, mathematical and string functions.

UNIT 3 ARRAYS AND STRINGS**9 Hrs.**

Arrays: Single and multidimensional arrays, array declaration and initialization of arrays, array as function arguments. Strings: Declaration, initialization and string handling functions. Structure and Union: Defining structure, declaration of structure variable, accessing structure members, nested structures, array of structures, structure assignment, structure as function argument, function that returns structure, union.

UNIT 4 STORAGE CLASSES AND POINTERS**9 Hrs.**

Storage class specifier - auto, extern, static & register, Pointers: The '&' and '*' operators, pointers expressions, pointers Vs arrays.

UNIT 5 MEMORY MANAGEMENT**9 Hrs.**

Pointer to functions, Function returning pointers Direct Memory Access functions: malloc(), calloc(), sizeof(), free() and realloc(). Preprocessor directives. Command line arguments

Max. 45 Hrs.**TEXT / REFERENCE BOOKS**

1. Balaguruswami. E., "Programming in C", TMH Publications, 1997
2. Yashavant P. Kanetkar., "Let us C", Fifth Edition
3. Gottfried, "Programming with C", Schaums Outline Series, TMH publications, 1997
4. Mahapatra, "Thinking in C", PHI publications, 2nd Edition.
5. Subburaj . R, "Programming in C", Vikas Publishing, First Edition, 2000

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.**

PART A: 2 Questions each from CO1-CO4, 1 question each from CO5 and CO6 - No choice

20 Marks

PART B: 4 Questions each with internal choice from CO1-CO4, 1 question from CO5 and CO6 with internal choice, each carrying 16 marks

80 Marks

SME4052	ENGINEERING GRAPHICS II (Common to Mech, M&P, Aero & Auto)	L	T	P	Credits	Total Marks
		1	0	3	2	100

COURSE OUTCOMES:

On completion of the course, student will be able to

- CO1 - Draw the section of solids with cutting plane perpendicular to one plane and parallel or inclined to other plane.
- CO2 - Draw the development drawings required to make the sheet metal work with frustum or truncation.
- CO3 - Draw the isometric projections for the given solids and combination of solids using box method.
- CO4 - Interpret the orthographic projections for the given three dimensional isometric picture.
- CO5 - Use three dimensional features of a CAD package to sketch the required engineering drawing.
- CO6 - Sketch three dimensional geometric models in a CAD package with layout selection, dimensioning, annotations, symbols and tolerances.

UNIT 1 SECTION OF SOLIDS**6 Hrs.**

Sectioning of prisms, pyramids, cylinder and cone in simple vertical positions with cutting planes perpendicular to one plane and parallel or inclined to other plane.

UNIT 2 DEVELOPMENT OF SURFACES**6 Hrs.**

Need for development of surfaces - Development of prisms, pyramids, cylindrical and conical surfaces.

UNIT 3 ISOMETRIC PROJECTION**6 Hrs.**

Isometric scale - Isometric View and Isometric Projection of simple solids and combination of solids.

UNIT 4 ORTHOGRAPHIC PROJECTION**6 Hrs.**

Drawing orthographic views (plan, elevation and profile) of objects from their isometric views.

UNIT 5 COMPUTER AIDED DRAFTING**6 Hrs.**

AutoCAD 2015 Advanced commands - Sectioning of part modeling - Combination of basic geometric entities like cone, cylinder, prisms, pyramids and cube - Preparation of fabrication drawing (Development of surfaces) - Detailing of storage tank, heat exchanger, distillation column, A/C duct system and nozzle orientation diagram - Preparation of detail design drawing of piping fittings like pipe, elbow, reducers, drain, vent, T-Joint, flange, washer, fasteners, valves and strainers - Preparation of isometric drawings for an piping system - Preparation of detail design drawing for support structures - pipe rack design (steel / RCC structure) - Hanger support, rigid support, floor support, anchors support etc.,

TEXT / REFERENCE BOOKS

1. Natarajan, K.V., A text book of Engineering Graphics, Dhanalakshmi Publishers, 2006
2. Bhatt, N.D. and Panchal, V.M., Engineering Drawing, Charotar Publishing House, 2010
3. Ibrahim Zeid., CAD / CAM Theory and Practice, McGraw Hill, 1991
4. Venugopal, K. and Prabhu Raja, V., Engineering Drawing and Graphics + AutoCAD, New Age International, 2009.
5. Trymbaka Murthy, S., Computer Aided Engineering Drawing, I.K. International Publishing House, 2009.
6. SP 46: Engineering Drawing Practice for schools and colleges, Bureau of Indian Standards.
7. AutoCAD - 2D CAD Reference Guide.

END SEMESTER EXAM QUESTION PAPER PATTERN**By using mini drafter: 50 marks****By using AutoCAD: 50 marks**

Note: Only after submission of all drawing sheets prescribed by staff member, the students will be allowed for university practical examination.

SPR1202	ENGINEERING METROLOGY (Common to Mech , M&P & Auto)	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Apply the suitable measuring instruments to measure various geometric features of components.
- CO2 - Select the measuring instruments for Linear and angular measurements.
- CO3 - Measure thermo physical properties with appropriate instrument.
- CO4 - Calculate the thread parameters and gear terminologies.
- CO5 - Determine internal and external taper angles, straightness and flatness of a given surface using specific instrument.
- CO6 - Apply advanced measuring techniques in industries for quality control.

UNIT 1 INTRODUCTION TO METROLOGY**8 Hrs.**

Accuracy, precision, resolution and sensitivity of measuring instruments, classification of errors in measurements, alignment errors, evaluation and propagation of errors , Limits, fits and tolerances. Terminologies in Measurement - Care of Measuring Instruments- Reliability.

UNIT 2 LINEAR AND ANGULAR MEASUREMENTS**9 Hrs.**

Linear Measuring Instruments - Evolution - Types - Classification - gauge design - concepts of interchangeability and selective assembly - Comparators, slip gauges - Types - Angular measuring instruments - Sine bar, angle gauges, autocollimator, angle dekkor, tool maker's microscope, Bevel protractor, clinometers, spirit levels- Alignment telescope - Applications.

UNIT 3 MEASUREMENT OF POWER, PRESSURE, TEMPERATURE AND FLOW**10 Hrs.**

Power, Force and Torque - mechanical, hydraulic, pneumatic and electrical type - Pressure - low pressure measurement using McLeod gauge, thermal conductivity gauge and ionization gauges - high pressure measurement using diaphragm gauges and bulk modulus pressure gauge. Temperature - thermo couple, RTD, thermistor-electrical resistance thermometer- pyrometers. Flow - Turbine type flow meter, magnetic flow meter, ultra sonic flow meter, thermal flow meter and hot wire anemometer. : Venturimeter, Orifice meter, Rotameter, Pitot tube - Temperature: bimetallic strip.

UNIT 4 FORM MEASUREMENT**9 Hrs.**

Standard thread profiles, Measurement of major, minor and effective diameter, 3 wire method and best wire size, gear tooth profile measurement, run out and composite error measurement, gear pitch measurements. Form measurement - Straightness - Flatness, Roundness, Surface finish measurement.

UNIT 5 ADVANCES IN METROLOGY**9 Hrs.**

Interferometry - laser interferometers - types - Applications - Computer Aided Inspection-Basic concept of Co-ordinate Measuring Machines(CMM) - Types of CMM - Constructional features - Probes - laser interferometer, working principle, applications, alignment and errors; Machine Vision, elements of vision system, applications in manufacturing; introduction to atomic force microscopy (AFM), Scanning tunneling microscopy (STM), Nano metrology.

Max.45 Hrs.**TEXT / REFERENCE BOOKS**

1. Connie L Dotson, "Fundamentals of Dimensional Metrology", Thomson Delmar Learning, 2006.
2. Beckwith T.G. and Marangoni, "Mechanical Measurements", Addison Wesley, 2000.
3. Gupta I C, "Text Book of Engineering Metrology", Dhanpat Rai Publishers, 2003.
4. Jain R.K., "Engineering Metrology", Khanna Publishers, 1994.
5. Alsutko, Jerry.D.Faulk, Thomson, "Industrial Instrumentation", Asia Pvt Ltd., 2011
6. Sirohi, "Mechanical Measurements", New Age Publications, 2013.
7. Gupta S.C., "Engineering Metrology", Dhanpat Rai Publications, 1993.
8. Gaylor & Shotbolt, "Engineering Metrology", Mc Donald & Co Publications, 2005.
9. Hume K.J., "Engineering Metrology", ELBS, 1970.
10. Whitehouse D.J., The Handbook of Surface and Nano metrology, CRC Press, 2011.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 2 Questions each from CO1-CO4, 1 question each from CO5 and CO6 - No choice**20 Marks****PART B:** 4 Questions each with internal choice from CO1-CO4, 1 question from CO5 and CO6 with internal choice, each carrying 16 marks**80 Marks**

SME4056	MATERIAL TESTING LAB (Common to Mech, M&P & Auto)	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Measure the specimens as per the standard procedures.
- CO2 - Categorize the material from its microstructure.
- CO3 - Evaluate the tensile strength of the given specimen using UTM.
- CO4 - Measure the hardness of the given specimen.
- CO5 - Determine the impact strength of the given specimen.
- CO6 - Develop the load-deformation and spring characteristics.

a) METALLURGY LAB**SUGGESTED LIST OF EXPERIMENTS**

1. To study the metallurgical microscope.
2. Studying the preparation of a specimen for metallographic examination
3. To study the microstructure of plain carbon steel (Low carbon steel, medium carbon steel and high speed steel).
4. To study the effect of heat treatment on plain carbon steel (Annealing, Normalizing and Hardening)
5. To study the microstructure of alloy steels (Stainless steels, Tool steels)
6. To study the microstructure of cast iron (Grey cast iron, white cast iron, malleable cast iron and spheroidal graphite cast iron)
7. To study the microstructure of light alloys (Aluminium alloy and Magnesium alloy)
8. To study the microstructure of heavy alloys (Copper alloy, Nickel alloy)
9. To determine the Hardenability of steel by Jominy end quench testing.
10. To study the hardness of ferrous and non-ferrous alloys.

b) MATERIAL TESTING LAB

1. Hardness test on metals- Brinell, Vicker and Rockwell Hardness tests.
2. Impact test on metals-Charpy, Izod impact tests.
3. Shear test on metals-direct shear strength, single shear, double shear.
4. Deflection test on beams-load deformation characteristics, Young's modulus, Maxwell's reciprocal law verification.
5. Torsion test on beams-torque and angle of twist characteristics, shear stress, modulus of rigidity, energy.
6. Tests on helical springs-compression, tension springs-load deformation characteristics, stiffness, shear stress, modulus of rigidity, energy.
7. Compression test on given specimen on universal testing machine.
8. Tension test on metals-stress strain characteristics, ductility, resilience, toughness.

SPR4051	MANUFACTURING PROCESS LAB – I (Common to Mech, M&P & Auto)	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Build thorough knowledge of various machines, devices used in engineering practice.
- CO2 - Create weldments using gas and arc welding and evaluate the quality of welded joint.
- CO3 - Develop the product by machining operations such as turning, step turning, facing, knurling and grooving.
- CO4 - Modify the product by Threading operations.
- CO5 - Compare the product by drilling, boring and reaming.
- CO6 - Prepare a product to a required dimension using square thread cutting.

SUGGESTED LIST OF EXPERIMENTS

1. Study of carpentry, welding, fitting tools and lathe
2. Carpentry - half lap joint , v joint and mortises
3. Welding - lap joint, tee joint and v joint
4. Fitting - v joint and dove tail fitting
5. Lathe - facing, turning
6. Step turning and knurling
7. External thread cutting (single start and double start)
8. Internal thread cutting
9. Drilling and boring
10. Reaming and grooving
11. Eccentric turning
12. Square thread cutting

SPR1206	MANUFACTURING PROCESSES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Recognize the different types of manufacturing process.
- CO2 - Learning various machine tools operations and applications.
- CO3 - Understanding the concept of Surface finishing operation and Micro manufacturing concepts.
- CO4 - Understand and Develop various Non Traditional Machining process.
- CO5 - Explain the operations and capabilities of CNC machines used in manufacturing.
- CO6 - Select the suitable manufacturing process in order to produce the various components.

UNIT 1 CASTING, JOINING AND FORMING PROCESSES**9 Hrs.**

Types of Moulding Methods - Gating Design. Special Casting processes, Defects in Castings-Inspection Methods. Principle and applications of submerged arc welding- Electro slag welding - TIG welding -MIG welding special welding processes - Plasma arc welding- Thermit welding - Friction welding - Diffusion welding - Welding defects Processing of plastics - Types, Applications, Advantages and Limitations - Injection Moulding, Blow moulding.

UNIT 2 MACHINE TOOLS**9 Hrs.**

Working principle, Applications, Advantages and Limitations of Centre lathe, Capstan and turret lathes - automats -single spindle, Swiss type, automatic screw type, multi spindle - Turret Indexing mechanism, bar feed mechanism. shaper, planer, slotter, Milling, Gear cutting, forming, generation, shaping, hobbing.

UNIT 3 SURFACE FINISHING & MICRO-MANUFACTURING**9 Hrs.**

Abrasive processes: grinding wheel - specifications and selection, types of grinding process - cylindrical grinding, Surface grinding, centreless grinding - honing, lapping, super finishing, polishing and buffing. Introduction and Scaling Laws for micro-manufacturing, Silicon Layer Processes, LIGA process Other Micro-fabrication Processes.

UNIT 4 NON TRADITIONAL MACHINING PROCESS**9 Hrs.**

Non-Traditional machining: Working principle, Applications, Advantages and Limitations- AJM-WJM-USM-ECM-ECG-EDM- EBM- EDG- LBM-PAM.

UNIT 5 CNC MACHINE TOOLS AND FUNDAMENTALS OF CAD/CAM**9 Hrs.**

Numerical control: Brief principles and description of numerical control application to M/c tools. DNC, CNC and adaptive control. Programming of CNC M/C tools, CNC programming based on CAD. Fundamentals of CAD/CAM, Computer integrated manufacturing, Compute Aided Process Planning, Computer Integrated, Production Planning system.

Max. 45 Hrs**TEXT / REFERENCE BOOKS**

1. Ghosh, A., Mallik, A.K., Manufacturing Science, 2nd Edition, East West Press, 2010.
2. Hajra Choudhury, "Elements of Workshop Technology", Vol. I and II, Media Promoters and Publishers Pvt.Ltd. Mumbai, 2005.
3. Jain R.K., Production Technology, Khanna Publishers, 2001.
4. Tata McGraw-Hill, Production Technology by HMT, 2002.
5. Kalpakjian .S and Schmid S R, Manufacturing Processes for Engineering Materials, Pearson Education, 2009.
6. Roy. A. Linberg, "Process and Materials of Manufacture", PHI, 2000.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each- No choice**20 Marks****PART B:** 2 Questions from each unit with internal choice, each carrying 16 marks**80 Marks**

SAU1202	AUTOMOTIVE ENGINES	L	T	P	Credits	Total Marks
		3	0	0	3	100

Course Outcomes:

On completion of the course, student will be able to

CO1: Understand the operational principle of two stroke & four stroke engine and analyze the Otto cycle, Diesel cycle and Dual cycle

CO2: Explain the SI engine and CI engine fuel feed system.

CO3: Analyze the combustion phenomena in SI engine and CI engine & explain types of combustion chamber

CO4: Explain the principle of cooling & various lubrication system in engines

CO5: Analyze the effect of engine variables on knocking in SI engine.

CO6: Analyze various performance parameters of engine and explain the modern engine technologies

UNIT 1: CONSTRUCTION AND OPERATION**9 hrs**

Fundamentals of I.C Engine, engine nomenclature, constructional details of Spark Ignition (SI) and compression Ignition (CI) engines, working principles, two stroke SI and CI engines, comparison of SI and CI engines and four stroke and two stroke engines, engine classification, firing order. Otto, diesel and dual cycles, **theoretical & actual valve timing & port timing diagram.**

UNIT 2: SI ENGINES**9 hrs**

Air fuel ratio requirements - carburetion - types of carburetor, automobile carburetor, injection system in SI engines - MPFI & GDI system ignition system - battery coil, magneto & electronic ignition system, combustion in SI engines - combustion chambers, factors controlling **combustion chamber design**, stages of combustion - factors affecting flame propagation, turbulence air motion, knock in SI engines, variables affecting knocking.

