

PROGRAMME CURRICULUM
AND
SYLLABI OF
DIPLOMA PROGRAMME IN
AUTOMOBILE ENGINEERING
UNDER RATIONALISED SEMESTER SYSTEM
(IMPLEMENTED FROM ACADEMIC YEAR 2020-2021)



BOARD OF TECHNICAL EDUCATION, GOA STATE

DTE Building, Alto Porvorim, Bardez, Goa 403521

Ph. +91-832-2413571, +91-832-2412146

Fax +91-832-2413572

Email: dir-dte.goa@nic.in

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DIPLOMA IN AUTOMOBILE ENGINEERING

(GC101) Communication Skills

1. COURSE OBJECTIVE :

The course aims to develop Communication skills in English by improving students' ability to write ,speak, listen and read effectively. Emphasis is also laid on students' personality development, helping them to build their confidence in interpersonal / group communication.

2. TEACHING AND EXAMINATION SCHEME

Semester	I								
Course code & course title		Periods/Week (in hours)			Total Hours	Examination Scheme			
						Theory Marks	Practical Marks	Total Marks	
(GC101) Communication Skills		L	T	P	H	TH	TM	TW	PR/OR
		-	-	02	32	-	-	25	25
									50

3. COURSE OUTCOMES:

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

GC101.CO1 Understand the essentials of effective Communication.

GC101CO2 Develop reading, writing, speaking , listening and effective presentation skills.

GC101.CO3 Select the appropriate mode of Communication .

GC101.CO4 Demonstrate reading, writing, speaking , listening and effective presentation skills.

4.Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO1	0	0	0	0	3	3	3
CO2	1	0	1	0	3	3	3
CO3	1	0	1	0	3	3	3
CO4	1	0	0	0	3	3	3

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Phr = Practical hours	CO = Course Outcomes		
Unit	M	Phr	CO	
1 UNIT NAME: FUNDAMENTALS OF COMMUNICATION SKILLS	-			
1.1 Communication Skills fundamentals Definition, communication process, importance of Communication Skills, essentials of effective communication		01	CO1	
1.2 Types of communication: verbal Communication and Nonverbal communication (Body language, facial expressions, gestures, eye contact, posture, dress and grooming/personal appearance, deportment, personal hygiene) Paralinguistic (Volume, pace, pitch, pauses)		02	CO2 CO3 CO4	
1.3 Barriers to communication: physical barriers, psychological barriers and cultural barriers		01		
2. Unit: PRESENTATION SKILLS				
2.1 Presentations: Methods and style of presentation, Importance, planning a presentation, venue selection, audience awareness (age, gender, profession background, educational and social background) time and duration, audio visual aids (OHP, LCD projector, flip charts, white/black/green board, computer, microphone)		02	CO2 CO3 CO4	
2.2 Public speaking: preparatory steps, tips for good beginning and end, delivery style, techniques for a good speech (repetition, signs, pictures, humor), body language		02		
3 UNIT: TECHNICAL Writing				
3.1 Report writing Functions and parts of a report, Qualities of a good report, and types: Report on any institute function, Accident report, Industrial visit Report		04	CO1 CO2 CO4	

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3.2 Business letters Principles of effective letter writing, parts of a business letter, formats (Full block style, Semi block style, modified block style) Routine/ Generic letters (letter to the heads of the institute, letter to the heads of various departments/sections of the institute) Types of letters: Enquiry Letter, Quotation, Purchase Order, Letter of Complaint		06	
3.3 Job application Tips for a good C.V and a Resume		02	
4 UNIT GRAMMAR	-		
4.1 Fundamentals of English writing Subject verb agreement, homonyms, homophones, homographs, articles, Punctuation, synonyms, fundamentals of sentence construction		02	CO1 CO2 CO4
4.2 Paragraph Writing: Developing Topics (the main idea), body (supporting sentences), conclusion, proof reading		02	
UNIT V: LANGUAGE WORKSHOP	-		
5.1 Reading Skills strategies to use for building vocabulary and reading fluencies (read extensively, identify new words, use of dictionary, online dictionary apps), reading comprehension, pronunciation, debate, role play,		08	CO1 CO2 CO4
5.2 Listening Skills How to listen effectively, listening comprehension			
5.3 Speaking skills speech, group discussion			
5.4 Writing skills précis writing, comprehension			
Total		32	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, videos, exercises

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	NO of lectures	Marks
1	Fundamental of Communications skills	04	-
2	Presentation Skills	04	-
3	Technical Writing	12	-
4	Grammar	04	-
5	Language workshop	08	-
	Total	32	25

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical
1.	Practical Title: Fundamental of Communications skills
i.	Comprehension
ii.	Précis writing
iii.	Self-Introduction
2	Practical Title: Presentation Skills
iv.	Extempore speech
v.	Presentation on any given Topic
3	Practical Title: Technical Writing
vi.	Accident Report
vii.	Report on Institute function
viii.	Industrial visit report
ix.	Generic letters to the heads of various department/ Sections of the institute
x.	Inquiry letter
xi.	Quotation
xii.	Purchase or supply order
xiii.	Complaint letter
xiv.	Job application
4	Grammar
xv.	Exercises in subject – verb agreement
xvi.	Exercises in use of preposition
xvii.	Exercises in use of Homophones, homonyms, homographs
xviii.	Exercises in use of punctuation
xix.	Exercises relating to correcting the sentences
xx.	Paragraph writing
5	Language workshop
xxi.	Exercises to improve Reading skills
xxii.	Exercises to improve Writing skills
xxiii.	Group discussion
xxiv.	Listening comprehension

9. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	R. C. Sharma & Krishna Mohan	Business Correspondence and Technical Writing	Tata McGraw Hill
2	P. Prasad, Sharma, K. Rajendra	The Functional aspects of communication skills	S.k. Kataria & sons
3	Sanjay Kumar, Pushpa Lata	Communication Skills	Oxford University Press
4	A.K. Jain, A.M. Shaikh & Pravin S R Bhatia	Professional communication Skills	S. Chand
5	Wren & Martin	High School English Grammar & Composition	S. Chand, N. Delhi

10. Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Raul R. Timm	How to make winning presentations	Sneha Printers
2	Dale Carnegie, Training CPI	Stand and Deliver, How to become a masterful communicator and public speaker	Cox & Wyman, UK
3	John Seely	The Oxford Guide to Effective Writing and speaking	Oxford University Press

Autobiographies, self-help books, Audio speeches given by famous personalities

Internet and Web Resources

<https://www.grammarly.com/>

<https://www.bbc.co.uk/programmes/articles/5QFnVy3xzT5htTh13cmP2P8/teacher-resources>

<https://Ted.com>

Videos and Multimedia Tutorials

https://you.tu.be/AykYRO5d_II

(GC102) Engineering Mathematics I

1. COURSE OBJECTIVE:

1. The course is aimed at providing mathematical knowledge, developing computational skills and reasoning. It also helps students to think logically and in systematic manner so as to grasp mathematical concepts easily. It helps to build analytical thinking which play an important role in solving real world problems in all scientific discipline.

2.TEACHING AND EXAMINATION SCHEME

Semester	I								
Course code & course title		Periods/Week (in hours)			Total hours	Examination Scheme			
						Theory Marks		Term Work	Total Marks
(GC102) Engg.Maths I		L	T	P	H	TH	TM	TW	
		4	2	-	96	75	25	25	125

3.COURSE OUTCOMES:

GC102.CO1. Understand the basic mathematical concepts for Engineering applications.

GC102.CO2. Identify and use appropriate formulae for solving practical engineering problems

GC102.CO3. Apply formulae of algebra, geometry, trigonometry and calculus for solving problems.

GC102.CO4 . Co-relate mathematical formulae to practical problems.

4.Mapping Course Outcomes with Program Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO1	3	2	1	0	0	0	2
CO2	3	3	1	0	1	0	1
CO3	2	2	3	3	2	0	1
CO4	2	3	3	2	1	1	1

Relationship :Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours	CO = Course Objectives			
Unit			Marks	Thr	CO
1 MATHEMATICS FUNDAMENTAL			8	6	CO1
1.1 Polynomials: Types of polynomials, addition subtraction, (no question to be asked), Multiplication and division of polynomials			3	2	
1.2 : Algebraic equations: Different types of equations and their geometric meaning(line, circle parabola only) ,equations with one, two and three variables and solving equations with two and three variables Quadratic equations and nature of their solutions			3	2	
1.3: Logarithm: Definition of log, log with base 'e' and base '10' Properties of log, log and antilog , problems using definition and properties of log.			2	2	
2. STRAIGHT LINES AND CIRCLES			15	14	CO1, CO4
2.1: Straight line: Intercept, slope, intersection of lines Equations of line: 1. Slope intercept form, slope point form, two points form, parallel and perpendicular lines, angle between lines Perpendicular distance of a point from line			8	7	
2.2: Circle: circle as a locus, Centre, diameter, chord of a circle Equations of circle: Centre radius form, diameter form, general form and sums			7	7	
3. TRIGONOMETRY					CO1, CO3
3.1: Angle and measurement, degree and radians and conversion and related sums, arc length and area of sector and sums 3.2: Trigonometric ratios and identities 3.3: Trigonometric ratios of compound and allied angles 3.4: Product formulae $\sin A \pm \sin B$, $\cos A \pm \cos B$ 3.5: Sum and difference formulae 3.6: Multiple angle $2A$, and their trigonometric ratios, 3.7: Sine rule, Cosine rule in triangle, solution of triangle			12	15	

4: MENSURATION	10	6	CO1, CO4
4.1: Areas of 2D figures like quadrilaterals, circle triangle etc (no questions to be asked) 4.2: Surface area and volumes of cube, sphere, cylinder, cone, (no question to be asked) Surface areas and volumes of prism, pyramid, 4.3: Frustum of cone, pyramid and their surface areas and volumes. 4.4: Simpson's 1/3 rd rule for area and volume			
5: CALCULUS	30	23	CO1, CO2, CO3, CO4
5.1: Limits 5.1.1 : Pre requisite : Sets , intervals, relation and function (no questions to be asked) 5.1.2 : Limit of a function , algebraic properties of limits 5.1.3: Limits of algebraic, trigonometric, exponential, logarithmic functions	7	6	
5.2 : Derivatives 5.2 .1: Derivative definition by first principle (no question to be asked) 5.2.2: Standard formulae, Algebraic properties of derivative (u+v) etc. 5.2.3: Derivatives of algebraic, trigonometric, exponential, logarithmic functions 5.2.4: Derivative of product of functions (uv rule). 5.2.6: Derivative of quotient of functions (u/v rule) 5.2.7: Derivative of composite functions 5.2.8: Derivative of parametric functions 5.2.9: Derivative of implicit functions 5.2.10 : Logarithmic differentiations 5.2.11: Second order derivatives (no question to be asked)	15	12	
5.3 : Applications of derivatives 5.3.1: Application to the geometry: i) derivative as a slope of a tangent ii) to find equations of tangent and normal at given point on the curve 5.3.2: Application to the Linear motion: i) displacement, velocity, acceleration 5.3.3: Application to the rate measure i) to find rate change in area and volume etc 5.3.4 : Maxima and minima	8	5	
Total	75	64	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises

7. SPECIFICATION TABLE FOR THEORY

Unit No	Unit	Number of lectures	Marks
1	Mathematics Fundamental	06	8
2	Straight line and circle	14	15
3	Trigonometry	15	12
4	Mensuration	06	10
5	Calculus	23	30
	Total	64	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

- Tutorial books should be maintained by students (5 marks)
- Two home assignments per semester (5 marks)

The Two assignments each comprises of thirty questions which includes 15 short questions and fifteen long questions. First assignment will cover fifty percent of syllabus

and second assignment will cover remaining portion of syllabus

- Topic-wise class assignment (15 marks)

Class assignment comprises of ten short and ten long questions.

9. LEARNING RESOURCES

Text Books

S. No.	Title of Books	Author	Publishers
1	Mathematics for Polytechnic Students(Basic Mathematics)	S.P. Deshpande	Pune VidyarthiGrihaPrakashan 1786, Sadashiv Peth, Pune
2	Mathematics for Polytechnic Students(Engineering Mathematics)	S.P. Deshpande	Pune VidyarthiGrihaPrakashan 1786, Sadashiv Peth, Pune
3	S.B. Gore, M.B.Patil, S.P. Pawar	Applied Mathematics	Vrinda Publications

Reference Books for further study

S. No.	Title of Books	Author	Publishers
1	Applied Mathematics I	Dr. U.B.Jangam, K.P. Patil, Nalini Kumthekar	Nandu Printers& Publishers pvt. Ltd. Mumbai
2	Applied Mathematics for Polytechnics	H.K. Dass	CBS Publishers and distributors Pvt.Ltd. ,Pune
3	Set Theory and related topics	Seymour Lipschutz	McGraw-Hill

(GC103) APPLIED PHYSICS-I

1.COURSE OBJECTIVE :

On successful completion of the course, Students completing the Applied Physics I course will be able to demonstrate competency and understanding of the basic concepts found in, Units and Dimensions, Kinematics of motion in one dimension Force Work Power and Energy, Circular Motion and Gravitation, Properties of Matter and Heat and will be able to utilize the knowledge to demonstrate competency with experimental methods that are used to discover and verify the concepts related to content knowledge

2.TEACHING AND EXAMINATION SCHEME

Semester	I									
Course code & course title		Periods/Week (in hours)			Total Hours	Examination Scheme				
						Theory Marks		Practical Marks		Total Marks
(GC103) Applied Physics I		L	T	P	H	TH	TM	TW	PR/OR	
		03	0	02	80	75	25	25	-	125

3.COURSE OUTCOMES:

GC103.CO1: Understand the Fundamental concepts of physical quantities, Force, Power, Energy, Motion, Matter and heat transfer used in Engineering applications.

GC103.CO2: Explain the concepts of Dimensions, Work, Power, Energy, Motion, properties of matter and heat transfer

GC103.CO3: Apply the Knowledge of Physical quantities, Types of motions, Force, work, Power, properties of matter and heat transfer in Engineering applications

GC103. CO4: Analyze different types of Physical quantities, motions, properties of matter, and modes of heat transfer

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4. Mapping Course Outcomes with Program Outcomes

Relationship: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentatn & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life-long Learning
CO 1	3	1	1	3	2	0	3
CO 2	3	1	2	3	0	0	3
CO 3	3	1	2	2	0	1	1
CO 4	1	1	2	2	0	1	1

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours	CO = Course Outcomes			
Unit	Thr	M	CO		
1 UNIT NAME: UNITS AND DIMENSIONS	08	12	CO1, CO2, CO3, CO4		
1.1 Fundamental and Derived units ,					
1.2 Different system of units, SI unit conversion from one system to other,					
1.3 Principle of Homogeneity,					
1.4 Dimensions, dimensional formula,					
1.5 dimensional correctness of given equation using dimensions					
1.6 least count of vernier calliper and screw gauge					
1.7 zero errors-- in case of vernier calliper and screw gauge					
1.8 Types of error.					
2. UNIT NAME: MOTION IN ONE DIMENSION, FORCE, WORK, POWER AND ENERGY	10	16	CO1, CO2, CO3, CO4		
2.1 Distance and displacement,					
2.2 Scalar and Vectors					
2.3, Speed and Velocity, Uniform Velocity, ,					

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2.4 Uniform acceleration, acceleration due to gravity			
2.5 Equation of motion ($v=u+at$, $v^2=u^2+2as$, $s=ut+\frac{1}{2}at^2$)(no derivation)			
2.6 Motion under gravity. Force and its unit.			
2.7 Work and its unit. Energy, law of conservation of energy,			
2.8. Kinetic and Potential energy equation and examples.			
3. UNIT NAME: Uniform Circular Motion and Gravitation	10	16	CO1, CO2, CO3, CO4
3.1 Uniform circular motion,			
3.2 Definition angular displacement, angular velocity, ,			
3.3 Conversion from rpm to rad/sec, $v=r\omega$, tangential velocity, radial acceleration			
3.4 Centripetal force and centrifugal force, examples,			
3.5 Banking of roads, superelevation, expression for angle of banking			
3.6 Newton's law of gravitation, acceleration due to gravity ,			
3.7 Expression for acceleration due to gravity. Escape velocity, Critical velocity, and periodic time definition and expression (no derivation)			
3.8. Satellite, types (Geostationary, communication remote sensing)			
4. UNIT NAME: PROPERTIES OF MATTER	10	16	CO1, CO2, CO3, CO4
4.1 Elasticity ,			
4.2 Stress, Strain, Hooke's law,			
4.3 Young's Modulus,			
4.4 Bulk Modulus, Rigidity Modulus,			
4.5 Stress v/s Strain graph			
4.6 Yield point, breaking stress, factor of safety, ,			
4.7 Surface tension definition and example			
4.8. Adhesive and cohesive force, application,			
4.9 liquid meniscus and angle of contact, capillarity,			
4.10 Expression for surface tension (no derivation), applications. viscosity,			
4.11 Definition velocity gradient, Newton's law of viscosity, terminal velocity, Stokes law,			

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4.12 Streamline flow and turbulent flow, critical velocity, application of viscosity.			
5. UNIT NAME: HEAT	10	15	CO1, CO2, CO3, CO4
5.1 Statements of boyles law, charles law, gay lussacs law			
5.2 General gas equation, specific heat definition and unit, Latent heat definition and unit			
5.3 Modes of transfer of heat, conduction, convection and radiation,			
5.4 Conduction of heat through a metall rod,			
5.5 Variable and Steady state			
5.6 law of thermal conductivity (With Derivation)			
5.7 Applications of thermal conductivity, ,			
5.8. Thermal expansion of solids			
5.9 linear expansion, superficial expansion,			
5.10 Cubical Expansion			
5.11 Relation between α, β, γ (no derivation)			
5.12 Engineering applications of expansion of solids.			

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies.

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	UNITS AND DIMENSIONS	8	12
2	MOTION IN ONE DIMENSION, FORCE, WORK AND ENERGY	10	16
3	UNIFORM CIRCULAR MOTION AND GRAVITATION	10	16
4	PROPERTIES OF MATTER	10	16
5	HEAT	10	15
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS

No	Practicals	Marks
1.	Basic Conversion Techniques from one system of units to the other	25
2.	Use of Vernier callipers to find the Volume of Hollow cylinder, Block	25
3.	Use of Screw gauge to find the cross-sectional area of a wire and thickness of a clip	25
4.	To find the Coefficient of Viscosity of a given liquid by stokes method	25
5.	To Find the coefficient of Thermal Conductivity by Searle's Method	25
6	To Find the Surface Tension of a given liquid by capillary rise method	25
7	To Find Young's Modulus by Searles Method	25
8	To Find acceleration due to gravity by simple pendulum method.	25
	Total (Average)	25

9. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	B G Dhande	Applied Physics of Polytechnics	Pune Vidyarthi Griha Prakashan
2	Bhandarkar	Applied Physics of Polytechnics	Vrinda publication
3	R K Gaur and S L Gupta	Engineering Physics	Dhanpat Rai & Sons Delhi
4	Dr. Vasudev R Bhagwat	A Text Book of Applied Physics for Polytechnics	Broadway Publishing House
5	B L Thereja	Engineering Technology	S. Chand

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Halliday D and Resnick	Physics Part I-II	Wiley Eastern Ltd.
2	Satish k. Gupta	ABC of Physics I&II	Modern Publisher
3	Saxena HC and Singh Prabhakar	Applied Physics Vol I & II	S. Chand Publisher

(GC104) Applied Chemistry

1. COURSE OBJECTIVE:

Chemistry is the branch of Science which deals with the study of composition, properties and changes in matter. An understanding of the basic concepts of Applied Chemistry, chemical principles and chemical properties of materials is essential to all the engineers. The emphasis is on applying the knowledge of principles of chemistry in all the fields of engineering wherein students appreciate the significance of chemistry in day to day life. The subject develops in students the habit of scientific enquiry, the ability to investigate cause and effect relationship & the ability to interpret & analyze the results.

2. TEACHING AND EXAMINATION SCHEME

Semester	I								
Course code & course title	Periods/Week (in hours)			Total Credits (Hours)	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
(GN104) Applied Chemistry	L	T	P	H	TH	TM	TW	PR/OR	125
	3	-	2	80	75	25	25	-	

3. COURSE OUTCOMES:

- GC 104.CO1: Understand the fundamental concepts of Atomic Structure, electrochemistry, water quality, corrosion and polymers.
- GC 104.CO2: Explain the process of Chemical bonding, water softening, electroplating, corrosion control and polymerization
- GC 104.CO3: Relate the principles of Chemical Bonding, Electrolysis, water hardness for domestic and Industrial applications and properties of polymers.
- GC 104.CO4: Distinguish between types of Chemical bonding, Water softening methods, corrosion control methods, different processes of metal coating and different polymers.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimenting & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life-long Learning
CO1	3	2	1	1	2	1	1
CO2	2	3	2	1	3	1	2
CO3	3	2	2	2	3	1	2
CO4	3	2	2	2	2	1	1

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours	CO = Course Objectives	
Unit	Mks	Thr	CO
UNIT 1.0 : <u>ATOMIC STRUCTURE AND CHEMICAL BONDING</u>	15	10	CO1 CO2 CO3 CO4
1.1 Atomic Structure 1.1.1 Fundamental particles and their characteristics. 1.1.2 Energy levels - Definition & designation 1.1.3 Sub Energy levels- Definition & designation 1.1.4 Orbital – Concept & shape (s and p only) 1.2 Quantum numbers 1.2.1 Designation, definition, values.			
1.3 Electronic distribution (Elements from atomic Number 1-20) 1.3.1 Bohr – Bury’s laws for distribution of electrons in shells (1 st three laws only) 1.3.2 Aufbau Principle. for distribution of electrons in sub-shells 1.3.3 Pauli’s Exclusion Principle. 1.3.4 Hund’s Rule of maximum multiplicity 1.3.5 Orbital Electronic Configuration of elements (from atomic numbers 1 to 20 only).			
1.4 Chemical Bonding 1.4.1 Lewis and Longmuir concept of stable configuration. 1.4.2 Electrovalent - Bond - Concept Formation of Electrovalent Compound (NaCl & MgO) 1.4.3 Covalent Bond – Concept Formation of Colvalent Compounds (Cl ₂ , O ₂ , N ₂) 1.4.4 Co-ordinate Bond - Concept Formation of Co-ordinate Compounds (O ₃) 1.4.5 Properties of Electrovalent, Colvalent & Co-Ordinate compounds.			

UNIT 2.0 : WATER	15	10	CO1 CO2 CO3 CO4
2.1 Hardness of Water 2.1.1 Soft and Hard Water - Concept Soap Test (Chemical Equation not expected) 2.1.2 Causes of Hardness 2.1.3 Types of Hardness 2.1.4 Degree of Hardness & Units of Hardness (mg/L & ppm)			
2.2 Disadvantages of Hard Water 2.2.1 Domestic Purpose Drinking, cooking, Washing & Bathing. 2.2.2 Industrial Purpose (Paper Industry, Textile & Dyeing Industry, Sugar Industry, Bakery & Concrete Making) 2.2.3 Boilers- Steam Generation Purpose. Sludge formation – causes & Disadvantages (No chemical equation expected)			
2.3 Water Softening 2.3.1 Zeolite and Ion Exchange process of water softening			
2.4 Desalination of water 2.4.1 Electrodialysis & Reverse Osmosis process. 2.4.2 pH- Concept, pH scale & Importance of pH			
UNIT 3.0 : <u>ELECTROCHEMISTRY</u>	12	08	CO1 CO2 CO3 CO4
3.1 Electrolytic dissociation 3.1.1 Arrhenius theory of Electrolytic dissociation 3.1.2 Factors affecting degree of Ionization- nature of solute, nature of solvent, concentration of solution and temperature.			
3.2 Electrolysis 3.2.1 Mechanism of Electrolysis. Ionization Reactions Reactions at cathode, Activity series of Cations. Reactions at Anode, Activity series of Anions. 3.2.2 Electrolysis of Molten NaCl using Carbon Electrodes. Aqueous NaCl using Platinum Electrodes. Aqueous CuSO ₄ using Platinum Electrodes. Aqueous CuSO ₄ using copper Electrodes.			
3.3 Electrochemical series – Definition and Significance			
UNIT 4.0 : CORROSION AND ITS CONTROL	25	14	CO1 CO2 CO3
4.1 Dry /Direct Chemical corrosion 4.1.1 Definition			

4.1.2 Oxidation corrosion 4.1.3 Corrosion due to other gases.			CO4
4.3 Types of Electrochemical corrosion. 4.3.1 Galvanic Cell corrosion 4.3.2 Concentration cell corrosion(Metal ion concentration & differential Aeration)			
4.4 Corrosion Control Protection of metals by: 4.4.1. Using Pure Metals & Metal alloys 4.4.2 Proper designing 4.4.3 Modifying the environment (De- aeration, Deactivation, Dehumidification, Alkaline neutralization) 4.4.4 Cathodic protection (Sacrificial anode and Impressed current cathodic protection) 4.4.5 Metal Coating (Galvanizing, Tinning, Metal-Spraying, Electroplating & powder coating)			
UNIT 5: POLYMERS	08	06	CO1 CO2 CO3 CO4
5.1 Concept of Monomers & Polymers 5.2 Polymerization- Definition. 5.2.1 Addition polymerization-Definition. 5.2.2 General equation of polymerization of :- Ethylene to Polyethylene. Vinyl chloride to Polyvinylchloride Tetra fluoro ethylene to Poly tetra fluoroethylene(PTFE) 5.2.3 Condensation Polymerization-Definition 5.2.4 General Equation for formation of Phenol formaldehyde Resin. 5.3 Plastics. 5.3.1 Types of plastic (Thermosetting and Thermo softening), Examples 5.3.2 Properties and applications of Poly-ethylene, PVC, polystyrene, Nylons, Bakelite & silicones.			
5.4 Rubber 5.4.1 Natural Rubber 5.4.2 Drawbacks of Crude rubber. 5.4.3 Vulcanization of Rubber (General Equation) 5.4.4 Rubber examples. 5.4.5 Properties of Synthetic Rubber & related applications.			

8. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	ATOMIC STRUCTURE AND CHEMICAL BONDING	10	15
2	WATER	10	15
3	ELECTROCHEMISTRY	08	12
4	CORROSION & IT'S CONTROL	14	25
5	POLYMERS	06	08
	Total	48	75

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical
	Practical Title
1.	Double Acid-Base Titration using Phenolphthalein.
2.	Acid- Base titration using Methyl orange.
3.	Redox Titration of KMnO ₄ soln., FeSO ₄ soln. and Oxalic acid
4.	Determination of degree of Hardness by E.D.T.A method.
5.	Determination of Total Alkalinity of water sample.
6.	Determination of Chloride content of water sample by Mohr's method.
7.	pH- Metric titration.
8.	Conduct metric Titration.
9.	Determination of Conductivity of water samples from different water body sources.
10.	Corrosion Susceptibility of Aluminum to Acid or Base.
11.	Determination of pH of different food items.
	Total Marks: 25
	No Class room Assignments

* Any TEN of the above.

****Term Work Assessment Scheme:**

1. Performance:15 marks (Carrying out experiment, Readings, Calculations and Results)
- 2.Knowledge :05 Marks(Theory of the experiment)
3. Journal : 05 Marks

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	M.M. Uppal	Text book of Engg. Chemistry	Khanna Publisher
2	V.P.Mehta	Text book of Engg. Chemistry	Jain Bros. Delhi
3	S.N Narkhede	Textbook of Engg. Chemistry	Niraj Prakashan
5	S S Dara	A Textbook of Engg. Chemistry	S Chand & Co
4	P.C. Jain and M.Jain	Engg. Chemistry.	Dhanpat Rai Publishing Co.

(GC105) Basic Engineering Practice (Electronics& Comp.)

1. COURSE OBJECTIVE:

The students will be able to acquire knowledge about safety aspects, firefighting, first-aid and carpentry, fitting, plumbing skills. The students will learn proper ways of using various hand tools, measuring devices in acquiring these skills and will also interpret simple electrical drawings/circuit diagrams.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Hours	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
(GC 106) Basic Engineering Practice	L	T	P	H	TH	TM	PR/OR	TW	150
	0	0	5	80	-	-	50	100	

3. COURSE OUTCOMES:

PART A

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

GC106.CO1. Understand safety procedures to be followed in carpentry, fitting, and plumbing.

GC106.CO2. Identify various tools used for carpentry, fitting, and plumbing.

GC106.CO3: Demonstrate basic working skills in carpentry, fitting and plumbing.

GC106.CO4: Plan & execute a job/activity using job drawing.

PART B

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

GC106.CO1. List the safety measures.to be observed in electrical workshop.

GC106.CO2. Identify various electrical tools, fittings used for electrical measurements & troubleshooting.

GC106.CO3: Distinguish between single phase and three phase supply.

GC106.CO4: Plan & execute a job/activity from electrical circuit drawing.

4. MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES

PART A

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life -long Learning
CO1	2	1	1	3	2	2	3
CO2	2	1	2	3	2	2	2
CO3	2	1	1	3	2	2	2
CO4	2	1	3	3	2	3	2

Relationship: Low-1 Medium-2 High-3

PART B

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life -long Learning
CO1	2	1	1	3	2	2	3
CO2	2	1	2	3	2	2	2
CO3	3	1	1	2	2	1	2
CO4	2	1	3	3	2	3	2

Relationship: Low-1 Medium-2 High-

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Hr = Practical Hours	CO = Course Outcomes		
Unit			M	Hr
1 General Safety, Housekeeping, Fire Fighting & First Aid			10	06
1.1 Introduction to General Safety aspects of engineering workshop 1.2 Meaning and importance of housekeeping. 1.3 Fire hazards, fire triangle, types of fire extinguishers – selection and use. 1.4 Basic knowledge of first aid with specific inputs on cuts, burns, electric shocks, artificial respiration, handling emergencies.				CO1
2 Fitting Workshop Practice			30	18
2.1 Introduction to the trade. 2.2 Introduction to various hand Tools, Measuring and Marking Tools, cutting tools, Holding tools, Striking tools 2.3 Types of files and filing methods.				CO1 CO2 CO3

2.4 Drill bits and drilling Processes, using portable and pillar drilling machine.			
2.5 Operations performed in fitting shop such as measuring, marking, chipping, filing, grinding, sawing, drilling			
2.6 Threading using taps and dies.			
3 Carpentry Workshop Practice	20	18	
3.1 Introduction to carpentry			CO1
3.2 Types of wood and its characteristics, forms of wood, defects in timber and its identification, wood working hand tools			CO2
3.3 Wood working processes.			CO3
3.4 Different types of joints and their usage.			
3.5 Introduction to wood working machines:			
3.6 Lathe			
3.7 Circular saw			
3.8 Band saw			
3.9 Wood planner			
3.10 Universal wood working machine			
4 Electrical Workshop Practice	30	32	
4.1 Brief introduction to power distribution and Electrical Safety.			CO1
4.2 Use of different hand tools used in electrical trade			CO2
4.3 Collection of details of motors and transformers.			CO3
4.4 Introduction to Control Panel and its various sections/components.			CO4
4.5 Making of wire joints.			
4.6 Measurement of current, voltage, frequency and Power Consumption.			
4.7 Connecting and starting of Induction Motor & Measurement of its speed. Changing of Direction of rotation of induction motor.			
4.8 Introduction to commonly used electrical Fittings (Domestic & Industrial).			
4.9 Wiring of Simple Electric Circuit (Bulb & plug point and switches) on wooden board			
4.10 Study, connection & use of Energy Meter			
4.11 Testing of components using Series test lamp & Multimeter			
4.12 Study of Fuses & practice replacement of Fuse			
4.13 Study & Troubleshooting of Tube Light			
5 Plumbing	10	06	
5.1 Plumbing tools, pipe fittings and method of joining pvc pipes.			CO1
5.2 Use of spirit level and plumb bob.			CO2
5.3 Minor repairs and replacement of fittings.			CO3
5.4 Reading of plumbing drawings. <i>[Note: Plumbing restricted to domestic plumbing and pvc piping.]</i>			
Total	100	80	

6. COURSE DELIVERY:

The Course will be delivered through workshop practical sessions in mechanical and electrical workshops.

