SRI VENKATESWARA COLLEGE OF ENGINEERING
(An Autonomous Institution, Affiliated to Anna University, Chennai)
SRIPERUMBUDUR TK. - 602 117

REGULATIONS 2018
B.E. AUTOMOBILE ENGINEERING
CURRICULUM

SEMESTER I

SL. No	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C	Prerequisites	Movable/ Fixed
1	HS18151	Communicative English	HS	3	3	0	0	3	Nil	F
2	MA18151	Engineering Mathematics I	BS	4	3	1	0	4	Nil	F
3	PH18151	Engineering Physics	BS	3	3	0	0	3	Nil	F
4	CY18151	Engineering Chemistry	BS	3	3	0	0	3	Nil	F
5	EE18151	Basic Electrical and Electronics Engineering	ES	3	3	0	0	3	Nil	F
6	GE18151	Engineering Drawing	ES	5	3	0	2	4	Nil	F
PRACTICALS										
7	PC18161	Physics and Chemistry Laboratory	BS	2	0	0	2	1	Nil	F
8	GE18161	Engineering Practices Laboratory	ES	3	0	0	3	1.5	Nil	F
			TOTAL	**26**	**18**	**1**	**7**	**22.5**		

(Recommended by BoS - Meeting held on 28.07.2018)

SEMESTER II

SL. No	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C	Prerequisites	Movable/ Fixed
1	HS18251	Technical English	HS	3	3	0	0	3	Nil	F
2	MA18251	Engineering Mathematics II	BS	4	3	1	0	4	Nil	F
3	IT18101	Programming for Problem Solving	ES	3	3	0	0	3	Nil	F
4	GE18251	Environmental Science and Engineering	BS	3	3	0	0	3	Nil	F
5	AE18201	Applied Mechanics	ES	3	3	0	0	3	Nil	F
6	PH18251	Engineering Materials	BS	3	3	0	0	3	Nil	F
PRACTICALS										
7	IT18111	Programming for Problem Solving Laboratory	ES	3	0	0	3	1.5	Nil	F
8	GE18261	Computer Aided Drafting Laboratory	ES	3	0	0	3	1.5	Nil	F
			TOTAL	**25**	**18**	**1**	**6**	**22**		

(Recommended by BoS - Meeting held on 28.07.2018)

SEMESTER III

SL. No	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C	Prerequisites	Movable/ Fixed
1	AE18301	Automotive Engines	PC	3	3	0	0	3	Nil	F
2	AE18302	Basic and Applied Thermodynamics	PC	4	3	1	0	4	Nil	F
3	AE18303	Fluid Mechanics and Hydraulic Machines	PC	4	3	1	0	4	Nil	F
4	AE18304	Automotive Fuels and Lubricants	PC	3	3	0	0	3	Nil	F
5	AE18305	Production Processes	ES	3	3	0	0	3	Nil	F
6	AE18306	Mechanics of Machines	ES	4	3	1	0	4	Nil	F
PRACTICALS										
7	AE18311	Engine Performance and Emission Testing Laboratory	PC	3	0	0	3	1.5	Nil	F
8	AE18312	Automotive Fuels and Lubricants Laboratory	PC	3	0	0	3	1.5	Nil	F
9	ME18411	Fluid Mechanics and Machinery Laboratory (Common to AE & ME)	PC	3	0	0	3	1.5	Nil	F
			TOTAL	**30**	**18**	**3**	**9**	**25.5**		

(Recommended by BoS - Meeting held on 23.02.2019)

SEMESTER IV

SL. No	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C	Prerequisites	Movable/ Fixed
1	MA18452	Partial Differential Equations and Computational Methods	BS	4	3	1	0	4	Nil	F
2	AE18401	Thermal Engineering and Heat Transfer	PC	4	3	1	0	4	AE18302	M
3	AE18402	Strength of Materials	PC	4	3	1	0	4	Nil	M
4	AE18403	Automotive Chassis	PC	3	3	0	0	3	Nil	F
5	AE18404	Manufacturing Technology and Systems	ES	3	3	0	0	3	Nil	F
PRACTICALS										
6	AE18411	Automotive Components Laboratory	PC	3	0	0	3	1.5	Nil	F
7	AE18412	Strength of Materials Laboratory (Common to AE CE)	PC	3	0	0	3	1.5	Nil	F
8	AE18413	Manufacturing Technology Laboratory	ES	3	0	0	3	1.5	Nil	F
			TOTAL	**27**	**15**	**3**	**9**	**22.5**		

(Recommended by BoS - Meeting held on 23.02.2019)

SEMESTER V

SL. No	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C	Prerequisites	Movable/ Fixed
1	AE18501	Automotive Electrical, Electronics and Microcontroller Systems	PC	3	3	0	0	3	Nil	F
2	AE18502	Battery and Fuel Cell Technology for Electric Vehicles	PC	3	3	0	0	3	Nil	M
3	AE18503	Design of Machine Elements and Transmission Systems	PC	4	3	1	0	4	Nil	F
4	AE18504	Automotive Transmission	PC	3	3	0	0	3	Nil	F
5		Professional Elective I	PE	3	3	0	0	3	Nil	M
6		Open Elective I	OE	3	3	0	0	3	Nil	M
PRACTICALS										
7	AE18511	Automotive Electrical, Electronics and Microcontroller Laboratory	PC	4	0	0	4	2	Nil	F
8	AE18512	CAD/CAM Laboratory	ES	3	0	0	3	1.5	Nil	F
			TOTAL	**26**	**18**	**1**	**7**	**22.5**		

(Recommended by BoS - Meeting held on 23.02.2019)

SEMESTER VI

SL. No	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C	Prerequisites	Movable/ Fixed
1	AE18601	Automotive Components Design	PC	4	3	1	0	4	AE18301	F
2	AE18602	Hybrid and Electric Vehicles	PC	3	3	0	0	3	Nil	M
3	AE18603	Automotive Control System for Driveline	PC	3	3	0	0	3	Nil	M
4	AE18604	Vehicle Design Data Characteristics	PC	3	3	0	0	3	Nil	F
5		Professional Elective II	PE	3	3	0	0	3	Nil	M
PRACTICALS										
6	AE18611	Simulation of Engine and Chassis Components Laboratory	PC	4	0	0	4	2	Nil	F
7	HS18561	Interview and Career Skills Laboratory (Common to all branches except BT & EE)	HS	3	0	0	3	2	Nil	M
8	AE18612	Comprehension	EEC	2	0	0	2	1	Nil	F
			TOTAL	**25**	**18**	**1**	**9**	**21**		

(Recommended by BoS - Meeting held on 23.02.2019)

SEMESTER VII

SL. No	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C	Prerequisites	Movable/ Fixed
1	AE18701	Vehicle Dynamics	PC	4	3	1	0	4	AE18201	F
2	AE18702	Vehicle Maintenance	PC	3	3	0	0	3	AE18403	F
3	AE18703	Mobility Engineering Management	PC	3	3	0	0	3	Nil	M
4		Professional Elective III	PE	3	3	0	0	3	Nil	M
5		Professional Elective IV	PE	3	3	0	0	3	Nil	M
6		Open Elective II	OE	3	3	0	0	3	Nil	M
PRACTICALS										
7	AE18711	Vehicle Testing and Maintenance Laboratory	PC	3	0	0	3	1.5	Nil	F
8	AE18712	Vehicle Simulation Laboratory	PC	3	0	0	3	1.5	Nil	F
9	AE18713	Design Project	EEC	4	0	0	4	2	Nil	F
			TOTAL	**29**	**18**	**1**	**10**	**24**		

(Recommended by BoS - Meeting held on 23.02.2019)

SEMESTER VIII

SL. No	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C	Prerequisites	Movable/ Fixed
1		Professional Elective V	PE	3	3	0	0	3	Nil	M
PRACTICALS										
3	AE18811	Project Work	EEC	20	0	0	20	10	Nil	F
			TOTAL	**23**	**3**	**0**	**20**	**13**		

(Recommended by BoS - Meeting held on 23.02.2019)

PROFESSIONAL ELECTIVES

Professional Elective I & III (Odd Semester)

SL. NO.	COURSE CODE	COURSE TITLE
1.	AE18001	Advanced Theory of IC Engines
2.	AE18003	Alternative Fuels and Energy Systems
3.	AE18005	Artificial Intelligence for Automotive Applications
4.	AE18007	Automotive Automation
5.	AE18009	Automotive Noise, Vibration and Harshness
6.	AE18011	Automotive Pollution and Control
7.	ME18023	Composite Materials and Mechanics **(Common to AE & ME)**
8.	AE18013	Two and Three Wheeler Technology
9.	AE18015	Manufacturing of Automotive Components
10.	AE18017	Off Highway Vehicles
11.	GE18751	Principles of Management **(Common to AE, EE, EC & ME)**
12.	AE18019	Quality Control and Reliability
13.	AE18021	Automotive Safety and Ergonomics
14.	ME18019	Operations Research (**Common to AE & ME)**
15.	AE18023	Vehicle Body Engineering

(Recommended by BoS - Meeting held on 23.02.2019)

Professional Elective II & V (Even Semester)

SL. NO.	COURSE CODE	COURSE TITLE
1.	AE18002	Additive Manufacturing
2.	AE18004	Advanced Vehicle Technology
3.	AE18006	Automotive Aerodynamics
4.	AE18008	Automotive Air Conditioning
5.	GE18010	Total Quality Management **(Common to AE, CH, MR & ME)**
6.	ME18016	Computational Fluid Dynamics **(Common to AE & ME)**
7.	AE18010	Embedded Systems for Automotive Applications
8.	ME18404	Hydraulics and Pneumatics Systems **(Common to AE & ME)**
9.	AE18012	Finite Element Analysis for Automobile Engineers
10.	AE18014	Fundamentals of Nano Science and Technology
11.	ME18008	Industrial Robotics **(Common to AE, MR & ME)**
12.	AE18016	Engine and Vehicle Management Systems
13.	AE18018	Simulation of IC Engines
14.	AE18020	Vehicle Multiplexing
15.	AE18022	Virtual Instrumentation in Automobile Engineering

(Recommended by BoS - Meeting held on 23.02.2019)

Professional Elective IV

SL. NO.	COURSE CODE	COURSE TITLE
1.	MG18001	Data Analysis **(Common to all branches except MR)**
2.	MG18002	Industrial Engineering **(Common to all branches except MR)**
3.	MG18003	Inventory Management **(Common to all branches except MR)**
4.	MG18004	Macro Economics **(Common to all branches except MR)**
5.	MG18005	Market Research **(Common to all branches except MR)**
6.	MG18006	Production Management **(Common to all branches except MR)**
7.	MG18007	Supply Chain Management **(Common to all branches except MR)**
8.	MG18008	Understanding Financial Statement **(Common to all branches except MR)**

(Recommended by BoS - Meeting held on 23.02.2019)

OPEN ELECTIVES

Open Electives offered in ODD Semester

SL. NO.	COURSE CODE	COURSE TITLE
1	OE18101	Fundamentals of Automobile Engineering
2	OE18103	Fundamentals of Automotive Air Conditioning

Open Electives offered in EVEN Semester

SL. NO.	COURSE CODE	COURSE TITLE
1	OE18102	Automotive Fault Diagnostics
2	OE18104	Fundamentals of Automotive Safety and Maintenance
3	OE18106	Fundamentals of Automotive Pollution and Control Methods

(Recommended by BoS - Meeting held on 23.02.2019)

VALUE ADDED COURSES

SL. NO.	COURSE CODE	COURSE TITLE	Contact Periods	L	T	P	C
1	VA18101	Internet of Things for Automobile Engineers	3	1	0	2	2
3	VA18102	Statistics for Engineers	2	2	0	0	2

(Recommended by BoS – Meeting held on 23.02.2019)

MANDATORY COURSES

SL. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
1	MC18001	Indian Constitution (Common to All Branches, Except MR)*	MC	3	3	0	0	0
2	MC18002	Communicative German (Common to All Branches, Except MR)**	MC	3	3	0	0	0
3	MC18003	Communicative Japanese (Common to All Branches, Except MR)**	MC	3	3	0	0	0
4	MC18004	Communicative Hindi (Common to All Branches, Except MR)**	MC	3	3	0	0	0

*Mandatory
**Student will have study any one of mentioned communicative languages

ONLINE COURSES

SL. NO.	COURSE CODE	COURSE TITLE
1	OC18101	Railway-Engineering-an-Integral-Approach
2	OC18102	Electric cars - Introduction, Policy and Business
3	OC18103	Noise Reduction strategies for mechanical systems
4	OC18104	Rotor and Wake Aerodynamics
5	OC18105	Principles of Quality Engineering

HS18151	COMMUNICATIVE ENGLISH	L	T	P	C
	(Common to all Branches)	3	0	0	3

OBJECTIVES:

- To enable learners to interact fluently on everyday social contexts.
- To enable learners to engage in conversations in an academic/scholarly setting.
- To enable learners to overcome public speaking barriers.
- To develop learners' ability to take notes and in the process, improve their listening skills
- To develop learners' reading skill through reading text passages for comprehension and contemplation.
- To enable learners to write on topics of general interest and drafting correspondences for general purposes.

UNIT I **9**

Listening - short video clips - conversational scenes form movies, celebrities' speeches/interviews. Speaking - several ways of introducing oneself at several situations, introducing others at several situations, inviting people for several occasions, describing people and their places. Reading - short comprehension passages - making inferences, critical analysis. Writing - completing the incomplete sentences - developing hints from the given information. Grammar - Wh-Questions and Yes or No questions - Parts of speech. Vocabulary development - prefixes - suffixes - articles - countable / uncountable nouns.