UNIT 3: CI ENGINES**9 hrs**

Diesel fuel injection system, CRDI system, function of components, jerk type pump, distributor pump, mechanical and pneumatic governor, fuel injector, types of nozzle, importance of swirl, squish and air motion, combustion in CI engines - combustion chambers, factors controlling combustion chamber design, stages of combustion, factors affecting ignition delay, knock in CI engines, variables affecting knocking.

UNIT 4: AUXILIARY SYSTEMS**9 hrs**

Types of supercharging and turbo charging, relative merits, matching of turbocharger, cooling system - types of cooling systems- air and liquid cooling systems, thermo siphon and forced circulation and pressurized cooling systems - lubrication system - requirements of lubrication systems, types-mist, pressure feed, dry and wet sump systems.

UNIT 5: PERFORMANCE TESTING AND MODERN ENGINE TECHNOLOGY**9 hrs**

Necessity and limitations, charge cooling, basic performance parameters, **performance characteristics, factors affecting performance characteristics, performance maps - SI and CI engines, heat balance test, morse test**, introduction to modern engine technologies - lean burn engines, stratified charged engines, low heat rejection engines, homogeneously charged compression ignition engines engine management systems.

TOTAL: 45 hrs**REFERENCE BOOKS:**

1. Ganesan.V, "Internal Combustion Engines" 4th edition, Tata McGraw Hill publication 2011
2. Rajput R. K, "A textbook of Internal Combustion Engines", 2nd edition, Laxmi Publications (P) Ltd, 2007.
3. Mathur and Sharma "Internal Combustion Engines" "Dhanpat Rai and Sons Publication, 2002
4. John B. Heywood, "Fundamentals of Internal Combustion Engine" 1st edition, 1998, Tata McGraw Hill publication.
5. Heinz Heisler "Advanced Engine Technology" 2nd edition SAE Publication, 2002.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration : 3 Hrs.****PART A:** 10 questions of 2 marks each - No choice**20 Marks****PART B :** 2 questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SME4055	MACHINE DRAWING PRACTICE (Common to Mech, M&P & Auto)	L	T	P	Credits	Total Marks
		1	0	3	2	100

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1 - Adapt the drawing standards, practices and conventions in the preparation of the machine drawing.

CO2 - Interpret the sectional drawings for the given machine component.

CO3 - Use the fits and tolerance tables appropriately to set the correct fits and tolerance values to the specified machine components.

CO4 - Interpret and draw the assembly drawings from the given individual component drawings according to the BIS standards, conventions and practices.

CO5 - Draw the machine drawing of the given machine assembly case study according to the BIS standards, conventions and practices after interpreting the dimensions and finding the features for sectioning.

CO6 - Use a CAD package to represent the assembly model of the given machine component/ assembly drawing with the appropriate application of scale, layout, annotation, sectioning, views and text.

UNIT 1 DRAWING STANDARDS**10 Hrs.**

BIS code of practice for Engineering Drawing - Machine drawing conventions - Conventional representation of common machine elements such as bolts, screws, bolts, nuts, keys, gears, bearings and springs - Abbreviations and symbols used in machine drawing - Types of sections - Half section - Full section - Partial or local section - Removed section - Revolved section.

UNIT 2 LIMITS, FITS AND TOLERANCES**10 Hrs.**

Limits - Upper limit - Lower limit - Fits - Types of fits - Clearance fit - Interference fit - Transition fit - Hole basis system - Shaft basis system - Tolerance - Tolerance grades - Use of tolerance table and specification of tolerance.

UNIT 3 ASSEMBLY DRAWING (MANUAL AND USING CAD PACKAGES)**10 Hrs.**

Preparation of assembled views given part details of components followed by practicing the same using standard CAD packages - Suggested assemblies: Sleeve and cotter joint, Universal coupling, Screw jack, Snug type plummer block, Octagon type plummer block, Swivel bearing, Tail stock, Machine vice, Steam stop valve.

Max.30 Hrs.**TEXT / REFERENCE BOOKS**

1. Gopalakrishnan, K.R., Machine Drawing, Subhas Publications, 16th Edition, 2008.
2. PSG Design Data Book.
3. Bhatt N.D., Machine Drawing, Charotar Publishing House, 44th Edition, 2009.
4. Lakshminarayanan V, Mathur M.L., Text Book on Machine Drawing with Computer Graphics, Jain Brothers, 12th Edition, 2007.
5. SP 46: Engineering Drawing Practice for schools and colleges, Bureau of Indian Standards.
6. AutoCAD - 2D and 3D CAD Reference Guide.

END SEMESTER EXAM QUESTION PAPER PATTERN**By using mini drafter: 50 marks****By using CAD: 50 marks**

Note: Only after submission of all drawing sheets prescribed by staff member, the students will be allowed for university practical examination.

SAU4051	FUELS LUBRICANTS AND ENGINE TESTING LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To gain in depth knowledge of properties of fuels and lubricants
- To impart the skill of testing fuels and lubricants for their properties using various testing equipment's.

SUGGESTED LIST OF EXPERIMENTS

1. Study of International and National standards for fuels and lubricants.
2. Study of Octane and Cetane Number of fuels.
3. ASTM distillation test of liquid fuels
4. Aniline point test of diesel.
5. Calorific value of liquid fuel.
6. Calorific value of gaseous fuel.
7. Reid vapour pressure test.
8. Flash and fire points of petrol and diesel.
9. Copper strip corrosion Test
10. Cloud & pour point Test.
11. Temperature dependence of viscosity of lubricants & fuels by Redwood Viscometer.
12. Viscosity Index of lubricants & fuels by Saybolt Viscometer.
13. Ash content and carbon residue Test.
14. Drop point of grease and mechanical penetration in grease.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand the International and National standards for fuels and lubricants.
 CO2 - Understand distillation of liquid fuels.
 CO3 - Understand the different properties of fuels and lubricants.
 CO4 - Determine the properties of fuels and lubricants using various testing equipments.
 CO5 - Analyze important fuel and lubricant properties for the application in specific conditions.
 CO6 - Compare the values of important physical properties of fuels and lubricants.

S15PT1	PROFESSIONAL TRAINING 1	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Explain the working of machinery, mechanisms, business processes, management etc.
- CO2 - Identify the problems relating to various mechanisms.
- CO3 - Learn the industry practices, ethics, standards and requirements.
- CO4 - Prepare the document by detailing the knowledge gathered.
- CO5 - Present and communicate the knowledge to the fellow students.
- CO6 - Develop the technical skills and become industry-ready.

SPR1304	INDUSTRIAL MECHATRONICS (Common to Mech, M&P & Auto)	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Propose the appropriate sensors for the specified mechatronics application.
- CO2 - Suggest the appropriate microprocessor/ microcontroller for the specified mechatronics system.
- CO3 - Formulate the system models for the given mechanical/ electrical/ thermal/ fluid systems.
- CO4 - Develop the PLC ladder diagram for the stated mechatronics application.
- CO5 - Recommend the recent technology, such as MEMS, AI, etc., on to the mechatronics application.
- CO6 - Design a mechatronic system systematically after investigating the given mechatronics case study.

UNIT 1 MECHATRONICS, SENSORS AND TRANSDUCERS**10 Hrs.**

Introduction to Mechatronics Systems - Key elements, Information systems, Real time interfacing, Elements of data acquisition system. Sensors and Transducers - Performance Terminology - Sensors for Displacement, Position and Proximity; Velocity, Motion, Force, Fluid Pressure, Liquid Flow, Liquid Level, Temperature, Range sensors, Light Sensors, Humidity, Vibration. Special transducers - Piezoelectric transducer - Magnetostrictive transducer - Shape memory alloy (SMA) transducer. - Selection of Sensors.

UNIT 2 SIGNAL CONDITIONING**8 Hrs.**

Signal Conditioning & Interfacing Microcontroller- Comparison between microprocessor and micro controller, organization of a microcontroller system, architecture of controller and Applications. Computer Numerical Control systems (a) Position and velocity control loops (b) Adaptive Control applications for machine tools like lathe, grinding etc. Digital Logic Control - Micro Processors Control.

UNIT 3 SYSTEM MODELS AND CONTROLLERS**10 Hrs.**

Building blocks of Mechanical, Electrical, Fluid and Thermal Systems. Rotational - Translational Systems, Electromechanical Systems - Hydraulic - Mechanical Systems. Continuous and discrete process Controllers - Control Mode - Two Step mode - Proportional Mode - Derivative Mode - Integral Mode - PID Controllers - Digital Controllers - Velocity Control - Adaptive Control.

UNIT 4 PROGRAMMING LOGIC CONTROLLERS**9 Hrs.**

PLC: Introduction to the design and mode of operation of programmable logic control (PLC) - Basic Structure - Input / Output Processing - Programming - Mnemonics - Timers, Internal relays and counters - Shift Registers - Master and Jump Controls - Data Handling - Analog Input / Output - Selection of a PLC.

UNIT 5 DESIGN OF MECHATRONICS SYSTEM**8 Hrs.**

Introduction to MEMS, Micro sensors in mechatronics, Sensors for condition monitoring, Artificial intelligence in mechatronics, Stages in designing Mechatronics Systems - Traditional and Mechatronic Design Possible Design Solutions. Case studies of Mechatronics systems- Pick and place Robot- piece counting system, Autonomous mobile robot-Wireless surveillance balloon- Engine Management system- Automatic car park barrier.

Max.45 Hrs.**TEXT / REFERENCE BOOKS**

1. Bolton, "Mechatronics", Pearson education, second edition, fifth Indian Reprint, 2003
2. Smaili.A and Mrad.F, "Mechatronics integrated technologies for intelligent machines", Oxford university press, 2008
3. Rajput. R.K, A textbook of mechatronics, S. Chand & Co, 2007
4. Michael B. Histan and David G. Alciatore, "Introduction to Mechatronics and Measurement Systems", McGraw-Hill International Editions, 2000.
5. Bradley D. A., Dawson D., Buru N.C. and. Loader A.J, "Mechatronics", Chapman and Hall, 1993.
6. Dan Neculescu, "Mechatronics", Pearson Education Asia, 2002 (Indian Reprint).
7. HMT, Mechatronics, Tata McGraw-Hill Publishing Company Ltd., New Delhi 2004.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 2 Questions each from CO1-CO4, 1 question each from CO5 and CO6 - No choice**20 Marks****PART B:** 4 Questions each with internal choice from CO1-CO4, 1 question from CO5 and CO6 with internal choice, each carrying 16 marks**80 Marks**

SAU1304	VEHICLE DYNAMICS	L	T	P	Credits	Total Marks
		3	1	0	4	100

OBJECTIVE

- To understand basic principles of vibration and dynamic analysis of vehicles

UNIT 1: INTRODUCTION**12 hrs**

Classification of vibrations- mechanical vibrating systems, single degree of freedom, two degree of freedom, multi degree of freedom, free, forced and damped vibrations, modeling and simulation studies, model of an automobile, magnification factor, transmissibility, vibration absorber.

UNIT 2: APPLIED NUMERICAL METHODS**12 hrs**

Close-coupled and far-coupled systems, determination of mass & stiffness matrices -eigen value problems- -orthogonality of mode shapes, modal analysis, approximate methods for determining fundamental frequency, Dunkley's lower bound, Rayleigh upper bound, Holzer method for closed coupled system and branched system.

UNIT 3: SUSPENSION SYSTEM**12 hrs**

Vehicle dynamics and suspension requirements, natural spring frequencies, force acting on a semi-elliptic suspension, design of laminated spring, design of coil spring and torsion bar, spring characteristics, mechanics of an independent suspension system, roll axis and the vehicle under the action of side forces, coupled front and rear suspension effects, relative pitch and bounce frequencies, anti-roll rates, roll angles in cornering, attitudes changes due to brakes, traction and independent suspension.

UNIT 4: PERFORMANCE OF AUTOMOBILES**12 hrs**

Forces and couples on the wheels, tractive and braking properties of tires, cornering properties of tires, slip angle, cornering force, camber thrust, deformation of wheel and ground, power of propulsion, road performance curves, resistances- air, rolling and grade, determination of center of gravity of vehicle, load distribution, stability on a curved track slope and a banked road, calculation of tractive effort and reactions for different drives.

UNIT 5: WHEELS AND TYRES**12 hrs**

Automobile wheels, pneumatic tires, tire- construction, properties, characteristics, tread, bite, operation and inflation pressure, wheel balancing, tire, dynamics, ride characteristics power consumed by a tire, over steer, under steer, steady state cornering, effect of braking, driving torques on steering, effect of camber, transient effects in cornering

TOTAL: 60 hrs**REFERENCE BOOKS:**

1. Giri N.K – Automotive Mechanics, Khanna Publishers, 2002.
2. Rao J.S and Gupta. K "Theory and Practice of Mechanical Vibrations", Wiley Eastern Ltd., New Delhi - 2002.
3. Ellis.J.R - "Vehicle Dynamics"- Business Books Ltd., London- 1991
4. Giles.J.G.Steering - "Suspension and Tyres", - Illiffe Books Ltd., London- 1998
5. Wong J.Y. Theory of Ground Vehicles, 4th edition, Wiley
6. Thomas D. Gillespie, "Fundamental of Vehicle Dynamics, Society of Automotive Engineers", USA 1992.
7. Rajesh Rajamani, "Vehicle Dynamics and Control", Springer, 2012.

Course Outcomes:

On completion of the course, students will be able to

- CO 1:** Understand vibration modes and its problems related to Automobile Engineering.
CO 2: Understand how passenger comforts is achieved along with vehicle stability.
CO 3: Design and conduct experiments on tires on different road conditions.
CO4: Demonstrate the ability to design a system, component or process to meet the stability needs of vehicles
CO5: Understand the concepts in lateral and longitudinal dynamics of automobiles.
CO6: Understand the methods of predicting vehicle performance.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration : 3 Hrs.****PART A:** 10 questions of 2 marks each - No choice**20 Marks****PART B :** 2 questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SAU4052	AUTOMOTIVE ELECTRICAL AND ELECTRONICS LAB (For Automobile)	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- Recognize and understand the different wiring diagrams used in automobile Manuals
- Understand basic electrical and electronic circuits used in automobile systems and also understand the basic programming with the 8085 microprocessor

SUGGESTED LIST OF EXPERIMENTS

1. Testing of batteries and battery maintenance.
2. Testing of starting motors, generators and alternators.
3. Testing of regulators and cut outs.
4. Diagnosis of ignition system faults.
5. Study of Automobile electrical wiring.
6. Identification of fault on Multipoint Fuel Injection System (MPFI).
7. Identification of fault on Common Rail Direct Injection (CRDI) system.
8. Tuning of horns and sound level measurement.
9. Making of starting and Ignition circuits.
10. Making of generating and lighting circuits.
11. Study of electronic control module.
12. Study of electronic fuel feed system.

AUTO ELECTRONICS LAB

1. Study of rectifiers and filters.
2. Study of logic gates, adder and flip-flops.
3. Study of SCR and IC timer.
4. Micro controller programming and interfacing.
5. Interfacing ADC and DAC for Data Acquisition and Control Application.
6. Interfacing Actuators.
7. Fault Diagnosis of various sensors.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Understand battery Testing and maintenance.

CO2 - Understand Testing of starting motors, generators and alternators.

CO3 - Understand the Diagnosis of ignition system faults.

CO4 - Identification of fault on Multipoint Fuel Injection System (MPFI).

CO5 - Identification of fault on Common Rail Direct Injection (CRDI) system.

CO6 - Understand the micro controller programming and interfacing.

SAU4053	AUTOMOTIVE ENGINE AND CHASSIS COMPONENTS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To study, dismantling and assembling of various chassis components of the vehicle.
- To study, dismantling and assembling of various Engine components of the vehicle.