7. SPECIFICATION TABLE FOR PRACTICALS/ MACRO-LESSON PLAN

Unit No	Unit	Number of hrs.	Marks
1	General Safety, Housekeeping, Fire Fighting & First Aid	06	10
2	Fitting Workshop Practice	18	30
3	Carpentry Workshop Practice	18	20
4	Electrical Workshop Practice	32	30
5	Plumbing	06	10
	Total	80	100

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Hrs.
1	General Safety, Housekeeping, Fire Fighting & First Aid	06
a	Demonstration on use of Safety Measures while working in Workshop and use of safety signs.	03
b	Demonstration on use of First Aid and Artificial Respiration procedure ,Training on fire and emergency services (using video presentation /fire and safety expert talk)	03
2	Fitting Workshop Practice	18
a	Identification of various hand Tools, Measuring and Marking Tools, cutting tools, Holding tools, Striking tools	03
b	Identification of various types of files and demonstration on filing methods.	03
c	Identification of various types of Drill bits, taps, dies and Drilling machines such as portable and Pillar Drilling machine.	03
d	Job involving filing, marking, cutting operation on MS Flat.	06
e	Job involving Drilling and Tapping operation on MS flat.	03
3	Carpentry Workshop Practice	18
a	Identification of various types of woods and wood working hand tools	03
b	Identification of various types of Carpentry joints and their usage.	03
c	Introduction to wood working machines such as wood working Lathe, Circular saw ,Band saw, Wood planner, Universal wood working machine	03
d	Job involving marking, measuring, planning, sawing, chiseling, joint preparation and assembly of wooden blocks.	06
e	Preparation of job on wood working lathe.	03
4	Electrical Workshop Practice	32
a	Measurement of Single Phase and Three Phase supply Voltage using multimeter.	02
b	Identification of various hand tools used in electrical trade.	02
c	Measurement of electric circuit parameters using Ammeter, Voltmeter, Frequency meter, Wattmeter.	04
d	Making of Straight and T wire joints.	02
e	Testing of electrical components such as Choke, starter, Fuse, Switch using Series Test lamp and Multimeter	02
f	Starting of induction motor using DOL Starter	02
g	Reversal of direction of rotation of Three phase induction motor	02

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h	Identification of commonly used electrical fittings.	02
i	Wiring of simple electrical circuit using bulb and socket.	04
j	Measurement of Energy using Energy Meter.	02
k	Identification of Different types of Fuses and their replacement in circuit.	02
l	Testing of various components and connection of Tube light circuit.	02
m	Collecting Name plate Details of Motors and Transformers and operating and controlling speed of motor from Control panel.	04
5	Plumbing	06
a	Identification of Plumbing tools and pipe fittings , Reading of plumbing drawings, methods of joining PVC pipes, use of spirit level and plumb bob in piping.	03
b	To carry out minor repairs and replacement of fittings.	03

9. LEARNING RESOURCES

TEXT BOOKS

S. No.	Author	Title of Books	Publishers
1	N. Sesha Prakash	Manual of Fire Safety	CBS Publishers and Distributors
2	S.K. Hajara-Chaudhary	Workshop Technology	Media Promoters
3	B.S. Raghuwanshi	Workshop Technology-	Dhanpat Rai and sons, New Delhi
4	R K Jain-	Production Technology	Khanna Publishers, New Delhi
5	H. S .Bawa	Workshop Technology	Tata McGraw Hill Publishers, New Delhi
6	Kent	Mechanical Engineering Hand book	John Wiley and Sons, New York
7	B.L. Theraja	Fundamentals of Electrical Engineering and Electronics	S. Chand – New Delhi

REFERENCE BOOKS FOR FURTHER STUDY

S. No.	Author	Title of Books	Publishers
1	CIMI- Central Instructional Media Institute Madras	Turner – Trade Theory – Ist and IInd Year	Wiley Eastern Ltd. New Delhi

(GC106) Basic Engineering Practice (Mech & Elect.)

2. COURSE OBJECTIVE:

The students will be able to acquire knowledge about safety aspects, firefighting, first-aid and carpentry, fitting, plumbing skills. The students will learn proper ways of using various hand tools, measuring devices in acquiring these skills and will also interpret simple electrical drawings/circuit diagrams.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Hours	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
(GC 106) Basic Engineering Practice	L	T	P	H	TH	TM	PR/OR	TW	
	0	0	5	80	-	-	50	75	125

3. COURSE OUTCOMES:

PART A

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

GC106.CO1. Understand safety procedures to be followed in carpentry, fitting, and plumbing.

GC106.CO2. Identify various tools used for carpentry, fitting, and plumbing.

GC106.CO3: Demonstrate basic working skills in carpentry, fitting and plumbing.

GC106.CO4: Plan & execute a job/activity using job drawing.

PART B

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

GC106.CO1. List the safety measures to be observed in electrical workshop.

GC106.CO2. Identify various electrical tools, fittings used for electrical measurements & troubleshooting.

GC106.CO3: Distinguish between single phase and three phase supply.

GC106.CO4: Plan & execute a job/activity from electrical circuit drawing.

4. MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES

PART A

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life -long Learning
CO1	2	1	1	3	2	2	3
CO2	2	1	2	3	2	2	2
CO3	2	1	1	3	2	2	2
CO4	2	1	3	3	2	3	2

Relationship: Low-1 Medium-2 High-3

PART B

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life -long Learning
CO1	2	1	1	3	2	2	3
CO2	2	1	2	3	2	2	2
CO3	3	1	1	2	2	1	2
CO4	2	1	3	3	2	3	2

Relationship: Low-1 Medium-2 High-

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Hr = Practical Hours	CO = Course Outcomes			
Unit			M	Hr	CO
1 General Safety, Housekeeping, Fire Fighting & First Aid				06	
1.1 Introduction to General Safety aspects of engineering workshop 1.2 Meaning and importance of housekeeping. 1.3 Fire hazards, fire triangle, types of fire extinguishers – selection and use. 1.4 Basic knowledge of first aid with specific inputs on cuts, burns, electric shocks, artificial respiration, handling emergencies.					CO1
2 Fitting Workshop Practice				18	
2.7 Introduction to the trade. 2.8 Introduction to various hand Tools, Measuring and Marking Tools, cutting tools, Holding tools, Striking tools 2.9 Types of files and filing methods. 2.10 Drill bits and drilling Processes, using portable and pillar drilling machine. 2.11 Operations performed in fitting shop such as measuring, marking, chipping, filing, grinding, sawing, drilling 2.12 Threading using taps and dies.					CO1 CO2 CO3
3 Carpentry Workshop Practice			20	18	
3.10 Introduction to carpentry 3.11 Types of wood and its characteristics, forms of wood, defects in timber and its identification, wood working hand tools 3.12 Wood working processes. 3.13 Different types of joints and their usage. 3.14 Introduction to wood working machines: a. Lathe b. Circular saw c. Band saw d. Wood planner e. Universal wood working machine					CO1 CO2 CO3
4 Electrical Workshop Practice			30	32	
4.1 Brief introduction to power distribution and Electrical Safety. 4.2 Use of different hand tools used in electrical trade 4.3 Collection of details of motors and transformers. 4.4 Introduction to Control Panel and its various sections/components. 4.5 Making of wire joints. 4.6 Measurement of current, voltage, frequency and Power Consumption. 4.7 Connecting and starting of Induction Motor & Measurement of					CO1 CO2 CO3 CO4

its speed. Changing of Direction of rotation of induction motor. 4.8 Introduction to commonly used electrical Fittings (Domestic & Industrial). 4.9 Wiring of Simple Electric Circuit (Bulb & plug point and switches) on wooden board 4.10 Study, connection & use of Energy Meter 4.11 Testing of components using Series test lamp & Multimeter 4.12 Study of Fuses & practice replacement of Fuse 4.13 Study & Troubleshooting of Tube Light			
5 Plumbing		06	
5.1 Plumbing tools, pipe fittings and method of joining pvc pipes. 5.2 Use of spirit level and plumb bob. 5.3 Minor repairs and replacement of fittings. 5.4 Reading of plumbing drawings. <i>[Note: Plumbing restricted to domestic plumbing and pvc piping.]</i>			CO1 CO2 CO3
Total		80	

6. COURSE DELIVERY:

The Course will be delivered through workshop practical sessions in mechanical and electrical workshops.

7. SPECIFICATION TABLE FOR PRACTICALS/ MACRO-LESSON PLAN

Unit No	Unit	Number of hrs.	Marks
1	General Safety, Housekeeping, Fire Fighting & First Aid		10
2	Fitting Workshop Practice		30
3	Carpentry Workshop Practice		20
4	Electrical Workshop Practice		30
5	Plumbing		10
	Total		100

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Hrs.
1	General Safety, Housekeeping, Fire Fighting & First Aid	06
a	Demonstration on use of Safety Measures while working in Workshop and use of safety signs.	03
b	Demonstration on use of First Aid and Artificial Respiration procedure ,Training on fire and emergency services (using video presentation /fire and safety expert talk)	03
2	Fitting Workshop Practice	18
a	Identification of various hand Tools, Measuring and Marking Tools, cutting tools, Holding tools, Striking tools	03
b	Identification of various types of files and demonstration on filing methods.	03
c	Identification of various types of Drill bits, taps, dies and Drilling machines such as portable and Pillar Drilling machine.	03
d	Job involving filing, marking, cutting operation on MS Flat.	06
e	Job involving Drilling and Tapping operation on MS flat.	03
3	Carpentry Workshop Practice	18
a	Identification of various types of woods and wood working hand tools	03
b	Identification of various types of Carpentry joints and their usage.	03
c	Introduction to wood working machines such as wood working Lathe, Circular saw ,Band saw, Wood planner, Universal wood working machine	03
d	Job involving marking, measuring, planning, sawing, chiseling, joint preparation and assembly of wooden blocks.	06
e	Preparation of job on wood working lathe.	03
4	Electrical Workshop Practice	32
a	Measurement of Single Phase and Three Phase supply Voltage using multimeter.	02
b	Identification of various hand tools used in electrical trade.	02
c	Measurement of electric circuit parameters using Ammeter, Voltmeter, Frequency meter, Wattmeter.	04

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d	Making of Straight and T wire joints.	02
e	Testing of electrical components such as Choke, starter, Fuse, Switch using Series Test lamp and Multimeter	02
f	Starting of induction motor using DOL Starter	02
g	Reversal of direction of rotation of Three phase induction motor	02
h	Identification of commonly used electrical fittings.	02
i	Wiring of simple electrical circuit using bulb and socket.	04
j	Measurement of Energy using Energy Meter.	02
k	Identification of Different types of Fuses and their replacement in circuit.	02
l	Testing of various components and connection of Tube light circuit.	02
m	Collecting Name plate Details of Motors and Transformers and operating and controlling speed of motor from Control panel.	04
5	Plumbing	06
a	Identification of Plumbing tools and pipe fittings , Reading of plumbing drawings, methods of joining PVC pipes, use of spirit level and plumb bob in piping.	03
b	To carry out minor repairs and replacement of fittings.	03

9. LEARNING RESOURCES

TEXT BOOKS

S. No.	Author	Title of Books	Publishers
1	N. Sesha Prakash	Manual of Fire Safety	CBS Publishers and Distributors
2	S.K. Hajara-Chaudhary	Workshop Technology	Media Promoters
3	B.S. Raghuwanshi	Workshop Technology-	Dhanpat Rai and sons, New Delhi
4	R K Jain-	Production Technology	Khanna Publishers, New Delhi
5	H. S .Bawa	Workshop Technology	Tata McGraw Hill Publishers, New Delhi
6	Kent	Mechanical Engineering Hand book	John Wiley and Sons, New York

7	B.L. Theraja	Fundamentals of Electrical Engineering and Electronics	S. Chand – New Delhi
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REFERENCE BOOKS FOR FURTHER STUDY

S. No.	Author	Title of Books	Publishers
1	CIMI- Central Instructional Media Institute Madras	Turner – Trade Theory – Ist and IInd Year	Wiley Eastern Ltd. New Delhi

(GC201) ENGINEERING MATHEMATICS II

1. COURSE OBJECTIVE:

- The course is aimed at providing mathematical knowledge, developing computational skills and reasoning. It also helps students to think logically and in systematic manner so as to grasp mathematical concepts easily. It helps to build analytical thinking which play an important role in solving real world problems in all scientific discipline.

2. TEACHING AND EXAMINATION SCHEME

Semester	II				Total hours	Examination Scheme			
Course code & course title		Periods/Week (in hours)			Total hours	Theory Marks	TERM WORK		Total Marks
		L	T	P		TH	TM	TW	PR/OR
(GC201) Engineering Mathematics II		4	2	-	96	75	25	25	-
									125

3. COURSE OUTCOMES:

GC201.CO1: Understand the basic principles of Matrices ,Integration, Determinants and Vectors in engineering problems.

GC201.CO2: Interpret the formulae to solve problems of Matrices ,Integration, Determinants and Vectors.

GC201.CO3: Apply appropriate mathematical methods for solving engineering problems.

GC201.CO4: Analyse the knowledge of Matrices ,Integration, Determinants and Vectors for various Engineering applications.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO1	3	1	1	2	0	2	2
CO2	3	1	1	2	0	2	2
CO3	2	2	2	3	1	2	2
CO4	1	3	2	3	1	2	2

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours	CO = Course Objectives			
Unit			Marks	Thr	CO
1 .DETERMINANTS AND MATRICES			15	12	CO1, CO2, CO4
1.1 Determinants: Definition & order of determinant, value of determinant, properties of determinants(no question), Cramer's rule for solving equations with two & three variables			7	4	
1.2 Matrices: - Definition & order of matrix, types of matrices, Equality of matrices, addition & subtraction, multiplication of matrices, adjoint & inverse of a matrix , solution of linear equations with two & three variables using matrices			8	8	
2 .INTEGRATION			20	22	CO1, CO2, CO4
Definition, Standard Formulae, properties of Integration for sum, difference and scalar multiplication, integration of algebraic, trigonometric, inverse trigonometric, exponential, logarithmic, composite function, Integration by substitution, integration by partial fraction, integration by parts					
3 .DEFINITE INTEGRALS			10	08	CO3
Definition of definite integral and Properties of definite integral ,integration by parts Applications:Area under the curves & lines and area between the curves and Volumes (simple problems)					
4 .VECTORS			15	12	CO1, CO2, CO4
Definition of scalars & vectors, equality of vectors, Addition & subtraction of vectors, triangle, parallelogram laws for addition, position vector, dot product & cross product and their properties and applications, relation between dot and cross product and scalar triple product and applications					
5 .STATISTICS / COMPLEX NUMBERS			15	10	CO3
Statistics : (ME and Allied courses only) 5.1:Measures of central Tendency -mean, median, mode for ungrouped & grouped data 5.2:Measures of dispersion –Range, mean deviation, standard deviation, variance, coefficient of variation 5.3: Corrected mean and relation between standard deviation and mean.					

5.Complex Numbers (electronics and Allied courses only) 5.1:Definition of complex number and Argand diagram, equality of complex numbers, 5.2:powers of 'i' ,complex conjugates, 5.3:Addition& subtraction of complex nos. Multiplication& division of complex nos. 5.4: Modulus and argument of a complex number 5.5:Polar form & exponential form of complex no. 5.6: De Moivre's theorem., nth root of complex nos. 5.7:Hyperbolic, exponential, circular functions			CO3
Total	75	64	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY (GC201)

Unit No	Unit	Number of lectures	Marks
1	Determinants & Matrices	12	15
2	Integration	22	20
3	Definite Integrals	08	10
4	Vectors	12	15
5	Statistics /Complex Number	10	15
	Total	64	75

- Tutorial books should be maintained by students (5 marks)
- Two home assignments per semester (5 marks)

The Two assignments each comprises of thirty questions which includes 15 short questions and fifteen long questions. First assignment will cover fifty percent of syllabus

and second assignment will cover remaining portion of syllabus

- Topic-wise class assignment (15 marks)

Class assignment comprises of ten short and ten long questions.

9. LEARNING RESOURCES

Text Books /reference books

S. No.	Title of Books	Author	Publishers
1	Mathematics for Polytechnic Students(Basic Mathematics)	S.P. Deshpande	Pune VidyarthiGrihaPrakashan 1786, Sadashiv Peth, Pune
2	Mathematics for Polytechnic Students(Engineering Mathematics)	S.P. Deshpande	Pune VidyarthiGrihaPrakashan 1786, Sadashiv Peth, Pune
3	Applied Mathematics	S.B. Gore, M.B.Patil, S.P. Pawar	Vrinda Publications

Reference Books for further study

S. No.	Title of Books	Author	Publishers
1	Applied Mathematics I	Dr. U.B.Jangam, K.P. Patil, Nalini Kumthekar	Nandu Printers& Publishers Pvt. Ltd. Mumbai
2	Applied Mathematics for Polytechnics	H.K. Dass	CBS Publishers & Distributers Pvt. Ltd. Pune
3	Advanced Engineering mathematics	H.K. Dass	S. Chand

(GC 202) APPLIED PHYSICS- II

1. COURSE OBJECTIVE:

On successful completion of the course, Students completing the Applied Physics II course will be able to demonstrate competency and understanding of the basic concepts found in, Electrostatics, Current Electricity, Electromagnetism and Electromagnetic Induction, Light and Optics and Sound, and will be able to utilize the knowledge to demonstrate competency with experimental methods that are used to discover and verify the concepts related to content knowledge.

2. TEACHING AND EXAMINATION SCHEME

Semester	II									
Course code & course title		Periods/Week (in hours)			Total Hours	Examination Scheme				
						Theory Marks		Practical Marks		Total Marks
(GC202) Applied Physics- II		L	T	P	H	TH	TM	TW	PR/OR	
		03	0	02	80	75	25	25	-	125

3. COURSE OUTCOMES:

GC202.CO1: Understand the Fundamental Concepts of Electrostatics, Current Electricity, Electromagnetism and Electromagnetic Induction, Light, Optics and Sound.

GC202.CO2: Explain the basic principles of Electrostatics, Current Electricity, Electromagnetism and Electro Magnetic Induction, Light, Optics and sound.

GC202.CO3: Apply the knowledge of Electrostatics, Current Electricity, Electromagnetism and Electromagnetic Induction, Light, Optics and Sound to specific applications.

GC202.CO4: Compute various parameters in the field of Electrostatics, Current Electricity, Electromagnetism and Electromagnetic Induction, Light, Optics and Sound.

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4. Mapping Course Outcomes with Program Outcomes

Relationship : 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentatn & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life -long Learning
CO 1	3	3	1	1	2	0	3
CO 2	3	3	1	1	2	0	2
CO 3	3	2	3	3	3	1	1
CO 4	2	2	2	3	1	1	1

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours	CO = Course Objectives			
Unit	M	Thr	CO		
1 UNIT NAME: ELECTROSTATICS	12	8	CO1,		
1.1 Coulomb's law, Electric field,			CO2,		
1.2 Electric field Intensity, Electric lines of force and properties			CO3,		
1.3 Electric potential, Definition of Absolute potential			CO4		
1.4, Potential difference, Potential of sphere,					
1.5 Potential of earth.					
1.6 Capacitance,					
1.7 Capacitors in Parallel Derivation of Expression					
1.8. Capacitor in series Derivation Of Expression					
2. UNIT NAME: CURRENT ELECTRICITY	20	12	CO1,		
			CO2,		
2.1 Definition of Electric Current and its Unit, Ohm's Law, Resistance,			CO3,		
2.2 Factors on which resistance depends, Specific resistance. Effect of temperature on resistance			CO4		
Temperature coefficient of resistance,					

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2.3 Resistances in Series and parallel			
2.4 EMF and Internal resistance of cell			
2.5 General Equation of ohm's law.			
2.6. Wheatstone's Network and Principle of Meter Bridge			
2.7 Principle of Potentiometer ($V \propto L$) and Applications to compare EMF of given cells by single cell method and sum difference method			
2.8 Determination of Internal resistance of a cell using potentiometer.			
2.9 Electric Power and Electric Energy, KWh			
2.10 Calculation of Energy bills			
2.11 Heating Effect of Electric current. Joule's law.			
2.12 Applications in house hold appliances			
3. UNIT NAME: ELECTROMAGNETISM AND EM INDUCTION	16	10	CO1,
3.1 Magnet, Magnetic field, Magnetic flux, and magnetic flux density and its unit			CO2,
3.2 Magnetic effect of Current, Oersted's Experiment, Right hand Thumb Rule, Biot Savart law			CO3,
3.3 Magnetic field at the center of the coil (no derivation), Magnetic field due to coil (Qualitative discussion only)			CO4
3.4 Electromagnet. Force acting on a current carrying conductor placed in magnetic field and expression (no derivation)			
3.5 Fleming's left-hand rule. Electromagnetic Induction. Faraday's Experiment			
3.6. Faraday's laws Lenz's law. Self-Induction and Mutual Induction.			
3.7 Transformer Principle.			
3.8 Step up and Step-down transformer.			
3.9 Induction Heating			
3.10 Induction heater and uses			
4. UNIT NAME: LIGHT AND OPTICS	16	10	CO1,
4.1 Frequency Range of Infrared, ultraviolet and visible light and their uses			CO2,
4.2 Reflection, Refraction, Snell's law, refractive index.			CO3,
4.3 Refraction through glass slab and prism.			CO4

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4.4 Total Internal reflection applications in optical fibers.			
4.5 Advantages of optical fibers. LASER, sources and applications.			
4.6. Luminous Intensity, Intensity of Illumination			
4.7 Inverse square law of Illumination (No derivation)			
4.8 Principle of Photometry, X rays,			
4.9 Production of X Rays by Coolidge tube			
4.10 Properties and applications			
5. UNIT NAME: SOUND	11	08	CO1,
5.1 Sound as longitudinal wave,wavelength,frequency,time period, amplitude,			CO2,
5.2 Free vibration force vibration,resonance, examples,			CO3,
5.3 Echo reverberation ,pitch loudeness,intensity of sound,			CO4
5.4 Ultrasonic waves, Piezo electric effect, Principle of Production of ultra-sonics waves			
5.5 Application of Ultra sonics in finding depth of sea,			
5.6. Detection of flaws in metal, soldering, Drilling,			
5.7 Ultrasonic Cleaning			
5.8Ultrasound for medical purposes.(Just Uses)			

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	ELECTROSTATICS	8	12
2	CURRENT ELECTRICITY	12	20
3	ELECTROMAGNETISM AND EM INDUCTION	10	16
4	LIGHT AND OPTICS	10	16
5	SOUND	8	11
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS

No	Practicals	Marks
1.	Specific Resistance by Ammeter Voltmeter Method	25
2	Specific Resistance by Meter Bridge Method	25
3	To Verify the Series Law of Resistance by Meter Bridge Method	25
4	To Verify the Parallel Law of Resistance by Meter Bridge Method	25
5	To Compare the emf of two cells by single cell method	25
6	To find the internal resistance of a cell by Potentiometer Method	25
7	To find the velocity of sound by Resonance Tube method	25
8	To find the Refractive index	25
	Total (Average)	25

9. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	B G Dhande	Applied Physics of Polytechnics	Pune Vidyarthi Griha Prakashan
2	Bhandarkar	Applied Physics of Polytechnics	Vrinda publication
3	R K Gaur and S L Gupta	Engineering Physics	Dhanpat Rai & Sons Delhi
4	Dr. Vasudev R Bhagwat	A Text Book of Applied Physics for Polytechnics	Broadway Publishing House
5	B L Thereja	Engineering Technology	S. Chand

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Halliday D and Resnick	Physics Part I-II	Wiley Eastern Ltd.
2	Satish k. Gupta	ABC of Physics I&II	Modern Publisher
3	Saxena HC and Singh Prabhakar	Applied Physics Vol I & II	S. Chand Publisher

(GC203) ENVIRONMENTAL STUDIES

1. COURSE OBJECTIVE:

Environment is the nurturing force upon which we depend. It decides our well being, our health & quality of our life. The environment is deteriorating at an alarming rate due to increasing human activity and can be saved only by timely human action. The aim of Environmental studies is to sensitize the students towards the need to conserve & protect natural resources & biological support systems. With the aim to develop an attitude of concern for the environment the students will learn to choose environmentally friendly options for sustainable development and live in harmony with nature.

2. TEACHING AND EXAMINATION SCHEME :

Semester	I									
Course code & course title		Periods/Week (in hours)			Total Credits	Examination Scheme				
						Theory Marks		Practical Marks		Total Marks
(GC203) Environmental Studies		L	T	P	H	TH	TM	TW	PR/OR	
		04	-	-	64	75	25	-	-	100

3. COURSE OUTCOMES:

GC203.CO1: Understand the role and importance of various elements of Environment.

GC203.CO2: Identify the concerns related to the natural resources, ecosystems, biodiversity, pollution and social issues of environment.

GC203.CO3: Develop sensitivity towards Environmental issues.

GC203.CO4: Co-relate causes affecting the environment & biodiversity.

4. Mapping Course Outcomes with Program Outcomes :

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation	Engg. Practices for Society, Sustainability	Project Management	Life-long Learning
CO1	2	1	1	0	3	2	2
CO2	2	1	1	0	3	2	2
CO3	1	1	1	0	3	2	2
CO4	1	1	2	0	3	2	2

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours	CO = Course Objectives	
Unit	Mks	Thr	CO1, CO3, CO4
UNIT 1.0 : Multidisciplinary Nature of Environmental Studies	09	08	CO1, CO3, CO4
1.1 Environmental studies : Definition , Scope and Importance			
1.2 Need for Public Awareness			
1.3 Environment & Human Health			
1.4 Environmental Ethics			
1.5 Value Education			
1.6 From Unsustainable to Sustainable Development : Concept and Guidelines			
1.7 Concept of Environmental Audit (EA) Environment Impact Assessment (EIA)			
1.8 Ecological Foot Prints			
UNIT 2.0 : ECOSYSTEM AND BIODIVERSITY	15	13	CO1, CO2, CO3, CO4
2.1 Ecosystem			
2.1.1 Concept, Structure & functions of ecosystem (Function of producer, consumer and decomposer)			
2.1.2 Food chain & Food web- Concept & Examples			
2.1.3 Energy flow in Ecosystem			
2.1.4 Ecological Pyramids (Inverted & Upright) Pyramid of Number, Biomass & Energy.			
2.1.5 Ecological Succession (Primary & Secondary Succession)			
2.1.6 Study of Ecosystem: characteristic features structure and functions) Terrestrial(Forest, Grassland, Desert) Aquatic(Pond, River & Ocean)			
2.2 Biodiversity			
2.2.1 Definition of Biodiversity			
2.2.2. Types of Diversity (Genetic, Species & Ecosystem)			
2.2.3. Value of Biodiversity (Consumptive , Productive, Social ,Aesthetic Moral & Optional value)			
2.2.4 India as a Mega- diversity Nation			
2.2.5 Biogeographical classification of India			
2.2.6 Extinct, Endangered, Threatened & Endemic Species -Examples (of India)			
2.2.7 Threats to Biodiversity (Habitat loss, Poaching of Wild life & Man Wildlife Conflict)			
2.2.8 Reasons for loss of Biodiversity			
2.2.9 Conservation of Biodiversity (Insitu & Exsitu conservation)			
UNIT 3.0 : NATURAL RESOURCES	18	15	CO1, CO2, CO3, CO4
3.1 Forest Resource			
3.1.1 Direct & Indirect value of Forest			
3.1.2 Deforestation-causes & effects			
3.1.3 Forest Management			

3.2 Water Resource 3.2.1 Water as a scarce Resource 3.2.2 Use and over exploitation of surface and ground water 3.2.3 Need for Water Conservation 3.2.4 Construction of dams- Benefits and draw backs (Rehabilitation & Resettlement of people) 3.2.5 Rain water Harvesting. 3.2.6 Watershed Management 3.2.7 Conflicts over water in India 3.3 Energy Resource 3.3.1 Renewable & Non-Renewable sources of Energy 3.3.2 Growing Energy Needs. 3.3.3 Alternate Source of Energy (Solar ,Wind, Bio, Geothermal, Hydro & Nuclear Energy)			
3.4 Food Resource 3.4.1 Sources of Food 3.4.2 World Food Problems (Undernourishment & Malnourishment) 3.4.3 Changes caused by agriculture & overgrazing 3.4.5 Effects of modern agriculture on environment (use of synthetic fertilizers & synthetic pesticides in agriculture) 3.5 Mineral Resource 3.5.1 Types of Minerals 3.5.2 Use & Overexploitation of Minerals 3.5.3 Environmental Impact of Mining. 3.6 Land Resource 3.6.1 Pattern of Land Utilization (In India and World) 3.6.2 Land Degradation – Causes & Control Measures			
UNIT 4.0 : ENVIRONMENTAL POLLUTION- Sources , Effects & Control Measures	24	20	
4.1 Air Pollution 4.1.1 Definition, sources of air pollution(Primary and Secondary air pollutants with examples) 4.1.2 Effects on human health, animals, plants & Materials 4.1.3 Control of Air Pollution. 4.1.4 Removal of Particulate matter 4.1.5 Principles & Application of Control Equipments (Gravity and Inertial Separators, Cyclones, Filters, Electrostatic precipitators, Wet scrubbers) 4.1.6 Removal of Gaseous Pollutants (Combustion, Adsorption, Absorption) 4.1.7 Global Issues Definition, Cause & effects of Green House effect & Global Warming. Ozone layer Depletion, Acid Rain.			CO1, CO2, CO3, CO4

4.6 <u>Noise Pollution :-</u> 4.6.1 Definition. 4.6.2 Sources of Noise Pollution 4.6.3 Effects of Noise Pollution on Human health (Noise Induced hearing loss, Physiological & Psychological Effects) 4.6.4 Control of Noise Pollution.			
4.7. <u>Nuclear Pollution / Radioactive Pollution:-</u> 4.7.1 Definition 4.7.2. Sources of nuclear Pollution (Natural & Man made) 4.7.3. Effects of Nuclear Pollution 4.7.4. Control of Nuclear Pollution 4.7.5. Disposal of Nuclear waste (Low, Medium & High activity waste) 4.7.6 Nuclear Accidents & Holocaust – case study			
4.8 Solid Waste Pollution. Definition: Refuse, Garbage Sources of Solid waste Types of solid waste (MSW, HW, BMW & EW) Effects of Consumerism Segregation of Solid waste at source Treatment of MSW (Open dumping, Land filling, incineration & composting) Waste Utilization (Reuse, Reclaim & Recycle) Solid waste Management System – Flow sheet diagram			
4.9 Role of an Individual in Prevention of Pollution.			
UNIT 5.0 : SOCIAL ISSUES & ENVIRONMENT	09	08	CO2, CO3, CO4
5.1 Environmental Legislation Article 47 & Article 51-A(g) of the constitution on Environment. 5.1.1 Protection Functions of Ministry of Environment and Forest Govt. of India Objectives & Functions of Central & state pollution Control Boards Environmental Protection Act. Air (Prevention & Control of Pollution) Act. Water (Prevention & Control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Motor vehicle Act.			
5.2 Social Issues 5.2.1 Women & Child Welfare 5.2.2 Role of IT in Environment & Human Health 5.2.3 AIDS 5.2.4 Population Growth & Variation among Nations 5.2.5 Human Rights			

COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	MULTI-DISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES	08	09
2	ECOSYSTEM AND BIODIVERSITY	13	15
3	NATURAL RESOURCES	15	18
4	ENVIRONMENTAL POLLUTION	20	24
5	SOCIAL ISSUES & ENVIRONMENT	08	09
	Total	64	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

9. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Erach Bharucha	Textbook of Environmental Studies	Universities Press (India) Private Ltd.
2	Dr. Suresh K. Dhameja	Environmental studies	S.K. Kataria & Sons
3	Y. Anjaneyulu	Introduction to Environmental Science	B.S Publications
4	S. Deswal & A. Deswal	A Basic Course in Environmental Studies	Dhanpat Rai & Co.
5	P. Meenakshi	Elements of Environmental Science and Engineering	Prentice Hall of India (PHI)

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Pandya and Camy	Environmental Engineering	Tata McGraw Hill
2	Asthana D.K. and Asthana Meera	Environmental Problems and Solutions	S. Chand & Co.
3	Gilbert M. Masters	Introduction to Environmental Engineering and Science.	Prentice Hall of India (PHI)
4.	M N Rao & HVN Rao	Air Pollution	Tata McGraw Hill

FIELD ACTIVITIES (OPTIONAL)

1. Visit to Selaulim/ Anjunem Dam.
2. Visit to show Hill cuttings, mining areas.
3. Visit to show Rain water harvesting project / Vermicomposting plant / watershed management project. (Krishi Vigyan Kendra – Old Goa)
4. Visit to Garbage treatment plant.

***On Completion of visit Report to be submitted.**

(GC204) ENGINEERING DRAWING

1. Course Objective: Drawing is a graphical language of engineering field. Engineering technician irrespective of his/her field of operation in an industry is expected to possess a thorough understanding of drawing, which includes visualization of objects and the proficiency in reading and interpreting a wide variety of engineering drawings. It is the skill, which translates an engineering idea into lines and dimensions. Besides this he/she is also expected to possess a certain degree of drafting skills- depending upon his/her job.

2. TEACHING AND EXAMINATION SCHEME:

Course Code & Course Title	Periods/ Week (In Hours)			Total Hours	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
(GC204)	L	T	P	H	TH	TM	TW	PR/OR	100
Engineering Drawing	-	-	5	80	-	-	50	50	

3. Course Outcomes:

On successful completion of the course the student will be able to:

GC204.CO1: Understand different methods of projection, sectioning of solids and development of surfaces.

GC204.CO2: Select the relevant procedural methods for preparing Engineering Drawing.

