

B.E. Automobile Engineering

CURRICULUM AND SYLLABUS - I to IV Semesters

REGULATIONS 2022

CHOICE BASED CREDIT SYSTEM

SEMESTER I

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK				Total Periods	Prerequisite	Position
				L	T	P	C			
1	IP22151	Induction Programme (Common to all Branches)		--	--	--	--	--	--	
THEORY										
2	HS22151	Tamil Language and Heritage of Ancient Tamil Society (Common to all Branches)	HS	1	0	0	1	1	Nil	F
3	HS22152	Communicative English (Common to all Branches)	HS	2	1	0	3	3	Nil	F
4	MA22151	Applied Mathematics I (Common to all Branches except MR)	BS	3	1	0	4	4	Nil	F
5	PH22152	Engineering Physics (Common to AE, CE, ME, MN, MR)	BS	3	0	0	3	3	Nil	F
6	CY22152	Engineering Chemistry (Common to AE, ME, MN)	BS	3	0	0	3	3	Nil	F
7	BT22101	Biology for Engineers (Common to BT, AE, IT)	BS	3	0	0	3	3	Nil	F
8	AE22101	Computer Aided Engineering Drawing	ES	3	0	2	4	5	Nil	F
PRACTICAL										
9	CY22161	Chemistry Laboratory (Common to all Branches except AD, CS, IT)	BS	0	0	2	1	2	Nil	F
10	ME22162	Basic Mechanical Engineering Laboratory (Common to AE, BT, CH)	ES	0	0	2	1	2	Nil	F
Total				19	1	6	23	26		

(Recommended by BoS on 06.10.2022 and Approved by Academic Council on 08.10.2022)

SEMESTER II

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK				Total Periods	Prere quisite	Position
				L	T	P	C			
THEORY										
1	HS22251	Science and Technology in Ancient Tamil Society (Common to all Branches)	HS	2	0	0	2	2	Nil	F
2	HS22252	Technical English (Common to all Branches)	HS	2	1	0	3	3	Nil	F
3	MA22251	Applied Mathematics II (Common to all Branches except MR)	BS	3	1	0	4	4	Nil	F
4	PH22253	Engineering Materials (Common to AE, ME, MN)	BS	3	0	0	3	3	Nil	F
5	EE22151	Basic Electrical and Electronics Engineering (Common to all Branches except CH, EE, EC)	ES	3	0	0	3	3	Nil	F
6	AE22201	Production Processes	ES	3	0	0	3	3	Nil	F
7	IT22251	Computer Programming and Practice (Common to AE, BT, CE, CH)	ES	2	0	2	3	4	Nil	F
PRACTICAL										
8	PH22161	Physics Laboratory (Common to all Branches except BT)	BS	0	0	2	1	2	Nil	F
9	EE22111	Basic Electrical and Electronics Engineering Laboratory (Common to all Branches except EC)	ES	0	0	2	1	2	Nil	F
Total				18	2	6	23	26		

(Recommended by BoS on 06.10.2022 and Approved by Academic Council on 08.10.2022)

SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK				Total Periods	Prere quisite	Position
				L	T	P	C			
THEORY										
1	AE22301	Basic and Applied Thermodynamics	ES	3	1	0	4	4	Nil	F
2	AE22302	Fluid Mechanics and Hydraulic Machines	ES	3	0	0	3	3	Nil	F
3	AE22303	Manufacturing Technology and Systems	PC	3	0	0	3	3	Nil	F
4	AE22308	Automotive Fuels and Lubricants: Theory and Practices	PC	3	0	2	4	5	Nil	F
5	AE22309	Automotive Engines: Theory and Practices	PC	3	0	2	4	5	Nil	F
6	MA22355	Partial Differential Equations and Numerical Methods (Common to AE, BT, MN)	BS	3	1	0	4	4	Nil	F
PRACTICAL										
7	AE22311	Fluid Mechanics and Hydraulic Machines Laboratory	ES	0	0	2	1	2	Nil	F
8	AE22312	Production Technology Laboratory	PC	0	0	2	1	2	Nil	F
Total				18	2	8	24	28		

(Recommended by BoS – Meeting held on 12.04.2023)

SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK				Total Periods	Prerequisite	Position
				L	T	P	C			
THEORY										
1	AE22401	Applied Mechanics	ES	3	1	0	4	4	Nil	F
2	AE22402	Automotive Electrical, Electronics and Microcontroller Systems	PC	3	0	0	3	3	Nil	F
3	AE22403	Thermal Engineering and Heat Transfer	ES	3	1	0	4	4	AE22301	F
4	AE22408	Automotive Chassis Components: Theory and Practices	PC	3	0	2	4	5	Nil	F
5	AE22409	Mechanics of Solids: Theory and Practices	ES	3	0	2	4	5	Nil	F
6	GE22451	Environmental Sciences and Sustainability (Common to all Branches)	BS	3	0	0	3	3	Nil	F
PRACTICAL										
7	AE22411	Automotive Electrical, Electronics and Microcontroller Laboratory	PC	0	0	3	1.5	3	Nil	F
8	AE22412	Vehicle Maintenance Laboratory I	ES	0	0	3	1.5	3	Nil	F
Total				18	2	10	25	30		

(Recommended by BoS - Meeting held on 12.04.2023)

பாடத்தின்நோக்கங்கள்:

1. தமிழ் மொழியின் தோற்றம் பற்றியும், திணை கருத்துக்கள் வாயிலாக வாழ்வியல் முறைகளை பற்றியும் கற்றுக் கொள்வார்கள்.
2. இந்திய தேசிய சுதந்திர இயக்கத்தில் தமிழர்களின் பங்களிப்பு மற்றும் தமிழர்களின் மேலாண்மை முறைகளை பற்றியும் கற்றுக் கொள்வார்கள்.

அலகு I தமிழுக்கும் தொழில்நுட்ப கல்விக்கும் உள்ள தொடர்பு 3

மொழி மற்றும் பாரம்பரியம்:: இந்தியாவில் உள்ள மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழில் செம்மொழி இலக்கியம் - உ.வே. சுவாமிநாத ஐயர்., ஆறுமுக நாவலர் ஆகியோரின் பங்களிப்பு - தொழில் நுட்ப கல்வியில் தமிழ், மொழிக் கல்வியின் முக்கியத்துவம்.

LANGUAGE AND HERITAGE: Language families in India – Dravidian Languages – Tamil as a Classical language – Classical Literature in Tamil – Contribution of U. Ve. Saminathaiyar, Arumuka Navalar – Importance of Tamil language in technical education.

அலகு II திணை கருத்துக்கள் 9

திணை கருத்துக்கள் : - ஐந்து வகை நிலங்கள், தமிழர்களின் தாவரங்கள் மற்றும் விலங்கினங்கள், கடவுள்கள், தொழில்கள், வாழ்க்கை முறை, பண், கூத்து, உணவு முறை - தொல்காப்பியம் மற்றும் சங்க இலக்கியங்களில் இருந்து அகம் மற்றும் புறம் கருத்து - தமிழ் அறம் கருத்து - சங்க காலத்தில் கல்வி மற்றும் எழுத்தறிவு - பண்டைய நகரங்கள் மற்றும் சங்க காலத்தில் துறைமுகங்கள் - சங்க காலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - சோழ மன்னர்களின் வெளிநாட்டு வெற்றிகள்.

Thinai Concepts : - Five types of lands, animals, Gods, occupation, life styles, music, dance, food style, Flora and Fauna of Tamils - Agam and puram concept from Tholkappiyam and Sangam Literature – Aram concept of Tamil – Education and Literacy during Sangam Age – Ancient cities and Ports of Sangam Age – Export and Import during Sangam Age - Overseas Conquest of Cholas.

அலகு III தமிழரின் மரபு 3

இந்திய தேசிய சுதந்திர இயக்கம் மற்றும் இந்திய கலாச்சாரத்திற்கு தமிழர்களின் பங்களிப்பு:- சுப்ரமணிய பாரதி, வாஞ்சிநாதன், சுப்பிரமணிய சிவா, வீரபாண்டிய கட்டபொம்மன், வ. உ. சிதம்பரம் பிள்ளை, தீரன் சின்னமலை, மருது பாண்டிய சகோதரர்கள், பூலித் தேவர், திருப்பூர் குமரன், வீர மங்கை வேலுநாச்சியார், தமிழர் இலக்கியங்களில் மேலாண்மை கருத்துக்கள் (கி. மு. 500 முதல் கி. பி 200 வரை) - அகநானூறு, புறநானூறு, திருக்குறள் ஆகியவற்றில் மேலாண்மைக் கருத்துக்கள்.

பாடநெறிமுடிவுகள்:

பாடத்திட்டத்தின் வெளிப்பாடு		RBT LEVEL
CO1	மாணவர்கள் தமிழ் மொழி தோற்றம் பற்றி தெரிந்து கொள்வார்கள்.	1
CO2	தமிழர்களின் வாழ்வியல் முறைகளை தெரிந்து கொள்வார்கள்.	2
CO3	தமிழர்களின் சுதந்திர போராட்ட வீரர்களை பற்றியும், மேலாண்மை முறைகளை பற்றியும் தெரிந்து கொள்வார்கள்.	2

பாடநூல்கள்:

1. பொன். முத்துகுமாரன் (2002), “தமிழ் மரபு”, காந்தளகம், 68, அண்ணா சாலை, சென்னை 600 002.
2. பி. டி ஸ்ரீனிவாச ஐயங்கார் (தமிழக்கமும் திறனாய்வும்) புலவர் கா. கோவிந்தன் (1988), “தமிழர் வரலாறு (முதல் பகுதி”, திருநெல்வேலி தென்னிந்திய சைவ சித்தாந்த நூற்பதிப்பு கழகம்,154, TTK சாலை, சென்னை 18.
3. டாக்டர் கே கே பிள்ளை (2009), “தமிழக வரலாறு மக்களும் பண்பாடும்”, உலக தமிழாராய்ச்சி நிறுவனம், தரமணி , சென்னை 600113
4. முனைவர். ச. இராஜேந்திரன் (2004), "தமிழில்சொல்லாக்கம்", தஞ்சாவூர் தமிழ் பல்கலைக் கழகம்வெளியீடு.

COURSE ARTICULATION MATRIX

COs													PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
CO1			3		3	3	2		3	3		2		
CO2			3	2	3	3		1	3	3				
CO3			3	2	3	3	2		3	3		2		
Average			3	2	3	3	2	1	3	3		2		

COURSE OBJECTIVES:

1. Enable learners to interact fluently on everyday social contexts.
2. Train learners to engage in conversations in an academic/scholarly setting.
3. Instil confidence in learners to overcome public speaking barriers.
4. Develop learners' ability to take notes and in the process, improve their listening skills.
5. Enhance learners' reading skill through reading text passages for comprehension and contemplation.
6. Improve learners' skill to write on topics of general interest and drafting correspondences for general purposes.

UNIT I**9**

Listening - short video clips - conversational scenes from 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 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:**

Course Outcomes		RBT LEVEL
Upon successful completion of the course, the students should be able to:		
CO1	Acquire adequate vocabulary for effective communication.	3
CO2	Listen to formal and informal communication and read articles and infer meanings from specific contexts from magazines and news papers.	3
CO3	Participate effectively in informal/casual conversations; introduce themselves and their friends and express opinions in English.	4
CO4	Comprehend conversations and short talks delivered in English.	6
CO5	Write short write-ups and personal letters and emails in English.	6

REFERENCES:

1. Department of English, Anna University, "Mindscapes: English for Technologists and Engineers". Orient Black Swan, Chennai, 2017.
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.