SUGGESTED LIST OF EXPERIMENTS-AUTOMOTIVE CHASSIS COMPONENTS LAB

Study and measurement of the following chassis frames

1. Heavy duty vehicle frame (Leyland, Tata etc.)
2. Light duty vehicle frame (Ambassador, Maruti Van etc.) Study, Dismantling and Assembling of
3. Front Axle
4. Rear Axle
5. Differential Unit.
6. Steering systems along with any two steering gear boxes.
7. Braking systems-Hydraulic, Servo, Vacuum, Compressed air power Brakes.
8. Leaf spring, Coil Spring, Torsion Bar, Hydraulic shock Absorber.
9. Clutch assembly of different types
10. Gear box
11. Transfer Case
12. Propeller shaft.

SUGGESTED LIST OF EXPERIMENTS-AUTOMOTIVE ENGINE COMPONENTS LAB

1. Dismantling, study and Assembling of 4 strokes four-cylinder petrol engine.
2. Dismantling, study and Assembling of 4 strokes six-cylinder Diesel engine.
3. Study of oil filter, fuel filter, fuel injection system, carburetor, MPFI system.
4. Study of ignition system components-coil, magneto and electric ignition system.
5. Study of engine cooling system components.
6. Study of engine lubrication system components.
7. Ovality and taper measurement of cylinder bore and comparison with standard specification.
8. Ovality and taper measurement of engine crank shaft and comparison with standard specification

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1-Gain extensive knowledge about heavy duty and light duty vehicle frame
 CO2-Know the dismantling and assembling procedure of front and rear axle system
 CO3-Understand the dismantling and assembling procedure of different brake system.
 CO4-Know the dismantling and assembling procedure of six-cylinder diesel engine
 CO5-Gain knowledge about fuel injection system and ignition system.
 CO6-Study the Ovality and taper measurement of cylinder bore

SAU1305	AUTOMOTIVE CHASSIS DESIGN	L	T	P	Credits	Total Marks
		3	1	0	4	100

OBJECTIVE

- To understand the various standards and procedures involved in the design of automotive chassis components

UNIT 1: INTRODUCTION TO ERGONOMICS**12 hrs**

Anthropometry, ergonomics design methodology, environmental terms influencing human performance – design of seat.

UNIT 2 :VEHICLE FRAME AND SUSPENSION**12 hrs**

Study of loads, moments and stresses on frame members, computer aided design of frame for passenger and commercial vehicles, computer aided design of leaf springs, coil springs and torsion bar springs.

UNIT 3: FRONT AXLE AND STEERING SYSTEMS**12 hrs**

Analysis of loads, moments and stresses at different sections of front axle, determination of bearing loads at kingpin bearings, wheel spindle bearings, choice of bearings, determination of optimum dimensions and proportions for steering linkages ensuring minimum error in steering.

UNIT 4: CLUTCH DESIGN CALCULATION**12 hrs**

Design of single plate clutch, multi plate clutch, Design of centrifugal clutch and cone clutch. Energy dissipated, Torque capacity of clutch. Design of clutch components, design details of roller.

UNIT 5: GEAR BOX, FINAL DRIVE AND REAR AXLE**12 hrs**

Performance of vehicle, total resistance to motion, traction and tractive effort, acceleration, calculation of gear ratio, design of three speed gear box, design of four speed gear boxes. Design of propeller shaft, design details of final drive gearing, design details of full floating, semi-floating and three quarter floating rear shafts and rear axle housings.

Total: 60 hours**Course Outcomes:**

On completion of the course, student will be able to

CO1: Understand and implement Engineering Design process**CO2:** Apply engineering principles and analytical techniques in the design process**CO3:** Develop knowledge on design procedure of various chassis components.**CO4:** Analyze the loads, moments and stresses acting on various chassis components**CO5:** Design components of clutch**CO6:** Design gear box, final drive and real axle**REFERENCE BOOKS:**

1. Giri.N.K- "Automobile Mechanics"- Khanna Publisher, New Delhi- 2002
2. Khurmi.R.S – "Machine Design" - S.Chanb – Eurasia Publications House pvt Ltd, Ramnagar, New Delhi.
3. Heldt.P.M - "Automotive Chassis"- Chilton Co., New York- 1992
4. Steeds. W -"Mechanics of Road Vehicles"- Illiffe Books Ltd., London- 1990
5. Giles.K.G - Steering, Suspension and tyres"- Illiffe Books Ltd., London - 1988
6. Newton Steeds & Garret- "Motor Vehicle"- Illiffe Books Ltd., London – 2000
7. Heldt.P.M- "Torque converter" - Chilton Book Co., New York - 1982
8. Dean Avern - "Automobile Chassis Design"- Illiffe Books Ltd – 1992

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration : 3 Hrs.****PART A:** 10questionsof 2markseach - No choice**20 Marks****PART B :** 2 questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SAU4054	TWO WHEELER AND THREE WHEELER LAB (For Automobile)	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS**COURSE OBJECTIVES**

- To gain knowledge on the standards of measurement and calibration.
- To analyze faults in the vehicles.
- To learn the service and maintenance.

SUGGESTED LIST OF EXPERIEMENTS -TWO WHEELER LAB

1. Road performance test of a two wheeler using chassiss dynamometer.
2. Dismantling and assembling of two wheeler engine.
3. Performance test on a shock absorber. and coil springs
4. Two wheeler chain tension test.
5. Brake and clutch adjustment as per specification.
6. Dismantling and assembling of two wheeler gear box and finding gear ratio.

SUGGESTED LIST OF EXPERIEMENTS -THREE WHEELER LAB

1. Dismantling and assembling of three wheeler engine.
2. Dismantling and assembling of three wheeler gear box and finding gear ratios.
3. Three wheeler brake and clutch play adjustment.4.Study of three wheeler steering systems.
4. Study of three wheeler chassiss frame and power transmission systems.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1-Gain knowledge about the engines employed for two and three wheelers.
- CO2-Understand about the Chassis and its sub-systems.
- CO3-Perceive the functionality of Brakes and wheels.
- CO4-Gain knowledge through specific case studies of major Indian models.
- CO5-Gather information about servicing, maintenance and troubleshooting of two and three wheelers.
- CO6-Understand the Clutch and brake adjustment.

SAU4055	COMPUTER AIDED ENGINE DESIGN AND CHASSIS DESIGN LAB (For Automobile)	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To gain practical experience in engineering modeling through computer aided systems.
- To understand the functioning of 2D drafting and 3D modeling software systems.

SUGGESTED LIST OF EXPERIMENTS

1. Design and drawing of piston.
2. Piston pin and piston rings and drawing of these components.
3. Design of connecting rod small end and big end, shank design, design of big end cap, bolts and drawing of the connecting rod assembly
4. Design of crankshaft, balancing weight calculations.
5. Development of short and long crank arms, front end and rear end details, drawing of the crankshaft assembly.
6. Design and drawing of flywheel.
7. Ring gear design, drawing of the flywheel including the development of ring gear teeth.
8. Design and drawing of the inlet and exhaust valves.
9. Design of cam and camshaft, cam profile generation, drawing of cam and camshaft.
10. Design of combustion chamber.

COMPUTER AIDED CHASSIS DESIGN LAB**SUGGESTED LIST OF EXPERIMENTS**

1. Design of heavy duty vehicle frame (Leyland, Tata etc.)
2. Design of light duty vehicle frame (Ambassador, Maruti van etc.)
3. Front bumper crashworthiness optimization.
4. Simulation of full-scale passenger car impacts.
5. Design of front axle and rear axle
6. Automotive styling: sketching, modeling, surfacing and visualization.
7. Design of differential
8. Design of steering systems along with any two types of steering gear box
9. Design of braking systems - hydraulic servo vacuum, compressed air power brakes.
10. Design of leaf spring, coil spring, torsion bar spring, hydraulic shock absorber
11. Design of clutch assembly of different types
12. Design of gear Box

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Understand the fundamentals of computer aided design.

CO2 - Implement their knowledge in designing a model.

CO3 - Understand the various limits and tolerances.

CO4 - Understand various dimensioning styles.

CO5 - Implement their knowledge to model various 2D and 3D models.

CO6 - Understand various commands and keyboard shortcuts for faster modelling skills

S15PT2	PROFESSIONAL TRAINING II	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OUTCOMES:

On completion of the course, student will be able to

- CO1: Expand the engineering knowledge, problem solving skills, and the engineering practices necessary to work in the multi-disciplinary engineering environments
- CO2: Develop the technical problem solving skills needed for enhancing the employability.
- CO3: Develop the general problem solving skills, aptitude and language skills needed for cracking the competitive examinations.
- CO4: Develop the communication skills necessary for the personality development and leadership skills through peer-to-peer interactions, seminars, group presentation and group discussion.
- CO5: Develop the entrepreneurship skills necessary to familiarize with the start up, procedure, management, finance and marketing strategies.
- CO6: Show the technical, general problem solving and soft skills to work in multi-disciplinary environment, crack the competitive examinations, personality development, and/or, entrepreneurship skill development.

SPR4054	CAD /CAM LAB (Common to Mech, M&P & Auto)	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1: Perform the numerical engineering analysis for the stated 1D and 2D static structural problems using FEA package.
- CO2: Perform the numerical engineering analysis for the stated 1D and 2D thermal engineering problems using FEA package.
- CO3: Simulate the part program for CNC milling operations using a CAM package.
- CO4: Simulate the part program for CNC turning operations using CAM package.
- CO5: Produce the machined product for the given part drawing using the CNC milling machine as per the standards and specifications.
- CO6: Produce the machined product for the given part drawing using CNC turning center as per the standards and specifications.

SUGGESTED LIST OF EXPERIMENTS**A.CAD LAB****CAD ANALYSIS USING ANALYSIS SOFTWARE**

Exercises will be given on Analyzing of mechanical components using Suitable Software

1. Cantilever beam with Point load at the end
2. Simply supported beam with inclined load
3. Overhanging beam with Uniformly distributed load (UDL)
4. Determination of deflection for a Truss system
5. Determination of deflection in a Pressure vessel
6. Determination of deflection in a Bent tube
7. Determination of temperature distribution in a stepped bar
8. Analysis of a bicycle frame
9. Thermal - mixed boundary example

B.CAM LAB**1. CNC Milling:**

- (i) Part Programming for: Point to point motions, Contour motions, Circular milling, Linear motions, Pocket milling, Mirroring Commands, Circular interpolations (both CW & CCW), Rectangular milling.
- (ii) Part Programming involving fixed or canned cycles: Drilling, Peck drilling, Boring and Tapping.
- (iii) Part programming using: Do loops, Sub Routines.

2. CNC Lathe:

- (i) Part programming for: Turning, Facing, Chamfering, Grooving, Step Turning, Taper Turning, Circular Interpolation.
- (ii) Part programming using standard fixed cycles: Turning, Facing, Taper Turning, Thread Cuttings.

SPR4056	VEHICLE MAINTENANCE AND RECONDITIONING LAB (For Automobile)	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- List down the various maintenance procedures.
- Ensure the maximum availability of vehicle without any major problem.
- Prepare the Workshop layout and statements.

SUGGESTED LIST OF EXPERIMENTS

1. Cylinder reboring-checking the cylinder bore and setting the tool and reboring.
2. Valve grinding, valve lapping.
3. Setting the valve angle and checking for valve leakage
4. Calibration of fuel injection pump
5. Wheel alignment - testing of camber, caster.
6. Testing kingpin inclination, toe-in and toe-out.
7. Chassis alignment testing
8. Brake adjustment and brake bleeding.
9. Head light adjustment.
10. Tyre changing.
11. Wheel balancing.

STUDY EXPERIMENTS

1. Tools and instruments required for maintenance.
2. Safety aspects with respect to man, machine and tools.
3. General procedures for servicing, maintenance schedule and record maintenance.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Understand about the tools and Equipment's used in automotive workshop.

CO2 - Troubleshoot and service various sub systems in the vehicle

CO3 - Demonstrate the cylinder re-boring

CO4 - Perform the valve grinding and lapping

CO5 - Demonstrate the Wheel alignment for a vehicle

CO6 - Demonstrate the removal of tyre and tube

SBA1101	PRINCIPLES OF MANAGEMENT AND PROFESSIONAL ETHICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Comprehend various management principles and practices followed in industries.

CO2: Analyze the types of business organization, plant layout and its safety measures.

CO3: Develop appropriate behavior as an individual and as a team to excel in industries.

CO4: Develop expertise knowledge on the impact of Leadership Communication and Group dynamics in industry.

CO5: Comprehend the basics of ethical behaviour and corporate social responsibility practiced in industries.

CO6: Investigate business cases by applying the ethical guidelines in industrial real life situations.

UNIT 1 MANAGEMENT FUNCTIONS & STRUCTURE**9 Hrs.**

Management - Definition -Role of managers- Levels of management-Basic Function - Contribution of Taylor & Fayol. Types of structures - Line, staff, Functional, Committee and Project & Matrix - Structures. Departmentalization - Centralization - Decentralization - Span of control. Management by COURSE OBJECTIVES (MBO)- Management by Exception (MBE).

UNIT 2 MANAGEMENT OF ORGINASATION**9 Hrs.**

Forms of Business / Industrial Ownership - Sole Trader, Partnership, Joint stock Company, Performance Appraisal - Basic Principles - Pitfalls - Methods to Overcome. Industrial Safety - Causes of Accidents - Cost of Accidents - Measures to avoid Accidents. Plant Layout & Maintenance - Need, Types & Managerial Aspects.

UNIT 3 ORGANISATIONAL BEHAVIOUR**9 Hrs.**

Organisational Behaviour - Definition - Nature & Scope - Contributing Disciplines - Importance of OB to Managers. Personality - Definition - Theories - Factors Influencing Personality. Motivation - Definition - Theories. Transactional Analysis. Morale & Job Satisfaction - Factors Influencing Job Satisfaction.

UNIT 4 GROUP DYNAMICS 9 Hrs.

Group - Definition - Types - Determinants of Group Cohesiveness. Communication - Process - Barriers - Effective Communication. Leadership-Definition- leadership styles- Theories of leadership - Factors Contributing to Effective Leadership. Trade Unions- Role of Trade Union in Organizations - Types and Functions o f Trade Unions.

UNIT 5 PROFESSIONAL ETHICS**9 Hrs.**

Ethics in Workplace - Formulation of Ethics - Managerial Ethics - Managing Ethical Behaviour - Codes of Ethics Encouraging Ethical Behaviour - Ethical Leadership - Ethical Decision making. Corporate Social Responsibility (CSR) Intellectual Property Rights (IPR)- Meaning- Laws relating to Intellectual Property Rights (IPRs)

Max. 45 Hrs.**TEXT / REFERENCE BOOKS**

1. Gupta C.B., "Management Theory and Practice", 14th Edition, Sultan Chand & Sons, 2009.
2. Prasad L.M., "Principle & Practice of Management", 7th Edition, Sultan Chand & Sons, 2008.
3. Aswathappa, "Organisational Behaviour", 8th Edition, Himalaya Publishing House, 2010.
4. Prasad L.M., "Organisational Behaviour", 4th Edition, Sultan Chand & Sons, 2008.
5. Harold Koontz, "Principles of Management", 1st Edition, Tata McGraw Hill, 2004.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.**

PART A: 2 Questions each from CO1-CO4, 1 question each from CO5 and CO6 - No choice

20 Marks

PART B: 4 Questions each with internal choice from CO1-CO4, 1 question from CO5 and CO6 with internal choice, each carrying 16 marks

80 Marks

SAU1404	VEHICLE DESIGN CHARACTERISTICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

OBJECTIVES:

- To make the students understand the design concepts and principles of various vehicle characteristics.

UNIT 1: INTRODUCTION**9 hrs**

Assumptions to be made in designing a vehicle, range of values for gross vehicle weight, frontal area, maximum speed, maximum acceleration, gradability in different gears, basics of automobile design, vehicle design considerations, drive arrangement.