GC204.CO3: Draw Isometric views and orthographic projection of full and sectioned objects and development of surfaces

GC204.CO4: Examine and Interpret Engineering Drawings

4. Mapping Course Outcomes with Program Outcomes

Relationship- 1:Slight (low) 2:Moderate(Medium) 3: Substantial(High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
	Basic and discipline specific knowledge	Problem analysis	Design & development of solution	Engg tools exptn and & testing	Engg Practice for society,sustainability and environment	Project management	Lifelong learning
CO1	3	2	1	3	1	1	1
CO2	3	1	2	3	1	2	2
CO3	2	2	2	3	1	2	2
CO4	2	2	2	2	1	2	3

5. Detailed course Contents/ Micro lesson plan

M=Marks

Prhr= Teaching Hrs

CO=Course Outcomes

Unit	Mark	Prhr	CO
1. Introduction 1.1 Importance of engineering drawing as a means of communication. 1.2 Planning of drawing sheet as per SP 46(latest revision) 1.3 Indian standard practices of laying out and folding of drawing 1.4 Different types of lines used in engineering drawing. 1.5 Importance of scale in Engineering Drawings. 1.6 Lettering 1.7 Methods of dimensioning, Dimensioning terms and notation -use of SP 46(latest revision), General rules for dimensioning, Dimensioning of cylinder, holes, arcs of circle, narrow space, angles, countersunk hole, taper.	05	05	CO2
2. Geometrical construction & Engineering Curves 2.1Construction of an Equilateral and Isosceles triangle, Square, Regular pentagon & Regular hexagon given length of a side using general method of construction 2.2Construction of Engineering curves like: Ellipse- by focus & directrix method and arcs of circles method Parabola- by focus & directrix method and rectangle method Hyperbola- Focus and directrix method 2.3 Cycloid- by generating circle rolling on a straight line 2.4 Involute of a circle. 2.5 Draw normal & tangents to the above curves from given point on the curve Curves to be explained with the help of applications.	05	15	CO2
3. Orthographic projection 3.1 Definitions of various terms associated with orthographic projections. Planes of projections. Concept of Quadrants. 3.2 First and third angle method of projection. 3.3 Projection of points 3.4Projection of lines	18	30	CO1, CO2, CO3, CO4

Parallel to both Principal planes Parallel to one and Perpendicular to other Principal plane. Inclined to one plane and parallel to other plane. 3.5 Projection of planes: Triangle, Square, circle when inclined to one principal plane & perpendicular to other plane. 3.6 Projection of solids: Cylinder, cone. Right regular solids such as (i) Prism: Square & Pentagonal (ii) Pyramid: Triangular & Square. Projections of above mentioned solids when axis is inclined to one principal plane & Parallel to other principal plane. 3.7 Conversion of simple pictorial views into orthographic views. <i>Problems where one end of the line is in one quadrant & other end in other quadrant and traces are to be excluded.</i> <i>Problems where apparent shape of plane are given, true shape & slope angle are to be drawn are excluded.</i>			
4. Section of solids Development of lateral surfaces 4.1 Concept of sectioning planes, Auxiliary planes and true shape of section. 4.2 Drawing section of solids like square prism, square pyramid, cylinder and cone with sectioning plane inclined to one principal plane and Perpendicular to the other principal plane (Axis of solid perpendicular to one principal plane and parallel to the other) 4.3 Concept and importance of surface development in the engineering field. Methods of development of surfaces-Radial & Parallel line method. Development of surfaces for solids like square prism, square pyramid, cylinder and cone. <i>Development of solids standing on its base & cut by a plane inclined to HP and perpendicular to VP is also included.</i>	10	15	CO1, CO3
5. Isometric Views 5.1 Difference between Isometric projection & Isometric view. 5.2 Isometric view of geometrical planes and solids. 5.3 Conversion of orthographic views into isometric views.	12	15	CO3, CO4

5.4 Construction of Isometric view for any real object.			
Total	50	80	

6. Course Delivery:

The course will be delivered through Practicals, class room interaction and exercises.

7. Specification table for Practical/Macro Lesson Plan

Unit No.	Unit	No. Of Practical Hrs.	Marks
1	Introduction	05	05
2	Geometrical construction & Engineering Curves	15	05
3	Orthographic projection	30	18
4	Section of solids Development of lateral surfaces	15	10
5	Isometric Views	15	12
	Total	80	50

8. Specification table for Practical/ Termwork:

No.	Practical
1	TYPES OF LINES, LETTERING, DIMENSIONING.
2	GEOMETRICAL CONSTRUCTIONS
3	ENGINEERING CURVES
4	PROJECTION OF POINTS & LINES
5	PROJECTION OF PLANES
6	PROJECTIONS OF SOLIDS
7	ORTHOGRAPHIC PROJECTIONS (First angle)
8	ORTHOGRAPHIC PROJECTIONS(Third angle)
9	SECTIONS AND DEVELOPMENT OF SOLIDS
10	ISOMETRIC VIEWS

9. Learning Resources:

Text Books

S.No.	Author	Title	Publisher
1	N.D. Bhatt	Engineering Drawing	Charoter Publisher,Anand
2.	R. K. Dhawan	Engineering Drawing	S. Chand Publishing
3.	K.R. Gopalakrishna	Engineering Drawing	Subhas Publications.

Reference Books only for further study

S.No.	Author	Title	Publisher
1	P.S. Gill	Geometrical Drawing	Kataria & Sons
2	P.S. Gill	Machine Drawing	Kataria & Sons
3	N.D. Bhatt	Machine Drawing	Charoter Publisher,Anand

Indian and International codes needed

S.No.	Author	Title	Publisher
1.	BIS, India	SP 46. (Latest revision).	BIS, India

(GC205) ENGINEERING MATERIALS

1. COURSE OBJECTIVE:

This course is introduced with an objective of providing knowledge to students regarding properties and composition of materials for engineering applications and enabling them to make comparative study of materials while selecting the appropriate material for various engineering applications.

2. TEACHING AND EXAMINATION SCHEME

Semester	II				Total Hours	Examination Scheme				Total Marks
Course code & course title		Periods/Week (in hours)			Total Hours	Theory Marks		Practical Marks		Total Marks
		L	T	P		TH	TM	TW	PR/OR	
(GC205) ENGINEERING MATERIALS		3	--	--	48	75	25	--	--	100

3. COURSE OUTCOMES:

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

GC205.CO1: List out the properties of materials used in engineering applications.

GC205.CO2: Explain the composition and properties of various engineering materials.

GC205.CO3: Classify materials based on composition and properties.

GC205.CO4: Select the appropriate material/s for the given engineering application/s.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life-long Learning
CO1	3	2	0	0	0	0	1
CO2	3	2	1	0	0	0	1
CO3	2	2	2	1	1	0	1
CO4	2	3	3	2	1	0	1

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours	CO = Course Objectives			
Unit			M	Thr	CO
1 INTRODUCTION TO ENGINEERING MATERIALS			08	04	
1.1 Classification of Materials: Metal and Non-metal, Ferrous Metal & Non-ferrous Metals, Differences between Metals & Non-metals					CO1, CO2, CO3, CO4
1.2 Properties of Materials:(Note: Properties to be explained with relevant examples.)					
1.2.1 Physical properties – Melting point, Freezing point, Boiling point, Density, Linear co-efficient of expansion, Thermal conductivity, Electrical resistivity					
1.2.2 Mechanical properties – Strength, Elasticity, Plasticity, Ductility, Malleability, Toughness, Brittleness, Hardness, Fatigue, Creep.					
1.2.3 Electrical properties – Resistivity, Conductivity, Temperature coefficient of resistance, Dielectric strength, Thermo-electricity, Super conductivity					
1.2.4 Magnetic properties – Permeability and Coercive force					
1.2.5 Chemical properties - Corrosion resistance and Chemical composition					
2 FERROUS & NON-FERROUS METALS & ITS ALLOYS			18	12	
2.1 FERROUS ALLOYS:					CO1, CO2, CO3, CO4
1.1.1 Low carbon steel, Medium carbon steel, High carbon steel, their carbon percentage, properties & uses.					
1.1.2 Cast iron: grey cast iron, white cast iron, their properties & uses					
1.1.3 Alloy steels: Constituents of alloy steels such as Phosphorous, Sulphur, Silicon, Manganese and their effect on properties of materials.					
1.1.4 Stainless steel, Nickel-chromium-molybdenum steel, its properties & uses.					
1.1.5 Tool steel – composition, HSS, properties & uses					
2.2 NON-FERROUS METALS & ALLOYS:					CO1, CO2, CO3, CO4
2.2.1 Aluminium – Properties & uses					
2.2.2 Aluminium alloys – constituents of alloy & their effect on properties of metal					
2.2.3 Properties & uses of Duralumin, Y-alloy and Al-Si alloy					
2.2.4 Copper – Properties & uses.					
2.2.5 Copper alloys – Constituents of alloy & their effect on properties of metal					
2.2.6 Properties & uses of Copper – Zinc alloys such as Muntz metal, manganese, bronze, Copper-Tin alloys such as Bronze, Copper-Aluminium alloys such as Aluminium bronzes.					
2.2.7 Lead and its hazard to the environment					
3 NON-METALLIC MATERIALS			18	10	
3.1 CONSTRUCTION MATERIALS					CO1, CO2, CO3, CO4
3.1.1 Classification of rocks, common building stones and their applications.					
3.1.2 Cement: Types of cement, composition and applications					
3.1.3 Bricks: Composition, properties, Classification, Special bricks-Refractory and fly-ash bricks and uses					
3.1.4 Clay: Types, products of clay- tiles and pipes					
3.1.5 Sand- sources – river, crushed aggregates, applications					

3.2 ENGINEERING CERAMICS				CO1, CO2, CO3, CO4
3.2.1 Refractories: Desirable properties, Properties and Applications of Fire clay and Silica Refractory, Difference between acid, basic & neutral refractories				
3.2.2 Glass: Properties & uses of soda glass, borosilicate glass and fibre glass				
3.2.3 Glass wool: Composition, properties & uses				
3.2.4 Timber: Common varieties of timber, uses of wood products, veneer and plywood				
3.2.5 Natural & Synthetic abrasive materials: Introduction, Properties & uses				
4 CONDUCTOR, SEMI -CONDUCTOR, AND INSULATING MATERIALS		16	12	CO1, CO2, CO3, CO4
4.1 Classification of Materials as Conductor, Semiconductor and Insulating materials				
4.2 Conductor Material:				
4.2.1 High conductivity materials: Copper, Aluminium, Carbon, Silver, Lead & Tungsten, their properties as conducting materials and applications.				
4.2.2 High resistivity materials: nichrome, constantan, manganin and their applications				
4.3 Insulating Materials: Introduction and Characteristics of Good Insulating materials				
4.3.1 Solid Insulating materials- wood, paper, rubber, mica, glass fibre, porcelain, PVC, resins, their characteristics as insulating materials and applications				
4.4 Semiconductor Materials: Silicon & Germanium, their specifications as semiconductor material and uses.				
Unit 5 MAGNETIC & COMPOSITE MATERIALS		15	10	
5.1 Magnetic Materials: Classification as Diamagnetic, Paramagnetic, Ferromagnetic, List of these materials and their applications				CO1, CO2, CO3, CO4
5.2 Composite Materials: metal matrix, ceramic matrix and polymer matrix composites, types of reinforcement materials and their applications				
5.3 Paints & Lubricants:				
5.3.1 Classification: oil based and polymer based paints				
5.3.2 Constituents of Paints – resin, binder, pigment, additives, solvents				
5.3.3 Lubricants – Functions of lubricants, Types of Lubricants, Composition and Applications				
Total		75	48	

6. COURSE DELIVERY:The Course will be delivered through lectures and class room interactions

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit Name	Number of lectures (hrs)	Marks
1	Introduction to Engineering Materials	04	08
2	Ferrous & Non-Ferrous Metals & its alloys	12	18
3	Non-Metallic Materials	10	18
4	Conductor, Semi-Conductor, & Insulating Materials	12	16
5	Magnetic & Composite Materials	10	15
		48	75

8. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	R.S. Khurmi	Material Science	S. Chand
2	R. Srinivasan	Engineering Materials & Metallurgy	Tata McGraw Hill
3	TTTI Madras	Electrical Engineering Materials	McGraw Hill Education, 2004
4	S. K. Hajra Choudhury	Material Science and Processes	Indian book distribution
5	P. C. Varghese	Building Materials	PHI
6	J. B. Gupta	Electrical and Electronic Engineering Materials	Katson

(CC301) ENGINEERING MECHANICS

1. COURSE OBJECTIVES:

The students will be able to acquire knowledge of Engineering Mechanics is imperative in the analysis of static or dynamic force systems. The related concepts find extensive applications in the analysis of machine elements, fluids, structures, and every engineering problem that involves force or motion. The subject is a basis of myriads of higher-level subjects like Hydraulics, Strength of Materials, Theory of Machines and Machine Design, and practically there is no branch of engineering where the subject renders no scope.

2. TEACHING AND EXAMINATION SCHEME

Semester	III				Total	Examination Scheme				
Course code & course title		Periods/Week (in hours)			Hours	Theory Marks		Practical Marks		Total Marks
Engineering Mechanics		L	T	P	H	TH	TM	TW	PR/OR	Total Marks
		3	1	1	5	75	25	25	-	

3. COURSE OUTCOMES:

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

CC301CO1: Define various force systems, Equilibrium, centre of gravity, friction & dynamics.

CC301CO2: Explain methods to determine unknown reactions, forces, velocities and accelerations, Centroid, centre of gravity, friction machine efficiency, momentum & impulse.

CC301CO3: Solve problems on equilibrium of rigid bodies, centre of gravity, simple machines, friction, kinetics, momentum & impulse.

CC301CO4: Verify various laws & machine equations.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PS01	PSO2
CO1	3	1						1	1
CO2	3	2	1	1		1		2	1
CO3	3	3	2	1		1	2	2	2
CO4	3	3	1	2	1	2	2	2	1

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Mark s	Thr = Teaching hours				
Unit			M	Thr	CO
1 Forces and Moments.					CO1 CO2 CO3 CO4
1.1 FUNDAMENTALS Definition and unit of force, types of force, characteristics of force, effects of force, principle of transmissibility of force, resultant, equilibrant.			3	1	
1.2 FORCE SYSTEM System of forces, resolution and composition of forces (Resolution along x and y axis), resolution of force along a plane and perpendicular to it (only introduction, no problems to be framed.)			3	2	
1.3 RESULTANT Application of the principle of resolution to—1) find the resultant of a coplanar, concurrent force system, and 2) determine the missing force when the resultant is given.			6	3	
1.4 MOMENT Moment—Definition, unit, sign convention (clockwise moment +, anticlockwise -), couple and its characteristics. Avignon’s theorem-- statement and application to compute the resultant in magnitude, direction and position in case of coplanar non-concurrent, and coplanar parallel force system.			6	4	
2 Equilibrium.					
2.1 FUNDAMENTALS Concept of equilibrium of forces, conditions of equilibrium of two forces, three forces, concurrent and non-concurrent force systems, concept and drawing of free body diagram for not more than three bodies.			3	2	

2.2 LAMI'S THEOREM Lami's theorem- statement and application to problems based on strings with suspended weights, and spheres.	6	3	CO1 CO2 CO3 CO4
2.3 BEAMS Types of beams, types of support, types of loadings. Application of equilibrium conditions to the beams (Beams with simple or roller support at the two ends) with concentrated loading, UDL, partially applied UDL only.	6	5	
3 Centroid and Centre of gravity.			
Definition of centroid, centroid of rectangle, triangle, circle, semicircle, trapezium. Centroid of simple composite figures (including cut out sections.) Definition of centre of gravity. Centre of gravity of solids-- cone, sphere, cylinder, hemisphere, rectangular solid. Centre of gravity of simple composite solids (including cut out solid portions)	9	7	CO1 CO2 CO3
4 Friction and Simple machines			
4.1 Friction—FUNDAMENTALS Concept of friction, Coulomb's law of static friction, coefficient of friction, angle of friction, cone of friction, angle of repose.	3	1	
4.2 APPLICATIONS Application of concept of friction to a block resting on horizontal or inclined plane, ladder friction.	6	5	CO1 CO2 CO3
4.3 FUNDAMENTALS OF SIMPLE MACHINES Definition of simple machine, load, effort, mechanical advantage, velocity ratio, efficiency of machine, law of machine, reversibility of machine, self-locking machine. (Simple problems to be framed, no derivations.)	3	2	CO4
4.4 STUDY OF SIMPLE MACHINES Simple axle and wheel, single purchase crab, double purchase crab, screw jack.	6	4	

(Simple problems to be framed, no derivation.)			
5 Dynamics			
5.1 KINETICS D' Alembert's principle and its applications to solve simple problems related to motion of lift, two bodies connected by a single string passing over a pulley, two string connected bodies of which one is lying on a horizontal plane (or on inclined plane) while the other suspended freely.	9	5	CO1 CO2 CO3 CO4
5.2 MOMENTUM, IMPULSE AND IMPULSIVE FORCE Momentum, impulse and impulsive force—definition and unit. Law of conservation of momentum, simple problems based on momentum, impulse, impulsive force, and law of conservation of momentum.	6	4	
Total	75	48	

6. COURSE DELIVERY:

The course will be delivered through lectures, class room interactions, exercises and case studies.

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Force and moment	10	18
2	Equilibrium	10	15
3	Centroid and centre of gravity	7	9
4	Friction and simple machines	12	18
5	Dynamics	9	15
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS.

Sr. No.	Practical (Minimum six to be conducted)	Marks
1.	Verification of Polygon law of forces.	
2.	Verification of Lami's theorem.	
3.	Determination of coefficient of friction (between any two different surfaces.)	
4.	Calculation of support reactions using Beam apparatus.	
5.	Determination of MA, VR, efficiency and law of machine for any three simple lifting machines.	
6.	Determination of angle of repose.	
7.	Determination of the resultant of coplanar and concurrent forces (Graphical analysis, one sheet.)	
8.	Determination of the resultant of coplanar, non-concurrent forces, and parallel forces. (Graphical analysis, one sheet.)	
No	Class room Assignments	
1	At least three assignments covering above units.	
No	Tutorial Exercise	
1	At least six problems on each of the units mentioned above.	
	Total	25

9. LEARNING RESOURCES

9.1 Text Books

S. No.	Author	Title of Books	Publishers
1	Dhade, Jamdar and Walawalkar.	Fundamentals of Applied Mechanics	SaritaPrakashan, Pune.
2	R.S.Khurmi	Applied Mechanics	S. Chand
3	A. R. Basu	Engineering Mechanics	Tata MacGraw Hill, Delhi.
4	Patel, Sanghavi and Thakur	Engineering Mechanics	Mahajan Publishing House, Ahmedabad.

9.2 Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Beer-Johnson	Engineering Mechanics	Tata McGraw Hill, Delhi.
2	Joseph F. Shegley	Vector Mechanics for Engineers Vol-1 and 2	Tata McGraw Hill, Delhi.

9.3Internet and Web Resources

S. No.	Author	Title of Books	Publishers
1	WizIQ	https://www.wiziq.com/tutorials/applied-mechanics	-
2	NPTEL	https://nptel.ac.in/courses/122102004	-

9.4 Videos and Multimedia Tutorials

S. No.	Author	Title of Books	Publishers
1	NITTTTR	CDs of experiments in Engineering Mechanics.	-
2	NPTEL	CDs of experiments in Engineering Mechanics.	-

(MC302) MANUFACTURING PROCESSES

1. COURSE OBJECTIVES:

The students will be able to acquire knowledge of various manufacturing processes, tools, equipment's and Machines required for converting raw materials into finished product in the recommended manner. Knowledge about various Manufacturing processes and allied areas will be of great use to the personnel involved in production. This will provide the students an opportunity to skill themselves for the industrial scenario.

2. TEACHING AND EXAMINATION SCHEME

Semester	III									
Course code & course title		Periods/Week (in hours)			Total Hours	Examination Scheme				
						Theory Marks		Practical Marks		Total Marks
MC302		L	T	P	H	TH	TM	TW	PR/OR	
Manufacturing Processes		3	-	2	5	75	25	25	-	125

3. COURSE OUTCOMES:

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

MC302CO1: State basic manufacturing processes for manufacturing different components.

MC302CO2: Explain basic principles of various manufacturing processes and working of machine tools.

MC302CO3: Select the specific manufacturing process for getting the desired type of output.

MC302CO4: Compare various manufacturing processes in producing jobs.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	2	1	1	1	1	1	1	1	
CO2	2	2	1	1	1	1	1	1	1
CO3	3	3	2	3	3	3	2	2	2
CO4	3	3	2	3	3	2	2	2	2

Relationship: Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours			
Unit		M	Thr	CO
1. FOUNDRY		15	10	
1.1 PATTERN MAKING Introduction, Material used, types- Single piece, Multiple piece, Cope and drag pattern, gated pattern, Patterns allowances, introduction to Cores.				CO1 CO2 CO3 CO4
1.2 MOULDS Mould materials, Types of moulding sand, Moulding processes				
1.3 MELTING PRACTICE Construction and working of Cupola furnace & electrical furnace				
1.4 CASTING Casting principle and operation: Centrifugal, Pressure Die casting, Types of casting defects and remedies.				
2. WELDING		15	10	
2.1 Classification				CO1 CO2 CO3 CO4
2.2 MANUAL METAL ARC WELDING working Principle and procedure, polarity, Equipment & electrodes used,				
2.3 GAS WELDING working Principle and procedure, Types of gas welding flames and their applications, Equipment's used				
2.4 BRAZING AND SOLDERING Introduction, Principles & Applications				
2.5 WELDING DEFECTS Different types of welding defect and remedies				
3. METAL FORMING PROCESSES		6	10	
3.1 Basic working principle of mechanical and hydraulic press				CO1
3.2 SHEET METAL WORKING				CO2

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Trimming, Punching, notching, blanking, embossing, stamping and deep drawing.			CO3
3.2 FORGING Open die & Close die forging			CO4
4. LATHE	15	10	
4.1 Introduction, Description and functions of various parts of Centre lathe			CO1
4.2 Specification of Centre Lathe, Parameters- Speed, feed, Depth of cut according to materials.			CO2
4.3 Operations and tools- Turning, parting off, Knurling, facing, boring, threading, taper turning.			
5. DRILLING AND MILLING PROCESSES	20	12	
5.1 DRILLING Introduction, Classification of drilling machines, Nomenclature of a drill, Basic parts and their function- Sensitive, Radial drilling machine			CO1
5.2 Types of drilling operations, Types of drill and reamers			CO2
			CO3
5.3 MILLING Introduction, Classification of Milling machines, Basic parts and their function- Column and knee type milling machine			CO4
5.4 Types of milling operations, Types of milling cutters			
TOTAL	75	48	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies.

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Foundry	10	15
2	Welding	10	15

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3	Metal forming Processes	6	10
4	Lathe	10	15
5	Drilling and Milling Processes	12	20
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS.

No	Practical	Marks
	Practical Title	
1	To prepare a single piece pattern: One Job	2.5
2	To Prepare a mould cavity using split pattern: One Job	2.5
3	To prepare a welding job in flat and horizontal position by arc welding process	05
4	One turning job on lathe containing the operations like plain turning, step turning, grooving, knurling	7.5
5	One job on milling and drilling operation	05
6	One job on sheet metal	2.5
	Total	25

9. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	S.K Hajra Chaudhary & A. K. Hajra Chaudhary	Elements of workshop Technology – Volume I & II	Media Promoters and Publishers limited
2	P.N Rao	Manufacturing Technology (Foundry, Forming & Welding)	Tata McGraw Hill Publishers, New Delhi
3	O.P Khanna	A Textbook of Production Technology	Dhanpat Rai Publication, New Delhi
4	M. Adithan and A.B. Gupta	Manufacturing Technology	New Age International (P) Ltd, New Delhi

(ME301) MACHINE DRAWING

1. COURSE OBJECTIVES:

The students will be able to acquire knowledge to develop proficiency in reading and interpreting a wide variety of production drawings. Also, to impart skills in visualizing component assemblies and freehand sketching. Students will be able to use IS conventions on drawings; they should also be able to draw free hand proportionate orthographic views of machine components & assembly and detailed drawings of machine components.

2. TEACHING AND EXAMINATION SCHEME

Semester	III									
Course code & course title		Periods/Week (in hours)			Total Hours	Examination Scheme				
						Theory Marks		Practical Marks		Total Marks
ME301 Machine Drawing		L	T	P	H	TH	TM	TW	PR/OR	
		02	-	04	06	75	25	50	-	150

3. COURSE OUTCOMES:

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

ME301CO1: Define conventional representations, elements of production drawings, machine parts, pipe joints & weld joints.

ME301CO2: Demonstrate the skill of free hand sketching of machine components, assembly & detailed drawing of machine parts, piping & welding drawings.

ME301CO3: Interpret assembly and detailed drawings of machine components, piping & welding drawings.

ME301CO4: Develop the assembly and detailed drawings.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	2	1	1	1	2		2	2	1
CO2	2	2	2	1	1	1	2	2	1
CO3	3	3	3	1	2	2	2	2	2

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CO4	3	3	3	2	2	3	3	3	2
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Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

Marks	Thr = Teaching hours	CO = Course Objectives			
Unit			M	Thr	CO
1. Conventional Representations	09	03			
1.1 Conventional representation of different materials					CO1
1.2 Long and short break representation of pipes and shafts.					
1.3 Conventional representation for ball bearings, roller bearings, springs, screws, spoked wheels, studs, nuts and bolts.					
1.4 Representation of different types of sections.					
2. Free Hand Sketches	09	04			
2.1 Hexagonal headed bolt, washer and nut (Assembled & individual), Sunk key, Feather key, Woodruff key, Gib and cotter joint.					CO1
2.2 Muff Coupling, Flexible coupling, V-belt pulley and Flat belt pulley with arms.					CO2
2.3 Pipe Joints Socket joint, socket and spigot joint, union joint and expansion joint					
3. Assembly and Detailed Drawings	30	11			
3.1 Assembly drawings Knuckle joint, Protected type flange coupling, Foot step bearing, non-return Valve.					CO1 CO2
3.2 Detailed Drawings Socket and spigot joint, Universal coupling, Plummer block, simple eccentric.					CO3 CO4
4. Pipe Fittings, welds and Welded Joints	18	08			
4.1 Different types of pipe fittings Coupling, cap, Tee, elbows, cross, lateral, reducer, valves, union, plug. Single line and					

double line Representation of the pipe fittings.			CO1
4.2 Different types of welded Joints Lap joint, butt joint, Tee joint, corner joint, fillet weld.			
4.3 Representation of weld details on drawing Conventional/Sectional representation of fillet, butt, single and double U, V, J and Bevel weld, seam weld, spot weld. Chipping, grinding finish & machining finish & contour. Representation of weld on arrow side, site weld, weld all round, on other side, intermittent weld, weld length, weld size, concave & convex finish, flush finish.			
5. Elements of production Drawing	09	06	
5.1 Introduction to ISO system of tolerancing Elements of interchangeable system, hole and shaft-based system, limits, fits and allowances. Selection of Fit.			CO1 CO3
5.2 Geometrical Tolerances Types, terminology, representation of geometrical tolerances on drawings.			
5.3 Dimensional Tolerances Terminology, selection of dimensional tolerances, representation of dimensional tolerances on drawings.			
5.4 Surface Roughness Terminology, representation of surface roughness on drawings.			
Total	75	32	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Conventional Representations	03	09
2	Free Hand Sketches	04	09
3	Assembly and Detailed Drawings	11	30

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4	Pipe Fittings, welds and Welded Joints	08	18
5	Elements of production Drawing	06	09
	Total	32	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS.

No	Practical	Marks
1.	Fair sheet on conventional representation & freehand sketches	08
2.	Fair sheet on assembly drawing of machine Component	12
3.	Fair sheet on detail drawings of machine Component	12
4.	Fair sheet on piping & welded joints.	08
5.	Fair sheet on production drawing.	10
	Total	50

9. LEARNING RESOURCES

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	N.D. Bhatt. & V.M. Panchal	Machine Drawing	Charotkar publishing house
2	R.V. Mali & B.S. Chaudhari	Mechanical Engineering Drawing	Vrinda Publication
3	P. S Gill	A Text book of Machine Drawing	S.K. Kataria & Sons
4	N. Sidheswar, P. Kannaiah, VVS Sastry	Machine Drawing	Tata McGraw Hill
5	R. K. Dhawan	Machine Drawing	S. Chand

(MC 303) THERMAL ENGINEERING

1. COURSE OBJECTIVES:

Mechanical engineering diploma holders have to work with various power producing, power absorbing and heat transfer devices. In order to understand the principles, construction & working of these devices, it is essential to understand the concept of energy, work, heat & conversion between them. Thermal engineering includes the study of various sources of energy, basic laws & concept of thermodynamics, gas laws, properties of steam & generation. Heat transfer forms the basis for different power engineering application. Boilers find application in different process industries. Steam turbines and Condensers are the major component of any steam power plant. Mechanical engineer will be able to understand working and application of these devices.

2. TEACHING AND EXAMINATION SCHEME

Semester	III				Total				
Course code & course title	Periods/Week (in hours)	L	T	P	H	Examination Scheme			
						Theory Marks	Practical Marks	Total Marks	
THERMAL ENGINEERING						TH	TM	TW	PR/OR
		03	01	01	05	75	25	25	-

3. COURSE OUTCOMES:

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

MC303CO1: Define the various thermodynamic processes and gas laws.

MC303CO2: Explain the construction and working of various thermodynamic equipments.

MC303CO3: Solve various problems on laws of thermodynamics, gas laws, properties of steam and heat transfer.

MC303CO4: Compare the various types of thermodynamic equipments.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	3	1			1		2	2	1
CO2	3	3	1	2		1	2	2	1
CO3	3	2	2	2		1	3	3	2
CO4	3	3	1	1	1		1	2	1

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours			
Unit		M	Thr	CO
1 BASICS OF THERMODYNAMICS (No Numericals)		06	04	
1.1 Types of systems, Properties of systems, Extensive and intensive properties and their units				CO1
1.2 Work and Energy—Thermodynamic definition of work, heat, difference between and work, definition of potential energy, kinetic energy and internal energy.				
1.3 Concept of enthalpy and entropy.				
2. LAWS OF THERMODYNAMICS		12	07	
2.1 Laws of Thermodynamics—Zeroth's law, First law of Thermodynamics, Principle of conservation of energy, irreversibility.				CO1 CO3
2.2 Second Law of Thermodynamics, Kelvin Plank and Clausius statements, Applications to heat engines, refrigerator and heat pumps (simplenumericals).				
3 IDEAL GAS		15	10	
3.1 Concept of ideal gas, Charles Law, Boyle's Law, Gay-Lussac's Law, Avogadro's Law, Equation of state for a perfect gas				CO1 CO3
3.2 Characteristic gas equation (no derivation), Universal Gas constant (Simple Numericals).				
3.3 Ideal Gas Processes- Isobaric, Isochoric, Isothermal, Adiabatic and Polytropic processes with representation on P-V AND T-S diagram (simplenumericals).				
4. STEAM AND STEAM BOILERS		24	15	
4.1 Enthalpy and Entropy of water and steam, Generation of steam at constant pressure with representation on various charts such as T-H, T-S and H-S.				CO1
4.2 Properties of steam, quality of steam and use of steam tables. (Simple Numericals)				
4.3 Types of steam calorimeter – Barrel, Separating and Throttling (No Numericals).				

4.4 Steam Boilers- Classification of Boilers			CO2
4.5 Principle and Working of Packaged Type Fire Tube Boiler			CO3
4.6 Principle and working of Babcock and Wilcox, Lamont and Benson Boiler			CO4
4.7 Boiler mountings- construction and working of Water level indicator, Pressure gauge, Feed check valve, Spring loaded safety valve (Ramsbottom valve), blow-off cock and fusible plug.			
4.8. Boiler accessories- construction and working of Economiser, Air preheater and Superheater.			
5. HEAT TRANSFER	18	12	
5.1 Modes- Conduction, Convection and Radiation			
5.2 Fourier's law of heat conduction-Equation and terminologies.			
5.3 Heat transfer by conduction through a single slab (Simple Numericals)			
5.4 Heat Exchangers- Construction and working of Direct contact type, Indirect contact type, Parallel flow, Counter flow and Cross flow.			CO1
5.5 Condensers: Classification of condenser			CO2
5.6 Surface Condenser-Construction and working of 1.) Shell and tube type - Down flow 2) Evaporative condenser			CO3
5.7 Cooling Towers: Types, Construction and working of Natural draught, and Forced draught			CO4
Total	75	48	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies.

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Basics of Thermodynamics	04	06
2	Laws of Thermodynamics	07	12
3	Ideal Gas	10	15
4	Steam and Steam Boilers	15	24
5	Heat Transfer	12	18
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS.

No	Practical	Marks
1.	Demonstration of Babcock and Wilcox boiler model	5
2.	Study of Package boiler (Field visit/Video presentation)	5
3.	Study of Shell & Tube Heat Exchanger	5
4.	Demonstration of a cooling tower (Field visit/Video presentation)	5
5.	Study of surface condensers (Field visit/Video presentation)	5
	Total	25

9. LEARNING RESOURCES

9.1 Text Books

S. No.	Author	Title of Books	Publishers
1	Patel & Karamchandani	Elements of Heat Engines- VOL 1 & 2	Acharya Publications
2	R S. khurmi	A text book of Thermal Engg	S. chand
3	Pandya & Shah	Heat Engines Vol 1	Charotar publishing house Pvt Ltd
4	R K Rajput	Thermal Engg	Laxmi publications (pvt) ltd
5	P L Ballaney	Thermal Engg	Khanna Publishers.

9.2 Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	P K Nag	A text book of Engg Thermodynamics	McGraw Hill
2	R K Rajput	A text book of Engg Thermodynamics	Laxmi Publications (pvt.) Ltd

(AU301) GARAGE EQUIPMENT

1. COURSE OBJECTIVES:

The students will be able to familiarise with the various kinds of tools and equipment required in an auto repair shop. They will understand the functions and working principle of various tools and equipment. It will help them to develop the ability to choose the right tools and equipments in a garage and use it efficiently.

2. TEACHING AND EXAMINATION SCHEME

Semester	III				Total					
Course code & course title		Periods/Week (in hours)			Hours	Examination Scheme				
						Theory Marks	Practical Marks	Total		Marks
AU301		L	T	P	H	TH	TM	TW	PR/OR	
GARAGE EQUIPMENT		3	-	2	5	75	25	25	-	125

3. COURSE OUTCOMES:

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

AU301CO1. Describe the features and uses of various tools and equipments used in a garage.

AU301CO2. Explain the construction and working of various types of tools and equipment.

AU301CO 3. Select appropriate tool and/or process for the task associated with the repair of the vehicle.