UNIT II **9**

Listening - customer care voice files, short narratives - identifying problems and developing telephone etiquettes. Speaking - speaking over skype/whatsapp, making business calls, making self-recorded informative videos, inquiring about a concept/activity, describing a concept/activity. Reading - reading the headlines on news magazines - slogans and taglines from advertisements. Writing - free writing - writing - headlines , slogans and taglines individual inspirations. Grammar - conjunctions, idioms, phrases, quotes. Vocabulary development - guessing the meanings of words in various different contexts.

UNIT III **9**

Listening - courtroom scenes from movies, debates and talks from news channels, notes taking. Speaking - language and tone for arguments, discussion, deliberation, contemplation, expressing opinions, reacting to different situations in an alien country. Reading - language used in instruction manuals of household appliances, cookery and other basic instructions. Writing- understanding the structure of texts - use of reference words, discourse markers-coherence, rearranging the jumbled sentences. Grammar - adjectives - degrees of comparison, framing direct and indirect questions. Vocabulary development - concise approach, single word substitution.

UNIT IV **9**

Listening - Sports commentaries, advertisements with users' criticisms; Speaking - for social causes, for promoting a concept, negotiating and bargaining; Reading - review of a product, movie, movement or a system; Writing - writing for advertisements, selling a product; Grammar - Tenses - Simple Past, Present and Future, Continuous - Past, Present and Future; Vocabulary Development - synonyms, antonyms and phrasal verbs.

UNIT V **9**

Listening - video lectures, video demonstration of a concept; Speaking - presenting papers/concepts, delivering short speeches, discourses on health, suggesting natural home remedies, cleanliness, civic sense and responsibilities; Reading - columns and articles on home science; Writing - correspondences of requests, basic enquiry/observation and basic complaints; Grammar - modal verbs, perfect tenses - Vocabulary development - collocations.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Read articles and infer meanings from specific contexts from magazines and newspapers.
- Participate effectively in informal/casual conversations; introduce themselves and their friends and express opinions in English.
- Comprehend conversations and short talks delivered in English.
- Write short write-ups and personal letters and emails in English.

REFERENCES:

1. Department of English, Anna University, Mindscapes : English for Technologists and Engineers. Orient Black Swan, Chennai, 2017.
2. Downes and Colm, "Cambridge English for Job-hunting", Cambridge University Press, New Delhi, 2008.
3. Murphy and Raymond, "Intermediate English Grammar with Answers", Cambridge University Press, 2000.
4. Thomson, A.J., "Practical English Grammar 1 & 2", Oxford, 1986.

Websites

1. http://www.usingenglish.com
2. http://www.uefap.com3
3. https://owl.english.purdue.edu/owl/
4. www.learnenglishfeelgood.com/esl-printables-worksheets.html

Software

1. Face 2 Face Advance – Cambridge University Press, 2014.
2. English Advance Vocabulary- Cambridge University Press.
3. IELTS test preparation – Cambridge University Press 2017.
4. Official Guide to the TOEFL Test With CD-ROM, 4th Edition.
5. CAMBRIDGE Preparation for the TOEFL TEST- Cambridge University Press, 2017.

MA18151	ENGINEERING MATHEMATICS I	L	T	P	C
	(Common to all Branches Except MR)	3	1	0	4

OBJECTIVES:

- To understand and apply matrix techniques for engineering applications.
- To make the student knowledgeable in statistical methods of analyzing and interpret the data for engineering problems.
- To familiarize the student with basic calculus including functions of several variables. This is needed in many branches of engineering.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

UNIT I MATRICES 12

Eigen values and Eigen vectors of a real matrix - Characteristic equation - Properties of Eigen values and Eigen vectors - Statement and Applications of Cayley-Hamilton Theorem - Diagonalization of matrices - Reduction of a quadratic form into canonical form by orthogonal transformation - Nature of quadratic forms.

UNIT II STATISTICAL METHODS 12

Scatter diagram - Karl Pearson coefficient of correlation for raw data - Spermann rank correlation coefficient - lines of regression - Regression equation X on Y and Y on X- Curve fitting by Principle of least squares - Fitting a straight line $y = ax + b$ and a parabola $y = ax^2 + bx + c$.

UNIT III APPLICATION OF DIFFERENTIAL CALCULUS 12

Curvature in Cartesian co-ordinates - Centre and radius of curvature - Circle of curvature - Evolutes - Envelopes.

UNIT IV DIFFERENTIAL CALCULUS OF SEVERAL VARIABLES 12

Limits and Continuity - Partial derivatives - Total derivatives - Differentiation of implicit functions - Jacobians and properties - Taylor's series for functions of two variables - Maxima and Minima of functions of two variables - Lagrange's method of undetermined multipliers.

UNIT V MULTIPLE INTEGRALS 12

Double integrals in Cartesian and polar coordinates - Change of order of integration - Area enclosed by plane curves - Change of variables in double integrals - Triple integrals - Volume of solids.

TOTAL (L:45 + T:15) : 60 PERIODS

OUTCOMES:

- This course equips the students to have basic knowledge and understanding of fundamental statistics to analyze and interpret data.
- Basic application of calculus in Engineering problems and to tackle for different geometries.
- To apply the idea of reducing complex Engineering problems into simple form using matrix technique.

TEXT BOOKS:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th Edition, John Wiley, 1999.
2. Bali N.P and Manish Goyal, "A Text book of Engineering Mathematics", Eighth Edition, Laxmi Publications Pvt. Ltd., 2011.
3. Grewal. B.S, "Higher Engineering Mathematics", 41st Edition, Khanna Publications, Delhi, 2011.

REFERENCES:

1. Gupta S.C and Kapoor V.K, "Fundamentals of Mathematical Statistics", S.Chand Private Ltd.,11th Edition, 2005.
2. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2012.
3. Peter V.O'Neil, "Advanced Engineering Mathematics", 7th Edition, Cengage Learning, 2012.
4. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2008.
5. Sivarama Krishna Das P. and Rukmangadachari E., "Engineering Mathematics", Volume I, Second Edition, Pearson Publishing, 2011.

PH18151	ENGINEERING PHYSICS	L	T	P	C
	(Common to all Branches)	3	0	0	3

OBJECTIVES:

- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

UNIT I CRYSTAL PHYSICS 12

Unit cell - Bravais Lattices - Miller indices - Distance between Inter planar distance 'd' (derivation) - discussion of various crystal structures: calculation of Atomic radius, Coordination number, effective number of lattice points and Atomic Packing Factor for the SC, BCC, FCC, HCP, Diamond Cubic (derivation) - discussion about the NaCl, Graphite structures. Crystal defects **:** Zero dimensional, one dimensional, Two dimensional and Three dimensional defects. Diffraction of X-rays by crystal planes - Bragg's spectrometer - Powder Diffraction method.

UNIT II THERMAL PHYSICS 6

Modes of heat transfer: Newton's law of cooling - thermal conductivity - Lee's disc method (derivation and expt) - Radial heat flow - Rubber tube method - conduction through compound media (series and parallel).

UNIT III WAVE MECHANICS 9

Quantum principles: Black body radiation - Planck Hypothesis (qualitative), Compton's effect (derivation).

Wave-particle duality - De-Broglie matter waves - Heisenberg's uncertainty principle - Wave function and its significance - Schrödinger's wave equation (time dependent and Time independent) (derivation) - Application of Schrodinger's wave equation - Particle in one dimensional box (derivation) - Degenerate and non-degenerate energy states.

UNIT IV ACOUSTICS AND ULTRASONICS 9

Acoustics: Classification of Sound - Characteristics of Musical Sound - Quality (Timbre), Pitch, Intensity of Sound - Units of Sound - decibel - Reverberation of sound - Reverberation time - absorption of sound energy by materials - Absorption coefficient - Sabine's Formula (derivation) - Factors affecting the acoustics of buildings - Remedies.

Ultrasonics **:** Introduction to ultrasonics - Properties of ultrasonic waves - Production of Ultrasonics - Magnetostriction method, Piezo electric method - detection of ultrasonics - Ultrasonic Acoustic grating - Applications of ultrasonic waves - SONAR, NDT, Sonogram.

UNIT V OPTOELECTRONICS AND FIBER OPTICS 9

Lasers: Basic properties of Lasers - Einstein's coefficients (Derivation) - Population inversion - Types of Lasers - Molecular Gas Lasers (CO_2 Laser) - Solid state Laser (Nd: YAG Laser) - Applications of Lasers in Engineering and Medicine.

Fibre optics: Introduction - Principle and structure of optical fibers - Acceptance angle-Numerical aperture-Types of optical fibers-Optical fiber communication system (block diagram) - Advantages and its applications.

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to

- gain working knowledge of fundamental physics and basic engineering principles in one or more engineering disciplines.
- to understand and to compute problems in Quantum Physics.
- to use modern engineering physics techniques and tools.
- to enhance knowledge about photonics and optical fiber communication system.

TEXT BOOKS:

1. Gaur R.K. and Gupta S.L, "Engineering Physics", Dhanput Publications, 2015.
2. Shatendra Sharma and Jyotsna Sharma, "Engineering Physics", Pearson, 2006.
3. Rajendran V, "Engineering Physics", Tata McGraw Hill, 2009.
4. Arumugam M, "Materials Science", Anuradha Publications, 2015.

REFERENCES:

1. David Halliday, Robert Resnick Jearl Walker, "Principles of Physics", 10th Edition, Wiley, 2015.
2. Peter Atkins and Julio De Paula, "Physical Chemistry", 10th Edition., Oxford University Press, 2014.
3. Arthur Beiser, Shobhit Mahajan and Rai Choudhury S, "Concepts of Modern Physics", 7th Edition, McGraw Hill Education, 2017.
4. Raghavan V, "Materials Science and Engineering", PHI Learning Pvt. Ltd., 2010.

CY18151	ENGINEERING CHEMISTRY	L	T	P	C
	(Common to all Branches Except MR)	3	0	0	3

OBJECTIVES:

- To make the students conversant with boiler feed water requirements, related problems and the water treatment techniques.
- To develop an understanding the principle, types and mechanism of corrosion and protective coatings.
- To acquaint the students with the basics of nanomaterials, their properties and applicants.
- To develop an understanding of the laws of photochemistry and basic spectral (UV and IR) analysis.
- To enable the students to understand the types of fuels, its calorific values and the significance flue gas analysis.

UNIT I WATER TECHNOLOGY 9

Sources, hard & soft water, estimation of hardness by EDTA method, boiler feed water, boiler problems, cause and preventive measures, softening of water, zeolite process & demineralization by ion exchangers, internal treatment methods, specifications for drinking water, BIS & WHO standards, treatment of water for domestic use, desalination - reverse osmosis & electrodialysis.

UNIT II CORROSION AND ITS CONTROL 9

Corrosion: Basic concepts - mechanism of chemical, electrochemical corrosion - Pilling Bedworth rule – Types of Electrochemical corrosion - galvanic corrosion - differential aeration corrosion - pitting corrosion – stress corrosion – factors influencing corrosion. Corrosion control: Cathodic protection – sacrificial anodic method - corrosion inhibitors. Protective coatings: surface preparation For metallic coatings - electro plating (copper plating) and electroless plating (Nickel plating) - chemical conversion coatings - anodizing, phosphating & chromate coating.

UNIT III NANOCHEMISTRY 9

Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties. nanoparticles: nano cluster, nano rod, nanotube (CNT) and nanowire. Synthesis: precipitation, thermolysis, hydrothermal, solvothermal, electrodeposition, chemical vapour deposition, laser ablation; Properties and applications of nanomaterials.

UNIT IV PHOTOCHEMISTRY AND SPECTROSCOPY 9

Photochemistry: Laws of photochemistry - Grotthuss - Draper law, Stark-Einstein law and Lambert Beer Law. Quantum efficiency - Photo processes - Internal Conversion, Inter-system crossing, Fluorescence, Phosphorescence and Photo-sensitization. Spectroscopy: Electromagnetic spectrum - Absorption of radiation - Electronic, Vibrational and rotational transitions. UV-visible and IR spectroscopy - principles, instrumentation (Block diagram only) and applications.

UNIT V FUELS AND COMBUSTION 9

Fuel: Introduction - classification of fuels - calorific value - higher and lower calorific values - coal analysis of coal (proximate and ultimate) - carbonization - manufacture of metallurgical coke (Otto Hoffmann method) - petroleum- refining - manufacture of synthetic petrol (Bergius process) - knocking octane number - diesel oil - cetane number - natural gas - compressed natural gas (CNG) - liquefied petroleum gases (LPG) - producer gas - water gas. Combustion of fuels: introduction - theoretical calculation of calorific value - calculation of stoichiometry of fuel and air ratio - flue gas analysis by ORSAT Method.

TOTAL: 45 PERIODS

OUTCOMES:

- The knowledge acquired on fuels, corrosion and its control, nanochemistry and water treatment techniques will make better understanding of engineering processes and applications for further learning.

TEXT BOOKS:

1. Jain P.C. and Monica Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 2010.
2. Dara S.S, Umare S.S, "Engineering Chemistry", S. Chand & Company Ltd., New Delhi 2010.
3. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2008.

REFERENCES:

1. Ozin G. A. and Arsenault A. C., "Nanochemistry: A Chemical Approach to Nanomaterials", RSC Publishing, 2005.
2. B.R. Puri, L.R. Sharma, M.S. Pathania., "Principles of Physical Chemistry", Vishal Publishing Company, 2008.

EE18151 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING L T P C
(Common to AE, BT, CE, CS, IT, MR & ME) 3 0 0 3

OBJECTIVES:

- To understand the basic theorems used in Electrical circuits and the principles of measuring instruments.
- To educate the different concepts and function of electrical machines.
- To introduce the fundamentals of semiconductor and applications.
- To explain the principles of digital electronics.
- To impart knowledge of communication.

UNIT I ELECTRICAL CIRCUITS & MEASURMENTS 10

Ohm's Law - Kirchhoff's Laws - Steady State Solution of DC Circuits using Mesh Analysis - Introduction to AC Circuits - Waveforms and RMS Value - Power and Power factor - Single Phase and Three Phase AC Balanced Circuits. Construction and working Principle of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters (Qualitative treatment only).