UNIT 2: PERFORMANCE CURVES**9 hrs**

Resistance, power and torque curve, driving force against vehicle speed – acceleration and gradability in different gears for a typical car or truck plotted from specifications, calculation of engine cubic capacity, bore and stroke length, calculation, tabulation and plotting of torque and mechanical efficiency for different vehicle speeds

UNIT 3: RESISTANCE TO VEHICLE MOTION**9 hrs**

Calculation and plotting the curves of air, rolling and gradient resistances, driving force – engine power, speed, rear axle ratio, torque and mechanical efficiency at different vehicle speeds, calculation and plotting of driving force, power requirement for different loads and acceleration, maximum power calculation

UNIT 4: ENGINE DESIGN**9 hrs**

Pressure volume diagram, frictional mean effective pressure, engine capacity, velocity and acceleration, gas force, inertia and resultant force at various crank angles – side thrust on cylinder walls, calculation of the displacement- velocity- acceleration of piston and connecting rod.

UNIT 5: GEAR RATIOS**9 hrs**

Determination of gear ratios- four speed constant mesh gear box- sliding mesh gear box, acceleration and gradability - typical problems on vehicle performance of four wheeler, alternate methods for obtaining gear ratios, algebraic method, tabular method, compound epicycle gear train.

TOTAL: 45**hrs****Course Outcomes:**

On completion of the course, student will be able to

- CO1:** Describe the concepts and assumptions to be made in designing a vehicle.
- CO2:** Formulate the engine performance parameters and draw the performance curves
- CO3:** Identify the various resistances to vehicle motion and plot the graphs.
- CO4:** Evaluate the various forces and moments and plot the graphs
- CO5:** Evaluate the vehicle performance parameters and draw the performance curves.
- CO6:** Demonstrate the calculation of various gear ratios for vehicle.

REFERENCE BOOKS:

- Giri. N.K. "Automobile Mechanics" Khanna Publishers – New Delhi – 2002.
- Heldt P.M "High Speed Combustion Engine" Oxford & IBH Publishing Co., Calcutta 1989.
- Lichty "IC Engines", Kogakusha Co., Ltd. Tokyo, 1991
- William H.Crouse, William Harry Crouse "Automobile Mechanics" Tata McGraw-Hill Education, 2006.
- Gupta. R.B., "Automobile Engineering", Sathya Prakashan, 8 edit., 2013.
- Josep Heitner "Automobile Mechanics principles and practice " CBS publishers,2004.
- Srinivasan.S "Automobile Mechanics" Tata McGraw-Hill Education, 2003

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration : 3 Hrs.****PART A:** 10 questions of 2 marks each - No choice**20 Marks****PART B :** 2 questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SAU1601	AUTOMOTIVE AERODYNAMICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

OBJECTIVE

- To understand and apply basic principles of aerodynamics for the design of vehicle body

UNIT 1: INTRODUCTION**10 hrs.**

Scope, historical developments of flow phenomenon related to vehicles, external and internal flow problem, resistance to vehicle motion, performance, fuel consumption and performance potential of vehicle aerodynamics, engine cooling requirement, air flow to passenger compartment, duct for air conditioning, cooling of transverse engine and rear engine

UNIT 2: AERODYNAMIC DRAG OF CARS**8 hrs.**

Cars as a bluff body, flow field around car, drag force, types of drag force, analysis of aerodynamic drag, drag coefficient of cars, strategies for aerodynamic development, low drag profiles

UNIT 3: SHAPE OPTIMIZATION OF CARS**7 hrs**

Front end modification, front and rear wind shield angle, boat tailing, hatch back, fast back and square back, dust flow patterns at the rear, effects of gap configuration, effect of fasteners, optimization of car bodies for low drag case studies on modern vehicles

UNIT 4: VEHICLE HANDLING**10 hrs**

The origin of forces and moments on a vehicle, lateral stability problems, methods to calculate forces and moments – vehicle dynamics under side winds, the effects of forces and moments, characteristics of forces and moments, dirt accumulation on the vehicle, wind noise, drag reduction in commercial vehicles and racing cars.

UNIT 5: WIND TUNNELS FOR AUTOMOTIVE AERODYNAMICS**10 hrs.**

Introduction, principle of wind tunnel technology, limitation of simulation, stress with scale models, full scale wind tunnels, measurement techniques, equipment and transducers, road testing methods, flow visualization techniques, numerical methods, CFD analysis.

TOTAL: 45 hrs**Course Outcomes:**

On completion of the course, students will be able to

- CO:1** Acquire strong basics in motion of the vehicle in all aspects of the constraints.
CO:2 Understand the fundamentals of aerodynamics, vehicle body optimization, measuring aerodynamics forces.
CO:3 Predict component or process to meet the desired needs within realistic constraints such as comfort, Environmental and safety,
CO:4 Analyze, interpret data and simulate the structures in automobiles.
CO:5 Choose the appropriate characteristics of forces and moments in vehicle for multi-disciplinary areas.
CO:6 Design, formulate and optimistically solve problems related to Automobile Engineering.

REFERENCE BOOKS:

- Hucho.W.H-"Aerodynamics of Road Vehicles", Butterworth's Co Ltd., 1997.
- Pope. A-"Wind Tunnel Testing"-John Wiley & Sons-2nd Edition, New York, 1974.
- Automotive Aerodynamics: Update SP-706-SAE-1987.
- Vehicle Aerodynamics-SP-1145-SAE-1996.
- Scibor-Rylski A.J, Road Vehicle Aerodynamics, Pentech press, London 2nd Edition,1984

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration : 3 Hrs.****PART A:** 10 questions of 2 marks each - No choice**20 Marks****PART B :** 2 questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SAU1603	AUTOMOTIVE SAFETY	L	T	P	Credits	Total Marks
		3	0	0	3	100

OBJECTIVES:

- To give good exposure to automotive safety aspects including the understanding of the various safety equipments

UNIT 1: INTRODUCTION**8 hrs.**

Introduction to safety and vehicle structural crashworthiness & crash testing, types of impacts, and impact with rebound, driver assistance systems in automobiles, concept of crumple zone, characteristics of vehicle structure, role of safety systems in automobiles, importance of ergonomics in automotive safety.

UNIT 2: SAFETY CONCEPTS**7 hrs.**

Active safety: driving safety, conditional safety, perceptibility safety, operating safety- passive safety: exterior safety, interior safety, deformation behavior of vehicle body, speed and acceleration characteristics of passenger compartment on impact.

UNIT 3: SAFETY EQUIPMENTS**10 hrs.**

Seat belt, regulations, automatic seat belt lightener system, collapsible steering column, tilt able steering wheel, air bags, electronic system for activating air bags, bumper design for safety, type of safety glass & their requirements.

UNIT 4: COLLISION WARNING AND AVOIDANCE**10 hrs.**

Collision warning system, causes of rear end collision, frontal object detection, rear vehicle object detection system, object detection system with braking system interactions.

UNIT 5: COMFORT AND CONVENIENCE SYSTEM**10 hrs.**

Steering and types of different mirrors & their location, mirror adjustment, central locking system, garage door opening system, tire pressure control system, rain sensor system, and environment information system.

TOTAL: 45 hrs**Course Outcomes:**

On completion of the course, student will be able to

CO1: Understand the importance of vehicle safety and explain different vehicle collision and its effects.

CO2: Explain different types of safety concept and understand the deformation behaviour of vehicle body during collision.

CO3: Explain the operation of different safety equipment and understand various collision warning system.

CO4: Understand vehicle ergonomics system and psychological factors in man machine system.

CO5: Explain different types of mirror and their location and working principle of central locking system garage door opening system.

CO6: Explain rain sensor system and environment information system

REFERENCES:

1. Powloski.J - "Vehicle Body Engineering" - Business books limited, London - 1969.
2. Ronald.K.Jurgen - "Automotive Electronics Handbook" - Second edition- McGraw-Hill Inc., - 1999.
3. Johnson, W., and Mamalis, A.G., "Crashworthiness of Vehicles, MEP, London, 1995
4. Bosch - "Automotive Handbook" - 5th edition - SAE publication - 2000.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration : 3 Hrs.****PART A:** 10 questions of 2 marks each - No choice**20 Marks****PART B :** 2 questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SAU1605	MODERN AUTOMOBILE ACCESSORIES	L	T	P	Credits	Total Marks
		3	0	0	3	100

OBJECTIVE:

- To introduce the modern developments in vehicle technology

UNIT 1: ENGINE MANAGEMENT SYSTEMS**9 hrs**

Electronically controlled SI and CI engine fuel injection systems, related hardware and software, open loop and closed loop engine control and ignition system, engine cooling and lubrication control system, engine exhaust emission control system, catalytic converters and particulate traps

UNIT 2: CHASSIS**9 hrs**

Active suspension control, pneumatic suspensions, hydro-pneumatic suspension, rheological suspension, electronic braking system, fail safe braking system, antilock braking system, brake by wire system, regenerative braking system, anti-skid braking system

UNIT 3: HEATING AND AIR CONDITIONING**9 hrs**

Principles of vehicle air conditioning and heating, vapour absorption air conditioning, vapour compression air conditioning, CO, CO₂ level monitoring inside the cabin

UNIT 4: COMFORT AND CONVENIENCE**9 hrs**

Adaptive cruise control, car entertainment, power windows, navigation system, adaptive noise control, electric seats, driver information system, power steering- electric power steering, satellite control of vehicle operation, tyre pressure monitoring system

UNIT 5: SAFETY AND SECURITY SYSTEMS**9 hrs**

Airbags, seat belt tightening system, collapsible and tiltable steering column, anti-theft system, anti-lock braking system, electronic stability control system/traction control system, roll over protection system, collision avoiding system, central locking system, rain sensor wiper motor system.

TOTAL: 45 Hrs**Course Outcomes:**

On completion of the course, student will be able to

- CO1:** Explain the concepts of Engine & Chassis Management system.
- CO2:** Explain the principles of Heating and Air-Conditioning system.
- CO3:** Analyze the Comfort, Convenience, Safety & Security systems.
- CO4:** Analyze various emission control technique in engines
- CO5:** Design Modern chassis components
- CO6:** Develop and analyze various safety and security systems.

REFERENCE BOOKS:

1. Tom Denton - "Automobile Electrical and Electronic Systems" - Edward Arnold, London, 1995.
2. Eric Chowanietz - 'Automotive Electronics' - SAE International, USA, 1995
3. Bosch Automotive Hand Book - 5th Edition - SAE Publication, USA, 2000.
4. Giri. N.K. "Automobile Mechanics" Khanna Publishers, New Delhi, 2002.
5. James E. Duffy "Modern Automobile Technology" 2008.
6. Heldt P.M "High Speed Combustion Engine" Oxford & IBH Publishing Co., Calcutta 1989.
7. Srinivasan.S "Automobile Mechanics" Tata McGraw Hill Education, 2003

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration : 3 Hrs.****PART A:** 10 questions of 2 marks each - No choice**20 Marks****PART B :** 2 questions from each unit of internal choice; each carrying 16 marks**80 Marks**

ELECTIVE COURSES (GROUP B)

SME1606	COMBUSTION ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OUTCOMES

On completion of the course, student will be able to

CO1- Understand various types of fuels and its ppts

CO2- Understand the concept of gaseous fuels

CO3- Will able to differentiate gaseous and liquid fuels

CO4- Will understand the concept of solid fuels

CO5- Student learns about fluidized bed combustion

CO6- Student understands the fundamentals in combustion of fuels.

UNIT 1 COMBUSTION OF FUELS**9 Hrs.**

Fuels & Fuel Analysis-Combustion equation, Stoichiometry, theoretical & actual combustion processes. Combustion equations, excess air, air fuel ratio, equivalence ratio, exhaust gas composition, Air fuel ratio from exhaust gas composition.

UNIT 2 THERMODYNAMICS OF COMBUSTION**9 Hrs.**

Enthalpy of Formation; Enthalpy of Reaction; Heating Values; First law Analysis of Reaction System and Second Laws Analysis of Reaction System, Adiabatic combustion temperature criteria for Chemical Equilibrium, Equilibrium constant for gaseous mixtures, **Evaluation of equilibrium composition, chemical availability.**

UNIT 3 KINETICS OF COMBUSTION**9 Hrs.**

Law of Mass Action; Reaction Rate; Simple and Complex Reaction; Reaction order and Molecularity, Arrhenius Laws; Activation Energy; Chain Reaction; Steady Rate and Partial Equilibrium Approximation; Chain Explosion; Explosion Limit and Oxidation Characteristics of Hydrogen, Carbon Monoxide, Hydrocarbons.

UNIT 4 FLAMES**9 Hrs.**

Remixed Flame Structure and Propagation of Flames in Homogeneous Mixtures; Relation, Properties of Hugoniot Curve, Analysis of Deflagration and Detonation Branches. Theories of Flame Propagation & **Calculation of Flame Speed Measurements. Stability Limits of Laminar Flames; Flammability Limits & Quenching Distant, Burner Design**, Mechanism of Flame Stabilization In Laminar & Turbulent Flows, Flame Quenching, Diffusion Flames; Comparison of Diffusion With Premixed Flame, Combustion of Gaseous Fuel, Jets Burke & Schumann Development.

UNIT 5 ENGINE COMBUSTION**9 Hrs.**

Combustion in SI and CI engines, stages of combustion in SI and CI engines, Normal combustion and abnormal combustion, Emissions from premixed combustion, Emission from Non-premixed combustion, Control of emissions.

Max. 45 Hours**TEXT / REFERENCE BOOKS**

1. Stephen R. Turns, "An Introduction to Combustion", McGraw Hill Book Company, 1996.
2. Irwin Glassman, "Combustion", Third Edition, Academic Press, 1996.
3. Sharma S.P. and Chandramohan, "Fuels and Combustion", Tata McGraw Hill Book Co., 1984.
4. Samir Sarkar, "Fuels and Combustion", Orient Longman, 1984.
5. Kuo K.K. "Principles of Combustion", John Wiley & Sons, 1984.
6. Heywood J.B, "Internal Combustion Engine Fundamentals", Mc Graw Hill Book Co., 1988.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks: 80****Exam Duration : 3 Hrs.****PART A : 2 Questions from each unit, each carrying 2 marks****20 Marks****PART B : 2 Questions from each unit with internal choice, each carrying 12 marks****60 Marks**

SME1608	COMPUTER SIMULATION OF IC ENGINES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OUTCOMES

On completion of the course, student will be able to

CO1- Understand first and second laws of thermodynamics.

CO2- Understand the basic Heat transfer models for engines.

CO3- Apply the simulation techniques for modification of combustion chamber.

CO4- Apply the simulation techniques to develop new engines.

CO5- Apply the simulation techniques Combustion in SI engines.

CO6- Apply the simulation techniques Combustion in CI engines.

UNIT 1 SIMULATION PRINCIPLES**9 Hrs.**

Simulation principles-First and second laws of thermodynamics - Estimation of properties of gas mixtures - Structure of engine models - Open and closed cycle models - Cycle studies, Chemical Reactions, First law application to combustion, Heat of combustion - Adiabatic flame temperature, Chemical Equilibrium and calculation of equilibrium composition - Heat transfer in engines - Heat transfer models for engines.

UNIT 2 SIMULATION OF COMBUSTION IN SI ENGINES**9 Hrs.**

Simulation in SI engine - Combustion in SI engines, Flame propagation and velocity, Single zone models - Multi zone models - Mass burning rate, Turbulence models - One dimensional models - Chemical kinetics modeling - Multidimensional models, Flow chart preparation.

UNIT 3 SIMULATION OF COMBUSTION IN CI ENGINES**9 Hrs.**

Main difference between SI and CI engine simulation, differences between ideal and actual cycles, Combustion in CI engines - Single zone models - Premixed-Diffusive models - Wiebe' model - Whitehouse way model, Two zone models - Multizone models - Meguerdichian and Watson's model, Hiroyasu's model, Lyn's model - Introduction to Multidimensional and spray modeling, Flow chart preparation.

UNIT 4 SIMULATION OF TWO STROKE ENGINES**9 Hrs.**

Thermodynamics of the gas exchange process - Flows in engine manifolds - One dimensional and multidimensional models, determination of the pressure-crank angle variation, computation of performance parameters. Flow around valves and throughports Models for scavenging in two stroke engines - Isothermal and non-isothermal models, Heat Transfer and Friction. simulation for pollution estimation.

UNIT 5 SIMULATION OF GAS TURBINE COMBUSTORS**9 Hrs.**

Gas Turbine Power plants - Flame stability, Combustion models for Steady Flow Simulation - Emission models. Flow chart preparation.