AU301CO4. Propose the safety norms/procedures to be followed while using various Garage Equipments.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	2	1	1	2	1	1	2	2	2
CO2	2	2	1	2	1	1	2	2	2
CO3	1	2	2	3	2	2	3	2	2
CO4	1	2	2	2	3	2	2	2	2

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours	CO = Course Objectives		
Unit	M	Thr	CO	
1 HAND TOOLS & BODY SHOP EQUIPMENTS	18	10		
1.1 Spanners			CO1	
1.2 Pliers			CO2	
1.3 Creaper			CO3	
1.4 Scrapers			CO4	
1.5 Screw Drivers				
1.6 Taps				
1.7 Files				
1.8 Dies				
1.9 Punches				
1.10 Reamers				
1.11 Snips				
1.12 Allen Keys				
1.13 Torque Wrench				
1.14 Hammers				
1.15 Vices				
1.16 Nut Splitter				
1.17 Circlip Plier				
1.18 Stud Remover				
1.19 Mig Welder				
1.20 Dent Master				
1.21 Crash Repair System				
1.22 Body Alignment Jack				

1.23 Plasma Cutter			
1.24 Robotic Spot Welder			
2 SPECIAL TOOLS	15	10	
2.1 Battery Testing Equipment			CO1
2.2 Grease Guns			CO2
2.3 Mechanical And Hydraulic Jacks			CO3
2.4 Trolley Jack			CO4
2.5 Pulley Block			
2.6Screw Extractor			
2.7Piston Ring Expander			
2.8Valve Spring Compressor			
2.9Vehicle Props			
2.10Arbor Press			
2.11Tube Repair Kit			
2.12Spark Plug Tester			
2.13 Spark Plug Cleaner			
3 INSPECTION TOOLS	15	10	
3.1 Combination Set			CO1
3.2VernierCalipers			CO2
3.3 Pitch Gauges			CO3
3.4Cylinder Dial Gauge			CO4
3.5Dial Gauges			
3.6 Feeler Gauges			
3.7 Outside Micrometer			
3.8 Wire Micrometer			

3.9 Inside Micrometer			
3.10 Depth Gauge Micrometer			
3.11 Bevel Protractor			
3.12 Surface Plate			
3.13 V-Block			
3.14 Height Gauge			
3.15 Vernier Depth Gauge			
3.16 Trammels			
3.17 Callipers			
4 RECONDITIONING, SERVICING AND LIFTING EQUIPMENT	18	10	
4.1 Specifications And Use Of Air Compressor, Oil Pump Blowers			CO1
4.2 Car Washers-Water And Steam			CO2
4.3 Brake Drum Turning Lathe			CO3
4.4 Cylinder Honing Machine			CO4
4.5 Cylinder Boring Machine			
4.6 Cylinder Head Refacing Machine			
4.7 Valve Lapping			
4.8 Crankshaft And Cam Shaft Grinding Machine			
4.9 Valve Refacing Machine			
4.10 Flexible Shaft Grinder			
4.11 Sanders			
4.12 Polishers			
4.13 Engine Stands			
4.14 Tyre Changer			
4.15 Battery Charger			
4.16 Spray Painting Equipment			

4.17 Two&four Post Hydraulic Lifts			
4.18 Engine Lifting Tool			
4.19 Transmission Holding Tool			
5 INSPECTION AND TESTING EQUIPMENT	09	08	
5.1 Method Of Testing And Use Of Compression Gauge, Vacuum Gauge			CO1
5.2 Bearing Noise Tester			CO2
5.3 Tyre Pressure Gauge			CO3
5.4 Bosch Smoke Meter			CO4
5.5 Hartridge Smoke Meter			
Total	75	48	

6. COURSE DELIVERY:

The Course will be delivered through lectures and class room interactions.

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Hand tools	10	18
2	Special tools	10	15
3	Inspection tools	10	15
4	Reconditioning and servicing equipment	10	18
5	Inspection and testing equipment	08	09
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	DemonstrationanduseofTorquewrench.	
2.	DemonstrationanduseofOutsidemicrometer.	
3.	DemonstrationanduseofInsidemicrometer.	
4.	DemonstrationanduseofTrammel.	
5.	DemonstrationanduseofHydrometer.	
6.	DemonstrationanduseofCombinationset.	
7.	DemonstrationanduseofSparkplugTester.	
8.	DemonstrationanduseofFlywheelpuller.	
9.	DemonstrationofCylinderhoningmachine.	
10.	DemonstrationofCylinderboringmachine.	
11.	DemonstrationofCylinderheadrefacingmachine.	
12.	DemonstrationofCrankshaftandcamshaftgrindingmachine.	
13.	DemonstrationofValverefacingmachine.	
	Total	25

9. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	JamesD.Halderman	AutomotiveEngines,Theory&Servicing	Dorling Kindersley (India) Pvt. Ltd.
2	Venk&Spicer	AutomotiveMaintenance&Trouble Shooting	American Technical Society
3	Don Knowles	AutomotiveEngineering,Suspension &SteeringSystems,ShopManual	Delmar, Cengage Learning
4	Crouse&Anglin	AutomotiveMechanics	McGraw-Hill Companies
5	JackErjavec	AutomotiveEngineering Transmission&Transaxle	Cengage Learning
6	ShekharR.Narvekar	Garage equipment & Vehicle Testing	

(MC 304) COMPUTER AIDED DRAFTING

1.COURSE OBJECTIVES:

The students will be able to acquire knowledge of CAD software for preparing 2D and 3D drawings. The market driven economy demands frequent changes in product design to suit the customer needs and the introduction of drafting and designing softwares in manufacturing has made the task of incorporating frequent changes as per requirement easier. This course will make the student capable of creating, editing and plotting quality CAD drawings using CAD software.

2. TEACHING AND EXAMINATION SCHEME

Semester	III				Total	Examination Scheme				
Course code & course title		Periods/Week (in hours)			Hours	Theory Marks		Practical Marks		Total Marks
		L	T	P		TH	TM	TW	PR/OR	
COMPUTER AIDED DRAFTING		-	-	4	4	-	-	50	50	100

3.COURSE OUTCOMES:

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

MC304CO1: Identify the various Toolbars and commands required for making 2D & 3D drawing.

MC304CO2: Interpret the use of Toolbars & commands in making 2D & 3D drawing.

MC304CO3: Select the correct toolbars & commands in making 2D & 3D Drawings.

MC304CO4: Develop 2D & 3D drawing in CAD environment.

4. Mapping Course Outcomes with Program Outcomes

Relationship : Low-1 Medium-2 High-3

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	2	-	1	1		1	2		
CO2	2	1	1	1		1	2	1	
CO3	2	2	2	1		1	2	1	
CO4	2	2	3	2	2	2	3	2	2

5. DETAILED COURSE CONTENTS FOR TERM WORK & PRACTICALS

Marks	Phr = Practical hours			
Unit		M	Phr	CO
1 Introduction and CAD Preliminaries.		-	2	
1.1 Computer aided drafting concept.				CO1 CO2
1.2 Hardware and various CAD software available				
1.3 Components of a CAD software such as various toolbars in respective software's				
1.4 File features Management: (like New file, Saving the file, Opening, Import and Export of file)				
1.5 Setting up the CAD environment				
2 Drawing, Editing, Modifying and organizing 2D drawing:		-	28	
2.1 Drawing basic geometric elements				CO1 CO2 CO3 CO4
2.2 All View Commands: (like Zoom all, Zoom Previous, Zoom Extents, zoom window, zoom real time, Zoom Dynamic, Zoom Pan)				
2.3 All Modify commands / Transformation commands: such as Mirror, Array, Move, Scale, Trim, chamfer, fillet.				
2.4 Concepts of layers and blocks.				
3 Dimensioning and Tolerancing		-	12	
3.1 Dimensioning: Types of dimensioning, Linear, Horizontal, Vertical, Aligned, rotated, Baseline, continuous, diameter, radius, angular dimension, Leader.				CO1 CO2 CO3 CO4
3.2 Dimension scale variable, adding geometric tolerances				
3.3 Editing dimensions				
3.4 Text styles: selecting font, size, arrows, alignment, line text, Multiline text.				
4 Solid Modelling		-	16	

4.1 3D features such as understanding co-ordinate system, Viewing in 3D			CO1 CO2 CO3 CO4
4.2 Concept of solid modelling			
4.3 Creating predefined solid primitives such as box, cone, cylinder, sphere, torus, wedge.			
4.4 Creating an extruded solid, creating a revolved solid.			
4.5 Creating composite solids			
4.6 Rendering			
5 Model space, Paper space, viewports, layouts & Printing/Plotting	-	6	
5.1 Concept of model space and paper space			CO1 CO2
5.2 Creating viewports in model space and creating floating viewport in paper space.			
5.3 Shifting from model space to paper space and vice versa.			
5.4 Selecting various plotting parameters such as paper size, paper units, drawing orientation, plot scale, plot offset, plot area, print preview.			
Total	50	64	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies.

7. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS.

No	Practical	Marks
1.	Drafting of common template for all the following assignments with Institute logo and standard title block.	03
2.	At least Five problems on different geometrical shapes using basic commands.	05
3.	At least Three problems with transformation features.	07
4.	Two problems on orthographic views for various Engineering drawing objects covering dimensioning, text.	10
5.	Create at least two solid models, which cover all the features available in solid modelling.	15
6.	Drafting project: a) Civil Engg. & Architectural Engineering: Plan, elevation and section of a single-story residential building.	10

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	b) Electrical & Electronics and Allied Engg. Branches: Electrical layout of components like bulbs, fan, A.C., T.V. point, telephone point, etc. for a single-story house. c) Mechanical and Allied Engg. Branches: Industrial components such as machines, automobiles, jigs and fixtures with dimensioning, tolerancing, text, title block, Assembly etc. d) Shipbuilding Engg. Body plan of a ship. e) F.T.E.E.: Front View and Bottom View of a Simple truss like Saw Tooth truss, King-Post truss, Snow Tooth truss. (Any one of the three)	
	Total	50

8. LEARNING RESOURCES

8.1 Text Books

S. No.	Author	Title of Books	Publishers
1	P. Nageshwar Rao	AutoCAD for Engineering drawing made easy – P. Nageshwar Rao- Tata McGraw Hill.	Tata McGraw Hill.
2	SagarLinkan	AutoCAD 2018 training Guide	BPB Publications
3			
4	Sham Tickoo	PRO/ Engineer PTC creo parametric 3.0	Dreamtech Press (2015)
5	Sham Tickoo	Solid Works 2018	BPB Publication
6	Nader G. Zamani.	CATIA V5 Tutorials	SDC Publications

8.2 Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Sham Tickoo	Pro/ENGINEER Wildfire 5.0 for Designers	CADCIM Technologies
2	Sham Tickoo	AutoCAD 2019: A problem Solving Approach	BPB Publication
3	George Omura	Mastering AutoCAD	BPB Publication
4	Sham Tickoo	CATIA V5-6R2017 for Designers 15th Revised Edition	BPB Publication

(ME 401) STRENGTH OF MATERIALS

1. COURSE OBJECTIVES:

Through this course the students will be able to understand the fundamentals of solid mechanics, acquire the elementary knowledge of stresses, strains and their effects. They will also analyze the behavior of machine parts under various loads. It is important to understand and analyze various types of loads, stresses and strains, which are the main causes of failure of machine parts. The subject also deals with understanding the properties of engineering materials and applying the same in solving engineering problems.

2. TEACHING AND EXAMINATION SCHEME

Semester	IV				Total				
Course code & course title	Periods/Week (in hours)	L	T	P	H	Examination Scheme			
						Theory Marks	Practical Marks	Total Marks	
(ME 401) Strength of Materials						TH	TM	TW	PR/OR
		3	1	1	5	75	25	25	-

3. COURSE OUTCOMES:

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

ME401CO1: Describe behaviour of engineering materials under the action of external loads.

ME401CO2: Represent simple stress & strain, SF & BM, Moment of inertia, bending stresses & torsion.

ME401CO3: Solve various problems on simple stresses & strains, SF & BM diagrams, bending stresses, moment of inertia & torsion.

ME401CO4: Analyse the behaviour of materials under various loads.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimenting & Testing	Engg. Practices for Society, Sustainability	Project Management	Life-long Learning		
CO1	3	1	0	0	2	0	2	1	1
CO2	3	3	1	1	0	1	1	2	
CO3	3	2	2	1	0	0	2	3	1
CO4	3	3	2	1	1	1	2	2	1

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours			
Units:			M	Thr
1. SIMPLE STRESS AND STRAIN			15	10
1.1 Definition of stress and strain (Numericals on stress and strain)				
1.2 Stress – strain Curve for Ductile Material labeling the significant points on the curve.				
1.3 Concept of elastic limit, Hooks law & Young's Modulus of Elasticity				
1.4 Deformation expression of a body subjected to single force [$\delta l = PL/AE$]				
1.5 Numericals based on concept of principle of Superposition [Bars of uniform cross section & Bars of different cross sections only]				
1.6 Concept of lateral strain and Poisson's Ratio. [Numericals on lateral strain & Poisson's Ratio to be covered]				
1.7 Concept of shear stress, shear strain and Modulus of Rigidity.				
1.8 Definition of term- volumetric strain and bulk Modulus [No Numericals] Note: - [Numericals on stresses in composite sections are to be excluded.]				
2. SHEAR FORCE & BENDING MOMENT			15	10

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2.1 Types of beams and Supports.			CO1 CO2 CO3 CO4
2.2 Concepts of shear force & Bending Moment.			
2.3 Sign Conventions for shear force & Bending Moment.			
2.4 Shear force and bending moment diagram for simple cantilever and simply supported beams subjected to point and uniformly distributed load only.			
3. MOMENT OF INERTIA	15	10	
3.1 Definition of Moment of Inertia			CO1 CO2 CO3
3.2 Perpendicular & Parallel Axis Theorem.			
3.3 Expression of M.I of Rectangular, circular, Triangular & hollow Rectangular sections (No derivations, simple numericals).			
3.5 Numericals on sections like L section, T section and I section			
4. THEORY OF SIMPLE BENDING	15	09	
4.1 Concept of pure Bending.			CO1
4.2 Theory of simple Bending, Neutral Axis and Bending equation.			CO2
4.3 Bending stress distribution diagram			CO3
4.4 Application of bending equation for solid rectangular, solid circular section, hollow rectangular and hollow circular section. (simple numericals)			CO4
5. TORSION	15	09	
5.1 Concept of pure Torsion			CO1 CO2 CO3 CO4
5.2 Torsion equation assumptions in Theory of pure torsion.			
5.3 Strength of circular solid & hollow shaft in pure torsion.			
5.4 Shear stress distribution diagram.			
5.5 Polar Modulus, power transmitted by shaft.			
Total	75	48	

N.B: - Question paper will not carry questions on derivations

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and tutorials.

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	SIMPLE STRESS AND STRAIN	10	18
2	SHEAR FORCE & BENDING MOMENT	10	18
3	MOMENT OF INERTIA	10	15
4	THEORY OF SIMPLE BENDING	09	12
5	TORSION	09	12
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS.

No	Practical (no 1 and 2 are compulsory and any 03 from 3 to 8)	Marks
1.	Tensile Test on M.S or Al using UTM	4
2.	Compression Test on wood/Resin sample using UTM	3
3.	Shear Test on M.S using UTM	3
4.	Brinell Hardness Test on Hardness Testing Machine	3
5.	Rockwell Hardness Test on Hardness Testing Machine	3
6.	Izod Impact Test on M.S or Al.	3
7.	Charpy Impact Test on M.S. or Al.	3
8.	Torsion Test on M.S Specimen.	3
	Total	25
No	Tutorial Exercise	
1	Solve atleast 5 problems on unit 1	
2	Solve atleast 5 problems on unit 2	
3	Solve atleast 5 problems on unit 3	
4	Solve atleast 5 problems on unit 4	
5.	Solve atleast 5 problems on unit 5	

9. LEARNING RESOURCES

9.1 Text Books

S. No.	Author	Title of Books	Publishers
1	R.S Khurmi	Strength of Materials	S.Chand Publisher
2	S.S. Bhavikatti	Strength of Materials	Vikas Publishing
3	S. Ramamurtham	Strength of Materials	DhanpatRai&Sons
4	R. K. Rajput	Strength of Materials	S.Chand Publisher

9.2 Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	F.L. Singer	Strength of Materials	London Harper & row
2	Timoshenko & Gere	Mechanics of Materials	CBS Publisher &Distributors, New Delhi

(MC402) MECHANICAL WORKSHOP PRACTICE

1.COURSE OBJECTIVES:

The students will be able to acquire knowledge to Plan methodology and prepare the job as per given specification by selecting and applying appropriate manufacturing process and Understand the concepts, procedures, types of cutting tools, work holding devices, various operations performed on these machines, their working principles and practices related to various manufacturing processes.

2. TEACHING AND EXAMINATION SCHEME

Semester	IV				Total				
Course code & course title	Periods/Week (in hours)	L	T	P	H	Examination Scheme			
						Theory Marks	Practical Marks	Total Marks	
(MC402) MECHANICAL WORKSHOP PRACTICE						TH	TM	TW	PR/OR
		-	-	04	-	-	-	50	50
									100

3. COURSE OUTCOMES:

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

MC402CO1: Identify different types of machine tools and machining processes to produce a component.

MC402CO2: Outline a manufacturing sequence to produce a given part.

MC402CO3: Apply basic skills in the use of various machine tools (milling m/c, grinding machine, shaper and lathe) to perform job following safety guidelines.

MC402CO4: Plan a maintenance schedule for effective functioning of machine tools.

4. Mapping Course Outcomes with Program Outcomes

Relationship: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO 1	3	1	1	2	2	1	1	1	1
CO 2	3	2	2	1				1	1
CO 3	3	2	2	3	1	1	1	2	2
CO 4	2	1	2	3	1	1	1	1	2

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5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks		Phr = Practical hours		
Unit	M	Phr	CO	
1. LATHE.				
1.1 Introduction to types of Lathe.			CO1 CO2 CO3	
1.2Centre Lathe: Tool nomenclature, thread cutting operation. Preventive maintenance, maintenance schedule and lubrication chart. Types of Coolants.				
1.3Introduction to Capstan and turret lathe, Principal parts of capstan and turret lathe.				
1.4Introduction to CNC lathe, main elements of CNC lathe, Hand operation, operating element. CNC operation- operating and control elements, co-ordinate system. CNC programming- methods of programming-absolute system and Incremental system, Preparatory functions (G-functions), CNC program input format.				
2. Milling machine				
2.1Introduction, column and knee type milling machine (horizontal and vertical), milling cutters, milling operations.			CO1 CO2 CO3 CO4	
2.2Universal dividing head-construction and working, Indexing-direct and simple indexing only.				
2.3Preventive maintenance, maintenance schedule and lubrication charts. Coolants.				
3 Grinding.				
3.1Introduction, grinding machine types. Work holding devices.			CO1 CO2 CO3	
3.2Types of abrasive and bond. Grite, Grade and structure of wheel, dressing and truing of wheel, marking system, mounting of wheel, balancing of wheel.				
3.2Use of Coolant				
4 Shaper.				
4.1Introduction to Shaper.			CO1 CO2 CO3 CO4	
4.2 Main parts of standard shaper, work holding devices shaper operations.				
4.3Preventive maintenance schedule and lubrication chart.				
Total		64		

6. COURSE DELIVERY:

The Course will be delivered through shop talk, shop floor interactions, demonstrations, assignments, video clips and Practicals.

7. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

Sr. No	Unit No	Practicals/Assignment	Phrs
1	1	Job on external threading	04
2	1	Prepare simple job on CNC machine	04
3	2	Produce a hexagonal head/spur gear by indexing device	08
4	2	Machine sides of a rectangular block (centre lathe/milling machine) and mill two slot or opposite sides and a V-groove on one side (V-block)	08
5	3	Prepare job on the following grinding machine 1) Surface grinder-flat surface-01 2) Cylindrical grinder-cylindrical surface-01	04
6	3	Grind lathe tool	04
7	4	Machine two flat horizontal opposite sides of the rectangular block on a shaper (to complete V-block. at Sr. No 4)	08
8	1,2,4	Prepare a preventive maintenance schedule(daily/monthly) and a lubrication chart for any one of the following machine tools (1) Centre lathe (2) Milling machine (3) Shaper	06
09	1,2,4	Identify different types of machine tools in your workshop and write down its specifications and uses	04

Note: A field visit to modern workshop to be arranged during the semester

8. LEARNING RESOURCES

8.1 Text Books

S. No.	Author	Title of Books	Publishers
1	S.K Hajara Chaudhary	Elements of W/s Technology Vol I & II	Media Promoter & Publisher Pvt. Ltd
2	Raghuwanshi	Workshop Technology Vol II	DhanpatRai& Co
3	P.C Sharma	Production Technology	S. Chand & Co
4	Kaushik and Gupta	Workshop Technology	

8.2 Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	R.K Jain	Production Technology	Khanna Publishers
2	W.A.J Chapman	Workshop Technology Vol I& II	CBS

(AU401) AUTOMOBILE ENGINES

1. COURSE OBJECTIVES :

The students will be able to understand fundamentals of IC engines and associated systems. They will know the construction, working and function of engine components, engine cooling, lubrication and fuel feed systems. They will be able to dismantle and assemble engines using appropriate tools and following safety procedures. They will also learn to trouble shoot faults and suggest remedies to problems with engine and associated systems.

2. TEACHING AND EXAMINATION SCHEME

Semester	IV				Total	Examination Scheme				
Course code & course title		Periods/Week (in hours)			Hours	Theory Marks		Practical Marks		Total Marks
AU401 AUTOMOBILE ENGINES		L	T	P	H	TH	TM	TW	PR/OR	
		3	-	2	5	75	25	25	25	150

3. COURSE OUTCOMES:

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

AU401CO1. List the components of automobile, IC engine and associated systems and state the functions of each.

AU401CO2. Describe terminology and fundamentals of automobile engines and associated systems.

AU401CO3. Explain construction and working of engine components and associated systems.

AU401CO4. Apply the knowledge of automobile engines and associated systems for trouble shooting of faults.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	1	1			1	1	2	1	1
CO2	2	1	1	1	1	1	2	1	1
CO3	2	2	2	2	2	1	2	2	2
CO4	3	3	2	2	2	1	2	2	2

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours	CO = Course Objectives			
Unit			M	Thr	CO
1. ENGINE PRINCIPLES AND FUNDAMENTALS	9	6			
1.1 Introduction- Components of an automobile					CO1
1.2 Basic engine terminology, Engine cycles, Classification of automobile engines.					CO2
1.3 Working of 2-stroke and 4 stroke cycle petrol and diesel engines, Comparison of 2 - stroke & 4- stroke engines, Comparison of C.I. & S.I. engines, Firing order, Comparison of single and Multi cylinder engines, Number and arrangement of engine cylinders, Numbering of Engine cylinders.					
2. CONSTRUCTIONAL DETAILS OF BASIC ENGINE COMPONENTS	18	12			
2.1 Introduction-Parts of engine					CO1
2.2 Constructional details-I					CO2
Cylinder block, Cylinder head, Crank case, Oil pan, Manifolds, Gaskets, Cylinder liners, Piston, Piston rings, Connecting rod and Piston pin.					CO3
2.3 Constructional details-II					CO4
Crankshaft, Engine bearings, Valve timing, Poppet valves, Valve cooling, Valve seats, Valve actuating mechanisms, Camshafts, Camshaft arrangements, Flywheel, Vibration damper and Mufflers.					
2.4 Engine Service					
3. ENGINE COOLING SYSTEM	15	10			
3.1 Introduction- Heat developed in an engine, Purpose of cooling system					CO1
3.2 Methods of cooling- Air cooling system, Water cooling system (pump circulation system), Comparison of air and water cooling system.					CO2
3.3 Main components of water cooling system - Water jackets, Radiator, Expansion tank, Radiator pressure cap, Thermostat, Water pump, Radiator fan, Drive belt, Coolant temperature indicator and gauges, Coolant level indicator.					CO3
3.4 Coolants and anti-freeze solutions.					CO4
3.5 Cooling system trouble shooting.					
4. LUBRICATION SYSTEM	15	10			

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4.1 Introduction- Purpose of lubrication, Parts to be lubricated.			CO1
4.2 Requirements of lubricants, Types of lubricants, Viscosity rating, Service rating, Additives for lubricants, Effects of engine conditions on lubricating oil, Critical lubrication conditions for engines, Consumption of lubricating oil.			CO2 CO3 CO4
4.3 Engine Lubrication systems – Petroil lubrication system, Wet sump lubrication system, Splash lubrication system, Pressure lubrication system, Dry sump lubrication system, Pre-Lubrication system.			
4.4 Main components of Pressure lubrication system – Oil strainers, Oil pumps, Pressure relief valve, Oil filters, Oil coolers, Oil level indicators, Oil pressure gauges, Oil pressure warning light.			
4.5 Lubrication system trouble shooting.			
5. FUELS AND FUEL SYSTEMS	18	10	
5.1 Introduction- Petroleum, Hydrocarbons, Refining of crude oil, Desirable properties of engine fuels.			CO1 CO2 CO3 CO4
5.2 Types of auto engine fuels- Petrol (Gasoline) as fuel, Characteristics of gasoline, Octane rating, Diesel as fuel, Characteristics of diesel, Cetane rating. Alternative fuels – Alcohols, CNG, LNG, LPG, Bio-diesel.			
5.3 Auto fuel safety considerations.			
5.4 Fuel supply systems- Components of fuel feed system in petrol engine, Functions of a carburetor, Construction and working of a simple carburetor, Basic working principle of Petrol injection system, Comparison of petrol injection system with carburetor method.			
5.5 Components and basic working principle of fuel feed system in Diesel engine, Air fuel mixture ratio in petrol and diesel engines.			
5.6 Fuel supply system trouble shooting.			
Total	75	48	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies.

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Engine principles and fundamentals	6	9
2	Constructional details of basic Engine components	12	18
3	Engine cooling system	10	15
4	Lubrication system	10	15
5	Fuel and fuel systems	10	18
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Operate a cut section model to explain 2-stroke engine.	
2.	Operate a cut section model to explain 4-stroke engine.	
3.	Dismantling, examination and re-assembling of different engine parts of Petrol Engine.	
4.	Dismantling, examination and re-assembling of different engine parts of Diesel Engine.	
5.	Dismantling, checking, cleaning and refitting of various parts of water cooling system in automobiles.	
6.	Maintenance of Lubrication system in automobiles.	
7.	Carburettor overhauling, float adjustment and tuning.	
	Total	25

9. LEARNING RESOURCES

9.1 Text Books

S. No.	Author	Title of Books	Publishers
1	Dr. Kirpal Singh	Automobile Engineering Vol. 2	Standard Publisher Distributors
2	Crouse/Anglin	Automotive Mechanics	McGraw Hill Education
3	Anil Chhikara	Automobile Engineering Vol. 1 - Engine System	SatyaPrakashan, New Delhi
4	G.B.S. Narang	Automobile Engineering	Khanna Publishers

9.2 Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	M.L Mathur, R.P Sharma	Internal Combustion Engines	DhanpatRai Publications
2	K. Newton, W. Steeds, T. K. Garrett	The Motor Vehicle	Butterworth-Heinemann

(AU402) AUTOMOBILE TRANSMISSION SYSTEMS

1. COURSE OBJECTIVES:

The students will be able to illustrate the vehicle layouts, chassis frame & location of various systems. They will know the principle, construction and working of clutch, gearboxes, propeller shafts, universal joints, slip joints & final drive in the transmission system. They will understand the terminology of wheels & tyres. They will be able to dismantle and assemble different transmission systems using appropriate tools and following safety procedures.

2. TEACHING AND EXAMINATION SCHEME

Semester	IV								
Course code & course title		Periods/Week (in hours)			Total Hours	Examination Scheme			
						Theory Marks	Practical Marks	Total Marks	
AU402		L	T	P	H	TH	TM	TW	PR/OR
Automobile Transmission Systems		3	-	2	5	75	25	25	25
									150

3. COURSE OUTCOMES:

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

AU402CO1. List the different types of units and components which comprise the chassis and drive systems of an automobile and state the functions of each.

AU402CO2. Explain the construction and working of the different components of the chassis and drive systems of an automobile.

AU402CO3. Illustrate the construction of the various components of the chassis and the drive systems of an automobile.

AU402CO4. Apply the knowledge of the various components of the chassis and drive systems of an automobile for trouble shooting of faults.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	3	1	0	0	1	1	2	1	1
CO2	3	2	2	2	2	2	2	2	2
CO3	3	1	1	2	0	1	3	2	1
CO4	1	2	2	3	2	2	2	3	2

Relationship :Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours	CO = Course Objectives			
Unit	M	Thr	CO		
1 Vehicle layout and Chassis frame:	15	10			
1.1 Classification and specifications of Chassis- 2-Wheeler, Passenger car, Commercial Vehicle.			CO1		
			CO2		
1.2 Vehicle layout & its types—2 Wheel Drive- Front Engine Front Wheel Drive, Rear Engine Rear Wheel Drive, Front Engine Rear Wheel Drive & 4 Wheel Drive.			CO3		
			CO4		
1.3 Major assemblies – their locations and functions.					
1.4 Various loads acting on chassis frame.					
1.5 Functions of frames, Type of frames-Conventional frame, Integral or unit construction, Monocoque and Space frame construction, Half integral and half frame chassis.					
1.6 Trouble shooting					
2 Clutch	15	10			
2.1 Functions of Clutch.			CO1		
2.2 Principles of operation of clutch.			CO2		
2.3 Various types of clutches used in Automobiles – single plate diaphragm clutch, multiplate clutch - dry & wet clutches			CO3		
			CO4		
2.4 Materials used for clutch lining.					

2.5 Hydraulic& mechanical clutch linkage, Cable operated clutch linkage.			
2.6 Trouble shooting			
3 Gear Box	15	10	
3.1 Function and necessity of Gear Box.			CO1
3.2 Types, construction and working of gear boxes & their layouts such as sliding mesh, constant mesh, synchromesh type, vario - drive, transfer case.			CO2
3.3 Gear shift mechanism.			CO3
3.4 Concepts of automatic gear box.			CO4
3.5 Torque Converter- principle, construction and working			
3.6 Trouble shooting			
4 Propeller shafts, universal joints, slip joints, Wheels and Tyres	15	10	
4.1 Necessity and function of Propeller Shaft.			CO1
4.2 Drive line for front wheel drive-Constant velocity joint.			CO2
4.3 Drive line for rear wheel drive-Universal joint and slip joint.			CO3
4.4 Types of wheels, rims and tyres.			CO4
4.5 Tyre materials, construction.			
4.6 Necessity and types of treads.			
4.7 Tyre inflation and its effect.			
4.8 Tyre rotation and nomenclature.			
4.9 Trouble shooting			
5 Final drive	15	08	
5.1 Principle, Necessity and function of final drive and differential.			CO1
5.2 Construction & Working of differential			CO2
5.3 Limited slip differential.			CO3
5.4 Types of rear axles such as full floating type, semi – floating and three quarter floating.			CO4
5.5 Transmission in two wheeler- chain drive and belt drive.			

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5.6 Trouble shooting			
Total	75	48	

6. COURSE DELIVERY:

The Course will be delivered through lectures and class room interactions.

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Vehicle layout and Chassis frame	10	15
2	Clutch	10	15
3	Gear Box	10	15
4	Propeller shafts, universal joints, slip joints, Wheels and Tyres	10	15
5	Final drive	08	15
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Identify different parts of the chassis.	
2.	Dismantling and Assembling of a single plate clutch.	
3.	Dismantling and Assembling of a multi plate clutch used in two wheelers.	
4.	Dismantling and assembling of a Synchromesh gear box.	
5.	Dismantling and assembling of automatic transmission devices such as torque converter, vario drives.	
6.	Dismantling and assembling of propeller shaft, universal joint and slip joint.	
7.	Dismantling and assembling of a differential.	

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8.	Dismantling and assembling of tyres, wheels and rims.	
	Total	25

9. LEARNING RESOURCES

9.1 Text Books

S. No.	Author	Title of Books	Publishers
1	Anthony Schwaller	Motor automotive technology	Delmar Publisher Inc.
2	Tim Gills	Automotive service	Delmar Publisher Inc.
3	Anil Chikkara	Automobile Engineering Vol. II	SatyaPrakashan New Delhi
4	Crouse / Anglin.	Automobile Mechanics	TATA McGraw – HILL
5	Kirpal Singh	Automobile Engineering Vol.I	Standard Publication
6	HarbansSingh Royat	The Automobile	S. Chand Publication
7	R.B. Gupta	Automobile Engineering	SatyaPrakashan New Delhi
8	S. Srinivisan	Automotive Mechanics	TATA McGraw – HILL
9	H M Sethi	Automotive Technology	TATA McGraw – HILL

9.2 Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	R.K Rajput	A text book of Automobile Engineering	Firewall Media
2	John Whipp	Transmission Chassis & related systems	Cengage Learning EMEA

MC 404) Fluid Machinery

1. COURSE OBJECTIVES:

The students will be able to acquire knowledge to apply the concept introduced in Fluid Machinery to engineering applications such as turbo machinery and flow measurement. Fluid machinery plays an important role in the conversion of hydraulic energy to mechanical energy and vice-versa. Hydraulic turbines are used for meeting our day-to-day power demands. Also, different types of pumps are essential equipment in all the industries. Hydraulic systems have a wide range of applications in machine tools, material handling, marine, mining, metal processing, equipment and other fields.

2. TEACHING AND EXAMINATION SCHEME

Semester	IV				Total	Examination Scheme				
Course code & course title		Periods/Week (in hours)			Hours	Theory Marks		Practical Marks		Total Marks
(MC 404) Fluid Machinery		L	T	P	H	TH	TM	TW	PR/OR	
		03	-	02	05	75	25	25	-	125

3. COURSE OUTCOMES:

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

MC404CO1: Define various terms related to fluid mechanics & fluid machineries.

MC404CO2: Explain fluid properties, fluid pressure, fluid flow, water turbine, pumps, accumulator & intensifier.

MC404CO3: Apply laws and theorems on statics and dynamics to calculate various parameters of fluids, flowing through pipes and various devices.

MC404CO4: Classify fluids, fluid flow, water turbines & pumps.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	2	1		1			1	1	1
CO2	2	1	1	1	1	1	2	2	1
CO3	3	3	3	2	1	1	2	2	1
CO4	3	2	1	1	2	1	3	1	1

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours			
Unit		M	Thr	CO
1 Introduction to fluid mechanics and Pressure Measurement		12	10	
1.1 Definition and classification of fluids, Branches of hydraulic -Hydrostatics & Hydrodynamics				
1.2 Fluid properties Density, Specific gravity, specific weight - (Simple Numerical) Viscosity, surface tension, capillarity, compressibility (No Numerical)				
1.3 SI Units of Pressure, Pressure head, Atmospheric pressure, Positive and Negative Gauge pressure, Absolute pressure (Simple Numerical on pressure, pressure head and conversion to equivalent heads of other liquids)				
1.4 Pascal's Law and its applications.				
1.5 Pressure measuring devices Manometers-principle & working of piezometer tube, simple 'U' tube, differential 'U' tube and inverted 'U' tube manometers (Simple Numerical)				
1.6 Bourdon pressure gauge-its working principle & constructions, Calibration of pressure gauges				CO1 CO2 CO3 CO4
2 Hydrostatics		12	06	
2.1 Total pressure, Centre of Pressure				
2.2 Pressure on plane surfaces immersed in liquid – horizontally, vertically & inclined to free surface, calculation of total pressure and determination of position of centre of pressure for circular, triangular & rectangular surfaces immersed vertically and inclined in one type liquid. (Simple Numerical)				CO1 CO2 CO3
3 Hydrodynamics		21	14	
3.1 Types of flow - steady; unsteady, - uniform, non-uniform, laminar and turbulent flow, compressible, incompressible flow.				

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3.2 Continuity equation, Energies of liquid - pressure head, Datum head, velocity head, Total energy of liquid, Bernoulli's theorem (Simple Numerical)			
3.3 Application of Bernoulli's theorem: Pitot tube, Venturi-meter (Simple Numerical on Discharge through Horizontal Venturi-meter)			CO1
3.4 Definition of orifice, types, Vena contracta, Hydraulic coefficients Cc, Cv and Cd, Discharge through a circular orifice. (Simple Numerical)			CO2
3.5 Laws of fluid friction, Reynold's number and its significance, Various losses in pipe flow- major and minor losses- loss of head due to entrance, sudden enlargement, sudden contraction. (Simple numerical on loss of head due to friction, sudden expansion and contraction)			CO3 CO4
3.6 Hydraulic gradient line, Total energy line (No numerical)			
3.7 Water hammer in pipes - causes, effect and remedial measures			
4 Water Turbines (No numerical in this unit)	12	08	
4.4 Water Turbines: Classification of water-turbines			
4.5 Impulse turbines: Pelton Turbine-Construction and working			
4.6 Reaction Turbines: Francis Turbine- construction and working, Kaplan turbine – Construction and working			CO1
4.7 Difference between Impulse turbine and Reaction Turbine			CO2
4.8 Advantages and Disadvantages of Francis Turbine over a Pelton wheel			CO4
5 Pumps, Accumulator and Intensifier (No numerical in this Unit)	18	10	
5.1 Centrifugal Pumps: Classification, construction & working, Types of casings, Types of impellers, Multistage centrifugal pumps, pumps in series, pumps in parallel, Priming, Cavitation, faults & remedies of centrifugal pumps. Definition of Static head, delivery head, manometric head, NPSH			
5.2 Reciprocating pumps: Classification of reciprocating pumps, Construction and working of single acting reciprocating pump, Slip and negative slip, Air vessels, functions of air vessels.			
5.3 Difference between centrifugal pump and reciprocating pump.			CO1
5.4 Construction, working and application of rotary vane pump, External Gear pumps			CO2
5.5 Construction, working and application of Accumulator and Intensifier			CO4
Total	75	48	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Introduction to fluid mechanics and Pressure Measurement	10	12
2	Hydrostatics	06	12
3	Hydrodynamics	14	21
4	Water Turbines	08	12
5	Pumps, Accumulator and Intensifier	10	18
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS.

No	Practical	Marks
1.	Measurement of pressure of water in a pipe by manometer	03
2.	Verification of Bernoulli's theorem	03
3.	Determination of coefficient of Discharge of Venturi meter	03
4.	To determine the relationship between loss of head and velocity for pipe flow	03
5.	Demonstrate the construction and operation of a Pelton Turbine	04
6.	Demonstrate the construction and operation of a Francis Turbine	03
7.	Demonstrate the construction and operation of a Centrifugal Pump	03
8.	Demonstrate the construction and operation of a Reciprocating Pump	03
	Total	25

9. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	R.K. Rajput	Fluid Mechanics and Hydraulic Machines	S. Chand Ltd
2	R.K. Bansal	Fluid Mechanics and Hydraulic Machines	LaximiPvt. Ltd
3	R.S. Khurmi	A Text book of Hydraulics, Fluid Mechanics and Hydraulic Machines	S. Chand Ltd
4	P.N. Modi/S.M. Seth	Hydraulics and Fluid Mechanics including Hydraulic Machines	RajsonsPvt. Ltd

(AU403) ORGANISATIONAL BEHAVIOUR

1. COURSE OBJECTIVES:

The students will be able to link the theories of Organisational Behaviour with all the managerial actions undertaken during the course of their careers as Engineers, while also exhibiting the appropriate etiquette in both social as well as professional environments.

2. TEACHING AND EXAMINATION SCHEME

Semester	IV				Total				
Course code & course title	Periods/Week (in hours)	L	T	P	H	Examination Scheme			
						Theory Marks	Practical Marks	Total Marks	
AU403						TH	TM	TW	PR/OR
Organisational Behaviour	4	0	0		4	75	25	-	-
									100

3. COURSE OUTCOMES:

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

AU403CO1: Understand the scope and implications of various life skills & concepts of Organisational Behaviour in any Industrial setup.

AU403CO2: Explain the relationships between various life skills and Organisational Structures and cultures in any industrial setup.

AU403CO3: Identify appropriate behavioural pattern and etiquettes while operating in both a social and professional environment.

AU403CO4: Propose various measures, using the appropriate life skills to manage real life management situations occurring in a variety of Organisational settings.

4. Mapping Course Outcomes with Program Outcomes

CO /PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	1	0	0	0	2	3	3	0	2
CO2	1	0	1	0	2	3	3	0	3
CO3	1	0	1	0	2	3	3	0	2
CO4	1	0	2	0	2	3	3	0	3

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours	CO = Course Objectives		
Unit	M	Thr	CO	
1. Fundamentals of Organisational Behaviour	9	5		
1.1 Definition of OB			CO1	
1.2 Scope & Implications of OB				
1.3 Relationship between OB & Industry				
1.4 Evolution of OB				
1.5 Limitations of OB				
2. Individual Behaviour	27	18		
2.1 Attitudes at the workplace – Definition of Attitudes, Components of Attitude, Types of job-related Attitude			CO1 CO2 CO3 CO4	
2.2 Job Satisfaction – Factors conducive to job satisfaction, Effect of Job Satisfaction on Employee Performance. Importance of high job satisfaction.				
2.3 Values – Definition of Values, Value System, Importance of Values, Sources for our value systems, Types of Values.				
2.4 Assertiveness – Necessity for Assertiveness, Non-assertive Behaviour, Aggressive Behaviour, Tips or Techniques to develop assertive Behaviour.				
2.5 Emotional Intelligence – Gender differences in Emotions, Skills involved in				

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Emotional Intelligence.			
2.6 Time Management – Benefits of Time Management, Obstacles to Effective Time Management.			
2.7 Motivation – Types of Motivation, Locus of Control, Creators & Victims, Theories of Motivation – Theory of Wage Incentive, Maslow's theory of Motivation.			
2.8 Stress Management-Work Stress, Sources of work Stress, Consequences of Work Stress, Managing Stress			
3. Group Behaviour	24	15	
3.1 Work Teams – Definitions of Work Groups & Work Teams, Types of Teams – Problem Solving, Self Managed Work Teams & Cross functional Teams. Lessons for effective Team building.			CO1
3.2 Leadership – Styles of Leadership, Leadership Qualities, Significance of Leadership			CO2
3.3 Conflict Resolution Skills – definition of Conflict, Views on Conflict, Levels of Conflict, Causes of Conflict, Methods of avoiding conflicts, Constructive and Destructive Conflict, Advantages & disadvantages of Conflict, Conflict Management Styles, Conflict Resolution Process.			CO3
3.4 Negotiation Skills – Need for Negotiation, Features of Negotiation, Negotiation process, Negotiation Types, Negotiation Concepts (BATNA and ZOPA)			CO4
4. Organization Systems	9	6	
4.1 Organization structure, Key Elements in design of Organization Structure – work Specialization, Departmentalization, Chain of Command, Span of Control, Centralization and decentralization, Formalization.			CO1
4.2 Virtual Organization, Boundary-less Organization			CO2
4.3 Organization Culture, Characteristics of Organization Culture.			CO3
5. Corporate Ethics & Etiquette	6	4	CO4

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5.1 Basic courtesy & Good mannerism			CO1
5.1 General Rules of Behaviour			CO2
5.2 Body Language			CO3
5.3 Personal Dressing & Grooming			CO4
5.4 Telephone Etiquette			
5.5 Dining Etiquette			

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies.

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Fundamentals of Organisational Behaviour	5	9
2	Individual Behaviour	18	27
3	Group Behaviour	15	24
4	Organization Systems	6	9
5	Corporate Ethics & Etiquette	4	6
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Exercise on Attitude Survey	3
2	Exercise on Values	3
3	Exercise on Motivation	3
4	Exercise on Group Behaviour	5

5	Exercise on Conflict Handling	3
6	Exercise on Bureaucratic Orientation Test	3
7	Exercise on Stress Analysis	5
	Total	25

9. LEARNING RESOURCES

9.1 Text Books

S. No.	Author	Title of Books	Publishers
1	Stephen Robins Timothy Judge Neharika Vohra	OrganisationalBehaviour	
2	M. N. Mishra	OrganisationalBehaviour	
3	K. Ashwathappa	OrganisationalBehaviour	
4	Fred Luthans	OrganisationalBehaviour	

9.2Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	UdayPareek	Understanding OrganisationalBehaviour.	
2	Niraj Kumar	OrganisationalBehaviour	

(AU501) AUTO TRAINING I

1. COURSE OBJECTIVES:

During the course of Industrial training a student will get an opportunity to familiarize himself with the industrial environment & work culture. The student will get detailed insights into management systems, roles of different departments and would also obtain a hands-on experience in the use of the various tools, machines, equipment & instruments used in the auto industry. This phase of training would also enable him to assimilate more effectively the theory taught to him on his return to the Institute for the subsequent terms.

2. TEACHING AND EXAMINATION SCHEME

Semester	V					
Course code & course title	Examination Scheme					
	TERM WORK		PR/OR		Total Marks	
	AU501 AUTO TRAINING I	DAILY DAIRY	PROGRESSIVE ASSESSMENT	TRAINING REPORT		SEMINAR / VIVA
	50	50	50	50	GRADE	

3. COURSE OUTCOMES:

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

AU501CO1: Describe the layout of the industry, organization structure and roles and responsibilities of different departments in the auto industry.

AU501CO2: Make use of various tools, machines, equipment & instruments used in the automotive industry following proper procedures and safety norms.

AU501CO3: Execute repairs and maintenance of vehicle systems as per standard operating procedures under supervision.

AU501CO4: Prepare training report and give oral presentation related to training undertaken.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	3	2	2	2	2	2	2	2	2
CO2	3	3	2	3	3	2	3	3	2
CO3	3	3	3	3	3	2	3	3	3
CO4	2	0	0	0	0	3	2	2	2

Relationship: Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours	CO = Course Objectives	
Unit			CO
1 COMPANY INFORMATION			
1.1 Collect information about the industry 2.2 Understand the plant/factory layout, organization structure and roles and responsibilities of different departments in the auto industry.			CO1
2 TRAINING JOBS			CO2 CO3 CO4
Students are required to perform and/or familiarize themselves with at least 4 of the following jobs/ assignments/tasks during the training period:			
1. Periodic Maintenance Servicing of a vehicle 2. Dismantling & Assembling of an Engine 3. Dismantling & Assembling of a gear Box/Transmission 4. Dismantling & Assembling of a Clutch 5. Dismantling & Assembling of a Driveline & Differential 6. Dismantling & Assembling of a Suspension System 7. Engine Tune-up 8. Maintenance & Repair of a Braking System 9. Maintenance & Repair of a Steering System 10. Maintenance & Repair of a Engine Cooling System 11. Maintenance & Repair of the Electrical/Electronic Systems 12. Maintenance & Repair of the Hydraulic/Pneumatic Systems 13. Body Engineering aspects of Denting / Sheet metal work 14. Body Engineering aspects of Painting 15. Body Engineering aspects of Corrosion Protection 16. Body Engineering aspects of Chassis lubrication			

6. COURSE DELIVERY:

The Course will be delivered through In-plant training.

7. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS

No	Practical	Marks
1.	DAILY DIARY Every student undergoing In-plant Training is required to maintain a 'Daily Diary' in the prescribed booklet supplied to them, giving a brief account of the various activities performed during the day for the entire period of the training. The entries should be authenticated /validated on a regular basis by the supervising authority at the place of work.	50

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2.	PROGRESSIVE ASSESSMENT The evaluation system will also include three assessments during the training period. There will be two assessments done at the institute wherein a student will be required to give a presentation of the jobs undertaken by him during his training. Besides these there will also be an assessment done at the industry in consultation with industry personnel.	50
3.	TRAINING REPORT	50
	The student is expected to write a detailed 'Training Report', in a hard bound booklet as per the format provided by the department. The report should include information about the company, organization structure, plant/workshop layout and details of jobs/assignments/major activities undertaken during the training supported with diagrams, pictures, graphs etc. Assessment of Training Report be based on Knowledge, Presentation, Quality of contents and Sketches.	
4.	SEMINAR/VIVA The appointed examiners shall assess the trainee based on their training report and performance in viva.	50
	Total	200

Note:

1. Grades will be awarded based on marks scored as follows:

- a. 80% and above Marks – Grade 'A'
- b. 60% to 79% Marks – Grade 'B'
- c. 40% to 59% Marks – Grade 'C'
- d. Marks below 40% - Grade 'D'

2. TW and PR/OR shall be separate heads of passing. Student has to secure minimum Grade 'C' for passing.

3. Student with Grade D, under the Head TW, shall be declared T.N.G. and a student whose term is granted but obtains Grade D, under the Head PR/OR, shall be declared Failed/ATKT.

1. COURSE OBJECTIVES:

Every automobile possesses various kinds of electrical/electronic equipment required for the functioning of the vehicle and sometimes simply as supporting systems to the main vehicle system. This course provides valuable insight into these areas while equipping a student with the necessary fundamentals to tackle problems arising out of malfunctioning of any of these systems.

2. TEACHING AND EXAMINATION SCHEME

Semester	VI				Total Credits	Examination Scheme				
Course code & course title		Periods/Week (in hours)			Total Credits	Theory Marks		Practical Marks		Total Marks
AU601 AUTOMOTIVE ELECTRICAL & ELECTRONICS SYSTEM		L	T	P		TH	TM	TW	PR/OR	
		3	-	2	5	75	25	25	25	150

3. COURSE OUTCOMES:

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

AU601CO1: Identify the various electrical and electronic components and systems used in automobiles.

AU601CO2: Describe the functions of various electrical and electronic components and accessories used in automobiles.

AU601CO3: Explain the construction and working of various automotive electrical components and systems.

AU601CO4: Apply the knowledge for troubleshooting and maintenance following standard procedures and safety norms.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	3	2	2	0	2	2	2	2	2
CO2	2	0	2	0	0	2	1	2	2
CO3	3	2	2	2	0	2	2	2	1
CO4	3	3	2	3	3	3	3	3	3

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours			
Unit		M	Thr	CO
Unit 1 AUTOMOTIVE BATTERIES		18	10	
1.1 Lead Acid battery its construction and operation, main components, chemical action.				CO1 CO2 CO4
1.2 Maintenance-Free batteries- construction				
1.3 Battery ratings and specifications.				
1.4 Battery maintenance and safety precautions.				
1.5 Battery testing – Open circuit test, Hydrometer Test, Load Test.				
1.6 Battery charging- Slow and fast rate charging and trickle charging.				
1.7 Jump Starting- Procedure and precautions.				
1.8 Battery failures– cycle failure, internal short circuit, overcharging, local action and sulphation.				
Unit 2 WIRING AND ELECTRICAL ACCESSORIES		15	10	
2.1 Role of electricity in modern vehicles and energy demand.				CO1 CO2 CO3
2.2 Automotive Lighting: Purpose and construction of each lamp.				
2.2.1 Head lamps: Beam setting and adjustments				
2.2.2 Halogen lamps (components)				
2.2.3 Auxiliary lamps: Driving Lamps, Fog Lamps				
2.3 Headlight reflectors: parabolic and bi-focal				
2.4 Automotive Wiring:				
2.4.1 Electric cables: Cable sizes				
2.4.2 Cable colour codes				
2.4.3 Wiring harness				
2.4.4 Types of cables (Advantages and Disadvantages).				
2.4.5 Symbols used in electrical wiring.				
2.4.6 Insulated & Earth return systems				
2.4.7 Positive & negative earth systems.				
2.5 Accessories: Construction and Working of				
2.5.1 Ignition warning light				
2.5.2 Horn relay				
2.5.3 Magnetic or coil type Fuel gauge				
2.5.4 Windscreen Wiper Mechanism.				
Unit 3 ELECTRIC MOTORS AND GENERATORS		12	08	
3.1 DC motors: -Principle, Construction and applications.				CO1 CO2 CO3 CO4
3.2 AC motors: -Principle, Construction and applications.				
3.3 Stepper Motor- Principle, construction, applications and specifications.				
3.4 Introduction, working principle of Alternator.				
3.5 Purpose of charging system.				
3.6 Advantage of an Alternator.				
3.7 Alternator: its construction and operation, main components, Rectification from AC to DC.				
3.8 Regulators: Electronic voltage regulator and its advantages.				

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3.9 Maintenance, trouble shooting and its remedies.			
Unit 4 STARTING SYSTEM	15	10	
4.1 Construction and working of starting system.			CO1 CO2 CO3 CO4
4.2 Types of starter drive (Bendix and overrunning clutch types only) construction and working.			
4.3 Testing of starting system – Quick testing, Current draw test, Insulated circuit resistance test, Ground circuit test, No crank test, free speed test.			
Unit 5 IGNITION SYSTEM	15	10	
5.1 Need of ignition system.			CO1 CO2 CO3
5.2 Conventional ignition system: its construction and operation, main components. - (Ignition coils, distributor, contact breaker, dwell angle, ballast resistor, capacitor).			
5.3 CDI system: its construction and operation.			
5.4 Distributer-less ignition system: its construction and operation.			
5.5 Electronic ignition system with contactless trigger: its construction and operation.			
5.6 Electronic Spark advance.			
Total	75	48	

6. COURSE DELIVERY:

The course will be delivered through lectures, class room interactions, exercises and case studies.

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Automotive Batteries	10	18
2	Wiring and Electrical Accessories	10	15
3	Electric Motors and Generators	08	12
4	Starting System	10	15
5	Ignition System	10	15
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS.

Sr. No.	Practical	Marks
1	Study of various components Lead Acid Battery.	
2	Study of various components of different types of Ignition system.	
3	Study of automotive wiring system.	
4	Study of various components of a Dynamo.	
5	Study of various components of an Alternator.	
6	Study of various components of a Starter Motor.	
	Total	25

9. LEARNING RESOURCES

9.1 Text Books

S. No.	Author	Title of Books	Publishers
1	Al Santini	Automotive Technology (Electricity and Electronics)	Cengage Learning
2	W. Crouse & D. Anglin	Automotive Mechanics	McGraw Hill
3	A.W Judge	Auto Electrical Maintenance	Sir Isaac Pitman & Sons
4	P. L. Kohli	Automotive Electrical	Tata McGraw-Hill
5	C.P. Nakra	Auto Electrical Systems	Dhanpat Rai Publication

(AU602) ADVANCE AUTOMOBILE ENGINES

1. COURSE OBJECTIVES:

This subject deals with the aspects of injection systems in both Petrol as well as Diesel Engines, while also covering up topics like supercharging, emission control which are important features of the modern day automobile. It also provides a student with a brief insight into the diagnostics of the engine.

2. TEACHING AND EXAMINATION SCHEME

Semester	VI									
Course code & course title		Periods/Week (in hours)			Total Credits	Examination Scheme				
						Theory Marks		Practical Marks		Total Marks
AU602 ADVANCE AUTOMOBILE ENGINES		L	T	P	C	TH	TM	TW	PR/OR	
		3	-	2	5	75	25	25	25	150

3. COURSE OUTCOMES:

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

AU602CO1: Describe the fundamentals of various automobile engine systems.

AU602CO2: Explain the operating principles, construction and functions of various automobile engine systems.

AU602CO3: Select appropriate diagnostic tools for inspection and troubleshooting of faults associated with different automobile engine systems.

AU602CO4: Analyse engine condition by performing various tests.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	3	2	2	0	0	2	2	3	2
CO2	3	2	2	0	2	2	2	2	1
CO3	3	3	2	3	3	3	3	3	3
CO4	3	3	2	3	3	3	2	2	2

Relationship: Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours				
Unit		M	Thr	CO	
Unit 1 THEORY OF COMBUSTION		12	06		
1.1 Stages of combustion in SI engine				CO1	
1.2 Effect of engine variables on Ignition lag.					
1.3 Effects of engine variables on flame propagation					
1.4 Abnormal combustion- Detonation, pre-ignition and their effects					
1.5 Control of detonation.					
1.6 Stages of combustion in CI engine					
1.7 Air Fuel ratio in Diesel engines					
1.8 Delay period and variables affecting delay period.					
1.9 Diesel knock and its control.					
Unit 2 PETROL & DIESEL ELECTRONIC INJECTION SYSTEM		18	12		
2.1 Petrol EFI systems: - Functions, Operating Principles.				CO1 CO2 CO3	
2.2 Air-Fuel ratio metering & requirement, Stoichiometric A/F ratio					
2.3 Types of Petrol EFI systems: - TBI & MPFI. Comparison of MPFI and TBI systems.					
2.4 Main components of the Petrol EFI system					
2.4.1 Air Induction system components & its function: - Air Filters, Throttle body assembly, Air box & Intake Manifold.					
2.4.2 Fuel Injection system & its function: - Fuel Tank & Electric Fuel Pumps, Fuel Pressure Regulator & Fuel Lines, Fuel Filters, Fuel Accumulator, Fuel Injector Design & operation.					
2.4.3 Electronic control system: - Functions & Composition of the Engine Control Unit.					
2.5 Sensing Devices & its applications in EFI: - O2 sensors, Thermistors, Potentiometers, Pressure sensors, Mass Air Flow sensors, Hall Effect Switches, Optical Sensors, Detonation sensors.					
2.6 Actuating devices & its applications in EFI: - Solenoids, Relays.					
2.7 Diesel EFI systems: - Functions, Operating Principles.					
2.8 Types of Diesel EFI systems: - EUI & CRDI					
2.9 CRDI: - Main components and their function (Fuel tank and Transfer pump, Fuel Filters, High pressure fuel pump, Fuel metering control valve, Fuel rail pressure control valve, Fuel rail pressure sensor, Common rail, Fuel Injectors.					
2.9.1 Common Rail Fuel Injection sub-systems: - Low pressure, High pressure delivery and fuel leak back circuit					
2.10 Advantages of a CRDI system over conventional systems.					
Unit 3 FUEL ECONOMY, AIR POLLUTION AND EMISSION CONTROL		15	08		
3.1 Fuel Economy standards.					
3.2 Pollutants from gasoline engines.					
3.3 Gasoline engine emission control, Catalytic Converters.					

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3.4 Diesel emission, Diesel smoke and control			CO1 CO2 CO3
3.5 Electronically controlled Exhaust-Gas recirculation (EGR) system.			
3.6 Positive crankcase ventilation (PCV) system			
3.7 Electric assist choke system			
3.8 Evaporation emission control system.			
3.9 Euro Norms and Bharat stage Norms.			
3.10 Theory of Gas Analysis. (Concentration Sampling, Constant Volume Sampling)			
Unit 4 SUPERCHARGERS AND TURBOCHARGERS	12	10	CO1 CO2 CO3 CO4
4.1 Introduction and Objectives of supercharging			
4.2 Supercharging of SI and CI engines, its effects on performance			
4.3 Supercharging Limits			
4.4 Reducing Supercharger drag			
4.5 Types of Superchargers: Construction and Operation of Root type, Spiral or (Scroll) type, Centrifugal type.			
4.6 Turbocharger, its construction, operation, main components			
4.7 Electronically controlled Waste-gate.			
4.8 Turbocharger Lag			
4.9 Turbocharger trouble diagnosis and service.			
Unit 5 I.C. ENGINE TESTING AND DIAGNOSTICS	18	12	CO3 CO4
5.1 Engine Power – Indicated, Brake and Frictional Power.			
5.2 Efficiency- Mechanical, Thermal, Relative and Volumetric.			
5.3 Morse test, Motoring test.			
5.4 Heat Balance Sheet.			
5.5 Diagnostic Trouble Codes.			
5.6 Technical Service Bulletins.			
5.7 Pinpoint testing. (Testing of a load component. Testing of PCM)			
5.8 Purpose, Function, Advantages & Limitation of the following diagnostic Equipment. Scan tools. Breakout Boxes. Non-Powered Test Lights. Logic Probes.			
Total	75	48	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Theory Of Combustion	6	12
2	Petrol & Diesel electronic Injection System	12	18
3	Fuel Economy, Air Pollution And Emission Control	08	15
4	Superchargers And Turbochargers	10	12
5	I.C. Engine Testing And Diagnostics	12	18
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Performance Test on Single Cylinder 4-stroke SI or CI Engine.	
2	Performance Test on Double Cylinder 4-stroke SI or CI Engine.	
2.	Heat Balance Test of Single Cylinder 4-Stroke CI Engine.	
3.	Morse Test on 4-Stroke Double Cylinder CI Engine.	
4.	Study of Induction and Exhaust system of Turbocharged Engine.	
5.	Study of injection system for SI system.	
6.	Study of injection system for CI system.	
7.	Perform Exhaust Gas Analysis of an engine exhaust using gas Analyzer.	
	Total	25

9. LEARNING RESOURCEText

Books

S. No.	Author	Title of Books	Publishers
1	W. Crouse & D. Anglin	Automotive Mechanics	McGraw Hill
2	Ken Pickerill	Automotive Engineering (Engine Performance)	CENGAGE Learning
3	Joseph Heitner	Automotive Mechanics	Automotive Mechanics
4	Tim Gills	Automotive Service	Delmar Publisher Inc.

(AU603) AUTOMOBILE CHASSIS AND BODY SYSTEMS

1. COURSE OBJECTIVES:

The students will be able to comprehend information on automotive aerodynamics, body construction & design and vehicle corrosion prevention. They will gain fundamental knowledge on the construction and working of steering, suspension, braking and HVAC systems in an automobile. They will also be able to attain basic knowledge on the maintenance, troubleshooting and diagnosis of the steering, suspension, braking and HVAC systems.

2. TEACHING AND EXAMINATION SCHEME

Semester	VI				Total Credits	Examination Scheme				
Course code & course title		Periods/Week (in hours)			Total Credits	Theory Marks		Practical Marks		Total Marks
		L	T	P		TH	TM	PR/OR	TW	
AU603 AUTOMOBILE CHASSIS AND BODY SYSTEMS		3	-	2	5	75	25	-	25	125

3. COURSE OUTCOMES:

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

AU603CO1: State the purpose and necessity of different automobile chassis and body systems.

AU603CO2: Describe the fundamentals of different automotive chassis systems and automotive aerodynamics.

AU603CO3: Explain the construction and working of different automobile chassis and body systems.

AU603CO4: Apply the knowledge for diagnosis and troubleshooting of issues related to automobile chassis and body systems.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	3	1	2	0	0	2	2	2	1
CO2	3	2	2	0	1	2	2	2	2
CO3	3	2	2	1	2	2	2	3	2
CO4	3	3	3	3	3	3	3	3	3

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours	CO = Course Objectives			
Unit	M	Thr	CO		
Unit 1 STEERING SYSTEMS	15	10			
1.1 Front Wheel Assembly & Types of Axles.					
1.2 Purpose & necessity of steering systems.					
1.3 Types of Steering gears: 1.3.1 Recirculating ball type: Construction & working. 1.3.2 Rack and Pinion type: Construction & working.					
1.4 Power steering systems: 1.4.1 Hydraulic Power Steering: Construction & working. 1.4.2 Electronic Power Steering: Construction & working.					
1.5 Front Wheel geometry, Wheel alignment & Balancing					
1.6 Diagnosis and troubleshooting of steering systems					
Unit 2 SUSPENSION SYSTEMS	18	12			
2.1 Purpose & necessity of suspension systems.					
2.2 Types of springs: - Coil, Leaf, Torsion, Air spring.					
2.3 Types of Shock absorber: - Twin-tube shock, Mono-tube, Spring-assisted.					
2.4 Dependent and Independent systems: Features, Advantages of Independent over dependent type.					
2.5 Front & Rear Suspension systems: 2.5.1 Coil spring Suspension: Double wishbone type / Short-Long arm type (SLA): Construction & Main Parts. 2.5.2 MacPherson Strut Suspension: Construction & Main Parts. 2.5.3 Leaf Spring Suspension: Construction & Main Parts. 2.5.4 Torsion Bar Suspension: Construction & Main Parts. 2.5.5 Air suspension system: Construction & Main Parts.					
2.6 Anti-Roll / Stabilizer Bar					
2.7 Diagnosis & troubleshooting of Suspension systems.					
Unit 3 BRAKING SYSTEMS	18	12			
3.1 Purpose and necessity of braking system.					
3.2 Classification of brakes and braking systems.					
3.3 Principle, construction and working of – disc brakes, drum brake					
3.4 Construction and working of the following braking systems: 3.4.1 Mechanical braking system 3.4.2 Hydraulic Braking system. 3.4.3 Air Braking system.					
3.5 Properties of Brake material, Brake fluids and their specifications					
3.6 Parking Brakes					
3.7 Diagnosis & troubleshooting of Braking systems.					

Unit 4 BODY ENGINEERING AND AERODYNAMICS	12	8	
4.1 Introduction to body engineering: Vehicle body requirements, Visibility, Classifications based on type of construction and body shapes.			
4.2 Monocoque and Space frame construction.			
4.3 Vehicle major body sections & nomenclature of various structural body parts: Front section, Centre section and Rear section.			
4.4 Industrial Automotive Painting: Study of different stages involved in Automotive Painting			
4.5 Vehicle body protection & rust prevention techniques: 4.5.1 Conversion Coatings 4.5.2 Hot Melt Wax Coatings 4.5.3 E-Coating 4.5.4 Metallic Coatings 4.5.5 Organic & Powder Coatings			CO2
4.6 Vehicle Aerodynamics: Introduction and its Importance			
4.7 Various Aerodynamic Forces: Aerodynamic Lift and Aerodynamic Drag			
4.8 Concept of an Airfoil, Basics of Boundary layer flow and Flow separation.			
4.9 Down Force and Grounding effect.			
4.10 Diffusers, Spoilers, Dams, Wings, Vortex generators			
Unit 5 AUTOMOTIVE AIR CONDITIONING	12	6	
5.1 Purpose of the HVAC system.			
5.2 Air conditioning components (Function, Construction and Operation) 5.2.1 Compressor (Piston type, Vane type, Swash plate type) 5.2.2 Condenser. 5.2.3 Evaporator. 5.2.4 Orifice tube. 5.2.5 Thermostatic Expansion Valve. 5.2.6 Receiver-dryer. 5.2.7 Accumulator.			CO1 CO2 CO3
5.3 Servicing of AC systems. 5.3.1 Refrigerant Identification. 5.3.2 Vacuum Pump. 5.3.3 Evacuating Procedure. 5.3.4 Refrigerant Charging. 5.3.5 Refrigerant Recovery.			
Total	75	48	

6. COURSE DELIVERY:

The course will be delivered through lectures, class room interactions, exercises and case studies.

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	STEERING SYSTEMS	10	15
2	SUSPENSION SYSTEMS	12	18
3	BRAKING SYSTEMS	12	18
4	BODY ENGINEERING AND AERODYNAMICS	08	12
5	AUTOMOTIVE HEATING, VENTILATION AND AIR CONDITIONING	06	12
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS.

No	Practical	Marks
1.	Study of different Steering section:- Recirculating ball, Rack & Pinion, hydraulic power steering.	
2.	Study of different Suspension systems:- Twin-Tube type Shock absorber MacPherson, SLA, Leaf spring type.	
3.	Study of different types of braking systems.	
4.	Diagnosis & Troubleshooting of Braking systems.	
5.	Study of automotive HVAC system.	
6.	Dismantling and Assembling of Master cylinder, wheel cylinder assembly.	
7.	Diagnosis & Troubleshooting of Steering & Suspension systems.	
8.	Servicing of air conditioning system.	
	Total	25

9. LEARNING RESOURCES

9.1 Text Books

S. No.	Author	Title of Books	Publishers
1	Anthony Schwaller	Motor Automotive Technology	Delmar Publisher Inc.
2	Crouse / Anglin	Automobile Mechanics	Tata McGraw- Hill
3	Kirpal Singh	Automobile Engineering Vol.I	Standard Publication
4	R.B. Gupta	Automobile Engineering	Satya Prakashan New Delhi
5	S. Srinivisan	Automotive Mechanics	Tata McGraw- Hill

9.2 Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Boyce H. Dwiggin	Automobile Conditioning Air	THOMSON LEARNING
2	Tim Gills	Automotive Service	Delmar Publisher Inc.
3	Anil Chikara	Automobile Engineering Vol. II	Satya Prakashan New Delhi

(AU604) MODERN AUTOMOTIVE SYSTEMS

1. COURSE OBJECTIVES:

The students will be able to gain exposure to several modern automotive technologies related to stability, suspension and braking, safety, comfort and convenience, vehicle engine & drive train systems. They will also be able to attain basic knowledge on the working principle, construction and working of such modern automotive systems.

2. TEACHING AND EXAMINATION SCHEME

Semester	VI				Total Credits	Examination Scheme				Total Marks
Course code & course title		Periods/Week (in hours)			Total Credits	Theory Marks		Practical Marks		Total Marks
		L	T	P		TH	TM	PR /OR	TW	
AU604 MODERN AUTOMOTIVE SYSTEMS		3	-	-	3	75	25	-	-	100

3. COURSE OUTCOMES:

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

AU604CO1: Demonstrate understanding of fundamentals of various modern automotive systems. AU604CO2: Describe the block diagram of various modern automotive systems.

AU604CO3: Explain the constructional features, working principles and functions of various modern automotive systems.

AU604CO4: Compare the advantages and disadvantages between modern versus conventional automotive systems.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	3	2	2	3	2	2	2	2	3
CO2	3	2	2	2	1	2	2	2	2
CO3	3	2	2	2	2	3	3	2	2
CO4	3	0	0	0	2	2	2	1	2

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours	CO = Course Objectives			
Unit	M	Thr	CO		
Unit 1 Modern Automotive Braking, Suspension & Stability systems	20	12			
1.1 Antilock Braking Systems: Working Principle, Construction & main components, Operation & Basic Troubleshooting.					
1.2 Traction Control Systems: Working Principle, Construction & main components, Operation.					
1.3 Electronic Stability Control Program: Construction & main components, Operation, ESP features.					
1.4 Electronic Brake Force Distribution: Construction & Operation.					
1.5 Active Suspension System: Working Principle, Construction & Operation.					
1.6 Liquid Filled Engine Mountings: Operation.					
1.7 Four Wheel Steering: Working Principle, Main Components, and Operation.					
Unit 2 Modern Automotive Safety Systems	15	12			
2.1 Crumple Zones: Necessity, Main Features and Working Principle.					
2.2 Laminated and Tempered Glass: Main Features, Advantages & Applications.					
2.3 Advanced Automatic Collision Notification: Necessity, Main components, Operation.					
2.4 Airbags: Necessity, Types & Location of Airbags, Construction & main components, Operation.					
2.5 Auto Retracting Seat belts: Pre-tensioner & Force Limiter, Construction & Operation.					
2.6 Pedestrian Protection Systems: Necessity, Methods used for Pedestrian Protection (FPS, Active Bonnet, Pedestrian Airbags)					
2.7 Reverse Backup Sensors: Electromagnetic v/s Ultrasonic types, Main components and Working.					
2.8 Adaptive Headlamps: Necessity, Construction & main components, Working principle.					
2.9 Collision Mitigation Braking System: Necessity, Main components, Working.					
2.10 Whiplash protection system: Whiplash, Necessity, Working Principle.					
2.11 Child Safety Seats: Necessity, Types of Child Seats.					
2.12 Collapsible Steering: Necessity and Working Principle.					
Unit 3 Modern Automotive Engine Systems	15	8			

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3.1 Variable Valve Timing: Variable Valve Lift & Variable Cam Phasing, Necessity, Working, Advantages			CO1 CO2
3.2 Variable Geometric Turbines: Necessity, Main components, Working, Advantages.			
3.3 Variable Displacement Engines: Necessity, Working principle, Advantages.			CO3 CO4
3.4 Start- Stop Systems: Necessity, Main Components, Working.			
3.5 Hybrid Engine Vehicles: Working Principle, Main components, Advantages over Conventional Engines.			
3.6 Electric Vehicles: Working Principle, Advantages over Conventional Engines			
3.7 Flexible Fuel Vehicles: Flex-Fuel Production, Flex Fuel advantages over Conventional Fuels (Petrol, Diesel)			
3.8 Gasoline Direct injection: Principle of Working, Benefits over M.P.F.I. systems			
Unit 4 Modern Automotive Comfort & Convenience Systems	15	10	CO1 CO2 CO3 CO4
4.1 Telematics: Scope & Applications of telematics in modern automobiles			
4.2 Keyless Go & Push Button Ignition: Features, Basic components & Working, Advantages.			
4.3 Power Windows: Comparison with traditional windows, Basic components & working.			
4.4 Power & Memory Seats: Features and Benefits, basic components.			
4.5 UV & IR reducing glass: Features and benefits.			
4.6 Heads Up Display: Features & Benefits, Basic components and working.			
4.7 Adaptive Cruise Control: Features and Advantages, Main components and working.			
Unit 5 Modern Automotive Drive Train Systems	10	6	CO1 CO2 CO3 CO4
5.1 Electronic Limited Slip Differential: Necessity, Benefits over conventional types, Working principle.			
5.2 Run-Flat & Self Sealing tires: Construction and advantages over conventional types.			
5.3 Tire pressure-monitoring systems: Necessity, Main components & Basic working.			
Total	75	48	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and tutorials.

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Modern Automotive Braking, Suspension & Stability systems	12	20
2	Modern Automotive Safety Systems	12	15
3	Modern Automotive Engine Systems	08	15
4	Modern Automotive Comfort & Convenience Systems	10	15
5	Modern Automotive Drive Train Systems	06	10
	Total	48	75

8. LEARNING RESOURCES

8.1 Text Books

S. No.	Author	Title of Books	Publishers
1	William B. Ribbens	Understanding Automotive Electronics	6 th Edition, Newnes/ Butter worth Heinemann Woburn.
2	Crouse / Anglin	Automobile Mechanics	Tata McGraw- Hill
3	Robert N Brady	Automotive computers and Digital Instrumentation	A Reston Book, Prentice Hill, Eagle Wood Cliffs, New Jersey.
4	Ronald K Jurgen	Navigation and Intelligent Transportation systems – Progress in technology	Automotive Electronics Series, SAE, USA.
5	Bechhold	Understanding Automotive Electronics	SAE.
6	LjuboVlagic, Michel Parent and Fumio Harashima	Intelligent Vehicle Technologies	Butterworth-Heinemann publications, Oxford.

8.2 Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Robert Bosch	Automotive Handbook	SAE, 2000
2	Allan W M B	Automotive Computer Controlled Systems	Elsevier Butterworth-Heinemann.

(AU605) AUTOMOBILE WORKSHOP PRACTICE

1. COURSE OBJECTIVES

To provide students with the basic knowledge and skills required in the adjustments, testing, maintenance and repair of various automobile systems. The students will be able to demonstrate various skills required while working on jobs using appropriate tools, equipments, instruments and following safety norms and procedures. Students will be able to do troubleshooting of faults in automotive systems.

2. TEACHING AND EXAMINATION SCHEME

Semester	VI				Total Credits	Examination Scheme				
Course code & course title		Periods/Week (in hours)			Total Credits	Theory Marks		Practical Marks		Total Marks
		L	T	P		TH	TM	TW	PR/OR	
AU605 AUTOMOBILE WORKSHOP PRACTICE		-	-	5	5	-	-	50	50	100

3. COURSE OUTCOMES:

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

AU605CO1: Identify various tools, equipments and instruments used in automobile workshop.

AU605CO2: Explain various procedures to be followed for testing repairs and maintenance in automobile workshop.

AU605CO3: Execute testing, repairs and maintenance of various automotive systems using appropriate tools and equipments following proper procedures and safety norms.

AU605CO4: Apply the knowledge for fault finding and trouble shooting.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	3	2	2	3	0	2	2	2	2
CO2	2	3	2	2	2	2	2	2	1
CO3	3	3	2	3	3	2	3	3	3
CO4	3	3	3	2	2	2	3	3	3

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours	CO = Course Objectives	
Unit	M	Thr	CO
1 Automobile Workshop Basics		12	
1.1 Safety Precautions 1.2 Protective clothing 1.3 Measuring tools 1.4 Fasteners, sealants and cleaning liquids. 1.5 Automotive hand tools 1.6 Workshop tools and equipments			CO1
2 Engine testing and overhauling		30	
2.1 Introduction 2.2 Cylinder bore measurement and calculation of oversize. 2.3 Crankshaft journal measurement and calculation of undersize. 2.4 Troubleshooting 2.5 Compression tests on petrol/diesel engines - Dry & Wet test 2.6 Valve clearance adjustment 2.7 Valve timing 2.8 Lapping of valve seat			CO1 CO2 CO3 CO4
3 Maintenance of Petrol and Diesel engine fuel system		18	
3.2 Introduction 3.3 Carburetor 3.3 Fuel pump of petrol engine 3.4 Fuel injection pump of diesel engine 3.5 FIP timing. 3.6 Fuel injector 3.7 Testing fuel injector			CO1 CO2 CO3 CO4
4 Wheel mechanics		18	
4.1 Introduction 4.2 Wheel balancing of rimmed and alloy wheels 4.3 Wheel alignment			CO1 CO2 CO3 CO4
5 Auto Body work practice		24	

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5.1 Introduction			
5.2 Automobile body repair			
5.3 Removing of dents			
5.4 Paints and varnishes			
5.5 Materials used for painting			
5.6 Preparation of surface			
5.6.1 Patching/Body filling, Levelling, Priming, Surfacing			
5.7 Painting equipment			
5.7.1 Air-compressor and spray-gun,			
5.7.2 Its use, care and maintenance and operating instructions			
5.8 Type of Spray-painting and advantages of spray painting.			
5.9 Manual spray painting			
5.10 Rust protection			
Total	-	96	-

CO1
CO2
CO3

6. COURSE DELIVERY:

The Course will be delivered through class room interactions, practicals and field visits.

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Automobile Workshop Basics	12	
2	Engine testing and overhauling	30	
3	Maintenance of Petrol and Diesel engine fuel system	18	
4	Wheel mechanics	18	
5	Auto Body work practice	24	
	Total	96	-

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1	Identification of general tools and equipments in an automobile workshop.	
2	Cylinder bore measurement and calculation of oversize.	
3	Crankshaft journal measurement and calculation of undersize.	
4	Compression tests on petrol/diesel engines.	
5	Valve timing and troubleshooting.	
6	Overhauling and setting timing of fuel injection pump.	
7	Overhauling and testing of fuel injector.	
8	Demonstration of Wheel alignment.	
9	Demonstration of Wheel balancing.	
10	Job on Body repair and spray painting.	
	Total	50

9. LEARNING RESOURCES

Books

S. No.	Author	Title of Books	Publishers
1	Automotive Mechanics	Joseph Heitner	Affiliated East west Press Pvt. Ltd, New Delhi
2	Automotive Mechanics	S. Srinivasan	Tata McGraw Hill Publishing Company, New Delhi
3	Automobile Engineering (Vol.2)	Kirpal Singh	Nem Chand Jain, Delhi
4	Automotive Mechanics	William H. Crouse	Tata McGraw Hill Publishing Company, New Delhi

AUDIT COURSE

(AC102) INDIAN CONSTITUTION

1. COURSE OBJECTIVES:

As a proud citizen of this country every student must be aware about the Indian Constitution to appreciate the provisions available for the people of this biggest democracy in Indian Constitution so that the youth of this country plays active role in development of the country by participating in the formation of sensitive and proactive Government at national and state level. This course intends to make students aware about various constituents of the Indian Constitution.

2. TEACHING AND EXAMINATION SCHEME

Semester	VI				Total Hours	Examination Scheme				
Course code & course title		Periods/Week (in hours)			Total Hours	Theory Marks		Practical Marks		Total Marks
		L	T	P		TH	TM	TW	PR/OR	
(AC102) INDIAN CONSTITUTION		2	-	-	2	-	-	-	-	-

3. Course Content

Unit 1 – The Constitution - Introduction • The History of the Making of the Indian Constitution • Preamble and the Basic Structure, and its interpretation • Fundamental Rights and Duties and their interpretation • State Policy Principles
Unit 2 – Union Government • Structure of the Indian Union • President – Role and Power • Prime Minister and Council of Ministers • Lok Sabha and Rajya Sabha
Unit 3 – State Government • Governor – Role and Power • Chief Minister and Council of Ministers • State Secretariat
Unit 4 – Local Administration • District Administration • Municipal Corporation • Zila Panchayat
Unit 5 – Election Commission • Role and Functioning • Chief Election Commissioner • State Election Commission

4. Suggested Learning Resources:

Title of Book	Author	Publication
1. Ethics and Politics of the Indian Constitution	Rajeev Bhargava	Oxford University Press, New Delhi, 2008
2. The Constitution of India	B.L. Fadia	Sahitya Bhawan; New edition (2017)
3. Introduction to the Constitution of India	DD Basu	Lexis Nexis; Twenty-Third 2018 edition

5. Suggested Software/Learning Websites:

a. https://www.constitution.org/cons/india/const.html
b. http://www.legislative.gov.in/constitution-of-india
c. https://www.sci.gov.in/constitution
d. https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-ofindia/

(AU617) ELECTRIC & HYBRID VEHICLES

1. COURSE OBJECTIVES: This course will introduce general aspects of advanced Hybrid Electric Vehicles (HEV), including architectures, modeling, sizing, sub-system design and hybrid vehicle control. It will cover energy storage sources, electric propulsion systems, power electronics design, and HEV control.

2. TEACHING AND EXAMINATION SCHEME

Semester	VII				Total Credits	Examination Scheme				
Course code & course title		Periods/Week (in hours)			Total Credits	Theory Marks		Practical Marks		Total Marks
		L	T	P		TH	TM	TW	PR/OR	
AU617 Electric & Hybrid Vehicles		3	-	2	5	75	25	-	25	125

3. COURSE OUTCOMES:

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

AU617CO1: State the role of hybrid/electric vehicles and its impact on the environment.

AU617CO2: Describe the construction and working of various systems and devices used in electric/hybrid vehicles.

AU617CO3: Explain the fundamentals and system configurations of electric/hybrid vehicles.

AU617CO4: Explain various energy storage technologies and energy management strategies used in hybrid and electric vehicles.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	2	0	2	0	3	2	3	2	2
CO2	2	2	2	2	0	0	2	2	2
CO3	2	2	2	2	2	2	3	2	2
CO4	2	2	2	2	2	2	2	2	2

Relationship: Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours				
Unit			M	Thr	CO
Unit 1 INTRODUCTION TO HYBRID/ELECTRIC VEHICLES:			9	6	CO1
1.1 History of hybrid and electric vehicles					
1.2 Social and environmental importance of hybrid and electric vehicles					
1.3 Classification of EVs based on					
-Propulsion devices (PEV and HEV)					
-Energy Sources (BEV, PHEV and FCEV)					
1.4 Benefits and comparison of EVs over IC Engines					
1.5 Challenges faced by EVs					
Unit 2 ELECTRIC MACHINES AND SIZING OF ELECTRIC MACHINES FOR ELECTRIC AND HYBRID VEHICLES			15	10	CO2
2.1 Introduction to EV Motors, Requirement of DC Machine					
2.2 Compare Torque vs Speed and Power vs Speed Characteristic curve of IC engines vs EVs					
2.3 Working of 3 Phase AC motor					
2.4 Types of AC motors: Construction and Working					
- Induction Machine					
- Permanent Magnet Machine,					
- Switch Reluctance motor					
2.5 Sizing of Electric Machines					
2.6 Peak Torque and Power					
2.7 Constant Power Speed Ratio					
2.8 EM Sizing					
2.9 Sizing Power Electronics					
Unit 3 ELECTRIC VEHICLE SUB-SYSTEMS AND CONFIGURATIONS			18	12	CO2 CO3
3.1 Introduction to electric components/ subsystems used in EVs					
3.2 Basic Configuration and control of Battery Electric Vehicle (BEV),					
3.3 Basic Configuration and control of Fuel Cell Electric Vehicle (FCEV)					
3.4 Types of EV Propulsion systems					
3.4.1 Based on Mechanical Arrangements					
-Longitudinal front wheel drive					
-Front Gearing and no clutch					
-Transverse front wheel drive					
-Dual motor drive					
-Outer motor drive					
3.4.2 Based on Energy Source					
-Battery Energy source					
-Hybrid battery source					
-Fuel cell arrangement					
3.5 Challenges faces by Battery Electric Vehicle (BEV)					
Unit 4 HYBRID VEHICLE SUB-SYSTEMS AND CONFIGURATIONS			15	10	
4.1 Introduction to Hybridization in EVs.					
4.2 Need for Hybridization.					

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4.3 Conventional HEV- Micro Mild and Full			CO2 CO3
4.4 Energy use in conventional vehicles, Energy saving potential of hybrid drive trains			
4.5 Types of Hybrid EV Configuration			
-Series Hybrid EV			
-Parallel Hybrid EV			
-Series Parallel Hybrid EV			
-Complex Hybrid EV			
4.6 Challenges faces by Hybrid Electric Vehicle			
Unit 5 ENERGY SOURCE TECHNOLOGY AND ENERGY MANAGEMENT	18	10	
5.1 Introduction to energy sources			CO4
5.2 Types of Energy Sources: Construction, Working - Battery (Lithium ion batteries) - Ultra capacitor - Ultra Flywheel - Fuel Cells			
5.3 Regenerative Braking			
5.4 Introduction to Battery Charging Technology			
5.4.1 Charging schemes for EVs			
5.4.2 Charging Mechanism (Wire, Wireless)			
5.4.3 Inductive Power Transfer (IPT)			
5.4.4 Park and Charge			
5.4.5 Move and Charge			
5.5 Battery Management System			
5.6 Energy Management Strategies used in hybrid and electric vehicles - Function of Control System in HEVs and EVs - Overview of Control System: The Electronic Control Unit (ECU) - Control Area Network (CAN)			
Total			
	75	48	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Introduction To Hybrid/Electric Vehicles	06	9
2	Electric Machines And Sizing Of Electric Machines For Electric And Hybrid Vehicles	10	15
3	Electric Vehicle Sub-Systems And Configurations	12	18
4	Hybrid Vehicle Sub-Systems And Configurations	10	15
5	Energy Source Technology And Energy Management	10	18
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Study various components of Electric Vehicles.	
2.	Demonstrate the wiring layout of Electric Vehicle.	
3.	Case Study: Car Comparison Project between one Hybrid and Non-Hybrid Vehicle.	
4.	Study of various Energy storage systems used in Electric vehicles.	
5.	Case Study of any Hybrid series parallel Circuit.	
6.	Study on Hybrid electric vehicle propulsion system.	
7.	Case study on Vehicle configuration (Electric, Hybrid, Engine)	
8.	Study on Energy management strategy for fuel cell hybrid vehicles.	
Total		25

9. LEARNING RESOURCEText

Books

S. No.	Author	Title of Books	Publishers
1	Iqbal Husain	"Electric and Hybrid vehicles Design Fundamentals"	CRC Press, second edition 2013
2	James Larminie, John Lowry	"Electric vehicle technology Explained"	Second Edition, Wiley 2012
3	Ali Emadi	"Hand book of Automotive Power Electronics and Motor Drives"	CRC Press 2005
4	Ali Emadi, Mehrdad Ehsani, John M. Muller	"Vehicular Electric Power Systems"	Marcel Dekker, Inc., 2004

9.1 Internet and Web Resources

S. No.	Author	Title of Books	Publishers
1	NPTEL	https://nptel.ac.in/courses/108/103/108103009/	-

1. COURSE OBJECTIVES:

The students will be able to gain basic understanding of how the material selection & design process is established for an automobile part. They will comprehend how a product is designed based on different types of stresses induced on it. Subject covers basic knowledge on design procedures of different automotive parts such as shafts, bolted joints, clutches, springs and internal combustion engine parts

2. TEACHING AND EXAMINATION SCHEME

Semester	VII									
Course code & course title		Periods/Week (in hours)			Total Credits	Examination Scheme				
						Theory Marks		Practical Marks		Total Marks
AU702 AUTOMOBILE COMPONENT DESIGN		L	T	P	C	TH	TM	PR/OR	TW	
		3	2	-	5	75	25	-	25	

3. COURSE OUTCOMES:

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

AU702CO1: Identify various types of loads and forces acting on the component and the stresses induced in them.

AU702CO2: Demonstrate understanding of basic concepts of design of automotive components. AU702CO3: Discuss the design procedure used in automotive component design.

AU702CO4: Solve problems using the design methodology for various automotive components and systems.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	3	2	2	2	0	2	2	3	2
CO2	3	3	2	2	0	2	2	2	1
CO3	2	3	2	2	3	2	3	2	2
CO4	3	3	3	2	2	2	2	2	2

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours	CO = Course Objectives			
Unit	M	Thr	CO		
Unit 1 BASIC CONCEPTS OF DESIGN	18	10			
1.1 Introduction to design.					
1.2 General consideration for selection of material and manufacturing processes.					
1.3 General design consideration.					
1.4 Design Procedure.					
1.5 Stress analysis: 1.5.1 Types of external loads. 1.5.2 Types of induced stresses: tensile, compressive, shear, crushing and bearing pressure, bending, torsion, thermal stresses, creep, proof stresses. 1.5.3 Stress – Strain diagram for ductile & brittle material & its importance. 1.5.4 Factor of safety, Selection of factor of safety. 1.5.5 Ergonomics: Design and requirement of driver, passenger seats.					CO1 CO2 CO3 CO4
Unit 2 DESIGN OF SHAFTS	09	06			CO1 CO2 CO3 CO4
2.1 Design of shaft subjected to Twisting Moment					
2.2 Design of shaft subjected to Bending Moment and Twisting Moment					
Unit 3 DESIGN OF SCREWED FASTENERS	12	08			
3.1 Bolts subjected to direct tensile load					CO1 CO2 CO3 CO4
3.2 Bolts subjected to shear load					
3.3 Bolts subjected to eccentric load: 3.3.1 Bolt axis and load line are parallel to each other 3.3.2 Bolt axis and load line are perpendicular to each other					
Unit 4 DESIGN OF SPRINGS	12	06			
4.1 Helical spring` 4.1.1 Spring terminology 4.1.2 End connections for compression helical springs 4.1.3 Design of helical compression spring 4.1.4 Applications and functions of helical spring					CO1 CO2 CO3 CO4
4.2 Semi elliptical leaf spring 4.2.1 Design of semi elliptical leaf spring 4.2.2 Applications and functions of Semi elliptical leaf spring					

Unit 5 DESIGN OF CLUTCH & BASIC ENGINE COMPONENTS	24	18	CO1 CO2 CO3 CO4
5.1 Design of Single plate clutch (Using Uniform Pressure & Uniform Wear Theory)			
5.2 Design of Multi plate clutch (Using Uniform Pressure & Uniform Wear Theory)			
5.3 Buckling of struts and columns			
5.4 Application of Euler's and Rankine's formulae			
5.5 Design of connecting rod			
5.6 Design of connecting rod – small end			
5.7 Design of connecting rod –big end and bolts			
5.8 Design of push rods			
5.9 Design of piston crown by bending strength and thermal considerations			
5.10 Design of piston rings and skirt length			
Total	75	48	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and tutorials.

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	BASIC CONCEPTS OF DESIGN	10	18
2	DESIGN OF SHAFTS	06	09
3	DESIGN OF SCREWED FASTENERS	08	12
4	DESIGN OF SPRINGS	06	12
5	DESIGN OF CLUTCH & BASIC ENGINE COMPONENTS	18	24
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS.

No	Class room Assignments	Marks
1	Problems on types of Induced stresses.	
2	Problems on Design of shafts under combined torsion & bending.	
3	Problems on Design of Screwed fasteners.	
4	Problems on Design of Helical Springs.	
5	Problems on Design of Semi- Elliptical leaf springs.	
6	Problems on Design of Single & Multi-plate clutches.	
7	Problems on Design of I.C. engine parts.	
	Total	25

9. LEARNING RESOURCES

9.1 Text Books

S. No.	Author	Title of Books	Publishers
1	R.S. Khurmi & J.K. Gupta	A Textbook on Machine Design	S. Chand
2	R.K. Jain	Machine Design	Khanna Publications
3	V.B. Bhandari	Design of Machine Elements	Tata McGraw Hill
4	Pandya and Shah	Machine Design	Dhanpat Rai & Sons

(AU703) AUTOMOBILE PROJECT

1. COURSE OBJECTIVES

Automobile project would enable the students to apply knowledge of Automobile Engineering to identify, analyze, solve and design a project work in order to provide effective solutions to an engineering problem so that it benefits the society and environment at large. In the process of doing so he would be called upon to carry out the tasks of Planning, Scheduling and Coordinating. Student would be able to develop the ability of problem solving and decision making. Student would be able to develop skills such as imagination, creativity & resourcefulness.

2. TEACHING AND EXAMINATION SCHEME

Semester	VII				Total Credits	Examination Scheme				
Course code & course title		Periods/Week (in hours)			Total Credits	Theory Marks		Practical Marks		Total Marks
		L	T	P		TH	TM	TW	PR/OR	
AU703 AUTOMOBILE PROJECT		-	-	8	8	-	-	100	50	150

3. COURSE OUTCOMES:

On successful completion of the course, the student will be able to: AU703CO1: Identify problem areas requiring solutions.

AU703CO2: Plan the necessary activities for the implementation of the project. AU703CO3: Apply engineering knowledge in arriving at innovative solutions. AU703CO4: Execute the project and compile a project report.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	2	2	1	0	0	2	2	2	2
CO2	2	1	2	0	0	3	2	2	2
CO3	3	3	3	3	2	2	2	3	3
CO4	3	3	3	3	2	3	2	3	3

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

Unit
1 PROJECT SELECTION
Students in groups of not more than 5 will in consultation with the respective staff member appointed by the Head of Department, choose a developmental topic in Automobile Engineering for their project. Some areas or fields from which the project is chosen could include: 1.Modification of Existing automotive systems 2.Traffic investigations and surveys 3.Design & fabrication of auto systems 4.Design & fabrication of testing equipment and devices 5.Process improvement 6.Layout modification The project selected should be related to the courses covered by the students.
2 PLANNING
1. Listing down the various activities/tasks involved till the completion of the project. 2. Finalization of the plan in consultation with the guide.
3 EXECUTION
1. The work should proceed according to the plan. 2. Any deviations from the plans should be monitored & corrected or else the plan should be modified to suit the prevailing conditions. 3. Students should maintain a daily diary to record all the activities carried out. 4. All the activities should be in consultation & coordination with the guide.
4 REPORT WRITING
Students are required to prepare a detailed report containing some or all of the following information: 1. Introduction or foreword, theory related to the project, design calculations, drawings, charts, sketches, catalogues, graphs, photographs, etc related to the project, Observations ,readings or any other data, suggestions if any, Conclusions or inferences and References. 2. The above report should be typewritten and hard bound and submitted in duplicate to the department.
5 EVALUATION AND ASSESSMENT
The evaluation and assessment of the project will be done periodically during the term followed by an end of term oral examination.

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies.

7. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Project selection	10
2.	Planning	10
3.	Execution	40
4.	Report writing	40
	Total	100

PROJECT REVIEW SCHEDULE

SR.NO	REVIEW NO	WEEK OF SEMESTER
1	Review 1	Second Week
2	Review 2	Seventh Week
3	Review 3	Twelfth Week
4	Review 4	Fifteenth Week

Note: In the project review assessment to be done based on

- 1) Presentation made by the students showing the progress of their project.
- 2) Involvement and contribution of individual student in project group.
- 3) Uniqueness of project.

Project Guide should strictly follow the project review schedule.

(CC501) ENTREPRENEURSHIP DEVELOPMENT

1. COURSE OBJECTIVES:

Student will be able to start his own venture with all fundamentals of business. Today Entrepreneurship is given importance by the government to bring the youth of our country to overcome the problem of unemployment and bring them in the main stream of global business to strengthen Indian economy by Make in India philosophy. Government has announced various financial schemes for young youth and women to support them for setting up an enterprise. To fulfill this, youth are to be prepared for setting an enterprise. The students undergoing this course will develop entrepreneurial traits and confidence within themselves and choose entrepreneurship as a career to brighten their future.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
CC501 Entrepreneurship Development	L	T	P	C	-	-	PR/OR	TW	25
	-	-	2	2	-	-	-	25	

3. COURSE OUTCOMES:

CC501CO1: List the terms associated with Entrepreneurship Development.

CC501CO2: Explain the terminologies and procedures involved in Entrepreneurship Development
CC501CO3: Identify legal implications for Entrepreneurs.

CC501CO4: Develop the project report for new enterprise.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	1	0	0	0	2	3	2	1	1
CO2	1	0	0	0	1	3	2	1	1
CO3	0	1	2	0	0	0	2	1	1
CO4	3	2	2	0	2	0	2	1	1

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS

M=Marks	Phr= Practical hours	CO – Course Outcomes			
Unit			M	Phr	CO
1 Introduction to Entrepreneurship Development				4	
1.1 Introduction to Entrepreneurship Development (EDP)					CO1 CO2 CO3 CO4
1.2 Entrepreneur definition, Types of Entrepreneur, Characteristics of entrepreneur and entrepreneurship					
1.3 Enterprises: Micro, Small and Medium Enterprises (MSME), Service industry, Manufacturing Industry, Franchises and Start up.					
1.4 Organisations: Sole proprietorship, Partnership, Public, Co-operative Society.					
2. Identification of business opportunity				6	
2.1 Business ideas- Exploring business ideas in terms of marketability, technical feasibility, financing and authorities					CO1 CO2 CO3 CO4
2.2 Business terms: - Clients, vendors market description, demand, supply, banking & non-banking, financing companies, Loans of various types, GST, peers Promoters, Lenders, Consortium.					
2.3 Government Departments: - IDC, EDC, Civic Body, Pollution Control department.					
3. Market Research				4	
3.1 Data Collection: - Data collection of Business idea such as Number of players, Total demand, Total supply					CO1 CO2 CO3 CO4
3.2 Analysis of Data: - Analysis of data and projection of data with respect to various factor (such as GDP, Climate etc through case studies).					
3.1 Questionnaire: - Preparing a questionnaire for business idea to assess business opportunity.					
4. Legal Aspect				10	
4.1 Legal Financial Term: - Know the various terms such as Resources, Assets, Liabilities, Advances, Depreciations, Investments, Fixed Capital, Working Capital (cash credit), Employee Cost, Miscellaneous Expense, Other Income, Profit & Loss Statement, Cash Flow Analysis, and Balance Sheet.					CO1 CO2 CO3 CO4
4.2 Legal Aspects: - Procedure for Registration with various government agencies, GST, PAN, Slab of Income Tax. Difference in use of electricity, water & LPG for domestic purpose and industrial applications					
4.3 Business Analyses: - 1) Swot Analysis 2) Break – Even Analysis					
5. Project Report				8	

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5.1 Need for project report, Importance of Project report, Scope of project report: Economic aspects, Technical aspects, Financial aspects, Managerial aspects, Production aspects. List the contents of a project report. Proforma of a project report which includes: -Introduction, Schemes, Profitability and Projections, Infrastructure, Break Even Point, Names and Addresses of suppliers, remarks.			CO1 CO2 CO3 CO4
5.2 Project Profile: - Project appraisal criteria: - Technical feasibility, Financial feasibility, Economic viability, Commercial viability, Managerial competency, Political and Labour considerations			
5.3 Scope of Business: - Further scope with Capital infusion, Exit plan Analysis.			
Total	25	32	

6. COURSE DELIVERY:

Videos / Lectures/ Practicals /Expert lectures / Industry visits

7. SPECIFICATION TABLE FOR PRACTICALS

Unit No.	Topic	Teaching Hours/ Semester	MARKS
1	Entrepreneurship Development	4	3
2	Identification of business opportunity	6	5
3	Market Research	4	3
4	Legal Aspect	10	8
5	Project Report	8	6
TOTAL		32	25

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICAL HOURS

No	Classroom Assignments	Marks
1.	Prepare a Case Study on leading enterprise	
2.	Prepare a Case Study on small scale unit	
3.	Prepare a report on various government schemes for startup.	
4.	Prepare SWOT analysis for a new business idea.	
5.	Prepare Project Report for a new business idea.	
	Total	25

9. LEARNING RESOURCES

S.No.	Author	Title of Books	Publisher
1.	Sharad Jawadekar, Shobha Dodlani,	Business entrepreneurship	Suvichar prakashan mandal, pune,
2.	S.S. Khanna	Entrepreneurship development	S. Chand & Co. Ltd, New Delhi,
3.	Vasant Desai	Management of small- Scale Industry in India	Himalaya Publishing House
4.	Dilip Sarwate	Entrepreneurial development Concepts and practices	Everest Publication House, Pune
5.	CB Gupta and P Srinivasan	Entrepreneurship Development	S. Chand and Sons, New Delhi

AUDIT COURSE

(AC101) ESSENCE OF INDIAN KNOWLEDGE AND TRADITION

1. COURSE OBJECTIVES:

This course aims at imparting basic principles of thought process, reasoning and inferencing by human being. Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature. Holistic life style of Yogis, science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions. The course thus focuses on introduction to Indian Knowledge System, Indian perspective of modern scientific world-view, basic principles of Yoga and holistic health care system.

2. TEACHING AND EXAMINATION SCHEME

Semester									
Course code & course title	Periods/Week (in hours)			Total Hours	Examination Scheme				
					Theory Marks	Practical Marks		Total Marks	
(AC101) Essence of Indian Knowledge and Tradition	L	T	P	H	TH	TM	TW	PR/OR	
	2	-	-	2	-	-	-	-	

Course Content:

Basic Structure of Indian Knowledge System:

(i) वेद, (ii) उन्नेवेद (आयुर्वेद, धनुर्वेद, गन्धर्वेद, स्थानत्य आदद) (iii) वेदांग (शिक्षा, कल्न, ननरुत, व्याकरण, ज्योनतष छांद), (iv) उन्नाइग (धर्म सि, रीरांसा, नुराण, तकमिस)

Y Modern

Science and Indian Knowledge System

S. No.	Title of Book	Author	Publication
1.	Cultural Heritage of India- Course Material	V. Sivaramakrishna	Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014
2.	Modern Physics and Vedant	Swami Jitatmanand	Bharatiya Vidya Bhavan
3.	The wave of Life	Fritzof Capra	
4.	Tao of Physics	Fritzof Capra	
5.	Tarkasangraha of Annam Bhatta, International	V N Jha	Chinmay Foundation, Velliarnad, Amakuam
6.	Science of Consciousness Psychotherapy and Yoga Practices	RN Jha	Vidyanidhi Prakasham, Delhi, 2016

(AU801) AUTO TRAINING II

1. COURSE OBJECTIVES:

During the course of the second phase of Industrial training a student will get a more detailed insight into the industrial environment, work culture, management systems & professional ethics. It would also enable him to obtain a hands-on experience in the use of the various tools, machines, equipment & instruments used in the auto industry. This phase of training would also enable him to assimilate more effectively the management principles and concepts taught to him during his final term at the institute and develop leadership skills and team spirit.

2. TEACHING AND EXAMINATION SCHEME

Semester	VIII					
Course code & course title	Examination Scheme					
	TERM WORK		PR/OR		Total Marks	
	DAILY DAIRY	PROGRESSIVE ASSESSMENT	TRAINING REPORT	SEMINAR / VIVA		
AU801 AUTO TRAINING II	50	50	50	50	GRADE	

3. COURSE OUTCOMES:

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

AU801CO1: Understand industry culture, office environment and professional ethics. AU801CO2: Develop leadership and team spirit.

AU801CO3: Perform testing, repairs and maintenance of vehicle systems as per standard operating procedures independently or perform the role of a Supervisor / Foreman/ Service advisor /Sales advisor / Content developer.

AU801CO4: Prepare training report and give oral presentation related to the training undertaken.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	0	0	0	0	3	2	2	0	3
CO2	0	0	0	0	2	3	3	0	3
CO3	3	3	2	3	2	2	2	3	2
CO4	2	0	2	0	0	3	2	2	2

Relationship: Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours	CO = Course Objectives	
Unit			CO
1 COMPANY INFORMATION			CO1
1.1 Collect information about the industry 2.2 Understand the plant/factory layout, organization structure and roles and responsibilities of different departments in the auto industry.			
2 TRAINING JOBS			CO2 CO3 CO4
Students are expected to undertake a ‘project’, in consultation with the Industry personnel, on a topic related to the area of training. Students are required to perform and/or familiarize themselves with at least 4 of the following jobs/ assignments/tasks during the training period: 1. Periodic Maintenance Servicing of a vehicle 2. Dismantling & Assembling of an Engine 3. Dismantling & Assembling of a gear Box/Transmission 4. Dismantling & Assembling of a Clutch 5. Dismantling & Assembling of a Driveline & Differential 6. Dismantling & Assembling of a Suspension System 7. Engine Tune-up 8. Maintenance & Repair of a Braking System 9. Maintenance & Repair of a Steering System 10. Maintenance & Repair of a Engine Cooling System 11. Maintenance & Repair of the Electrical/Electronic Systems 12. Maintenance & Repair of the Hydraulic/Pneumatic Systems 13. Body Engineering aspects of Denting / Sheet metal work 14. Body Engineering aspects of Painting 15. Body Engineering aspects of Corrosion Protection 16. Body Engineering aspects of Chassis lubrication Or 1. Role of a Supervisor/Foreman/Service advisor/Sales advisor/Contentdeveloper			

6. COURSE DELIVERY:

The Course will be delivered through In-plant training.

7. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	DAILY DIARY Every student undergoing In-plant Training is required to maintain a 'Daily Diary' in the prescribed booklet supplied to them, giving a brief account of the various activities performed during the day for the entire period of the training. The entries should be authenticated /validated on a regular basis by the supervising authority at the place of work.	50
2.	PROGRESSIVE ASSESSMENT The evaluation system will also include three assessments during the training period. There will be two assessments done at the institute whereina student will be required to give a presentation of the jobs undertaken by him during his training. Besides these there will also be an assessment doneat the industry in consultation with industry personnel.	50
3.	TRAINING REPORT The student is expected to write a detailed 'Training Report', in a hard bound booklet as per the format provided by the department. The report should include information about the company, organization structure, plant/workshop layout and details of jobs/assignments/major activities undertaken during the training supported with diagrams, pictures, graphs etc. Assessment of Training Report be based on Knowledge, Presentation, Quality of contents and Sketches.	50
4.	SEMINAR/VIVA The appointed examiners shall assess the trainee based on their training report and performance in viva.	50
	Total	GRADE

Note:

1. Grades will be awarded based on marks scored as follows:

- a. 80% and above Marks – Grade 'A'
- b. 60% to 79% Marks – Grade 'B'
- c. 40% to 59% Marks – Grade 'C'
- d. Marks below 40% - Grade 'D'

2. TW and PR/OR shall be separate heads of passing. Student has to secure minimum Grade 'C' for passing.

3. Student with Grade D, under the head TW, shall be declared T.N.G. and a student whose term is grantedbut obtains Grade D, under the head PR/OR, shall be declared Failed/ATKT.

ELECTIVES-I

(AU611) AUTOMOTIVE QUALITY SYSTEMS

1. COURSE OBJECTIVES:

Through this course the students will acquire the knowledge of quality concepts, tool and techniques used in automotive industries, and also acquire knowledge of quality management system and standards. They will also analyze and apply management tools and techniques for process improvement. Student will also get familiarized with automotive TS16949 quality system practices.

2. TEACHING AND EXAMINATION SCHEME

Semester									
Course code & course title	Periods/Week (in hours)			Total Hours	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
AU611 AUTOMOTIVE QUALITY SYSTEMS	L	T	P	H	TH	TM	TW	PR/OR	
	3	-	2	5	75	25	25	25	150

3. COURSE OUTCOMES:

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

AU611CO1: Understand the fundamentals of quality and various quality management systems.

AU611CO2: Explain the details of various quality management systems along with tools and techniques.

AU611CO3: Apply management tools and techniques for process improvement. AU611CO4: Make use of statistical and other quality tools for system analysis.

4. Mapping Course Outcomes with Program Outcomes

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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	2	0	0	0	0	2	2	2	2
CO2	3	2	1	0	0	2	2	2	2
CO3	3	3	3	3	3	3	3	3	2
CO4	3	3	3	3	2	3	3	3	3

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours			
Units:	M	Thr	CO	
1. BASIC CONCEPTS OF QUALITY	12	9		
1.1 Quality, classification of quality and services				
1.2 Quality systems overview				
1.3 Product Quality design				
1.4 Quality engineering in design of production processes				
1.5 Quality characteristics				
1.6 Quality , Reliability and Safety				
1.7 Quality engineering in production				
1.8 Quality engineering in service				
2. QUALITY MANAGEMENT SYSTEMS	18	10		
2.1 Quality Management – A conceptual Frame Work				
2.2 Dimensions of Quality				
2.3 Costs of Quality				
2.4 Quality System Standards				
2.5 ISO 9000 clauses and its interpretations				
2.6 ISO TS16949 clauses and interpretation				
3.MODERN MANAGEMENT TOOLS AND TECHNIQUES	18	12		
3.1 Introduction to Modern Management Techniques				
3.2 5s concepts				
3.3 Kaizen techniques				
3.4 Six sigma methodologies				
3.5 Quality circles				
3.6 Taguchi loss function				
3.7 POKE –YOKE Techniques				
3.8 TPM				
4. ISO TS16949 TOOL AND TECHNIQUES	15	08		
4.1 Advanced Product Quality Planning (APQP)				
4.2 Design Failure Mode Effects Analysis				
4.3 Process Failure Mode Effects Analysis				
4.4 Production Part Approval Process (PPAP)				
5. QUALITY TOOLS	12	9		
5.1 Concepts of SPC detection vs. Prevention				
5.2 Data collection methods				
5.3 Measures of central tendency and dispersion (Simple numericals) Mean, Median, Mode, Range, Standard deviation and Variance				
5.4 Statistical Tools i. Flow chart ii. Histogram iii. Cause and Effect diagram iv. Check sheet v. Control Charts vi Pareto charts				
Total	75	48		

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and tutorials.

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Basic Concepts of Quality	9	12
2	Quality Management Systems	10	18
3	Modern Management Tools and Techniques	12	18
4	ISO TS16949 Tool And Techniques	8	15
5	Quality Tools	9	12
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS.

No	Practical	Marks
1	With suitable case study demonstrate concepts of quality management and improvement.	
2	Case study to understand the role of technology, managers, employees, and customers in developing a quality-based workplace.	
3	Case study demonstrating the application of Modern Management Tools and Techniques.	
4	Demonstrate data gathering and analysis tools and prepare a report.	
5	Demonstrate Quality Tools.	
6	Case study to understand the ethical issues as related to quality of services and products.	
7	Field visit to identify current trends and benchmark organizations related to Quality Management.	
	Total	25

9. LEARNING RESOURCES

9.1 Text Books

S.No.	Author	Title of Books	Publishers
1	David Hoyle,	Automotive quality system Handbook	Butterworth – Heinemann ltd, second edition, oxford, 2000
2	William M Feld	“Lean Manufacturing: Tools, Techniques and How to Use Them”	APICS, 2001

9.2 Reference Books for further study

S.No.	Author	Title of Books	Publishers
1	Montgomery Douglas C	Introduction to Statistical Quality Control	John Wiley and Sons, New Delhi, 2007.
2	Logo Thetis N	Managing for Total Quality – From Deming to Taguchi and SPC	Prentice Hall of India, Private Limited, New Delhi, 1997
3	NIL	Advanced product quality planning and control plan	2nd Edition ,Standards media (2008)

(CC503) RENEWABLE ENERGY SYSTEMS AND ENERGY MANAGEMENT

1. COURSE OBJECTIVES:

To compare the different conventional energy sources with renewable energy sources. This course will also provide valuable insight on different energy conservation devices and its applications in the real world. It will also help to conduct energy audits using energy management techniques for energy conservation.

2. TEACHING AND EXAMINATION SCHEME

Semester									
Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks	Practical Marks		Total Marks	
CC503 RENEWABLE ENERGY SYSTEMS AND ENERGY MANAGEMENT	L	T	P	C	TH	TM	TW	PR/OR	150
	3	-	2	5	75	25	25	25	

3. COURSE OUTCOMES:

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

CC503CO1: List the various renewable and non-renewable sources of energy. CC503CO2: Describe the principle and applications of energy conservation.

CC503CO3: Explain the construction, working and applications of various alternate energy devices CC503CO4: Apply the knowledge of energy conservation and energy management techniques to conduct energy audits.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	2	0	0	0	2	2	2	1	1
CO2	2	1	2	1	2	2	2	2	2
CO3	2	2	2	2	2	3	2	2	2
CO4	2	2	3	3	3	2	2	2	3

Relationship: Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours			
Unit	M	Thr	CO	
Unit 1 INTRODUCTION TO ENERGY SOURCES	10	06		
1.1 Energy Scenario				
1.2 Need of Alternate energy sources.				
1.3 Types of Renewable energy sources - Basic concepts of Solar energy, Wind Energy, Tidal energy, Biomass Energy, Fuel Cell				CO1
Unit 2 SOLAR ENERGY SYSTEMS	16	10		
Solar Energy				
2.1 Principle of conversion of solar energy into heat and electricity				
2.2 Solar Radiation: Solar Radiations at earth's surface				
2.3 Solar Radiation Geometry: Declination angle, hour angle, altitude angle, incident angle, zenith angle, solar azimuth angle				CO1
2.4 Charactersitics of PV cell and concept of MPPT				CO2
2.5 Construction and working of typical flat plate collector and solar concentrating collectors and their applications, advantages and limitations				CO3
2.6 Space heating and cooling.				
2.7 Solar distillation, Solar cooking and furnace.				
2.8 Main applications of wind energy for power generation and pumping.				
Unit 3 WIND ENERGY SYSTEMS	16	10		
3.1 Basic Principle of wind energy conversion.				
3.2 Advantages and limitations of wind energy conversion.				
3.3 Classification of wind mills				CO1
3.4 Construction and working of horizontal and vertical axis wind mills, their comparison				CO2
3.5 Main considerations in selecting a site for wind mills.				CO3
3.6 Wind turbine Efficiency, Wind turbine control parameters- Yaw angle, Pitch angle, hub height, Solidity				
Unit 4 APPLICATIONS OF SOLAR AND WIND ENERGY SYSTEMS	18	12		
4.1 PV system for street lights				
4.2 Design of PV system for domestic load.				CO2
4.3 PV water pumping system				CO3
4.4 Design of household thermal heating system				
4.5Design of micro wind turbine for domestic load.				

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Unit 5 ENERGY MANAGEMENT	15	10	CO4
5.1 Energy scenario in various sectors and Indian economy			
5.2 Need and importance of energy conservation and management			
5.3 Principles of energy conservation.			
5.4 Concept of Energy audit			
5.5 Types of Energy Audit			
5.6 Energy Conservation – Case study of Domestic system			
5.7 Energy Conservation – Case study of Industrial system			
Total	75	48	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies.

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Introduction To Energy Sources	06	10
2	Solar Energy Systems	10	16
3	Wind Energy Systems	10	16
4	Applications of Solar and Wind energy systems	12	18
5	Energy Management	10	15
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Collect information about Indian energy market and prepare a report.	
2.	Study the construction and working of photo voltaic cell.	
3.	Study the construction, working of a solar cooker.	
4.	V-I, P-V Characteristics of Photovoltaic panel	
5.	Case Study on a nearest wind farm.	
6.	Visit to plant of solar heating system for hotel/hostel/railway station etc. and prepare a report.	
7.	Perform energy audit for workshop/Office/Home/SSI unit.	
8.	Study of various waste heat recovery devices.	
	Total	25

9. LEARNING RESOURCEText

Books

S. No.	Author	Title of Books	Publishers
1	DrB.H.Khan	Non-conventional	Tata McGraw Hill
2	S. P. Sukhatme	Energy Resources	Tata McGraw Hill
3	Arrora	Solar energy	Dhanpat Rai & co.
4	Domkundwar	Power plant engineering	Wiley Press
5	Gilbert M Masters	Renewable and Efficient Electric Power Systems	Wiley Interscience, New Jersey, 2004
6	Chetan Singh Solanki	Solar Photovoltaics; Fundamentals, Technologies and applications	PHI

(AU620) AUTOMOTIVE POLLUTION & CONTROL

1. COURSE OBJECTIVES: The purpose of this course is to impart adequate knowledge on automotive emission formation & its effect on the environment. This course also provides valuable insight into the various emission control systems used in an SI and CI engines. Students will also gain knowledge on emission standards followed and instruments used for measurement of emissions.

2. TEACHING AND EXAMINATION SCHEME

Semester									
Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
AU620 AUTOMOTIVE POLLUTION & CONTROL	L	T	P	C	TH	TM	TW	PR/OR	
	3	-	2	5	75	25	25	25	150

3. COURSE OUTCOMES:

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

AU620CO1: Understand the fundamentals of automotive pollution and

control. AU620CO2: Describe automotive emissions and its effects.

AU620CO3: Explain the function, working principle and construction of various automotive emission control systems.

AU620CO4: Explain the principle of operation of emission measuring instruments and emission test procedures.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	2	0	0	0	2	2	1	2	2
CO2	2	0	1	0	2	2	2	2	2
CO3	3	2	2	2	2	2	3	3	3
CO4	3	3	3	3	2	3	3	3	3

Relationship: Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours			
Unit	M	Thr	CO	
Unit I: EMISSIONS AND STANDARDS	09	06		
1.1 Vehicle Population Assessment in Metropolitan Cities and Contribution to Pollution.			CO1 CO2	
1.2 Effects On Human Health and Environment, Global Warming.				
1.3 Types of Emission, Transient Operational Effects on Pollution.				
1.4 Emission Standards, Driving Cycles - USA, Japan, Euro and India.				
Unit-2 EMISSIONS FROM SI ENGINES AND THEIR CONTROL	18	11		
2.1 Emission formation in SI engines (CO, HC and NO _x)			CO1 CO2 CO3	
2.2 Effect of design and operating variables on emission formation				
2.3 Control techniques -Thermal reactor, exhaust gas recirculation				
2.4 Three-way catalytic convertor and Charcoal canister control for evaporative emission				
2.5 Positive crank case ventilation for blow by gas control.				
Unit 3 EMISSIONS FROM CI ENGINES AND THEIR CONTROL	18	11		
3.1 Emission formation in CI engines (HC, CO, NO _x , aldehydes, smoke and particulates)			CO1 CO2 CO3	
3.2 Effect of design and operating variables on emission formation				
3.3 Control techniques, exhaust gas recirculation, NO _x selective catalytic reduction, diesel oxidation catalytic convertor.				
3.4 Diesel particulate filter, NO _x versus particulates –trade off				
Unit 4 EMISSION AND NOISE POLLUTION CONTROL	12	08		
4.1 Engine Noise Emissions, Types of Catalytic Conversion			CO1 CO2 CO3	
4.2 Open Loop and Closed Loop Operation to The Oxidizing Catalytic Converter				
4.3 Evaporative Emissions				
4.4 Internal and External Noise, Identification of Noise Sources.				
4.5 Noise Control Techniques.				
Unit 5 EMISSION MEASURING INSTRUMENTS AND TEST PROCEDURES	18	12		
5.1 Principle of operation of emission measuring instruments used in SI and CI engines, Measurement of CO ₂ and CO by NDIR			CO1 CO4	
5.2 Hydrocarbon emission by FID, Chemiluminescent analyser for NO _x , Liquid and Gas chromatograph.				
5.3 Spot sampling and continuous indication type smoke meters (Bosch and AVL smoke meters) emission test procedures – FTP, Euro and Bharat norms.				
Total	75	48		

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Emissions And Standards	06	09
2	Emissions From SI Engines And Their Control	11	18
3	Emissions From CI Engines And Their Control	11	18
4	Emission And Noise Pollution Control	08	12
5	Emission Measuring Instruments And Test Procedures	12	18
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Case Study: Vehicle Population Assessment in the nearest city.	
2.	Measure CO, HC from the S.I. engine exhaust using gas analyzer & compare it with pollution norms.	
3.	Measure particulate matter, from C.I. engine exhaust using smoke meter & compare it with pollution norms.	
4.	Case study: Air pollution due to automobiles at different places in your city.	
5.	Case study : Measure noise level in your city at different places like Bus stand, Railway station, Airport, Hospitals, Schools, Traffic jam conditions etc. & prepare a report on it.	
	Total	25

9. LEARNING RESOURCEText

Books

S. No.	Author	Title of Books	Publishers
1	Ganesan V,	“Internal combustion engines”	4th edition, Tata McGraw Hill Education, 2012
2	Rajput R. K	“A textbook of Internal Combustion Engines”	2nd edition, Laxmi Publications (P) Ltd, 2007
3	Paul Degobert	“Automobiles and Pollution”	SAE International ISBN-1-56091-563-3, 1991
4	SAE Transactions	“Vehicle Emission”	1982 (3 volumes).

(AU614) GARAGE ORGANISATION & VEHICLE LAWS

1. COURSE OBJECTIVES:

Organisation and management of any garage and application of the motor vehicle act forms a very important activity for any automobile engineer. A clear idea of organisational structure, policies and procedures will result in effective handling of personnel and activities within the organisation, which will ultimately result in overall development of an undertaking. An in depth Knowledge of the motor vehicle act aids in assisting the public to have a disciplined traffic. This course provides sufficient insight in this area.

2. TEACHING AND EXAMINATION SCHEME

Semester									
Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
AU614 GARAGE ORGANISATION & VEHICLE LAWS	L	T	P	C	TH	TM	TW	PR/OR	
	3	-	2	5	75	25	25	25	150

3. COURSE OUTCOMES:

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

AU614CO1: Understand basic concepts of garage organisation, costing, motor vehicle act and safedriving techniques.

AU614CO2: Explain garage operation procedures, motor vehicle act and driving rules. AU614CO3: Plan a layout of a garage.

AU614CO4: Apply motor vehicle act.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	3	1	1	2	2	1	2	1	1
CO2	2	1	1	1	2	2	2	1	1
CO3	2	3	3	2	2	3	3	2	2
CO4	2	3	3	3	3	2	3	2	1

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours	CO = Course Objectives		
Unit	M	Thr	CO	
1 LOCATION AND LAYOUT OF GARAGE.	15	09		
1.1 Types of Garages			CO1 CO2 CO3	
1.2 Location of a Garage				
1.3 Layout of a Garage				
1.4 Functions of a Garage				
1.5 Personnel required in a Garage				
1.6 Safety procedures of Garages and Service stations				
2 GARAGE PROCEDURES	12	08		
2.1 Diagnostic sheets			CO1 CO2 CO3	
2.2 Estimate of repairs				
2.3 Job card				
2.4 Job loading				
2.5 Time booking				
2.6 Inspection				
2.7 Final report				
2.8 Billing of repairs				
2.9 Feedback.				
2.10 Types of Spares				
2.11 Purchase Procedures				
2.12 Stock records & Inventory Control				
2.13 Economics of rebuilding.				
3 COSTING	12	08		
3.1 Job costing			CO1 CO2	
3.2 Unit costing				
3.3 Batch costing				
3.4 Process costing				
3.5 Marginal costing.				
4 DRIVING SKILLS	12	08		
4.1 Instructions in driving of motor vehicle : Driving theory, traffic education, light vehicle driving practice, Vehicle mechanism & repair, Public relations for drivers, Fire hazards, vehicle maintenance, first aid.			CO1 CO2	
4.2 Traffic signs: Mandatory signs, Cautionary signs, Informatory signs. Traffic signals.				
4.3 Causes of accident and remedies.				
4.4 Measures to avoid accidents				
4.5 Defensive driving : Rain and flood, fog and mist, snow and ice,				
4.6 Fitness to drive : Driving and age, stress due to traffic jam, night driving.				
5 MOTOR VEHICLE ACT	24	15		
5.1 Licensing of Drivers of Motor Vehicle: Necessity, Age limit, Responsibility of owners, Restriction on holding a driving license, General, Preliminary test and driving test.				
5.2 Conductor's license: Necessity, Eligibility, Documents required and rules for conductors.				

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5.3 Registration of Vehicles: Necessity, Where to be made, How to be made, Temporary registration, Production of vehicle at the time of registration, Form and manner of display of registration mark, Size of letters and numerals of registration mark, Transfer of Ownership of Motor Vehicle.			CO1 CO2 CO4
5.4 Control of Transport: Transport authorities, Difference between STA & RTA, Necessity of Permit, All types of Permit, Transfer of permit, Temporary permit, Tourist permit, National permit. Speed limits.			
5.5 Construction of Motor Vehicle: Overall dimensions, General provision regarding construction and maintenance of motor vehicle. Power of central government to make rules.			
5.6 Taxation: Objectives, Basis of taxation, Methods of levying tax, Tax exemption.			
5.7 Insurance: Motor Vehicle Insurance, No-fault liability, Procedure for accident claim.			
Total	75	48	-

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Location and layout of garage	09	15
2	Garage procedures	08	12
3	Costing	08	12
4	Driving Skills	08	12
5	Motor Vehicle Act	15	24
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Draw a layout of a garage	
2.	Prepare a report showing different road signs and signals	
3.	Study, fill up, highlight the important points & prepare report on following forms under M V rules -- a. Medical certificate b. Learner's license. c Driving license. d. Addition of license. e. Renewal license f. Registration of vehicle. g. Transfer of vehicle.	
	Total	25

9. LEARNING RESOURCEText

Books

S. No.	Author	Title of Books	Publishers
1	-	Motor Vehicles Act 1988	Home Department (M.S.)
2	-	Central M.V.Rules 1989	Home Department (M.S.)

ELECTIVESII

(AU613) AUTOMOTIVE SALES

1. COURSE OBJECTIVES

Although sales is quite often considered as an ‘art’, it is based on a few basic principles which generally apply to all forms of sales. A person intending to venture into sales would need to familiarise himself with these basic fundamentals and aim to apply them in all his dealings whether it involves the task of selling vehicles or even for that matter service. This course would provide the student with fundamental knowledge of automotive sales, vehicle finance, and insurance, value added services and vehicle resale to make a successful career as a sales executive in automotive industry. After undergoing this course student will be able to apply the knowledge to make a successful career as a sales executive.

2. TEACHING AND EXAMINATION SCHEME

Semester									
Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
AU613 AUTOMOTIVE SALES	L	T	P	C	TH	TM	TW	PR/OR	
	3	-	2	5	75	25	25	25	150

3. COURSE OUTCOMES:

On successful completion of the course, the student will be able to: AU613CO1: Understand the fundamentals of automotive sales.

AU613CO2: Describe the terminology used in automotive sales. AU613CO3: Explain the processes used in automotive sales.

AU613CO4: Apply the principles of automotive sales in real life situations.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	2	2	2	0	2	3	2	2	2
CO2	2	2	1	1	2	3	2	2	2
CO3	2	3	2	0	2	3	3	2	2
CO4	3	3	2	2	3	3	3	2	3

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours	CO = Course Objectives			
Unit	M	Thr	CO		
1 SALES AND SALES PROCESS	15	10			
1.1 Introduction Definition and importance of sales.			CO1 CO2 CO3 CO4		
1.2 Salesmanship Definition, Features of salesmanship, Fundamentals of salesmanship, Importance of salesmanship.					
1.3 Factors affecting sales- Internal and external factors, Qualities of a good sales executive, Duties of a good salesman.					
1.4 Sales process Flow chart of sales process, Steps in sales process, After sales service and its importance.					
2 FINANCE	15	10			
2.1 Introduction Definition, Benefits of automotive finance.			CO1 CO2 CO3 CO4		
2.2 Terms used in Finance Rack rate, Reducing balance and Fixed interest rates, Subvention, Subvented loan and Subvented lease, Hypothecation, Foreclosure and prepayment charges, EMI-step up, step down and Bullet EMI, Processing fees, Late payment charges, Margin amount, Post dated cheque, Electronic clearance system (ECS), Zero percent finance, Loan to value (LTV) ratio.					
2.3 Finance documentation For- Salaried Individual, Self employed Individual, Private and Public Limited Company. Differences between Proprietorship and partnership. Vehicle finance calculation.					
3 INSURANCE	15	10			
3.1 Introduction Definition and Purpose of vehicle insurance Benefits of vehicle insurance Auto Insurance in India What is covered and not covered under auto insurance			CO1 CO2		

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3.2 Types of Auto Insurance With respect to vehicle type –Private car insurance, Two wheeler insurance and commercial vehicle insurance. Based on coverage- Third party Policy, Comprehensive policy, Nil or Zero depreciation policy. Difference between Zero Depreciation and normal car insurance. Decision on which policy to buy.			CO3 CO4
3.3 Terms used in insurance IDV, Insurance coverage, proposal form, claim form, Premium– breakup and calculation, sum assured. Deductible- Compulsory and voluntary deductibles. Endorsement-Definition and types of endorsements. No claim bonus (NCB). Cashless insurance and its benefits to the customer. Personal accident cover.			
3.4 Process of making vehicle insurance policy			
4 VALUE ADDED SERVICES	15	10	
4.1 Introduction What are value added services in automobile sales			
4.2 Warranty and Extended warranty What is warranty and extended warranty, benefits to the customer, Services covered and not covered under warranty, Eligibility for extended warranty, Registration procedure for extended warranty, Claim procedure, precautions and important information.			CO1 CO2 CO3
4.3 Accessories Definition, Types of accessories, sources of accessories			
4.4 Teflon Cavity Antirust (TCA) What is TCA, Process of TCA on cars, Benefits of TCA to the customers, disadvantages of TCA.			
5 VEHICLE RESALE	15	8	
5.1 Introduction Overview of vehicle exchange market in India, Reasons for growth of used car market in India, Scope and future of vehicle exchange market in India			CO1 CO2 CO3
5.2 Objectives of exchange, Benefits of Vehicle Exchange to the customer and manufacturer, Initiatives taken by manufacturers to initiate an exchange of vehicle, assessment or evaluation of used vehicle			
5.3 Certified Pre-owned (CPO) cars			
5.4 Procedure for vehicle Resale			
Total	75	48	-

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies.

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Sales and sales process	10	15
2	Finance	10	15
3	Insurance	10	15
4	Value added services	10	15
5	Vehicle resale	08	15
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Study the sales process of any one automobile dealership and prepare a report.	
2.	Collect and present interest rate, various charges, fees and penalties on vehicle loan of any bank and finance company.	
3.	Collect and study different types of vehicle insurance policies of any vehicle.	
4.	Collect and study Extended warranty document of any vehicle.	
5.	Study the vehicle resale/ exchange business in Goa and prepare a report.	
	Total	25

9. LEARNING RESOURCEText

Books

S. No.	Author	Title of Books	Publishers
1	Jeffrey Knott	From Zero to Hero: How to Master the Art of SELLING CARS	iUniverse Star
2	Graham Hill	Car Finance - A Simple Guide	GHAF Publishing
3	Emmett J. Vaughan	Fundamentals of Risk and Insurance	Wiley
4	Sheryl Lilke	Understanding Personal Auto Insurance	Dearborn Trade Pub

(AU615) AUTOMOTIVE SAFETY & ERGONOMICS

1. COURSE OBJECTIVES:

The students will be able to gain exposure to several automotive safety technologies related to stability, suspension and braking. They will gain basic knowledge on the vehicle ergonomics and human-technology interaction.

2. TEACHING AND EXAMINATION SCHEME

Semester										
Course code & course title		Periods/Week (in hours)			Total Credits	Examination Scheme				
						Theory Marks		Practical Marks		Total Marks
AU615 AUTOMOTIVE SAFETY & ERGONOMICS		L	T	P	C	TH	TM	PR /OR	TW	
		3	-	2	5	75	25	25	25	150

3. COURSE OUTCOMES:

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

AU615CO1: Relate to different concepts on vehicle safety.

AU615CO2: Understand the concept of vehicle ergonomics and human – technology interaction.

AU615CO3:

Explain the working principle of various vehicle safety systems and safety technology available in the market.

AU615CO4: Apply the knowledge of automotive safety and ergonomics for designing vehicles which are safe and comfortable.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	3	2	2	0	2	0	2	2	1
CO2	3	2	2	1	2	1	2	2	2
CO3	2	2	2	2	3	2	2	2	2
CO4	3	3	3	2	3	2	3	3	3

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours	CO = Course Objectives	
Unit	M	Thr	CO
Unit 1 INTRODUCTION	20	12	CO1
1.1 Introduction to Vehicle Safety.			
1.2 Design Of The Body For Safety, Engine Location.			
1.3 Effects Of Deceleration Inside Passenger Compartment			
1.4 Deceleration On Impact With Stationary And Movable Obstacle			
1.5 Active And Passive Safety			
1.6 Types Of Crash / Roll Over Tests, Regulatory Requirements For Crash Testing			
Unit 2 SAFETY CONCEPTS	15	12	CO1 CO2
2.1 Active Safety- Driving Safety, Conditional Safety			
2.2 Perceptibility Safety, Operating Safety			
2.3 Passive Safety: Exterior Safety, Interior safety			
2.4 Deformation Behaviour Of Vehicle Body, Speed And Acceleration Characteristics Of Passenger Compartment on Impact			
2.5 Pedestrian Safety - Human Impact Tolerance Determination Of Injury Thresholds			
2.6 Severity Index, Study Of Comparative Tolerance, Study Of Crash Dummies			
Unit 3 VEHICLE SAFETY TECHNOLOGY	15	8	CO1 CO2 CO3
3.1 Crumple Zones			
3.2 Airbags & Active Head Rest			
3.3 Pedestrian Protection systems			
3.4 Conventional & Auto-Retracting Seatbelts			
3.5 Collision mitigation braking system & Lane assist systems			
3.6 Collapsible steering			
3.7 Antilock Braking System & Traction control system			
3.8 Electronic Brake distribution & Electronic Stability Program			
Unit 4 VEHICLE ERGONOMICS	15	10	

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4.1 Vehicle Ergonomics: 4.1.1 Introduction To Human Body - Anthropometrics And Its Application To Vehicle Ergonomics 4.1.2 Cockpit Design 4.1.3 Driver Comfort – Seating, Visibility 4.1.4 Passenger, Child seat and Luggage compartment design requirement: Requirements for passenger seats, Split seats for rear passengers, Child Lock, Child seat & luggage compartment requirements and design. 4.1.5 Vehicle Exterior ergonomics and dimensions (Engine compartment, Fuel tank, Spare tire, ground clearance, front & rear bumper positions)			CO2 CO4
4.2 Environmental & Psychological Conditions: 4.2.1 Illumination. 4.2.3 Heat, Ventilation & Air-conditioning. 4.2.3 Noise, Vibration, Harshness. Speed and Acceleration. 4.2.4 Psychological Factors – Stress, Attention			
Unit 5 HUMAN-TECHNOLOGY INTERACTION	10	6	CO2
5.1 Human-Technology Interaction, Human – Machine Systems: Manual and Automated			
5.2 Human system reliability and conceptual designs & development.			
5.3 Human system modelling.			
5.4 Input Interfaces: Text, Symbols & Codes, Visual Display & Graphics, Tactual, Auditory & Speech Communications.			
Total	75	48	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and tutorials.