UNIT II ELECTRICAL MACHINES 10

Construction, Principle of Operation, Basic Equations and Applications of DC Generators, DC Motors, Single phase induction Motor, Single Phase Transformer.

UNIT III SEMICONDUCTOR DEVICES AND APPLICATIONS 9

Characteristics of PN Junction Diode - Zener Effect - Zener Diode - LED, Photo diode and its Characteristics - Half wave and Full wave Rectifiers - Voltage Regulation. Bipolar Junction Transistor - CB, CE, CC Configurations and Characteristics - Photo transistors.

UNIT IV DIGITAL ELECTRONICS 9

Binary Number System - Logic Gates - Boolean Algebra - Half and Full Adders - Flip-Flops - Registers and Counters - A/D and D/A Conversion (single concepts).

UNIT V FUNDAMENTALS OF COMMUNICATION ENGINEERING 7

Types of Signals: Analog and Digital Signals - Modulation and Demodulation: Principles of Amplitude and Frequency Modulations.

Communication Systems: Radio, TV, Fax, Microwave, Satellite and Optical Fiber (Block Diagram Approach only)..

TOTAL: 45 PERIODS

OUTCOMES:

- Study the fundamental laws governing electrical circuits and to describe the working of measuring instruments.
- Understand the construction and characteristics of different electrical machines.
- Describe the fundamental behavior of different semiconductor devices and circuits.
- Learn the fundamental concepts of digital electronics circuits.
- Recognize the type of signals, data transfer and able to apply in communication systems.

TEXT BOOKS:

1. Mittle V.N, Arvind Mittal, "Basic Electrical Engineering", Tata McGraw Hill(India), Second Edition, 2013.
2. Sedha R.S., "A Text Book of Applied Electronics", S. Chand & Co., 2014.

REFERENCES:

1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, "Basic Electrical, Electronics Engineering", Tata McGraw Hill, 2013.
2. I.J. Nagrath and D.P. Kothari, "Basic Electrical Engineering", Tata McGraw Hill ((India), Third Edition, 2010.
3. Mehta V K, "Principles of Electronics", S. Chand & Company Ltd, 2010.
4. M. Morris Mano, "Digital Logic & Computer Engineering", Printice Hall of India, 2004.
5. Mahmood Nahvi and Joseph A. Edminister, "Electric Circuits", Schaum' Outline Series, McGraw Hill, Fourth Edition, 2007.

GE18151	ENGINEERING DRAWING	L	T	P	C
	(Common to all Branches)	3	0	2	4

OBJECTIVES:

- This course will introduce students to Engineering Drawing and build their ability to read drawings and interpret the position and form of simple geometry, culminating into understanding of simple technical assemblies.

UNIT 0 ENGINEERING DRAWING FUNDAMENTALS (Not for Examination) 5

Drawing standard: BIS, Lettering, Dimensioning, Type of lines, Conventions, Geometrical constructions: Dividing a straight line into equal parts, Bisecting a given angle, Construction of polygon - Triangle, Square, Pentagon and Hexagon using drawing tools.

UNIT I CURVES AND PROJECTION OF POINTS AND LINES 15

Construction of Engineering Curves: Conic Sections - Ellipse, Parabola, Hyperbola using Eccentricity method, Cycloid, Involute of Circle and Pentagon.

Projection: Principal Planes, Projection of Points using Four Angles of Projection, Projection of Straight Lines - Lines parallel or inclined to one or both planes using Rotating Line Method in First Angle of Projection.

UNIT II PROJECTION OF PLANES AND SOLIDS 15

Projection of Plane Figures - Inclined to any one Principal Plane,

Projection of Solids - Simple Solids (Prisms, Pyramids, Cone and Cylinder) axis inclined to any one Principal Plane.

UNIT III SECTION OR SOLIDS & DEVELOPMENT OF SURFACES 15

Section of Solids - Sectional views of simple vertical solids cut by section plane inclined to any one Principal Plane.

Development of Surfaces - Development of lateral surfaces of truncated and frustum of simple solids.

UNIT IV PICTORIAL PROJECTION 15

Introduction to Pictorial Projection, Isometric Projection - Principle, Isometric Planes, Isometric Scales, Isometric Projection of simple solids and their combination.

Free Hand Drawing - Orthographic Projection - Orthographic views of simple blocks from their Isometric view, Isometric view of simple blocks from their Orthographic views.

UNIT V PERSPECTIVE PROJECTION 10

Perspective Projection of full solids in simple positions with respect to projection planes by visual ray and vanishing point method.

TOTAL: 75 PERIODS

OUTCOMES:

On Completion of the course the student will be able to

- Perform free hand sketching of basic geometrical constructions and multiple views of objects.
- Do orthographic projection of lines and plane surfaces.
- Draw projections and solids and development of surfaces.
- Prepare isometric and perspective sections of simple solids.
- Demonstrate computer aided drafting.

TEXT BOOKS:

1. Bhatt N.D, Panchal Pramod V.M and Ingle R, "Engineering Drawing", Charotar Publishing House, 2014.

REFERENCES:

1. Venugopal K and Prabhu Raja V, "Engineering Graphics", New Age International (P) Limited, 2009.
2. Shah M.B and Rana B.C, "Engineering Drawing", Pearson Education, 2009.
3. Gopalakrishna K.R, "Engineering Drawing" (Vol. I & II), Subhas Publications, 2010.
4. Natrajan K.V, "A Textbook of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2006.
5. Gowri S and Jeyapoovan T, "Engineering Graphics", Vikas Publishing House Pvt. Ltd., 2011.

PC18161	PHYSICS AND CHEMISTRY LABORATORY (Common to all Branches)	L 0	T 0	P 2	C 1

PHYSICS LABORATORY

OBJECTIVES:

- To make the student to acquire practical skills in the determination of various physical properties of materials.

LIST OF EXPERIMENTS (Any 5 experiments to be conducted)**:**

1. Determination of compressibility of the liquid - Ultrasonic interferometer.
2. Determination of thickness of the given object by Air wedge method.
3. Determination of dispersive power of a prism by Spectrometer.
4. Determination of Young's modulus of wooden scale by Non-Uniform bending.
5. Determination of wavelength, particle size and numerical aperture of fibre using Lasers.
6. Lee's Disc – Thermal conductivity of the poor conductor.
7. Torsional Pendulum – Determination of Rigidity modulus and moment of inertia.

OUTCOMES:

- The student will be able to analyze the physical principle using the various instruments, also relate the principle to engineering applications.
- The various experiments in the areas of optics, mechanics and thermal physics will nurture the students in all branches of Engineering.
- The students will be able to think innovatively and also improve the creative skills that are essential for engineering.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Spectrometer, Mercury Vapour lamp, Lee's disc experimental setup, Travelling microscope, Ultrasonic interferometer, Sodium vapour lamp, Diode laser, Optical fiber kit.

CHEMISTRY LABORATORY

OBJECTIVES:

- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
- To acquaint the students with the determination of molecular weight of a polymer by viscometery.

LIST OF EXPERIMENTS (Any 5 experiments to be conducted)**:**

1. Determination of total, temporary & permanent hardness of water by EDTA method.
2. Estimation of copper by EDTA.
3. Conductometric titration of a strong acid with a strong base
4. Estimation of iron content of the given solution using potentiometer.
5. Estimation of iron content of the water sample using spectrophotometer.
6. Determination of molecular weight of polymer using viscometer.
7. Determination of Alkalinity in water.

TOTAL: 30 PERIODS

OUTCOMES:

- The students will be equipped with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

1. Conductivity meter - 10 Nos
2. Spectrophotometer - 10 Nos
3. Ostwald Viscometer - 10 Nos
4. Potentiometer - 10 Nos
5. Electronic Balance - 2 Nos

Common Apparatus: Pipette, Burette, conical flask, iodine flask, porcelain tile, dropper (each 30 Nos.)

REFERENCES:

1. Rajendran V, "Engineering Physics", Tata McGraw Hill, 2009.
2. Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., "Vogels Textbook of Practical Organic Chemistry", 8th Edition, LBS Singapore, 2014

GE18161	ENGINEERING PRACTICES LABORATORY (Common to all Branches)	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

LIST OF EXPERIEMNTS

GROUP A (CIVIL & MECHANICAL)

I CIVIL ENGINEERING PRACTICE

Buildings:

(a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:

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

Carpentry using Power Tools only:

a) Study of the joints in roofs, doors, windows and furniture.
b) Hands-on-exercise:
Wood work, joints by sawing, planning and cutting.

II MECHANICAL ENGINEERING PRACTICE

Welding:

a) Preparation of arc welding of butt joints, lap joints and tee joints.
b) Gas welding practice

Basic Machining:

a) Simple Turning and Taper turning
b) Drilling Practice

Sheet Metal Work:

a) Forming & Bending:
b) Model making – Trays, funnels, etc.
c) Different type of joints.

Machine assembly practice:

a) Study of centrifugal pump
b) Study of air conditioner

Demonstration on:

a) Smithy operations, upsetting, swaging, setting down and bending.
Example – Exercise – Production of hexagonal headed bolt.
b) Foundry operations like mould preparation for gear and step cone pulley.
c) Fitting – Exercises – Preparation of square fitting and vee – fitting models.

GROUP B (ELECTRICAL & ELECTRONICS)

III ELECTRICAL ENGINEERING PRACTICE

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter
2. Fluorescent lamp wiring.
3. Stair case wiring
4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5. Measurement and comparison of energy for resistive and LED load using single phase energy meter.
6. Measurement of resistance to earth of an electrical equipment.

IV ELECTRONICS ENGINEERING PRACTICE

1. Identification of circuit components
    a) Resistor, capacitor, diode (PN & Zener),transistors.
    b) Soldering practice – Circuits – Using general purpose PCB.
2. Evaluating the parameters for DC power supply and AC power supply (peak-peak, rms, average, period, frequency) using function generator and CRO.
3. Study and implementation of logic functions using NAND, NOR, and NOT gates.
4. VI Characteristics of PN Junction diode.
5. VI Characteristics of Solar photovoltaic panel.
6. Design a 5V/12V Regulated Power Supply: using FWR rectifier and IC7805/IC7812.

TOTAL: 45 PERIODS

OUTCOMES:

- Fabricate carpentry components and to lay pipe connections including plumbing works.
- Use welding equipments to join the structures.
- Wiring of basic electrical system and measurement of electrical parameters.
- Study and implementation of basic electronic components, circuits and solar photovoltaic panel.
- Design a basic regulated power supply.

REFERENCES:

1. Jeyachandran K., Natarajan S. & Balasubramanian S., "A Primer on Engineering Practices Laboratory", Anuradha Publications, 2007.
2. Jeyapoovan T., Saravanapandian M. & Pranitha S., "Engineering Practices Lab Manual", Vikas Puplishing House Pvt.Ltd, 2006.
3. Bawa H.S., "Workshop Practice", Tata McGraw Hill Publishing Company Limited, 2007.
4. Rajendra Prasad A. and Sarma P.M.M.S., "Workshop Practice", Sree Sai Publication, 2002.
5. Kannaiah P. & Narayana K.L., "Manual on Workshop Practice", Scitech Publications, 1999.
6. Mittle V.N, Arvind Mittal, "Basic Electrical Engineering", Tata McGraw Hill(India), Second Edition,2013.
7. Sedha R.S., "A Text Book of Applied Electronics", S. Chand & Co., 2014.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S. No.	Description of Equipment	Qty
	CIVIL	
1.	Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings.	15 Sets.
2.	Carpentry vice (fitted to work bench)	15 Nos.
3.	Standard woodworking tools	15 Sets.
4.	Models of industrial trusses, door joints, furniture joints	5 each
5.	Power Tools: (a) Rotary Hammer (b) Demolition Hammer (c) Circular Saw (d) Planer (e) Hand Drilling Machine (f) Jigsaw	2 Nos
	MECHANICAL	
1.	Arc welding transformer with cables and holders	5 Nos.
2.	Welding booth with exhaust facility	5 Nos.
3.	Welding accessories like welding shield, chipping hammer, wire brush, etc.	5 Sets.
4.	Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.	2 Nos.
5.	Centre lathe	2 Nos.
6.	Hearth furnace, anvil and smithy tools	2 Sets.
7.	Moulding table, foundry tools	2 Sets.
8.	Power Tool: Angle Grinder	2 Nos
9.	Study-purpose items: centrifugal pump, air-conditioner	1 each
	ELECTRICAL	
1.	Assorted electrical components for house wiring	15 Sets
2.	Electrical measuring instruments	10 Sets
3.	Study purpose items: Iron box, fan and regulator, emergency lamp	1 each
4.	Megger (250V/500V)	1 No.
5.	Power Tools: (a) Range Finder 2 Nos (b) Digital Live-wire detector	2 Nos.
6.	LED lamp 8 W & 16 W	2 Nos. each
	ELECTRONICS	
1.	Soldering guns	10 Nos.
2.	Assorted electronic components for making circuits	50 Nos.
3.	Small PCBs	10 Nos.
4.	Multimeters	10 Nos.
5.	Study purpose ICs: IC7805/IC7812	1 each
6.	Photovoltaic panel: 5 W/10 W	2 Nos.
7.	Light Source for PV panel	1 No.

HS18251	TECHNICAL ENGLISH	L	T	P	C
	(Common to all Branches)	3	0	0	3

OBJECTIVES:

- To enable learners to define and understand technical communication and scientific writing
- To expose learners to nuances of seminar presentation, group discussion, and public speaking
- To expose learners to writing for scientific purposes
- To expose learners to drafting correspondences for business purposes
- To expose learners to writing for documenting purposes
- To enable students to have a holistic understanding of job interviews and recruiting process.

UNIT I **9**

Listening - AV files pertaining to manufacturing processes of products, scientific documentaries; **Speaking** - syllable division and word stress, intonation, sharing opinions; **Reading** - news articles related to science and technology; **Writing** - definitions, instruction, recommendation, data interpretation, resume; **Grammar** - tenses and their aspects, sentence connectors - discourse markers, sequential words, active and passive voice, subject-verb agreement.

UNIT II **9**

Listening - AV pertaining to marketing strategies, peer reading and pronunciation; **Speaking** - turn taking, sharing opinions; conducting and attending a meeting, understanding the nuances of spoken communication among internal audience and external audience; **Reading** - analytical documents, descriptive documents; **Writing** - fliers, brochures, resume - letter of application, checklists; **Grammar** - modal verbs, clauses - types and uses, conditional clauses, articles.

UNIT III **9**

Listening - AV related to how to use components, scientific description, **Speaking** - speaking for motivation and initiation, speaking at a seminar presentation; **Reading** - scientific journals, papers; **Writing** - Technical descriptions - process description, purpose and function, PowerPoint, Google forms, user manuals; **Grammar** - phrasal verbs, prepositions, technical and scientific affixes.

UNIT IV **9**

Listening - scientific debates, crisis management; **Speaking** - handling conflicts, speaking about the loss of benefits, progress or decline of business, identifying the connotative meanings, **Reading**- documented evidences of uses and functions of a product, review of a product, **Writing** - memos, follow-up letters, reports - proposal, project, progress reports, sales reports, reports on industrial visits, executive summary. **Grammar** - reported speech and tag questions, sentence structure - comparative, imperative, cause and effect, infinitive of result.

UNIT V **9**

Listening - AV of Group discussions, panel discussions, face to face interviews for recruitment purposes; **Speaking**- speaking at group discussions, interviewing a personality, answering at the interviews; **Reading** - WebPages of topnotch engineering companies, **Writing** - blogging, e-mails, letter of complaint, minutes of the meeting; **Grammar** - one word substitution, collocations, better word/sentence substitution (rephrasing the content/improvising ideas).

TOTAL: 45 PERIODS

Suggested Activities [task based] - case study, guest lectures as models, problem solving, understanding team work.

OUTCOMES:

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

- understand the nuances of technical communication and scientific writing
- present papers and give seminars
- discuss in groups and brainstorm
- draft business correspondences and write for documenting purposes
- face job interviews with confidence

REFERENCES:

1. Department of English, Anna University. Mindscapes : English for Technologists and Engineers. Orient Blackswan, Chennai. 2012.
2. Downes, Colm, Cambridge English for Job-hunting, Cambridge University Press, New Delhi. 2008.
3. Murphy, Raymond, Intermediate English Grammar with Answers, Cambridge University Press 2000.
4. Thomson, A.J., "Practical English Grammar 1 & 2", Oxford, 1986.
5. Herbert A J, "The Structure of Technical English", Longman, 1965.

Websites

1. http://www.usingenglish.com
2. http://www.uefap.com3
3. https://owl.english.purdue.edu/owl/
4. www.learnenglishfeelgood.com/esl-printables-worksheets.html

Software

1. Face2Face Advance – Cambridge University Press, 2014
2. English Advance Vocabulary- Cambridge University Press
3. IELTS test preparation – Cambridge University Press 2017
4. Official Guide to the TOEFL Test With CD-ROM, 4th Edition

5 . CAMBRIDGE Preparation for the TOEFL TEST- Cambridge University Press, 2017

MA18251	ENGINEERING MATHEMATICS II	L	T	P	C
	(Common to all Branches Except MR)	3	1	0	4

OBJECTIVES:

- To acquaint the student with the concepts of vector calculus needed for problems in all engineering disciplines.
- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence in application areas such as heat conduction, elasticity, fluid dynamics and flow of electric current.
- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

UNIT I VECTOR CALCULUS 12

Gradient, divergence and curl - Directional derivative - Irrotational and solenoidal vector fields - Vector integration - Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem (excluding proofs) - Simple applications involving cubes and rectangular parallelopipeds.

UNIT II ORDINARY DIFFERENTIAL EQUATIONS 12

Higher order linear differential equations with constant coefficients - Method of variation of parameters - Cauchy's and Legendre's linear equations - Simultaneous first order linear equations with constant coefficients.

UNIT III LAPLACE TRANSFORM 12

Laplace transform - Sufficient condition for existence - Transform of elementary functions - Basic properties - Transforms of derivatives and integrals of functions - Derivatives and integrals of transforms - Transforms of unit step function and impulse functions - Transform of periodic functions. Inverse Laplace transforms -Statement of Convolution theorem - Initial and final value theorems - Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

UNIT IV ANALYTIC FUNCTION 12

Functions of a complex variable - Analytic functions: Necessary conditions - Cauchy-Riemann equations and sufficient conditions (excluding proofs) - Harmonic and orthogonal properties of analytic function - Harmonic conjugate - Construction of analytic functions - Conformal mapping - Translation, rotation and inversion ($w = z+c$, cz, $1/z$, z^2) - Bilinear transformation.

UNIT V COMPLEX INTEGRATION 12

Complex integration - Statement and applications of Cauchy's integral theorem and Cauchy's integral formula - Taylor's and Laurent's series expansions - Singular points - Residues - Cauchy's residue theorem - Evaluation of real definite integrals as contour integrals around unit circle and semi-circle (excluding poles on the real axis).

TOTAL (L:45 + T:15) : 60 PERIODS

OUTCOMES:

- The subject helps the student to develop the fundamental and basic concepts in vector calculus, ODE, Laplace Transforms and complex functions. Students will be able to solve problems related to engineering applications by using these techniques.

TEXT BOOKS:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th Edition, John Wiley, 1999.
2. Bali N.P and Manish Goyal, "A Text book of Engineering Mathematics", Eighth Edition, Laxmi Publications Pvt. Ltd., 2011.
3. Grewal. B.S, "Higher Engineering Mathematics", 41st Edition, Khanna Publications, Delhi, 2011.

REFERENCES:

1. Dass, H.K., and Er. Rajnish Verma, "Higher Engineering Mathematics", S.Chand Private Ltd., 2011.
2. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2012.
3. Peter V.O'Neil, "Advanced Engineering Mathematics", 7th Edition, Cengage Learning, 2012.
4. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2008.
5. Sivarama Krishna Das P. and Rukmangadachari E., "Engineering Mathematics", Volume I, Second Edition, Pearson Publishing, 2011.

IT18101	PROGRAMMING FOR PROBLEM SOLVING	L	T	P	C
	(Common to all Branches Except MR)	3	0	0	3

OBJECTIVES:

The students should be made to:

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

UNIT I INTRODUCTION TO PROBLEM SOLVING 9

Simple model of a Computer - Hardware - Software - Data Representation, Introduction to Computer Networks and Internet, Problem Solving Techniques - Bottom up design and top down design - applications, Introduction to Algorithms and Flow Chart.

UNIT II C PROGRAMMING BASICS 9

Introduction to 'C' programming - structure of a 'C' program - compilation and linking processes. Conversion of simple algorithm to program.

Constants, Variables - Data Types - Expressions using operators in 'C' - Managing Input and Output operations - Decision Making and Branching - Looping statements - solving simple scientific and statistical problems.

UNIT III ARRAYS AND STRINGS 9

Arrays - Initialization - Declaration - One dimensional and Two dimensional arrays - String- String operations - Arrays of strings.

UNIT IV FUNCTIONS AND USER DEFINED DATA TYPES 9

Function - definition of function - Declaration of function - Pass by value - Pass by reference - Recursion - Enumerators - Structures - Unions.

UNIT V POINTERS AND FILES 9

Macros - storage classes - Pointers - Definition - Initialization - Pointers arithmetic - Double Pointers, Basic file operations - Example problems.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Design and represent solutions to problems as algorithm and flow chart
- Write simple C Programs
- Develop modularized applications in C.

TEXT BOOKS:

1. Pradip Dey and Manas Ghosh, "Programming in C", First Edition, Oxford University Press, 2018.
2. Byron S Gottfried, "Programming with C", Schaum's Outlines, Third Edition, Tata McGraw-Hill, 2010.

REFERENCES:

1. Kernighan B.W and Ritchie D.M, "The C Programming Language", Second Edition, Pearson Education, 2015.
2. Yashavant P. Kanetkar, "Let Us C", BPB Publications, 2011.
3. Paul J Deitel and Harvey M. Deitel, "C How to Program", Seventh Edition, Pearson Education, 2016.

GE18251 ENVIRONMENTAL SCIENCE AND ENGINEERING L T P C
(Common to all Branches) 3 0 0 3

OBJECTIVES:

- To study the nature and facts about environment.
- To study the interrelationship between living organism and environment.
- To implement scientific, technological, economic and political solutions to environmental problems.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management..

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 12

Definition, scope and importance of environment - need for public awareness - concept of an ecosystem - structure and function of an ecosystem - energy flow in the ecosystem - ecological succession - food chains, food webs and ecological pyramids - Introduction, types, characteristic features, structure and function of the forest ecosystem, grassland ecosystem, desert ecosystem, aquatic ecosystems, Introduction to biodiversity definition: genetic, species and ecosystem diversity - biogeographical classification of India - value of biodiversity - Biodiversity at global, national and local levels - India as a mega-diversity nation - hot-spots of biodiversity - threats to biodiversity - man-wildlife conflicts - endangered and endemic species of India - conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

UNIT II NATURAL RESOURCES 10

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people - Water resources: Use and over - utilization of surface and ground water, floods, drought, conflicts over water, dams - benefits and problems - Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer - pesticide problems, water logging, salinity, case studies - Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies - Land resources: Land as a resource - role of an individual in conservation of natural resources - Equitable use of resources for sustainable lifestyles.

UNIT III ENVIRONMENTAL POLLUTION AND DISASTER MANAGEMENT 10

Definition - causes, effects and control measures Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards - solid waste management: causes, effects and control measures of municipal solid wastes, e-Waste, risk related to e-Waste - role of an individual in prevention of pollution - pollution case studies - disaster management: floods, earthquake, cyclone and landslides, land degradation, man induced landslides, soil erosion and desertification.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

From unsustainable to sustainable development - urban problems related to energy - water conservation, rain water harvesting, watershed management - resettlement and rehabilitation of people; its problems and concerns, case studies - role of non-governmental organization- environmental ethics: Issues and possible solutions - Principles of green chemistry, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies - wasteland reclamation - consumerism and waste products - Environment protection act - Air (Prevention and Control of Pollution) act - Water (Prevention and control of Pollution) act - Wildlife protection act - Forest conservation act - central and state pollution control boards - Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations - population explosion - family welfare programme - environment and human health - human rights - value education - HIV / AIDS, Swine flu, Dengue

fever - women and child welfare - role of information technology in environment and human health management - case studies.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Solve problems that cannot be solved by mere environmental laws.
- Acquire awareness on environmental issues at their infant stage.
- Integrate facts, concepts and methods for multiple disciplines and apply them to solve environmental and social problems.
- Analyse the connectivity between manmade activities - pollution - environmental issues - social problem and provide eco-friendly solutions.

TEXT BOOKS:

1. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, New Delhi, 2012.
2. Gilbert M.Masters, "Introduction to Environmental Engineering and Science", 2nd edition, Pearson Education, 2010.

REFERENCES:

1. Dharmendra S. Sengar, "Environmental law", Prentice hall of India PVT LTD, New Delhi, 2012.
2. Erach Bharucha, "Textbook of Environmental Studies", Universities Press(I) PVT, LTD, Hydrabad, 2015.
3. Rajagopalan, R, "Environmental Studies - From Crisis to Cure", Oxford University Press, 2011.
4. Tyler Miller. G and Scott E. Spoolman, "Environmental Science", Cengage Learning India PVT, LTD, Delhi, 2013.

AE18201 **APPLIED MECHANICS** **L T P C**
3 0 0 3

OBJECTIVES:

- To develop capability to predict the effect of force and motion in the course of carrying out the design functions of engineering.

UNIT I INTRODUCTION OF ENGINEERING MECHANICS 9

Basic concepts of System of Forces - Coplanar Concurrent Forces - Components in Space - Resultant- Moment of Forces and its Application - Couples and Resultant of Force System - Equilibrium of System of Forces - Free body diagrams- Equations of Equilibrium of Coplanar Systems and Spatial Systems.

UNIT II FRICTION AND KINEMATICS 9

Types of friction - Limiting friction - Laws of Friction - static and Dynamic Frictions - Motion of Bodies - Wedge, Screw jack, Rolling resistance of tire.
Rectilinear and Curve linear motion - Velocity and Acceleration - Motion of a Rigid Body - Types and their Analysis in Planar Motion.

UNIT III TRANSMISSION OF BELT POWER 9

Belt Drivers - Open, Crossed, compound belt and camshaft timing belt drives - length of belt - tensions - tight side - slack side - Power transmitted and condition for maximum power.

UNIT IV CENTROID, CENTER OF GRAVITY AND MASS MOMENT OF INERTIA 9

Centroids - Theorem of Pappus - Centroids of Composite figures - Centre of Gravity of a vehicle - Area moment of Inertia of vehicle frame: - polar Moment of Inertia - Transfer - Theorems - Moments of Inertia of Composite Figures - product of Inertia - Transfer Formula for product of Inertia. Moment of Inertia of Masses - Transfer Formula for Mass Moments of Inertia - Mass moment of inertia of connecting rod and crankshaft.

UNIT V KINETICS 9

Analysis as a particles and Analysis as a Rigid Body in Translation - Central Forces of motion - Equations of Plane Motion - Fixed Axis Rotation - Rolling Bodies - Work - Energy Method - Equation for Translation - Work -Energy application to vehicle motion, Connected System - Fixed axis Rotation and Plane Motion.

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able

- to explain the differential principles applied to solve engineering problems dealing with force, displacement, velocity and acceleration.
- to analyse the forces in vehicle.
- to determine the centroid, center of gravity, Area Moment of inertia and Mass Moment of Inertia.
- to solve rigid body subjected to dynamic forces.

TEXT BOOKS:

1. Rajput. R.K., "A Textbook of Applied Mechanics", 3rd Edition, Laxmi Publications, 2016.
2. Timashenko. S, Young. D.H., Rao. J.V. and Sukumar Pati, "Engineering Mechanics", 1st Edition, McGraw Hill Education, 2017.

REFERENCES:

1. Arthur P. Boresi and Richard J. Schmidt, "Engineering Mechanics (Statics and Dynamics)", 1st Edition, Cengage Learning India Pvt. Ltd, 2007.

2. Tayal. A.K, "Engineering Mechanics Statics and Dynamics", 14th Edition, Umesh Publications, 2011.
3. Nelson E.W, Charles L. Bes, McLean W.G. and Merle Potter, "Engineering Mechanics Dynamics (Schaum's Outlines)", McGraw-Hill Education; 1st edition, 2010.
4. Hibbeler R.C, "Engineering Mechanics - Statics and Dynamics", Pearson Education India; 11th edition, 2009.

PH18251 **ENGINEERING MATERIALS** **L T P C**
3 0 0 3

OBJECTIVES:

- To impart the knowledge about the properties of engineering and ceramic materials to the students.
- To enhance the knowledge about the electron behaviour in the semiconductor and dielectric materials.

UNIT I PHASE DIAGRAMS **8**

Solid solutions - Hume Rothery's rules - The phase rule - single component system - one-component system of iron - binary phase diagrams - isomorphous systems - the tie-line rule - the lever rule - application to isomorphous system - eutectic phase diagram - Peritectic phase diagram - other invariant reactions – free energy composition curves for binary systems - microstructural change during cooling.

UNIT II FERROUS ALLOYS AND HEAT TREATMENT **10**

The iron-carbon equilibrium diagram - phases, invariant reactions - microstructure of slowly cooled steels - eutectoid steel, hypo and hypereutectoid steels - effect of alloying elements on the Fe-C system - diffusion in solids - Fick's law - phase transformations - T-T-T-diagram for eutectoid steel - pearlite, baintic and martensitic transformations - tempering of martensitic - heat treatment of steels - annealing - normalizing - quenching and tempering - case hardening - induction, flame and laser hardening - carburizing, cyaniding, carbonitriding and Nitriding.

UNIT III SEMICONDUCTING MATERIALS **8**

Introduction - classification of materials based on band theory (metals, semiconductors and insulators) - intrinsic and extrinsic semiconductors - carrier concentration in intrinsic semiconductor (derivation) - effect of temperature on Fermi level - compound semiconductors - variation of electrical conductivity in intrinsic semiconductors with temperature - Band gap determination of intrinsic semiconductor (derivation and Expt) - Hall effect (derivation and experiment).

UNIT IV DIELECTRIC, MAGNETIC AND SUPERCONDUCTING MATERIALS **10**

Introduction to dielectric materials - Dielectric constant - Polarization of dielectric materials - Types of Polarization (Polarisability) - Equation of internal fields in solid (One- Dimensional) (Derivation) - Claussius-Mosotti Relation for elemental dielectric materials - Dielectric Breakdown - Frequency dependence of dielectric constant, Dielectric Losses - Important applications of dielectric material.

Dia, Para and Ferro magnetic material - Domain theory for Ferro magnetic materials - Phenomena of Hysteresis and its applications - Ferrites and its structures.

Introduction to Superconductivity - Meissner effect - Properties of superconductors - Type I and Type II superconductors - BCS theory (Qualitative) - Low Tc and High Tc (alloy) superconductors - Ceramic superconductors (oxide superconductors) - Applications of Superconductors.

UNIT V CERAMIC AND NEW MATERIALS **9**

Ceramics : types and applications, **Composites:** Ceramic Fibres - Fibre reinforced Plastics - Fibre reinforced Metal - **Metallic glasses**: preparation, Properties and applications - **Shape memory alloys :** shape memory effect, phases, pseudo elastic effect, NiTi alloy, Properties and applications - **Nanomaterials**: preparation, properties and applications - Bio materials (qualitative).

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able

- to know about the phase diagrams, heat treatment of alloys and alloy steels.
- to understand the behaviour of electrons in the semiconductors.
- to know about the properties and engineering applications of magnetic and dielectric materials.
- to enhance knowledge about ceramics and smart materials.

TEXT BOOKS:

1. Arumugam. M, "Materials Science", Anuradha Publications, 2015.
2. Rajendran. V, "Engineering Physics", Tata McGraw Hill, 2015.
3. Suresh. R and Jayakumar. V, "Materials Science", Lakshmi Publications, 2003.
4. Raghavan. V, "Materials Science and Engineering - A first course", Sixth Edition, PHI publications, 2015

REFERENCES:

1. Gaur. R.K and Gupta. S.L, "Engineering Physics", Dhanpat Publications, 2015.
2. Avadhnaulu. M.N and Kshirsagar, "A Textbook of Engineering Physics", S. Chand & Co. 2006.
3. Kittlel. C, "Introduction to Solid State Physics", 7^{th} Edition, Wiley Eastern Ltd., 2004.
4. Azaroff. L.V and Brophy. J.J, "Electronic Processes In Materials", McGraw Hill., 1963.

IT18111	PROGRAMMING FOR PROBLEM SOLVING LABORATORY	L	T	P	C
		0	0	3	1.5

(Common to all Branches Except MR)

OBJECTIVES:

The students should be made to

- Be exposed to the syntax of C.
- Be familiar with programming in C.
- Learn to use arrays, strings, functions, pointers, structures and unions in C.

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LIST OF EXERCISES

1. Usage of Basic Linux commands
2. C Programming using Simple statements and expressions
3. Scientific problem solving using decision making and looping
4. Simple programming for one dimensional and two dimensional arrays
5. Solving problems using Strings
6. C Programming using Pointers
7. C Programming using user defined functions (Pass by value and Pass by reference)
8. C Programming using Recursion
9. C Programming using structures and union
10. C Programming using enumerated data types
11. C Programming using macros and storage classes
12. C Programming using Files

TOTAL: 45 PERIODS

OUTCOMES:

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

- Write simple C Programs
- Able to solve scientific problems using C.

REFERENCES:

1. Pradip Dey and Manas Ghosh, "Programming in C", First Edition, Oxford University Press, 2018.
2. Byron S Gottfried, "Programming with C", Schaum's Outlines, Third Edition, Tata McGraw-Hill, 2010.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. No.	Description of Equipment	Qty
HARDWARE:		
1.	Computer	30
SOFTWARE:		
2.	Open Source Linux OS	30
3.	C compiler	30

GE18161 COMPUTER AIDED DRAFTING LABORATORY L T P C
(Common to AE, CE & MR) 0 0 3 1.5

OBJECTIVES:

- To develop skill to use software to create 2D and 3D models.

LIST OF EXERCISES USING SOFTWARE CAPABLE OF DRAFTING AND MODELING

1. Study of capabilities of software for Drafting and Modeling - Coordinate systems (absolute, relative, polar, etc.) - Creation of simple figures like polygon and general multi-line figures.
2. Drawing of a Title Block with necessary text and projection symbol.
3. Drawing of curves like parabola, spiral, involute using Bspline or cubic spline.
4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning.
5. Drawing front view, top view and side view of objects from the given pictorial views (eg. V-block, Base of a mixie, Simple stool, Objects with hole and curves).
6. Drawing of a plan of residential building (Two bed rooms, kitchen, hall, etc.)
7. Drawing of a simple steel truss.
8. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
9. Drawing isometric projection of simple objects.
10. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

Note: Plotting of drawings must be made for each exercise and attached to the records written by students.

TOTAL: 45 PERIODS

OUTCOMES:

- Students will be able to draw the two dimensional sketches by using different commands in Auto CAD software.
- Students will be able to draw the Isometric projection drawings from the two dimensional drawing and building layouts.
- Students will be able to draw the basic solid models drawing and make a pattern material model for different appearance of the solids

REFERENCES:

1. George Omura and Brian C. Benton, “Mastering AutoCAD 2016 and AutoCAD LT 2016: Autodesk Official press”, Wiley Publishers, 2015.
2. Elise Moss, “Autodesk AutoCAD 2016 Fundamentals”, SDC Publications, 2015.
3. James D. Bethune, “Engineering Graphics with AutoCAD 2017”, PEACHPIT Press, 2016.
4. Cheryl R. Shrock, Steve Heather, “Advanced AutoCAD 2016 Exercise Workbook”, Industrial Press, 2016.
5. Ibrahim Zeid and Sivasubramanian R, "CAD/CAM: Theory and Practice", Tata McGraw-Hill Education India, 2009.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Sl. No	Description of Equipment	Quantity
1.	Pentium IV computer or better hardware, with suitable graphics facility	30 Nos.
2.	Licensed software for Drafting and Modeling.	30 Licenses
3.	Laser Printer or Plotter to print / plot drawings	2 Nos.

AE18301 **AUTOMOTIVE ENGINES** **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the basic principles of engines used for automobiles and different systems.

UNIT I CONSTRUCTION AND OPERATION 9

Introduction and classification of engines. Constructional details of spark ignition (SI) and compression ignition (CI) engines. Working principles of Four stroke and Two stroke SI and CI engines with P-V and T-S diagrams. Firing order, Comparison of SI and CI engines and four stroke and two stroke engines. Introduction to modern automotive engines.

UNIT II FUEL SYSTEMS 9

SI engine Fuel systems - Air/Fuel ratio requirements, Air/Fuel ratio and emissions, Principle of carburetion, working of a Simple fixed venturi carburetor, Constant vacuum carburetor, Single Point and Multi Point Fuel Injection systems.

CI engine Fuel systems - Injection pumps - Jerk type, Distributor type, Nozzles - Single-hole, Multi-hole, Pintle and Pintaux, Unit injector and CRDI systems. Fuel Injection pump calibration. Need for a governor, working principle of a simple governor.

UNIT III COMBUSTION AND COMBUSTION CHAMBERS 9

Combustion of SI and CI engines - Introduction and stages of combustion. Factors affecting flame propagation. Knock in SI and CI engines - Formation, factors affecting and comparison.

Combustion chambers of SI and CI engines - Requirements, types and factors controlling combustion chamber design. Importance of swirl, squish and turbulence.

UNIT IV SUPERCHARGING, TURBOCHARGING AND ENGINE TESTING 9

Concept of Supercharging and Turbocharging, Construction and Working of Superchargers and Turbochargers, Turbocharger controls - waster gate, variable geometry, variable nozzle types. Loading devices - Mechanical, Hydraulic and Electrical Dynamometers, Performance Test - Load test and Speed test, Thermal and Volumetric efficiencies, Measurement of Air flow, Fuel flow, Friction, Cylinder pressure. Engine performance maps, Engine testing standards.

UNIT V COOLING AND LUBRICATION SYSTEMS 9

Need for engine cooling, Cooling system - Requirements and Types - air and liquid cooling systems. Thermo syphon and forced circulation and pressurized cooling systems. Properties of coolants, coolants used in modern automotive engines.

Need for engine lubrication, Lubrication system - Requirements and Types - mist, pressure feed, dry and wet sump systems. Properties of lubricants, lubricants used in modern automotive engines.

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to

- know the construction and operation of Automotive Engines.
- gain the knowledge in SI and CI engine fuels systems.
- know the lubrication and cooling systems of Automotive engines.
- understand the combustion in Automotive engines and different types of combustion chambers.
- know the principles of super-charging, turbo-charging and testing of automotive engines.

TEXT BOOKS:

1. Ganesan V., "Internal Combustion Engines", Fourth Edition, Tata McGraw Hill, 2012.
2. Ramalingam K.K., "Internal Combustion Engines", Second Edition, SciTech Publications, 2009.
3. Devaradjane. Dr. G., Dr. M. Kumaresan, "Automobile Engineering", AMK Publishers, 2013.

REFERENCES:

1. Heisler, "Advanced Engine Technology" SAE Publication, 1995.
2. Edward F. Obert "Internal Combustion Engines" 3 Edition, 1970.
3. Gupta. H.N. "Fundamentals of Internal Combustion" Engines, Second Edition, PHI Learning Pvt. Ltd. 2012.
4. Mathur and Sharma "Internal Combustion Engines" Dhanpat Rai and Sons, 2010.
5. John B. Heywood, "Internal Combustion Engine Fundamentals", First Edition, McGraw Hill Education, 2011.

AE18302 BASIC AND APPLIED THERMODYNAMICS L T P C
3 1 0 4

(Use of Standard and approved Steam Table, Mollier Chart, Compressibility Chart and Psychrometric Chart permitted)

OBJECTIVES:

- To familiarize the students to understand the fundamentals of Thermodynamics and to perform thermal analysis of equipments on their behavior and performance.
  (Use of Standard and approved Steam Table, Mollier Chart, Compressibility Chart and Psychrometric Chart permitted)

UNIT I BASIC CONCEPTS AND FIRST LAW 12

Basic concepts - concept of continuum, comparison of microscopic and macroscopic approach. Path and point functions. Intensive and extensive properties, total and specific quantities. System and their types. Thermodynamic Equilibrium State, path and process. Quasi-static, reversible and irreversible processes. Heat and work transfer, definition and comparison, sign convention. Displacement work and other modes of work. Zeroth law of thermodynamics. First law of thermodynamics - application to non-flow and steady flow systems. Unsteady flow processes (Descriptive only).

UNIT II SECOND LAW AND AVAILABILITY ANALYSIS 12

Heat reservoirs - source and sink. Heat Engine, Refrigerator, Heat pump. Statements of second law and its corollaries. Carnot and reversed Carnot cycles. Concept of entropy, T-s diagram, Entropy change for ideal gases - different processes. Available and unavailable energy. Exergy and Irreversibility (Descriptive Only). I and II law Efficiency.

UNIT III GAS MIXTURES AND THERMODYNAMIC RELATIONS 12

Ideal and real gas - properties and comparison - Equations of state for ideal and real gases - Reduced properties - Compressibility factor - Simple Calculations using Generalised Compressibility Chart. Properties of gas mixture - Molar mass, gas constant, density, change in internal energy, enthalpy, entropy. Maxwell relations, T ds Equations, Difference and ratio of heat capacities, Energy equation, Joule-Thomson Coefficient, Clausius Clapeyron equation.

UNIT IV STEAM, STEAM NOZZLES AND STEAM POWER CYCLE 12

Formation of steam and thermodynamic properties, p-v, p-T, T-v, T-s, h-s diagrams. p-v-T surface. Use of Steam Table and Mollier Chart. Determination of dryness fraction. Flow of steam through nozzles, shapes of nozzles, effect of friction, critical pressure ratio, supersaturated flow. Ideal and actual Rankine cycles, Reheat and Regenerative cycles. Binary and Combined cycles (Description Only).

UNIT V REFRIGERATION AND REFRIGERATION CYCLES 12

Fundamentals of refrigeration, C.O.P., simple vapour compression refrigeration system, T-s, p-h diagrams, simple problems. Simple vapour absorption refrigeration system (Description Only), desirable properties of an ideal refrigerant.

TOTAL (L: 45 + T: 15): 60 PERIODS

OUTCOMES :

Students will be able to

- analyze various Energy transferring / transforming equipment using I & II law of thermodynamics.
- analyze the performance of steam power plant cycle and with the help of steam table and charts.
- obtain different thermodynamic relations & equations for ideal and real gases.
- understand steam formation, expansion of steam through nozzles and various steam

power cycles.

- understand the basics of refrigeration and refrigeration cycles.

TEXT BOOKS:

1. Nag. P.K., "Engineering Thermodynamics", 5th Edition, Tata McGraw-Hill, New Delhi, 2013.
2. Natarajan. E., "Engineering Thermodynamics: Fundamentals and Applications", Anuragam Publications, 2012.
3. Rajput. R.K., "Thermal Engineering", Laxmi Publications, Tenth Edition, 2017.

REFERENCES:

1. Cengel. Y and M. Boles, "Thermodynamics - An Engineering Approach", 8th Edition, Tata McGraw Hill, 2014.
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. Chattopadhyay, P, "Engineering Thermodynamics", Oxford University Press, 2010.
5. Arora C.P, 'Thermodynamics ', Tata McGraw-Hill, New Delhi, 2003.
6. Van Wylen and Sonntag, 'Classical Thermodynamics ', Wiley Eastern, 1987
7. Venkatesh. A, 'Basic Engineering Thermodynamics ', Universities Press (India) Limited, 2007.
8. Kau-Fui Vincent Wong, "Thermodynamics for Engineers", CRC Press, Indian Reprint, 2010.
9. Prasanna Kumar: "Engineering Thermodynamics" Pearson Education, 2013.

AE18303 FLUID MECHANICS AND HYDRAULIC MACHINES L T P C
3 1 0 4

OBJECTIVES:

- This course imparts the basic knowledge of fluids in static, kinematic and dynamic equilibrium.
- They will also gain the knowledge of the applicability of physical laws in addressing problems in hydraulics.
- This course imparts the importance of various types of flow in pumps and turbines.

UNIT I FLUID PROPERTIES AND FLOW CHARACTERISTICS 12

Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, surface tension and capillarity. Pressure measurement devices - U-tube manometers, pressure gauges. Flow characteristics – concept of control volume - application of continuity equation, energy equation and momentum equation - venturi, airfoil, spoiler.

UNIT II FLOW THROUGH CIRCULAR CONDUITS AND BOUNDARY LAYER 12

Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli - Boundary layer concepts - types of boundary layer thickness - Darcy Weisbach equation - friction factor - Moody diagram - commercial pipes - minor losses - Flow through pipes in series and parallel - Boundary Layer Concepts - Drag and Lift - Case study.

UNIT III DIMENSIONAL ANALYSIS 12

Need for dimensional analysis - methods of dimensional analysis - Similitude - types of similitude - Dimensionless parameters- application of dimensionless parameters - Model analysis - Similarity between Model and Prototype Vehicle.

UNIT IV PUMPS 12

Impact of jets - Euler's equation - Theory of roto-dynamic machines - various efficiencies - velocity components at entry and exit of the rotor- velocity triangles - Centrifugal pumps - working principle - work done by the impeller - performance curves - Reciprocating pump - working principle - Diaphragm pump - Rotary pumps - Gear, Vane and Lobe types.

UNIT V TURBINES 12

Classification of turbines - heads and efficiencies - velocity triangles. Axial, radial and mixed flow turbines - Turbochargers - Pelton wheel, Francis turbine and Kaplan turbines - working principles - work done by water on the runner - draft tube. Specific speed - unit quantities - performance curves for turbines - governing of turbines.

TOTAL (L: 45 + T: 15): 60 PERIODS

OUTCOMES:

- The students will be able to get a basic knowledge of fluids in static, kinematic and dynamic equilibrium.
- They will also gain the knowledge of the applicability of physical laws in addressing problems in hydraulics.
- They will also gain the knowledge of the applicability of dimensional analysis and modeling.
- The students will be able to critically analyse the performance of rotodynamic pumps and reciprocating pumps used in automotive application.
- The students will gain the knowledge of working of turbines and select the type of turbine for an application.

TEXT BOOKS:

1. Bansal, R.K., “Fluid Mechanics and Hydraulics Machines”, 5th edition, Laxmi Publications Pvt. Ltd, New Delhi, 2008.
2. Modi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi, 2004.

REFERENCES:

1. Fox W.R. and McDonald A.T., "Introduction to Fluid Mechanics", John-Wiley and Sons, Singapore, 1995.
2. Jain A. K. "Fluid Mechanics", Khanna Publishers, 2010.
3. Roberson J.A and Crowe C.T., " Engineering Fluid Mechanics", Jaico Books Mumbai, 2000.
4. Streeter, V.L., and Wylie, E.B., "Fluid Mechanics", McGraw Hill, 2000.
5. White, F.M., "Fluid Mechanics", Tata McGraw Hill, 5th Edition, New Delhi, 2003.

AE18304 AUTOMOTIVE FUELS AND LUBRICANTS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the properties of fuels and lubricants for the design and operation of the I.C engines.

UNIT I MANUFACTURE OF FUELS AND LUBRICANTS 9

Types of Fuel, Chemical structure of petroleum, refining process, thermal cracking, catalyt cracking, polymerization, reforming, alkylation, isomerisation, blending, products of refining proces Manufacture of lubricating oil base stocks, manufacture of finished automotive lubricants.

UNIT II THEORY OF LUBRICATION 9

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.

UNIT III LUBRICANTS 9

Specific requirements for automotive lubricants, oxidation deterioration and degradation of lubricants, additives and additive mechanism, synthetic lubricants, lubricating oils - classification, properties and tests. Grease - classification, properties and testing.

UNIT IV PROPERTIES AND TESTING OF FUELS 9

Thermo-chemistry of fuels, properties and testing of fuels, relative density, calorific value, flash point, fire point, distillation, vapour pressure, spontaneous ignition temperature, viscosity, pour point, flammability, ignitability, diesel index, API gravity, aniline point, carbon residue, copper strip corrosion etc.

UNIT V COMBUSTION & FUEL RATING 9

SI Engines – flame propagation and mechanism of combustion, normal combustion, knocking, octane rating, fuel requirements. CI Engines, mechanism of combustion, diesel knock, cetane rating, fuel requirements. Additive - mechanism, requirements of an additive, petrol fuel additives and diesel fuel additives – specifications of fuels.

TOTAL : 45 PERIODS

OUTCOMES:

Students will be able to

- know various processes involved in the manufacture of fuels and lubricants.
- understand the friction in the engine moving parts and importance of lubrication.
- know various types of lubrications and lubricants.
- understand fuel properties and determination of fuel properties.
- gain knowledge about the mechanism of combustion of fuels and associated problems.

TEXT BOOKS:

1. Ganesan, V.,"Internal Combustion Engines", 4th Edition, Tata McGraw-Hill Book Co., 2013.
2. Mathur. M.L., Sharma. R.P. “Internal Combustion Engines”, Dhanpatrai publication,2014.
3. Obert.E.F “Internal Combustion Engineering and Air Pollution”, International book Co., 1988.

REFERENCES:

1. Brame, J.S.S. and King, J.G. – "Fuels Solids, Liquids, Gaseous". Edward Arnold, 1961.
2. Francis, W, "Fuels and Fuel Technology", Vol. I & II, Pergamon, 1965.
3. Hobson, G.D. &Pohl.W "Modern Petroleum Technology", 1974.
4. Lansdown. A.R., Lubrication, "A practical guide to lubricant selection", Pergamon press, 1982.
5. Raymond. C. Gunther, "Lubrication", Chilton Book Co., 1971.

AE18305 **PRODUCTION PROCESSES** **L T P C**
3 0 0 3

OBJECTIVES:

- To introduce the concepts of basic manufacturing processes and fabrication techniques such as metal casting, metal joining, metal forming and manufacture of plastic components.

UNIT I CASTING **9**

Casting steps, types of pattern, core making, Cupola and Induction furnaces, procedure to make sar mould, moulding tools, machine moulding, special moulding processes – CO_2 moulding, she moulding, investment moulding, permanent mould casting, pressure die casting, centrifugal castin continuous casting, casting defects.

UNIT II WELDING **9**

Classification of welding processes. Principles of Oxy-acetylene gas welding. AC metal arc welding, resistance welding, submerged arc welding, tungsten inert gas welding, metal inert gas welding, plasma arc welding, thermit welding, friction welding, electron beam welding, laser beam welding, defects in welding, soldering and brazing.

UNIT III METAL FORMING AND POWDER METALLURGY **9**

Hot and Cold working - Principles and applications of the following processes: Forging, Rolling, Extrusion, Wire drawing.

Powder metallurgy - Principal steps involved advantages, disadvantages and applications of powder metallurgy.

UNIT IV SHEET METAL PROCESSES **9**

Sheet metal characteristics - shearing, bending and drawing operations - Stretch forming operations - Formability of sheet metal - Test methods - Special forming processes - Metal spinning - Explosive forming, Magnetic pulse forming, Electro-Hydraulic forming, Super plastic forming - Micro forming.

UNIT V PLASTIC MATERIALS AND PROCESSES **9**

Types of plastics - Characteristics of the forming and shaping processes – Injection moulding - Blow moulding - Rotational moulding - Film blowing - Extrusion - Thermoforming - Compression moulding - Transfer moulding - typical industrial applications, Laminated plastics. Bonding of Thermoplastics - Fusion and solvent methods - Induction and Ultrasonic methods.

TOTAL : 45 PERIODS

OUTCOMES:

Students will be able to

- select the best casting process for a component to be manufactured based on the economy of manufacture and its application.
- choose the best joining process involved in the fabrication of components based on the simplicity, application and cost.
- choose the best metal forming or powder metallurgy process for a component to be manufactured based the on the economy of manufacture and its application.
- select the powder metallurgy process for a component to be manufactured based on its application.
- choose best method of moulding/joining of plastics of a part based on cost and its use.

TEXT BOOKS:

1. Hajra Choudhary S K, Hajra Choudhury A K and Nirjhar Roy, "Elements of workshop Technology", Volume I, Media promoters & Publishers Pvt. Ltd., Mumbai, 2008.
2.. Kalpakjian. S, “Manufacturing Engineering and Technology”, Pearson Education India Edition, 2013.

REFERENCES:

1. Jain R.K. “Production Technology”, 21st Edition, Khanna Publishers, 2005.
2. Paul Degarma E, Black J.T and Ronald A. Kosher, "Materials and Processes, in Manufacturing" 8th Edition, Prentice – Hall of India, 1997.
3. Rao, P.N. "Manufacturing Technology: Foundry, Forming and Welding", 4th Edition, McGraw Hill Education (India) Private Limited, New Delhi, 2017.
4. Roy. A. Lindberg, "Processes and Materials of Manufacture", Fourth Edition, PHI/Pearson Education 2015.
5. Sharma, P.C., "A Text book of Production Technology", S.Chand and Co. Ltd., 2014.

AE18311	ENGINE PERFORMANCE AND EMISSION TESTING LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To conduct performance test and emission test on the IC engines.

LIST OF EXPERIMENTS:

1. Study of hydraulic, electrical and eddy current dynamometers
2. Valve timing and port timing diagram
3. Performance and emission test on two wheeler SI engine
4. Performance and emission test on automotive multi-cylinder SI engine
5. Performance and emission test on automotive multi-cylinder CI engine
6. Retardation test on I.C. Engines.
7. Heat balance test on automotive multi-cylinder SI engine
8. Heat balance test on automotive multi-cylinder CI engine
9. Morse test on multi-cylinder SI engine
10. P-θ and P-V diagrams for IC engine with piezo-electric pick up, charge amplifier, angle encoder and PC

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to control the emission and use of different equipments to conduct performance test.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1.	Hydraulic dynamometer	1 No.
2.	Eddy current dynamometer	1 No.
3.	Electrical dynamometer	1 No.
4.	Single cylinder two stroke cut section engine	1 No.
5.	Single cylinder four stroke cut section engine	1 No.
6.	Two-wheeler engine test rig.	1 No.
7.	Automotive multicylinder SI engine test rig with heat balance arrangement	1 No.
8.	Automotive multicylinder CI engine test rig with heat balance arrangement	1 No.
9.	Emission Measuring Instruments for Petrol & Diesel Engines	1 No. each
10.	Piezo-electric pick up, Charge Amplifier, Angle Encoder and PC	1 set

REFERENCES:

1. Rajupt. R.K., "Thermal Engineering", Laxmi Publications, Tenth Edition, 2017.
2. Kothandaraman.C.P., Domkundwar. S, Domkundwar. A.V., "A course in thermal Engineering", Fifth Edition, Dhanpat Rai & Sons, 2002.
3. Ganesan. V, "Internal Combustion Engines", Third Edition, Tata McGraw-Hill, 2007.
4. Rudramoorthy, R, "Thermal Engineering", Tata McGraw-Hill, New Delhi, 2003.
5. Ramalingam. K.K., "Thermal Engineering", SCITECH Publications (India) Pvt. Ltd., 2009.

AE18312 AUTOMOTIVE FUELS AND LUBRICANTS LABORATORY

L	T	P	C
0	0	3	1.5

OBJECTIVES:

- To study the characteristics of the fuels and Lubricants used in automobile.

LIST OF EXPERIMENTS:

ELECTRONICS

1. Study of International and National standards for fuels and lubricants.
2. Study of Octane and Cetane Number of fuels.
3. ASTM distillation test of liquid fuel
4. Aniline Point test of diesel
5. Calorific value test of liquid fuel.
6. Calorific value test of gaseous fuel.
7. Reid vapour pressure test.
8. Flash and Fire point tests of petrol, diesel and lubricating oil.
9. Copper strip corrosion test
10. Cloud & Pour point tests of liquid fuel.
11. Temperature dependence of viscosity of lubricants & Fuels by Redwood Viscometer.
12. Viscosity Index of lubricants & Fuels by Saybolt Viscometer
13. Ash content and Carbon residue test
14. Drop point test of grease
15. Mechanical penetration test of grease.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to characteristic and chase the fuels and Lubricants for the automobiles.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Sl. No	NAME OF THE EQUIPMENT	Qty.
1	ASTM Distillation Test Apparatus	1 No
2	Aniline Point Apparatus	1 No.
3	Bomb Calorimeter	1 No.
4	Gas Calorimeter	1 No.
5	Reid Vapor Pressure Test Apparatus	1 No.
6	Flash and Fire Point Apparatus (for petrol)	1 No.
7	Copper Strip Corrosion Test Apparatus	1 No.
8	Cloud and Pour point Apparatus	1 No.
9	Redwood Viscometer	1 No.
10	Saybolt Viscometer	1 No.
11	Ash content Test Apparatus	1 No.
12	Carbon Residue Test Apparatus	1 No.
13	Drop Point Test Apparatus for Grease	1 No.
14	Mechanical Penetration Test Apparatus for Grease	1 No.

REFERENCES:

1. Brame, J.S.S. and King, J.G. – "Fuels Solids, Liquids, Gaseous". Edward Arnold, 1961.
2. Francis, W, "Fuels and Fuel Technology", Vol. I & II, Pergamon, 1965.
3. Lansdown. A.R., Lubrication, "A practical guide to lubricant selection", Pergamon press, 1982.
4. Raymond. C. Gunther, "Lubrication", Chilton Book Co., 1971.

ME18411 FLUID MECHANICS AND MACHINERY LABORATORY

L	T	P	C
0	0	3	1.5

OBJECTIVES:

- Upon Completion of this subject, the students can able to have hands on experience in flow measurements using different devices and also perform calculation related to losses in pipes and also perform characteristic study of pumps, turbines etc.,

LIST OF EXPERIMENTS:

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Calculation of the rate of flow using Rota meter.
4. Determination of friction factor for a given set of pipes.
5. Conducting experiments and drawing the characteristic curves of centrifugal pump/ submergible pump
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
7. Conducting experiments and drawing the characteristic curves of Gear pump.
8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to use the measurement equipments for flow measurement
- Ability to do performance trust on different fluid machinery

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1.	Orifice meter setup	1 No.
2.	Venturi meter setup	1 No.
3.	Rotameter setup	1 No.
4.	Pipe Flow analysis setup	1 No.
5.	Centrifugal pump/submergible pump setup	1 No.
6.	Reciprocating pump setup	1 No.
7.	Gear pump setup	1 No.
8.	Pelton wheel setup	1 No.
9.	Francis turbine setup	1 No.
10.	Kaplan turbine setup	1 No.

REFERENCES:

1. Modi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi, 2004.
2. Streeter, V. L. and Wylie E. B., "Fluid Mechanics", McGraw Hill Publishing Co., 2010.
3. Kumar K. L., "Engineering Fluid Mechanics", Eurasia Publishing House(p) Ltd., New Delhi, 2004.
4. Robert W.Fox, Alan T. McDonald, Philip J.Pritchard, “Fluid Mechanics and Machinery”, 2011.
5. Graebel. W.P, "Engineering Fluid Mechanics", Taylor & Francis, Indian Reprint, 2011.

MA18452 **PARTIAL DIFFERENTIAL EQUATIONS AND COMPUTATIONAL METHODS** **L T P C**

3 1 0 4

OBJECTIVES:

- To introduce the effective mathematical tools for the solutions of partial differential equations for linear and non-linear systems.
- To provide the necessary basic concepts of a few numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 12

Formation of partial differential equations - Singular integrals - Solutions of standard types of first order partial differential equations - Lagrange's linear equation - Linear homogeneous partial differential equations of second and higher order with constant coefficients.

UNIT II APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12

Classification of PDE - Method of separation of variables - Solutions of one dimensional wave equation - One dimensional equation of heat conduction - Steady state solution of two dimensional equation of heat conduction (excluding insulated edges).

UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 12

Solution of algebraic and transcendental equations - Newton Raphson method - Solution of linear system of equations - Gauss elimination method - Pivoting - Gauss Jordan method - Iterative methods of Gauss Jacobi and Gauss Seidel - Matrix Inversion by Gauss Jordan method - Eigen values of a matrix by Power method.

UNIT IV INTERPOLATION AND APPROXIMATION 10

Interpolation with unequal intervals - Lagrange's interpolation - Newton's divided difference interpolation - Interpolation with equal intervals - Newton's forward and backward difference formulae.

UNIT V INITIAL AND BOUNDARY VALUE PROBLEMS IN PARTIAL DIFFERENTIAL EQUATIONS 14

Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.

TOTAL (L:45 + T:15): 60 PERIODS

OUTCOMES:

Students will be able

- to understand of the mathematical principles on partial differential equations
- to know the applications of partial differential equations
- to formulate and solve partial differential equations
- to have a clear perception of interpolation and approximation
- to solve initial and boundary value problems

TEXT BOOKS:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India, 2011.
2. Grewal. B.S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers, Delhi, 2012.
3. Narayanan.S., Manicavachagom Pillay. T.K and Ramanaiah. G "Advanced Mathematics for Engineering Students" Vol. II & III, S.Viswanathan Publishers Pvt. Ltd.1998.
4. Grewal. B.S., and Grewal. J.S.,"Numerical Methods in Engineering and Science", Khanna Publishers, 9th Edition, New Delhi, 2007.

REFERENCES:

1. Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 7th Edition, Laxmi Publications Pvt Ltd, 2007.
2. Glyn James, "Advanced Modern Engineering Mathematics", 4th Edition, Pearson Education, 2011.
3. Veerarajan. T., "Transforms and Partial Differential Equation", Tata McGraw Hill Publishing Company Limited, New Delhi, 2012.
4. Ray Wylie. C and Barrett.L.C, "Advanced Engineering Mathematics" Tata McGraw Hill Education Pvt Ltd, Sixth Edition, New Delhi, 2012.
5. Peter V.O' Neil, "Advanced Engineering Mathematics", Cengage Learning India pvt. Ltd. 7th Edition, New Delhi, 2012.
6. Iyengar. S.R.K., and Jain. R.K, "Numerical Methods", New Age International Publishers, New Delhi, 2012.

AE18401 THERMAL ENGINEERING AND HEAT TRANSFER L T P C
3 1 0 4

OBJECTIVES:

- To familiarize the students to understand the applied thermodynamics and heat transfer.

(Use of Standard and approved Steam Table, Mollier Chart, Compressibility Chart and Psychrometric Chart permitted)

UNIT I GAS POWER CYCLES AND AIR COMPRESSORS 12

Air standard cycles: Otto, Diesel, Dual - Work output, Efficiency and MEP calculations. Comparison of the cycles for same compression ratio and heat addition, same compression ratio and heat rejection, same peak pressure, peak temperature and heat rejection, same peak pressure and heat input, same peak pressure and work output, Simple Brayton cycle.

Single acting and double acting air compressors, work required, effect of clearance volume, volumetric efficiency, isothermal efficiency, free air delivery. Rotary compressors (Descriptive only).

UNIT II PSYCHROMETRY AND AIR CONDITIONING 12

Psychrometric properties and chart. Property calculations of air vapour mixtures by using chart and expressions. Psychrometric processes - adiabatic saturation, sensible heating and cooling, humidification, dehumidification, evaporative cooling and adiabatic mixing.
Air conditioning system - Processes, Types and Working Principles - Concept of RSHF, GSHF, ESHF - Cooling load estimation (Descriptive only).

UNIT III CONDUCTION 12

Basic Concepts, Mechanism of Heat Transfer: Conduction, Convection and Radiation. General Differential equation of Heat Conduction, Fourier Law of Conduction in Cartesian Coordinates, One Dimensional Steady State Heat Conduction through Plane Wall, Cylinders and Spherical systems and Composite Systems. Conduction with Internal Heat Generation. Extended Surfaces. Unsteady Heat Conduction: Lumped analysis, Simple problems. Use of Heisler chart (Descriptive only).

UNIT IV CONVECTION 12

Basic Concepts, Convective Heat Transfer Coefficients, Boundary Layer Concept. Forced Convection: Flow over Plates, Cylinders and Spheres and Bank of tubes. Laminar and Turbulent Flow through tubes. Free Convection: Flow over Vertical Plate.

UNIT V RADIATION AND HEAT EXCHANGERS 12

Basic Concepts, Laws of Radiation: Stefan Boltzman Law, Kirchoff Law. Black Body Radiation, Grey body radiation, Shape Factor, Electrical Analogy, Radiation Shields, Introduction to Gas Radiation.

Heat Exchangers: Parallel, Counter and Cross flow, LMTD, simple problems. Heat exchangers in automotive applications. Introduction to NTU concept.

TOTAL (L:45 + T:15): 60 PERIODS

OUTCOMES:

Students will be able to

- know the application of thermodynamics and its use in analysis of gas power cycles.
- understand different types of air compressors and estimate the power required to run the compressor.
- understand the moist air, its properties and use of Psychrometric chart to obtain the properties of moist air and also know the different types of air conditioning systems.
- understand various modes of heat transfer and the estimation of rate of heat transfer.
- gain the knowledge about basic types of heat exchangers and their applications in

automobiles.

TEXT BOOKS:

1 R.K. Rajput, "Applied Thermodynamics", 2nd edition, Laxmi Publishing (P) Ltd., New Delhi, 2015.

2 J.P. Holman, "Heat Transfer", 10th edition, Tata McGraw Hill, 2009.

Kothandaraman. C.P., Domkundwar. S, Domkundwar. A.V., "A course in Thermal Engineering", Fifth Edition, Dhanpat Rai & Sons, 2002.

REFERENCES:

1 P.K. Nag, "Heat Transfer", 3rd edition, Tata McGraw Hill, New Delhi, 2011.

2 C.P. Kothandaraman, "Fundamentals of Heat and Mass Transfer", 6th edition, New Age International, New Delhi, 2010.

3 P.K. Nag, "Basic and Applied Thermodynamics", 2nd edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2009.

4 Arora. C.P, "Refrigeration and Air Conditioning", Tata McGraw-Hill Publishers, 1994.

5 Rajupt. R.K., "Thermal Engineering", Laxmi Publications, Tenth Edition, 2017.

AE18402	STRENGTH OF MATERIALS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES

1 To develop the relationship between the loads applied to a non-rigid body and the internal stresses and deformations induced in the body.
2 To familiarize the student in calculating the effect of transverse loading on beams and stresses in beam
3 To make the students to learn Deflection and slopes in various types of beams for different loading conditions.
4 To solve practical problems related to springs and shafts.
5 To do the analysis of stresses in two dimensions

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 12

Elementary definition of stress and strain - Tension, Compression, Shearing stress and Strain - stress-strain relationship - Hooke's law - Deformation of simple and compound bars - Composite bars - Thermal stresses - Poisson's ratio - Elastic constants.

UNIT II TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM 12

Beams - types transverse loading on beams, Shear force and bending moment in beams. Construction of Shear force and Bending moment diagrams for different types of static loading on cantilever, simply supported and overhanging beams.

Theory of simple bending, bending stresses, section modulus, bending stress and shear stress distribution in beams.

UNIT III DEFLECTION OF BEAMS 12

Governing differential equation - Macaulay's method - Area moment method for computation of slopes and deflections in beams - Conjugate beam method.

UNIT IV TORSION OF SHAFTS AND SPRINGS 12

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 subjected to tension only, Leaf springs.

UNIT V ANALYSIS OF STRESSES IN TWO DIMENSIONS 12

Biaxial state of stress - Stress at a point - stresses on inclined planes - Principal stresses and Principal strains and Mohr's circle of stress.

Stresses in thin cylindrical shell due to internal pressure - circumferential and longitudinal stresses - Deformation in Thin cylinders and Thin spherical shells.

TOTAL : (L:45 + T:15) = 60 PERIODS

OUTCOMES:

Student will be able to

- Predict the behavior of the materials for different loading and support conditions.
- Select suitable cross sections for the beams and draw the shear force and bending moment diagram based on the loading conditions.
- Estimate the Deflection of beams under different types of loading conditions.
- Select the dimensional parameters for the shafts and springs under various type of loads.
- Develop the basic understanding of Biaxial Stresses.

TEXT BOOKS:

1. Bansal, R.K., "A Textbook of Strength of Materials", Laxmi Publications (P) Ltd., 6th edition, 2018.
2. Jindal U.C., "Strength of Materials", Asian Books Pvt. Ltd., New Delhi, 2007.

REFERENCES:

1. Egor. P. Popov, "Engineering Mechanics of Solids", Pearson, 2010.
2. Ferdinand P. Beer, Russell Johnson,and John J. Dewole "Mechanics of Materials", McGraw Hill Education, 2005.
3. Hibbeler, R.C., "Mechanics of Materials", Pearson Education, Low Price Edition, 2007.
4. Rattan, "Strength of Materials", McGraw Hill Education, 3rd Edition, 2017.
5. Ramamrutham S and Narayan R, "Strength of Materials", DhanpatRai and Sons, New Delhi, 2008.

AE18403 **AUTOMOTIVE CHASSIS** **L T P C**
3 0 0 3

OBJECTIVES:

- Study of the Constructional details and Theory of important drive line, Structural, Steering, Braking and Suspension Systems of Automobiles. Problem–Solving in Steering Mechanism, Propeller Shaft, Braking and Suspension Systems are to be done.

UNIT I LAYOUT, FRAME, FRONT AXLE AND STEERING SYSTEM 9

Basic construction of chassis, Types of Chassis layout, with reference to Power Plant location and drive, various, types of frames, Loads acting on vehicle frame, Types of Front Axles and Stub Axles, Front Wheel Geometry. Condition for True Rolling Motion. Ackerman's and Davi's Steering Mechanisms, Steering Linkages, Different Types of Steering Gear boxes, Slip Angle, Over-Steer and Under-Steer, Reversible and Irreversible Steering, Power Steering.

UNIT II DRIVE LINE, FINAL DRIVE AND DIFFERENTIAL 9

Driving Thrust and its effects, torque reactions and side thrust, Hotchkiss drive, torque tube drive, radius rods and stabilizers, Propeller Shaft, Universal Joints, Constant Velocity Universal Joints, Final drive, different types of final drive, Double reduction final drive, Twin speed rear axle, Differential principle. Constructional details of differential unit, Differential housings, Non–Slip differential, Differential locks.

UNIT III REAR AXLES, WHEELS, RIMS AND TYRES 9

Construction of rear axles, Types of Loads acting on rear axles, Full-Floating, Three-Quarter Floating and Semi-Floating Axles, Types, Multi axles vehicles. Wheels and Rims, Types of Tyres and their constructional details. Fifth wheel coupling and tow hitch.

UNIT IV SUSPENSION SYSTEM 9

Requirement of Suspension System, Types of Suspension Springs, Constructional details and characteristics of Single Leaf, Multi-Leaf spring, Coil and Torsion bar Springs, Rubber, Pneumatic and Hydro-elastic Suspension Spring Systems, Independent Suspension System, Shock Absorbers, Types and Constructional details of Leaf and Coil Springs.

UNIT V BRAKE SYSTEMS 9

Need for Brake systems, Stopping Distance, Time and Braking Efficiency, Effect of Weight Transfer during Braking, Classification of brakes , Braking Torque, drum brake and disc Brake Theory, Types and Construction of Hydraulic Braking System, Mechanical Braking System, Pneumatic Braking System, Power-Assisted Braking System, Servo Brakes, Retarders- Principles and its types - antilock braking systems (ABS). Principle of Electronic Brake force distribution, Corner Stability Program

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to

- know the constructional details of basic automotive structure.
- know the working of automotive transmission system.
- understand the constructional details of wheels, axles and tyres.
- understand the construction and working principles of suspension systems.
- know the construction and working principles of brake systems.

TEXT BOOKS:

1. Newton Steeds and Garret, “Motor Vehicles” 13th Edition, Butterworth, London, 2005.
2. Heinz Hazler, “Modern Vehicle Technology”, Butterworth, London, 2005.
3. Devaradjane. Dr. G., Dr. M. Kumaresan, "Automobile Engineering", AMK Publishers, 2013.

REFERENCES:

1. Heldt P.M., “Automotive Chassis” Chilton Co., New York, 1990.
2. Giri. N.K., “Automotive Mechanics” Khanna Publishers, New Delhi, 2005.
3. Milliken & Milliken, “Race Car Vehicle Dynamics”, SAE, 1995.

AE18404 MANUFACTURING TECHNOLOGY AND SYSTEMS L T P C
3 0 0 3

OBJECTIVES:

- To understand the working of standard machine tools such as lathe, shaping and allied machines, milling, drilling and allied machines, grinding and allied machines and broaching, gear manufacturing, thread making, Unconventional machining.
- To provide knowledge on the correct procedure to be adopted to measure the dimension of gears and screw threads.
- To understand the application of computers in various aspects of manufacturing.

UNIT I MACHINING 9

General principles (with schematic diagrams only) of working and commonly performed operations in the following machines: Lathe, Shaper, Planer, Horizontal milling machine, Universal drilling machine, Broaching machines, Cylindrical grinding machine, Capstan and Turret lathe. Super finishing processes.

UNIT II MANUFACTURING AND TESTING OF GEAR, SCREW THREADS 9

Gear cutting - forming and generation principle and construction of gear milling, hobbing and gear shaping processes - finishing of gears. Thread Rolling.

Measurement of elements of screw thread and gear - techniques and measuring instruments - Screw thread Micrometers, Tool maker's microscope, Gear Tooth Vernier Caliper, Rolling gear tester, Co-ordinate measuring machine.

UNIT III COMPUTER AIDED MANUFACTURING 9

Introduction to NC systems and CNC - Machine axis and Co-ordinate system - CNC machine tools- Principle of operation CNC- Introduction of Part Programming, types - Detailed Manual part programming on Turning centres and Vertical Milling centres using G codes and M codes- Cutting Cycles, Loops, Sub program.

UNIT IV UNCONVENTIONAL MACHINING PROCESSES 9

General principles and applications of the following processes: Abrasive jet machining, Ultrasonic machining, Electric discharge machining, Electro chemical machining, Electro chemical grinding, Plasma arc machining, Chemical machining, Electron beam machining and Laser beam machining.

UNIT V ADVANCED MANUFACTURING PROCESSES AND SYSTEMS 9

Group Technology (GT), Part Families - Parts Classification and coding - Cellular Manufacturing - Types of Flexibility - Flexible Manufacturing System(FMS) - FMS Components - FMS Application and Benefits.
Robot Anatomy - Classification of Robots - Robot Control systems - Sensors in Robotics - Industrial Robot - Applications, Additive Manufacturing, Lean Manufacturing.

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to

- plan the sequence of machining operations or unconventional machining process involved in the manufacturing of a part to be produced.
- select for a given type of gear, a particular gear manufacturing process.
- apply NC and CNC programming concepts to develop part programme for Lathe and Milling Machines.
- to summarize the different types of techniques used in Cellular Manufacturing and FMS.
- gain knowledge about robot anatomy, classification and thereby will be able to select an appropriate type of robot for the given task.

TEXT BOOKS:

1 Hajra Choudhary S K, Hajra Choudhury A K and Nirjhar Roy, "Elements of workshop Technology", Volume II, Media promoters & Publishers Pvt. Ltd., 14th edition, 2014.

2 Rao. P.N "Manufacturing Technology: Metal Cutting and Machine Tools", 4th edition, McGraw Hill Education (India) Private Limited,New Delhi, 2018.

3 Jain R.K. "Engineering Metrology", 21st Edition, Khanna Publishers, 2017.

4 Mikell. P. Groover, "Automation, Production Systems and Computer Integrated Manufacturing", 4th edition, Pearson India Education Services Pvt. Ltd., 2016.

5 Mikell. P. Groover, "Industrial Robotics: Technology, Programming, and Applications", 2nd Edition, McGraw Hill Education (India) Private Limited,New Delhi, 2017.

REFERENCES:

1 I.C. Gupta, "A Text book on Engineering Metrology", 7th Edition, Dhanpat Rai Publications, 2018.

2 Pandey P.C. and Shan H.S. "Modern Machining Processes" Tata McGraw-Hill Publishing Company Limited, New Delhi, 2007.

3 Richerd R Kibbe, John E. Neely, Roland O. Merges and Warren J.White "Machine Tool Practices", 10th edition, Pearson education, 2015.

4 HMT, "Production Technology", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2001.

5 Radhakrishnan P, Subramanyan S.and Raju V., "CAD/CAM/CIM", 2nd Edition, New Age International (P) Limited, New Delhi, 2004.

6 Geofrey Boothroyd, "Fundamentals of Metal Machining and Machine Tools", CRC Press, 3rd edition, 2005.

7 Roy. A.Lindberg, "Process and Materials of Manufacture", 4th Edition, PHI/Pearson Education, 2015.

AE18411 AUTOMOTIVE COMPONENTS LABORATORY

L	T	P	C
0	0	3	1.5

OBJECTIVES:

- To train the Students to know the details of different components, dismantle and assembling them

LIST OF EXPERIMENTS:

1. Study and measurement of light and heavy commercial vehicle Frame
2. Study, dismantling and assembling of front axle
3. Study, dismantling and assembling of rear axle
4. Study, dismantling and assembling of differential
5. Study, dismantling and assembling of Clutch
6. Study, dismantling and assembling of Gear Box
7. Study, dismantling and assembling of steering system
8. Dismantling, study and Assembling of Multi-cylinder Petrol Engine
9. Dismantling, study and Assembling of Multi-cylinder Diesel Engine
10. Study of petrol engine fuel system
11. Study of diesel engine fuel system

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to dismantle and assemble the automotive components.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1.	Multi Cylinder Petrol Engine	2 Nos.
2.	Multi Cylinder Diesel Engine	2 Nos.
3.	Petrol and Diesel fuel systems	2 Nos. each
4.	Heavy duty vehicle chassis frame	1 No.
5.	Light duty vehicle chassis frame	1 No.
6.	Front axle	2 Nos.
7.	Rear axle	2 Nos.
8.	Differential	2 Nos.
9.	Clutch and Gear box (light duty, heavy duty)	2 Nos. each
10.	Steering systems with different gearboxes	2 Nos.

REFERENCES:

1. Heinz Hazler, “Modern Vehicle Technology”, Butterworth, London, 2005.
2. Devaradjane. Dr. G., Dr. M. Kumaresan, "Automobile Engineering", AMK Publishers, 2013.
3. Giri. N.K., “Automotive Mechanics” Khanna Publishers, New Delhi, 2005.

AE18412 STRENGTH OF MATERIALS LABORATORY

L	T	P	C
0	0	3	1.5

OBJECTIVES:

- To supplement the theoretical knowledge gained in Mechanics of Solids with practical testing for determining the strength of materials under externally applied loads. This would enable the student to have a clear understanding of the design for strength and stiffness

LIST OF EXPERIMENTS:

1. Tension test on a mild steel rod
2. Double shear test on Mild steel and Aluminium rods
3. Torsion test on mild steel rod
4. Impact test on metal specimen
5. Hardness test on metals – Vickers Microhardness, Brinnell and Rockwell Hardness Number
6. Deflection test on beams
7. Compression test on helical springs
8. Strain Measurement using Rosette strain gauge
9. Effect of hardening- Improvement in hardness and impact resistance of steels.
10. Tempering- Improvement Mechanical properties Comparison
    i. Unhardened specimen
    ii. Quenched Specimen and
    iii. Quenched and tempered specimen.
11. Microscopic Examination of
    i. Hardened samples and
    ii. Hardened and tempered samples.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to perform different destructive testing
- Ability to characteristic materials

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1.	Universal Tensile Testing machine with double 1 shear attachment (40 Ton Capacity)	1 No.
2.	Torsion Testing Machine (60 Nm Capacity)	1 No.
3.	Impact Testing Machine (300 Nm Capacity)	1 No.
4.	Brinell Hardness Testing Machine	1 No.
5.	Rockwell Hardness Testing Machine	1 No.
6.	Spring Testing Machine for tensile and compressive loads (2500 N)	1 No.
7.	Metallurgical Microscopes	3 Nos.
8.	Muffle Furnace ($800^{o}C$)	1 No.
9.	Vickers Microhardness	1 No

REFERENCES:

1. Strength of Materials Laboratory Manual, Anna University, Chennai - 600 025.
2. IS1786-2008, Specification for cold worked steel high strength deformed bars for concrete reinforcement, 2008.

AE18413 MANUFACTURING TECHNOLOGY LABORATORY

L	T	P	C
0	0	3	1.5

OBJECTIVES:

- Demonstration and study of the various machines. The Main emphasis will be on a complete understanding of the machine capabilities and processes.

LIST OF EXPERIMENTS:

UNIT I LATHE PRACTICE

a. Plain Turning
b. Taper Turning
c. Thread Cutting

Estimation of machining time for the above turning processes.

UNIT II DRILLING PRACTICE

a. Drilling
b. Tapping
c. Reaming

UNIT III MILLING

a. Surface Milling
b. Gear Cutting
c. Contour Milling

UNIT IV PLANNING AND SHAPING

a. Cutting Key Ways
b. Dove tail machining

UNIT V GRINDING

a. Grinding of Cylindrical components using cylindrical grinding
b. Grinding of cylindrical components using centreless grinding

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to use different machine tools to manufacturing gears.
- Ability to use different machine tools for finishing operations
- Ability to manufacture tools using cutter grinder

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1.	Lathe	15 Nos.
2.	Drilling Machine	1 No.
3.	Milling Machine	2 Nos.
4.	Planning Machine	1 No.
5.	Shaping Machine	2 Nos.
6.	Cylindrical Grinding Machine	1 No.
7.	Centreless Grinder	1 No.

REFERENCES:

1. Hajra Choudhury, "Elements of Workshop Technology", Vol. I and II, Media Promoters and Publishers Pvt., Ltd., Mumbai, 2005.
2. Nagendra Parashar B.S. and Mittal R.K., "Elements of Manufacturing Processes", Prentice-Hall of India Private Limited, 2007.