Max. 45 Hours**TEXT / REFERENCE BOOKS**

1. Ashley S. Campbell, Thermodynamic Analysis of Combustion Engines, Krieger publication co, 1985.
2. Ganesan V., Computer Simulation of Spark Ignition Engine Processes, Universities Press, 2000.
3. Ganesan V., Computer Simulation of C.I. Engine Processes, Universities Press, 2000.
4. Cohen H. Rogers GEC. - Gas Turbine Theory - Pearson Education India Fifth edition, 2001.
5. Bordon P. Blair, The Basic Design of two-Stroke engines, SAE Publications, 1990.
6. Horlock and Winterbone, The Thermodynamics and Gas Dynamics of Internal Combustion Engines, Vol. I & II, Clarendon Press, 1986.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks: 80****Exam Duration : 3 Hrs.****PART A : 2 Questions from each unit, each carrying 2 marks****20 Marks****PART B : 2 Questions from each unit with internal choice, each carrying 12 marks****60 Marks**

SAU1609	TRANSPORT MANAGEMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Demonstrate different theories in practice within companies and various supply chains.
 CO2 - Understand and take into consideration the importance of transportation management.
 CO3 - Evaluate knowledge/science within the area transportation management.
 CO4 - Describe the various transport systems and advantages of motor transport.
 CO5 - Apply the Motor Vehicle Act in fleet management and various maintenance activities to vehicles.
 CO6 - Assess the operating costs for transport vehicles and estimate the fare structure.

UNIT 1 INTRODUCTION**9 Hrs.**

Transport Functions and Systems: accessibility/connectivity, mobility, Role of Transport: economic role, social role, political role and cultural values, Transport personnel management: job description, employment tests, interviewing, Introduction to training objectives, advantages, methods of training, training procedure, psychological tests.

UNIT 2 TRANSPORT SYSTEMS**9 Hrs.**

Introduction to various transport systems - Advantages of motor transport. Principal function of administrative - traffic - secretarial and engineering divisions - chain of responsibility, forms of ownership by state, municipality, public body and private undertakings.

UNIT 3 TRANSPORT PLANNING AND ANALYSIS**9 Hrs.**

Transport planning and its scope, Components of comprehensive planning, Urban transport system planning, Land use forecast, travel forecast, Systems approach to transportation planning, Levels of urban transport planning, Modal split analysis, Basic approaches of Modal split analysis.

UNIT 4 TRANSPORT ADMINISTRATION AND CONTROL**9 Hrs.**

State Regulation, Contract and Rates Household Good Carriers: Radial and Non-radial Operations, Multi mode transportation, Taxation of commercial motor transport, Regulation of road transport in India, Administration and financial road construction, Current problems of surface transport.

UNIT 5 MAINTENANCE**9 Hrs.**

Preventive maintenance system in transport industry, tire maintenance procedures - Causes for uneven tire wear; remedies, maintenance procedure for better fuel economy, Design of bus depot layout.

Max. 45 Hours**TEXT / REFERENCE BOOKS**

1. John Duke, "Fleet Management", McGraw-Hill Co, USA, 1984.
2. Kitchin.L.D., - Bus Operation - Illiffe and Sons Co., London, III edition - 1992
3. Government Motor Vehicle Act, Publication on latest act to be used as on date

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks: 80****Exam Duration : 3 Hrs.****PART A : 2 Questions from each unit, each carrying 2marks****20 Marks****PART B : 2 Questions from each unit with internal choice, each carrying 12marks****60 Marks**

SATHYABAMA UNIVERSITY

(Established under section 3 of UGC Act, 1956)

Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai - 119.



SYLLABUS

**BACHELOR OF ENGINEERING PROGRAMME
IN**

**AUTOMOBILE ENGINEERING (8 SEMESTERS)
REGULATIONS 2010**

**B.E. - AUTOMOBILE ENGINEERING
REGULATIONS – 2010 - CURRICULUM
LIST OF SUBJECTS**

SEMESTER I

Sl. No.	SUBJECT CODE	SUBJECT TITLE	L	T	P	C	Page No.
1	SMTX1001	Engineering Mathematics – I	3	1	0	4	1
2	SCHX1001	Environmental Science and Engineering	3	0	0	3	2
3	SPHX1001	Physics of Materials	3	0	0	3	3
4	SCYX1001	Engineering Chemistry	3	0	0	3	4
5	SCSX1002	Programming In C	3	0	0	3	5
6	SMEX1001	Engineering Graphics	1	2	0	3	6
7	SMEX1002	Engineering Mechanics	2	1	0	3	7

PRACTICALS

1	SPRX4002	CAD Lab – I	0	0	4	2	8
2	SCSX4002	Programming In C Lab	0	0	4	2	8

TOTAL CREDITS 26

SEMESTER II

Sl. No.	SUBJECT CODE	SUBJECT TITLE	L	T	P	C	Page No.
1	SHSX1001	English for Science and Technology	3	0	0	3	9
2	SMTX1002	Engineering Mathematics – II	3	1	0	4	10
3	SPHX1002	Applied Physics	3	0	0	3	11
4	SCYX1003	Chemistry of Industrial Materials	3	0	0	3	12
5	SCSX1003	Programming in C++	3	0	0	3	13
6	SEEX1002	Basic Electrical and Electronics Engineering	3	0	0	3	14
7	SPRX1001	Basic Mechanical and Civil Engineering	3	0	0	3	15

PRACTICALS

1	SPRX4001	Mechanical Workshop Lab	0	0	4	2	16
2	SCSX4007	Programming in C++ Lab	0	0	4	2	16

TOTAL CREDITS 26

L - Lecture hours; T - Tutorial hours; P - Practical hours; C - Credits

SEMESTER III

Sl. No.	SUBJECT CODE	SUBJECT TITLE	L	T	P	C	Page No.
1	SMTX 1009	Engineering Mathematics – III	3	1	0	4	17
2	SMEX 1003	Kinematics of Machines	2	1	0	3	18
3	SMEX 1004	Engineering Thermodynamics	2	1	0	3	19
4	SMEX 1005	Fluid Mechanics and Machinery	2	1	0	3	20
5	SMEX 1006	Machine Drawing	1	2	0	3	21
6	SAUX 1001	Automotive Petrol Engines	3	0	0	3	22
7	SAUX 1002	Fuels and Lubricants	3	0	0	3	23

PRACTICALS

1	SMEX 4006	Fluid Mechanics and Machinery Lab	0	0	4	2	24
2	SAUX 4001	Fuels and Lubricants and Engine Testing Lab	0	0	4	2	25

TOTAL CREDITS 26**SEMESTER IV**

Sl. No.	SUBJECT CODE	SUBJECT TITLE	L	T	P	C	Page No.
1	SMTX 1010	Engineering Mathematics – IV	3	1	0	4	26
2	SMEX 1008	Dynamics of Machinery	3	1	0	4	27
3	SMEX 1009	Thermal Engineering	3	1	0	4	28
4	SMEX 1010	Strength of Materials	2	1	0	3	29
5	SECX 1011	Microprocessor and Microcontroller	3	0	0	3	30
6	SAUX 1003	Automotive Diesel Engines	3	0	0	3	31

PRACTICALS

1	SMEX 4008	Material Testing Lab	0	0	4	2	32
2	SECX 4014	Electronics and Microprocessor Lab	0	0	4	2	32

TOTAL CREDITS 25

SEMESTER V

SI. No.	SUBJECT CODE	SUBJECT TITLE	L	T	P	C	Page No.
1	SMTX 1011	Applied Numerical Methods	3	1	0	4	33
2	SPRX 1044	Measurements and Metrology	3	0	0	3	34
3	SMEX 1006	Material Technology	3	0	0	3	35
4	SAUX 1004	Automotive Electrical and Electronics	3	0	0	3	36
5	SAUX 1005	Automotive Engine Components Design	3	1	0	4	37
6	SAUX 1006	Automotive Chassis	3	0	0	3	38
7	SAUX 1007	Vehicle Dynamics	3	0	0	3	39

PRACTICALS

1	SAUX 4002	Automotive Engine Components Lab and0 Automotive Chassis Components Lab	0	4	2	40	
2	SAUX 4003	Automotive Electrical and Electronics Lab	0	0	4	2	40

TOTAL CREDITS 27**SEMESTER VI**

SI. No.	SUBJECT CODE	SUBJECT TITLE	L	T	P	C	Page No.
1	SMEX 1017	Resource Management Techniques	3	0	0	3	41
2	SAUX 1008	Vehicle Maintenance	3	0	0	3	42
3	SAUX 1009	Automotive Pollution and Control	3	0	0	3	43
4	SAUX 1010	Automotive Transmission	3	0	0	3	44
5		Elective – I	3	0	0	3	
6		Elective – II	3	0	0	3	

PRACTICALS

1	SAUX 4004	Vehicle Maintenance Lab	0	0	4	2	45
2	SAUX 4005	Two Wheeler and Three Wheeler Lab	0	0	4	2	45

TOTAL CREDITS 22

SEMESTER VII

Sl. No.	SUBJECT CODE	SUBJECT TITLE	L	T	P	C	Page No.
1	SAUX 1011	Automotive Chassis Design	3	1	0	4	46
2	SAUX 1012	Vehicle Body Engineering	3	0	0	3	47
3	SMEX 1021	Total Quality Management	3	0	0	3	48
4	SAUX 1013	Heat Transfer Applied to I.C.Engines	3	1	0	4	49
5		Elective – III	3	0	0	3	
6		Elective – IV	3	0	0	3	

PRACTICALS

1	SAUX 4006	Vehicle Reconditioning Lab	0	0	2	1	50
2	SAUX 4007	Computer Aided Engine Design and Chassis Design Lab	0	0	2	1	50

TOTAL CREDITS 22

SEMESTER VIII

Sl. No.	SUBJECT CODE	SUBJECT TITLE	L	T	P	C	Page No.
1	SBAX 1001	Principles of Management and Professional Ethics	3	0	0	3	51
2	SPRX1007	CAD/CAM	3	0	0	3	52
3	SAUX 1014	Vehicle Design Characteristics	3	0	0	3	53

PRACTICALS

1	SAUX 4008	Modeling and Analysis of Engine components Lab	0	0	2	1	54
2	SAUX 4009	Computer Aided Manufacturing Lab	0	0	2	1	54
3	S86XPROJ	Project Work and Viva Voce	0	0	30	15	54

TOTAL CREDITS 26

TOTAL CREDITS FOR THE COURSE 200

LIST OF ELECTIVE SUBJECTS**Note: ONE SUBJECT IS TO BE CHOSEN FROM EACH GROUP COMPULSORILY****GROUP I: AUTOMOBILE ENGINEERING**

Sl. No.	SUBJECT CODE	SUBJECT TITLE	L	T	P	C	Page No.
1	SAUX1015	Automotive Air Conditioning	3	0	0	3	55
2	SAUX1016	Alternate Fuels and Energy Systems	3	0	0	3	56
3	SAUX1017	Vibration and Noise Control in Automobiles	3	0	0	3	57
4	SAUX1019	Two and Three Wheeled Vehicles	3	0	0	3	58
5	SAUX1022	Modern Automobile Accessories	3	0	0	3	59
6	SAUX1023	Fuel Cell and Applications	3	0	0	3	60
7	SAUX1024	Off Road Vehicles	3	0	0	3	61
8	SMEX1024	Advanced Internal Combustion Engineering	3	0	0	3	62
9	SMEX1027	Combustion Engineering	3	0	0	3	63

GROUP II: MANAGEMENT

1	SAUX1020	Transport Management	3	0	0	3	64
2	SMEX1034	Solid Waste Management	3	0	0	3	65
3	SMEX1035	Energy Engineering and Management	3	0	0	3	66
4	SMEX1040	Industrial Handling and Storage Systems	3	0	0	3	67

GROUP III: ADVANCED DESIGN

1	SMEX1038	Computational Fluid Dynamics	3	0	0	3	68
2	SMEX1039	Finite Element Analysis	3	0	0	3	69
3	SMEX1031	Design of Heat Transfer Equipment	3	0	0	3	70
4	SAUX1018	Automotive Aerodynamics	3	0	0	3	71

GROUP IV: ADVANCED TECHNOLOGY

1	SPRX1019	Industrial Robotics and Applications	3	0	0	3	72
2	SMEX1041	Artificial Intelligence and Expert Systems	3	0	0	3	73
3	SAUX1021	Automotive Safety	3	0	0	3	74
4	SMEX1030	Bio Energy Conversion Technologies	3	0	0	3	75

SCSX1002	PROGRAMMING IN C (Common to all Branches of B.E / B.Tech.)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I**10 hrs.**

Introduction: Algorithms & flowcharts-Overview of C-Features of C-IDE of C Structure of C program-Compilation & execution of C program-Identifiers, variables, expression, keywords, data types, constants, scope and life of variables, local and global variables. Operators: arithmetic, logical, relational, conditional and bitwise operators- Special operators: size of () & comma (,) operator-Precedence and associativity of operators & Type conversion in expressions.

Basic input/output and library functions: Single character input/output i.e. getch(), getchar(), getche() & putchar()-Formatted input/output: printf() and scanf()-Library Functions: concepts, mathematical and character functions.

UNIT II**10 hrs.**

Control structures: Conditional control-Loop control and Unconditional control structures.

Functions: The Need of a function-User defined and library function- Prototype of a function-Calling of a function-Function argument-Passing arguments to function- Return values-Nesting of function- main()-Command line arguments and recursion. Storage class specifier – auto, extern, static, & register.

UNIT III**10 hrs.**

Arrays: Single and multidimensional arrays-Array declaration and initialization of arrays-Array as function arguments.

Strings: Declaration-Initialization and string handling functions.

Structure and Union: Defining structure-Declaration of structure variable-Accessing structure members-Nested structures-Array of structures-Structure assignment-Structure as function argument-Function that returns structure- Union.

UNIT IV**10 hrs.**

Pointers: The '&' and '*' operators-Pointers expressions-Pointers vs arrays-Pointer to functions-Function returning pointers-Static and dynamic memory allocation in C.

DMA functions: malloc(), calloc(), sizeof(), free() and realloc()-Preprocessor directives.

UNIT V**10 hrs.**

File management: Defining, opening & closing a file, text file and binary file- Functions for file handling: fopen, fclose, gets, puts, fprintf, fscanf, getw, putw, fputs, fgets, fread, fwrite-Random access to files: fseek, ftell, rewind-File name as Command Line Argument.

Graphics in PC-Initialize Graphics Mode-Functions used In Graphics - Drawing a Point on the Screen-Drawing lines, rectangles, ovals, circles, arcs, polygon, filling colors-Using Text in Graphics Display.

REFERENCE BOOKS:

1. Balaguruswami.E, 'Programming in C', TMH Publications,1997
2. Behrouz A. Forouzan & Richard F. Gilberg, "Computer Science A Structured Programming using C", Cengage Learning, 2007
3. Gottfried , 'Programming with C', schaums outline series, TMH publications,1997
4. Mahapatra , 'Thinking in C', PHI publications, 2nd Edition.
5. Stevens , 'Graphics programming in C', BPB publication,2006
6. Subbura.R , 'Programming in C', Vikas publishing, 1st Edition, 2000

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80

Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks

20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

SMEX1001	ENGINEERING GRAPHICS (Common to all Branches of B.E / B.Tech)	L	T	P	Credits	Total Marks
		1	2	0	3	100

UNIT I CONSTRUCTION OF PLANE CURVES**10 hrs.**

Introduction - Importance of graphics in engineering applications – Use of drafting instruments – BIS specifications and conventions – Size, layout and folding of drawing sheets – Lettering and dimensioning- Polygons used in engineering practice– methods of construction of pentagon and hexagon– Construction of ellipse, parabola and hyperbola.

