



**SNS COLLEGE OF
TECHNOLOGY**
(An Autonomous Institution)



Approved by AICTE, Recognized by UGC & Affiliated to Anna University
Accredited by NBA-AICTE, NAAC-UGC with 'A++' Grade
Saravanampatti, Coimbatore – 641035.

REGULATION 2023 CURRICULAM
I – VIII SEMESTER
CHOICE BASED CREDIT SYSTEM

B.E - AUTOMOBILE ENGINEERING

**DEPARTMENT OF AUTOMOBILE
ENGINEERING**



**SNS COLLEGE OF
TECHNOLOGY**
(An Autonomous Institution)
COIMBATORE-35



DEPARTMENT OF AUTOMOBILE ENGINEERING
R 2023 – SUGGESTED CURRICULUM
B.E – AUTOMOBILE ENGINEERING

Description / Semester	AICTE	SNSCT – Suggested	Sem 1	Sem 2	Sem 3	Sem 4	Sem 5	Sem 6	Sem 7	Sem 8
Humanity, Social Science & Mandatory (HSMC)	12	11	3	4	2	-	-	-	2	-
Basic Science (BSC)	25	31	8	11	5	7	-	-	-	-
Engineering Sciences (ESC)	24	28	8	8	12	-	-	-	-	-
Programme Core (PCC)	48	43	-	-	4	12	10	13	4	-
Programme Elective (PEC)	18	18	-	-	-	-	3	3	6	6
Open Elective (OEC)	18	9	-	-	-	-	3	3	3	-
Project/Seminar/Internship (EEC)	15	31	3	1	1	3	6	3	2	12
Mandatory Courses (MC)	(Non Credit)									
TOTAL	160	171	22	24	24	22	22	22	17	18

SEMESTER I									
S.No.	CourseCode	Course	L	T	P	Contact hrs/week	Credit	Int/Ext	Category
Theory Courses									
1.	23MAT101	Matrices and Calculus	3	1	0	4	4	40/60	BSC
2.	23PYT101	Engineering Physics	3	0	0	3	3	40/60	BSC
3.	23MET101	Engineering Mechanics	3	0	0	3	3	40/60	ESC
4.	23EET101	Basics of Electrical and Electronics Engineering	3	0	0	3	3	40/60	ESC
5.	23GET103	Heritage of Tamils	1	0	0	1	1	40/60	HSMC
Theory Integrated Practical Courses									
6.	23GEB101	Design Thinking and Innovation	1	0	4	5	3	50/50	EEC
Practical Courses									
7.	23PYP101	Physics Laboratory	0	0	2	2	1	60/40	BSC
8.	23ENP101	Professional Communication	0	0	4	4	2	60/40	HSMC
9.	23GEP101	Workshop Practices	0	0	4	4	2	60/40	ESC
Non Credit Mandatory Course									
10.	23CHT103	Environmental Science and Sustainability	2	0	0	2	0	100/0	MC
11.	23HST101	3 Weeks Induction Program							
Total			16/1/14			31	22		

SEMESTER II									
SNo.	Course Code	Course	L	T	P	Contact hrs/week	Credit	Int/Ext	Category
Theory Courses									
1.	23MAT102	Complex Analysis and Laplace Transformation	3	1	0	4	4	40/60	BSC
2.	23CHT102	Chemistry of Engineering Materials	3	0	0	3	3	40/60	BSC
3.	23ENT101	Communicative English	3	0	0	3	3	40/60	HSMC
4.	23ITT101	Programming in C and Data Structures	3	0	0	3	3	40/60	ESC
5.	23MET102	Engineering Drawing	1	0	4	5	3	40/60	ESC
6.	23AUT101	Elements of Automotive Systems	3	0	0	3	3	40/60	BSC
7.	23GET104	Tamils and Technology	1	0	0	1	1	40/60	HSMC
Practical courses									
8.	23CHP101	Chemistry Laboratory	0	0	2	2	1	60/40	BSC
9.	23ITP101	Programming in C and Data Structures Laboratory	0	0	4	4	2	60/40	ESC
10.	23AUP101	Internship-I	2 Weeks			-	1	100/0	EEC
Mandatory Course									
11.	23HST103	Indian Constitution	2	0	0	2	0	100/0	MC
Total			19/1/10			30	24		

EMESTER III											
S No.	Course Code	Course	L	T	P	Contact hrs/week	Credit	Int/Ext	Category	Corequisites	
Theory Courses											
1.	23MAT201	Partial Differential Equations and Transforms	3	0	0	3	3	40/60	BSC		
2.	23AUT201	Thermal Science and Engineering	3	0	0	3	3	40/60	ESC		
3.	23AUT202	Automotive Engines and Emission Control	3	0	0	3	3	40/60	ESC		
4.	23GET275	VQAR-I	2	0	0	2	2	40/60	BSC		
Theory Integrated Practical Courses											
5.	23AUB201	Automotive Electrical Drives and Controls	3	0	2	5	4	50/50	PCC		
6.	23GEB202/ 3/4/5	Language Elective	1	0	2	3	2	50/50	HSMC		
Practical Courses											
7.	23ITP204	Programming in Python	0	0	4	4	2	60/40	ESC		
8.	23AUP201	Automotive Systems Laboratory	0	0	4	4	2	60/40	ESC		
9.	23AUP202	Automotive Engines and Emission Control Laboratory	0	0	4	4	2	60/40	ESC		
10.	23AUP203	Mini Project - I	0	0	2	2	1	100/0	EEC		
Total			15/0/18			33	24				

SEMESTER IV											
S No.	Course Code	Course	L	T	P	Contact hrs/week	Credit	Int/Ext	Category	Corequisites	
Theory Courses											
1.	23MAT204	Statistics and Numerical Methods	3	0	0	3	3	40/60	BSC		
2.	23AUT203	Mechanics of Automobile Systems	3	0	0	3	3	40/60	PCC	23MET101	
3.	23AUT204	Solid and Fluid Mechanics	3	0	0	3	3	40/60	PCC	23MET101	
4.	23AUT205	Hybrid Electric and Fuel Cell Vehicles	3	0	0	3	3	40/60	PCC		
5.	23AUT206	Smart Manufacturing Technology	3	0	0	3	3	40/60	PCC		
6.	23GET276	VQAR-II	2	0	0	2	2	40/60	BSC		
Practical Courses											
7.	23AUP204	Mechanical Sciences Laboratory	0	0	4	4	2	60/40	BSC		
8.	23GEP275	Personal Branding	0	0	4	4	2	60/40	EEC		
9.	23AUP205	Internship-II	2 Weeks					1	100/0	EEC	
Total			17/0/8			25	22				

SEMESTER V										
S No.	Course Code	Course	L	T	P	Contact hrs/week	Credit	Int/Ext	Category	Corequisites
Theory Courses										
1.	23AUT301	Vehicle Dynamics and Structures	3	0	0	3	3	40/60	PCC	23MET101
2.	23AUT302	Automotive Component Design	3	0	0	3	3	40/60	PCC	
3.		Professional Elective - I	3	0	0	3	3	40/60	PEC	
4.		Open Elective - I	3	0	0	3	3	40/60	OEC	
Theory Integrated Practical Courses										
5.	23AUB301	Automotive Fuels and Lubricants	3	0	2	4	4	50/50	PCC	
6.		Career Course -I	2	0	4	6	4	50/50	EEC	
Practical Courses										
7.	23AUP301	Mini Project – II	0	0	2	2	1	100/0	EEC	
8.	23AUP302	Automotive Component Design Laboratory	0	0	2	2	1	100/0	EEC	
Total			17/0/10			26	22			

SEMESTER VI										
S No.	Course Code	Course	L	T	P	Contact hrs/week	Credit	Int/Ext	Category	Corequisites
Theory Courses										
1.	23AUT302	Artificial Intelligence and Internet of Vehicles	3	0	0	3	3	40/60	PCC	
2.	23AUT303	Electric Vehicle Technology	3	0	0	3	3	40/60	PCC	
3.	23AUT304	Special Vehicle	3	0	0	3	3	40/60	PCC	
4.		Professional Elective - II	3	0	0	3	3	40/60	PEC	
5.		Open Elective - II	3	0	0	3	3	40/60	OEC	
Theory Integrated Practical Courses										
6.	23AUB303	Finite Element Methods and Analysis	3	0	2	5	4	50/50	PCC	
7.		Career Course -II	1	0	2	3	2	50/50	EEC	
Practical Course										
8.	23AUP302	Internship-III	2 Weeks				1	100/0	EEC	
Mandatory Course										
9.	23HST105	Essence of Indian Traditional Knowledge	2	0	0	2	0	100/0	MC	
Total			21/0/4			25	22			

SEMESTER VII										
S No.	Course Code	Course	L	T	P	Contact hrs/week	Credit	Int/Ext	Category	CORE REQUISITES
Theory Courses										
1.	23GET401	Universal Human Values	2	0	0	2	2	40/60	HSMC	
2.	23AUT401	Fleet Management	3	0	0	3	3	40/60	PCC	
3.		Professional Elective - III	3	0	0	3	3	40/60	PEC	
		Open Elective – III*	3	0	0	3	3	40/60	OEC	
Theory Integrated Practical Courses										
5.	23AUB401	Vehicle Maintenance and Reconditioning	3	0	2	4	4	50/50	PCC	
Practical courses										
6.	23AUP401	Project - I	0	0	4	4	2	60/40	EEC	
	Total		14/0/6			19	17			

SEMESTER VIII										
S No.	Course Code	Course	L	T	P	Contact hrs/week	Credit	Int/Ext	Category	CORE REQUISITES
Theory Courses										
1.		Professional Elective - IV	3	0	0	3	3	40/60	PEC	
2.		Professional Elective - V	3	0	0	3	3	40/60	PEC	
Practical courses										
3.	23AUP402	Project - II	0	0	24	24	12	60/40	EEC	
	Total		6/0/24			30	18			

LANGUAGE ELECTIVE COURSES

S.No	Course Code	Courses Offered	L	T	P	J	C
1	23GEB202	Hindi	1	0	2	0	2
2	23GEB203	Japanese	1	0	2	0	2
3	23GEB204	German	1	0	2	0	2
4	23GEB205	French	1	0	2	0	2

PEC- Professional Elective Courses

S.No	Course Code	Courses Offered	L	T	P	J	C
Professional Elective – I							
1	23AUE301	Automotive control system	3	0	0	0	3
2	23AUE302	Automotive Safety and Infotronics	3	0	0	0	3
3	23AUE304	Intelligent Vehicle Technology	3	0	0	0	3
4	23AUE305	AR and VR in Automobile	3	0	0	0	3
5	23AUE306	Automotive Embedded system	3	0	0	0	3
6	23MEE305	Principles of Management	3	0	0	0	3
Professional Elective – II							
1	23AUE307	Lean Manufacturing	3	0	0	0	3
2	23AUE308	Computer Integrated Manufacturing	3	0	0	0	3
3	23AUE309	Industrial Safety for Automobile	3	0	0	0	3
4	23AUE310	Metrology in Automotive Industry	3	0	0	0	3
5	23AUE311	Advanced Materials in Automobile	3	0	0	0	3
6	23MEE310	Engineering Economics and Cost Analysis	3	0	0	0	3
Professional Elective – III							
1	23AUE401	Operation Research	3	0	0	0	3
2	23AUE402	Product Management	3	0	0	0	3
3	23AUE403	Battery Technology	3	0	0	0	3
4	23AUE404	Total Quality Management	3	0	0	0	3
5	23AUE405	Biology for Automotive Fuels and Emissions	3	0	0	0	3
6		Traffic Rules and Management	3	0	0	0	3
Professional Elective – IV							
1	23AUE405	Automotive Computational Fluid Dynamics	3	0	0	0	3
2	23AUE406	Ergonomics in Automotive Design	3	0	0	0	3
3	23AUE407	Automotive Aerodynamics and Acoustics	3	0	0	0	3
4	23AUE408	Automotive Vibration and Noise control	3	0	0	0	3
5	23AUE409	Geometric Dimension and Tolerance	3	0	0	0	3
6	23AUE410	Automotive Interior Design	3	0	0	0	3

Professional Elective – V							
1	23AUE411	Two and Three Wheeler Technology	3	0	0	0	3
2	23AUE412	Vehicle Air Conditioning	3	0	0	0	3
3	23AUE413	Motorsport Engineering	3	0	0	0	3
4	23AUE414	Rubber Technology	3	0	0	0	3
5	23AUE415	Composite Materials for Automobile	3	0	0	0	3
6	23AUE416	Vehicle Body Engineering	3	0	0	0	3
Professional Elective – VI							
1	23AUE417	Power Electronics for EV	3	0	0	0	3
2	23AUE418	Electric Two Wheeler Technology	3	0	0	0	3
3	23AUE419	Battery Management System	3	0	0	0	3
4	23AUE420	EV Charging Station Design	3	0	0	0	3
5	23AUE421	Alternative Electrical Energy Source	3	0	0	0	3
6	23AUE422	Recent Trends in Electrical Vehicle	3	0	0	0	3

CAREER COURSES (UG)

S.No	Course Code	Courses Offered	Sem	L	T	P	J	C
Track 1 Job (6 Credits)	23GEB375	Personnel Psychology and Technical Interviewing	V Semester	2	0	4	0	4
	23GEB379	Employable Skill Development	VI Semester	1	0	2	0	2
Track 2 Entrepreneurship (6 Credits)	23GEB376	Entrepreneurship and Business Canvas Model	V Semester	2	0	4	0	4
	23GEB382	Economics, Finance and Accounting and Intellectual Property Rights	VI Semester	1	0	2	0	2
Track 3 Higher Education (6 Credits)	23GEB377	Advanced Verbal Quantitative Aptitude and Reasoning and Networking	V Semester	2	0	4	0	4
	23GEB380	Higher Studies in Abroad and India	VI Semester	1	0	2	0	2
Track 4 Govt. /RRB/ Bank (6 credits)	23GEB378	Foundation Course on Competitive Exams	V Semester	2	0	4	0	4
	23GEB381	Personnel Psychology for Government. Jobs	VI Semester	1	0	2	0	2

Mandatory Courses (UG)

Course Code	Course Title	L	T	P	J	C
23HST101	Induction Program (3 Weeks)	0	0	0	0	0
23CHT103	Environmental Sciences and sustainability	2	0	0	0	0
23HST103	Indian Constitution	2	0	0	0	0
23HST105	Essence of Indian Traditional Knowledge	2	0	0	0	0

Other Special Courses (UG)

Course Code	Course Title	L	T	P	J	C
23GEB101	Design Thinking and Innovation	1	0	0	4	3
23GET275	VQAR – I	2	0	0	0	2
23GET277	Biology for Engineers	2	0	0	0	2
23GEP275	Personality Branding	0	0	4	0	2
23GET276	VQAR - II	2	0	0	0	2
23GET201	Professional Ethics and Human Values	2	0	0	0	2

Open Elective Courses (UG)

S.No	Course Code	Courses Offered	L	T	P	J	C
1	23AUO301	Basics of Electric Vehicle Technology	3	0	0	0	3
2	23AUO302	Recent Trends in Automobiles	3	0	0	0	3
3	23AUO303	Road Safety and Traffic Rules	3	0	0	0	3
4	23AUO304	Two Wheeler Technology	3	0	0	0	3
5	23AUO305	Automotive Maintenance	3	0	0	0	3
6	23AUO306	Off Road Vehicles	3	0	0	0	3

SEMESTER I

23MAT101	MATRICES AND CALCULUS	L	T	P	C
		3	0	3	3

UNIT I	MATRIX EIGEN VALUE PROBLEM	9+3
Eigen values and Eigenvectors of a real matrix – Properties of Eigen values and Eigenvectors – Cayley Hamilton Theorem (statement only) and its applications – Eigen value problems arising from population models (Leslie model).		

UNIT II	ORTHOGONAL TRANSFORMATION OF A REAL SYMMETRIC MATRIX	9+3
Diagonalization of a real symmetric matrix – Quadratic form – Canonical form – Nature of the quadratic form – Reduction of quadratic form to canonical form by orthogonal transformation – Applications: Stretching of an elastic membrane.		

UNIT III	DIFFERENTIAL CALCULUS	9+3
Curvature – Radius of Curvature in Cartesian co-ordinates – Centre of curvature and circle of curvature in Cartesian Co-ordinates – Evolutes – Envelopes.		

UNIT IV	FUNCTIONS OF SEVERAL VARIABLES	9+3
Partial derivatives – Homogeneous functions and Euler’s theorem – Jacobians – Taylor’s series for functions of two variables – Applications: Maxima and minima of functions of two variables – Lagrange’s method of undetermined multipliers.		

UNIT V	MULTIPLE INTEGRALS	9+3
Double integrals (Cartesian co-ordinates) – Change of order of integration – Applications of double integrals (Area) – Triple integrals (Cartesian co-ordinates) – Applications: Volume of solids.		

L: 45 T: 15 P: 0 TOTAL : 60 PERIODS

TEXT BOOKS

1.	Kreyszig, E., Advanced Engineering Mathematics, John Wiley and Sons, 10 th Edition, New Delhi 2016.
2.	James Stewart, Calculus, Cengage Learning, 8 th Edition, New Delhi 2015.

REFERENCES

1.	Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers, New Delhi, 44 th Edition, 2018.
2.	Bali, N.P, Goyal, M. and Watkins, C., Advanced Engineering Mathematics, Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.), New Delhi, 7 th Edition, 2009.
3.	Jain, R.K. and Iyengar, S.R.K., Advanced Engineering Mathematics, Narosa Publications, New Delhi, 5 th Edition, 2016.
4.	Ramana, B.V., Higher Engineering Mathematics, McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
5.	Thomas, G. B., Hass, J, and Weir, M.D, Thomas Calculus, 14 th Edition, Pearson India, 2018.

COURSE OUTCOMES	
CO1	Know about Eigen values and Eigen vectors and its role in the system of equations.
CO2	Transform the real symmetric matrix from quadratic form to canonical form by means of orthogonal transformation.
CO3	Determine the radius, centre and circle of curvature of any curve.
CO4	Use differential calculus ideas on several variable functions.
CO5	Apply multiple integral ideas in solving areas, volumes and other practical problems.

23PYT101	ENGINEERING PHYSICS	L	T	P	C
		3	0	3	3

UNIT I	CRYSTAL STRUCTURE	9
Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances - coordination number and packing factor for SC, BCC, FCC, HCP structures; Crystal imperfections –point, line, surface and volume imperfections		

UNIT II	QUANTUM PHYSICS	9
Black body radiation – Planck’s theory (derivation) – Deduction of Wien’s displacement law and Rayleigh – Jean’s Law from Planck’s theory — Properties of Matter waves –Physical significance of wave function-Schrödinger’s wave equations: Time independent and time dependent equations–Particle in a one dimensional box–Electron microscope-Scanning Electron Microscope (SEM) -Transmission Electron Microscope (TEM).		

UNIT III	ELASTICITY	9
Elasticity – Stress-strain diagram and its uses - factors affecting elastic modulus and tensile strength – torsional stress and deformations – twisting couple - torsion pendulum: theory and experiment - bending of beams - bending moment – cantilever: theory and experiment – uniform and non-uniform bending: theory and experiment - I-shaped girders		

UNIT IV	PHYSICS OF ADVANCED MATERIALS	9
Conductors: classical free electron theory (Lorentz –Drude theory) – electrical conductivity. Superconductors: definition – Meissner effect – type I & II superconductors – BCS theory. Nanomaterials: introduction and properties – synthesis – top-down process: Ball milling method -bottom-up approach: Physical Vapour deposition – applications.		

UNIT V	NON-DESTRUCTIVE TESTING	9
Introduction- Types of defects-Methods of NDT-Visual inspection- Liquid/Dye penetrant testing-Magnetic particle testing-Eddy current testing-Ultrasonic inspection method-Advantages-X-Ray radiography- X-ray fluoroscopy-Comparison of conventional and real time radiography.		

L: 30 T: 0 P: 0 TOTAL : 45 PERIODS

TEXT BOOKS	
1.	Gaur R.K. and Gupta S.L, “Engineering Physics”, Dhanpat Raipublishers,2013
2.	Dr.M.N.Avandhanulu,Dr.P.G.Kshirsagar,“ATextbookofEngineeringPhysics”, S.Chand,2014
3.	Murugesan R And Kiruthika Sivaprasath , “Modern Physics”18 th edition, S.Chand2016

REFERENCES	
1.	Rajendran.V, Engineering Physics,Tata Mcgraw-Hill Publishing Company Limited, NewDelhi.2017.
2.	“Engineering Physics”,Wiley, 2013
3.	A.S.Vasudeva,“Modern Engineering Physics”, S.Chand,2001
4.	B.K.Pandey Chaturvedi,“Engineering Physics”,CengageLearning,2012
5.	Charles Kittel,“Solid State Physics”,Wiley(2009),
6.	Arthur Beiser, Concepts of Modern Physics, Tata McGraw-Hill, New Delhi, 2010.
7.	C.P. Poole and F.J. Owens, Introduction to Nanotechnology, Wiley, New Delhi, 2007

COURSE OUTCOMES	
CO1	Understand the properties of Crystalline Materials.
CO2	learn the basic concepts of Quantum Mechanics
CO3	Analyze the elastic properties of materials.
CO4	Utilize the knowledge to identify and develop the materials for specific applications.
CO5	Make use of Knowledge on different Non-Destructive testing techniques.

23MET101	ENGINEERING MECHANICS	L	T	P	C
		3	0	3	3

UNIT I	BASICS & STATICS OF PARTICLES	9
Introduction - Units and Dimensions - Vectorial representation of forces and moments – Coplanar Forces - Laws of Mechanics - Lamé’s theorem, Resolution and Composition of forces -Equilibrium of a particle - Principle of transmissibility –Free body diagram		

UNIT II	EQUILIBRIUM OF RIGID BODIES	9
Types of supports and their reactions -requirements of stable equilibrium -Moments and Couples- -Vectorial representation of moments and couples —Varignon’s theorem and applications–Forces in space-Equilibrium of a particle in space–Equilibrium of Rigid bodies in three dimensions		

UNIT III	PROPERTIES OF SURFACES AND-SOLIDS	9
Determination of centroid of areas, volumes and mass–moment of inertia of plane- Parallel axis theorem and perpendicular axis theorem-product of inertia-mass moment of inertia.		

UNIT IV	DYNAMICS OF PARTICLES	9
Displacements, Velocity and acceleration, their relationship-Relative motion–Curvilinear motion-Newton’s law-Work Energy Equation of particles		

UNIT V	FRICTION AND RIGID BODY DYNAMICS	9
Friction force - Laws of sliding friction - equilibrium analysis of simple systems with sliding friction -wedge friction-. Rolling resistance -Translation and Rotation of Rigid Bodies – Velocity and acceleration		

L: 45 T: 0 P: 0 TOTAL :45 PERIODS

TEXT BOOKS	
1.	Beer,F.P and JohnstonJr.E.R.“Vector Mechanics for Engineers”, McGraw-Hill

	Education 11th Edition (India) Pvt Ltd. (2016).
2.	J.L.Meriam&L.G.Karidge,EngineeringVolumeI)andEngineeringMechanics: Dynamics, 8th edition, Wiley student edition, 2016

REFERENCES	
1.	VelaMurali,“EngineeringMechanics”,OxfordUniversityPress(2010)
2.	D.P.Sharma “Engineering Mechanics”,Dorling Kindersley (India)Pvt. Ltd,New Delhi2010.
3.	Dr.I.S Gujral“EngineeringMechanical”secondedition,2011,LakshmiPublication (P).Ltd.
4.	ArthurP.BoresiandRichardJ.Schmidt,“EngineeringMechanics:Staticsand Dynamics”, ThomsonAsiaPrivate Limited,Singapore, 2010.
5.	Hibbeller,R.C.,“EngineeringMechanics”,14thedition,Prenticehall(2016).

COURSE OUTCOMES	
CO1	Recognize the basics of equilibrium of particles in2d and3d
CO2	Review the requirements of equilibrium of rigid bodies in 2D and 3D
CO3	Compute the center of mass and moment of inertia of surfaces and solids
CO4	Predict displacement, velocity and acceleration of dynamic particles
CO5	Solve for friction force and rigid body dynamics

23EET101	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C
		3	0	3	3

UNIT I	ELECTRICAL CIRCUITS	9
DC Circuits: Conductor, Resistor, Inductor, Capacitor – Ohm’s Law - Kirchhoff’s Laws – Simple problems: Nodal analysis, Mesh analysis with Independent sources only (Steady state) AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor (Simple problems only)		

UNIT II	ELECTRICAL MACHINES	9
Construction, Principle of operation, Basic equations and applications of DC Generator, DC Motor-Elementary treatment of Single phase Transformer, Single and three phase Induction Motors, Synchronous Generator		

UNIT III	WIRING, GROUNDING AND SAFETY	9
Wiring: General Rules, materials and accessories, Types of wiring - Conduit wiring –Wiring layout of Residential building, Grounding: Importance of grounding, Types of grounding - Safety: Causes of accidents, Accident prevention.		

UNIT IV	ANALOG ELECTRONICS	9
Construction, working principle and VI characteristics of Diode, Zener diode, BJT, MOSFET, Applications: Bridge Rectifier, Voltage regulators, UPS, SMPS		

UNIT V	DIGITAL ELECTRONICS AND MEASURING INSTRUMENTS	9
Boolean Algebra-Logic Gates - Half Adder and Full Adders - A/D and D/A Conversion (Any one concept) Functional elements of an instrument, Construction and Operating Principle: Moving Coil and Moving Iron meters, Measurement of three phase power, Energy Meter, Data acquisition		

L: 30 T: 0 P: 0 TOTAL : 45 PERIODS

TEXT BOOKS	
1.	Muthusubramanian R, Salivahanan S, "Basic Electrical and Electronics Engineering", Tata McGraw Hill Publishers, 2010
2.	Kothari DP and I.J Nagrath, "Basic Electrical and Electronics Engineering", Second Edition, McGraw Hill Education, 2020

REFERENCES	
1.	V.Mittle, "Basic Electrical Engineering", Tata McGraw Hill Publishers, 2017
2.	Mehta VK, Mehta Rohit, "Principles of Electrical Engineering and Electronics", S.Chand & Company Ltd, 2010
3.	Black & Decker, "The complete guide to Electrical Wiring", S.Chand & Company Ltd, 2012
4.	Nagrath. I.J, "Electronics: Analog and Digital", Prentice Hall India Pvt. Ltd., 2013
5.	Mehta V K, Mehta Rohit, "Principles of Electronics", S.Chand & Company Ltd, 2005

WEB RESOURCES	
	<ul style="list-style-type: none"> • www.phyclips.com • www.howstuffworks.com

COURSE OUTCOMES	
CO1	Familiarize the elementary concept of electric circuits
CO2	Understand the construction, operation and applications of electrical machines
CO3	Apply the concept of wiring and acquire the importance of grounding and safety
CO4	Gain knowledge on electronic devices and its applications
CO5	Acquire knowledge on basics of digital electronics and measurements

23GET103	HERITAGE OF TAMILS	L	T	P	C
		1	0	0	1

UNIT I	LANGUAGE AND LITERATURE	3
Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature- Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.		

UNIT II	HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE	3
Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.		

UNIT III	FOLK AND MARTIAL ARTS	3
Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils..		

UNIT IV	THINAI CONCEPT OF TAMILS	3
Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.		

UNIT V	CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE	9
Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.		

L: 30 T: 0 P: 0 TOTAL : 15 PERIODS

TEXT & REFERENCES BOOKS	
<ol style="list-style-type: none"> 1. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL 2. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies. 3. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies). 4. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.) 5. Keeladi - ‘Sangam City Civilization on the banks of river Vaigai’ 6. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) 7. Porunai Civilization Journey of Civilization Indus to Vaigai (R.Balakrishnan) 	

23GEB101	DESIGN THINKING AND INNOVATION	L	T	P	C
		3	0	3	3

UNIT I	INTRODUCTION TO DESIGN THINKING	3+1 2
A brief insight to Design Thinking and Innovation- People Centered Design & Evoking the ‘right problem’- Purpose of Design Thinking- Design Thinking Framework.		

UNIT II	PROCESS IN DESIGN THINKING (EMPATHY, DEFINE)	3+12
Design Thinking Process – Empathy – Uncovering and Investigating Community Concerns - Define: Examine and Reflect on the problem.		

UNIT III	CONCEPTING AND BUILDING (IDEA, CREATE)	3+12
Generating Ideas-Identifying top three ideas-Bundling the Ideas and create concepts-Rapid Prototyping		

UNIT IV	TESTING, REFINING AND PITCHING THE IDEAS	3+12
Importance & Testing the Design with People-Retest and Redefine Results-Creating a Pitch for the design.		

UNIT V	VALUE PROPOSITION DESIGN	3+12
Business Vs Startup-Briefing the Problem-Problem Validation and User Discovery-Challenge Brief.		

TEXT BOOKS

1.	Robert A Curedale, Design Thinking Process & Methods 4th Edition, December 2017, Design Community College Inc.
2.	Andrew Pressman, Design Thinking: A Guide to Creative Problem Solving for Everyone, First Edition, Nov 2018, Routledge.

REFERENCES

1.	Idris Mootee, Design Thinking for Strategic Innovation - What They Can't Teach You at Business or Design School, First Edition, 2017, Wiley.
2.	Yves Pigneur, Greg Bernarda, Alan Smith, Trish Papadacos Alex Osterwalder, Value Proposition Design: How to Create Products and Services Customers Want, 2015, Wiley.
3.	Brown, Tim, and Barry Katz. Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, 2009, Harper Business.

COURSE OUTCOMES

CO1	Learn new approach-design thinking—that enhances innovation activities in terms of market impact, value creation, and speed.
CO2	Feel the Empathy and can define their problems based on the Community Concerns
CO3	Strengthen their individual and collaborative capabilities to identify customer needs, create sound concept hypotheses, collect appropriate data, and develop a prototype that allows for meaningful feedback in a real-world environment
CO4	Translate broadly defined opportunities into actionable innovation possibilities and recommendations for client organization
CO5	Become an Entrepreneurs

23PYP101	PHYSICS LABORATORY (Common to All Branches)	L	T	P	C
		0	0	2	1

BASIC MEASURING INSTRUMENT

1. Screw Gauge
2. Vernier Caliper
3. Travelling Microscope
4. Spectrometer

LIST OF EXPERIMENTS (ANY EIGHT) 30 hours

1. Determination of wavelength of mercury spectrum – Spectrometer grating.
2. Determination of Young’s modulus of the material – uniform bending.
3. Determination of viscosity of liquid – Poiseuille’s method.
 - (a) Particle size determination using Diode Laser.
 - (b) Determination of Laser parameters – Wavelength.
4. Determination of the Numerical Aperture and the acceptance angle of an optical fiber.
5. Determination of thickness of a thin wire – Air wedge method.
6. Determination of dispersive power of a prism using spectrometer.
7. Determination of Young’s modulus of the material – non uniform bending.
8. Torsional Pendulum - determination of rigidity modulus of wire and moment of Inertia of disc.
9. Determination of Band gap of semiconductor material.

TEXT BOOKS

1. Physics Laboratory Manual, Department of Physics, SNSCT, 2019.

REFERENCES

1. R.Jayaraman, V.Umadevi, S.Maruthamuthu, B.Saravanakumar “Engineering Physics Laboratory Manual”, Pearson Education India,2013.

COURSE OUTCOMES

CO1	Evaluate the young’s and Rigidity Modulus of the given material.
CO2	Utilize the concept of diffraction to determine the wavelength of given light source
CO3	Extend the knowledge on applying the principles of laser, fiber optics, viscosity and Band Gab of the Materials.

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	S	M							M			M		
CO2	S	M							M			M		
CO3	S	M							M			M		
CO4														
CO5														

23ENP101	PROFESSIONAL COMMUNICATION	L	T	P	C
		0	0	4	2

UNIT I	LISTENING SKILLS	10
The process of Listening & Barriers of listening, Listening to talks and note taking, Listening to conversations for specific information, Listening to classroom lectures/talks/ Documentaries		

UNIT II	READING	10
Cloze exercises, Picture perception, Reading and paraphrasing, Reading and interpreting.		

UNIT III	PROFESSIONAL WRITING	10
Cover letter & Resume preparation, Email writing – formal & Informal, Content writing – Planning – writing – editing and proofreading, Report writing – types of report, report format – Fire Accident & Road Accident.		

UNIT IV	COMMUNICATION & SOFT SKILLS	15
Communication & Barriers of Communication Verbal & Nonverbal Communication, Time Management, Stress Management, Inter & Intrapersonal skills, Professional ethics, Basic Etiquettes – Social Etiquette – Telephone Etiquettes – Corporate Etiquette.		

UNIT V	SPEAKING	15
Introduction of self and others, Extempore Speech, Public Speaking, Art of Storytelling – Describing and Narrating, Presentation Skills – preparing PPT and Oral presentation, – Group Discussion – Team building – Mock GD, Interview skills – resume based questions – competency based question – Mock Interview.		

L: 0 T: 0 P: 60 TOTAL : 60 PERIODS

TEXT BOOKS	
1.	Raman, Meenakshi & Sangeeth Sharma. Technical Communication: Principles and Practice, Oxford University Press, NewDelhi, 2011.
2.	Rizvi, Ashraf. M. Effective Technical Communication, Tata McGraw-Hill, NewDelhi,2005.

REFERENCES	
1.	Muralikrishna,&SunitaMishra.CommunicationSkillsforEngineers.Pearson,NewDelhi.2011
2.	Mitra K.Barun, -Effective Technical Communication– A Guide for Scientists and Engineers, Oxford University Press, New Delhi, 2006.
3.	Leo Jones, Richard Alexander, New International Business English, updated Edition, Cambridge University Press, NY, USA.
4.	Smith—Worthington, Darlene &Sue Jefferson.Technical Writing for Success. Cengage, Mason USA.
5.	Sharon J. Gerson, Steven M. Gerson, -Technical Writing– Process&Productl. 3rdEdition,PearsonEducation(Singapore)(P) Ltd.,NewDelhi.

COURSE OUTCOMES	
CO1	Makeuse of listening skills in both formal and informal contexts
CO2	Develop reading skill to comprehend ambiguity and complexity, and can articulate their own interpretations.
CO3	Demonstratetheirwritingskillsforeffectivecommunicationinbothformalandinformal situations
CO4	Discuss clearly, confidently, comprehensibly and communicate with one or many listeners using appropriate communicative strategies
CO5	Apply the various principles of communication in the workplace environment

S.No	LIST OF EXPERIMENT
1	Listening Exercises
2	Reading Exercises
3	Cover letter &Resume
4	E-Mail writing
5	Content Writing
6	Report writing
7	Public Speaking
8	Presentation Skills
9	Group Discussion
10	Interview skills

Course	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1								S	M					
CO2								S	M					
CO3								S	S					
CO4								S	S					
CO5								S	S					

23GEP101	WORKSHOP PRACTICES	L	T	P	C
		0	0	4	2

LIST OF EXPERIMENTS

GROUP A (CIVIL & MECHANICAL)	30
CIVIL ENGINEERING 12	
Study of plumbing tools and Components Preparation of threads in pipes	
Preparation of single and multi-tap connections for domestic	
Study of carpentry tools and its applications	
Preparation of Cross Lap and Dove Tail Joints.	
MECHANICAL ENGINEERING 18	
Study of different types of Welding and its applications	
Preparation of Butt, Lap and Tee joints	
Study of sheet metal and its applications	
Preparation of Rectangular, Square Trays and Funnel	
Demonstration of Lathe and Drilling Operations	
Demonstration of Smithy, Foundry tools and Power Tool Operations	
Plastic Moulding and Glass Cutting	
GROUP B (ELECTRICAL AND ELECTRONICS) 30	
ELECTRICAL ENGINEERING PRACTICE 18	
Residential house wiring using switches, fuse, miniature circuit breaker, indicator, Lamp and energy meter.	
Fluorescent lamp wiring	
Stair-case wiring.	
Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.	
Measurement of energy using single phase energy meter.	
Measurement of insulation resistance to earth of electrical equipment.	
Measurement of single and three phase voltages.	
Study of Iron Box, Emergency Lamp and Fan.	
ELECTRONICS ENGINEERING PRACTICE 12	
Study of Electronic components and equipments – Resistor, color coding, measurement of AC signal parameter (peak-peak, rms period, frequency) using CRO.	
Verification of logic gates: AND, OR, Ex-OR and NOT.	
Generation of Clock Signal.	
Soldering practice – Components, Devices and Circuits	
Using general purpose PCB. Characteristics of a PN Junction diode	

L: 0 T: 0 P: 60 TOTAL : 60 PERIODS

COURSE OUTCOMES	
At the end of the course student should be able to:	
CO1	Demonstrate plumbing system and Carpentry for the required applications.
CO2	Relate the basic machining operations with engineering problems.
CO3	Apply different types of Welding processes and Sheet metal processes for the Industrial applications.
CO4	Illustrate Residential House wiring and simple wiring circuits.
CO5	Employ knowledge on measuring electrical quantities and usage of energy meters.

23CHT103	ENVIRONMENTAL SCIENCE & SUSTAINABILITY	L	T	P	C
		2	0	0	0

UNIT I	ENVIRONMENT AND BIODIVERSITY	9
<p>Definition, scope and importance of environment – need for public awareness. Eco-system and Energy flow– ecological succession. Introduction to biodiversity– Values of biodiversity – threats to biodiversity – endangered and endemic species of India – conservation of biodiversity: In-situ and ex- situ conservation of biodiversity. Field visit on Biodiversity.</p>		

UNIT II	ENVIRONMENTAL POLLUTION	9
<p>Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollutions. Solid, Hazardous and E-Waste management. Case studies on Occupational Health and Safety Management system (OHASMS). Environmental protection, Environmental protection acts.</p>		

UNIT III	RENEWABLE SOURCES OF ENERGY-NIT (Trichy)	9
<p>Energy management and conservation, New Energy Sources: Need of new sources. Solar energy, Wind energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy. Case study on Present Energy resources in India and its sustainability.</p>		

UNIT IV	SUSTAINABILITY PRACTICES	9
<p>Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transports. Sustainable energy: Energy Cycles carbon cycle, emission and Sequestration, Sustainable urbanization and technological change.</p>		

UNIT V	SUSTAINABILITY AND MANAGEMENT	9
<p>Development, GDP, Sustainability - concept, needs and challenges-economic and social aspects of sustainability - millennium development goals and protocols Global, Regional and local environmental issues and possible solutions-case studies. Concept of Carbon Credit, Carbon Footprint. Environmental management in industry- A case study.</p>		

L: 30 T: 0 P: 0 TOTAL :30 PERIODS

TEXT BOOKS	
1.	Anubha Kaushik and C. P. Kaushik’s “Perspectives in Environmental Studies”, 6th Edition, New Age International Publishers ,2018.
2.	Benny Joseph, ‘Environmental Science and Engineering’, Tata McGraw-Hill, New Delhi,2016.
3.	Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.

REFERENCES	
1.	G.Tyler Miller, “Environmental Science” Cengage Learning India Pvt.Ltd. New Delhi.2011
2.	R.K. Trivedi, ‘Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards’, Vol. I and II, Enviro Media. 38 . Edition 2010.
3.	Gilbert M. Masters and Wendell. P.Ela, “Introduction to Environmental Engineering and Science” PHI Learning Pvt. Ltd. New Delhi.2010.
4.	Rajagopalan, R, ‘Environmental Studies-From Crisis to Cure’, Oxford University Press, Third Edition, 2015.
5.	Erach Bharucha “Textbook of Environmental Studies for Undergraduate Courses” Orient Blackswan Pvt. Ltd. 2013.

COURSE OUTCOMES

C01	Understand the ecological balance and preservation of bio diversity.
C02	Know the role of human in prevention of pollution and making a clean environment.
C03	Explore the environmental impact of various energy resources and also get knowledge about conservation of non-conventional energy resources.
C04	Recognize the different goals of sustainable development and apply them for suitable technological advancement and societal development.
C05	Demonstrate the knowledge of sustainability practices and identify green materials, energy cycles and the role of sustainable urbanization.

SEMESTER II

23MAT102	COMPLEX ANALYSIS AND LAPLACE TRANSFORMS	L	T	P	C
	(Common to AEROSPACE, AGRI, AUTO, BME, CIVIL, ECE, EEE, FT, MECH MCT)	3	1	3	4

UNIT I	VECTOR CALCULUS	9+3
Derivatives: Gradient and Directional derivatives – Divergence and Curl of a vector field – Solenoidal and Irrotational of a vector – Green’s, Gauss divergence and Stoke’s theorems (statements only) – Verification of theorems and application in evaluating line, surface and volume integrals.		

UNIT II	ORDINARY DIFFERENTIAL EQUATIONS	9+3
Higher order linear differential equations with constant coefficients – Method of variation of parameters – Homogenous equation of Euler’s and Legendre’s type – Solution of system of simultaneous linear first order differential equations with constant coefficients.		

UNIT III	COMPLEX DIFFERENTIATION	9+3
Derivatives of $f(z)$ – Analytic function – Cauchy-Riemann Equations – Harmonic function – Harmonic conjugate – Construction of Analytic function – Conformal Mapping – Mapping by functions: $w = z + c$, cz , $1/z$ – Bilinear transformations – Application to flow problems.		

UNIT IV	COMPLEX INTEGRATION	9+3
Cauchy’s integral theorem – Cauchy’s integral formula – Taylor’s series – Zeros of an analytic function – singularities – Laurent’s series – Residues – Cauchy Residue theorem .		

UNIT V	LAPLACE TRANSFORMS	9+3
Definition, properties, existence conditions – Transforms of elementary functions – Shifting theorem – Transforms of derivatives and integrals – Periodic functions – Initial and final value theorem – Inverse transforms – Application to solution of linear second order ordinary differential equations with constant coefficients.		

L: 45 T: 15 P: 0 TOTAL : 60 PERIODS

TEXT BOOKS

1.	Kreyszig, E., Advanced Engineering Mathematics, John Wiley and Sons, 10 th Edition, New Delhi 2016.
2.	Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers, New Delhi, 44 th Edition, 2018.

REFERENCES

1.	Bali. N.P, Goyal. M. and Watkins. C., Advanced Engineering Mathematics, Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.), New Delhi, 7 th Edition, 2009.
2.	G.B.Thomas, Calculus, 12 th Edition, Pearson Education India, 2015.
3.	Jain. R.K. and Iyengar. S.R.K., Advanced Engineering Mathematics, Narosa Publications, New Delhi, 5 th Edition, 2016.
4.	Peter V.O Neil, “Advanced Engineering Mathematics”, 7 th Edition, Cengage learning India Pvt Ltd, New Delhi, 2012.
5.	Srimanta Pal, Subodh C Bhunia, “Engineering Mathematics”, Oxford University Press, 2015.

COURSE OUTCOMES	
CO1	Evaluate gradient, divergence and curl and solve engineering problems involving cubes, rectangular parallelepipeds by applying various integral theorems.
CO2	Solve the higher order linear differential equations with various methods and apply them in some physical situations.
CO3	Test the analyticity, construct the analytic function and transform complex functions from z-plane to w-plane graphically by using conformal mapping.
CO4	Evaluate real and complex integrals over suitable closed path using various integral theorems.
CO5	Understand the mathematical principles on Laplace transforms and would provide them the ability to formulate and solve some of the physical problems of engineering.

23CHT102	CHEMISTRY OF ENGINEERING MATERIALS (Common to MECH,MCT,AUTO,AERO,AGRI,CIVIL & FT)	L	T	P	C
		3	0	0	3

UNIT I	CORROSION AND ITS CONTROL	9
Corrosion - Chemical corrosion (Oxidation corrosion)-Electrochemical corrosion-Types of electrochemical Corrosion -Corrosion control-Corrosion inhibitors-Cathodicprotection(SacrificialanodicprotectionandImpressedcurrentCathodicprotection)-Protective coating-Paints and its constituents -FireRetardant paint-Electroplating(Au)		

UNIT II	NANOMATERIALS	9
Nano materials and Bulk materials- Size dependent properties (Optical,ElectricalandMechanical)-Synthesis-Solgel method- Chemical Vapour Deposition,Solvo thermal,laser ablation- Types of Nano materials- Carbon nano tubes- Properties and uses Application of Nanotechnology in Electronics Energy science and Medicine.		

UNIT III	FUELS AND COMBUSTION	9
Fuels- Solid Fuel-Coal-classification-manufacture of metallurgical coke by Otto-Hoffmann method-Liquid Fuel--Synthetic petrol-Fischer and Bergius method- - Gaseous fuels- CNG and LPG.- Bio fuels:Categories,Types-Biodiesel,Biogas.Combustion-Calorificvalue-GrossandNetcalorificvalue- Definition-Flue gas analysis by Orsat Apparatus.		

UNIT IV	WATER TECHNOLOGY	9
Introduction-Hard water and Soft water-Hardness-Types-Boiler Troubles- Water Softening – Externaltreatment-Demineralization-InternalTreatment- WaterQualityparameters(pH,TDS,Chloride,Fluoride,Sulphate, Iron, BOD ,COD and Heavy metals)- Municipal water treatment - Desalination –Reverse osmosis.		

UNIT V	ALLOYS AND ENGINEERING MATERIALS	9
Alloys-classification -Ferrous alloys (Nichrome and stainless steel only)-Non-ferrous alloys (brass and bronze)Heat treatment of steel- Definition of light metals, Characteristics and applications of light metals-Super alloys -Lubricants –Solid lubricants (Graphite and Molybdenum disulphide)-Mechanism of Lubrications. Cement –Portl and cement-Chemical composition of Portl and cement. Functions and limitations of cement ingredients.		

L: 45 T: 0 P: 0 TOTAL : 45 PERIODS

TEXT BOOKS	
1.	P.C.Jain & Monicka Jain, "Engineering Chemistry", Dhanapat Rai Publising Company Pvt.Ltd.2017.
2.	Wiley, "Engineering Chemistry", John Wiley & Sons, Inc, USA (2014)

REFERENCES	
1.	B. Sivasankar "Engineering Chemistry" Tata Mc Graw-Hill Pub. Co. Ltd, New Delhi (2009).
2.	Shikha Agarwal, Engineering Chemistry - Fundamentals and Applications, Cambridge University Press, Delhi, Second Edition, 2019.
3.	Dr. Sivanesanand Nandagopal, "Engineering Chemistry-I" V.K. Pub. Pvt. Ltd. 2011.
4.	O.G. Palanna, "Engineering Chemistry" Tata McGraw-Hill Pub. Co. Ltd, New Delhi. 2017.
5.	Dara, S.S.; A Text Book of Engineering Chemistry (Tenth edition); S. Chand, 2003

COURSE OUTCOMES	
CO1	Develop new strategy for protection of metals and to improve engineering design
CO2	Design environmentally benign method for nanoparticle synthesis
CO3	Acquire knowledge on various types of fuels.
CO4	Develop innovative and eco-friendly method for water purification.
CO5	Gain skill sets and usage of various engineering materials.

Course	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	1			1								
CO2	3	2	1				2							
CO3	3		1											
CO4	3		2			1	2							
CO5	3					1	1							

23ENT101	COMMUNICATIVE ENGLISH	L	T	P	C
		3	0	3	3

UNIT I		9
Grammar - Tenses - Verb forms, Spelling and Importance of Punctuation, Vocabulary - Word formation- Prefixes & Suffixes, One word Substitution, Reading - Reading and understanding the Context, Writing - Sentence completion- filling the gap, Instructions- Imperative Instructions		

UNIT II		9
Grammar - Uses of Preposition, Active & Passive Voice- impersonal passive, Vocabulary - Technical Vocabulary- Synonyms-Antonyms-Compound words, Reading - Transfer of information (chart, pictures), Writing - Recommendations- writing suggestions, Preparing Checklist.		

UNIT III		9
Grammar - Concord (Subject & Verb agreement), Definite & Indefinite Article, Vocabulary - Uses of Connectives and Linking words, Reading - Summarizing the given passage - Précis writing, Writing - Paragraph writing - Process writing, Analytical, Argumentative paragraphs.		

UNIT IV		9
Grammar - Direct and Indirect speech, Cause and Effect Expression, Vocabulary - Logical sequence of words, Reading -Note-making using Linear method, Writing - Formal Letter writing- Permission letter for Industrial Visit & In-plant training.		

UNIT V		9
Grammar - Clauses -If Conditionals, Vocabulary - Words often confused - Verbal Analogy, Reading - Writing a Book Review Writing - Business Letters- Letter of Quotations, Clarification, Placing orders & Complaint letter.		

L:45 T: 0 P: 0 TOTAL : 45 PERIODS

TEXT BOOKS	
1.	Raman, Meenakshi & Sangeetha Sharma. Technical Communication: Principles and Practice, Oxford University Press, New Delhi, 2011.
2.	Rizvi, Ashraf. M. Effective Technical Communication, Tata McGraw-Hill, New Delhi, 2005.

REFERENCES	
1.	Muralikrishna, & Sunita Mishra. Communication Skills for Engineers. Pearson, New Delhi. 2011
2.	Mitra K. Barun, —Effective Technical Communication – A Guide for Scientists and Engineers, Oxford University Press, New Delhi, 2006.
3.	Leo Jones, Richard Alexander, New International Business English, updated Edition, Cambridge University Press, NY, USA.
4.	Smith—Worthington, Darlene & Sue Jefferson. Technical Writing for Success. Cengage, Mason USA.
5.	Sharon J. Gerson, Steven M. Gerson, —Technical Writing – Process & Productl. 3rd Edition, Pearson Education (Singapore) (P) Ltd., New Delhi.

COURSE OUTCOMES	
CO1	Use their active and passive vocabulary and construct basic sentence structures
CO2	Develop reading skill to comprehend ambiguity and complexity, and can articulate their own interpretations
CO3	Mark effectively and flawlessly avoiding grammatical errors for a variety of professional and social settings
CO4	Make use of their letter writing skills for effective communication in form Situations
CO5	Build their communication skills and enable to articulate with confidence

Course	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1		1		1				1	3	3	1	1		
CO2		1		1			2	2	3	3	3	3		
CO3		1		1			2	3	3	3	3	3		
CO4		1		1			2	2	3	3	3	3		
CO5		1		1			2	2	3	3	3	3		

23MET102	ENGINEERING DRAWING (Common to all Non Circuit Branches)	L	T	P	C
		1	0	4	3

UNIT I	PROJECTION OF POINTS, LINES AND PLANE SURFACES	3+12
Projection of points - Projection of straight lines located in the first quadrant - Determination of true Lengths and true inclinations - Projection of polygonal surface and circular lamina inclined to both reference planes.		

UNIT II	PROJECTION OF SOLIDS	3+12
Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method		

UNIT III	SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES	3+12
Sectioning of above solids in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other - Obtaining true shape of section. Development of lateral surfaces of Simple and truncated solids - Prisms, pyramids, cylinders and cones.		

UNIT IV	PICTORIAL PROJECTIONS AND FREEHAND SKETCHING	3+12
Principles of isometric projection - isometric scale - isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones. Freehand sketching: Representation of Three Dimensional objects - Need for importance of multiple views and their placement - First angle projection - layout views - Developing visualization skills through free hand sketching of multiple views from pictorial drawing. Perspective projection of prisms, pyramids and cylinders by visual ray method (Not for Examination).		

UNIT V	BUILDING DRAWING	3+12
Drawing of a plan, Elevation and sectioning of security room and residential building (Two bed rooms, kitchen, hall, etc.) Practicing design in the CAD Software (Not for Examination).		

L: 15 T: 0 P: 60 TOTAL :75 PERIODS

TEXT BOOKS	
1.	N.D. Bhatt and V.M. Panchal, "Engineering Drawing", Charotar Publishing House, 53 rd Edition, 2016
2.	K. R. Gopalakrishnan, "Engineering Drawing" (Vol. I & II), Subhas Publications, 2014

REFERENCES	
1.	K.V. Natarajan, "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2015
2.	M.S. Kumar, "Engineering Graphics", D.D. Publications, 2011
3.	K. Venugopal & V. Prabhu Raja, "Engineering Graphics", New Age International (P) Limited, 2014
4.	M.B. Shah and B.C. Rana, "Engineering Drawing", Pearson Education, 2011.
5.	K.L. Narayanan and P. Kannaiah, "Engineering Drawing" SciTech Publications, 2 nd edition, 2012.

COURSE OUTCOMES	
CO1	Sketch the projections of a points, straight lines and plane surfaces
CO2	Illustrate top view and front view of the solids

CO3	Sketch sectioned views and develop area required
CO4	Demonstrate knowledge about isometric, perspective and orthographic projections
CO5	Design simple buildings with detailed plan and sectional elevation

Course	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3													
CO2	3	2								2			1	
CO3	3	2								2	3			
CO4	3			2						2				1
CO5	3			2										

23AUT101	ELEMENTS OF AUTOMOTIVE SYSTEMS	L	T	P	C
		3	0	3	3

UNIT I	VEHICLE STRUCTURE	6
Brief history, introduction to automobile, layout of an automobile, Role and requirement of a chassis frame. Chassis – light, medium and heavy duty vehicle chassis, ladder chassis, integral body. Types of bodies, coach built convertibles. Body accessories, bumpers.		

UNIT II	STEERING SYSTEM	6
Steering - Principle, steering linkage layouts for rigid axle suspension and independent suspension systems, reversible and irreversible steering. Steering gearbox – Purpose, types. Steering geometry, wheel alignment and balancing, centre point steering. Power steering – Principle, types.		

UNIT III	TRANSMISSION SYSTEMS	6
Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, Over drive, transfer box, fluid flywheel, torque converter, propeller shaft, slip joints, universal joints. Construction - Differential, rear axle.		

UNIT IV	SUSPENSION SYSTEM	6
Suspension systems – Rigid axle suspension and independent suspension systems. Suspension springs – Leaf springs, coil springs, torsion bar springs, air springs, rubber springs, hydro elastic springs. Linked suspension system and air suspension system. Shock absorbers – Role, Types - Telescopic shock absorber and hydraulic shock absorber.		

UNIT V	BRAKING SYSTEM	6
Braking system - Need, principle, characteristics of good braking system. Wheel locking and stopping distance. Brakes – Drum brakes, disc brakes. Types of brake actuating systems – Mechanical brakes, hydraulic brakes, power brakes, servo brakes. Wheels and Rims. Tyres - Types and construction.		

L: 30 T: 0 P: 0 J:0 TOTAL : 30 PERIODS

TEXT BOOKS	
1.	K.K.Ramalingam, “Fundamentals of Automobile Engineering”, Scitech Publications (India) Private Limited, Chennai, 2013
2.	Kirpal Singh, “Automobile Engineering”, Vol. 1 & 2, Standard Publishers, New Delhi, 13 th Edition, 2017.
3.	Crouse W. H., Anglin D. L., “Automotive Mechanics”, McGraw Hill Education Private Limited, New Delhi, 10 th Edition, 2017.

REFERENCES	
1.	Srinivasan S., “Automotive Mechanics” McGraw Hill Education Private Limited, New Delhi, 2 nd Edition, 2017.
2.	Giancarlo Genta and L. Morello, “The Automotive Chassis: Volume 1: Components Design”, Springer Science & Business Media, 2008.
3.	Jain K.K. and Asthana R.B., “Automobile Engineering”, Tata McGraw Hill Publishers, New Delhi, 6 th Edition, 2002.

COURSE OUTCOMES
At the end of the course, the student should be able to: CO1: Identify the vehicle based on its structure. CO2: Familiarize the layout and design features of an automobile. CO3: Understanding on different types of steering system, transmission systems and axles. CO4: Get the exposure to the suspension system CO5: Understanding on tyre and braking system.

23GET104	TAMILS AND TECHNOLOGY	L	T	P	C
	(Common Branches)	1	0	0	0

UNIT I	WEAVING AND CERAMIC TECHNOLOGY	
Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.		
UNIT II	DESIGN AND CONSTRUCTION TECHNOLOGY	
Designing and Structural construction House & Designs in household materials during Sangam Age – Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram – Sculptures and Temples of Mamallapuram – Great Temples of Cholas and other worship places – Temples of Nayaka Period – Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal – Chetti Nadu Houses, Indo – Saracenic architecture at Madras during British Period.		
UNIT III	MANUFACTURING TECHNOLOGY	
Art of Ship Building – Metallurgical studies – Iron industry – Iron smelting, steel -Copper and goldCoins as source of history – Minting of Coins – Beads making-industries Stone beads -Glass beads – Terracotta beads -Shell beads/ bone beats – Archeological evidences – Gem stone types described in Silappathikaram.		
UNIT IV	AGRICULTURE AND IRRIGATION TECHNOLOGY	
Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry – Wells designed for cattle use – Agriculture and Agro Processing – Knowledge of Sea – Fisheries – Pearl – Conche diving – Ancient Knowledge of Ocean – Knowledge Specific Society.		
UNIT V	SCIENTIFIC TAMIL & TAMIL COMPUTING	
Development of Scientific Tamil – Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.		

23CHP101	CHEMISTRY LABORATORY (Common to All Branches)	L	T	P	C
		0	0	2	1
LIST OF EXPERIMENTS (ANY EIGHT) 30 hours					
<ol style="list-style-type: none"> 1. Estimation of alkalinity of water sample by indicator method 2. Determination of hardness of water sample by EDTA method 3. Estimation of Dissolved oxygen in water sample by Winkler's method 4. Estimation of Chloride in water sample by Argentometric method 5. Estimation of copper in brass by EDTA method 6. Determination of strength of HCl and CH₃COOH present in a mixture conductometrically 7. Estimation of strength of iron by potentiometric titration 8. Determination of molecular weight of given polymer by Ostwald's viscometer 9. Determination of Strength of HCl by pH metry 10. Determination of corrosion rate of mild steel by weight loss method 11. Demo Experiments 12. Synthesis of nanomaterials by chemical precipitation method 13. Estimation of strength of iron by spectrophotometry 14. 					

L :0 T: 0 P: 30 T: 30 PERIODS

TEXT BOOKS	
1.	Department of Chemistry "Chemistry Laboratory Manual",2019
REFERENCE BOOKS	
1.	Vogel's "Text book of Quantitative Analysis", Jeffery G H,Basset J.Mentom J,Denney R.C.,6 th edition,EBS,2009.

23ITP101	PROGRAMMING IN C AND DATA STRUCTURES LABORATORY (Common to BME, ECE and All Non Circuit Branches)	L	T	P	C
		0	0	4	2

LIST OF EXPERIMENTS	
1	Algorithms and Flow Chart i) Sequential ii) Branching and Looping
2	Operators & Expressions i) Arithmetic ii) Logical iii) Relational
3	Condition Statements i) Nested if else ii) Else-if Ladder
4	Looping i) For ii) While iii) Do-while
5	Functions i) With and without arguments ii) With and without return type iii) Call by value and Call by reference

6	Arrays i) Searching element in one dimensional array ii) Matrix multiplication
7	Structures
8	Pointers
9	Implementation of Stack ADT
10	Implementation of Queue ADT
11	Implementation of Tree Traversal
12	Implementation of Binary Search Tree ADT
P: 60	
TOTAL: 60 PERIODS	
HARDWARE / SOFTWARE REQUIRED	
(For a Batch of 30 Students)	
Hardware	<ul style="list-style-type: none"> • 30 PCs with Processor-2.0 GHz or Higher • RAM-1 GB or Higher • Hard disk-20 GB or Higher
Software	<ul style="list-style-type: none"> • TURBO C version 3 (or) GCC version 3.3.4 • OS-Windows2000/Windows XP/NT
COURSE OUTCOMES	
At the end of the course students should be able to	
CO 1: develop algorithm and draw flow chart to solve problem. CO 2: write simple programs using basic concepts and control statements in C language. CO 3: write programs using arrays, structures and pointers. CO 4: implement stack and queue data structure CO 5: implement binary search tree ADT	

23AUP 101	INTERNSHIP – I	L	T	P	C
		0	0	0	2
<ol style="list-style-type: none"> The Internship is provided for the students to update themselves with the recent Technologies and professional skills for better prospects in the future. Internship in industry subjected to permissions from Government and concern Industry subject to the conditions of following the SOP issued by the concern and written consent of the student and parents. Student is supposed to produce joining letter and relieving letter once the internship is over in case of offline internship in any industry. Online internship in industry / other agencies. Seminar by student under mentorship of a faculty. A detailed report shall be submitted based on his Internship and shall be done by only one student. A Mini Project- on some suitable topic related to the branch of study. It can be small fabrication / experimental results/ simulations / Programmes/ application development etc., depending on the branch of the student. Preferably a single student should do it. <p>Student has to prepare detailed report and submit to his/her college.</p> <ol style="list-style-type: none"> A copy of report can be kept in the departments for record. Each student must be assigned a faculty as a mentor from the college and an Industry expert as co-mentor. The evaluation of the work done by students will be carried by the internal and external examiner. External examiner will evaluate for 80 marks and internal examiner will evaluate for 20 marks. The presentation by student in the presence of all students is desirable. Student should produce successful completion certificate in case of offline / online internship in industry <p style="text-align: right;">2 Weeks</p>					

23HST103	INDIAN CONSTITUTION	L	T	P	C
		(Common to All B.E. / B. Tech. Courses)	2	0	0

UNIT I	INTRODUCTION	6
Historical Background – Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties – Citizenship – Constitutional Remedies for citizens.		
UNIT II	STRUCTURE AND FUNCTION OF CENTRAL GOVERNMENT	6
Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review.		
UNIT III	STRUCTURE AND FUNCTION OF STATE GOVERNMENT	6
State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts.		
UNIT IV	CONSTITUTION FUNCTIONS	6

Indian Federal System – Center – State Relations – President’s Rule – Constitutional Amendments – Constitutional Functionaries – Assessment of working of the Parliamentary System in India.				
UNIT V	ELECTION COMMISSION			6
Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.				
	L :30	T: 0	P: 0	J: 0
	T:30 PERIODS			
TEXT BOOKS				
1	Durga Das Basu, “Introduction to the Constitution of India”, Prentice Hall of India, New Delhi.			
2	R.C.Agarwal, “Indian Political System”, S.Chand and Company, New Delhi. (1997)			
REFERENCES				
1	Maciver and Page, “ Society: An Introduction Analysis “, Mac Milan India Ltd., New Delhi.			
2	K.L.Sharma, “Social Stratification in India: Issues and Themes”, Jawaharlal Nehru University, New Delhi. (1997)			
3	Sharma, Brij Kishore, “Introduction to the Constitution of India”, Prentice Hall of India, NewDelhi.			
4	U.R.Gahai, “Indian Political System”, New Academic Publishing House, Jalaendhar.			
5	R.N. Sharma, “Indian Social Problems”, Media Promoters and Publishers Pvt. Ltd.			
COURSE OUTCOMES :				
At the end of the course students should be able to				
CO1	Understand the functions of the Indian government.			
CO2	Know the structure and functioning of central government.			
CO3	Understand functioning of Indian constituent.			
CO4	Analyze the functions of the Indian government			
CO5	Summarize the functioning of election commission.			

SEMESTER – III

23MAT201	PARTIAL DIFFERENTIAL EQUATIONS AND TRANSFORMS			
	L	T	P	C
	(Common to Aerospace, Agri, Auto, BME, Civil, ECE, EEE, FT, Mech, MCT)			
	3	0	0	3
UNIT I	PARTIAL DIFFERENTIAL EQUATIONS			9
Formation of partial differential equations – Solutions of standard types of first order partial differential equations – Lagrange’s linear equation – Linear partial differential equations of second order with constant coefficients of homogeneous types – Applications.				
UNIT II	FOURIER SERIES			9
Dirichlet’s conditions – General Fourier series – Odd and even functions – Half range sine series and cosine series – Root mean square value – Parseval’s identity – Harmonic analysis.				
UNIT III	APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS			9
Classification of PDE – Fourier series solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (Cartesian coordinates only).				
UNIT IV	FOURIER TRANSFORMS			9
Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval’s identity.				
UNIT V	Z - TRANSFORMS AND DIFFERENCE EQUATIONS			9
Z-transforms – Elementary properties – Initial and final value theorems – Inverse Z-transform using partial fraction and convolution theorem – Formation of difference equations – Solution of difference equations using Z - transforms.				
L : 45				T:0
P: 0			Total: 45 PERIODS	
TEXT BOOKS				
1.	Kreyszig.E, Advanced Engineering Mathematics, John Wiley and Sons, 10 th Edition, New Delhi 2016.			
2.	Grewal.B.S., Higher Engineering Mathematics, Khanna Publishers, New Delhi, 44 th Edition, 2018.			

REFERENCES	
1.	Bali. N.P, Goyal. M. and Watkins. C., Advanced Engineering Mathematics, Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.), New Delhi, 7 th Edition, 2009.
2.	James. G., "Advanced Modern Engineering Mathematics", 4th Edition, Pearson Education, New Delhi, 2016.
3.	Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2018.
4.	Wylie. R.C. and Barrett . L.C., “Advanced Engineering Mathematics “Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.
5.	Andrews. L.C and Shivamoggi. B, "Integral Transforms for Engineers" SPIE Press, 1999.

COURSE OUTCOMES	
At the end of the course students should be able to	
CO1	Understand how to solve the given standard partial differential equations.
CO2	Solve differential equations using Fourier series analysis which plays a vital role in Engineering applications.
CO3	Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.
CO4	Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some physical problems of engineering.

CO5	Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.
------------	---

23AUT201	THERMAL SCIENCE AND ENGINEERING	L	T	P	C
		3	0	0	3
UNIT I	BASIC CONCEPT AND THERMODYNAMIC RELATIONS				9
Basic concepts - System and their types - Thermodynamic Equilibrium State - sign convention - Displacement work - Zeroth law of thermodynamics -concept of temperature - relationship between temperature scales - change in internal energy - enthalpy - entropy and Gibbs function-Properties of Ideal gas - Ideal and real gas comparison -Maxwell relations - Tds Equations - Difference and ratio of heat Capacities					
UNIT II	FIRST AND SECOND LAW OF THERMODYNAMICS AND ITS APPLICATION				9
First law of thermodynamics –application to closed systems -Equation for steady flow processes and its application in Turbine, Nozzle, and Heat Exchanger. Second law of Thermodynamics - Statements of second law and its corollaries – Application of II law.					
UNIT III	STEAM AND GAS POWER CYCLES				9
Ideal and actual Rankine cycles - Cycle Improvement Methods - Reheat and Regenerative Cycles. Otto cycle - Diesel cycle – Air Standard Efficiency & Mean Effective Pressure - Problems.					
UNIT IV	CONDUCTION				9
Basic Concepts - General Differential equation of Heat Conduction – Fourier Law of Conduction in Cartesian – One Dimensional Steady State Heat Conduction – Conduction through Plane Wall and Cylinders – Extended Surfaces.					
UNIT V	CONVECTION AND RADIATION				9
Basic Concepts – Convective Heat Transfer Coefficients – Types of Convection – Forced Convection – External Flow – Flow over Plates - Internal Flow – Laminar and Turbulent Flow– Free Convection – Flow over Vertical Plate. Basic Concepts, Laws of Radiation – Stefan Boltzmann Law, Kirchoff Law – Black Body Radiation –Grey body radiation - Shape Factor Algebra– Radiation Shields.					
		L :45	T: 0	P: 0	Total:45 PERIODS
TEXT BOOKS					
1.	Nag.P.K., “Engineering Thermodynamics”, 5 th Edition, Tata McGraw - Hill, New Delhi, 2013.				
2.	Cengel. Y and M.Boles, "Thermodynamics - An Engineering Approach", 8 th Edition, Tata McGraw Hill, 2014.				
3.	Rajput. R. K., “Thermal Engineering” S. Chand Publishers, 2017				
4.	Yunus A. Cengel, "Heat Transfer A Practical Approach", Tata McGraw Hill, 2010				
REFERENCES					
1	Natarajan E., "Engineering Thermodynamics: Fundamentals and Applications", Anuragam Publications, 2012.				
2	Holman.J.P. "Thermodynamics", 3rd Edition, McGraw - Hill, 1995.				
3	Rathakrishnan. E., "Fundamentals of Engineering Thermodynamics", 2nd Edition, Prentice - Hall of India Pvt. Ltd, 2006				
4	Arora C.P, “Thermodynamics”, Tata McGraw - Hill, New Delhi, 2007.				
5	Holman, J.P., "Heat and Mass Transfer", Tata McGraw Hill, 2011				
6	Natarajan E., "Engineering Thermodynamics: Fundamentals and Applications", Anuragam Publications, 2012.				
COURSE OUTCOMES					
At the end of the course student should be able to:					
CO1	Identify and describe various concepts of thermodynamics				
CO2	Describe the laws of thermodynamics and their application to a wide range of systems.				
CO3	Identify and describe the various gas power cycles				
CO4	Infer the physical behavior of various modes of heat transfer like conduction, convection & radiation				
CO5	Understand the concept of black body, grey body, view factor & Radiation Shield				

CO	PO										PSO			
	1	2	1	2	1	2	1	2	1	2	1	2	1	2
CO-1	3			3		2					2		1	
CO-2	3	3	3	1	2								3	
CO-3	2	2											3	2
CO-4	3		3	3			3							3
CO-5	2	3											3	

23AUT202	AUTOMOTIVE ENGINES AND EMISSION CONTROL				L	T	P	C
					3	0	0	3
UNIT I	INTRODUCTION							9
Constructional details of spark ignition (SI) and compression ignition (CI) engines. Working principles. Two stroke SI and CI engines – construction and working. Comparison of SI and CI engines and four stroke and two stroke engines – Indicated Power, Brake Power, Indicated thermal, brake thermal and volumetric efficiencies. Measurement of Engine CC								
UNIT II	FUEL SYSTEM							9
Air fuel ratio requirements of SI engines, Air fuel ratio and emissions, Working of a simple fixed venturi carburettor, Constant vacuum carburettor. Diesel fuel injection systems – Jerk pumps, distributor pumps, pintle and multihole nozzles, Unit injector and Common Rail Direct Injection systems. Description of a simple diesel engine governor.								

UNIT III	COOLING AND LUBRICATION SYSTEMS							9		
Need for cooling, types of cooling systems – air and liquid cooling systems. Forced circulation and pressurized cooling systems. Properties of coolants. Requirements of lubrication systems. Types – mist, pressure feed, dry and wet sump systems. Properties of lubricants.										
UNIT IV	COMBUSTION AND COMBUSTION CHAMBERS							9		
Introduction to combustion in SI and diesel engines and stages of combustion - Dependence of ignition timing on load and speed. Knock in SI and CI engines - Combustion chambers for SI and CI engines – Direct and indirect injection combustion chambers for CI engines – Importance of Swirl, squish and turbulence – Factors controlling combustion chamber design										
UNIT V	CONTROL TECHNIQUES FOR REDUCTION OF EMISSION							9		
Emission formation in SI and CI Engine - Design modifications – Fuel modification – Evaporative emission control – Exhaust gas recirculation – SCR – Fumigation – Secondary Air injection – PCV system – Particulate Trap – CCS – Exhaust treatment in SI engines – Thermal reactors – Catalytic converters – Catalysts – Use of unleaded petrol. Introduction to BS VI – Euro Norms.										
L : 45					T : 0		P : 0		Total: 45 PERIODS	

TEXT BOOKS

- Ganesan V., "Internal Combustion Engines", Tata McGraw Hill, 2007
- Ramalingam K.K., "Internal Combustion Engine", Sci-Tech Publications, 2005.
- Kirpal Singh, "Automobile Engineering", Vol 2, Seventh Edition, Standard Publishers, New Delhi, 1997.

REFERENCES

- Heisler, "Advanced Engine Technology" SAE Publication, 1995
- Edward F. Obert "Internal Combustion Engines" 3rd Edition, 1970.
- Gupta. H.N. "Fundamentals of Internal Combustion Engines, reprint, PHI Learning Pvt. Ltd. 2006
- Mathur and Sharma "Fundamental Combustion Engines" Dhanpat Rai and Sons, 2002.
- John B. Heywood, "Fundamentals of Internal Combustion Engines", 1988.

COURSE OUTCOMES

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

- | | |
|------------|--|
| CO1 | Understand the concept, construction and principle of operation of engine and various engine |
|------------|--|

	components
CO2	Acquire knowledge about fuel injection systems and air fuel ratio requirements
CO3	Illustrate the lubrication and cooling system so fan IC engine
CO4	Relate the petrol and diesel engine emission along with the formation of emission compounds
CO5	Use modern technologies and tools to control the vehicle emissions.

CO	PO										PSO	
	1	2	1	2	1	2	1	2	1	2	1	2
CO-1	3		2	3							3	
CO-2	2			2			3					3
CO-3	3			3			2					2
CO-4		3	3	2			3			2		2
CO-5					3	2				3		3

23GET275	VQAR-I				L	T	P	C	
	(Common to All B.E. / B. Tech. Courses)				2	0	0	2	
UNIT I	QUANTITATIVE ABILITY I							8	
Number theory- Shortcuts, Divisibility rule- Unit place deduction-LCM &HCF, Square root and Cube Root, Decimal & Fraction Percentage, Profit, loss and discount, Simple and compound interest, Ratio & Proportions, Mixtures & Allegation, Partnership.									
UNIT II	QUANTITATIVE ABILITY II							6	
Problems on Ages, Average, Clocks, Calendar, Data Interpretation- Bar chart- Pie chart- Line chart- Tables chart.									
UNIT III	VERBAL REASONING I							7	
Analytical reasoning– Linear and circular arrangement, Blood relation, Direction Problems, Puzzles. Logical reasoning - Number and Alpha series, Odd man out, Element series and Logical series, Coding and decoding, Analogy, Classification, Logical sequence of words.									
UNIT IV	LINGUISTICS SKILLS I							6	
Parts of Speech- Noun, Verb, Participle, Articles, Pronoun, Preposition, Adverb, Conjunction. Logical sequence of words, Tense & Voice, Comparison.									
UNIT V	LINGUISTICS SKILLSII							3	
Comprehension - Comprehend and understand a paragraph, Paragraph writing.									
					L :30	T: 0	P: 0	J: 0	T: 30 PERIODS
TEXT BOOKS									
1	Rajesh Varma, “Fast Track Objective Arithmetic”, ArihantPublications.								
2	M.K.Panday, “Analytical Reasoning”, MagicalSeries.								
3	BS Sijwali- InduSijwali, A New Approach to “Reasoning Verbal, Non-Verbal & Analytical”, ArihantPublications.								
4	John Eastwood, “Oxford Practice Grammar”,Oxford.								
REFERENCES									
1	R.V.Praveen, “Quantitative Aptitude and Reasoning” PHIPublication.								
2	R.S.Agarwal, “Quantitative Aptitude for Competitive Examinations”,S.Chand& Company Pvt Limited.								
3	R.S.Agarwal, “A modern approach to Verbal & Non-verbal reasoning”, S.Chand& Company PvtLimited.								
COURSE OUTCOMES :									
At the end of the course students should be able to									
CO 1	Apply the number system for solving application orientated concepts in quantitative aptitude.								
CO 2	Apply the financial ability for solving application orientated concepts in quantitative aptitude and in the data interpretation techniques.								
CO 3	Analyze the analytical reasoning and logical reasoning in verbal aptitude applications.								

CO 4	Apply appropriate grammar in both speaking and writing.
CO 5	Analyze the given content and write a creative content.

CO	PO										PSO			
	1	2	1	2	1	2	1	2	1	2	1	2		
CO-1	1	2				2	2	1	1			2	3	
CO-2	2	1	1				1	1			2		2	
CO-3	2	2		1			2		2			1	3	2
CO-4	1							2		1			2	3
CO-5								2		1			3	3

23AUB201	AUTOMOTIVE ELECTRICAL DRIVES AND CONTROLS	L	T	P	C
		3	0	2	4
UNIT I	ELECTRICAL SYSTEMS				15
Introduction – Electrical wiring, terminals and switching devices, HV wiring and harness Output Devices: Relays – Relay logic diagram – Contactors – Power distribution Unit – Fuses – Timer – Counter -Vehicle interior and exterior lighting systems (LEDs) - horn circuit - wiper circuit - power window circuit and central locking circuit.					
Experiments:					
1. Study of horn and lighting circuits					
2. Study of wiper motor circuit					

UNIT II	Charging and Starting System:				15
Requirements of charging system – Charging system principles – Alternators and charging circuits. EV Charging standards (Chademo, CCS), Indian Standards – Type_I, Type – II, DC fast charging, Super chargers. Starting system circuits – Starter motor- types – Integrated starter- Speed and Torque characteristics of motor – drive mechanisms – capacity requirements – servicing and troubleshooting.					
Experiments:					
1. Performance test on batteries					
UNIT III	Battery System				15
Types of Batteries, Battery Chemistry and characteristics, Battery Parameters (SOH, SOC). Battery Management System – Introduction, Battery architecture, Structural Design, Battery – Connectors and Advanced storage technology					
Experiments:					
1. Study of Battery Management System					
2. Testing of batteries					
UNIT IV	Power Electronic Devices				15
Concept of Power Electronics – Power electronic systems – Power Semiconductor Devices – Principle of operation – Steady state and switching characteristics of Power diodes - Power BJT - Power MOSFET - IGBT – Future switching devices.					
Experiments:					
1. Speed control of DC motor					
2. Speed control of Induction motor					
UNIT V	ELECTRIC MOTOR DRIVES				15
Introduction - DC to DC converters – Boost converter and Buck converter - Single phase and three phase DC to AC convertors - AC induction motor and control - BLDC motor and control - Plug in battery charger design. Stepper Motor and Control – Servo Motor and control - Permanent Magnet Synchronous Motor and control and Switched Reluctance Motors and control. Axial Flux motor and control					
Experiments:					
1. Speed control of BLDC motor					

2. Speed control of Self Reluctance motor						
		L :45	T: 0	P: 30	J: 0	Total:75 PERIODS
TEXT BOOKS						
1.	AK Babu, Automotive Electrical and Electronics,					
2.	Chris Mi, M. Abul Masrur, and David Wenzhong Gao, Hybrid and Electric Vehicles: Principles and Applications with Practical Perspectives, Wiley, 2017					
REFERENCES						
1	P. L. Kohli, Automotive Electrical Equipment, Tata McGraw-Hill, 2005.					
2	Iqbal Husain, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2011.					
3	James Larminie and John Lowry, Introduction to Electric Vehicles, Wiley, 2003.					
4	Muhammad H. Rashid, Power Electronics: Circuits, Devices & Applications, Pearson, 2013.					
5	Vedam Subrahmanyam, Electric Drives: Concepts and Applications, McGraw-Hill, 1994.					
COURSE OUTCOMES						
At the end of the course student should be able to:						
CO1	Understand and Analyze Electrical Systems in Vehicles					
CO2	Comprehend Charging and Starting Systems					
CO3	Understand Battery Systems and Management					
CO4	Explore Power Electronic Devices					
CO5	Analyze Electric Motor Drives and Control Systems					

CO	PO												PSO	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2
CO-1	3		2		3	1			2	2			2	
CO-2	3	3	2	2	3	1	1	1	2			2	3	
CO-3	3	3						1	2			3		2
CO-4	3	3		2	3	1			2	2	2	3	2	
CO-5	3	3	2	2	3	1			2	2	2	3		3

23ITP204	PROGRAMMING IN PYTHON (Common to All B.E/B.Tech Programme Except CSE, IT and AIML)	L	T	P	C
		0	0	4	2

LIST OF EXPERIMENTS

1. Program for various base conversion functions.
2. Programs to demonstrate the usage of operators and conditional statements
3. Programs to demonstrate usage of control structures
4. Program using array operation
5. Programs to demonstrate the usage of String functions
6. Program using classes and functions
7. Program to implement recursive function.
8. Program to implement lambda function.
9. Program on file manipulation
10. Programs to demonstrate the usage of lists, sets, dictionaries and tuples.
11. Program to implement function template.
12. Program to implement class template

COURSE OUTCOMES

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

CO1	Write simple programs using built-in data types of Python.
CO2	Apply the conditional statements and loops for solving problems.
CO3	Implement arrays, strings and functions in Python
CO4	Identify the commonly used operations involving lists, sets, dictionaries, tuples and file handling in real time applications.
CO5	Implement exemplary applications related to templates for solving real time problems.

23AUP201	AUTOMOTIVE SYSTEMS LABORATORY	L	T	P	C
		0	0	4	2

List of Experiments:

A. Automotive Systems

1. Measurement of Vehicle frame
2. Dismantling and Assembling of Rack & Pinion Steering System
3. Dismantling and Assembling of Recirculating ball steering system
4. Dismantling and Assembling of Motorized power Steering
5. Dismantling and Assembling of Coil Spring & Diaphragm Spring clutches
6. Dismantling and Assembling of Gear box
7. Dismantling and Assembling of Front Axle-Rzeppa joint assembly
8. Dismantling and Assembling of Rear Axle
9. Dismantling and Assembling of Differential Mechanism

B. Electric Vehicles

10. Study of motor and controllers
11. Study of Wiring Harness in E-Mobility
12. Retrofitting Electric vehicles

L: 0 T: 0 P: 30 J: 0 Total: 30 Periods

Course Outcome:

At the end of the course, the students will be able to

1. Understand the operation of various type of motors and controllers used in E-mobility
2. Assemble a complete retrofit system of both power train and drive train
3. Test, service and maintain the motors and power electronics systems in E-mobility
4. familiarize the layout and design features of an automobile
5. Understanding on different types of steering system, transmission systems and axles.

CO	PO												PSO	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2
CO-1	3			2	3		2	1	2			3	3	2
CO-2	3	3	3	2	3		2			3	3	2	3	3
CO-3	3						2	1	3	3	3	3	3	2
CO-4	3	3	3	2		1	2	1	2			3		3
CO-5	3	3	3	2	2	1	2				2	3		2

23AUP202	AUTOMOTIVE ENGINES AND EMISSION CONTROL LABORATORY	L	T	P	C
		0	0	4	2

List of Experiments

1. Valve timing and port timing diagram.
2. Performance test on two-wheeler SI engine.
3. Performance test on automotive multi-cylinder SI engine
4. Performance test on automotive multi-cylinder CI engine.
5. Morse test on multi-cylinder SI engine.
6. Heat balance test on automotive multi-cylinder SI engine.
7. Heat balance test on automotive multi-cylinder CI engine
8. Emission test on two-wheeler SI engine.
9. Emission test on automotive multi-cylinder SI engine
10. Emission test on automotive multi-cylinder CI engine.

MAJOR EQUIPMENTS REQUIRED

1. Four stroke SI engine and Two Stroke SI Engine Cut Section
2. Two wheeler SI engine.
3. Multi cylinder SI engine
4. Multi cylinder CI engine.
5. Heat balance –Multi cylinder SI engine.
6. Heat balance –Multi cylinder CI engine.
7. Emission test –two wheeler SI engine.
8. Emission test – multi cylinder SI engine
9. Emission test –multi cylinder CI engine.

CO	PO												PSO	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2
CO-1	3	3		2	2						2			
CO-2		3	3	2	2								2	
CO-3	2			2						2		2		
CO-4					2	3				2				
CO-5		2		2		2				2		2		

23AUP203	MINI PROJECT - I	L	T	P	C
		0	0	2	1

GUIDELINES

1. The scope of the project work is to enable the students in convenient groups (not more than 4 members) involving theoretical and experimental studies through Design Thinking approach.
2. The aim of the project work is to deepen comprehension of principles by applying them to a new problem based on the courses such as Physics, Chemistry, Electrical & Electronics Engineering, Material science, Engineering mechanics, Programming in C & Data structures studied by the students in the first year of study but not limited to.
3. Project periods shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.
4. Create a model/fabricate a model/conduct experiment/simulate mechanical system/implement the same. Analyze data, evaluate the results and conclude the appropriate solution, suggestion for feature work.
5. The continuous assessment shall be made according to the regulation which is tabulated below.

SEMESTER IV

23MAT204	STATISTICS AND NUMERICAL METHODS (Common to AEROSPACE,AGRI,AUTO,EEE,FT,MECH)			
	L	T	P	C
UNIT I	TESTING OF HYPOTHESIS			9
Sampling distributions – Tests for single mean, proportion and difference of means (large and small samples) – Tests for single variance and equality of variances – Chi square test for goodness of fit – Independence of attributes.				
UNIT II	DESIGNS OF EXPERIMENTS			9
One way and two way classifications – Completely randomized design – Randomized block design – Latin square design – Applications of ANOVA.				
UNIT III	SOLUTIONS OF EQUATIONS			9
Newton Raphson method – Solution of linear system of equations – Gauss elimination method – Pivoting Gauss Jordan methods – Iterative methods of Gauss Jacobi and Gauss Seidal.				
UNIT IV	INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION			9
Lagrange’s interpolation – Newton’s forward and backward difference interpolation – Approximation of derivatives using interpolation polynomials – Numerical single integration using Trapezoidal and Simpson’s 1/3 rules.				
UNIT V	NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS			9
Single step methods: Taylor’s series method – Euler’s method – Modified Euler’s Method – Fourth order Runge-Kutta method for solving first order equations – Multi step methods: Milne’s predictor-corrector methods for solving first order equations.				
L : 45		T:0	P: 0	Total: 45 PERIODS
TEXT BOOKS				
1.	Grewal, B.S., and Grewal, J.S., “Numerical methods in Engineering and Science”, Khanna Publishers, 10th Edition , New Delhi, 2015.			
2.	Johnson, R.A., Miller, I and Freund J., “Miller and Freund’s Probability and statistics for Engineers”, Pearson Education Asia, 9th Edition, 2018.			
REFERENCES				
1.	Walpole. R.E., Myers. R.H., Myers. S.L., and Ye. K., “Probability and Statistics for Engineers and Scientists”,9th Edition, Pearson Education, Asia, 2010.			
2.	Burden, R.L and Faires, J.D, "Numerical Analysis", 9 th Edition, Cengage Learning, 2016.			
3.	Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8 th Edition, 2014.			
4.	Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 7 th Edition, 2007.			
5.	Spiegel,M.R., Schiller, J. and Srinivasan,R.A., "Schaum’s Outlines on Probabilty and Statistics”, Tata McGraw Hill edition, 4th Edition, 2012.			

COURSE OUTCOMES	
At the end of the course students should be able to	
CO1	Test a hypothesis concerning variances and proportions.
CO2	Apply the basic concepts of classifications of design of experiments in the field of agriculture.
CO3	Solve a set of algebraic equations representing steady state models formed in engineering problems
CO4	Appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.
CO5	Predict the system dynamic behaviour through solution of ODEs modelling the system

3AUT203	MECHANICS OF AUTOMOTIVE SYSTEMS	L	T	P	C	
		3	0	0	3	
UNIT-I	BASICS OF MECHANISMS AND KINEMATICS					9
Mechanism – Basic terminology and definitions, degree of freedom, mobility. Kinematic inversions - 4-bar chain, slider crank chain. Determination of velocity and acceleration of simple mechanisms using relative velocity method.						
UNIT-II	STATIC AND DYNAMIC FORCE ANALYSIS					9
Applied and Constrained Forces – Free body diagrams – static Equilibrium conditions – Two, Three and four members – Static Force analysis in simple machine members – Dynamic Force Analysis – Inertia Forces and Inertia Torque – D-Alembert’s principle. Plane kinetics of rigid bodies: Linear and angular momentum.						
UNIT-III	MECHANISM OF CAMS					9
Fundamentals of cam, Classifications, displacement diagrams, uniform velocity, simple harmonic paths. Layout of plate cam profiles for different types of followers - knife - edged, roller, design, derivatives of follower motion.						
UNIT-IV	GEARING AND FRICTION DRIVES					9
Gear – Types and profile – nomenclature of spur & helical gears – laws of gearing – interference – requirement of minimum number of teeth in gears – gear trains – simple, compound and epicyclic gear trains. Sliding and Rolling Friction angle – friction in threads – Belt and rope drives						
UNIT-V	BALANCING OF MASSES & GOVERNORS					9
Static and dynamic balancing – single and several masses in different planes – primary and secondary balancing of reciprocating masses - Balancing of single and multicylinder engines. Governors – Watt, Porter, Proell, Hartnell.						
		L :45	T: 0	P: 0	Total:45 PERIODS	
TEXT BOOKS						
5.	Rattan.S.S, “Theory of Machines”, Tata Mc Graw Hill Education Private Limited, 3rdEdition, 2009.					
6.	Thomas Bevan, “The Theory of Machines” 3rd Edition, CBS Publisher, 2005.					
REFERENCES						
1	Rao, J.S and Dukkipati, R.V, “Mechanism and Machine Theory”, Second Edition, New Age International (P) Ltd. Reprint, 2006.					
2	Ballaney P. L, “Theory of Machines”, Khanna Book Publishing Co. (P) Ltd, New Delhi, 2008.					
3	Gosh, A. and Mallick, A.K., “Theory of Machines and Mechanisms”, East West Press, 3 rd Edition, 2006.					
4	R. S. Khurmi & J. K. Gupta, Theory of Machines - S. Chand and company Pvt Ltd, 14 th Edition, 2005.					
5	An Introduction to Modern Vehicle Design, J H Smith, Butterworth Heinemann, Oxford, 2010.					
COURSE OUTCOMES						
At the end of the course student should be able to:						
CO1	Analyze mechanisms in automobiles to calculate velocity and acceleration.					
CO2	Analyze the contribution of force equilibrium in the machines.					
CO3	Design cam profiles, understand classifications and displacement diagrams for followers.					
CO4	Explain vehicle gears and friction drives, covering terminology, laws, mechanics.					
CO5	Balance vehicle masses statically and dynamically, understand various governor mechanisms.					

CO/PO Mapping (S/M/W Indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	2	2			1	1		2	2	2	2	2
CO 2	3	3	2			1							3	
CO 3	3	2	3		2	1		1	1			2		2
CO 4	3	3	3	2	2		1		2	2				
CO 5	3	2	2	2	2		1		2	2		2	3	2

23AUT204	SOLID AND FLUID MECHANICS	L	T	P	C	
		3	0	0	3	
UNIT I	STRESS, STRAIN DEFORMATION OF SOLIDS					9
Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Elastic constants – Volumetric strains						
UNIT II	SHEAR FORCE AND BENDING MOMENT DIAGRAMS					9
Types of beams, Supports and Loads – Shear Force and Bending Moment Diagrams in beams – Cantilever, Simply Supported and Over Hanging beams- Maximum bending moment –Point of Contra Flexure						
UNIT III	SHAFTS AND SPRINGS					9
Torsion formulation stresses and deformation in circular and hollow shafts – Stepped shafts– Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs..						
UNIT-IV	THIN AND THICK CYLINDERS					9
Stresses in thin cylindrical shell due to internal pressure - circumferential and longitudinal stresses - deformation in thin and thick cylinders – Lamé’s theorem.						
UNIT-V	FLUID PROPERTIES , FLOW CHARACTERISTICS AND MACHINES					9
Units and dimensions - Properties of fluids -. Pascal’s law and hydrostatic law. Absolute, gauge and vacuum pressures. Pressure measurement devices - U-tube manometers, pressure gauges. Flow characteristics -concept of control volume – Pumps – Centrifugal, Reciprocating and Gear Pumps						
		L :45	T: 0	P: 0	J: 0	Total:45 PERIODS
TEXT BOOKS						
3.	R.K.Bansal, "Strength of Materials", Laxmi Publications (P) Ltd., 2018.					
4.	R. K. Bansal, Fluid Mechanics and Hydraulics Machines, 10 th Edition, Laxmi Publications(P)Ltd., New Delhi 2011					
REFERENCES						
1	R. K. Rajput, “Strength of Materials”, S. Chand and Company Ltd., New Delhi 2018					
2	Jindal U.C., "Strength of Materials", Asian Books Pvt. Ltd., New Delhi, 2009					
3	R.S.Khurmi, “Strength of Materials”, S. Chand and Company Ltd. New Delhi 2015					
4	Robert W. Fox, Alan T. Mc Donald, Philip J. Pritchard, “Fluid Mechanics and Machinery”, 2011					
5	Rajput. R. K, “A text book of Fluid Mechanics and Hydraulic Machines”, S. Chand & Company Ltd., New Delhi, sixth edition, 2010					
COURSE OUTCOMES						
At the end of the course student should be able to:						
CO1	Describe the fundamentals about the simple stresses, strains and deformation in components due to external loads.					
CO2	Draw the shear force and bending moment diagrams of various beams with different loads					
CO3	Explain the effect of torsion on shaft and springs.					
CO4	Evaluate the stresses in thin and thick cylindrical components.					
CO5	Explain the fundamental concepts of fluid mechanics with different properties of fluids.					

CO/PO Mapping (S/M/W Indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	3				2						2	3	
CO 2	3	3	3			2						2	3	
CO 3	3	3		2	2	2					2	2	3	2
CO 4	3				3	2						2	3	3
CO 5	3		2		3	3		3	2		2	2	2	2

23AUT205	HYBRID ELECTRIC AND FUEL CELL VEHICLES	L	T	P	C
		3	0	0	3
UNIT I	HYBRID VEHICLES				9
Concept of hybrid electric drive train - Architecture of hybrid electric drivetrains - Electrical coupling – Mechanical coupling - Torque and Speed coupling - Regenerative braking - Well-to-Wheel performance analysis- Comparison of ICEV and HEV.					
UNIT II	ENERGY STORAGE SYSTEMS				9
Cell Types (Lead Acid/Li/NiMH)- Solid State battery - Battery charging and discharging calculation - Cell Packaging Selection and sizing-Battery lay outing design-Battery Pack Design -Battery characteristics - Battery Characterization - Battery Management System- Thermal Management - Ultra capacitors.					
UNIT III	HEV PERFORMANCE				9
Vehicle performance -Maximum speed, Acceleration, Gradeability, Mechanics, Efficiency, Driving Cycles, Regulations - Sizing the propulsion motor - Power electronics in HEV - Design of a Hybrid Electric Vehicle (HEV) - Design of a Battery Electric Vehicle (BEV) - Vehicle Simulation Tools- Design and Analysis of Vehicle performance- Advancement of HEV- Case study on Design of HEV.					
UNIT IV	INTRODUCTION TO FUEL CELLS				9
Introduction – Working and types of fuel cell – Low, Medium and High Temperature fuel cells - Proton Exchange Membrane fuel cell- Solid Oxide fuel cell-Alkaline fuel cells - Molten carbonate fuel cell - Phosphoric acid fuel cell - Liquid and methanol type fuel cells - Microbial fuel cell- Case study on Hydrogen fuel cell Vehicle.					
UNIT V	FUEL CELLS COMPONENTS, APPLICATIONS AND ECONOMICS				9
Fuel cells for Automotive applications- Components of fuel cell - Membrane Electrode Assembly components, fuel cell stack, bi-polar plate, humidifiers and cooling plates - Materials for fuel cell- Fuel cell-based vehicle - Advancements in fuel cell vehicle - Economics and Environmental analysis- Problems in FCV- Case study on Design of FCV.					
		L :45	T : 0	P : 0	Total:45 PERIODS
TEXT BOOKS					
4.	“Electric and Hybrid Vehicles- Design Fundamentals” - Iqbal Husain, CRC Press, 2011.				
5.	“Electric and Hybrid – Electric Vehicles” - Ronald K Jurgen,, SAE International, 2011.				
REFERENCES					
1	“Electric Vehicle Technology Explained” - James Larminie, John Lowry, Wiley, 2012.				
2	Vehicle Technology Explained” - James Larminie, John Lowry, Wiley, 2012.				
3	"Fuel Cell Technology Handbook- SAE International" –Gregor Hoogers, CRC Press ISBN 0-8493- 0877-1-2003				
4	“Modern Electric, Hybrid Electric & Fuel Cell Vehicles”, Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, 2 nd Edition, CRC Press,2010				
5	“Fuel Cell Vehicles: Fundamentals, Theory and Design”, CRC Press, 2004"				
COURSE OUTCOMES					
At the end of the course student should be able to:					
CO1	Impart the knowledge about different configuration of hybrid vehicles				
CO2	Describe the various energy storage systems for hybrid & electric vehicles				
CO3	Design and analyze the performance of Hybrid electric vehicles				
CO4	Be familiar with the various components of the fuel cells				
CO5	Choose materials for fuel cells related to automobile applications				

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3		3		3		2		3		2			3
CO 2	3	2	2	3	2		3						2	1
CO 3	2		3		2		2						3	3
CO 4	3	3	2				3	3			2		2	
CO 5	3	3	3	3	3		1						3	

23AUT206	SMART MANUFACTURING TECHNOLOGY	L	T	P	C	
		3	0	0	3	
UNIT I	INDUSTRY 4.0				9	
Concept, Globalization and emerging issues, The Fourth Revolution, LEAN manufacturing, Smart and connected business perspectives, Smart factories.						
UNIT II	ADVANCED CAD TECHNOLOGIES				9	
Introduction to CAD. Enabling technologies: Digital twin, AR/VR, AI. Cloud computing, Touch/Voice/Motion enabled CAD, Customized CAD, Cloud based CAD, Digital twin and live simulation.						
UNIT III	SMART MANUFACTURING SYSTEMS				9	
Digital manufacturing: CNC, Cloud based manufacturing, IoT based manufacturing, Additive manufacturing. Robotics: Robotic automation- Collaborative robots-Autonomous robots and Modular robots.						
UNIT IV	SMART FACTORY ENABLERS				9	
Enabling technologies. Smart energy: Improving energy efficiency with data, Smart grids. Clean energy. Smart logistics. Smart Inspection. Smart decision making.						
UNIT V	NON-DESTRUCTIVE TESTING				9	
Principles of various NDT Techniques-Visual Inspection and Eddy Current Testing- Liquid Penetrant Testing-Magnetic Particle Testing-Equipment- Applications-advantages and limitations.						
		L :45	T: 0	P: 0	J: 0	Total:45 PERIODS
TEXT BOOKS						
1.	Flavio Craveiro, Jose Pinto Duarte, Helena Bartolo and Paulo Jorge Bartolo, “Additive manufacturing as an enabling technology for digital construction: A perspective on Construction 4.0”, Automation in Construction, Vol. 103,pp. 251- 267, 2019.					
2.	J.Prasad, C G K Nair , “ Non Destructive Testing and Evaluation of materials”, Tata McGraw Hill Education Private Limited					
REFERENCES						
1	Klaus Schwab, “Fourth Industrial Revolution”, Random House USA Inc, New York, USA, 2017.					
2	Oliver Grunow, ”Smart Factory and Industry 4.0. The current state of Application Technologies”, Studylab Publications, 2016					
3	Alasdair Gilchrist, “Industry 4.0: Industrial Internet of Things”, Apress, 2016					
4	Sang C. Suh, U. John Tanik, John N Carbone, Abdullah Eroglu, “Applied Cyber-Physical Systems”, Springer Publications, New York, 2013.					
5	American Metals society,” Non Destructive Examination and quality control”, Metals Hand Book, Vol.17,9 th Ed, Metals Park,OH,1989.					
6	Christoph Jan Bartodziej, “ <i>The Concept Industry 4.0 – An Empirical Analysis of Technologies and Application in Production Logistics</i> ”, Spinger Gabler, 2015					
COURSE OUTCOMES						
At the end of the course student should be able to:						
CO1	Introduce the concept of Industry 4.0 for Smart Manufacturing.					
CO2	Use the advanced CAD technologies to create the CAD models.					
CO3	Use the smart manufacturing technologies to produce the components and products.					
CO4	Recommend the enabling technologies to make various factory operations smarter.					
CO5	Understanding foundational principles of NDT.					

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	2	3	2	3		2							3	
CO 2		2	3	3				2		2			3	
CO 3	3			3		2					2			
CO 4	2	2		2			3				3			
CO 5	2	2					3				3			

23GET276	VQAR-II				L	T	P	C
	(Common to All B.E. / B. Tech. Courses)				2	0	0	2
UNIT I	QUANTITATIVE ABILITY III							6
Time, speed & distance-Average speed- Relative speed- Train problems- Boats and streams- Races, Chain rule, Time and work -Pipes and cisterns								
UNIT II	QUANTITATIVE ABILITY IV							4
Permutation & Combination, Probability, Mensuration								
UNIT III	VERBAL REASONING II							7
Machine Input and Output, Coded Inequalities, syllogisms, Problems on Cubes, Data sufficiency. Critical Reasoning -Statement and Argument, Statement and Assumption, Statement and Conclusion, Cause and effect, Course of action.								
UNIT IV	NON- VERBAL REASONING							5
Figure series, Odd man out, Mirror Image, Water image, Embedded Image, Cubes and Dices, Insert the Missing Characters, Analytical reasoning.								
UNIT V	LINGUISTICS SKILLS III							8
Sentences - Simple, Compound, Complex & Mixed sentences, Sentence Rearrangement, Idioms & Phrases, Reading Comprehension at higher level, Word Substitution, Synonyms & Antonyms, Error Spotting.								
L :30					T: 0	P: 0	J: 0	T: 30 PERIODS
TEXT BOOKS								
1	Rajesh Varma, “Fast Track Objective Arithmetic”, Arihant Publications.							
2	M.K.Panday, “Analytical Reasoning”, Magical Series.							
3	BS Sijwali- Indu Sijwali, A New Approach to “Reasoning Verbal, Non-Verbal & Analytical”, Arihant Publications.							
4	S.P.Bakshi, “Objective English” Arihant Publications.							
REFERENCES								
1	R.V.Praveen, “Quantitative Aptitude and Reasoning” PHI Publication.							
2	R.S.Agarwal, “Quantitative Aptitude for Competitive Examinations”, S.Chand & Company Pvt Limited.							
3	R.S.Agarwal, “A modern approach to Verbal & Non-verbal reasoning”, S.Chand & Company Pvt Limited.							
COURSE OUTCOMES :								
At the end of the course students should be able to								
CO1	Learn the time and distance for solving application orientated concepts in quantitative aptitude							
CO2	Apply the financial ability for solving application orientated concepts in quantitative aptitude							
CO3	Analyze the verbal reasoning and the critical reasoning in quantitative aptitude.							
CO4	Analyze the non-verbal reasoning in verbal aptitude applications							
CO5	Apply appropriate LSRW skills							

CO/PO Mapping														
(S/M/W Indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	3	3	2									3	
CO2	3	3	2	2									2	
CO3	3	3	3	2	2								3	2
CO4	3	3	2	2									2	2
CO 5	3	3	2									2	3	

23AUP204	MECHANICAL SCIENCES LABORATORY	L	T	P	C
		0	0	2	1
LIST OF EXPERIMENTS					
1. Torsion test on mild steel					
2. Impact test on metal specimen – (IZOD & Charpy)					
3. Deflection test on beam					
4. Performance test on Gear pump					
5. Cams – Cam profile drawing, Motion curves and study of jump phenomenon					
6. Whirling of shafts – Determination of critical speeds of shafts with concentrated loads					
7. a) Balancing of rotating masses b) Balancing of reciprocating masses					
8. Prepare the component using the following operations- Facing, Turning, Step turning, Taper turning and Knurling					
9. Prepare the component using the following operations- Facing, Turning and Thread cutting (Single start only)					
10. Prepare the component using the following operations- Drilling, Tapping and Reaming					

LIST OF EQUIPMENT FOR A BATCH OF 36 STUDENTS		
S.No	Description of Equipment	Quantity
1	Torsion Testing Machine for steel rods	1
2	IZOD Impact Testing Machine	1
3	Beam Deflection Test Apparatus	1
4	Extensometer	1
5	Compressometer	1
6	Dial Gauges	Few
7	Gear pump setup	1
8	Cams	1
9	Whirling of shafts	1
10	Balancing of rotating and reciprocating masses	1

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	2	2	3	3	2		3		2	3	3	3
CO 2	3	2	3	2	2	2	2		2			2	3	
CO 3	3	2	2	2	3	2	2		3		3	3	3	2
CO 4	3	3										2	1	
CO	3				1							2		2

5														
---	--	--	--	--	--	--	--	--	--	--	--	--	--	--

23GEP275	PERSONAL BRANDING (PRACTICAL)			
	L	T	P	C
	0	0	4	2
UNIT-I	SELF-AWARENESS & PERSONAL DEVELOPMENT			
Self-Awareness: Key Areas -Personality, Values, Habits, Needs & Emotions, Impact of Self-Awareness on Personal Development				
Personality –Definition, Elements, Determinants, Needs and Benefits, Personality traits. Personality development skills, Positive traits for effective people, SWOT :Analyzing Strength and weakness (SWOT), Building Esteem & Self-Confidence, Working on attitudes (aggressive, assertive, submissive), Self-Motivation				
UNIT-II	BODY LANGUAGE			
Body Language and Gestures, Personal Grooming, Personal Hygiene, Social Effectiveness, Business Etiquette				
UNIT-III	INTERVIEW AND LEADERSHIP SKILLS			
Resume Building, Video Resume, Leadership Styles, Leadership Traits, Group Dynamics- Conflict management				
UNIT-IV	SOCIAL IMAGE TRAITS			
Social etiquettes -Positive Social Image, Social Graces, Online Etiquettes, Dining Etiquettes, Voice Modulation, – Networking: Case Study and Company website references.				
UNIT-V	PERSONALITY TEST			
Big Five Personality Test, Open DISC Assessment Test.				

TEXT BOOKS

- Hurlock, E.B (2006). Personality Development, 28th Reprint. New Delhi: Tata McGraw Hill.
- Stephen P. Robbins and Timothy A. Judge (2014), Organizational Behavior 16th Edition: Prentice Hall.

S

REFERENCES

- Smith, B. Body Language. Delhi: Rohan Book Company. 2004
- Personality Development and Career management: By R.M.Onkar (S Chand Publications)

Practical-60 Hours, Total 60 Hours

Course Outcome

- To evaluate the quality of personality for self-development in a career perspective.
- To apply the body language in his professional interview modes.
- Apply the communication and leadership styles in public speaking.
- Apply the social imaging qualities in their presentation skill.
- Demonstrate personal branding skills in mock interviews.

S.No	List of Exercises
1	Swot Analysis
2	Grooming, Dressing and Photo-shoot
3	Body Language, Handshaking
4	Art of Storytelling, Marketing & selling yourself
5	Self-Discipline: Goal setting (Qualitative and Quantitative)
6	Teamwork & Leadership Activity

7	Dealing with Pressure, Failure & Decision Making
8	Psychological/Personality test
9	Video Resume
10	Business Card creation
11	Social Profiling in FB/Insta/Linked In/Personal Website
12	Online Interview
13	Speed Interview
14	Networking Event-Online/Offline

23AUP205	INTERNSHIP – II	L	T	P	C
		0	0	0	2
<p>8. The Internship is provided for the students to update themselves with the recent Technologies and professional skills for better prospects in the future.</p> <p>9. Internship in industry subjected to permissions from Government and concern Industry subject to the conditions of following the SOP issued by the concern and written consent of the student and parents.</p> <p>10. Student is supposed to produce joining letter and relieving letter once the internship is over in case of offline internship in any industry.</p> <p>11. Online internship in industry / other agencies.</p> <p>12. Seminar by student under mentorship of a faculty.</p> <p>13. A detailed report shall be submitted based on his Internship and shall be done by only one student.</p> <p>14. A Mini Project- on some suitable topic related to the branch of study. It can be small fabrication / experimental results/ simulations / Programmes/ application development etc., depending on the branch of the student. Preferably a single student should do it.</p> <p>Student has to prepare detailed report and submit to his/her college.</p> <p>7. A copy of report can be kept in the departments for record.</p> <p>8. Each student must be assigned a faculty as a mentor from the college and an Industry expert as co-mentor.</p> <p>9. The evaluation of the work done by students will be carried by the internal and external examiner.</p> <p>10. External examiner will evaluate for 80 marks and internal examiner will evaluate for 20 marks.</p> <p>11. The presentation by student in the presence of all students is desirable.</p> <p>12. Student should produce successful completion certificate in case of offline / online internship in industry</p>					
2 Weeks					

SEMESTER V

23AUT301	VEHICLE DYNAMICS AND STRUCTURES	L	T	P	C	
		3	0	0	3	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> • To understand the Fundamental Principles of Vehicle Dynamics. • To analyze Vehicle Performance Parameter. • To explore Emerging Trends and Innovations in Vehicle Dynamics. 						
UNIT I	VEHICLE PERFORMANCE					9
Assumptions to be made in designing a vehicle - Overview of dynamics in automotive and electric vehicle systems - Importance of ride, handling, and stability - Calculation of Vehicle parameters – Tire Forces and Moments – Magic Formulae Tire Model - Performance of Tire on Wet surface – Test on Various Road Surface – Tire Vibration.						
UNIT II	VERTICAL DYNAMICS					9
Human response to vibration - Sources of Vibration - Design and analysis of Passive, Semi-active and Active suspension using Quarter car model - Influence of suspension stiffness, suspension damping, and tire stiffness - Skyhook damping - Ride dynamics with battery placement considerations - Suspension requirements for EV platforms.						
UNIT III	LONGITUDINAL DYNAMICS					9
Aerodynamic forces and moments – Aerodynamic stability and design considerations - Optimization of structures for weight reduction - Load Distribution for three and four wheeler - Calculation of Maximum acceleration, Reaction forces for Front and Rear drives - Prediction of Vehicle performance - Traction control and anti-lock braking systems - Integration of motor torque control in vehicle dynamics.						
UNIT IV	LATERAL DYNAMICS					9
Steady state handling characteristics - Understeer, oversteer, and neutral steer behavior - Testing of handling characteristics - Transient response characteristics - Roll center, Roll axis, Vehicle under side forces - Stability of vehicle on banked road - Stability of vehicle while taking turn - Effect of suspension on cornering - Steering behaviour in vehicles with distributed motor systems.						
UNIT V	FUTURE TRENDS IN VEHICLE DYNAMICS AND STRUCTURES					9
Multi-body dynamics simulation tools - Real-time dynamic testing and validation - Crash safety considerations for EVs - Active aerodynamics - Adaptive chassis systems - Dynamic stability control for high-performance EVs - Role of AI in Vehicle dynamics - Recycling of battery and structural materials -Retrofitting of existing vehicle to E-vehicle.						
		L:45	T:0	P: 0	Total: 45 Periods	
TEXT BOOKS						
T1	Giri. N. K., "Automotive Mechanics," Khanna Publishers, New Delhi, 2008.					
T2	Thomas D. Gillespie, Fundamentals of Vehicle Dynamics, SAE International, 1st Edition, 2021.					

REFERENCES	
R1	William H. Crouse, "Automotive mechanics" – 10th Edition, Tata McGraw Hill Publications Co. New Delhi, 2016
R2	Iqbal Husain, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 1st Edition, 2010.
R3	Hans B. Pacejka, "Tire and Vehicle Dynamics", SAE International, 3rd edition, April 2012.
R4	J.Y. Wong, "Vehicle Dynamics", John Wiley & Sons, 5th edition, August 2022
R5	Rajesh Rajamani, "Vehicle Dynamics and Control", Springer, 1st edition, 2006
COURSE OUTCOMES	
At the end of the course students should be able to	
C01	Understand and analyze the fundamental concepts of vehicle performance, dynamics, and related parameters like Gross Vehicle Weight, Frontal Area, maximum speed, and gradeability.
C02	Evaluate the effects of vertical dynamics and vibration on ride comfort and vehicle stability, including the design and analysis of various suspension systems.
C03	Analyze the longitudinal dynamics of a vehicle, including aerodynamic forces, traction control, braking systems, and their effect on vehicle performance.
C04	Assess lateral dynamics characteristics such as understeer, oversteer, and vehicle handling behavior under various conditions.
C05	Apply emerging trends in vehicle dynamics, multi-body dynamics simulations, dynamic testing, EV structural design considerations, and sustainability measures

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
C01	3	3	3	2	2	1	2			1	1	3	3	
C02	3	3	3	3	3					2		3	3	
C03	3	3	3	3	3	1	2				2	3	3	
C04	3	3	3	3	3							3	3	
C05	3	3	2	2	3		3	1	2	2	2	3	3	

23AUT302	AUTOMOTIVE COMPONENT DESIGN	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> To understand the basic principles and functions of various automotive components. To explore different materials used in automotive manufacturing. To develop skills in project management, teamwork, and critical thinking. 					
UNIT I	VEHICLE FRAME AND FRONT AXLE	9			
Introduction to Design - Study of loads-moments and stresses on frame members - Design of Vehicle frame -Analysis of loads-moments and stresses in front axle - Design of front axle beam – Wheel Spindle Bearing.					
UNIT II	STEERING SYSTEM AND SUSPENSION SYSTEM	9			
Condition for True Rolling – Ackermann Principle in Steering System – Design of Steering System Components - Design of leaf Springs-Design of Coil springs – Design of torsion bar springs.					
UNIT III	ENGINE COMPONENTS	9			
Design of Cylinder – Design of Piston, Piston pins and Piston rings – Design of Connecting rod – Design of Valves - Design of Exhaust and Intake Manifold – Design of Crankshaft.					
UNIT IV	CLUTCH AND GEARBOX	9			
Design of single plate clutch - Design of multiplate clutch - Design of Centrifugal clutch – Layout of Gearboxes - Design of three speeds and four speed gearboxes.					
UNIT V	FINAL DRIVE AND BRAKING SYSTEM	9			
Design of Propeller Shaft – Design of Rear Axle Drive Assembly - Energy Absorbed by brakes – Heat to be dissipated during braking – Design of Drum Brake – Design of Disc Brake.					
		L:45	T:0	P: 0	Total: 45 Periods
TEXT BOOKS					
T1	N.K.Giri, “Automotive Mechanics” 9 th Reprint, Khanna Publishers 2021.				
T2	R.S.Khurmi&Gupta.J.K., "A text book of Machine Design", Eurasia Publishing House (Pvt) Ltd, 2011..				
REFERENCES					
R1	S.Md.Jalaludeen, “A text book of Machine Design”, AnuradhaPublications, 2014.				
R2	Heldt, P.M., "Automotive Chassis", literary licensing. 2020.				
R3	Julian Happian-Smith, “An Introduction to Modern Vehicle Design”, Butterworth Heinemann Publishers,2004				
R4	Dean Aaverns, "Automobile Chassis Design", Illife Book Co., 2016.				
R5	Mathur&Sharma, “A course in I.C. Engine”, DhanputRai& Sons, 221				

COURSE OUTCOMES	
At the end of the course students should be able to	
C01	Analyze various parameters for designing Vehicle frame and Front Axle.
C02	Design the Steering system and Suspension System.
C03	Interpret the design methodology of various Engine components.
C04	Discover the design of gearboxes and Automotive Clutches.
C05	Apply the design considerations in Final Drive and Braking System.

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PSO1	PSO2	PSO3
C01	2	3	3	2		2						3	3	
C02			3	3		3						3	2	
C03		2	3	3						2		3		
C04		3	2	2								2	3	
C05	3	2	3	2	2	3				2			3	

SEMESTER V

23AUB301	AUTOMOTIVE FUELS AND LUBRICANTS	L	T	P	C
		3	0	2	4
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> • To make students understand the Importance of fuels and lubricants in automotive applications. • To gain knowledge of energy sources and their role in transportation. 					
UNIT I	MANUFACTURE OF FUELS AND LUBRICANTS	9 + 6			
Structure of petroleum, refining process, fuels, thermal and catalytic cracking, polymerization, alkylation, isomerization, blending, products of refining process. Manufacture of lubricating oil base stocks, manufacture of finished automotive lubricants Experiments: 1. ASTM distillation test of liquid fuels. 2. Viscosity Index of Fuels using Saybolt Viscometer.					
UNIT II	THEORY OF LUBRICATION	9 + 6			
Engine friction: introduction, total engine friction, effect of engine variables on friction, hydrodynamic lubrication, Elasto hydrodynamic lubrication, boundary lubrication, bearing lubrication, functions of the lubrication system, introduction to design of a lubricating system. Experiments: 1. Temperature dependence of viscosity of lubricants using Redwood Viscometer 2. Viscosity Index of lubricants using Say bolt Viscometer					
UNIT III	TESTING OF FUELS AND LUBRICANTS	9+ 6			
Methods of testing fuel properties: ASTM standards for fuel quality analysis - Distillation, flash point, and calorific value testing. Lubricant testing techniques: Viscosity testing, oxidation stability, and deposit formation. Instruments used for testing and analysis Experiments: 1. Ash content and Carbon Residue Test. 2. Drop point of grease and mechanical penetration in grease.					
UNIT IV	ADVANCED FUELS AND LUBRICANTS	9+ 6			
Future trends in automotive fuels: Hydrogen as a fuel, fuel cells, and electric vehicle energy sources - Second and third-generation biofuels. Advances in lubricants: Nano-lubricants and biodegradable lubricants - Energy-efficient lubricants for EVs and hybrids. Role of AI and data analytics in fuel and lubricant optimization. Experiments: 1. Aniline Point test of diesel 2. Calorific value of liquid fuel 3. Flash and Fire points of petrol and diesel.					
UNIT V	CASE STUDIES AND APPLICATION	9+ 6			
Performance analysis of fuels and lubricants in different vehicle types - Case studies on alternative fuels and their adoption in industry - Role of lubricants in reducing engine wear and improving efficiency. Experiments: 1. Reid vapour pressure test.					

2. Cloud & Pour point Test			
	L:45	T:0	P: 30
Total: 75 Periods			
TEXT BOOKS			
T1	Francis, W, "Fuels and Fuel Technology", Vol. I & II, Pergamon, 1965.		
T2	M.L.Mathur and P.Sharma "A Course in Internal Combustion Engines," Dhanpatrai publications, 2012.		
REFERENCES			
R1	"Automotive Fuels and Lubricants" by Joseph D. Walter,2005.		
R2	Ganesan.V. "Internal Combustion Engineering", Tata McGraw-Hill Publishing, New Delhi, 2003.		
R3	Lansdown. A.R., Lubrication, "A practical guide to lubricant selection," Pergamon press, 2013.		
R4	Raymond. C. Gunther, "Lubrication", Chilton Book Co., 1972.		
R5	Obert.E.F "Internal Combustion Engineering and Air Pollution," International book Co., 1988.		
COURSE OUTCOMES			
At the end of the course students should be able to			
CO 1	Gain the knowledge on various fuel and lubrication manufacturing techniques.		
CO 2	Learn the detailed conception on lubrication.		
CO 3	Evaluate the various lubrication and it application.		
CO 4	Examine the properties of Fuels and Lubricants.		
CO 5	Apply the fuel and lubricant in day to day applications.		

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2		2			2			3	3	2	
CO2	3	3		2	2			2			3	3	1	1
CO3	3	3		2	2			2			3	3	3	2
CO4	3	3		2	2			2			3	3		
CO5	3				3		2	3	3	2	3	3	1	3

23AUP301	MINI PROJECT-II			L	T	P	C
				0	0	2	1
GUIDELINES							
<ol style="list-style-type: none"> 1. The scope of the project work is to enable the students in convenient groups (not more than 4 members) involving theoretical and experimental studies through Design Thinking approach. 2. The aim of the project work is to deepen comprehension of principles by applying them to a new problem based on the courses such as Mechanics of Automobile Systems, IoT in Automobile, Strength of Materials, Automotive Engines and Emission Control, Automotive Electrical and Electronics Engineering studied by the students in the second year of study but not limited to. 3. Project periods shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodic seminars on the progress made in the project. 4. Create a model/fabricate a model/conduct an experiment/simulate a mechanical system/implement the same. Analyze data, evaluate the results and conclude the appropriate solution, suggestion for future work. 5. The continuous assessments shall be made according to the regulation which is tabulated below. 6. The progress of the project is evaluated based on a minimum of two reviews. 7. The review committee may be constituted by the Head of the Department. 8. Each student shall finally produce a comprehensive report covering background information, empathy, problem statement, project work details, result and conclusion. 9. This final report shall be typewritten form as specified in the guidelines. 							
				L:0	T:0	P: 30	Total: 30 Periods
COURSE OUTCOMES At the end of the course students should be able to							
CO 1	Take challenging practical problems.						
CO 2	Understand, define and to identify new solutions to the industry or society problems.						
CO 3	Formulating proper methodology to carry out the project work.						

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02	PS03
C01	2			3								2		
C02	3		3	3							1	2		
C03			2	3								2		

PROFESSIONAL ELECTIVE-1

23AUE301	AUTOMOTIVE CONTROL SYSTEMS	L	T	P	C	
		3	0	0	3	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> To study about the control system basics, PID controller tuning, and advanced techniques. To analyze and design adaptive control systems for various automotive applications. 						
UNIT I	INTRODUCTION					9
Basics of controls systems – different types, tuning of PID controller, fault tolerant sliding model control design and analysis – Case study of armature controlled DC motor for electric power steering.						
UNIT II	ENGINE CONTROL SYSTEMS					9
Introduction –lambda control – engine model for lambda control- lambda control circuit adaptive Lambda control- Idle speed control – use of state space control –knock control- knock sensors adaptive knock control –Air fuel ratio model for open and closed loop systems using Root Locus sketch and Bode plot.						
UNIT III	TRANSMISSION AND DRIVELINE CONTROL					9
Goals of drive line control(static and dynamic gear shift experiments) – Basic drive line equation-modeling neutral gear- state space formulation controller formulation-speed control with active damping –simulations – Driveline control for gear shifting.						
UNIT IV	VEHICLE CONTROL SYSTEM					9
ABS control systems –control of yaw dynamics- road and driver model control – PID driver model and hybrid driver model- modeling and analysis of electric and Hybrid Vehicle using PID controller.						
UNIT V	VEHICLE STABLITY ANALYSIS					9
Linear vehicle model- non-linear vehicle model- vehicle stability model using Routh Hurwitz criteria- Nyquist stability criteria – modeling and analysis of Roll and Yaw Stability in control Mode.						
		L:45	T:0	P: 0	Total: 45 Periods	
TEXT BOOKS						
T1	A. Galip Ulsoy , Huei Peng “Automotive control systems”, Cambridge 2022.					
T2	Tom Weathers, Claud C. Hunter, “Automotive computers and controls”, Prentice-Hall 2021					
REFERENCES						
R1	M.Gopal, ”Control Systems: principles and design”, 4th edition,2022					
R2	<u>I J Nagrath M.Gopal</u> “Control system Engineering”, New Age International Publications 2017.					

R3	Thomas D. Gillespie “Fundamentals of vehicle dynamics”, SAE Revised Edition 2022
R4	Kani A N ,”Control Systems for BE/BTech courses “5Ed CBS publishers & distributors ,2020
R5	Wong J Y, “Theory of Ground Vehicles”, John Wiley & Sons, New York, 2017
COURSE OUTCOMES	
At the end of the course students should be able to	
CO 1	Understand the basics of automotive control systems.
CO 2	Identify the various engine control systems and its application development.
CO 3	Examine the various transmission and driveline control system.
CO 4	Formulate the required vehicle control systems for any vehicle.
CO 5	Apply the concept of vehicle stability.

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
C01	3	2					3							
C02		2		3					1				3	
C03		3	3	3			3	2						3
C04		3	2									2		
C05		2		3			2							2

23AUE302	AUTOMOTIVE SAFETY AND INFOTRONICS			L	T	P	C
				3	0	0	3
COURSE OBJECTIVES:							
<ul style="list-style-type: none"> To study and develop advanced safety mechanisms in Automobile. To design and analyze systems like collision warning, active suspension. 							
UNIT I	INTRODUCTION						9
Design of the body for safety, energy equation, engine location, deceleration of vehicle inside passenger compartment, deceleration on impact with stationary and movable obstacle, concept of crumple zone, safety sandwich construction.							
UNIT II	SAFETY CONCEPTS						9
Active safety: driving safety, conditional safety, perceptibility safety, operating safety, passive safety: exterior safety, interior safety, deformation behaviour of vehicle body, speed and acceleration characteristics of passenger compartment on impact.							
UNIT III	SAFETY EQUIPMENTS AND COMFORT SYSTEM						9
Seat belt, regulations, automatic seat belt tightener system, collapsible steering column, tiltable steering wheel, air bags, electronic system for activating air bags, Steering and mirror adjustment, central locking system, tyre pressure control system, Active suspension system.							
UNIT IV	COLLISION WARNING AND AVOIDANCE						9
Collision warning system, causes of rear end collision, frontal object detection, rear vehicle object detection system, object detection system with braking system interactions.							
UNIT V	INFOTRONICS FOR AUTOMOBILES						9
TELEMATICS: Global positioning systems, geographical information systems, navigation systems, automotive vision system, road recognition, driver assistance systems							
ADAPTIVE CONTROL SYSTEMS: Adaptive cruise control - adaptive noise control - active roll control system							
				L:45	T:0	P: 0	Total: 45 Periods
TEXT BOOKS							
T1	George A. Peters, Barbara J. Peters, "Automotive Vehicle Safety" CRC Press, 2022.						
T2	Richard Bishop, "Intelligent Vehicle Technology and Trends" Artech House, 2022.						
REFERENCES							
R1	William Ribbens, "Understanding Automotive Electronics: An Engineering Perspective", Eight Edition, Elsevier Science & Technology Books., - 2017						
R2	Vivek D. "Ergonomics in the Automotive Design Process" Bhise publisher CRC press, Taylor and Francis group, - 2024						
R3	James E. Duffy "Modern Automotive Technology", 2020						
R4	Geoffrey Davies., "Materials for Automobile Bodies", Elsevier, 2012.						

R5	Bosch, “Automotive Handbook”, 11th Edition, SAE publication, 2022
COURSE OUTCOMES	
At the end of the course students should be able to	
CO 1	Recognize the need of design for safety.
CO 2	Demonstrate about various safety concepts.
CO 3	Summarize the safety equipment’s and comfort system.
CO 4	Explain collision warning and avoidance system.
CO 5	Apply the latest Infotronics equipments for Automobile

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PSO1	PSO2	PSO3
C01	2		3			3	3						3	
C02	3				3						2			
C03	3		2				1							
C04	2				3	3							3	
C05				3						2		3		

23AUE304	INTELLIGENT VEHICLE TECHNOLOGY	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> Apply key concepts in autonomous vehicle technologies and advanced safety systems. Analyze and integrate modern powertrain control, driveline systems, and sustainable vehicle technologies. 					
UNIT I	INTRODUCTION				9
Understanding autonomy and its levels (SAE Levels 0-5) - Role of control systems in autonomy. Advanced sensors and actuators for autonomy (e.g., LIDAR, RADAR, and cameras) - Examples of autonomy in practice: Adaptive cruise control, ABS, and Autonomous Emergency Braking (AEB). Case study: Tesla Autopilot and Waymo Driver.					
UNIT II	ENGINE AND POWERTRAIN CONTROL SYSTEMS				9
Fuel control and optimization - Ignition control in SI and CI engines - Lambda control and emission regulations (BS VI and beyond) - Advanced idle speed and knock control – mechanisms - Integration of hybrid powertrains: regenerative braking and energy management systems.					
UNIT III	ADVANCED DRIVELINE CONTROL SYSTEMS				9
Advanced speed control systems (including predictive controls) - Gear shifting and automated manual transmission (AMT) control - Traction control using advanced algorithms (e.g., machine learning-based systems) - Steering and suspension integration with stability control - Vehicle handling dynamics: ride comfort, NVH analysis, and adaptive cruise control.					
UNIT IV	INTELLIGENT TRANSPORTATION SYSTEM				9
Overview of smart mobility solutions. Control architecture for connected vehicles (V2X communication). Collision avoidance systems using AI and predictive algorithms. Traffic routing and congestion management. Automated highways and lane-keeping systems. Driver information and infotainment systems. Data communication: CAN, LIN, and Ethernet within vehicles.					
UNIT V	SAFETY AND FUTURE TRENDS				9
Vision enhancement systems: Night vision, 360-degree cameras, and augmented reality. Driver fatigue monitoring and advanced warning systems. Anti-lock braking systems and electronic stability programs (ESP). Route guidance and real-time navigation systems. Prognostics and predictive maintenance systems for vehicles. Advances in electric and hybrid vehicles: Solid-state batteries, wireless charging, and battery-swapping technologies. Future trends: Autonomous EVs, vehicle software over-the-air updates, and shared mobility models. Case study: Autonomous and electric commercial vehicles.					
		L:45	T:0	P: 0	Total: 45 Periods
TEXT BOOKS					
T1	N. K. Giri, <i>Automobile Mechanics</i> , 8 th Edition, Khanna Publishers, 2020.				
T2	K.K. Ramalingam, <i>Automobile Engineering</i> , Scitech Publications, 2021.				
REFERENCES					
R1	J. Reif, <i>Autonomous Driving: Technical, Legal, and Social Aspects</i> , Springer, 2018.				
R2	U. Kiencke and L. Nielsen, <i>Automotive Control Systems</i> , Springer, 2005.				

R3	R. Rajesh, Advanced Driver Assistance Systems, Wiley, 2022.
R4	R. Bosch GmbH, Bosch Automotive Handbook, 10th Edition, Wiley, 2018.
R5	J. P. Noronha, Intelligent Transportation Systems and Smart Vehicles, Elsevier, 2019.
COURSE OUTCOMES	
At the end of the course students should be able to	
CO 1	Understand the concepts and technologies behind autonomous vehicles.
CO 2	Analyze engine and powertrain control systems for efficiency and sustainability.
CO 3	Evaluate advanced driveline control systems for optimal vehicle performance.
CO 4	Critically assess intelligent transportation systems and V2X communication technologies.
CO 5	Apply innovative safety systems, predict future trends, and develop advancements in electric and autonomous vehicles.

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	P01	P02	P03	P04	P05	P06	P07	P08		P010	P011	PS01	PS02	PS03
C01	3		2			2	3	1	1	2	1	3	3	
C02	3	3	2		3	1	2		1		2		3	3
C03	3	3	3	3	3					1		2		3
C04		2		2		3	3	1	2	2	2	3		2
C05	3	2	2	3		3	3	2		2	2	3	3	3

23AUE305	AR AND VR IN AUTOMOBILE			L	T	P	C
				3	0	0	3
COURSE OBJECTIVES:							
<ul style="list-style-type: none"> To make students to understand the need of AR & VR in Automobile Industries. To gain knowledge of AR & VR and their applications. 							
UNIT I	INTRODUCTION TO AR AND VR						9
Introduction to Augmented Reality (AR) and Virtual Reality (VR) - Taxonomy, Technology and Features of Augmented Reality and Virtual Reality - AR Vs VR. - Historical development of AR and VR							
UNIT II	AUGMENTED REALITY						9
Computer vision for AR - Interaction - Modeling and Annotation Navigation - Wearable devices - Augmented Reality (AR) Taxonomy - Technology and Features of Augmented Reality - Challenges with AR, AR systems and functionality, - Augmented Reality Methods - Visualization Techniques for Augmented Reality - Enhancing interactivity in AR Environments - Evaluating AR systems.							
UNIT III	VIRTUAL ENVIRONMENT INPUT/OUTPUT DEVICES						9
VR Input Devices: Motion Capture Systems, Haptic Feedback Devices, 3D Scanners VR Output Devices: Head-Mounted Displays (HMDs, CAVE Systems (Cave Automatic Virtual Environment, Auditory Systems.							
UNIT IV	VR MODELING & VR PROGRAMMING						9
Modeling - Geometric Modeling - Virtual Object Shape - Object Visual Appearance - Kinematics Modeling - Transformation Matrices - Object Position - Transformation Invariants -Object Hierarchies - Viewing the 3D World - Physical Modeling - Collision Detection - Surface Deformation - Force Computation - Force Smoothing and Mapping - Behavior Modeling - Model Management. VR Programming - Toolkits and Scene Graphs - World ToolKit - Java 3D - Comparison of World ToolKit and Java 3D							
UNIT V	APPLICATIONS						9
Human Factors in VR - Methodology and Terminology - VR Health and Safety Issues - VR and Society- Education, Arts and Entertainment - Military VR Applications - Emerging Applications of VR - VR Applications in Automobile Manufacturing - Applications of VR in Robotics - Information Visualization - VR in Business							
				L:45	T:0	P: 0	Total: 45 Periods
TEXT BOOKS							
T1	Norman, K., Kirakowski, J., (2018), "Wiley Handbook of Human Computer Interaction," Wiley-Blackwell, ISBN: 9781118976135 (Unit I, II, III, IV, V).						
T2	Hassanien, A. E., Gupta, D., Khanna, A., Slowik, A., (2022), "Virtual and Augmented Reality for Automobile Industry: Innovation Vision and Applications," Springer, ISBN: 9783030941017 (Unit I,II,III,IV, V)						
REFERENCES							
R1	Charles Palmer, John Williamson, "Virtual Reality Blueprints: Create compelling VR experiences for mobile", Packt Publisher, 2018 (Unit I, II, III).						

R2	Dieter Schmalstieg, Tobias Hollerer, "Augmented Reality: Principles & Practice", Addison Wesley, 2016 (Unit I, II, III).
R3	"Understanding Virtual Reality: Interface, Application, and Design" by William R. Sherman and Alan B. Craig: The second edition of this book was published in 2018 by Morgan Kaufmann (Unit I, III).
R4	Anand, R., "Augmented and Virtual Reality," Khanna Publishing House, 2023 (Unit I, II, III, IV, V).
R5	Manivannan, M., (2018), "Virtual Reality Engineering," IIT Madras, (Unit I, II, III, IV, V).

COURSE OUTCOMES

At the end of the course students should be able to

CO 1	Understand the basic concepts of AR and VR.
CO 2	Understand the tools and technologies related to AR/VR.
CO 3	Know the working principle of AR/VR related Sensor devices.
CO 4	Design of various models using modeling techniques.
CO 5	Apply AR/VR in different domains.

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
C01	3	3	2		2			2			3	3	2	
C02	3	3		2	2			2			3	3	1	
C03	3	3		2	2			2			3	3	3	
C04	3	3		2	2			2			3	3		
C05	3				3			3	3	2	3	3	1	

23AUE306	AUTOMOTIVE EMBEDDED SYSTEM	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> To understand the embedded systems and their role in modern automotive applications. To integrate communication protocols, control systems, and sensor-actuator networks. To explore emerging trends in autonomous and connected vehicles. 					
UNIT I	INTRODUCTION TO AUTOMOTIVE EMBEDDED SYSTEMS	9			
Overview of Automotive Embedded Systems - Role of Embedded Systems in Modern Vehicles - Microcontrollers and Microprocessors in Automotive Applications - Overview of ECU Architecture - Automotive Communication Networks - Embedded System Design Flow for Automotive Applications - Real-Time Operating Systems (RTOS) and Scheduling Algorithms - Introduction to Embedded Software Development for Automotive Systems					
UNIT II	AUTOMOTIVE COMMUNICATION PROTOCOLS AND NETWORKS	9			
CAN Protocol in Automotive Systems - LIN Protocol for Low-Speed Communication - Flex Ray Protocol for High-Speed Communication - Automotive Ethernet and Its Applications - Time-Triggered Protocols- Vehicle-to-Vehicle (V2V) - Vehicle-to-Infrastructure (V2I) Communication - OBD-II (On-Board Diagnostics) Communication Protocol - Communication Security and Encryption in Automotive Networks - Advanced Communication Systems					
UNIT III	AUTOMOTIVE SENSORS, ACTUATORS, AND INTEGRATION	9			
Role of Sensors in Automotive Embedded Systems - Exhaust Sensors, Position, Speed, and Temperature Sensors in Vehicles - Sensors for Autonomous Vehicles (Radar, LIDAR, Camera) - Sensor Fusion and Data Integration for Advanced Driver Assistance Systems - Actuators in Automotive Systems (Motors, Solenoids, Valves) - Automotive Powertrain Control: ECU and Sensors Integration - Sensor Calibration, Fault Detection, and Diagnostics					
UNIT IV	EMBEDDED CONTROL SYSTEMS IN AUTOMOTIVE APPLICATIONS	9			
Engine Management Systems - Transmission Control Systems - Brake Control Systems - Battery Management Systems (BMS) for Electric and Hybrid Vehicles - Powertrain Control and Optimization - Electric Motor Control - Steering Control Systems - Climate Control Systems (HVAC) -Active Suspension Systems					
UNIT V	EMERGING TRENDS IN AUTOMOTIVE EMBEDDED SYSTEM	9			
Advanced Driver Assistance Systems - Autonomous Vehicle Systems - Machine Learning and Artificial Intelligence in Automotive Embedded System - Safety Standards for Automotive Embedded Systems - Cybersecurity in Automotive Embedded Systems - Testing and Validation of Automotive Embedded Systems - Over-the-Air (OTA) Updates for Automotive ECUs - Autonomous Parking Systems and Embedded Controls					
		L:45	T:0	P: 0	Total: 45 Periods
TEXT BOOKS					
T1	Navet, N., Simonot-Lion, F., "Automotive Embedded Systems Handbook," CRC Press, 2011.				

T2	Egert, J. O., "Embedded Systems in Automotive Applications," Springer, 2017.
REFERENCES	
R1	Guran, A. M., Bejan, A., Mihaila, G., "Vehicle Embedded Systems Handbook," CRC Press, 2015.
R2	Bosch, R., "Automotive Handbook," 9th Edition, Robert Bosch GmbH, 2014
R3	Karl-Heinz Tews, Thomas Mayer, and Stefan Kowalewski, "Automotive Embedded Systems: Architectures, Protocols, and Applications", Springer in 2021.
R4	M. Kathiresh and R. Neelaveni , "Automotive Embedded Systems: Key Technologies, Innovations, and Applications" Springer, 2021
R5	Adam Taylor, Dan Binnun, and Saket Srivastava, "Embedded Systems: A Complete Guide", The Art of Service, 2021
COURSE OUTCOMES	
At the end of the course students should be able to	
C01	Understand the embedded systems for various automotive applications, including powertrain control, ADAS, and climate control.
C02	Apply automotive communication protocols (CAN, LIN, Ethernet) to embedded system designs.
C03	Integrate sensors and actuators into automotive embedded systems for real-time monitoring and control.
C04	Evaluate the automotive safety standards, such as ISO 26262, in the design and development of embedded systems.
C05	Apply emerging trends, including autonomous vehicles and connected car technologies, and their impact on automotive embedded system development.

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PSO1	PSO2	PSO3
C01	2	2	3	3	3	2				3		3	3	
C02	3	3	2	3	3	2				2		3	3	
C03	3	3	3	3	3	3				3		3	3	
C04	2	1	1	2	3	2					2	3	3	
C05	3	3	3	3	2	3				2		3	3	

OPEN ELECTIVE-1

23AU0302	RECENT TRENDS IN AUTOMOBILES	L	T	P	C	
		3	0	0	3	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> • To explore the principles and technologies of vehicle control systems, and emerging trends in autonomous driving technologies. • To understand the transformative impact of advanced technologies, including automation, Industry 4.0, artificial intelligence. 						
UNIT I	DRIVER ASSISTANCE SYSTEMS					9
Introduction, driver support systems – driver information, driver perception, driver convenience, driver monitoring. Vehicle support systems – general vehicle control, collision avoidance, vehicle status monitoring. Future trends in ADAS development.						
UNIT II	TELEMATICS					9
Global positioning systems, geographical information systems, navigation systems, automotive vision system, road recognition, driver assistance systems, Lane warning System.						
UNIT III	SAFETY AND SECURITY SYSTEMS					9
Airbags, seat belt tightening system, collision warning systems, child lock, anti lock braking systems. Center Lock, smart card system, number plate coding.						
UNIT IV	COMFORT SYSTEMS					8
Active suspension systems, Hill Assist System, power steering, Collapsible and tiltable steering column, power windows & electronically adjustable mirrors. Flying cars and personal air vehicles, Role of artificial intelligence and big data in shaping future mobility, Overview of current research in automotive technology.						
UNIT V	AUTOMOTIVE MANUFACTURING INDUSTRY					10
Role of automation and robotics in manufacturing, Additive manufacturing (3D printing) in the automotive sector. Impact of Industry 4.0 on automotive production.						
		L:45	T:0	P: 0	Total: 45 Periods	
TEXT BOOKS						
T1	Ljubo Vlacic, Michel Parent and Fumio Harashima, "Intelligent Vehicle Technologies", Butterworth-Heinemann publications, Oxford, 2001.					
T2	Ronald K Jurgen, "Navigation and Intelligent Transportation Systems – Progress in Technology", Automotive Electronics Series, SAE, USA, 1998.					
REFERENCES						
R1	Heinz Heisler, "Advanced Vehicle Technology", second edition, Butterworth – Heinemann, New York, 2002.					
R2	William B Riddens, "Understanding Automotive Electronics", 5 th edition, Butter worth Heinemann Woburn, 1998.					
R3	Richard C.Dorf and Robert H.Bishop, Modern Control Systems, Pearson Prentice Hall, 14 th edition, 2020.					

R4	Alasdair Gilchrist, “Industry 4.0: The Industrial Internet of Things”, 2022 by Apress.
R5	Robert Bosch, “Automotive Handbook”, 11th edition, published in 2022 by Wiley
COURSE OUTCOMES	
At the end of the course students should be able to	
CO 1	Understand the systems which helps the drivers while running.
CO 2	Understand the information provided by various systems.
CO 3	Understand the working of safety and security systems.
CO 4	Understand the road handling comfort of modern vehicles.
CO 5	Apply the Industry 4.0 in Automotive Manufacturing.

23AUO303	ROAD SAFETY AND TRAFFIC RULES			L	T	P	C
				3	0	0	3
COURSE OBJECTIVES:							
<ul style="list-style-type: none"> To equip students with the knowledge and skills to investigate and analyze road accidents. To develop a comprehensive understanding of road safety principles, effective traffic management strategies. 							
UNIT I	ROAD ACCIDENTS						9
Causes, scientific investigations and data collection, Analysis of individual accidents to arrive at real causes, statistical methods of analysis of accident data, Basic concepts of Road accident statistics, Safety performance function: The empirical Bayes method Identification of Hazards road location. Application of computer analysis of accident data.							
UNIT II	SAFETY IN ROAD DESIGN						9
Operating the road network for safety, highway operation and counter measures, road safety audit, principles-procedures and practice, code of good practice and checklists, vehicle design factors & Driver characteristics influencing road safety.							
UNIT III	ROAD SIGNS AND TRAFFIC SIGNALS						9
Basic traffic signs and symbols: Classification, Location of Signs. Text versus symbols. Road markings and their meanings. Importance of seat belts, helmets, and child safety measures. Safety Barriers, Traffic Aid Posts Rules for pedestrians, cyclists, and motor vehicle drivers.							
UNIT IV	TRAFFIC MANAGEMENT TECHNIQUES						9
Integrated safety improvement and Traffic Calming Schemes, Speed and load limit, Traffic lights, Use of technology in traffic management (CCTV, speed cameras, etc.) Latest tools and techniques such as AI camera used for Road safety and traffic management. Road safety issues and various measures for road safety; Legislation, Enforcement, Education and Propaganda, Air quality, Noise and Energy Impacts; Cost of Road Accidents.							
UNIT V	INCIDENT MANAGEMENT						9
Introduction, Characteristics of Traffic Incidents, Types of Incidents, Impacts, Incident management process, Incident traffic management; Applications of ITS: Motorist information, Equipment used; Insurance policy for Vehicles. Best practice in Incident management programs. National importance of survival of Transportation systems during and after all natural disasters especially cyclones, earthquakes, floods etc. and manmade disasters like sabotage, terrorism etc							
				L:45	T:0	P: 0	Total: 45 Periods
TEXT BOOKS							
T1	Guidelines on Design and Installation of Road Traffic Signals, IRC: 93.						
T2	Road Safety Handbooks by the Ministry of Road Transport and Highways, Government of India.						
REFERENCES							

R1	Principles and Practice of Highway Engineering by L.R. Kadiyali and N.B. Lal., 2023, Khanna Publishers
R2	Hand Book of T.E. Myer Kutz, Editor McGraw Hill, 2 nd edition, 2011.
R3	"Traffic and Highway Engineering" by Garber and Hoel, 7th edition, 2018
R4	"Transportation Engineering: An Introduction" by Louis J. Pignataro, 4th edition, 2016
R5	"Principles of Highway Engineering and Traffic Analysis" by Fred L. Mannering and Walter P. Kilareski, 5th edition, 2015
COURSE OUTCOMES	
At the end of the course students should be able to	
CO 1	Attain the knowledge of accidents data collection and computer analysis.
CO 2	To learn about the various traffic regulations and their enforcement.
CO 3	Understand the traffic signs and traffic regulation.
CO 4	To promote awareness and responsibility among students regarding road safety.
CO 5	Apply & Summarize traffic incident types management programs.

23AUO305	AUTOMOTIVE MAINTENANCE	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> To help students the basics of maintaining vehicles, using tools and following safety practices. To make students learn how to inspect, repair and maintain different parts of a vehicle like the engine, brakes, steering and air conditioning. 					
UNIT I	MAINTENANCE, WORKSHOP PRACTICES, SAFETY AND TOOLS	9			
Need for Maintenance – importance, classification of maintenance work-basic problem diagnosis. Automotive service procedures – workshop – types - operations – workshop manual -. Safety – Personnel, machines and equipment, vehicles, fire safety - First aid. Basic tools – special service tools – measuring instruments –Scheduled maintenance services – service intervals - On-board diagnostics.					
UNIT II	ENGINE AND SUBSYSTEM MAINTENANCE	9			
Engine service- Dismantling of Engine components - Engine tuning - repair- working on the underside, front, top, ancillaries- Service of basic engine parts, cooling and lubricating system, fuel system, Intake and Exhaust system, electrical system - Electronic fuel injection and engine management service - fault diagnosis- servicing emission controls.					
UNIT III	TRANSMISSION AND DRIVELINE MAINTENANCE	9			
Clutch- general checks, adjustment and service- Dismantling, identifying, checking and reassembling transmission, transaxle- road testing- Removing and replacing propeller shaft, servicing of universal joint and constant velocity joints- Rear axle service points- removing axle shaft and bearings- servicing differential assemblies- fault diagnosis.					
UNIT IV	STEERING, BRAKE, SUSPENSION, WHEEL MAINTENANCE	9			
Inspection, Maintenance and Service of Hydraulic brake, Drum brake, Disc brake. Bleeding of brakes. Inspection, Maintenance and Service of Mc person strut, coil spring, leaf spring, shock absorbers. Dismantling and assembly procedures. Wheel alignment and balance, removing and fitting of tyres, tyre wear and tyre rotation. Inspection, Maintenance and Service of steering linkage, steering column, steering gear box service- Rack and pinion, Recirculating ball and Worm type and Power steering system.					
UNIT V	AUTO ELECTRICAL, AIR CONDITIONING AND VEHICLE BODY MAINTENANCE	9			
Maintenance of batteries, starting system, charging system and body electrical -Fault diagnosis using Scan tools. Maintenance of air conditioning parts like compressor, condenser, expansion valve, evaporator - Replacement of hoses- Leak detection- AC Charging- Fault Diagnosis Vehicle body repair like panel beating, tinkering, soldering, polishing, painting.					
		L:45	T:0	P: 0	Total: 45 Periods
TEXT BOOKS					
T1	Tim Gilles “Automotive Service” – 5 th Edition, Cengage Learning 2015.				

T2	James D Halderman, "Advanced Engine Performance Diagnosis" Prentice Hall India Learning Private Limited 2015
REFERENCES	
R1	Dr.Kripal Singh, "Automobile Engineering vol 1" 13 th Edition, Standard Publishers and distributors Pvt Ltd. in 2020.
R2	Clifton E. Owen "Basic Automotive Service and Systems " – 4 th Edition, Cengage Learning 2020.
R3	N.K.Giri, "Automotive Mechanics" 9 th Reprint, Khanna Publishers 2014.
R4	Bosch Automotive Handbook, Tenth Edition,2018.
R5	Ed May, Automotive Mechanics vol 1, Mc Graw Hill Publications, 2020.
COURSE OUTCOMES	
At the end of the course students should be able to	
C01	Understand the importance of maintenance.
C02	Diagnose engine and sub systems and resolving techniques.
C03	Diagnose failures in Transmission and its subsystems and give suitable solutions.
C04	Diagnose faults in Electrical system in the automobile and resolve the same.
C05	Apply the scanning tool to diagnose the problems in AC and its subsystem.