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	INTRODUCTION	10	15
2	SAFETY CONCEPTS	10	15
3	VEHICLE SAFETY TECHNOLOGY	10	20
4	VEHICLE ERGONOMICS	12	15
5	HUMAN-TECHNOLOGY INTERACTION	06	10
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS.

No	Practical	Marks
1	Study on types of vehicle crash situations.	
2	Study of Active and Passive safety systems.	
3	Study of Crash test dummies.	
4	Working of Air bags.	
5	Types of Pedestrian protection systems.	
6	Construction and working of Anti-lock braking system.	
7	Working of collision mitigation braking system.	
8	Comparison of visibility of different vehicles. Prepare a report.	
9	Study of ergonomics of human body & hence the design of driver's and passenger's seat.	
	Total	25

9. LEARNING RESOURCES

9.1 Text Books

S. No.	Author	Title of Books	Publishers
1	William B. Ribbens	Understanding Automotive Electronics	6 th Edition, Newnes/ Butter worth Heinemann Woburn.
2	Crouse / Anglin	Automobile Mechanics	Tata McGraw- Hill
3	Robert N Brady	Automotive computers and Digital Instrumentation	A Reston Book, Prentice Hill, Eagle Wood Cliffs, New Jersey.
4	Ronald K Jurgen	Navigation and Intelligent Transportation systems – Progress in technology	Automotive Electronics Series, SAE, USA
5	Bechhold	Understanding Automotive Electronics	SAE
6	LjuboVlagic, Michel Parent and Fumio Harashima	Intelligent Vehicle Technologies	Butterworth-Heinemann publications, Oxford

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Robert Bosch	Automotive Handbook	SAE
2	Allan W M B	Automotive Computer Controlled Systems	Elsevier Butterworth-Heinemann

(AU616) AUTOMOTIVE INSURANCE

1. COURSE OBJECTIVES:

Vehicle Insurance is a mandatory requirement for all vehicles that ply on the road. One of the roles performed by a student who acquires a diploma in Automobile Engineering is that of an insurance surveyor. This course exposes a student to all aspects of motor vehicle insurance and provides the necessary knowledge and skills set for that of an insurance surveyor.

2. TEACHING AND EXAMINATION SCHEME

Semester				Total Credits	Examination Scheme				
Course code & course title	Periods/Week (in hours)				Theory Marks		Practical Marks		Total Marks
					TH	TM	TW	PR/OR	
AU616 AUTOMOTIVE INSURANCE	L	T	P	C	TH	TM	TW	PR/OR	
	3	-	2	5	75	25	25	25	150

3. COURSE OUTCOMES:

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

AU616CO1: Understand the history and basic principles of Insurance, motor Insurance, fraudmanagement and Internal audit.

AU616CO2: Summarize the eligibility criteria for insurance and insurance surveyor.

AU616CO3: Apply Insurance norms and regulations to prepare Insurance documentation for adamaged vehicle.

AU616CO4: Estimate the repair cost of a damaged vehicle.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	2	1	1	1	2	1	2	1	1
CO2	2	2	2	2	2	2	2	2	2
CO3	2	3	3	2	2	2	3	1	2
CO4	3	3	3	3	3	3	3	3	3

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours	CO = Course Objectives		
Unit	M	Thr	CO	
1 History of Insurance	09	06		
1.1 History and development of Insurance				
1.2 General Insurance business				CO1
1.3 Structure of the Insurance market in India				CO2
1.4 Nature of Insurance business				CO3
1.5 Need for professionalism in Insurance Business				CO4
1.6 Continued professional development				
2 The Basic Principles of Insurance	18	12		
2.1 Utmost good faith:- Definition of Utmost good faith, Definition of Valid Contract, Essentials of a Valid Contract, Caveat Emor, Insurance Contracts, Uberrima Fides, Reciprocal duty.				
2.2 Insurable Interest:- Concept of insurable interest, subject matter of insurance, subject matter of contract, essentials of insurable interest.				CO1
2.3 Indemnity:- Definition of indemnity, link with insurable interest, how Indemnity is provided, cash payment , repair , replacement, Reinstatement.				CO2
2.4 Corollaries of Indemnity:- Subrogation, corollary of indemnity, extent of subrogation rights.				CO3
2.5 Proximate Cause:- Nature of perils, need for the doctrine, meaning of proximate cause.				CO4
3 Eligibility to be a surveyor and Code of Conduct	18	10		
3.1 Application for, and matters relating to, grant of license to individual surveyors and loss assessors.				CO2
3.2 Duties and responsibilities of a surveyor and loss assessor.				CO3
3.3 Code of conduct of a surveyor and loss assessor.				
4 Motor Insurance	15	10		
4.1 History of Motor Insurance				CO1
4.2 Law and Practice of Motor Insurance in India				CO2
4.3 Market scenario				CO3
4.4 New trends in Motor Insurance				CO4
5 Fraud Management and Internal Audit	15	10		
5.1 Frauds in third party claims: a)Reason for claims occurrence b) Fraud management				CO1
5.2 Frauds in motor insurance: a) Meaning of fraud and legal provisions b) Provisions of Indian Penal Code c) Making a false document d) Fabricating false evidence e) Provisions of Civil Procedure Code f) Criminal procedure code.				CO3
				CO4
Total	75	48		

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	History of Insurance	06	09
2	The Basic Principles of Insurance	12	18
3	Eligibility to be a surveyor and Code of Conduct	10	18
4	Motor Insurance	10	15
5	Fraud Management and Internal Audit	10	15
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
2.	Preparation of Insurance documentation in motor insurance.	
5.	Estimate preparation of 2 damaged vehicles.	
1	Study the insurance business in India and prepare a report.	
3	Study the new trends in Motor Insurance and prepare a report.	
4	Interact with any insurance surveyor/ assessor and present a report on roles and responsibilities, process followed and challenges faced.	
	Total	25

9. LEARNING RESOURCEText

Books

S. No.	Author	Title of Books	Publishers
1	P.Periaswami	Principles and Practice of Insurance	Himalaya Publishing House
2	Khan M.Y.	Financial Services	Tata Mc Graw Hill Co. Ltd.

(AU621) VEHICLE AERODYNAMICS AND DESIGN

1. COURSE OBJECTIVES:

The students will be able to gain exposure to the basics of Aerodynamics & Ergonomics and understand its use in various applications to improve vehicle efficiency. They will be able to attain knowledge on Vehicle performance and stability.

2. TEACHING AND EXAMINATION SCHEME

Semester				Total Credits	Examination Scheme				
Course code & course title	Periods/Week (in hours)				Theory Marks		Practical Marks		Total Marks
					TH	TM	PR /OR	TW	
AU621 VEHICLE AERODYNAMICS & DESIGN	L	T	P	C	TH	TM	PR /OR	TW	
	3	-	2	5	75	25	25	25	150

3. COURSE OUTCOMES:

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

AU621CO1: Understand the fundamentals of vehicle aerodynamics and design.

AU621CO2: Describe the effect of various aerodynamic parameters on the design of vehicle body. AU621CO3: Explain the concepts of aerodynamic drag, wind tunnel testing and ergonomics.

AU621CO4: Evaluate the aerodynamic parameters that decide the vehicle performance and directional stability of the vehicle.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	3	1	2	1	1	1	1	3	2

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CO2	3	3	3	2	3	2	2	2	3
CO3	3	3	3	3	3	3	3	3	2
CO4	3	3	3	3	3	3	3	2	3

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours	CO = Course Objectives			
Unit	M	Thr	CO		
Unit 1 AERODYNAMICS	12	10	CO1 CO2		
1.1 Introduction of aerodynamics: Historical Examples and future trends.					
1.2 Classification & practical objectives of aerodynamics					
1.3 Fundamental aerodynamic variables like Pressure, Density, Temperature, Flow Velocity.					
1.4 Aerodynamic forces & moments like Relative Wind, Free Stream, Lift, Drag, Pitching, Rolling, Yawing & Side forces.					
1.5 Concept of an Airfoil (Aerofoil).					
Unit 2 AERODYNAMIC DRAG & WIND TUNNEL TESTING	18	12	CO2 CO3		
2.1 Types of car bodies					
2.2 Flow field around the car - Air flow pattern, Pressure distribution					
2.3 Local origins of flow field - Front end, windshield wiper, A-pillar, Roof, Rear end.					
2.4 Water and dirt accumulation on the body -Safety, water flow, Dirt Deposits.					
2.5 Downforce and grounding effect in cars, Air Dams, Diffusers, Vortex generators, Spoilers.					
2.6 Wind tunnels: 2.6.1 Concept (no analytical treatment) 2.6.2 Construction 2.6.3 Existing wind tunnels:- Large, Small, full scale wind tunnel, Wind tunnel for scale model, Climatic tunnel, Climatic wind chamber					
2.7. Wind noise: 2.7.1 Wind noise sources: - Leak noise, Cavity noise, Wind- rush noise; 2.7.2 Design features of A-pillar, Outside rear view mirror, Windshield wipers, Radio antenna, Roof racks, Doors.					

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Unit 3 ERGONOMICS	15	8	CO2
3.1 Concept of Visibility			
3.2 Concept of Blind spot			
3.3 Driver seat design requirement			
3.4 Passenger seat design requirement			
3.5 Child seat design requirement			
Unit 4 DIRECTIONAL STABILITY	12	8	CO2 CO4
4.1 Aerodynamic stability			
4.2 Driving behavior in cross wind			
4.3 Driving with trailer			
4.4 Stability of vehicle on slope (numerical problems)			
4.5 Stability of vehicle on turns (numerical problems)			
Unit 5 VEHICLE PERFORMANCE	18	12	CO2 CO4
5.1 Various resistances faced by vehicle (air, rolling, gradient) (numerical problems)			
5.2 Power required to propel the vehicle (numerical problems)			
5.3 Maximum Drawbar pull (numerical problems)			
5.4 Tractive effort & Traction. (numerical problems)			
5.5 Relation between vehicle & engine speed. (numerical problems)			
5.6 Acceleration and Gradeability			
Total	75	48	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and tutorials.

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	AERODYNAMICS	12	20
2	AERODYNAMIC DRAG & WIND TUNNEL TESTING	12	15
3	ERGONOMICS	08	15
4	DIRECTIONAL STABILITY	08	12
5	VEHICLE PERFORMANCE	12	18
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS.

No	Practicals	Marks
1	Study of ergonomics of human body & hence the design of driver's and passenger's seat.	
2	Comparison of visibility of different vehicles. Prepare a report.	
3	Procedure for measurement of various aerodynamic forces and moments.	
4	Study of wind tunnel and procedure for wind load distribution on various body structures.	
5	Case study of an accidental vehicle, which took place due to improper body rework/body building.	
6	Procedure of measurement of air drag in wind tunnel.	
7	Prepare aerodynamic shape with the help of Graphics Software.	
8	Simple sketches of modern passenger car, truck, bus etc with suitable design showing importance of Aerodynamics.	
9	Simple sketches of airflow patterns on various types of vehicle.	
	Total	25

9. LEARNING RESOURCES

9.1 Text Books

S. No.	Author	Title of Books	Publishers
1	John. D Anderson, Jr.	Fundamentals of aerodynamics	McGraw-Hill Books Company, International student Edition
2	Wolf-Heinrich Hucho	Aerodynamics of road vehicles from fluid mechanics to vehicle	SAE International
3	Butterworth's, by Wolf-Heinrich Hucho	Aerodynamics of road vehicles from fluid mechanics to vehicle	SAE International
4	Richard stone, Jeffrey k. Ball	Automotive Eng. Fundamentals	SAE International

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	John Fenton	Vehicle body layout and analysis	Hutchinson, London
2	Lanusz Powloski	Vehicle body engineering	Business books Ltd., London

ELECTIVESIII

(AU619) AUTOMOTIVE AIR CONDITIONING

1. COURSE OBJECTIVES:

Through this course the students will acquire the knowledge of the basics of vehicle air-conditioning system, its components, working principle, control mechanism. They will learn and handle components of the automotive air-conditioning and their functions. They will also gain practical knowledge and will be able to carry out servicing of vehicle air conditioners and will diagnosing components and air conditioning systems. Student will also focus on the latest developments in this field.

2. TEACHING AND EXAMINATION SCHEME

Semester				Total Hours	Examination Scheme				
Course code & course title	Periods/Week (in hours)				Theory Marks		Practical Marks		Total Marks
					TH	TM	TW	PR/OR	
AU619 AUTOMOTIVE AIR CONDITIONING	L 3	T -	P 2	H 5	75	25	25	25	150

3. COURSE OUTCOMES:

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

AU619CO1: Describe the fundamentals of HVAC system in automobiles.

AU619CO2: Identify the different components of HVAC systems and their functions. AU619CO3: Explain the construction and working of HVAC systems and control devices. AU619CO4: Apply the knowledge for diagnosis and troubleshooting of HVAC systems.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	3	2	2	0	0	2	2	2	1
CO2	2	1	1	2	0	2	2	2	0
CO3	2	2	2	2	1	3	2	2	2
CO4	3	3	3	3	2	3	3	3	3

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours			
Units:		M	Thr	CO
1. AUTOMOTIVE AIR CONDITIONING FUNDAMENTALS		9	7	CO1
1.1 Purposes of Heating, Ventilation and Air Conditioning.				
1.2 Definitions: Heat, Heat intensity, Sensible heat, Specific heat capacity, latent heat and change of state, Conduction Convection and Radiation. Enthalpy Pressure and critical temperature pressure, Humidity, Dry and wet bulb temperature.				
1.3 Vapour Compression Refrigeration. Principle, components & working.				
1.4 Vapour Absorption Refrigeration, Principle, components & working.				
1.5 Location of air conditioning components in a car – Schematic layout of a vehicle refrigeration system.				
1.6 Introduction to Psychometry – Basic terminology and Psychometric mixtures- Psychometric Chart				
2. AUTOMOTIVE COOLING AND HEATING SYSTEM		18	12	CO1 CO2 CO3
2.1 Vehicle Refrigeration Systems i. Fixed thermostatic and Orifice tube system. ii. Variable displacement thermostatic and Orifice tube system.				
2.2 Types of Compressor i. Swash plate type ii. Scroll type iii. Vane type				
2.3 Compressor Clutches, Compressor Clutch electrical circuit.				
2.4 Compressor lubrication.				
2.5 Construction and working of Condensers, Evaporators, Expansion devices.				
2.6 Description and function of i. Evaporator temperature and pressure controls ii. receiver iii. drier iv. Accumulators v. refrigerant hoses vi. Connections and other assemblies.				
2.8 Heating system.				
3. AIR-CONDITIONING CONTROLS, DELIVERY SYSTEM AND REFRIGERANTS		18	12	CO2
3.1 Types of Control devices.				
3.2 Preventing Compressor damage, Preventing damage to other systems, Maintaining drivability, Preventing Overheating Ram air ventilation,				
3.3 Air delivery Components, Control devices, Vacuum Controls Containers.				
3.4 Refrigerant, Classification of refrigerants, Classification based on toxicity and flammability. Desirable properties of an ideal refrigerant.				
3.5 Environmental Concerns and Eco friendly refrigerants				
3.6 Important properties of commonly used refrigerants, R12 and R134a				
4. AUTOMATIC TEMPERATURE CONTROL		12	06	CO2
4.1 Different types of sensors and actuators used in automatic temperature control				
4.2 Fixed and variable displacement temperature control				

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4.3 Semi-Automatic- Controller design for Fixed and variable displacement type air conditioning system			
5. SYSTEM SERVICING AND TESTING	18	11	
5.1 Special tools for servicing vehicle air conditioning			CO4
5.2 Refrigeration system diagnosis, Diagnostic procedure Handling, Discharging, Charging & Leak detection			
5.3 Handling, Identification, Storage, Transfer and Disposal of Recycled, Reclaimed and Extracted Refrigerant.			
5.5 Diagnosing components and air conditioning systems			
5.6 Diagnosing cooling system and Air delivery system			
5.7 Automatic temperature Control system diagnosis and service			
Total	75	48	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and tutorials.

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Automotive air conditioning fundamentals	7	9
2	Automotive cooling and heating system	12	18
3	Air conditioning controls, delivery system and refrigerants	12	18
4	Automatic temperature control	6	12
5	System servicing and testing	11	18
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS.

No	Practical	Marks
1.	To study Schematic layout of a vehicle refrigeration system and Location of air conditioning components in a car.	
2.	To study fixed thermostatic and Orifice tube system.	
3.	To study Variable displacement thermostatic and Orifice tube system.	
4.	To study different types of compressor, Compressor Clutches, Compressor Clutch electrical circuit and Compressor lubrication.	
5.	To study Condensers, Evaporators, Expansion devices, Evaporator temperature and pressure controls, receiver, drier, Accumulators, refrigerant hoses, Connections and other assemblies.	
6.	To study types of Control devices and their role in Preventing Compressor damage, Preventing damage to other systems, Maintaining driveability, Preventing Overheating Ram air ventilation.	
7	To study Air delivery Components, Control devices, Vacuum Controls Containers.	
8	To study different types of sensors and actuators used in automatic temperature control.	
9	To study Special tools for servicing vehicle air conditioning.	
10	Diagnosing components and air conditioning systems.	

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11	Diagnosing cooling system and Air delivery system.	
12	Automatic temperature Control system diagnosis and service.	
13	Identify Refrigerant service connectors and hoses for R12 and R134a.	
	Total	25

9. LEARNING RESOURCES

9.1 Text Books

S. No.	Author	Title of Books	Publishers
1	Warren Farnell and James D. Halderman	"Automotive Heating, Ventilation, and Air Conditioning systems", Classroom Manual	Pearson Prentice Hall, 2004
2	Warren Farnell and James D. Halderman,	"Automotive Heating, Ventilation, and Air Conditioning systems"	Shop Manual, Pearson Prentice Hall, 2004
3	William H Crouse and Donald L Anglin,	"Automotive Air conditioning"	McGraw Hill Inc., 1990

9.2 Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Goings, L.F.	"Automotive Air Conditioning"	American Technical services, 1974
2	Mitchell Information Services, Inc.	"Mitchell Automatic Heating and Air Conditioning Systems"	Prentice Hall Inc., 1989
3	McDonald, K.L.	"Automotive Air Conditioning"	Theodore Audel series, 1978.
4	Paul Weisler	"Automotive Air Conditioning"	Reston Publishing Co. Inc., 1990.

(AU701) ROAD TRANSPORT MANAGEMENT**1. COURSE OBJECTIVES:**

Organisation and management of any motor and transport industry forms a very important activity of an automobile engineer. A clear idea of the operation and management of the bus and goods transport will result in effective handling of this industry. This course provides sufficient insight in the area.

2. TEACHING AND EXAMINATION SCHEME

Semester									
Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
AU701 ROAD TRANSPORT MANAGEMENT	L	T	P	C	TH	TM	TW	PR/OR	
	3	-	2	5	75	25	25	25	150

3. COURSE OUTCOMES:

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

AU701CO1: Understand the functioning of motor and transport Industry.

AU701CO2: Explain the organisation and operation of motor and transport Industry. AU701CO3: Apply costing and legal laws to motor and transport Industry.

AU701CO4: Plan a new transport service.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	2	2	2	2	1	1	2	2	2
CO2	2	1	2	2	2	3	2	2	2
CO3	2	3	3	2	3	2	3	2	2
CO4	2	3	3	2	3	2	3	2	2

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours	CO = Course Objectives		
Unit	M	Thr	CO	
1 ROAD TRANSPORT	15	06		
1.1 History of road transport			CO1 CO4	
1.2 Functions of transport: Economic, Social, Military				
1.3 Modes of urban passenger transport				
1.4 Modes of rural passenger transport				
1.5 Demand for transportation service				
1.6 Characteristics of different modes of transport.				
2 BUS TRANSPORT OPERATION	15	12		
2.1 Fare, Basic principles of fares charging: Flat fares, Telescopic fares, Cost of service, Value of service, Special rates, Differential rates for different types of services.			CO1 CO2 CO3 CO4	
2.2 Organization Setup: Government, Semi- Government, Private.				
2.3 Labour and labour relations, Incentive Schemes: Financial Incentive, Semi-Financial Incentive, Non-Financial Incentive.				
2.4 Taxation: Types of Taxes: Road Tax, Passenger Tax, GST				
2.5 Passenger amenities.				
3 BUS TRANSPORT MANAGEMENT	15	12		
3.1 Essentials of transport system, Planning a new service: Geographical and Economic considerations			CO1 CO2 CO3 CO4	
3.2 Depot layout, Object of a good layout, Effective handling of peak load, Depot Management, Developing the traffic, Traffic Investigation, Route planning and development, Management Information systems.				
3.3 Scheduling: Basic factors in bus, crew and maintenance scheduling.				
4 GOODS TRANSPORT	15	08		

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4.1 Goods Vehicle, Route, Trip.			CO1 CO2 CO3 CO4
4.2 Market potential: Type of goods, types of consignments, Period of use, Probable competition.			
4.3 Legal Compliance: Documents required as per M.V.A.			
4.4 Freight Calculation: Time base, distance base, Contract, Cubic feet, Tone method, Hiring of trucks, Toll, Staff wages.			
5 MOTOR INDUSTRY	15	10	
5.1 The Automobile Industry In India			
5.2 Importance of Automobile Engineer.			CO1 CO2 CO3 CO4
5.3 Working of Various State Transport Organizations. (KTCL,MSRTC, BEST)			
5.4 Various Research Organizations like- Central Institute of Road Transport. Automotive Research Association of India. Vehicle Research, Development & Establishment. Central Road Research Institute. Petroleum Conservation & Research Association			
Total	75	48	

6. COURSE DELIVERY:

The Course will be delivered through lectures and class room interactions.

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	ROAD TRANSPORT	06	15
2	BUS TRANSPORT OPERATION	12	15
3	BUS TRANSPORT MANAGEMENT	12	15
4	GOODS TRANSPORT	08	15
5	MOTOR INDUSTRY	10	15
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Study of a Fare table of the State of Goa.	

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2.	Prepare layout of a Depot.	
3.	Study of Road Tax and Passenger Tax of the State of Goa and prepare a report.	
4.	Study of the different documents used in transport organization.	
5.	Collection of Data of various automobile industries in India.	
	Study the working of KTCL and prepare a report	
	Total	25

9. LEARNING RESOURCES

9.1 Text Books

S. No.	Author	Title of Books	Publishers
1	Dr. P. Sudarsanam.	Passenger Amenities in STU	CIRT, Pune
2	Dr. P. Sudarsanam.	Fare structure in STU	CIRT, Pune
3	Dr. P. Sudarsanam.	Bus station Management	CIRT, Pune
4	Dr. P. Sudarsanam.	Bus & Crew scheduling	CIRT, Pune
5	O.P. Khanna.	Industrial Organization & Management	Dhanpat Rai & sons
6	Dr. P.G. Patankar. Director.	Compendium of Transport Terms	CIRT, Pune

9.2 Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Andrew Hastie	Practical Transport management	

(MC631) LEAN MANUFACTURING

1. COURSE OBJECTIVE:

This course will enable the student to understand the basics of Lean Manufacturing and its different tools used in Industries. Its set of principles and processes leads to identifying and eliminating different wastes in the system. Lean Manufacturing helps in streamlining operations or manufacturing with Customer TAKT time, identifying the bottle neck areas and eliminates the same, which in turn will lead to Reduced Cycle Times.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/Week in Hours			Total Hours	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
(MC631) LEAN MANUFACTURING	L	T	P	H	TH	TM	OR	TW	150
	3	-	2	5	75	25	25	25	

3. COURSE OUTCOMES:

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

MC631CO1: Identify value added and non-value-added activities in a

workplaceMC631CO2: Apply 5S concept to maintain a workplace.

MC631CO3: Use Lean tools to make improvements in the

systemMC631CO4: Select Standard Work/ Best Method.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	3	2	2	1	2	2	2	1	3
CO2	3	2	2	3	3	2	2	2	2
CO3	3	2	3	3	3	3	2	2	2
CO4	3	3	3	3	3	3	2	2	3

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours	CO = Course Outcomes		
Unit	M	Thr	CO	
1 INTRODUCTION TO LEAN MANUFACTURING	22	13		
1.1 History of lean manufacturing.				
1.2 Lean –Meaning &Definition, Objectives of Lean Manufacturing system				
1.3 Lean Manufacturing V/s Traditional Manufacturing				
1.4 Value added Activity, Non-Value-added activity				
1.5 Internal Customer and External Customer				
1.6 Concepts of Waste, Eight Types of Wastes				
1.7 Pull System and Push system, Difference between Pull and Push system,				
1.8 Introduction to Lean Six sigma, Lean v/s Six Sigma				
2 5S ORGANIZATION SYSTEM	9	5		
2.1 “5S” Terminology				
2.2 The Concept of 5-S with Examples				
2.3 Importance of 5S in Industry / Office,				
2.4 5S Visuals control.				
2.5 5S Audit				
3 ESSENTIAL LEAN TOOLS	22	15		
3.1 Standardized Work				
3.2 KAIZEN				
3.3 One-piece Flow or Continuous flow				
3.4 Pull system and Kanban, Heijunka /Leveling				
3.5 Visual Control / Management				
3.6 TAKT Time, Cycle Time, SMED/OTS (Single Minute Exchange of Dies/One Touch Setup)				
3.7 Jidoka,/Mistake proofing / Poka Yoke				
3.8 Introduction to Total Productive Maintenance				
4 JUST IN TIME	12	8		
4.1 Introduction				
4.2 Elements of JIT: Small lot Sizes, set up Time, Pull production system, Cellular layouts, Standardization of components and work methods, Supplier network, Flexible Resources, Continuous Improvement				
4.3 Just in Time Manufacturing				
4.4 Benefits of JIT				
5 VALUE STREAM MAPPING	10	8		
5.1 Concept of VSM				
5.2 VSM Methodology, symbol used				
5.3 Current and Future State Map				
5.4 Examples of VSM				
Total	75	48		

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	No of lectures	Marks
1	Introduction to Lean manufacturing	13	22
2	5S Organisation System	05	9
3	Essential Lean Tools	15	22
4	Just in Time	08	12
5	Value Stream Mapping	08	10
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS (ANY FIVE)

No	Practical	Marks
1	Identifying Wastes in an Industry where you had undergone training and suggest ways to improve.	
2	Set up Institute's Workshop / Office / Lab or any other workplace to 5S Standard & prepare a detailed report	
3	Case study on application of 5S in Industry.	
4	Pull System demonstration	
5	Prepare a report on implementation of Kaizen at workplace.	
6	Industry Visit to check best practices and make a Report.	
	Total	25

9. LEARNING RESOURCES

9.1 Text Books

S. No.	Author	Title of Books	Publishers
1	Jeffrey K. Liker	The Toyota way	McGraw Hill Professional
2	James P. Womack, Daniel T. Jones	The Machine That changed the world	Free Press, New York
3	Gopalkrishnan N.	Simplified Lean Manufacture: Elements, Rules, Tools and Implementation	PHI
4	Eric Ries	The Lean Startup	Penguin
5	Christopher Jahns, Nicolas Reinecke	Lean Production	DGM Icfai Books

9.2 Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	James P. Womack and Daniel T. Jones	Lean thinking	Lean enterprise Institute Cambridge
2	Mike Rother & John shook	Learning to See	Lean enterprise Institute Cambridge

(AU618) SPECIAL PURPOSE VEHICLES

1. COURSE OBJECTIVES:

Through this course the students will acquire the knowledge of different types and various classifications of special purpose vehicles. They will go in depth of the constructional details of special purpose vehicles and know their applications. They will also gain knowledge about the fundamentals of special purpose vehicles. Student will also focus on the latest developments in this field.

2. TEACHING AND EXAMINATION SCHEME

Semester				Total Hours	Examination Scheme				
Course code & course title	Periods/Week (in hours)				Theory Marks		Practical Marks		Total Marks
					TH	TM	TW	PR/OR	
AU618 Special Purpose Vehicles	L 3	T -	P 2	H 5	75	25	25	25	150

3. COURSE OUTCOMES:

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

AU618CO1: List the various special purpose vehicles.

AU618CO2: Understand the concept of various special purpose vehicles and their applications. AU618CO3: Explain the constructional details and functions of various special purpose vehicles. AU618CO4: Select the special purpose vehicles based on different applications.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	3	1	1	0	0	1	0	1	0
CO2	3	1	1	1	0	1	1	2	2
CO3	3	3	3	3	2	3	2	2	2
CO4	3	3	3	3	3	3	3	2	1

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours			
Units:	M	Thr	CO	
1. OFF ROAD EQUIPMENTS	15	10		
1.1 Transport Equipment: Powered Equipment, Tractors And Trolleys, - Constructional Details, Applications.				
1.2 Trailers, Platform Lift Trucks, Fork Lift Trucks, Containers And Supports.- Constructional Details, Applications			CO1	
1.3 Hauling Equipment: Types Of Dump Trucks, On-High Way Vehicles, Off High Way Vehicles. - Constructional Details, Applications			CO2	
1.4 Hoisting Equipment: Jacks, Truck Mounted Crane, Crawler Crane, and Outriggers. - Constructional Details, Applications			CO3	
			CO4	
2. FARM EQUIPMENTS	15	12		
2.1 Tractors In Earth Moving ,Applications Of Tractors, Rating of Tractors			CO1	
2.2 Wheeled And Crawler Tractor - Constructional Details, Applications			CO2	
2.3 Recent Trends In Tractor Design			CO3	
2.4 Power Shift Transmission And Final Drive In Caterpillar Tractor. – Mechanism			CO4	
3. EARTH MOVING MACHINES	15	12		
3.1 Bulldozers, Cable And Hydraulic Dozers. Constructional Details, Applications				
3.2 Crawler Tractor, Running And Steering Gears. Constructional Details, Applications			CO1	
3.3 Dump Trucks And Dumpers Constructional Details, Applications			CO2	
3.4 Loaders: Single Bucket, Multi Bucket And Rotary Types Constructional Details, Applications			CO3	
3.5 Power And Capacity Of Earth Moving Machines, Constructional Details, Applications			CO4	
4. CONSTRUCTION MACHINES	15	09		
4.1 Scrapers: Self-Powered Scrapers. Constructional Details, Applications			CO1	
4.2 Graders: Elevating Graders. Constructional Details, Applications			CO2	
4.3 Bush Cutters, Stumpers. Constructional Details, Applications			CO3	
4.4 Dozer, Rippers. Constructional Details, Applications			CO4	
5. SPECIAL APPLICATION MACHINES	15	05		
5.1 Power Shovel - Constructional Details, Applications - Drag Lines			CO1	
5.2 Revolving And Stripper Shovels			CO2	
5.3 Capacity Of Shovels			CO3	
5.4 Ditchers - Constructional Details, Applications			CO4	
Total	75	48		

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and tutorials.

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Off Road equipment's.	10	15
2	Farm equipment's	12	15
3	Earth moving machines	12	15
4	Construction machines	9	15
5	Special application machines	5	15
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS.

No	Practical	Marks
1.	Visit a service center of Tractor or Dozer or Excavator or Fork lift or Road Roller. Write report on various mechanisms used, service procedure adopted, cost of equipment and other financial aspects.	
2.	Visit to a mine/ Construction site to observe various operations of earth moving machines. Write report on the visit.	
3.	Demonstration to understand specifications and features like hydraulic circuit, control system of any one earth moving machine.	
4.	Demonstration on specifications and capacities of any one dozer. Draw the sketches and identify various dozer blades stating their applications.	
5.	Demonstration of any one Rope operated excavator/ fork lift in view of construction and operation.	
6.	Demonstration of crawler loader and its attachments/ road roller types and operations.	
	Total	25

9. LEARNING RESOURCES

9.1 Text Books

S. No.	Author	Title of Books	Publishers
1	Wang. J. T.	Theory of Grand vehicles	Butterworth – Heinemann ltd, second edition, oxford, 2000
2	Jagman Singh	Art of earth moving	APICS, 2001
3	Radichev	Tractor and Automobile	
4	Burge	Tractors and their power units	
5	Trucker	Earth moving Plants	

9.2 Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	nil	Off the Road Wheeled and Combined Traction Devices	Ashgate Publishing Co. Ltd. 1998
2	Peurifoy R L	Construction Planning Equipment and Methods	Tata McGraw Hill, New Delhi, 2002.
3	Ian Graham	Off-Road Vehicles	Heinemann Library, 2008.
4	Wong J	Terramechanics and Off-road Vehicle Engineering	Butterworth-Heinemann, 2009.
5	Roninson E G	Motor Graders	MIR Publications, Muscow, 1985
6	Rodhiev and Rodhiev	Tractors and Automobiles	MIR Publishers, Moscow, 1984
7	Greenwich and Soreking	Tractors	MIR Publishers, Moscow, 1967