UNIT II PROJECTION OF POINTS AND LINES**10 hrs.**

General principles of orthographic projection – first angle projection – layout of views – projections of points, straight lines located in the first quadrant – Determination of true lengths of lines and their inclinations to the planes of projection – Traces

UNIT III PROJECTION OF SOLIDS AND SECTION OF SOLIDS**10 hrs.**

Projection of solids like prism, pyramid, cylinder and cone when the axis is inclined to only one plane of projection – Change of position method only - Sectioning of above mentioned solids in simple vertical positions by cutting plane inclined to one reference plane and perpendicular to the other – True shapes of sections

UNIT IV DEVELOPMENT OF SURFACES AND FREE HAND SKETCHING**10 hrs.**

Need for development of surfaces – Development of lateral surfaces of simple and truncated solids – Prisms, pyramids, cylinders and cones.- Pictorial representation of engineering objects – Representation of three dimensional objects in two dimensional media – Need for multiple views – Developing visualization skills through free hand sketching of three dimensional objects.

UNIT V ISOMETRIC PROJECTIONS & PERSPECTIVE PROJECTIONS**10 hrs.**

Principles of isometric projection – Isometric scale – Isometric projections of simple solids and combination of solids - Prisms, pyramids, cylinders, cones and spheres (excluding isometric projections of truncated solids) - Perspective projections - Simple objects like – cube, prisms, pyramids by Vanishing point method & Visual Ray method (excluding perspective projections of truncated solids)

TEXT BOOKS / REFERENCE BOOKS:

1. Natarajan, K.V, “ A Textbook of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2006 .
2. Venugopal, K. and Prabhu Raja, V., “Engineering Graphics”, New Age International(P) Ltd.,2008.
3. Ramachandran. S, Pandian. K, Ramanamurthy. E.V.V. and Devaraj. R “Engineering Graphics”, AirWalk Publications, Chennai, 2009
4. IS 10711-2001: Technical Products Documentation – Size and Layout of Drawing Sheets
5. IS 9609 (Parts 0 & 1)-2001: Technical Products Documentation – Lettering
6. IS 10714(Part 20)-2001 & SP 46 -2003: Lines for Technical Drawings
7. IS 11669-1986 & SP 46-2003: Dimensioning of Technical Drawings
8. IS 15021(Parts 1 to 4)-2001: Technical Drawings-Projection Methods

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks : 80

Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks

20 marks

PART A : equal distribution of questions from each unit.

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

PART B - Split up:

Unit 1: 1 question from construction of hexagon / pentagon / ellipse &

1 question from construction of parabola / hyperbola

Unit 2: 1 question from projection of points & 1 question from projection of lines inclined to both the planes.

Unit 3: 1 question from projection of solids & 1 question from section of solids.

Unit 4: 1 question from development of surfaces & 1 question from orthographic projection.

Unit 5: 1 question from isometric projection & 1 question from perspective projection.

SPRX4002	CAD LAB-I	L	T	P	Credits	Total Marks
		0	0	4	2	100

1. Introduction

Basics, Fundamentals of feature based modeling.

2. Two Dimensional objects:

Create basic drawing objects - Points, Lines, Circles / Arcs, Planes and their combination,

Setup a drawing with correct scales, Draw with precision using Coordinate input & object

Snaps. Isometric drawing, Orthographic projection, Auxiliary views,

Modify with edit commands, Dimension and add text to drawing, Plot drawings

3. Three Dimensional objects:

Creating and Editing 3D objects, Viewing in 3D

4. Drawing creation from 3D models Creation of various views and dimensioning,

Dimensioning commands, Editing Dimensions and Dimension text, Creating and Saving

Dimension styles, Updating Dimensions, specification of tolerances and surface finish, annotations, symbols like welding, fillet, threads.

SCSX4002	PROGRAMMING IN C LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

1. To write a simple menu driven calculator program using switch statement.
2. To write a program to calculate the nCr using functions.
3. To write a program to find the largest and smallest number using arrays.
4. To write a program to generate Fibonacci series.
5. To write a program to find the factorial of a number using recursion.
6. To write a program to print the sum of elements of an array using pointers.
7. To write a program to implement file handling
8. To write a program to perform matrix addition and multiplication.
9. To write a program to check for perfect number.
10. To write a program to implement string manipulation functions without using library functions.
11. To write a program to perform ASCII equivalent keystrokes.
12. To write a program to solve a polynomial equation.

SPRX4001	MECHANICAL WORKSHOP LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

CARPENTRY

Handling of carpentry tools, A practice in marking, sawing planing and chiseling to size. Making simple joints such as half-lap, dove-tail and mortise and tenon joints. Use of modern materials such as plywood, chip board, novapan, laminated sheet (demonstration only).

FITTING

Use of fitting tools-practice in marketing, fitting to size and drilling-making of simple mating and profiles such as V, Square, Dove-tail, Half-round joints.

WELDING

i. Electric Arc Welding

a) Study on Edge preparation techniques for Arc welding

b) List of Welding Exercises 1. Lap Joint 2. Butt Joint 3. Fillet Joint 4. Tee Joint 5. V Joint 6. Corner Joint

ii. Study on gas welding and gas cutting

iii. Study on TIG & MIG welding

FOUNDRY

i. Sand testing - Grain fineness - Permeability test.

ii. Study on Pattern Allowances

iii. Preparation of green sand moulding 1. Flanges 2. Glands 3. Bush 4. Dumbbell

iv. Metal casting technique (Demonstration only)

SCSX4007	PROGRAMMING IN C++ LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

- Write a program to calculate final velocity using the formula: $v=u + a \cdot t$, with initial velocity, acceleration and time as input.
- Write a program to find the area of square, rectangle, circle using function overloading concept.
- Write a program to change the sign of an operands using unary operator overloading concept.
- Write a program to add two complex numbers using binary operator overloading concept.
- Write a program to find mean value of two integers using friend function concept.
- Write a program to multiple and divide two different data type using inline function concept.
- Implement parametrized constructor, default constructor, copy constructor and destructor
- Write a program to enter the sale value and print the agent's commission using single inheritance.
- Write a program to enter salary and output income tax and net salary using multiple inheritance concept.
- Write a program to enter the unit reading and output the customer's telephone bill using hierarchical inheritance.
- Write a program to find the grade of the students based on academic marks and sports using multilevel inheritance.
- Write a program having student as an abstract class and create many derived classes such as Engineering, Medical etc from student's class. Create their objects and process them.
- Write a program to count the words and characters in given text using virtual function.
- Write a program to calculate net pay of employee using virtual base class concept.
- Write a program to calculate division of two number with a try block to detect and throw an exception if the condition "divide by-zero" occurs.
- Write a program to merge two files into one single file
- Write a program to swap two values using funtion templates
- Write a program to sort the numbers using class templates

SMEX1006	MACHINE DRAWING	L	T	P	Credits	Total Marks
		1	2	0	3	100

UNIT I DRAWING STANDARDS**10 hrs.**

BIS code of practice for Engineering Drawing – Machine Drawing Conventions – Need for drawing conventions – Conventional representation of common machine elements such as screws, bolts, nuts, keys, gears, bearings, couplings, webs, ribs etc., - Abbreviations and symbols for use in technical drawings - Types of sections – Parts not usually sectioned.

UNIT II FITS, TOLERANCES AND PREFERRED NUMBERS**10 hrs.**

Fits – Types of fits – Allocation of fits for various machine parts – Tolerances – Types – Representation on the drawing – Tolerance data sheet – Geometric tolerance – Preferred numbers

UNIT III MANUFACTURING DRAWING (Only for practice; Not to be asked in the examination) 5 hrs.

Preparation of manufacturing drawing for the following machine components: Hexagonal headed bolts- Nuts – Square headed bolts – Cotter joints – Cotter joint with Sleeve – Socket and Spigot Cotter joint – Cotter joint with Gib and Cotter – Knuckle joint

UNIT IV ASSEMBLY DRAWING**15 hrs.**

Preparation of assembled views from the given parts – Screw jack – Plummer block – Snug and octagonal type – Swivel bearing – Lathe tail stock – Steam stop valve – Machine vice - Petrol Engine Connecting rod – Cross head for horizontal and vertical steam engine.

TEXT BOOKS:

1. Gopala Krishnan.K.R,"Machine Drawing ", 1st Edition, Sabhas Publications, 2008
2. N. D. Bhatt.N.D," Machine Drawing", 4th Edition, Charotar Publishing House, 2009
3. PSG Design Data Book

REFERENCE BOOKS:

1. Gill.P.S,"Machine Drawing". 5th Edition, S.K.Kataria & Sons,2009
2. Gupta.R.B,"Machine Drawing ", 1st Edition, Satya Prakash & Sons, 2006

UNIVERSITY EXAM QUESTION PAPER PATTERN

Note: 1. Question Paper will consists of two parts (A & B) of 3 hours duration.

2. All the students will have to submit all the drawing sheets in a file periodically for continuous assessment.

Part A: Problems on Limits (finding upper limit and lower limit) : 10 Marks

Problems on Clearance Fit / Interference fit / Transition fit : 15 Marks

Conventions symbols and abbreviations : 5 Marks

Part B: Assembly Drawing (only full sectional front view / top view) : 50 Marks

SAUX 1001	AUTOMOTIVE PETROL ENGINES	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I ENGINE CONSTRUCTION AND OPERATION**10 hrs.**

Constructional details of four stroke petrol engine, working principle, air standard Otto cycle, actual indicator diagram, two stroke engine construction and operation, comparison of four stroke and two stroke engine operation, firing order and its significance. **Port Timing, Valve Timing Diagram.**

UNIT II SI ENGINE FUEL SYSTEM**10 hrs.**

Carburettor working principle, requirements of an automotive carburettor, starting, idling, acceleration and normal circuits of carburettors. Compensation, maximum power devices, constant choke and constant vacuum carburettors, fuel feed systems; mechanical and electrical fuel feed pumps. Petrol injection, MPFI.GDI System, **Determination of air-fuel ratio and numerical problems on air-fuel ratio calculations.**

UNIT III IGNITION SYSTEM**10 hrs.**

Types and working of battery coil and magneto ignition systems, relative merits and demerits, centrifugal and vacuum advance mechanisms. Types and construction of spark plugs, electronic ignition systems. Transistorized coil ignition system, capacitive discharge ignition system

UNIT IV COOLING AND LUBRICATION SYSTEM**10 hrs.**

Need for cooling system, Types of cooling system: air cooling system, liquid cooling system, forced circulation system, pressure cooling system. Lubrication system; mist, wet sump lubrication system, properties of lubricants.

UNIT V COMBUSTION AND COMBUSTION CHAMBERS**10 hrs.**

Combustion in SI engine; stages of combustion, flame propagation, rate of pressure rise, abnormal combustion, detonation, effect of engine variables on knock, knock rating. Combustion chambers; different types, factors controlling combustion chamber design. **Engine Management Systems, Performance curves & Evaluation, Emission & Emission Control, Nano Problems, Heat release analysis.**

TEXT BOOKS:

1. Ganesan. V., "Internal Combustion Engines", Tata McGraw-Hill Publishing Co., New Delhi, 2003.
2. Mathur D.S.and Sharma R.P., "A course in Internal combustion engines", Dhanpat Rai & Sons Publications, New Delhi, 2001.
3. Ramalingam. K.K., "Internal Combustion Engines", SciTech Publications, Chennai, 2000.

REFERENCES:

1. Heldt. P.M., "High Speed Combustion Engines", Oxford IBH Publishing Co., Calcutta, 1975.
2. Obert. E.F., "Internal Combustion Engines Analysis and Practice", International Text Books Co., Scranton, Pennsylvania -8.198
3. William H.Crouse, "Automotive Engines", McGraw-Hill Publishers, 1985.
4. Ellinger. H.E., "Automotive Engines", Prentice Hall Publishers, 1992.
5. John B.Heywood, "Internal Combustion Engine Fundamental", McGraw-Hill, 1988.
6. Pulkrabek "Engineering Fundamentals of the Internal Combustion Engines", Practice Hall of India, 2003.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Mark: 80.

Exam Duration: 3hrs

PART A : 2 Questions from each unit, each carrying 2 marks

20 marks

PART B : **(100% Theory)**- 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

SAUX 1002	FUELS AND LUBRICANTS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I MANUFACTURE OF FUELS AND LUBRICANTS**10 hrs.**

Structure of petroleum, refining process, fuels, thermal cracking, catalytic cracking, polymerization, alkylation, isomerisation, blending, products of refining process. Manufacture of lubricating oil base stocks, manufacture of finished automotive lubricants, Distillation Curve.

UNIT II THEORY OF LUBRICATION**10 hrs.**

Engine friction: introduction, total engine friction, effect of engine variables on friction, hydrodynamic lubrication, elastic hydrodynamic lubrication, boundary lubrication, bearing lubrication, functions of the lubrication system, introduction to design of a lubricating system.

UNIT III LUBRICANTS**10 hrs.**

Specific requirements for automotive lubricants, oxidation deterioration and degradation of lubricants, additives and additive mechanism, synthetic lubricants, classification of lubricating oils, properties of lubricating oils, tests on lubricants. Grease, classification, properties, test used in grease.

UNIT IV PROPERTIES AND TESTING OF FUELS**10 hrs.**

Thermo-chemistry of fuels, properties and testing of fuels, relative density, calorific value, distillation, vapor pressure, flash point, spontaneous ignition temperature, viscosity, pour point, flammability, ignitability, diesel index, API gravity, aniline point etc. Octane and Cetane Numbers.

UNIT V COMBUSTION & FUEL RATING**10 hrs.**

SI Engines – flame propagation and mechanism of combustion, normal combustion, knocking, octane rating, fuel requirements. CI Engines - mechanism of combustion, diesel knock, Cetane rating, fuel requirements. Additive – mechanism - requirements of an additive, petrol fuel additives and diesel fuel additives – specifications of fuels. Alternative Fuels

TEXT BOOKS:

1. Ganesan. V. "Internal Combustion Engineering", Tata McGraw-Hill Publishing Co., New Delhi, 2003.
2. Mathur D.S., Sharma. R.P. "A course in internal combustion engines", Dhanpatrai publication, 2003.
3. Obert. E.F. "Internal Combustion Engineering and Air Pollution", International book Co., 1988.

REFERENCES:

1. Brame. J.S.S. and King. J.G – Fuels – Solids, Liquids, Gaseous.
2. Francis. W – Fuels and Fuel Technology, Vol. I & II
3. Hobson. G.D. & Pohl. W - Modern Petroleum Technology
4. Lansdowne A.R. – Lubrication – A practical guide to lubricant selection – Pergamum press – 1982.
5. Raymond.C.Gunther – Lubrication – Chilton Book Co., - 1971.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Mark: 80.

Exam Duration: 3hrs

PART A : 2 Questions from each unit, each carrying 2 marks

20 marks

PART B : (100% Theory)- 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

SECX1011	MICROPROCESSOR AND MICROCONTROLLER (Common to Mech & Auto)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I MICROPROCESSORS 8085**10 hrs.**

Microcomputer System – 8085 Architecture – 8085 Pin Diagram – Buses and Memory Operations - Addressing Modes, Basic concepts of microprocessor programming – Mnemonics – Hex code – fundamentals of assembly language - Instruction set for 8085.

UNIT II MICROPROCESSOR PROGRAMS AND INTERFACING - 8085**10 hrs.**

Program format - Simple programs – Addition, Subtraction, Multiplication, Division, Block movement of Data, Finding Smallest number array, and Sorting. Interfacing Chips: Parallel I/O (8255) – Keyboard and Display controller (8279) – Timer/ Counter (8253) - Programmable Interrupt Controller (8259).

UNIT III MICROPROCESSOR APPLICATIONS - 8085**10 hrs.**

8085 Microprocessor interfacing with simple control devices – Traffic light control – Stepper Motor control – Temperature and Humidity in Refrigeration & Air-Conditioning – Anti lock breaking - General Block diagram for Interfacing CNC machines.

UNIT IV 8051 MICROCONTROLLER**10 hrs.**

8051 Architecture: Microcontroller Hardware – I/O Pins, Ports – Internal and External memory – Counters and Timers – Serial data I/O – Interrupts – 8051 Assembly Language Programming: Addressing modes, Instruction set of 8051, Data transfer instructions, Arithmetic and Logical Instructions, Jump and Call Instructions interrupts and return interrupts and return interrupt handling.

UNIT V 8051 PROGRAMMING AND APPLICATIONS**10 hrs.**

Program format - Simple programs – Addition, Subtraction, Multiplication, Division, Finding Smallest number array, and Sorting.