Web Link:

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

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.										3				
2.										3				
3.										3				
4.										3				
5										3				
Average										3				

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

COURSE OBJECTIVES:

The student should be made to:

1. Compute Eigen values and Eigen vectors and use in diagonalization and in classifying real quadratic forms.
2. Study differential calculus and its applications to relevant Engineering problems.
3. Compute derivatives using the chain rule or total differentials.
4. Understand the rotation of two dimensional geometry using definite integrals.
5. Acquaint with the Mathematical tools needed in evaluating multiple integrals and their usage.

UNIT I MATRICES (9+3)

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 APPLICATION OF DIFFERENTIAL CALCULUS (9+3)

Curvature and radius of Curvature - Centre curvature - Circle of curvature - Evolutes - Envelopes - Evolute as Envelope of Normals.

UNIT III DIFFERENTIAL CALCULUS FOR SEVERAL VARIABLES (9+3)

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 IV APPLICATION OF DEFINITE INTEGRALS (9+3)

Integration by Parts - Bernoulli's formula for integration - Definite integrals and its Properties - Solids of Revolution - Disk Method - Washer Method - Rotation about both x and y axis and Shell method.

UNIT V MULTIPLE INTEGRALS (9+3)

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:

Course Outcomes		RBT LEVEL
Upon completion of the course, students will be able to:		
CO1	Solve the Eigen value problems in matrices.	3
CO2	Apply the basic notion of calculus in Engineering problems and to tackle for different geometries.	3
CO3	Perform calculus for more than one variable and its applications in Engineering problems.	3
CO4	Apply definite integrals for design of three dimensional components.	3
CO5	Evaluate multiple integral in Cartesian and polar coordinates.	3

TEXTBOOKS:

1. Erwin Kreyszing, Herbert Kreyszing, Edward Norminton, "Advanced Engineering Mathematics", 10th Edition, John Wiley, 2015.
2. Grewal. B.S, Grewal. J.S., "Higher Engineering Mathematics", 43rd Edition, Khanna Publications, Delhi, 2015.

REFERENCES:

1. Bali. N.P, and Manish Goyal, "A Text book of Engineering Mathematics", Ninth Edition, Laxmi Publications Pvt. Ltd., 2014.
2. Glyn James, "Advanced Modern Engineering Mathematics", 4th Edition, Pearson Education, 2016.
3. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2013.

Web Link:

1. <https://home.iitk.ac.in/~peeyush/102A/Lecture-notes.pdf>
2. <https://www.sydney.edu.au/content/dam/students/documents/mathematics-learning-entre/integration-definite-integral.pdf>

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	3	3	3	3								3	2	
2.	3	3										3		
3.	3	3	3	3								3	2	
4.	3	3										3	1	
5.	3	3	2	2								3	1	
Average	3	3	2.67	2.67								3	1.5	

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

COURSE OBJECTIVES:

1. To enhance the fundamental knowledge in Physics and its applications relevant to various Streams of Engineering.

UNIT I MECHANICS 9

Moment of inertia (M.I) - Radius of gyration - Theorems of M. I - M.I of circular disc, solid cylinder, hollow cylinder, solid sphere and hollow sphere - K.E of a rotating body - M.I of a diatomic molecule - Rotational energy state of a rigid diatomic molecule - centre of mass - conservation of linear momentum - Relation between Torque and angular momentum - Torsional pendulum.

UNIT II PROPERTIES OF MATTER AND THERMAL PHYSICS 9

Fluid - definition, distinction between solid and fluid - Units and dimensions - Properties of fluids - density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapour pressure, capillarity and surface tension - Fluid statics: concept of fluid static pressure, absolute and gauge pressures - pressure measurements by manometers - forces on planes - centre of pressure - buoyancy and floatation.

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

UNIT III ACOUSTICS AND ULTRASONICS 9

Classification of Sound - decibel - Weber-Fechner law - Sabine's formula - derivation using growth and decay method - Absorption Coefficient and its determination - factors affecting Acoustics of buildings and their remedies. Production of Ultrasonics by Magnetostriction and Piezoelectric methods - Acoustic grating - Non-Destructive Testing - pulse echo system through transmission and reflection modes - A, B and C - scan displays, medical applications - Sonogram.

UNIT IV PHOTONICS AND FIBER OPTICS 9

Photonics: population of energy levels, Einstein's A and B coefficients derivation - resonant cavity, optical amplification (qualitative) - Nd-YAG laser - CO₂ Laser - Applications.

Fiber optics: principle, numerical aperture and acceptance angle - types of optical fibers (material, refractive index, and mode) - losses associated with optical fibers - Fiber optic communication - fiber optic sensors: pressure and displacement - Endoscope.

UNIT V CRYSTAL PHYSICS 9

Single crystalline, polycrystalline and amorphous materials - single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices - interplanar

distances - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structure (qualitative) - crystal imperfections: point defects, line defects - Burger vectors, stacking faults.

TOTAL: 45 PERIODS

OUTCOMES:

Course Outcomes		RBT LEVEL
CO1	Gain knowledge in Mechanics.	2
CO2	Evaluate the concepts of properties of matter and thermal physics.	3
CO3	Learn to solve the issues related to defects in the buildings due to acoustic design and the significance of ultrasonic waves.	3
CO4	Develop an understanding about photonics and Fiber Optic communication system.	2
CO5	Classify and demonstrate the fundamentals of crystals and their defects.	3

TEXTBOOKS:

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

REFERENCES:

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

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	3	2		2						1			3	2
2.	3	2		2						1		2	2	2
3.	3		2		3	2	1			1				
4.	3		2		3	2	1			1		2	2	2
5.	3	2	2							1			1	
Average	3	2	2	2	3	2	1			1		2	2	2

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

COURSE OBJECTIVES:

1. To make the students to understand the importance of electrochemistry.
2. To appreciate the concepts of photochemistry and spectroscopy.
3. To impart knowledge on nanotechnology.
4. To understand the applications of engineering materials.
5. To familiarize the manufacture of fuels.

UNIT I ELECTROCHEMISTRY 9

Electrodes and electrochemical cells - electrode potential, standard electrode potential, single electrode potential and its determination, types of electrodes - calomel, quinhydrone and glass electrode. Nernst equation - determination of pH of a solution by using quinhydrone and glass electrode. Electrochemical series and its applications. Batteries - Primary (dry battery) and secondary batteries (Lead - acid storage battery and Lithium ion battery) and next generation batteries.

UNIT II PHOTOCHEMISTRY 9

Laws of photochemistry - Grotthuss-Draper law, Stark-Einstein law and Lambert Beer Law - determination iron by spectrophotometer. Quantum efficiency - Photo physical processes - internal conversion, inter-system crossing, fluorescence, phosphorescence and photosensitization-quenching of fluorescence and its kinetics, Stern - Volmer relationship. Applications of photochemistry.

UNIT III NANOCHEMISTRY 9

Basics and scale of nanotechnology, different classes of nanomaterials, Distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Synthesis of nanomaterials, fabrication (lithography) and its applications - Basics of nanophotonics and quantum confined materials (surface plasmon resonance).

UNIT IV ENGINEERING MATERIALS 9

Abrasives: definition, classification, grinding wheel, abrasive paper and cloth. Refractories: definition, characteristics, classification, properties - refractoriness and RUL, dimensional stability, thermal spalling, thermal expansion, porosity; Manufacture of alumina, magnesite and silicon carbide, Lubricants - classification, properties and applications. Basics of composite materials, properties and applications.

UNIT V FUELS AND COMBUSTION 9

Fuel: Introduction - classification of fuels - calorific value - higher and lower calorific values - 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 (ORSAT Method) - Uses of catalytic converters.

TOTAL: 45 PERIODS

OUTCOMES:

Course Outcomes		RBT LEVEL
On the successful completion of the course, students will be able to:		
CO1	Identify electrochemical cells, corrosion and fundamental aspects of batteries.	2
CO2	Interpret the photochemical reactions and make use of spectroscopic techniques.	2
CO3	Realize the structures, properties and applications of nanoparticles.	2
CO4	Acquire knowledge on the basic properties of engineering materials and its applications.	2
CO5	Illustrate the various types of fuels, its calorific value and significance of flue gas analysis.	3

TEXTBOOKS:

1. Jain P.C., and Monica Jain, "Engineering Chemistry", Dhanpat Rai & Sons, New Delhi, 17th Edition, 2018.
2. 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. Puri B.R., Sharma L.R., Pathania M.S., "Principles of Physical Chemistry", 47th edition, Vishal Publishing C., Jalandhar, 2018.
3. Sony P.L., and Chawla H.M., "Text Book of Organic Chemistry", Sultan Chand and Sons Publishers, New Delhi, 2000.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	3	3	2	3								3		
2.	3	3				3	3					3	3	
3.	3	3	2			3	3	3				3	2	
4.	3	3		3			3	3				3	1	
5.	3	3		3		3		3				3		
Average	3	3	2	3		3	3	3				3	2	

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

UNIT V REGULATIONS**8**

International and National regulatory bodies - Radiation in the electromagnetic spectrum, Electronic devices, Cell phones, Smart meters, Medical use of radiation and Nuclear power plants, Labeling Regulatory Requirements for Medical Devices, Ethics and privacy cameras and surveillance system, Regulation of Human Cloning and Embryonic Stem Cell Research, Privacy and ethical issues in 3D whole body scanning, Regulation of emerging gene technologies.

TOTAL: 45 PERIODS**OUTCOMES:**

Course Outcomes		RBT LEVEL
After completion of this course the students will be able to:		
CO1	Distinguish the structure and function of prokaryotic and eukaryotic cells.	4
CO2	Explains the usage of biological principles in engineering.	2
CO3	Integrate the concepts of biology with engineering through case studies.	3
CO4	Describe the influence of biologically inspired materials/machines/devices on environment and society.	2
CO5	Understand the regulations, ethics, security and safety of engineering applications.	2

TEXTBOOKS:

1. Johnson, A.T., "Biology for engineers", CRC Press, 2011.
2. Khandpur, R.S., "Biomedical instrumentation: Technology and applications", Vol. 1, New York: Mcgraw-hill, 2005.
3. Salvendy, G., "Handbook of human factors and ergonomics", 4th edition, John Wiley & Sons, 2012.
4. Vaccari, D.A., Strom, P.F., & Alleman, J.E., "Environmental biology for engineers and scientists", Vol. 7, p. 242, New York: Wiley-Interscience, 2006.
5. Waite, G.N., & Waite, L.R. "Applied cell and molecular biology for engineers", McGraw-Hill Education, 2007.

REFERENCES:

1. Kindt, T.J., Goldsby, R. A., Osborne, B. A., & Kuby, J., "Kuby immunology", Macmillan, 2007.
2. Nelson, D.L., Lehninger, A.L., & Cox, M.M., "Lehninger principles of biochemistry", Macmillan, 2008.
3. Subrahmanyam, S.A., "Textbook Of Human Physiology", S. Chand Limited, 1987.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	2											1		
2.	3	2				1							1	1
3.		2	1			2				2		1		
4.		1		2			3						1	1
5.						3	3	3				1	1	1
Average	2.5	1.7	1	2		2	3	3		2		1	1	1

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

COURSE OBJECTIVES:

1. To introduce students concept of Engineering Drawing and build their ability to read drawings.
2. To interpret the position and form of simple geometry, culminating into understanding of simple technical assemblies.
3. To provide the students with the fundamentals of Computer Aided Drafting (CAD) software package to draw 2D projections and 3D models.

UNIT 0 ENGINEERING DRAWING FUNDAMENTALS (Not for Examination) (2+3)

Drawing standard: BIS, Lettering, ASME Y14.5 dimensioning and tolerancing, Types of lines, Conventions, Geometrical constructions using drawing tools. Study the capabilities of CAD software for Drafting and Modeling - Coordinate systems - Drafting of simple geometries like polygon and general multi-line figures. Construction of Title block manually and CAD software.

UNIT I CURVES AND PROJECTION OF POINTS AND LINES (6+12)

Construction and drafting of Engineering Curves: Cycloid, Involute of Circle and Pentagon. Projection: Principal Planes, Projections of Points using Four Angles of Projection - Projection of Straight Lines parallel and inclined to one or both planes using Rotating Line Method in First Angle Projection.

Computer Drafting of Projection of Straight lines using Rotating Line Method in First Angle Projection.

UNIT II PROJECTION OF PLANES AND SOLIDS (6+12)

Projection of Plane Figures (Manual and using CAD software) - Inclined to any one Principal Plane.

Projections and drafting of orthographic views of Solids (Manual and using CAD software) - Simple Solids (Prisms, Pyramids, Cone and Cylinder) when the axis is inclined to any one Principal Plane.

UNIT III SECTION OF SOLIDS & DEVELOPMENT OF SURFACES (6+12)

Introduction to Conic sections (Manual and using CAD software) - Sections of Solids and drafting the sectional views of simple vertical solids when the solids are cut by section plane inclined to any one Principal Plane.

Development of Surfaces (Manual and using CAD software) of simple solids.

UNIT IV PICTORIAL PROJECTION (6+12)

Introduction to Pictorial Projection - Isometric Projection - Principle, Isometric Planes, Isometric Scales - Isometric Projection of simple solids (Manual and using CAD software).

Free Hand Drawing - Orthographic Projection - Orthographic views of simple blocks from their Isometric view, Isometric view of simple blocks from their Orthographic views.
Creation of 3D models of Simple Solids using Isometric Principles from orthographic views using CAD software.

UNIT V PERSPECTIVE PROJECTION (4+9)

Perspective Projection of solids in simple positions with respect to projection planes - Creation of 3D models of simple solids by visual ray method (Manual and using CAD software).

TOTAL(L:30+T:60): 90 PERIODS

OUTCOMES:

Course Outcomes		RBT LEVEL
CO1	Perform the sketching of basic geometrical constructions and Draw orthographic projections of lines, plane surfaces and solids.	3
CO2	Draw the views of sectioned surfaces and development of surfaces of simple solids.	3
CO3	Prepare isometric and perspective sections of simple solids.	3
CO4	Draw the 2D sketches of lines, planes and simple solids from their orthographic projections using the different commands in CAD software.	3
CO5	Model the 3D views of solids applying isometric and perspective projection principles using the different commands in CAD software.	4

TEXTBOOKS:

1. Bhatt N.D, Panchal Pramod V.M and Ingle R, "Engineering Drawing", Charotar Publishing House, 2014.
2. Gopalakrishna K.R., Sudhir Gopalakrishna, "Textbook Of Computer Aided Engineering Drawing", Subhas Publications, 2017.

REFERENCES:

1. George Omura and Brian C. Benton, "Mastering AutoCAD 2016 and AutoCAD LT 2016: Autodesk Official press", Wiley Publishers, 2015.
2. Gopalakrishna K.R, "Engineering Drawing" (Vol. I & II), Subhas Publications, 2017.
3. Gowri S and Jeyapoovan T, "Engineering Graphics", Vikas Publishing House Pvt. Ltd., 2019.
4. James D. Bethune, "Engineering Graphics with AutoCAD 2017", PEACHPIT Press, 2016.
5. Natrajan K.V, "A Textbook of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2006.
6. Venugopal. K and Prabhu Raja. V, "Engineering Graphics", New Age International (P) Limited, 2009.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	3	3	3	3	3					3			3	2
2.	3	3	3	3	3					3			2	2
3.	3	3	3	3	3					3			2	2
4.	3	3	3	3	3					3				
5.	3	3	3	3	3					3			3	3
Average	3	3	3	3	3					3			2.5	2.25

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

COURSE OBJECTIVES:

The objective of the Chemistry Laboratory is to acquaint the students with the basic phenomenon/concepts of chemistry, the student face during course of their study in the industry and engineering field.

1. To appreciate the need and importance of water quality parameters for industrial and domestic use.
2. To gain the knowledge on electrochemical instrumentation techniques like potential and current measuring used in electrochemistry applications.
3. To impart knowledge on separation of components using paper chromatography.
4. To enhance the thinking capability about polymer and properties like molecular weight.

LIST OF EXPERIMENTS:**(Minimum 8 Experiments)**

1. Determination of DO content of water sample by Winkler's method.
2. Determination of strength of given hydrochloric acid using pH meter.
3. Determination of strength of acids in a mixture using conductivity meter.
4. Estimation of iron content of the water sample using spectrophotometer (phenanthroline / thiocyanate method).
5. Determination of total, temporary & permanent hardness of water by EDTA Method.
6. Estimation of iron content of the given solution using potentiometer.
7. Determination of alkalinity in water sample.
8. Determination of Single electrode potential.
9. Separation of components from a mixture of red and blue inks using Paper chromatography.
10. Determination of molecular weight of polymer by using Ostwald's/Ubbelohde viscometer.

TOTAL: 30 PERIODS**OUTCOMES:**

Course Outcomes		RBT LEVEL
Upon successful completion of the course, students should be able to:		
CO1	Distinguish hard and soft water, solve the related numerical problems on water, purification and its significance in industry and daily life.	3
CO2	Interpret the knowledge of instruments to measure potential and current related parameters.	2

CO3	Demonstrate the basic principle for separation of components using paper chromatography.	3
CO4	Evaluate the molecular weight of polymer using Ostwald's/Ubbelohde viscometer.	3

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Common apparatus: Pipette, Burette, conical flask, porcelain tile, dropper (each 30 nos)

1	Iodine flask	30 Nos
2	pH meter	5 Nos
3	Conductivity meter	5 Nos
4	Spectrophotometer	5 Nos
5	Oswald/Ubbelohde Viscometer	30 Nos

REFERENCES:

1. Daniel R. Palleros, "Experimental organic chemistry", John Wiley & Sons, Inc., New York 2001.
2. Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., "Vogel's Textbook of practical organic chemistry", LBS Singapore 1994.
3. Jeffery G.H., Bassett J., Mendham J. and Denny Vogel's R.C, "Text book of quantitative analysis chemical analysis", ELBS 5th Edn. Longman, Singapore publishers, Singapore, 1996.
4. Kolthoff I.M., Sandell E.B. et al. "Quantitative chemical analysis", Mcmillan, Madras 1980.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	3	2				3	3	3	1		1	2	1	1
2.	3	2	1			3	3	3					1	1
3.	3					3	3					2	1	1
4.	3			1		3	3	3					1	1
Average	3	2	1	1		3	3	3	1		1	2	1	1

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

**ME22162 BASIC MECHANICAL ENGINEERING
LABORATORY**

**L T P C
0 0 2 1**

(Common to AE, BT, CH)

COURSE OBJECTIVES:

1. To provide exposure and hands on experience to the students on various basic mechanical engineering processes.

LIST OF EXPERIMENTS:

1. Welding - Butt joint and lap joint using Electric Arc and Gas welding.
2. Machining - Turning and facing using Centre Lathe.
3. Sheet metal work - Making of a cylinder using GI sheet and finishing using rivets.
4. Drilling and Tapping - Drilling of holes precisely and making internal threads by Tapping for various sizes.
5. Casting - Mould preparation using simple solid pattern and casting.
6. Plumbing - Making household pipeline PVC pipes, valves, taps, couplings, unions, reducers, elbows.
7. Fuel testing - Determination of Flash point and Fire point of fuels.
8. Refrigeration and Air Conditioning - Determination of Coefficient of Performance (COP) of refrigeration and air conditioning systems.
9. Automation - Basic pneumatic circuit using single and double acting cylinder.
10. 3D printing - Demonstration of printing of simple solids using Additive Manufacturing/3D printing.

TOTAL: 30 PERIODS

OUTCOMES:

Course Outcomes		RBT LEVEL
CO1	Students will be able to <i>Fabricate</i> components by various manufacturing processes.	3
CO2	Students will be able to <i>Prepare</i> pipeline for a given application.	3
CO3	Students will be able to <i>Evaluate</i> the ignition properties of fuels.	3
CO4	Students will be able to <i>Determine</i> the efficiency of refrigeration and air conditioning systems.	3
CO5	Students will be able to <i>Understand</i> the principles of low cost automation using pneumatic circuits.	2
CO6	Students will be able to <i>Understand</i> the principle of additive manufacturing/3D printing.	2

REFERENCES:

1. Anthony Esposito, "Fluid Power with Applications", Pearson Education, 7th edition, 2009.
2. Bawa H.S., "Workshop Practice", Tata McGraw Hill Publishing Company Limited, 2007.
3. Ian Gibson, David W Rosen, Brent Stucker., "Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010.

4. Jeyachandran K., Natarajan S. & Balasubramanian S., "A Primer on Engineering Practices Laboratory", Anuradha Publications, 2007.
5. Jeyapoovan T., Saravanapandian M. & Pranitha S., "Engineering Practices Lab Manual", Vikas Publishing House Pvt.Ltd, 2006.
6. Mechanical engineering practices lab manual, SVCE, 2022.
7. Rajput. R.K., "Thermal Engineering", Laxmi Publications, Tenth Edition, 2017.

LIST OF EQUIPMENT REQUIRED FOR A BATCH OF 30 STUDENTS

S. No.	Equipment	Qty.
1	Welding transformers, booths with exhaust and Welding accessories like welding shield, chipping hammer, wire brush, etc.	5 sets
2	Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.	2 sets
3	Centre lathe	2
4	Standard GI sheet working tools	10 sets
5	Drilling machine	2
6	Taps (various sizes)	5
7	Furnace	1
8	Moulding tools and accessories	5 sets
9	Assorted components for plumbing consisting of pipes, couplings, unions, elbows, plugs and other fittings.	15 sets
10	Flash point and fire point apparatus	1
11	Refrigeration and Air conditioning testing setup	1
12	Basic Pneumatic trainer kit	1
13	3D printing machine	1

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	2												1	1
2.	2													
3.	2												3	
4.	2												2	
5.	1				2									1
6.	1				2								2	2
Average	1.7				2								2	1.3

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

(Common to all Branches)

பாடத்தின் நோக்கங்கள்:

1. அறிவியலில் தமிழின் பயன்பாடு பற்றி தெரிந்து கொள்வார்கள்.
2. தொழில்நுட்பத்தில் தமிழ் பாரம்பரியத்தின் தாக்கம் பற்றி அறிந்து கொள்வார்கள்.

அலகு I**அறிவியலில் தமிழ்**

5

கருவி உருவாக்கம் - ஆராய்ச்சி மேம்பாடு - கல்வி வளர்ச்சி - அறிவியல் தமிழ் சொற்கள் உருவாக்கம்.

Scientific Tamil : Tool Development - Research Development - Educational Development - Scientific Tamil words Creation.

அலகு II**தொழில் நுட்பத்தில் தமிழ்**

25

வடிவமைப்பு மற்றும் கட்டுமான தொழில்நுட்பம் : சங்க காலத்தில் கட்டுமானப் பொருட்கள் - சோழர்களின் பெரிய கோவில்கள் மற்றும் பிற வழிபாட்டு தலங்கள் - பல்லவர்களின் சிற்பங்கள் மற்றும் கோவில்கள் (மாமல்லபுரம்) - நாயக்கன் கால கோவில்கள் (மதுரை மீனாட்சி அம்மன் கோவில்), திருமலை நாயக்கர் மஹால், செட்டி நாட்டு வீடுகள்.

Design and Construction Technology : Building materials in Sangam age – Great temples of Cholas and other worship places – Sculptures and Temples of Pallavas (Mamallapuram) – Temples of Nayakas period (Madurai Meenakshi Amman Temple), Thirumalai Nayakar Mahal, Chetti Nadu Houses.

உற்பத்தி தொழில்நுட்பம் : கப்பல் கட்டும் கலை, உலோகவியல் ஆய்வுகள், தங்கம், தாமிரம், இரும்பு பற்றிய அறிவு - தொல்பொருள் சான்றுகள் - சுட்டக் களிமண் மணிகள், சங்கு மணிகள், எலும்பு மணிகள்.

Manufacturing Technology : Art of Ship building, Metallurgical studies, Knowledge about Gold, Copper, Iron – Archeological evidences – Terracotta beads, Shell beads, Bone beads.

விவசாயம் மற்றும் நீர்ப்பாசன தொழில்நுட்பம் : அணைகள், ஏரிகள், குளங்கள், மதகுகள், சோழர் கால குழுவி தூம்பு ஆகியவற்றின் முக்கியத்துவம் - கால்நடை பராமரிப்பு, கால்நடைகளின் பயன்பாட்டிற்காக வடிவமைக்கப்பட்ட கிணறுகள். விவசாயம் மற்றும் வேளாண் செயலாக்கம் - கடல் பற்றிய அறிவு - மீன்பிடித்தல், முத்து குளித்தல், சங்கு சேகரித்தல்.

Agriculture and Irrigation Technology: Dams, Tank, ponds, sluice, Significance of Kumuzhi Thoombu of Cholas period- Animal Husbandry, Wells designed for cattle use. Agriculture and Agro processing, - Knowledge about Sea – Fisheries, Pearl, Conche diving.

தமிழ் கணினி: அறிவியல் தமிழ் வளர்ச்சி - தமிழ் கணினி, தமிழ் புத்தகங்களின் டிஜிட்டல் மயமாக்கல், தமிழ் டிஜிட்டல் நூலகம், தமிழ் மென்பொருள் உருவாக்கம் - தமிழ் மெய்நிகர் அகாடமி - சொற்குவை திட்டம்.

Tamil Computing : Development of Scientific Tamil – Tamil Computing, Digitization of Tamil books, Tamil Digital Library, Development of Tamil Softwares – Tamil virtual Academy – Sorkuvai project.

தமிழின் எதிர்காலமும் தகவல் தொழில்நுட்பமும்- உலகமயமாக்கலும் தகவல் தொழில் நுட்பமும் - கணினிக்கு தமிழ் கற்று கொடுத்தல் - தமிழ் மொழித் தொழில் நுட்பத்தில் வளங்கள்.

Future of Tamil and Information Technology- Globalization and Information Technology - Teaching Tamil for Computer - Resources in Tamil Language Technology.

TOTAL: 30 PERIODS

பாடநெறிமுடிவுகள்:

பாடத்திட்டத்தின் வெளிப்பாடு		RBT LEVEL
CO1	அறிவியலில் தமிழ் மொழியின் பயன்பாடு பற்றி தெரிந்து கொள்வார்கள்.	2
CO2	பல்வேறு தொழில்நுட்பத்தில் தமிழ் மொழியின் தாக்கம் பற்றி அறிந்து கொள்வார்கள்.	3

பாடநூல்கள்:

1. டாக்டர், வா.செ .குழந்தைசாமி (1985), " அறிவியல் தமிழ் " , பாரதி பதிப்பகம், 126/108, உஸ்மான் சாலை, தியாகராய நகர், சென்னை 600017.
2. சுப. திண்ணப்பன், (1995), "கணினியும்தமிழ்கற்பித்தலும்", புலமைவெளியீடு, 38-Bமண்ணத்தோட்டத்தெரு, ஆழ்வார்பேட்டை, சென்னை 600018.
3. மு. பொன்னவைக்கோ, (2003), "வளர்தமிழில் அறிவியல்-இணையத்தமிழ்", அனைத்திந்திய அறிவியல்தமிழ்க்கழகம், தஞ்சாவூர் 615 005.
4. துரை. மணிகண்டன், (2008), "இணையமும்தமிழும்", நல்நிலம்பதிப்பகம், 7-3, சிமேட்லிசாலை, தியாகராயநகர், சென்னை 600 017.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.			3	2	3	3	2	2	3	3		2		
2.			3	2	3	3	2		3	3		2		
Average			3	2	3	3	2	2	3	3		2		

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

COURSE OBJECTIVES:

1. Enable learners to define and understand technical communication and scientific writing.
2. Expose learners to the technicalities of seminar presentation, group discussion, and public speaking.
3. Develop learners' writing skills for scientific and documenting purposes.
4. Improve learners' ability to draft correspondences for business purposes.
5. Cultivate learners' ability to holistically understand the nuances 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**OUTCOMES:**

Course Outcomes		RBT LEVEL
Upon successful completion of the course, the students should be able to:		
CO1	Understand the nuances of technical communication and scientific writing.	3
CO2	Present papers and give seminars.	6
CO3	Discuss in groups and brainstorm.	6
CO4	Draft business correspondences and write for documenting purposes.	6
CO5	Face job interviews with confidence.	6

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. Herbert A J, "The Structure of Technical English", Longman, 1965.
4. Murphy, Raymond, "Intermediate English Grammar with Answers", Cambridge University Press, 2000.
5. Thomson, A.J., "Practical English Grammar 1 & 2", Oxford, 1986.

Web Link:

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

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.										3				
2.										3				
3.										3				
4.										3				
5.										3				
Average										3				

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

Conformal mapping - Mapping by functions $W = Z + C$, CZ , $1/Z$, Z^2 - Joukowski's transformation - Bilinear transformation.

UNIT V COMPLEX INTEGRATION (9+3)

Cauchy's integral theorem - Cauchy's integral formula - Taylor's and Laurent's series expansions - Singular points - Residues - Cauchy's Residue theorem - Application of residue theorem for evaluation of real integrals - Use of circular contour and semi-circular contour.

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

OUTCOMES:

Course Outcomes		RBT LEVEL
Upon completion of the course, students will be able to:		
CO1	Interpret the fundamentals of vector calculus and execute evaluation of line, surface and volume integrals using Gauss, Stokes and Green's theorems.	3
CO2	Solve first order linear, homogeneous differential equations and use series solution method to solve second order differential equations.	3
CO3	Determine the methods to solve differential equations using Laplace transforms and Inverse Laplace transforms.	3
CO4	Explain Analytic functions and Categorize transformations.	3
CO5	Perform Complex integration to evaluate real definite integrals using Cauchy integral theorem and Cauchy's residue theorem.	3

TEXTBOOKS:

1. Erwin Kreyszing, Herbert Kreyszing, Edward Norminton, "Advanced Engineering Mathematics", 10th Edition, John Wiley, 2015.
2. Grewal. B.S, Grewal. J.S, "Higher Engineering Mathematics", 43rd Edition, Khanna Publications, Delhi, 2015.

REFERENCES:

1. Bali. N.P., and Manish Goyal, "A Textbook of Engineering Mathematics", 9th Edition, Laxmi Publications Pvt. Ltd., 2014.
2. Dass, H.K., and Rajnish Verma, "Higher Engineering Mathematics", S. Chand Private Ltd., 2011.
3. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2013.

Web Link:

1. <https://nptel.ac.in/courses/111/105/111105134/>
2. <https://nptel.ac.in/courses/111/105/111105121/>

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	3	3	2	2								3	1	1
2.	3	3	3	3								3	3	3
3.	3	3	3	3								3	3	3
4.	3	3										3		
5.	3	3										3	1	
Average	3	3	2.33	2.33								3	2	2.3

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

COURSE OBJECTIVES:

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

UNIT I PHASE DIAGRAMS AND NON-FERROUS ALLOYS 8

Solid solutions - Hume Rothery's rules - Phase rule - single component system - one-component system of Iron - binary phase diagrams - Isomorphous systems - Tie-line rule - the Lever rule - application to Isomorphous system - Cu - Ni system - Eutectic phase diagram - Peritectic phase diagram - other invariant reactions - Cu - Zn system -Microstructural change during cooling.

UNIT II FERROUS ALLOYS AND HEAT TREATMENT 10

Fe-C 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 laws -phase transformations - T-T-T-diagram for eutectoid steel - Pearlite, Bainitic and Martensitic transformations - tempering of Martensitic. **Heat treatment of steels:** Annealing - Normalizing - Quenching and Tempering - Casehardening - 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 experiment) - Hall effect (derivation and experiment).

UNIT IV DIELECTRIC, MAGNETIC AND SUPERCONDUCTING MATERIALS 10

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.

Magnetic materials: 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 T_c and High T_c (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.

TOTAL: 45 PERIODS

OUTCOMES:

Course Outcomes		RBT LEVEL
Students will be able to:		
CO1	Demonstrate about the Phase diagrams of various alloys	3
CO2	Enhance knowledge about the heat treatment of alloys and alloy steels.	3
CO3	Demonstrate an understanding of various properties of Semiconducting materials and their internal structure	3
CO4	Summarize basics of magnetism and superconductivity. Explore a few of their technological applications. Analyse the properties of dielectric materials and apply them in various fields.	3
CO5	Develop an understanding about ceramics and various new engineering materials	2

TEXTBOOKS:

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

REFERENCES:

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

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	3	2	2							1		2	2	2
2.	3	2	2	2	2	2			2	1		2	2	2
3.	3					2				1		2	2	2
4.	3		2			2				1		2	2	2
5.	3	2	2	2	2	2			2	1		2	2	2
Average	3	2	2	2	2	2			2	1		2	2	2

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

OUTCOMES:

Course Outcomes		RBT LEVEL
CO1	Compute the electric circuit parameters for simple problems.	4
CO2	Understand the construction and characteristics of different electrical machines.	4
CO3	Describe the fundamental behavior of different semiconductor devices and circuits.	4
CO4	Design basic digital circuits using Logic Gates and Flip-Flops.	4
CO5	Analyze the operating principle and working of measuring instruments.	4

TEXTBOOKS:

1. Kothari DP and I.J Nagrath, "Basic Electrical and Electronics Engineering", Second Edition, McGraw Hill Education, 2020.
2. Mehta VK, "Principles of Electronics", S. Chand & Company Ltd, 2010.
3. Sedha R.S., "A Text Book of Applied Electronics", S. Chand & Co., 2014.

REFERENCES:

1. Mahmood Nahvi and Joseph A. Edminister, "Electric Circuits", Schaum' Outline Series, McGraw Hill, Fourth Edition, 2007.
2. Mehta V.K., "Principles of Electronics", S. Chand & Company Ltd, 2010.
3. Morris Mano M, "Digital Logic & Computer Engineering", Prentice Hall of India, 2004.
4. Muthu Subramanian R, Salivahanan S, and Muraleedharan K A, "Basic Electrical, Electronics Engineering", Tata McGraw Hill, 2013.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	3	3	3	3			2					2	1	1
2.	3	3	3	3			2					2	2	2
3.	3	3	3	3			2					2	2	2
4.	3	3	3	3			2					2	1	1
5.	3	3	3	3			2					2	1	1
Average	3	3	3	3			2					2	1.4	1.4

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

OUTCOMES:

Course Outcomes		RBT LEVEL
Students will be able to:		
CO1	Select the best casting process for a component to be manufactured based on the economy of manufacture and its application	3
CO2	Identify the best joining process involved in the fabrication of components based on the simplicity, application and cost	3
CO3	Choose the best metal forming or powder metallurgy process for a component to be manufactured based on the economy of manufacture and its application	3
CO4	Select the best sheet metal process for a component to be manufactured based on its application	3
CO5	Choose the best method of moulding/joining of plastics of a part based on cost and its use.	3

TEXTBOOKS:

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

REFERENCES:

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

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	3	2	2			2	1	2				1	1	
2.	3	2	2			2	1	2				1	1	
3.	3	2	2			2	1	2					1	
4.	3	2	2			2	1	2					1	
5.	3	2	2			2	2	2					1	
Average	3	2	2			2	1.2	2					1	

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

IT22251	COMPUTER PROGRAMMING AND PRACTICE	L	T	P	C
	(Common to AE, BT, CE, CH)	2	0	2	3

COURSE OBJECTIVES:

1. To know the basics of algorithmic problem solving.
2. To learn programming using a structured programming language.
3. To implement programs with basic features of C.

UNIT I FUNDAMENTALS OF COMPUTING (6+3)

Computing Devices - Identification of Computational Problems - Algorithms - Building Blocks of Algorithms - Pseudocodes and Flowcharts - Notion of memory, addresses, variables, instructions, execution of instructions - Operating system commands, file editing, compiling, linking, executing a program, Introduction to different programming languages.

Suggested Activities:

Practical

Use of operating system commands and file editing operations.

UNIT II BASICS OF C (6+9)

Data types - constants, variables - operators - expressions - basic input/output. Statements and blocks - Selection - if-else construct - iteration - while - for constructs.

Suggested Activities

Practical

Demonstration of programs using data types, operators and basic input/output.

Demonstration of programs using if-else, else-if, switch.

Demonstration of programs using, while, for, do-while, break, continue.

UNIT III ARRAYS AND STRINGS (6+6)

Array, declaration, initialization. Multi dimensional arrays. Strings and character arrays, string operations on arrays.

Suggested Activities

Practical

Demonstration of programs using arrays and operations on arrays.

Demonstration of programs implementing string operations on arrays.

UNIT IV FUNCTIONS AND STRUCTURES (6+6)

Functions, definition, call, arguments, call by value. Call by reference. Recursion, Introduction to structures and unions.

Suggested Activities

Practical

Demonstration of programs using functions.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	2	3	3	2	2	1		1	3	2		2	1	1
2.	2	3	2	2	2	1		1	3	2		2	1	1
3.	2	3	2	2	2	1		1	3	2		2	1	1
4.	3	3	2	2	2	1		1	3	2		2	1	1
5.	1	1	1	1	2	1		1	3	2		2	1	1
Average	2	2.6	2	1.8	2	2		1	3	2		2	1	1

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

COURSE OBJECTIVES:

1. To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics and properties of matter.

LIST OF EXPERIMENTS: (Any EIGHT Experiments)

1. a) Determination of Wavelength, and particle size using Laser.
b) Determination of acceptance angle in an optical fiber.
2. Determination of velocity of sound and compressibility of liquid - Ultrasonic Interferometer.
3. Determination of wavelength of mercury spectrum - spectrometer grating.
4. Determination of thermal conductivity of a bad conductor - Lee's Disc method.
5. Determination of Young's modulus by Non uniform bending method.
6. Determination of specific resistance of a given coil of wire - Carey Foster's Bridge.
7. Determination of Rigidity modulus of a given wire - Torsional Pendulum.
8. Energy band gap of a Semiconductor.
9. Determine the Hysteresis loss of a given Specimen.
10. Calibration of Voltmeter & Ammeter using potentiometer.

TOTAL: 30 PERIODS**OUTCOMES:**

Course Outcomes		RBT LEVEL
CO1	Analyze the physical principle involved in the various instruments; also relate the principle to new application.	4
CO2	Comprehend the Experiments in the areas of optics, mechanics and thermal physics to nurture the concepts in all branches of Engineering.	3
CO3	Apply the basic concepts of Physical Science to think innovatively and also improve the creative skills that are essential for engineering.	3
CO4	Evaluate the process and outcomes of an experiment quantitatively and qualitatively.	3
CO5	Extend the scope of an investigation whether or not results come out as expected.	3

REFERENCES:

1. Physics Laboratory practical manual, 1st Revised Edition by Faculty members, 2018.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	3	3	2	3	2				3	1		2	1	1
2.	3	3		3		2			3	1		2	1	1
3.	3	3	2	3	2	2			3	1		2	1	1
4.	3	3		3					3	1		2	1	1
5.	3	3		3	2				3	1		2	1	1
Average	3	3	2	3	2	2			3	1		2	1	1

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

EE22111	BASIC ELECTRICAL AND ELECTRONICS	L	T	P	C
		0	0	2	1

ENGINEERING LABORATORY
(Common to all Branches except EC)

COURSE OBJECTIVES:

1. To provide exposure to the students with hands on experience in basic of Electrical and Electronics wiring connection and measurements.
2. To introduce the students to Electrical Machines and basic laws of Electrical Circuits.

LIST OF EXPERIMENTS:

1. Wiring - Residential house wiring and Stair case wiring.
2. (a) AC Analysis - Measurement of electrical quantities - voltage, current, power, and power factor using RLC.

(b) Study of three phase system.
3. Energy conservation - Measurement and comparison of energy for incandescent lamp and LED lamp.
4. (a) Identification of circuit components (Resistor, Capacitor, Diode and BJT) and soldering practice.

(b) Signal Measurement - Measurement of peak to peak, RMS, average, period, frequency of signals using CRO.
5. (a) VI Characteristics of Solar photovoltaic panel.

(b) Design of Solar PV Array and Battery sizing for Residential solar PV system.
6. Design a 5V/12V Regulated Power Supply using FWR and IC7805 / IC7812.
7. DC Analysis - Verification of Ohm's Law and Kirchhoff's Laws.
8. Study of Transformer and motor characteristics.

TOTAL: 30 PERIODS

OUTCOMES:

Course Outcomes		RBT LEVEL
CO1	Wiring of basic electrical system and measurement of electrical parameters.	4
CO2	Verifying the basic laws of Electric circuits and select various Electrical Machines.	4
CO3	Construct electronic circuits and design solar photovoltaic system.	4
CO4	Apply the concept of a three-phase system.	4
CO5	Construct a fixed voltage regulated power supply.	4

REFERENCES:

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

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	3	3	3	3					2			2	2	1
2.	3	3	3	3					2			2	2	1
3.	3	3	3	3					2			2	3	2
4.	3	3	3	3					2			2	1	1
5.	3	3	3	3					2			2	1	1
Average	3	3	3	3					2			2	1.8	1.2

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

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

COURSE OBJECTIVES:

1. To familiarize the students to understand the fundamentals of thermodynamics.
2. To make the students perform thermal analysis of equipment on their behavior and performance.
3. To prepare the students to understand the behaviour of gas mixtures and thermodynamic relations related to real gases.
4. To make the learners to understand the steam and its generation and use as working fluid in thermal power plants.
5. To make the learners to realize the importance of study of refrigeration and refrigeration cycle.

UNIT I BASIC CONCEPTS AND FIRST LAW (9+3)

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 (9+3)

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 changes 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 (9+3)

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 (9+3)

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 (9+3)

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:

Course Outcomes		RBT LEVEL
Students will be able to		
CO1	Analyze various energy transferring / transforming equipment using I law of thermodynamics.	3
CO2	Analyze various energy transforming equipment and Heat and Reversed heat engines using II law of thermodynamics.	3
CO3	Obtain different thermodynamic relations & equations for ideal and real gases from basics and to estimate the properties of gas mixtures.	3
CO4	Discuss the process of steam generation and analyze steam flow through nozzles and steam power cycles.	3
CO5	Analyze thermodynamically the refrigeration and refrigeration cycles.	3

TEXTBOOKS:

1. Nag. P.K., "Engineering Thermodynamics", 6th Edition, Tata McGraw-Hill, New Delhi, 2017.
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, TataMcGraw 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", 1st Edition, Pearson Education, 2013.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	3	3	1	1		1							3	2
2	3	3	2	2		1	2						3	
3	3	3	2	2									2	
4	3	3	2	1									2	
5	3	3	2	2			2	1				2	3	2
Average	3	3	1.8	1.6		1	2	1				2	2.6	2

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

COURSE OBJECTIVES

- 1 To apply the knowledge of properties and characteristics of fluid in automotive applications.
- 2 To analyze the major and minor losses in pipes and boundary layer concept.
- 3 To perform the dimensional analysis in automotive applications.
- 4 To classify and discuss the working principles of pumps.
- 5 To classify and discuss the different types of turbines.

UNIT I FLUID PROPERTIES AND FLOW CHARACTERISTICS 9

Units and dimensions, Properties of fluids- 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 9

Hydraulic and energy gradient, Laminar flow through circular conduits, Darcy Weisbach equation - friction factor, Moody diagram, series and parallel pipes - major losses and minor losses, Boundary layer concepts - types of boundary layer thickness, Drag and Lift.

UNIT III DIMENSIONAL ANALYSIS 9

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 9

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 pumps - working principle, Rotary pumps - Gear, Vane and Lobe types.

UNIT V TURBINES 9

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

TOTAL: 45 PERIODS

OUTCOMES:

COURSE OUTCOMES		RBT LEVEL
	Students will be able to	
CO1	Describe the fluids in static, kinematic and dynamic equilibrium.	3
CO2	Analyze the applicability of physical laws in addressing problems of hydraulics.	3
CO3	Apply dimensional analysis and modeling to describe fluid properties and dimensionless quantities.	3
CO4	Critically analyze the performance of rotodynamic pumps and reciprocating pumps used in automotive application.	3
CO5	Explain the working principle of turbines and select the type of turbine for particular application.	3

TEXTBOOKS

- 1 Bansal, R.K., “Fluid Mechanics and Hydraulics Machines”, 5th edition, Laxmi Publications Pvt. Ltd, New Delhi, 2008.
- 2 Rajput, R. K., “Fluid Mechanics and Hydraulic Machines”, 6th edition, S. Chand Pvt. Ltd, New Delhi, 2017.

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.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	3	3	3										2	3
2	3	3	3										2	2
3	3	3	3										1	
4	3	3	3										2	2
5	3	3	3										1	
Average	3	3	3										1.6	2.33

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

COURSE OBJECTIVES

- 1 To understand the working of standard machine tools such as lathe, shaper, planer, milling, drilling, broaching, grinding and allied machines.
- 2 To familiarize with the concepts of gear manufacturing and thread making.
- 3 To provide knowledge on the correct procedure to be adopted to measure the dimension of gears and screw threads.
- 4 To understand the process capabilities of unconventional machining.
- 5 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

CO	COURSE OUTCOMES	RBT Level
1	Identify the capabilities of conventional machining processes and will select a suitable process for a particular application.	3
2	Outline the concepts of manufacturing, testing, measurement of gears and screw threads.	3
3	Apply NC and CNC programming concepts to develop part program for Lathe and Milling Machines.	3
4	Identify the capabilities of unconventional machining processes and will select a suitable process for a particular application.	3
5	Summarize the various concepts in advanced manufacturing processes and systems.	3

TEXTBOOKS

- 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.

REFERENCES

- 1 I.C. Gupta, "A Textbook 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

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	3	2	2			2	1	2				1	1	1
2	3	2	2		1		1	1				1	1	1
3	2	1	2		2		1	1					1	1
4	3	2	2			2	1	2				1	1	1
5	2	1	2		2		1	1					1	1
Average	2.6	1.6	2		1.67	2	1	1.4				1	1	1

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

COURSE OBJECTIVES:

1. To introduce the effective mathematical tools for the solutions of partial differential equations for linear and non-linear systems.
2. 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 (9+3)

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 (9+3)

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 (9+3)

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 (9+3)

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 (9+3)**

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

CO	COURSE OUTCOMES	RBT Level
Students will be able to		
1	Express proficiency in handling higher order Partial differential equations	3
2	Develop skills in classification, formulation, solution, and interpretation of PDE model	3
3	Apply numerical technique to solve algebraic and transcendental equations.	3
4	Apply the knowledge and skills of numerical methods to do interpolation and approximation.	3
5	Acquire the skill to solve partial differential equation numerically	3

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.

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.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	3	3	3								3			
2.	3	3	3	2							3			
3.	3	3	3								3			
4.	3	3	3	2							3			
5.	3	3	3								3			
Average	3	3	3	2							3			

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

AE22308	AUTOMOTIVE FUELS AND LUBRICANTS: THEORY AND PRACTICES	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES

- 1 To understand the extraction process of fuels and lubricants from crude oil.
- 2 To explore the importance of friction and in automotive engines.
- 3 To familiarize the requirements and properties of automotive lubricants.
- 4 To explore the properties and testing of automotive fuels.
- 5 To understand the importance choosing the fuel rating and additives.

UNIT I MANUFACTURE OF FUELS AND LUBRICANTS 9+2

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

Practical - ASTM distillation test of liquid fuel

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+8

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

Practical – Flash & Fire point tests of lubricating oil, Testing of Grease - Drop point test and Mechanical penetration test.

UNIT IV PROPERTIES AND TESTING OF FUELS 9+16

Thermo-chemistry of fuels, properties of fuels - relative density, 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.

Practical - Testing of liquid fuels - Aniline Point test, Ash content and Carbon residue test, Cloud & Pour point tests, Copper strip corrosion test, Flash & Fire point tests, Reid vapour pressure test, Viscosity index measurement by Redwood Viscometer and Saybolt Viscometer,

UNIT V FUEL RATING AND ADDITIVES 9+4

Specifications of fuels, fuel rating - octane number – motor octane number and research octane number, cetane number, calorific value, Additives - requirements of an additive, mechanism, petrol fuel additives and diesel fuel additives.

Practical - Study of Octane and Cetane Number of fuels, Calorific value test of gaseous and liquid fuel,

TOTAL(L:45+P:30): 75 PERIODS

CO	COURSE OUTCOMES	RBT Level
1	Explain the process of manufacturing of fuels and lubricants from crude oil.	3
2	Explain the sources of friction in engine components and discuss the different types of lubrication systems in managing the friction.	3
3	Discuss the characteristics of lubricants when in use and outline the need for requirements and additives of lubricants.	3
4	Outline various properties and testing of automotive fuels.	3
5	Explain and compare the mechanism of combustion, knocking, fuel additives in spark ignition and compression ignition engines.	3

TEXTBOOKS

- 1 Mathur. M.L., Sharma. R.P. “Internal Combustion Engines”, Dhanpatrai publication,2014.
- 2 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.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	2	2				3	3	3		2		1	1	
2.	3	3				3	3	3		2		1	1	
3.	3	3				3	3	3		2		1	1	
4.	2	2				2	2	2		2		1	1	
5.	2	1				1	2	1		1		1	1	
Average	2.4	2.2				2.4	2.6	2.4		1.8		1	1	

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

COURSE OBJECTIVES

To make the students to

- 1 understand the construction and basic principles of operation of IC engines used in automobiles.
- 2 realize the phenomena of combustion and to understand different combustion chambers of IC engines and the experimental prediction of cylinder pressure.
- 3 understand the concept of forced induction and the importance of cooling and lubrication in IC engines.
- 4 be familiar with various loading devices used in the determination of performance parameters experimentally.
- 5 carryout testing on IC engines and analyze their performance and emission parameters.

UNIT I IC ENGINES CONSTRUCTION AND OPERATION 12+2

Introduction and classification of IC 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 - Multi Point Fuel Injection systems and CRDI systems.

Practical: Laboratory demonstration - Obtaining valve timing and port timing diagram.

UNIT II COMBUSTION AND COMBUSTION CHAMBERS 10+4

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.

Practical: Experimentally obtaining p- θ and p-V diagrams of IC engine.

UNIT III FORCED INDUCTION, COOLING AND LUBRICATION SYSTEMS 11+2

Concept of Supercharging and Turbocharging, Construction and Working of Superchargers and Turbochargers, Turbocharger controls - waster gate, variable geometry, variable nozzle types.

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.

Practical: Laboratory demonstration.

UNIT IV LOADING DEVICES AND PERFORMANCE PARAMETERS 9+2

Loading devices - Mechanical, Hydraulic and Electrical Dynamometers, Performance Test - Load test and Speed test, Mechanical, Thermal and Volumetric efficiencies, Measurement of Air flow, Fuel flow, Friction and Cylinder pressure. Engine performance maps, Engine testing standards.

Practical: Laboratory demonstration of loading devices and testing Procedure.,

UNIT V PERFORMANCE AND EMISSION TESTING 3+20

Introduction to engine emissions. Practical: Performance and emission test on two-wheeler SI engine - Performance and emission test on automotive multi-cylinder SI and CI engines - Retardation test on I.C. Engines - Heat balance test on automotive multi-cylinder SI and CI engines - Morse test on multi-cylinder SI engine.

TOTAL(L:45+P:30): 75 PERIODS

CO	COURSE OUTCOMES	RBT Level
1	Describe the construction and operation of automotive engines.	3
2	Discuss and compare the combustion process and different types of combustion chambers in automotive engines.	3
3	Discuss and compare the forced induction, cooling and lubrication systems of automotive engines.	3
4	Describe different procedures employed in the testing of automotive engines.	3
5	Measure and analyse the performance, combustion, and emission characteristics of IC engines.	3

TEXTBOOKS

1	Ganesan V., "Internal Combustion Engines", Fourth Edition, Tata McGraw Hill, 2012.
2	Ramalingam K.K., "Internal Combustion Engines", Second Edition, SciTech Publications, 2009.

REFERENCES

1	Heisler, "Advanced Engine Technology", SAE Publication, 1995.
2	Edward F. Obert "Internal Combustion Engines", 3 rd Edition, 1970.
3	Gupta. H.N. "Fundamentals of Internal Combustion Engines", 2 nd 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", 1 st Edition, McGraw Hill Education, 2011

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1							1					2	3	
2	3		2		2	1	2	1	1			2	3	
3		2			3	2	2					2	3	
4	2	2			3	2	1	2	2	2		2	3	1
5	3	3	3	3	3	2	2	2	3	3	3	3	3	3
Average	3	2	1	3	2.75	1.75	1.6	1.66	2	2.5	3	2.2	3	2

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

COURSE OBJECTIVES:

- Upon Completion of this subject, the students can be 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
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: 30 PERIODS

OUTCOMES:

Course Outcomes		RBT LEVEL
Students will be able to:		
CO1	Use the flow measurement equipment.	3
CO2	Analyze the performance of various pumps.	3
CO3	Analyze the performance of various turbines.	3

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	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.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	3	3	3										2	2
2	3	3	3										2	2
3	3	3	3										2	2
Average	3	3	3										2	2

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

OBJECTIVES:

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

LIST OF EXPERIMENTS:**LATHE PRACTICE**

- Plain Turning
- Taper Turning
- Thread Cutting

Estimation of machining time for the above turning processes.

DRILLING PRACTICE

- Drilling
- Tapping
- Reaming

MILLING AND GEAR MANUFACTURING

- Round to hexagon in a Milling machine
- Gear milling
- Gear hobbing

PLANING AND SHAPING

- Cutting Key Ways
- Dove tail machining

GRINDING

- Grinding of Cylindrical components using cylindrical grinding
- Grinding of cylindrical components using centreless grinding

TOTAL: 30 PERIODS

Course Outcomes		RBT LEVEL
Students will be able to:		
CO1	Acquire the requisite skills to use different conventional machines to produce objects with required dimensions	3
CO2	Perform the finishing operations for typical components in different machines	2

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

- | | |
|---------------------------------|---------|
| 1. Lathe | 15 Nos. |
| 2. Drilling Machine | 1 No. |
| 3. Milling Machine | 2 Nos. |
| 4. Planing Machine | 1 No. |
| 5. Shaping Machine | 2 Nos. |
| 6. Gear hobbing Machine | 1 No. |
| 7. Cylindrical Grinding Machine | 1 No. |
| 8. Centreless Grinder | 1 No. |

REFERENCES:

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

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	3	2				1		2	2			2	1	2
2	3	1				1		1				2	1	1
Average	3	1.5				1		1.5	2			2	1	1.5

w), 2: Moderate (Medium), 3: Substantial (High)

COURSE OBJECTIVES

- 1 To develop capability to predict the effect of force on statics of particles
- 2 To study the basic concepts of moment and its effects on the bodies at rest or in motion
- 3 To predict the behavior of a moving body when acted on by gravity
- 4 To determine the effects of friction on static and moving bodies and also to analysis the forces acting on the vehicle.
- 5 To study the relationship between energy, work, power which causes the motion of connected bodies.

UNIT I INTRODUCTION & STATICS OF PARTICLES 9+3

Fundamental Concepts and Principles, Systems of Units, forces in a plane - force on a particle. resultant of two forces, vectors, resultant of several concurrent forces, resolution of a force into components, rectangular components of a force -unit vectors, equilibrium of a particle, free-body diagrams, forces in space - rectangular components of a force in space

UNIT II EQUIVALENT SYSTEMS OF FORCES & EQUILIBRIUM OF RIGID BODIES 9+3

External and Internal Forces, Principle of Transmissibility, Moment of a Force about a Point, Varignon's Theorem, Rectangular Components of the Moment of a Force, Moment of a Couple, Addition of Couples, Resolution of a Given Force into a Force and Couple. Free-Body Diagram, Equilibrium in Two Dimensions, Equilibrium in Three Dimensions

UNIT III CENTROIDS AND CENTERS OF GRAVITY 9+3

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 IV FRICTION & MOTION OF VEHICLES 9+3

The Laws of Dry Friction. Coefficients of Friction, Wedges, Wheel Friction. Rolling Resistance, Belt Drivers - Open, Crossed, compound belt and camshaft timing belt drives, Belt Friction, Types of Motions of Vehicles, Motion of a Vehicle Along a Level Track when the Tractive Force Passes Through its Centre of Gravity. Driving of a Vehicle, Motion of Vehicles on an Inclined Plane.

UNIT V KINETICS OF PARTICLES 9+3

Kinetic Energy of a Particle. Principle of Work and Energy, Power and Efficiency, Principle of Impulse and Momentum, Plane Motion of a Rigid Body. D'Alembert's Principle, Newton's Laws of Motion of Rotation, Torque and Angular Acceleration, Relation Between Kinetics of Linear Motion and Kinetics of Motion of Rotation, Flywheel, Motion of Two Bodies Connected by a String and Passing Over a Pulley.

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

	COURSE OUTCOMES	RBT Level
CO1	Explain the different principles applied to solve engineering problems dealing with force, displacement, velocity and acceleration.	3
CO2	Analyze the frictional forces acting on a system and examine the velocity and acceleration inducing on a body with rectilinear and curvilinear motions.	4

CO3	Identify and examine the centroid, center of gravity, area moment of inertia and mass moment of inertia.	4
CO4	Identify and analyze the application of friction force on various belt drives.	4
CO5	Investigate the dynamic forces subjected to a rigid body.	4

TEXTBOOKS

- 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”, 1 St 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.
- 5 R. S. Khurmi and N. Khurmi, "A Textbook of Applied Mechanics", S. Chand Publication, 2010.

Web Link

https://dvr1980.files.wordpress.com/2020/01/applied_mechanics_theory_by_r_k_rajput-1.pdf

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	3	-	3	2	-	-	-	-	-	-	-	-	-	-
2.	3	-	3	2	-	-	-	-	-	-	-	2	2	2
3.	3	-	3	2	-	-	-	-	-	-	-	2	3	3
4.	3	-	3	-	-	-	-	-	-	-	-	2	1	3
5.	3	-	3	2								2	2	3
Average	3		3	1.6								1.6		

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

COURSE OBJECTIVES

- 1 It is essential to know the working of electrical and electronic systems.
- 2 To understand the working of starting system, charging system of an engine for smooth operation.
- 3 To understand the working of ignition and injection system of an engine.
- 4 To enhance the knowledge of sensor and microprocessor applications in vehicle control systems.
- 5 To gain knowledge in modern safety systems.

UNIT I	INTRODUCTION TO ELECTRICAL AND ELECTRONICS ACCESSORIES	9
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Basic electrical principles, electronic components and circuits, digital electronics, microprocessor systems, electrical wiring, terminals and switching, circuit diagrams and symbols, dashboard instruments, horn, trafficator.

UNIT II	STARTING SYSTEM, CHARGING SYSTEM, LIGHTING SYSTEM	9
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Starter motor characteristics, drive mechanisms, DC Generators, Alternators and their characteristics, electronic regulators. Vehicle interior lighting system, vehicle exterior lighting system, lighting design.

UNIT III	ELECTRONIC IGNITION AND INJECTION SYSTEM	9
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Spark plugs, different types of ignition systems, Electronically controlled advance mechanisms, Electronic fuel injection systems, mono and multi point fuel injection systems.

UNIT IV	SENSORS AND MICROPROCESSORS IN AUTOMOBILES	9
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Basic sensor arrangements, Types of sensors – Manifold absolute pressure sensor, Engine coolant sensor, Air temperature sensor, TMAP sensor, oxygen sensor, Mass air flow sensor, vehicle speed sensor, detonation sensor, accelerometer sensor, crank position sensor, engine speed sensor, Microprocessor and microcomputer controlled devices in automobiles such as voice warning system, travel information system, keyless entry system, and electronic steering system.

UNIT V	SAFETY SYSTEMS	9
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Antilock braking system, air bag restraint system, voice warning system, seat belt system, road navigation system, anti-theft system.

TOTAL: 45 PERIODS

OUTCOMES		
COURSE OUTCOMES		RBT LEVEL
	Students will be able to	
CO1	Describe the basic principles of electrical, electronics and automotive dashboard instruments	3
CO2	Identify the requirements and discuss the automotive starting system, charging system and lighting system.	3
CO3	Outline the application of electronics in automotive ignition and injection system.	3
CO4	Illustrate the working of sensors and microcomputer controlled devices in automobiles.	3
CO5	Outline the working principle of safety systems employed in vehicles.	3

TEXTBOOKS

- 1 Judge A.W, “Modern Electrical Equipment of Automobiles”, Chapman & Hall, London, 1992.
- 2 William Ribbens, “Understanding Automotive Electronics”, 8th Edition, Butterworth Heinemann, 2017.

REFERENCES

- 1 Crouse W.H, “Automobile Electrical Equipment”, Mc Graw Hill Book Co Inc. New York, 2005.
- 2 Robert N Brady, “Automotive Computers and Digital Instrumentation”, A Reston Book, Prentice Hill, Eagle Wood Cliffs, New Jersey, 1988.
- 3 Spread bury F.G, “Electrical Ignition Equipment”, Constable & Co Ltd., London, 1962.
- 4 Tom Denton, “Automotive Electrical and Electronics Systems”, 5th edition, Routledge, 2017.
- 5 Young A.P, & Griffiths L, “Automobile Electrical Equipment”, English Language Book Society & New Press, 1990.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	3			3		2	2					1		3
2.	3			2			2		1					3
3.	2		1							1	1	1	2	3
4.			2	3										3
5.	3					3	1				1	1	1	3
Average	3		1.5	2.75		2.5	1.66		1	1	1	1	1.5	3

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

COURSE OBJECTIVES:

1. To familiarize the students to know thermodynamic cycles for analyzing IC engines and air compressors.
2. To make the students understand the properties of moist air and its importance and impact on the designing of air conditioning systems.
3. To prepare the students to understand various modes of heat transfer and analyse the conduction heat transfer in various applications.
4. To make the students exposed to various regions in the thermal boundary layer and analyse various flow conditions and also to make the students understand mass transfer concepts.
5. To make the students understand the radiation and various modes of heat transfer in heat exchangers.

UNIT I GAS POWER CYCLES AND AIR COMPRESSORS 9 +3

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 9+3

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 RSHP, GSHP, ESHF - Cooling load estimation (Descriptive only).

UNIT III CONDUCTION 9+3

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 9+3

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.

Introduction to Mass Transfer – Basic concepts.

UNIT V RADIATION AND HEAT EXCHANGERS 9+3

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:

COURSE OUTCOMES		RBT LEVEL
CO1	Analyse the thermodynamic cycles of internal combustion engines, and air compressors.	3
CO2	Discuss the properties of moist air and use Psychrometric chart to analyse the properties of moist air and explain the basic working principles of various types of air conditioning systems.	3
CO3	Classify the various modes of heat transfer and estimate the rate of heat transfer by steady state and unsteady state conduction.	3
CO4	Discuss the phenomenon of boundary layer and estimate the rate of heat transfer by convective heat transfer.	3
CO5	Discuss the concept of radiation and estimate the rate of heat transfer by radiation heat transfer. Also analyse the performance of heat exchangers based on flow pattern.	4

TEXTBOOKS:

1. R.K. Rajput, "Applied Thermodynamics", 2nd edition, Laxmi Publishing (P) Ltd., New Delhi, 2016.
2. J.P. Holman, "Heat Transfer", 10th edition, Tata McGraw Hill, 2009.
3. 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.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	3	2	1	2	1	1	1	1				1	3	
2.	3	2	2	2	1	1	2	1				1	2	
3.	3	2	2	2	2		1						2	
4.	3	3	2	2	2		1						2	
5.	3	2	2	2	2		1					1	2	2
Average	3	2.2	1.8	2	1.6	1	1.2	1				1	2.2	2

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

COURSE OBJECTIVES

- 1 To make the student to be familiar with the Constructional details of chassis vehicle frames, front axles and steering systems
- 2 To familiarize the student in Constructional details and Theory of important drive line and differential
- 3 To understand the constructional feature of wheels and tyres.
- 4 To gain knowledge about the requirement of suspension and its types.
- 5 To make the student to be understand with the concept and various types of brake system.

UNIT I FRAME, FRONT AXLE AND STEERING SYSTEM 9+6

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.

Practical –dismantling and assembling of front axle and steering system of automotive vehicle.

UNIT II DRIVE LINE, FINAL DRIVE AND DIFFERENTIAL 9+6

Driving thrust, Torque reactions and Side thrust and its effects, Hotchkiss drive, Torque tube drive, Radius rods and Stabilizers, Propeller shaft, Universal Joints, Constant velocity universal Joints. Final drive and its types, double reduction final drive, twin speed rear axle, Differential principle, constructional details of differential unit, differential housings, non-slip differential, differential locks.

Practical – dismantling and assembling of driveline system of automotive vehicle.

UNIT III REAR AXLES, WHEELS, RIMS AND TYRES 9+6

Construction of rear axles, Types of loads acting on rear axles, Full –floating, Three-Quarter floating and Semi-floating axles, Multi axles vehicles. Wheels and Rims, types of tyres and their constructional details. Fifth wheel coupling and tow hitch.

Practical - dismantling and assembling of rear axle system of automotive vehicle.

UNIT IV SUSPENSION SYSTEM 9+6

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, Active suspension system.

Practical - dismantling and assembling of suspension system of automotive vehicle.

UNIT V BRAKE SYSTEMS 9+6

Need for Brake systems, Stopping Distance, 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.

Practical -dismantling and assembling of braking system of automotive vehicle.

TOTAL (L:45 +T:30) : 75 PERIODS

OUTCOMES		
	COURSE OUTCOMES	RBT LEVEL
CO1	Compare the different types of chassis layout, frames, steering systems and explain the front wheel geometry.	3
CO2	Explain the concepts of drive line and its components.	3
CO3	Select the rear axle, wheel, rim and tyre for a given vehicle.	3
CO4	Compare the characteristics of different types of suspension springs and explain the construction/working of different types of suspension systems.	3
CO5	Explain the construction/working of different types of braking systems and its components.	3

TEXTBOOKS

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

REFERENCES

- 1 Giri. N.K., "Automotive Mechanics", Khanna Publishers, New Delhi, 2005.
- 2 Heldt P.M., "Automotive Chassis" Chilton Co., New York, 1990.
- 3 Milliken & Milliken, "Race Car Vehicle Dynamics", SAE, 1995.
- 4 R.K. Rajput, "A Text-Book of Automobile Engineering", Laxmi Publications Private Limited, 2007.

E-BOOKS

- 1 https://books.google.co.in/books?id=nBVefxD_0agC&printsec=frontcover&dq=Automobile+engineering&hl=en&sa=X&ved=0ahUKEwjvgs3Por3gAhVQcCsKHQbTANYQ6AEIKDAA#v=onepage&q&f=false

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	3	2	1			1	1	2	2			3	1	2
2.	2	1				1		1	2			1	2	2
3.	2	2				2		2	2			1	1	2
4.	3	2	2			2	1	2	2			1		2
5.	3	2	2			2	1	2	2			1		2
Average	2.6	1.8	1.67			1.6	1	1.8	2			1.4	1.33	2

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

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 along with testing of metals.
- 2 To demonstrate to the student in calculating shear force bending stresses and bending moment diagrams.
- 3 To make the students 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 9+6

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.

Practical - Tension test and Hardness test on metals.

UNIT II TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM 9+6

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 the cantilever, simple supported and overhanging beams.

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

Practical - Double shear test on mild steel and aluminum rods.

UNIT III DEFLECTION OF BEAMS 9+6

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

Practical - Deflection test on the cantilever and simply supported beams.

UNIT IV TORSION OF SHAFTS AND SPRINGS 9+6

Torsion formulation stresses and deformation in circular and hollow shafts – Stepped shafts– Deflection in shafts fixed at both ends–Stresses in helical springs – Deflection of helical springs subjected to tension only, Leaf springs.

Practical - Compression test on helical springs and Torsion test on the mild steel rod.

UNIT V ANALYSIS OF STRESSES IN TWO DIMENSIONS 9+6

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

Practical - Impact test on metals.

TOTAL (L:45+P:30) : 75 PERIODS

OUTCOMES		
Course Outcomes		RBT LEVEL
Upon completion of the course, students will be able to:		
CO1	Predict the behavior of the materials for different loading conditions and characteristics of materials.	3

CO2	Select suitable cross-sections for the beams and springs based on theoretical and experimental work.	3
CO3	Estimate the Deflection of beams under a different types of loading conditions.	3
CO4	Select the dimensional parameters for the shafts and springs under torsion loads through the different types of testing.	3
CO5	Develop a basic understanding of Biaxial Stresses and impact tests on metals.	3

TEXTBOOKS

1. Bansal, R.K., "A Textbook of Strength of Materials", Laxmi Publications (P) Ltd., 2017
2. R S Khurmi Strength of Materials, KHANNA Publications New-Delhi 2014.
3. Jindal U.C., "Strength of Materials", Pearson Education , 2012.

REFERENCES

1. Rattan, "Strength of Materials", McGraw Hill Education, 3rdEdition, 2017.
2. Hibbeler, R.C., "Mechanics of Materials", Pearson Education, 10thEdition, 2016.
3. Popov E.P, "Engineering Mechanics of Solids", Prentice-Hall of India, New Delhi 2014.
4. Ferdinand P. Beer, Russell Johnson, J.r. and John J. Dewole "Mechanics of Materials", McGraw Hill Education, 2005.
5. Ramamrutham S and Narayan R, "Strength of Materials", Dhanpat Rai and Sons, New Delhi, 1997.

Web Link

https://books.google.co.in/books?id=QV3qBwAAQBAJ&pg=PA193&lpg=PA193&dq=mohr%27s+circles+simulation&source=bl&ots=KX1uJDqIVX&sig=WvLFnPPiTRfq8Sv463CExdkMO7g&hl=en&sa=X&ved=0ahUKEwi-k7rjhd_ZAhXLMo8KHWICdEQ6AEIczAI#v=onepage&q=mohr's%20circles%20simulation&f=false

https://books.google.co.in/books?id=2IHEqp8dNWwC&printsec=frontcover&dq=strength+of+materials&hl=en&sa=X&ved=0ahUKEwiSstLJiN_ZAhVBRY8KHY2iCVgQ6wEIJzAA#v=onepage&q=strength%20of%20materials&f=false

https://books.google.co.in/books?id=UUAi8JrJqDIC&printsec=frontcover&dq=strength+of+materials&hl=en&sa=X&ved=0ahUKEwiSstLJiN_ZAhVBRY8KHY2iCVgQ6wEIMzAC#v=onepage&q=strength%20of%20materials&f=false

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	3		3										3	
2.		3	3	3									3	
3.		3	3	3									3	
4.	3	3	2											3
5.		3	3										3	
Average	3	3	2.8	3									3	3

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

COURSE OBJECTIVES

- 1 To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize the biodiversity of India and its conservation.
- 2 To impart knowledge on the causes, effects and control or prevention measures of environmental pollution.
- 3 To study and understand the various types of renewable sources of energy and their applications.
- 4 To familiarize the concept of sustainable development goals, economic and social aspects of sustainability, recognize and analyze climate changes, and environmental management challenges.
- 5 To inculcate and embrace sustainability practices, develop a broader understanding of green materials and energy cycles, and analyze the role of sustainable urbanization.

UNIT I ENVIRONMENT AND BIODIVERSITY 9

Definition, scope and importance of environment – need for public awareness. Eco-system and Energy flow– food chains, food webs and ecological pyramids, ecological succession. Biodiversity- types- genetic, species and ecosystem diversity– values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: fragmentation and habitat loss, poaching of wildlife, human-wildlife conflicts – endangered and endemic species of India –conservation of biodiversity: In-situ and ex-situ.

UNIT II ENVIRONMENTAL POLLUTION 9

Definition, causes, effects and preventive measures of air, water and soil pollution. Marine and thermal pollution - causes, effects and control measures. Light and noise pollution-effect on flora and fauna. Nuclear pollution- Sources, effects and control measures. Disposal of radioactive wastes (Nuclear hazards). Pollution case studies. Role of an individual in the prevention of pollution. Solid, hazardous and E-waste management. Occupational health and safety management system (OHASMS). Environmental protection, Environmental protection acts, categorization of species according to IUCN.

UNIT III RENEWABLE SOURCES OF ENERGY 9

Energy resources: Growing energy needs, Nonrenewable resources – types, uses. Energy management and conservation - New energy sources, Need of new sources - geo suitability of establishing renewable energy sources, different types new energy sources. Applications of hydrogen energy, ocean energy resources, Tidal energyconversion. Concept, origin and power plants of geothermal energy. Role of an individual in conservation of energy.

UNIT IV SUSTAINABILITY AND MANAGEMENT 9

Development, GDP, Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols, Sustainable Development Goals-targets, indicators and intervention areas - Principles of green chemistry, Climate change- Global, Regional and local environmental issues and possible solutions-case studies - Role of non-governmental organization,Concept of carbon credit, carbon footprint - Environmental management in industry-A case study,

UNIT V SUSTAINABILITY PRACTICES 9

Zero waste and R concept, circular economy, ISO 18000 series, material life cycle assessment, environmental impact assessment. Wasteland reclamation,Sustainable habitat: green buildings,

green materials, energy efficiency and energy audit, sustainable transports. Energy cycles, carbon cycle, emission and sequestration, Green engineering: sustainable urbanization- socio-economical and technological change. Rainwater harvesting, watershed management, environmental ethics: Issues and possible solutions.

TOTAL: 45 PERIODS

OUTCOMES		
	COURSE OUTCOMES	RBT LEVEL
After completion of this course, the students will be able to		
CO1	Recognize the fundamental role of ecosystems and suggest an appropriate method for the conservation of biodiversity.	3
CO2	Describe the different types of pollution, their effects and strategies to minimize or eliminate pollution.	3
CO3	Identify the various renewable energy resources and use the appropriate one thereby conserving non-renewable resources for future generation.	3
CO4	Explain the various goals of sustainable development applicable to suitable technological advancement and societal development.	2
CO5	Summarize the various sustainability practices, green materials, energy cycles, and the role of green engineering in sustainable urbanization.	2

TEXTBOOKS

- 1 AnubhaKaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 7th Edition, NewAge International Publishers, 2022.
- 2 Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2016.
- 3 Gilbert M. Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
- 4 Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Pearson. 2011.
- 5 Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, CL Engineering, 2015.
- 6 Environment Impact Assessment Guidelines, Notification of Government of India, 2006.
- 7 Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998.

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- 1 R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media. 38
- 2 Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
- 3 Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT. LTD, New Delhi, 2007.
- 4 Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 3rd edition, 2015.
- 5 ErachBharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 3rd edition, 2021.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	3					3	3	2		2		1	3	2
2.	3					3	3	2		2		2	3	2
3.	3		1			3	3	1		2		1	2	2
4.	3					3	3	3		2		2	2	2
5.	3					3	3	3		2		2	2	2
Average	3		1			3	3	2.2		2		1.6	2.4	2

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

COURSE OBJECTIVES

- 1 To train the Students on various test equipment for automotive electrical and electronics systems.
- 2 To familiarize the students on fundamentals of working on electronics systems.
- 3 To familiarize the students on fundamentals of working on various microcontrollers and controllogic.

LIST OF EXPERIMENTS:

LIST OF EXPERIMENTS	
ELECTRICAL LABORATORY	
1.	Testing of batteries and battery maintenance
2.	Testing of Starter motor and alternator
3.	Testing of regulators
4.	Diagnostics of ignition system faults
5.	Study of Automobile Electrical wiring
6.	Study of electric horn and wiper motor
7.	Study of components of electric two wheeler
ELECTRONICS LABORATORY	
8.	Study of 8 bit Microcontroller architecture and programming.
9.	Perform 8 bit arithmetic and logic operations.
10.	Perform code conversion.
11.	Interfacing of ADC with Microcontroller.
12.	Interfacing of DAC with Microcontroller.
13.	Interfacing Programmable Keyboard and Display Controller with Microcontroller.
14.	Sensor interfacing with Microcontroller.
15.	Stepper motor interfacing with Microcontroller.
16.	DC motor interfacing with Microcontroller.

TOTAL: 45 PERIODS

OUTCOMES:

Course Outcomes		RBT LEVEL
Students will be able to:		
CO 1	Identify and troubleshoot the faults in various automotive electrical systems.	3
CO 2	Develop programs for arithmetic and logical operations in 8051.	3
CO 3	Develop programs for various peripheral interfacing with 8051.	3
CO 4	Develop programs for sensor and actuator interfacing with 8051.	3

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Batteries, hydrometer, refractometer, multimeter	3 No. each
2. Starter motor, regulator,	1 No. each
3. Distributor, ignition coil, sparkplug	1 No. each
4. Auto electrical wiring system	1 No.
5. Electric horn and wiper motor	2 No. each
6. Starter motor alternator test rig	1 No.
7. Electric Two Wheeler	1 No.
8. 8051 Microcontroller development Kit	10 Nos.
9. ADC Interfacing Kit	3 Nos.
10. DAC Interfacing Kit	3 Nos.
11. Stepper Motor Interfacing Kit	3 Nos.
12. DC Motor Interfacing Kit	3 Nos.
13. Keyboard Interfacing Kit	3 Nos.
14. Sensor Interfacing Kit	3 Nos.
15. CRO	3 Nos.
16. Stepper Motor & DC Motor	3 Nos.

REFERENCES:

1. Judge. A.W., “Modern Electrical Equipment of Automobiles”, Chapman & Hall, London, 1992.
2. Robert N Brady “Automotive computers and Digital Instrumentation”. A Reston Book, Prentice Hill, Eagle Wood Cliffs, New Jersey, 1988.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	3			3	3		1		3	1		2		3
2	3			2	2		2		2	3		3		3
3	3			3	3		2		3	2		3		3
4	3			3	3		3		2	3		3		3
Average	3			2.75	2.75		2		2.5	2.25		2.75		3

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

OBJECTIVES:

1. Demonstrate and study of the various vehicle components for servicing them.
2. To impart the technical knowledge for servicing the various electrical components

LIST OF EXPERIMENTS:

1. a) Inspection and replacement of engine oil and transmission oil.
b) Inspect and replacing of coolant, air filter and oil filter.
2. Inspection and servicing of sliding controlled and vacuum controlled carburetor.
3. Cleaning and servicing of two wheeler braking and clutch system.
4. Inspection and adjustment of inlet and exhaust valve clearance.
5. Decarburizing the piston and checking the engine compression (Cylinder pressure).
6. Inspection and adjustment of chain drive used in final drive.
7. Study of DVOM with simple measurements.
8. Diagnosing of various electrical circuits like headlight, horn, trafficators, tail lamp and brake light, etc.
9. Diagnosing of various components of fuel injection system and obtain the waveform of various sensors.
10. Diagnosing of various sensors using on board diagnostics tool.

TOTAL: 45 PERIODS**OUTCOMES:**

Course Outcomes		RBT LEVEL
Students will be able to:		
1	Acquire the requisite skills to service the vehicle	3
2	Diagnose the various vehicle components	3

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

- | | |
|-----------------|--------|
| 1. Two wheeler | 1 No |
| 2. Four wheeler | 1 No |
| 3. Carburetors | 2 Nos. |
| 4. DVOM | 2 Nos. |
| 5. Oscilloscope | 1 No. |
| 6. OBD tool | 1 No. |

REFERENCES:

1. William M. Metts, "Vehicle Maintenance Book", Independently Published, 2019.
2. William H Crouse, Donald L Anglin, "Automotive Mechanics", 10th edition, McGraw Hill Education, 2017.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	2			1	3			1		2		2	3	3
2	2			1	3			1		2		2	3	3
Average	2			1	3			1		2		2	3	3

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