8051 Interfacing with: LCD, Sensors, Stepper Motors, Keyboard, Pulse measurement, ADC and DAC.

TEXT BOOKS:

1. Ramesh S Gaonkar, Microprocessor Architecture, Programming and application with 8085, 3rd Edition, Penram International Publishing, New Delhi, 2000.
2. Douglas V., Hall, Microprocessors and Interfacing, TMH.
3. Kenneth J Ayala, The 8051 Microcontroller Architecture Programming and Application, 2nd Edition, Penram International Publishers (India), New Delhi, 1996.

REFERENCE BOOKS:

1. Mohammed Ali Mazidi and Janice Gillispie Mazidi, The 8051 Microcontroller and Embedded Systems, Pearson Education Asia, New Delhi, 2003.
2. Rafi Quazzaman M, Microprocessors Theory and Applications: Intel and Motorola prentice Hall of India, Pvt. Ltd., New Delhi, 2003.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max.Marks: 80

Exam Duration: 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks

20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

SAUX 1003	AUTOMOTIVE DIESEL ENGINES	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I BASIC THEORY**10 hrs.**

Diesel engine construction and operation, two stroke and four stroke diesel engine, dual cycle engines, diesel cycle, fuel-air and actual cycle analysis, diesel fuel, ignition quality, Cetane number, diesel fuels standards and specifications.

UNIT II FUEL INJECTION SYSTEM**10 hrs.**

Types of fuel injection system, Requirements, air and solid injection, functions of components, jerk and distributor type pumps common rail system, PTFI system pressure waves, injection lag, unit injector, mechanical and pneumatic governors, fuel injector, types of injection nozzle, spray characteristics, injection timing, pump calibration.

UNIT III AIR MOTION, COMBUSTION AND COMBUSTION CHAMBERS**10 hrs.**

Importance of air motion, swirl, squish and turbulence, swirl ratio, fuel air mixing, stages of combustion, delay period, factors affecting delay period, knock in CI engines. Combustion chamber: design requirements, direct and indirect injection combustion chambers, M type combustion chamber. Introduction -Inlet Manifold, Construction with reference to Efficiency.

UNIT IV SUPERCHARGING AND TURBOCHARGING**10 hrs.**

Necessity and importance of supercharger, types of supercharging and turbo charging, relative merits, design of Turbo charger Variable Geometrical Techniques, exhaust gas recirculation, charge cooling & Lubrication.

UNIT V DIESEL ENGINE TESTING AND PERFORMANCE**10 hrs.**

Automotive and stationary diesel engine testing and related emission standards. Engine performance and emission characteristics, variables affecting engine performance and emission, methods to improve engine performance, heat balance, performance maps. Engine management systems, CRDI, etc., Performance, Emission, Calculation & Testing of Emissions, Heat Release Analysis.

TEXT BOOKS:

1. Ganesan. V "Internal Combustion Engines", Tata McGraw-Hill Publishing Co., New Delhi, 2003.
2. Mathur D.S. and Sharma R. P. "A course in Internal Combustion Engines", Dhanpat Rai and Sons, 2002.

REFERENCES:

1. Ramalingam. K.K. "Internal Combustion Engines Theory and Practice", SciTech Publications (India) Pvt. Ltd. 2002.
2. Heywood. J.B. "Internal Combustion Engine Fundamentals", McGraw-Hill Book Co., 1988.
3. Heinz Heister "Advanced Engine Technology", SAE, 1995.
4. Pulkrabek "Engineering Fundamentals of the Internal Combustion Engines", Practice Hall of India 2003.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Mark: 80.

Exam Duration: 3hrs

PART A : 2 Questions from each unit, each carrying 2 marks

20 marks

PART B : (100% Theory)- 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

SMEX 4008	MATERIAL TESTING LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

1. Evaluation of engineering stress/ strain diagram on steel rod, Thin Wire and Twisted bars under tension.
2. Compression Test on bricks. Concrete blocks.
3. Deflection Test - Verification of Maxwell theorem.
4. Comparison of hardness values of Steel, Copper and aluminum using Brinell and Rockwell hardness measuring machines.
5. Estimation of spring constant. Under tension and compression.
6. Estimation of notch toughness of steel using a Charpy / Izod impact testing machine.
7. Double shear test in U.T.M.
8. Hardness values of Steel, Copper and aluminum using Vickers's hardness tester.
9. Load measurement using Load indicator, Load coils.
10. Strain Measurement using Rosette Strain Gauge.

SECX 4014	ELECTRONICS & MICROPROCESSOR LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

ELECTRONICS LAB

1. Study of logic gates.
2. Half and Full adder/ Subtractors.
3. Grey code converter
4. Ripple Counters and Mod – N Counters.
5. Encoders and decoders.
6. Multiplexers & Demultiplexers.

MICROPROCESSOR AND MICROCONTROLLER LAB

Using Microprocessor - 8085

1. Programs based on Arithmetic operations
2. Programs based on sorting
3. Interfacing of stepper motor.
4. Interfacing ADC and DAC.
5. Interfacing Traffic light control.

Using Microcontroller - 8051

6. Programs based on Arithmetic operations
7. Programs based on sorting
8. Interfacing of stepper motor.
9. Interfacing Traffic light control

SPRX1044	MEASUREMENTS AND METROLOGY (Common to Mech, Mech & Prod, Auto)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I CONCEPT OF MEASUREMENT**10 hrs.**

General concept- Methods of measurement- Generalised measurement system- Classification of instruments- Errors-systematic and random errors-correction, calibration-parameters associated with measurements like precision, accuracy, readability, span and range, hysteresis- sensors and transducers-mechanical and electrical type.

UNIT II MEASUREMENT OF POWER, PRESSURE, TEMPERATURE AND FLOW**10 hrs.**

Power, Force and Torque-mechanical, hydraulic, pneumatic and electrical type- Pressure- low pressure measurement using McLeod gauge, thermal conductivity gauge and ionization gauges-high pressure measurement using diaphragm gauges and bulk modulus pressure gauge. Temperature- thermo couple, RTD, thermistor and pyrometers.

Flow- Turbine type flowmeter, magnetic flowmeter, ultra sonic flow meter, thermal flowmeter and hot wire anemometer.

UNIT III LINEAR AND ANGULAR MEASUREMENT**10 hrs.**

Definition of Metrology-Linear measuring instruments-vernier, micrometer internal measurement, slip gauges and classification, interferometry, optical flats, introduction to limits, fits, tolerance and gauging, limit gauges- Comparator mechanical, pneumatic, electrical and optical types, applications.

Angular measurements: sine bar, optical bevel protractor, angle decker- Taper measurements, Autocollimator.

UNIT IV FORM MEASUREMENT**10 hrs.**

Measurement of screw threads- Terminology of screw threads, measurement of major and minor diameter, pitch, flank angle and effective diameter of screw threads, floating carriage micrometer- measurement of gears-tooth thickness-constant chord and base tangent method-Gleason and Parkson gear testing machines- Radius measurement-Surface finish, straightness, flatness and roundness measurements.

UNIT V LASER AND ADVANCES IN METROLOGY**10 hrs.**

Precision instruments based on laser principles- laser interferometer-application in linear and angular measurements and machine tool metrology – Coordinate measuring machine (CMM) – Constructional features- types, applications-digital devices-computer aided inspection.

TEXT BOOKS

1. T.G. Beckwith and Marangoni, "Mechanical Measurements", Addison Wesley, 2000.
2. R.K. Jain, "Engineering Metrology", Khanna Publishers, 1994.

REFERENCES

1. Alsutko, Jerry.D.Faulk, Thomson, "Industrial Instrumentation", Asia Pvt Ltd, 1988.
2. Sirohi, "Mechanical Measurements", New Age Publications., 1998
3. S.C. Gupta, "Engineering Metrology", Dhanpat Rai Publications, 1984.
4. Gaylor & Shotbolt, "Engineering Metrology", Mc Donald & Co Publications., 1994

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks : 80 Exam

Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks

20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

SAUX 1004	AUTOMOTIVE ELECTRICAL AND ELECTRONICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I BATTERIES, LIGHTING SYSTEM & ACCESSORIES**10 hrs.**

Principles and construction of lead-acid battery. Characteristics of battery, rating capacity and efficiency of batteries. Various tests on battery condition, charging methods. Constructional aspect of alkaline battery. Insulated & earth return systems. Positive & negative earth systems. Details of head light & side light. Headlight dazzling & preventive methods. Electrical fuel-pump, Speedometer, Fuel, oil & temperature gauges, Horn, Wiper system, Trafficator.

UNIT II STARTING SYSTEM & CHARGING SYSTEM**10 hrs.**

Condition at starting. Behavior of starter during starting. Series motor and its characteristics. Principle & construction of starter motor. Working of different starter drive units, care and maintenance of starter motor. Starter Switches. Generation of direct current. Shunt generator characteristics. Armature reaction. Third brush regulation. Cut-out. Voltage & current regulators. Compensated voltage regulator alternators principle & constructional aspects and bridge benefits.

UNIT III IGNITION SYSTEMS & FUEL INJECTION AND IGNITION SYSTEMS**10 hrs.**

Types, Construction & working of battery coil and magneto ignition systems. Relative merits, Centrifugal and vacuum advance mechanisms, types and construction of spark plugs, electronic ignition systems. Electronic Introduction, feed back carburetor systems. Throttle body injection and multi port or point fuel injection, fuel injection systems, Injection system controls. Advantages of electronic ignition systems: Types of solid-state ignition systems and their principle of operation, Contact less electronic ignition system, and electronic spark timing control.

UNIT IV AUTOMOTIVE ELECTRONICS & DIGITAL ENGINE CONTROL SYSTEM**10 hrs.**

Current trends in modern automobiles, Open and close loop systems-Components for electronic engine management. Electronic management of chassis system. Vehicle motion control. Open loop and closed loop control systems-Engine cranking and warm up control-Acceleration enrichment-Deceleration leaning and idle speed control. Distributor less ignition-Integrated engine control systems, Exhaust emission control engineering. Electronic dashboard instruments-Onboard diagnosis system, security and warning system.

UNIT V SENSORS AND ACTUATORS**10 hrs.**

Basic sensor arrangement, Types of sensors such as Oxygen sensors, Crank angle position sensors-Fuel metering, vehicle speed sensor and detonation sensor, Altitude sensor, flow sensor, Throttle position sensors. Solenoids, stepper motors, and relays.

REFERENCES:

1. Judge. A.W., Modern Electrical Equipment of Automobiles, Chapman & Hall, London, 1992.
2. Young. A.P., & Griffiths. L., Automobile Electrical Equipment, English Language Book Society & New Press, 1990.
3. Vinal. G.W., Storage Batteries, John Wiley & Sons Inc., New York, 1985.
4. Crouse. W.H., Automobile Electrical Equipment, McGraw Hill Book Co Inc., New York, 1980
5. Spreadbury. F.G. Electrical ignition Equipment, Constable & Co. Ltd., London 1962.
6. Kholi. P.L., Automotive Electrical Equipment, Tata McGraw-Hill Co. Ltd. New Delhi, 1975.
7. Automotive Hand Book, Robert Bosch, Bently Publishers, 1997.
8. William B. Ribbens, Understanding Automotive Electronics, 5th Edition, Butterworth, Heinemann Woburn, 1998.
9. Tom Weather Jr and Cland C. Hunter, Automotive Computers and Control System, Prentice Hall Inc., New Jersey.
10. Young. A.P. and Griffiths. L. Automobile Electrical Equipment, English Language Book Society and New Press.
11. Crouse. W.H., Automobile Electrical equipment, McGraw Hill Book Inc., New York, 1955.
12. Robert N Brady Automotive Computers and digital Instrumentation reston Book, Prentice Hall, Eagle Wood Cliffs, New Jersey,
13. Bechtold, Understanding Automotive electronics, SAE, 1998.
14. T.Mellard Automotive Electronics.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Mark: 80.

Exam Duration: 3hrs

PART A : 2 Questions from each unit, each carrying 2 marks

20 marks

PART B : (100% Theory)- 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

SAUX 1006	AUTOMOTIVE CHASSIS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I INTRODUCTION**10 hrs.**

Types of chassis lay out with reference to power plant locations and drives, vehicle frames, various types of frames, constructional details, materials, testing of vehicle frames, unitized frame body construction. Frame repairs and alignment – checking frame alignment.

UNIT II FRONT AXLE AND STEERING SYSTEM**10 hrs.**

Types of front axles, construction details, materials, front wheel geometry: castor, camber, king pin inclination, toe – in condition for true rolling motion of wheels during steering, steering geometry, Ackermann and Davis steering system, constructional details of steering linkages, different types of steering gear boxes, steering linkages and layouts, turning radius, wheel wobble, power assisted steering, steering of crawler tractors. Overall steering ratio – power steering – Centre point steering, Hard steering - Looseness in steering

UNIT III DRIVE LINE**10 hrs.**

Effect of driving thrust and torque reactions, Hotchkiss drive, torque tube drive and radius rods, propeller shaft, universal joints, front wheel drive, different types of final drive, double reduction and twin speed final drives, differential principle, construction details of differential unit, non slip differential locks, differential housings, construction of rear axles, types of loads acting on rear axle, fully floating, three quarter floating and semi floating rear axles housing, construction of different types of axle housings, multi axle vehicles. Final Drive Differential: Worm and worm wheel, Straight bevel gear, Spiral bevel gear and hypoid gear final drives.

UNIT IV SUSPENSION SYSTEM**10 hrs.**

Need of suspension system, type of suspension, suspension springs, constructional details and characteristics of leaf, coil and torsion bar springs, independent suspension, rubber suspension, pneumatics suspensions, shock absorbers. Torque reaction, Hotchkiss drive – torque tube drive, air suspension system

UNIT V BRAKING SYSTEM**10 hrs.**

Classification of brakes, drum brakes and disc brakes, constructional details, theory of braking, concept of dual brake system, parking brake, material, hydraulic system, vacuum assisted system, air brake system, anti lock braking, retarded engine brakes, eddy retarders, master cylinder, slave cylinder, servo action and self – energizing brakes.

REFERENCES:

1. Heldt.P.M., Automotive Chassis, Chilton Co., New York, 1990.
2. Steed.W., Mechanics of Road Vehicles, Illiffe Books Ltd., London, 1960.
3. Newton. Steeds & Garrot.Motor Vehicles, Butterworth's, London, 1983.
4. Judge.A.W.Mechanism of the car, Chapman and Halls Ltd., London1986.
5. Giles.J.G., Steering Suspension and tyres, Illiffe Book Co., London, 1988.
6. Crouse.W.H, Automotive Chassis and Body, McGraw Hill New York, 1971

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Mark: 80.

Exam Duration: 3 hrs

PART A : 2 Questions from each unit, each carrying 2 marks

20 marks

PART B : (100% Theory)- 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

SAUX 1008	VEHICLE MAINTENANCE	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I MAINTENANCE OF RECORDS AND SCHEDULES 10 hrs.

Importance of maintenance, preventive (scheduled) and break down (unscheduled) maintenance, requirements of maintenance, and preparation of check lists. Inspection schedule, maintenance of records, log sheets and other forms, safety precautions in maintenance.

UNIT II ENGINE MAINTENANCE – REPAIR AND OVERHAULING 10 hrs.

Dismantling of engine components and cleaning, cleaning methods, visual and dimensional inspections, minor and major reconditioning of various components, reconditioning methods, engine assembly, special tools used for maintenance, overhauling, engine tune up.

UNIT III CHASSIS MAINTENANCE – REPAIR AND OVERHAULING 10 hrs.

Mechanical and automobile clutch and gear box, servicing and maintenance servicing of propeller shaft and differential system. Maintenance, servicing of suspension system. Brake systems, types and servicing techniques. Steering systems, overhauling and maintenance. Wheel alignment, computerized alignment and wheel balancing.

UNIT IV ELECTRICAL SYSTEM MAINTENANCE – SERVICING AND REPAIRS 10 hrs.

Testing methods for checking electrical components, checking battery, starter motor, charging systems, DC generators and alternators, ignition system, lighting system. Fault diagnosis and maintenance of modern electronic controls, checking and servicing of dash board instruments

UNIT V MAINTENANCE OF FUEL SYSTEM, COOLING SYSTEMS, LUBRICATION SYSTEM AND VEHICLE BODY 10 hrs.

Servicing and maintenance of fuel system of different types of vehicles, calibration and tuning of engine for optimum fuel supply. Cooling systems, water pump, radiator, thermostat, anticorrosion and antifreeze additives. Lubrication maintenance, lubricating oil changing, greasing of parts. Vehicle body maintenance, minor and major repairs. Door locks and window glass actuating system maintenance. New technologies, processes and trends in the area of vehicle diagnostics

REFERENCES:

1. Jack E Rjavee Automotive Technology- A system approach, Thomson Asia Pvt Ltd. Singapore, 3rd edition 2004
2. De A Automobile Engineering, Galgotia Publishers Pvt Ltd, 2004
3. Ramalingam K. K, "Automobile Engineering", SciTech Publications Pvt. Ltd., 2005
4. Joseph Heitner, Automotive Mechanics Principle and Practice East west press, 2nd Edition 1999

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Mark: 80.

Exam Duration: 3hrs

PART A : 2 Questions from each unit, each carrying 2 marks

20 marks

PART B : (100% Theory)- 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SAUX 1012	VEHICLE BODY ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I CAR BODY DETAILS**10 hrs.**

Types of car bodies, Visibility: regulations, driver's visibility, tests for visibility, methods of improving visibility and space in cars. Safety: safety design, safety equipments for cars. Car body construction; design criteria, prototype making, initial tests, crash tests on full scale model,

UNIT II VEHICLE AERODYNAMICS**10 hrs.**

Objectives, Vehicle drag and its types; various types of forces and moments, effects of forces and moments, side wind effects on forces and moments, Various body optimization techniques for minimum drag, wind tunnel testing: flow visualization techniques, scale model testing, component balance to measure forces and moments.

UNIT III BUS BODY DETAILS**10 hrs.**

Types: mini bus, single Decker, double-decker, two level and articulated bus. Bus body layout; floor height, engine location, entrance and exit location, seating dimensions. Constructional details: frame construction, double skin construction, types of metal sections used, Regulations, Conventional and integral type construction.

UNIT IV COMMERCIAL VEHICLE DETAILS**10 hrs.**

Types of body; flat platform, drop side, fixed side, tipper body, tanker body, Light commercial vehicle body types. Dimensions of driver's seat relation to controls. Drivers cab design.

UNIT V BODY MATERIALS, TRIM AND MECHANISMS**10 hrs.**

Steel sheet, timber, plastic, GRP, properties of materials; Corrosion, anticorrosion methods, Selection of paint and painting process, Body trim items, Body mechanisms.

TEXT BOOK:

1. Powloski .J- "Vehicle Body Engineering" - Business Books Ltd, London -1989

REFERENCES:

1. Giles.J.C. - "Body construction and design" - Liiffe Books Butterworth & Co. - 1971.
2. John Fenton - "Vehicle Body layout and analysis" - Mechanical Engg. Publication Ltd., London – 1982.
3. Braithwaite.J.B. - "Vehicle Body building and drawing" - Heinemann Educational Books Ltd., London – 1977.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Mark: 80.

Exam Duration: 3hrs

PART A : 2 Questions from each unit, each carrying 2 marks

20 marks

PART B : (100% Theory)- 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

SAUX 4006	VEHICLE RECONDITIONING LAB	L	T	P	Credits	Total Marks
		0	0	2	1	50

1. Cylinder reboring – checking the cylinder bore.
2. Setting the tool and reboring.
3. Valve grinding, valve lapping.
4. Setting the valve angle and checking for valve leakage.
5. Calibration of fuel injection pump.
6. Wheel alignment – testing of camber, caster.
7. Testing kingpin inclination, toe-in and toe-out.
8. Chassis alignment testing.
9. Brake adjustment.
10. Brake bleeding.

SAUX 4007	COMPUTER AIDED ENGINE DESIGN AND CHASSIS DESIGN LAB	L	T	P	Credits	Total Marks
		0	0	2	1	50

COMPUTER AIDED ENGINE DESIGN LAB

1. Design and drawing of piston.
2. Piston pin and piston rings and drawing of these components.
3. Design of connecting rod small end and big end, shank design, design of big end cap, bolts and drawing of the connecting rod assembly.
4. Design of crankshaft, balancing weight calculations.
5. Development of short and long crank arms, front end and rear end details, drawing of the crankshaft assembly.
6. Design and drawing of flywheel.
7. Ring gear design, drawing of the flywheel including the development of ring gear teeth.
8. Design and drawing of the inlet and exhaust valves.
9. Design of cam and camshaft, cam profile generation, drawing of cam and camshaft.
10. Design of combustion chamber.

COMPUTER AIDED CHASSIS DESIGN LAB

1. Design of Heavy duty vehicle frame (Leyland, Tata etc).
2. Design of Light duty vehicle frame (Ambassador, Maruti van etc).
3. Design of Front Axle.
4. Design of Rear Axle.
5. Design of Differential.
6. Design of Steering systems along with any two types of steering gear box.
7. Design of Braking systems – hydraulic servo vacuum, compressed air power brakes.
8. Design of Leaf spring, coil spring, torsion bar spring, Hydraulic shock absorber.
9. Design of Clutch assembly of different types.
10. Design of Gear Box.

SAUX 4008	MODELING AND ANALYSIS OF ENGINE COMPONENTS LAB	L	T	P	Credits	Total Marks
		0	0	2	1	50

MODELING AND ANALYSIS OF THE FOLLOWING PARTS:

- | | |
|---------------------------------|-----------------------------|
| 1. Cylinder Head. | 2. Cylinder. |
| 3. Piston. | 4. Liner. |
| 5. Piston Pin and Piston Rings. | 6. Connecting Rod. |
| 7. Crankshaft | 8. Inlet and Exhaust Valves |
| 9. Cam. | 10. Cam Shaft. |

SAUX 4009	COMPUTER AIDED MANUFACTURING LAB	L	T	P	Credits	Total Marks
		0	0	2	1	50

SIMULATION OF MANUFACTURE OF THE FOLLOWING PARTS:

- | | |
|---------------------------------|-----------------------------|
| 1. Cylinder Head. | 2. Cylinder. |
| 3. Piston. | 4. Liner. |
| 5. Piston Pin and Piston Rings. | 6. Connecting Rod. |
| 7. Crankshaft | 8. Inlet and Exhaust Valves |
| 9. Cam. | 10. Cam Shaft. |

S86XPROJ	PROJECT WORK AND VIVA VOCE	L	T	P	Credits	Total Marks
		0	0	30	15	100

The objective of the project work is to make use of the knowledge gained by the student at various stages of the degree course. Students, will also be permitted to undertake industrial/consultancy project Work, outside the department, in industries/Research labs.

There shall be three assessments during the semester by a review committee. The student shall make three presentations on the progress made before the committee at various stages of the Project work. The Head of the Department shall constitute the review committee for each branch of study. The total marks obtained in the three reviews, shall be taken in to account. There will be a viva-voce examination at the end of the Project work, conducted by one internal examiner and one external examiner. The total marks secured will be the sum of marks secured in the Project reviews and Viva Voce Examination.

Each student is required to submit a Project report on the project assigned to him by the department. The report should be based on the information available in the literature or data obtained by the student by way of experiments conducted in the laboratory/industry.

SAUX 1015	AUTOMOTIVE AIR CONDITIONING (Common for all Branches)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I AIRCONDITIONING FUNDAMENTALS**10 hrs.**

Basic air conditioning system - location of air conditioning components in a car, schematic layout of a refrigeration system, compressor components, condenser and high pressure service ports, thermostatic expansion valve, expansion valve calibration, controlling evaporator temperature, evaporator pressure regulator, evaporator temperature regulator.

UNIT II AIR CONDITIONER – HEATING SYSTEM**10 hrs.**

Automotive heaters, manually controlled air conditioner, heater system, automatically controlled air conditioner and heater systems, automatic temperature control, air conditioning protection, engine protection.

UNIT III REFRIGERANT**10 hrs.**

Containers handling refrigerants, tapping into the refrigerant container, refrigeration system diagnosis, diagnostic procedure, ambient conditions affecting system pressures.

UNIT IV AIR ROUTING AND TEMPERATURE CONTROL**10 hrs.**

Objectives, evaporator airflow through the recirculation unit, automatic temperature control, duct system, controlling flow, vacuum reserve, testing the air control and handling systems.

UNIT V AIR CONDITIONING SERVICE**10 hrs.**

Air conditioner maintenance and service, servicing heater system removing and replacing components, trouble shooting of air controlling system, compressor service.

TEXT BOOKS:

1. William H. Crouse and Donald I. Anglin - "Automotive Air conditioning" – McGraw Hill Inc. - 1990.
2. Boyce H.D Wiggins - "Automotive Air Conditioning" - Delmar – 2002

REFERENCES:

1. Mitchell information Services, Inc - "Mitchell Automatic Heating and Air Conditioning Systems" - Prentice Hall Ind. - 1989.
2. Paul Weiser - "Automotive Air Conditioning" - Reston Publishing Co., Inc., - 1990.
3. MacDonald, K.I., - "Automotive Air Conditioning" - Theodore Audel series - 1978
4. Goings.L.F. – "Automotive Air Conditioning" - American Technical services -1974.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Mark: 80.

Exam Duration: 3hrs

PART A : 2 Questions from each unit, each carrying 2 marks

20 marks

PART B : (100% Theory)- 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

SAUX 1017	VIBRATION AND NOISE CONTROL IN AUTOMOBILES	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I BASICS OF VIBRATION**10 hrs.**

Introduction, classification of vibration: free and forced vibration, undamped and damped vibration, linear and non linear vibration, response of damped and undamped systems under harmonic force, analysis of single degree and two degree of freedom systems, torsion vibration, determination of natural frequencies.

UNIT II BASICS OF NOISE**10 hrs.**

Introduction, amplitude, frequency, wavelength and sound pressure level, addition, subtraction and averaging decibel levels, noise dose level, legislation, measurement and analysis of noise, measurement environment, equipment, frequency analysis, tracking analysis, sound quality analysis.

UNIT III AUTOMOTIVE NOISE SOURCES**10 hrs.**

Noise Characteristics of engines, engine overall noise levels, assessment of combustion noise, assessment of mechanical noise, engine radiated noise, intake and exhaust noise, engine accessory contributed noise, transmission noise, aerodynamic noise, tire noise, brake noise.

UNIT VI CONTROL TECHNIQUES**10 hrs.**

Vibration isolation, tuned absorbers, untuned viscous dampers, damping treatments, application dynamic forces generated by IC engines, engine isolation, crank shaft damping, modal analysis of the mass elastic model shock absorbers.

UNIT V SOURCE OF NOISE AND CONTROL**10 hrs.**

Methods for control of engine noise, combustion noise, mechanical noise, predictive analysis, palliative treatments and enclosures, automotive noise control principles, sound in enclosures, sound energy absorption, sound transmission through barriers

TEXT BOOKS:

1. Singiresu S.Rao - "Mechanical Vibrations" - Pearson Education, ISBN-81-297-0179-0 - 2004.
2. Kewal Pujara "Vibrations and Noise for Engineers, Dhanpat Rai & Sons, 1992.

REFERENCES:

1. Bernard Challen and Rodica Baranescu - "Diesel Engine Reference Book" 2nd Edition - SAE International - ISBN 0-7680-0403-9-1999.
2. Julian Happian-Smith - "An Introduction to Modern Vehicle Design"- Butterworth-Heinemann, ISBN 0750-5044-3 - 2004

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Mark: 80.

Exam Duration: 3hrs

PART A : 2 Questions from each unit, each carrying 2 marks

20 marks

PART B : (100% Theory)- 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

SAUX 1023	FUEL CELL AND APPLICATIONS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I INTRODUCTION TO FUEL CELL**10 hrs.**

Introduction – working and types of fuel cell – low, medium and high temperature fuel cell, liquid and methanol types, proton exchange membrane fuel cell solid oxide, hydrogen fuel cells – thermodynamics and electrochemical kinetics of fuel cells.

UNIT II FUEL CELL FOR AUTOMOTIVE APPLICATIONS**10 hrs.**

Fuel cell for automotive applications – technology advances in fuel cell vehicle systems – onboard hydrogen storage – liquid hydrogen and compressed hydrogen – metal hydrides, fuel cell control system – alkaline fuel cell – road map to market.

UNIT III FUEL CELL COMPONENTS AND THEIR IMPACT ON PERFORMANCE**10 hrs.**

Fuel cell performance characteristics – current/voltage, voltage efficiency and power density, ohmic resistance, kinetic performance, mass transfer effects – membrane electrode assembly components, fuel cell stack, bi-polar plate, humidifiers and cooling plates.

UNIT IV FUELING**10 hrs.**

Hydrogen storage technology – pressure cylinders, liquid hydrogen, metal hydrides, carbon fibers – reformer technology – steam reforming, partial oxidation, auto thermal reforming – CO removal, fuel cell technology based on removal like bio-mass.

UNIT V FUEL CYCLE ANALYSIS**10 hrs.**

Introduction to fuel cycle analysis – application to fuel cell and other competing technologies like battery powered vehicles, SI engines fueled by natural gas and hydrogen and hybrid electric vehicle.

TEXTBOOKS

1. Fuel Cells for automotive applications – professional engineering publishing UK. ISBN 1-86058 4233, 2004.
2. Gregor Hoogers, Fuel Cell Technology Handbook SAE International, CRC Press ISBN 0-8493-0877-1-2003.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Mark : 80

Exam Duration : 3hrs.

PART A : 2 Questions from each unit, each carrying 2 marks

20 marks

PART B : **(100% Theory)**- 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

SAUX 1024	OFF ROAD VEHICLES	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I CLASSIFICATION AND REQUIREMENTS OF OFF ROAD VEHICLES 10 hrs.

Construction layout, capacity and applications. Power Plants, Chassis and Transmission, Multivalve vehicles.

UNIT II EARTH MOVING MACHINES 10 hrs.

Earthmovers like dumpers, loaders - single bucket, Multi bucket and rotary types- bulldozers, excavators, backhoe loaders, scrappers, drag and self powered types, Bush cutters, stumpers, tree dozer, rippers etc. – **Power and capacity of earthmoving machines.**

UNIT III SCRAPPERS, GRADERS, SHOVELS AND DITCHERS 10 hrs.

Scrappers, elevating graders, motor graders, self powered scrappers and graders, Power shovel, revolving and stripper shovels – drag lines – ditchers – capacity of shovels.

UNIT IV FARM EQUIPMENTS, MILITARY AND COMBAT VEHICLES 10 hrs.

Power take off, special implements. Special features and constructional details of tankers, gun carriers and transport vehicles.

UNIT V VEHICLE SYSTEMS, FEATURES 10 hrs.

Brake system and actuation – OCDB and dry disc caliper brakes. Body hoist and bucket operational hydraulics. Hydro-pneumatic suspension cylinders. Power steering system. Kinematics for loader and bulldozer operational linkages. Safety features, safe warning system for dumper. Design aspects on dumper body, loader bucket and water tank of sprinkler.

TEXT BOOKS:

1. Robert L. Peurifoy, "Construction, planning, equipment and methods" Tata McGraw Hill Publishing company Ltd.
2. Nakra C.P., "Farm machines and equipments" Dhanparai Publishing company Pvt. Ltd.
3. Abrosimov.K. Branberg.A and Katayer.K, Road making machinery, MIR Publishers, Moscow, 1971.
4. SAE Handbook Vol. III, SAE, USA.
5. Wong.J.T., Theory of Ground Vehicles", John Wiley & Sons, New York, 1987.

REFERENCES:

1. Off the road wheeled and combined traction devices – Ash gate Publishing Co.Ltd. 1988.
2. Schulz Erich.J, Diesel equipment I & II, McGraw Hill company, London.
3. Bart H Vanderveen, Tanks and Transport vehicles, Frederic Warne and Co Ltd.,London.
4. Satyanarayana. B., Construction planning and equipment, standard publishers and distributors, New Delhi.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Mark: 80.

Exam Duration: 3hrs

PART A : 2 Questions from each unit, each carrying 2 marks

20 marks

PART B : (100% Theory)- 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks