



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**  
**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF AUTOMOBILE ENGINEERING**

## **COURSE STRUCTURE AND SYLLABUS**

**For UG – R20**

**B. TECH - AUTOMOBILE ENGINEERING**

*(Applicable for batches admitted from 2020-2021)*



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**COURSE STRUCTURE**

**I Year – I SEMESTER**

S. No	Course Code	Course Title	L	T	P	Credits
1	BSC-1	Mathematics - I	3	0	0	3
2	BSC-2	Engineering Chemistry	3	0	0	3
3	ESC-1	Engineering Mechanics	3	0	0	3
4	HSC-1	Communicative English	3	0	0	3
5	ESC-2	Programming for Problem Solving using C	2	0	2	3
6	BSC-L1	Engineering Chemistry Laboratory	0	0	3	1.5
7	ESC-L1	Programming for Problem Solving using C Laboratory	0	0	3	1.5
8	HSC-L1	English Communication Skills Laboratory	0	0	3	1.5
9	MC -1	Environmental Science	2	0	0	0
<b>Total Credits</b>			<b>17</b>	<b>0</b>	<b>11</b>	<b>19.5</b>

**I Year – II SEMESTER**

S. No	Course Code	Course Title	L	T	P	Credits
1	BSC-3	Mathematics – II (Mathematical Methods)	3	0	0	3
2	BSC-4	Engineering Physics	3	0	0	3
3	ESC-3	Metallurgy & Materials Science	3	0	0	3
4	ESC-4	Basic Electrical and Electronics Engineering	3	0	0	3
5	ESC-5	Engineering Graphics	2	0	2	3
6	ESC-L2	Basic Electrical and Electronics Engineering Lab	0	0	3	1.5
7	BSC-L2	Engineering Physics Laboratory	0	0	3	1.5
8	ESC-L3	Engineering Workshop & IT Workshop Laboratory	0	0	3	1.5
9	MC-2	Constitution of India	2	0	0	0
<b>Total Credits</b>			<b>17</b>	<b>0</b>	<b>9</b>	<b>19.5</b>



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**II YEAR I SEMESTER**

S. No.	Course Code	Course Title	L	T	P	Credits
1	BSC-5	MATHEMATICS-III(Vector Calculus, Transforms and PDE)	3	--	--	3
2	PCC-1	Thermodynamics	3	--	--	3
3	PCC-2	Mechanics of Solids	3	--	--	3
4	PCC-3	Fluid Mechanics & Hydraulic Machines	3	--	--	3
5	PCC-4	Components of Automobile Chassis	3	--	--	3
6	PCC-L1	Mechanics of Solids & Metallurgy Lab	0	0	3	1.5
7	PCC-L2	Automobile Chassis lab	--	--	3	1.5
8	PCC-L3	Fluid Mechanics & Hydraulic Machines lab	--	--	3	1.5
9	SOC-1	Computer aided drafting and modelling lab	0	0	4	2
10	MC-3	Essence of Indian Traditional Knowledge	2	0	0	0
		<b>Total Credits</b>	<b>17</b>	--	<b>13</b>	<b>21.5</b>

**II YEAR II SEMESTER**

S. No	Course Code	Course Title	L	T	P	Credits
1	ESC-6	Applied Thermodynamics	3	--	--	3
2	BSC-6	Complex Variables and Statistical Methods	3	--	--	3
3	PCC-5	Automobile Engines	3	--	--	3
4	PCC-6	Automobile Electrical and Electronics	3	--	--	3
5	HSC-2	Operations Research	3	--	--	3
6	ESC-L4	Automobile Assembly Drawing	--	--	3	1.5
7	PCC-L6	Automobile Engines & Fuels Lab	0	--	3	1.5
8	PCC-L7	Automobile Electrical & Electronics Lab	0	--	3	1.5
9	SOC-2	Machine Tools and Metrology Lab	1	0	2	2
		<b>Total Credits</b>	<b>16</b>	--	<b>11</b>	<b>21.5</b>



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I Year - I Semester		L	T	P	C
		3	0	0	3
<b>MATHEMATICS-I</b>					

**Course Objectives:**

- This course will illuminate the students in the concepts of calculus.
- To enlighten the learners in the concept of differential equations and multivariable calculus.
- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real world problems and their applications.

**Course Outcomes:**

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

- Utilize mean value theorems to real life problems (L3)
- Solve the differential equations related to various engineering fields (L3)
- Familiarize with functions of several variables which is useful in optimization (L3)
- Apply double integration techniques in evaluating areas bounded by region (L3)
- Students will also learn important tools of calculus in higher dimensions. Students will become familiar with 2- dimensional and 3-dimensional coordinate systems (L5 )

**UNIT I:** Sequences, Series and Mean value theorems: (10 hrs)

Sequences and Series: Convergences and divergence – Ratio test – Comparison tests – Integral test – Cauchy’s root test – Alternate series – Leibnitz’s rule.

Mean Value Theorems (without proofs): Rolle’s Theorem – Lagrange’s mean value theorem – Cauchy’s mean value theorem – Taylor’s and Maclaurin’s theorems with remainders.

**UNIT II:** Differential equations of first order and first degree: (10 hrs)

Linear differential equations – Bernoulli’s equations – Exact equations and equations reducible to exact form.

Applications: Newton’s Law of cooling – Law of natural growth and decay – Orthogonal trajectories – Electrical circuits.

**UNIT III:** Linear differential equations of higher order: (10 hrs)

Non-homogeneous equations of higher order with constant coefficients – with non-homogeneous term of the type  $e^{ax}$ ,  $\sin ax$ ,  $\cos ax$ , polynomials in  $x^n$ ,  $e^{ax} V(x)$  and  $x^n V(x)$  – Method of Variation of parameters.

Applications: LCR circuit, Simple Harmonic motion.

**UNIT IV:** Partial differentiation: (10 hrs)

Introduction – Homogeneous function – Euler’s theorem – Total derivative – Chain rule – Jacobian – Functional dependence – Taylor’s and Mc Laurent’s series expansion of functions of two variables.

Applications: Maxima and Minima of functions of two variables without constraints and Lagrange’s method (with constraints).



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**UNIT V:** Multiple integrals: (8 hrs)  
Double and Triple integrals – Change of order of integration – Change of variables.  
Applications: Finding Areas and Volumes.

**Text Books:**

- 1) B. S. Grewal, Higher Engineering Mathematics, 43<sup>rd</sup> Edition, Khanna Publishers.
- 2) B. V. Ramana, Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

**Reference Books:**

- 1) Erwin Kreyszig, Advanced Engineering Mathematics, 10<sup>th</sup> Edition, Wiley-India.
- 2) Joel Hass, Christopher Heil and Maurice D. Weir, Thomas calculus, 14<sup>th</sup> Edition, Pearson.
- 3) Lawrence Turyan, Advanced Engineering Mathematics, CRC Press, 2013.
- 4) Srimantha Pal, S C Bhunia, Engineering Mathematics, Oxford University Press.



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I Year - I Semester		L	T	P	C
		3	0	0	3
<b>ENGINEERING CHEMISTRY</b>					

Knowledge of basic concepts of Chemistry for Engineering students will help them as professional engineers later in design and material selection, as well as utilizing the available resources.

### COURSE OBJECTIVES

- **Importance** of usage of plastics in household appliances and composites (FRP) in aerospace and automotive industries.
- **Outline** the basics for the construction of electrochemical cells, batteries and fuel cells. Understand the mechanism of corrosion and how it can be prevented.
- **Express** the increases in demand as wide variety of advanced materials are introduced; which have excellent engineering properties.  
*Classify and discuss* the materials used in major industries like steel industry, metallurgical industries and construction industries and electrical equipment manufacturing industries. Lubrication is also *summarized*.
- **Relate** the need of fuels as a source of energy to any industry, particularly industries like thermal power stations, steel industry, fertilizer industry etc., and hence introduced.
- **Explain** the importance and usage of water as basic material in almost all the industries; *interpret* drawbacks of steam boilers and also how portable water is supplied for drinking purposes.

### UNIT I: POLYMER TECHNOLOGY

8 hrs

**Polymerisation:-** Introduction, methods of polymerization (emulsion and suspension), mechanical properties.

**Plastics:** Compounding, fabrication (compression, injection, blown film and extrusion), preparation, properties and applications (PVC, polycarbonates and Bakelite), mention some examples of plastic materials used in electronic gadgets, recycling of e-plastic waste (waste to wealth).

**Elastomers:-** Introduction, preparation, properties and applications (Buna S, thiokol and polyurethanes).

**Composite materials:** Fiber reinforced plastics, conducting polymers, biodegradable polymers, biopolymers, biomedical polymers.

**Course Outcomes:** *At the end of this unit, the students will be able to*

- **Analyze** the different types of composite plastic materials and *interpret* the mechanism of conduction in conducting polymers.

### UNIT II: ELECTROCHEMICAL CELLS AND CORROSION

10 hrs

Single electrode potential, electrochemical series and uses of series, standard hydrogen electrode, calomel electrode, construction of glass electrode, batteries (Dry cell, Li ion battery and zinc air cells), fuel cells (H<sub>2</sub>-O<sub>2</sub>, CH<sub>3</sub>OH-O<sub>2</sub>, phosphoric acid and molten carbonate).

**Corrosion:-** Definition, theories of corrosion (chemical and electrochemical), galvanic corrosion, differential aeration corrosion, stress corrosion, galvanic series, factors influencing rate of corrosion, corrosion control (proper designing and cathodic protection), Protective coatings (surface preparation, cathodic coatings, anodic coatings, electroplating and electroless plating [nickel]), Paints (constituents, functions and special paints).



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**Course Outcomes:** *At the end of this unit, the students will be able to*

- *Utilize* the theory of construction of electrodes, batteries and fuel cells in redesigning new engineering products and *categorize* the reasons for corrosion and study methods to control corrosion.

**UNIT III: CHEMISTRY OF MATERIALS**

10 hrs

**Part- A:**

**Nano materials:-** Introduction, sol-gel method, characterization by (Brunauer Emmet Teller [BET]), (scanning electron microscopy [SEM]) and (transmission electron microscopy [TEM]) with example (TiO<sub>2</sub>), applications of graphene and fullerenes, carbon nanotubes (types, preparation and applications)

**Thermal analysis techniques:** Instrumentation and applications of thermogravimetric analysis (TGA), differential thermal analysis (DTA), differential scanning calorimetry (DSC).

**Part-B:**

**Refractories:** - Definition, classification, properties (refractoriness, refractoriness under load, porosity and thermal spalling), failure of refractories.

**Lubricants:** - Definition, mechanism of lubricants, properties (definition and importance).

**Cement:** - Constituents, manufacturing, parameters to characterize the clinker formation: lime saturation factor (LSF), silica ratio (SR) and alumina ratio (AR), chemistry of setting and hardening, deterioration of cement.

**Course Outcomes:** *At the end of this unit, the students will be able to*

- *Synthesize* nanomaterials for modern advances of engineering technology.
- *Summarize* the techniques that detect and measure changes of state of reaction.
- *Illustrate* the commonly used industrial materials.

**UNIT IV: FUELS**

10 hrs

Introduction, calorific value, higher calorific value, lower calorific values, problems using Dulong's formula, proximate and ultimate analysis of coal sample and their significance, numerical problems, petroleum (refining-cracking), synthetic petrol (Fischer Tropsch and Bergius), petrol knocking, diesel knocking, octane and cetane ratings, anti-knocking agents, Introduction to alternative fuels (Bio-diesel, ethanol, methanol, natural gas, liquefied petroleum gas, compressed natural gas), Flue gas analysis by Orsat apparatus, rocket fuels.

**Course Outcomes:** *At the end of this unit, the students will be able to*

- *Differentiate* petroleum, petrol, synthetic petrol and have knowledge how they are produced.
- *Study* alternate fuels and *analyse* flue gases.

**UNIT V: WATER TECHNOLOGY**

8 hrs

Hardness of water, determination of hardness by complexometric method, boiler troubles (priming and foaming, scale formation, boiler corrosion, caustic embrittlement), internal treatments, softening of hard water (zeolite process and related sums, ion exchange process), treatment of industrial waste water, potable water and its specifications, steps involved in purification of water, chlorination, break point chlorination-desalination (reverse osmosis and electro dialysis).

**Course Outcomes:** *At the end of this unit, the students will be able to*

- *Analyze* the suitable methods for purification and treatment of hard water and brackish water.



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**Standard Books:**

1. P.C. Jain and M. Jain “**Engineering Chemistry**”, 15/e, Dhanpat Rai & Sons, Delhi, (Latest edition).
2. Shikha Agarwal, “**Engineering Chemistry**”, Cambridge University Press, New Delhi, (2019).
3. S.S. Dara, “**A Textbook of Engineering Chemistry**”, S.Chand & Co, (2010).
4. Shashi Chawla, “Engineering Chemistry”, Dhanpat Rai Publishing Co. (Latest edition).

**Reference:**

1. K. Sessa Maheshwaramma and Mridula Chugh, “**Engineering Chemistry**”, Pearson India Edn.
2. O.G. Palana, “**Engineering Chemistry**”, Tata McGraw Hill Education Private Limited, (2009).
3. CNR Rao and JM Honig (Eds) “**Preparation and characterization of materials**” Academic press, New York (latest edition)
4. B. S. Murthy, P. Shankar and others, “**Textbook of Nanoscience and Nanotechnology**”, University press (latest edition)





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I Year - I Semester		L	T	P	C
		3	0	0	3
<b>ENGINEERING MECHANICS</b>					

**Objectives:** The students completing this course are expected to understand the concepts of forces and its resolution in different planes, resultant of force system, Forces acting on a body, their free body diagrams using graphical methods. They are required to understand the concepts of centre of gravity and moments of inertia and their application, Analysis of frames and trusses, different types of motion, friction and application of work - energy method.

#### **UNIT – I**

**Objectives: The students are to be exposed to the concepts of force and friction, direction and its application.**

Introduction to Engg. Mechanics – Basic Concepts.

**Systems of Forces:** Coplanar Concurrent Forces – Components in Space – Resultant – Moment of Force and its Application – Couples and Resultant of Force Systems.

**Friction:** Introduction, limiting friction and impending motion, coulomb's laws of dry friction, coefficient of friction, cone of friction

#### **UNIT II**

**Objectives: The students are to be exposed to application of free body diagrams. Solution to problems using graphical methods and law of triangle of forces.**

**Equilibrium of Systems of Forces:** Free Body Diagrams, , Lami's Theorem, Equations of Equilibrium of Coplanar Systems, Graphical method for the equilibrium, Triangle law of forces, converse of the law of polygon of forces condition of equilibrium, Equations of Equilibrium for Spatial System of forces, Numerical examples on spatial system of forces using vector approach, Analysis of plane trusses.

#### **UNIT – III**

**Objectives: The students are to be exposed to concepts of centre of gravity. The students are to be exposed to concepts of moment of inertia and polar moment of inertia including transfer methods and their applications.**

**Centroid:** Centroids of simple figures (from basic principles) – Centroids of Composite Figures

**Centre of Gravity:** Centre of gravity of simple body (from basic principles), centre of gravity of composite bodies, Pappus theorems.

**Area moments of Inertia:** Definition – Polar Moment of Inertia, Transfer Theorem, Moments of Inertia of Composite Figures, Products of Inertia, Transfer Formula for Product of Inertia. **Mass Moment of Inertia:** Moment of Inertia of Masses, Transfer Formula for Mass Moments of Inertia, mass moment of inertia of composite bodies.



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**UNIT – IV**

**Objectives:** The students are to be exposed to motion in straight line and in curvilinear paths, its velocity and acceleration computation and methods of representing plane motion.

**Rectilinear and Curvilinear motion of a particle:** Kinematics and Kinetics- Work Energy method and application to particle motion- Impulse momentum method.

**UNIT – V**

**Objectives:** The students are to be exposed to rigid motion kinematics and kinetics

**Rigid body Motion:** Kinematics and kinetics of translation, Rotation about fixed axis and plane motion, Work Energy method and Impulse momentum method.

**TEXT BOOK:**

1. Engg. Mechanics - S.Timoshenko & D.H.Young., 4<sup>th</sup> Edn - , Mc Graw Hill publications.

**Course outcomes:**

1. The student should be able to draw free body diagrams for FBDs for particles and rigid bodies in plane and space and problems to solve the unknown forces, orientations and geometric parameters.
2. He should be able to determine centroid for lines, areas and center of gravity for volumes and their composites.
3. He should be able to determine area and mass moment of inertia for composite sections
4. He should be able to analyze motion of particles and rigid bodies and apply the principles of motion, work energy and impulse – momentum.



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>COMMUNICATIVE ENGLISH</b>					

### Introduction

The course is designed to train students in receptive (listening and reading) as well as productive and interactive (speaking and writing) skills by incorporating a comprehensive, coherent and integrated approach that improves the learners' ability to effectively use English language in academic/ workplace contexts. The shift is from *learning about the language* to *using the language*. On successful completion of the compulsory English language course/s in B.Tech., learners would be confident of appearing for international language qualification/proficiency tests such as IELTS, TOEFL, or BEC, besides being able to express themselves clearly in speech and competently handle the writing tasks and verbal ability component of campus placement tests. Activity based teaching-learning methods would be adopted to ensure that learners would engage in actual use of language both in the classroom and laboratory sessions.

### Course Objectives

- Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native speakers
- Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials
- Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations
- Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information
- Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing

### Learning Outcomes

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

- understand social or transactional dialogues spoken by native speakers of English and identify the context, topic, and pieces of specific information
- ask and answer general questions on familiar topics and introduce oneself/others
- employ suitable strategies for skimming and scanning to get the general idea of a text and locate specific information
- recognize paragraph structure and be able to match beginnings/endings/headings with paragraphs
- form sentences using proper grammatical structures and correct word forms

### Unit I:

**Lesson-1: A Drawer full of happiness** from “**Infotech English**”, Maruthi Publications

**Lesson-2: Deliverance by Premchand** from “**The Individual Society**”, Pearson Publications. (Non-detailed)

**Listening:** Listening to short audio texts and identifying the topic. Listening to prose, prose and Conversation.



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**Speaking:** Asking and answering general questions on familiar topics such as home, family, work, studies and interests. Self introductions and introducing others.

**Reading:** Skimming text to get the main idea. Scanning to look for specific pieces of information.

**Reading for Writing:** Paragraph writing (specific topics) using suitable cohesive devices; linkers, sign posts and transition signals; mechanics of writing - punctuation, capital letters.

**Vocabulary:** Technical vocabulary from across technical branches (20) GRE Vocabulary (20) (Antonyms and Synonyms, Word applications) Verbal reasoning and sequencing of words.

**Grammar:** Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns: countables and uncountables; singular and plural basic sentence structures; simple question form - wh-questions; word order in sentences.

**Pronunciation:** Vowels, Consonants, Plural markers and their realizations

**Unit II:**

**Lesson-1: Nehru's letter to his daughter Indira on her birthday** from “**Infotech English**”, Maruthi Publications

**Lesson-2: Bosom Friend by Hira Bansode** from “**The Individual Society**”, Pearson Publications.(Non-detailed)

**Listening:** Answering a series of questions about main idea and supporting ideas after listening to audio texts, both in speaking and writing.

**Speaking:** Discussion in pairs/ small groups on specific topics followed by short structured talks. Functional English: Greetings and leave takings. **Reading:** Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.

**Reading for Writing:** Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions.

**Vocabulary:** Technical vocabulary from across technical branches (20 words). GRE Vocabulary Analogies (20 words) (Antonyms and Synonyms, Word applications)

**Grammar:** Use of articles and zero article; prepositions.

**Pronunciation:** Past tense markers, word stress-di-syllabic words

**Unit III:**

**Lesson-1: Stephen Hawking-Positivity 'Benchmark'** from “**Infotech English**”, Maruthi Publications

**Lesson-2: Shakespeare's Sister by Virginia Woolf** from “**The Individual Society**”, Pearson Publications.(Non-detailed)

**Listening:** Listening for global comprehension and summarizing what is listened to, both in speaking and writing.

**Speaking:** Discussing specific topics in pairs or small groups and reporting what is discussed. Functional English: Complaining and Apologizing.

**Reading:** Reading a text in detail by making basic inferences - recognizing and interpreting specific context clues; strategies to use text clues for comprehension. Critical reading.

**Reading for Writing:** Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions. Letter writing-types, format and principles of letter writing. E-mail etiquette, Writing CV's.



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**Vocabulary:** Technical vocabulary from across technical branches (20 words). GRE Vocabulary (20 words) (Antonyms and Synonyms, Word applications) Association, sequencing of words

**Grammar:** Verbs - tenses; subject-verb agreement; direct and indirect speech, reporting verbs for academic purposes.

**Pronunciation:** word stress-poly-syllabic words.

**Unit IV:**

**Lesson-1: Liking a Tree, Unbowed: Wangari Maathai-biography** from “**Infotech English**”, Maruthi Publications

**Lesson-2: Telephone Conversation-Wole Soyinka** from “**The Individual Society**”, Pearson Publications.(Non-detailed)

**Listening:** Making predictions while listening to conversations/ transactional dialogues without video (only audio); listening to audio-visual texts.

**Speaking:** Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.Functional English: Permissions, Requesting, Inviting.

**Reading:** Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicative process or display complicated data.

**Reading for Writing:** Information transfer; describe, compare, contrast, identify significance/trends based on information provided in figures/charts/graphs/tables.Writing SOP, writing for media.

**Vocabulary:** Technical vocabulary from across technical branches (20 words) GRE Vocabulary (20 words) (Antonyms and Synonyms, Word applications) Cloze Encounters.

**Grammar:** Quantifying expressions - adjectives and adverbs; comparing and contrasting; degrees of comparison; use of antonyms

**Pronunciation:** Contrastive Stress

**Unit V:**

**Lesson-1: Stay Hungry-Stay foolish** from “**Infotech English**”, Maruthi Publications

**Lesson-2: Still I Rise by Maya Angelou** from “**The Individual Society**”, Pearson Publications.(Non-detailed)

**Listening:** Identifying key terms, understanding concepts and interpreting the concepts both in speaking and writing.

**Speaking:** Formal oral presentations on topics from academic contexts - without the use of PPT slides.Functional English: Suggesting/Opinion giving.

**Reading:** Reading for comprehension. RAP Strategy Intensive reading and Extensive reading techniques.

**Reading for Writing:** Writing academic proposals- writing research articles: format and style.

**Vocabulary:** Technical vocabulary from across technical branches (20 words) GRE Vocabulary (20 words) (Antonyms and Synonyms, Word applications) Coherence, matching emotions.

**Grammar:** Editing short texts – identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)

**Pronunciation:** Stress in compound words



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Prescribed text books for theory for Semester-I:

1. “**Infotech English**”, Maruthi Publications. (Detailed)
2. “**The Individual Society**”, Pearson Publications.(Non-detailed)

Prescribed text book for Laboratory for Semesters-I & II:

1. “**Infotech English**”, Maruthi Publications. (with Compact Disc)

**Reference Books:**

- Bailey, Stephen. *Academic writing: A handbook for international students*. Routledge, 2014.
- Chase, Becky Tarver. *Pathways: Listening, Speaking and Critical Thinking*. Heinley ELT;2nd Edition, 2018.
- Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
- Hewings, Martin. *Cambridge Academic English (B2)*. CUP, 2012.



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<b>I Year - I Semester</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>2</b>	<b>3</b>
<b>PROGRAMMING FOR PROBLEM SOLVING USING C</b>					

**Course Objectives:**

The objectives of Programming for Problem Solving Using C are

- To learn about the computer systems, computing environments, developing of a computer program and Structure of a C Program
- To gain knowledge of the operators, selection, control statements and repetition in C
- To learn about the design concepts of arrays, strings, enumerated structure and union types. To learn about their usage.
- To assimilate about pointers, dynamic memory allocation and know the significance of Preprocessor.
- To assimilate about File I/O and significance of functions

**Course Outcomes:**

Upon the completion of the course the student will learn

- To write algorithms and to draw flowcharts for solving problems
- To convert flowcharts/algorithms to C Programs, compile and debug programs
- To use different operators, data types and write programs that use two-way/ multi-way selection
- To select the best loop construct for a given problem
- To design and implement programs to analyze the different pointer applications
- To decompose a problem into functions and to develop modular reusable code
- To apply File I/O operations

**UNIT I**

Introduction to Computers: Creating and running Programs, Computer Numbering System, Storing Integers, Storing Real Numbers

Introduction to the C Language: Background, C Programs, Identifiers, Types, Variable, Constants, Input/output, Programming Examples, Scope, Storage Classes and Type Qualifiers.

Structure of a C Program: Expressions Precedence and Associativity, Side Effects, Evaluating Expressions, Type Conversion Statements, Simple Programs, Command Line Arguments.

**UNIT II**

Bitwise Operators: Exact Size Integer Types, Logical Bitwise Operators, Shift Operators.

Selection & Making Decisions: Logical Data and Operators, Two Way Selection, Multiway Selection, More Standard Functions.

Repetition: Concept of Loop, Pretest and Post-test Loops, Initialization and Updating, Event and Counter Controlled Loops, Loops in C, Other Statements Related to Looping, Looping Applications, Programming Examples.





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**UNIT III**

Arrays: Concepts, Using Array in C, Array Application, Two Dimensional Arrays, Multidimensional Arrays, Programming Example – Calculate Averages  
 Strings: String Concepts, C String, String Input / Output Functions, Arrays of Strings, String Manipulation Functions String/ Data Conversion, A Programming Example – Morse Code  
 Enumerated, Structure, and Union: The Type Definition (Type def), Enumerated Types, Structure, Unions, and Programming Application.

**UNIT IV**

Pointers: Introduction, Pointers to pointers, Compatibility, L value and R value  
 Pointer Applications: Arrays, and Pointers, Pointer Arithmetic and Arrays, Memory Allocation Function, Array of Pointers, Programming Application.  
 Processor Commands: Processor Commands.

**UNIT V**

Functions: Designing, Structured Programs, Function in C, User Defined Functions, Inter-Function Communication, Standard Functions, Passing Array to Functions, Passing Pointers to Functions, Recursion  
 Text Input / Output: Files, Streams, Standard Library Input / Output Functions, Formatting Input / Output Functions, Character Input / Output Functions  
 Binary Input / Output: Text versus Binary Streams, Standard Library, Functions for Files, Converting File Type.

**Text Books:**

- 1) Programming for Problem Solving, Behrouz A. Forouzan, Richard F. Gilberg, CENGAGE.
- 2) The C Programming Language, Brian W. Kernighan, Dennis M. Ritchie, 2e, Pearson.

**Reference Books:**

- 1) Computer Fundamentals and Programming, Sumithabha Das, Mc Graw Hill.
- 2) Programming in C, Ashok N. Kamthane, Amit Kamthane, Pearson.
- 3) Computer Fundam





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<b>I Year - I Semester</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>
<b>ENGINEERING CHEMISTRY LABORATORY</b>					

Introduction to Chemistry laboratory – Molarity, normality, primary, secondary standard solutions, volumetric titrations, quantitative analysis

1. Determination of HCl using standard Na<sub>2</sub>CO<sub>3</sub> solution.
2. Determination of alkalinity of a sample containing Na<sub>2</sub>CO<sub>3</sub> and NaOH.
3. Determination of Mn<sup>+2</sup> using standard oxalic acid solution.
4. Determination of ferrous iron using standard K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> solution.
5. Determination of Cu<sup>+2</sup> using standard hypo solution.
6. Determination of temporary and permanent hardness of water using standard EDTA solution.
7. Determination of Fe<sup>+3</sup> by a colorimetric method.
8. Determination of the concentration of acetic acid using sodium hydroxide (pH-metry method).
9. Determination of iso-electric point of amino acids using pH-metry method/conductometric method.
10. Determination of the concentration of strong acid vs strong base (by conductometric method).
11. Determination of strong acid vs strong base (by potentiometric method).
12. Determination of Mg<sup>+2</sup> present in an antacid.
13. Determination of CaCO<sub>3</sub> present in an egg shell.
14. Estimation of Vitamin C.
15. Determination of phosphoric content in soft drinks.
16. Adsorption of acetic acid by charcoal.
17. Preparation of nylon-6, 6 and Bakelite (demonstration only).

Of the above experiments at-least 10 assessment experiments should be completed in a semester.

**Outcomes:** The students entering into the professional course have practically very little exposure to lab classes. The experiments introduce volumetric analysis; redox titrations with different indicators; EDTA titrations; then they are exposed to a few instrumental methods of chemical analysis. Thus at the end of the lab course, the student is exposed to different methods of chemical analysis and use of some commonly employed instruments. They thus acquire some experimental skills.

**Reference Books**

1. A Textbook of Quantitative Analysis, Arthur J. Vogel.



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		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>
<b>PROGRAMMING FOR PROBLEM SOLVING USING CLABORATORY</b>					

**Course Objectives:**

- Apply the principles of C language in problem solving.
- To design flowcharts, algorithms and knowing how to debug programs.
- To design & develop of C programs using arrays, strings pointers & functions.
- To review the file operations, preprocessor commands.

**Course Outcomes:**

By the end of the Lab, the student

- Gains Knowledge on various concepts of a C language.
- Able to draw flowcharts and write algorithms.
- Able design and development of C problem solving skills.
- Able to design and develop modular programming skills.
- Able to trace and debug a program

**Exercise 1:**

1. Write a C program to print a block F using hash (#), where the F has a height of six characters and width of five characters.
2. Write a C program to compute the perimeter and area of a rectangle with a height of 7 inches and width of 5 inches.
3. Write a C program to display multiple variables.

**Exercise 2:**

1. Write a C program to calculate the distance between the two points.
2. Write a C program that accepts 4 integers p, q, r, s from the user where r and s are positive and p is even. If q is greater than r and s is greater than p and if the sum of r and s is greater than the sum of p and q print "Correct values", otherwise print "Wrong values".

**Exercise 3:**

1. Write a C program to convert a string to a long integer.
2. Write a program in C which is a Menu-Driven Program to compute the area of the various geometrical shape.
3. Write a C program to calculate the factorial of a given number.

**Exercise 4:**

1. Write a program in C to display the n terms of even natural number and their sum.
2. Write a program in C to display the n terms of harmonic series and their sum.  $1 + 1/2 + 1/3 + 1/4 + 1/5 \dots 1/n$  terms.
3. Write a C program to check whether a given number is an Armstrong number or not.

**Exercise 5:**

1. Write a program in C to print all unique elements in an array.
2. Write a program in C to separate odd and even integers in separate arrays.
3. Write a program in C to sort elements of array in ascending order.

**Exercise 6:**

1. Write a program in C for multiplication of two square Matrices.
2. Write a program in C to find transpose of a given matrix.



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**Exercise 7:**

1. Write a program in C to search an element in a row wise and column wise sorted matrix.
2. Write a program in C to print individual characters of string in reverse order.

**Exercise 8:**

1. Write a program in C to compare two strings without using string library functions.
2. Write a program in C to copy one string to another string.

**Exercise 9:**

1. Write a C Program to Store Information Using Structures with Dynamically Memory Allocation
2. Write a program in C to demonstrate how to handle the pointers in the program.

**Exercise 10:**

1. Write a program in C to demonstrate the use of & (address of) and \*(value at address) operator.
2. Write a program in C to add two numbers using pointers.

**Exercise 11:**

1. Write a program in C to add numbers using call by reference.
2. Write a program in C to find the largest element using Dynamic Memory Allocation.

**Exercise 12:**

1. Write a program in C to swap elements using call by reference.
2. Write a program in C to count the number of vowels and consonants in a string using a pointer.

**Exercise 13:**

1. Write a program in C to show how a function returning pointer.
2. Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using malloc( ) function.

**Exercise 14:**

1. Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using calloc( ) function. Understand the difference between the above two programs
2. Write a program in C to convert decimal number to binary number using the function.

**Exercise 15:**

1. Write a program in C to check whether a number is a prime number or not using the function.
2. Write a program in C to get the largest element of an array using the function.

**Exercise 16:**

1. Write a program in C to append multiple lines at the end of a text file.
2. Write a program in C to copy a file in another name.
3. Write a program in C to remove a file from the disk.



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		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>
<b>ENGLISH COMMUNICATION SKILLS LABORATORY</b>					

**TOPICS**

**UNIT I:**

Vowels, Consonants, Pronunciation, Phonetic Transcription, Common Errors in Pronunciation,

**UNIT II:**

Word stress-di-syllabic words, poly-syllabic words, weak and strong forms, contrastive stress (Homographs)

**UNIT III:**

Stress in compound words, rhythm, intonation, accent neutralisation.

**UNIT IV:**

Listening to short audio texts and identifying the context and specific pieces of information to answer a series of questions in speaking.

**UNIT V:**

Newspapers reading; Understanding and identifying key terms and structures useful for writing reports.

**Prescribed text book:** “**Infotech English**”, Maruthi Publications.

**References:**

4. Exercises in Spoken English Part 1,2,3,4, OUP and CIEFL.
5. English Pronunciation in use- Mark Hancock, Cambridge University Press.
6. English Phonetics and Phonology- Peter Roach, Cambridge University Press.
7. English Pronunciation in use- Mark Hewings, Cambridge University Press.
8. English Pronunciation Dictionary- Daniel Jones, Cambridge University Press.
9. English Phonetics for Indian Students- P. Bala Subramanian, Mac Millan Publications.



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	<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>ENVIRONMENTAL SCIENCE</b>				

**Course Objectives:**

The objectives of the course are to impart:

- Overall understanding of the natural resources.
- Basic understanding of the ecosystem and its diversity.
- Acquaintance on various environmental challenges induced due to unplanned anthropogenic activities.
- An understanding of the environmental impact of developmental activities.
- Awareness on the social issues, environmental legislation and global treaties.

**UNIT I**

Multidisciplinary nature of Environmental Studies: Definition, Scope and Importance – Sustainability: Stockholm and Rio Summit–Global Environmental Challenges: Global warming and climate change, acid rains, ozone layer depletion, population growth and explosion, effects. Role of information technology in environment and human health.

Ecosystems: Concept of an ecosystem. - Structure and function of an ecosystem; Producers, consumers and decomposers. - Energy flow in the ecosystem - Ecological succession. - Food chains, food webs and ecological pyramids; Introduction, types, characteristic features, structure and function of Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems.

**UNIT II**

Natural Resources: Natural resources and associated problems.

Forest resources: Use and over – exploitation, deforestation – Timber extraction – Mining, dams and other effects on forest and tribal people.

Water resources: Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems.

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources.

Food resources: World food problems, changes caused by non-agriculture activities-effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity.

Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources.

Land resources: Land as a resource, land degradation, Wasteland reclamation, man induced landslides, soil erosion and desertification; Role of an individual in conservation of natural resources; Equitable use of resources for sustainable lifestyles.

**UNIT III**

Biodiversity and its conservation: Definition: genetic, species and ecosystem diversity-classification - Value of biodiversity: consumptive use, productive use, social-Biodiversity at national and local levels. India as a mega-diversity nation - Hot-spots of biodiversity - Threats to biodiversity: habitat loss, man-wildlife conflicts. - Endangered and endemic species of India – Conservation of biodiversity: conservation of biodiversity.



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**UNIT IV**

Environmental Pollution: Definition, Cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Noise pollution, Nuclear hazards. Role of an individual in prevention of pollution. - Pollution case studies, Sustainable Life Studies. Impact of Fire Crackers on Men and his well being.

Solid Waste Management: Sources, Classification, effects and control measures of urban and industrial solid wastes. Consumerism and waste products, Biomedical, Hazardous and e – waste management.

**UNIT V**

Social Issues and the Environment: Urban problems related to energy -Water conservation, rain water harvesting-Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issues and possible solutions. Environmental Protection Act -Air (Prevention and Control of Pollution) Act. –Water (Prevention and control of Pollution) Act - Wildlife Protection Act -Forest Conservation Act-Issues involved in enforcement of environmental legislation. -Public awareness.

Environmental Management: Impact Assessment and its significance various stages of EIA, preparation of EMP and EIS, Environmental audit. Ecotourism, Green Campus – Green business and Green politics.

The student should Visit an Industry / Ecosystem and submit a report individually on any issues related to Environmental Studies course and make a power point presentation.

**Text Books:**

- 1) Environmental Studies, K. V. S. G. Murali Krishna, VGS Publishers, Vijayawada
- 2) Environmental Studies, R. Rajagopalan, 2<sup>nd</sup> Edition, 2011, Oxford University Press.
- 3) Environmental Studies, P. N. Palanisamy, P. Manikandan, A. Geetha, and K. Manjula Rani; Pearson Education, Chennai

**Reference Books:**

- 1) Text Book of Environmental Studies, Deeshita Dave & P. Udaya Bhaskar, Cengage Learning.
- 2) A Textbook of Environmental Studies, Shaashi Chawla, TMH, New Delhi
- 3) Environmental Studies, Benny Joseph, Tata McGraw Hill Co, New Delhi
- 4) Perspectives in Environment Studies, Anubha Kaushik, C P Kaushik, New Age International Publishers, 2014



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>MATHEMATICS - II (MATHEMATICAL METHODS)</b>					

**Course Objectives:**

- To instruct the concept of Matrices in solving linear algebraic equations
- To elucidate the different numerical methods to solve nonlinear algebraic equations
- To disseminate the use of different numerical techniques for carrying out numerical integration.
- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various realworld problems and their applications.

**Course Outcomes:**

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

- develop the use of matrix algebra techniques that is needed by engineers for practical applications (L6)
- solve system of linear algebraic equations using Gauss elimination, Gauss Jordan, Gauss Seidel (L3)
- evaluate approximating the roots of polynomial and transcendental equations by different algorithms (L5)
- apply Newton's forward & backward interpolation and Lagrange's formulae for equal and unequal intervals (L3)
- apply different algorithms for approximating the solutions of ordinary differential equations to its analytical computations (L3)

**UNIT I:** Solving systems of linear equations, Eigen values and Eigen vectors: (10 hrs)  
 Rank of a matrix by echelon form and normal form – Solving system of homogeneous and non-homogeneous equations linear equations – Gauss Elimination for solving system of equations – Eigen values and Eigen vectors and their properties.

**UNIT-II:** Cayley-Hamilton theorem and Quadratic forms: (10 hrs)  
 Cayley - Hamilton theorem (without proof) – Finding inverse and power of a matrix by Cayley-Hamilton theorem – Reduction to Diagonal form – Quadratic forms and nature of the quadratic forms – Reduction of quadratic form to canonical forms by orthogonal transformation. Singular values of a matrix, singular value decomposition (Ref. Book – 1).

**UNIT III:** Iterative methods: (8 hrs)  
 Introduction – Bisection method – Secant method – Method of false position – Iteration method – Newton-Raphson method (One variable and simultaneous Equations) – Jacobi and Gauss-Seidel methods for solving system of equations.

**UNIT IV:** Interpolation: (10 hrs)  
 Introduction – Errors in polynomial interpolation – Finite differences – Forward differences – Backward differences – Central differences – Relations between operators – Newton's forward and backward formulae for interpolation – Interpolation with unequal intervals – Lagrange's interpolation formula – Newton's divide difference formula.



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**UNIT V:** Numerical integration and solution of ordinary differential equations: (10 hrs) Trapezoidal rule – Simpson's  $1/3^{\text{rd}}$  and  $3/8^{\text{th}}$  rule – Solution of ordinary differential equations by Taylor's series – Picard's method of successive approximations – Euler's method – Runge-Kutta method (second and fourth order).

**Text Books:**

- 1) B. S. Grewal, Higher Engineering Mathematics, 43<sup>rd</sup> Edition, Khanna Publishers.
- 2) B. V. Ramana, Higher Engineering Mathematics, 2007 Edition, Tata Mc.Graw Hill Education.

**Reference Books:**

- 1) David Poole, Linear Algebra- A modern introduction, 4<sup>th</sup> Edition, Cengage.
  - 2) Steven C. Chapra, Applied Numerical Methods with MATLAB for Engineering and Science, Tata Mc. Graw Hill Education.
  - 3) M. K. Jain, S. R. K. Iyengar and R. K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International Publications.
- Lawrence Turyn, Advanced Engineering





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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>ENGINEERING PHYSICS</b>					

**Unit-I: Wave Optics**

12hrs

**Interference:** Principle of superposition –Interference of light - Interference in thin films (Reflection Geometry) & applications -Colors in thin films- Newton’s Rings- Determination of wavelength and refractive index.

**Diffraction:** Introduction - Fresnel and Fraunhofer diffraction - Fraunhofer diffraction due to single slit, double slit - N-slits(Qualitative) – Grating - Dispersive power and resolving power of Grating(Qualitative).

**Polarization:** Introduction-Types of polarization - Polarization by reflection, refraction and Double refraction - Nicol’s Prism -Half wave and Quarter wave plates.

**Unit Outcomes:**

**The students will be able to**

- **Explain** the need of coherent sources and the conditions for sustained interference (L2)
- **Identify** engineering applications of interference (L3)
- **Analyze** the differences between interference and diffraction with applications (L4)
- **Illustrate** the concept of polarization of light and its applications (L2)
- **Classify** ordinary polarized light and extraordinary polarized light (L2)

**Unit-II: Lasers and Fiber optics**

10hrs

**Lasers:** Introduction – Characteristics of laser – Spontaneous and Stimulated emissions of radiation – Einstein’s coefficients – Population inversion –Lasing action- Pumping mechanisms – Ruby laser – He-Ne laser - Applications of lasers.

**Fiber optics:** Introduction –Principle of optical fiber- Acceptance Angle-Numerical Aperture- Classification of optical fibers based on refractive index profile and modes – Propagation of electromagnetic wave through optical fibers - Applications.

**Unit Outcomes:**

**The students will be able to**

- **Understand** the basic concepts of LASER light Sources (L2)
- **Apply** the concepts to learn the types of lasers (L3)
- **Identifies** the Engineering applications of lasers (L2)
- **Explain** the working principle of optical fibers (L2)
- **Classify** optical fibers based on refractive index profile and mode of propagation (L2)
- **Identify** the applications of optical fibers in various fields (L2)

**UNIT III: Engineering Materials**

8hrs

**Dielectric Materials:** Introduction - Dielectric polarization - Dielectric polarizability, Susceptibility and Dielectric constant - Types of polarizations- Electronic (Quantitative), Ionic (Quantitative) and Orientation polarizations (Qualitative) - Lorentz internal field- Clausius- Mossotti equation- Piezoelectricity.



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**Magnetic Materials:** Introduction - Magnetic dipole moment - Magnetization- Magnetic susceptibility and permeability - Origin of permanent magnetic moment - Classification of magnetic materials: Dia, para, Ferro, antiferro & Ferrimagnetic materials - Domain concept for Ferromagnetism & Domain walls (Qualitative) - Hysteresis - soft and hard magnetic materials- Eddy currents- Engineering applications.

**Unit Outcomes:**

**The students will be able to**

- **Explain** the concept of dielectric constant and polarization in dielectric materials (L2)
- **Summarize** various types of polarization of dielectrics (L2)
- **Interpret** Lorentz field and Clausius- Mosotti relation in dielectrics(L2)
- **Classify** the magnetic materials based on susceptibility and their temperature dependence (L2)
- **Explain** the applications of dielectric and magnetic materials (L2)
- **Apply** the concept of magnetism to magnetic devices (L3)

**Unit-IV: Acoustics and Ultrasonics**

**10hrs**

**Acoustics:** Introduction – requirements of acoustically good hall– Reverberation – Reverberation time– Sabine’s formula (Derivation using growth and decay method) - Absorption coefficient and its determination – Factors affecting acoustics of buildings and their remedial measures.

**Ultrasonics:** Introduction - Properties - Production by magnetostriction and piezoelectric methods – Detection - Acoustic grating - Non Destructive Testing – pulse echo system through transmission and reflection modes - Applications.

**Unit Outcomes:**

**The students will be able to**

- **Explain** how sound is propagated in buildings (L2)
- **Analyze** acoustic properties of typically used materials in buildings (L4)
- **Recognize** sound level disruptors and their use in architectural acoustics (L2)
- **Identify** the use of ultrasonics in different fields (L3)

**Unit-V: Crystallography and X-ray diffraction**

**8hrs**

**Crystallography:** Space lattice, Basis, Unit Cell and lattice parameters – Bravais Lattice – crystal systems (3D) – coordination number - packing fraction of SC, BCC & FCC - Miller indices – separation between successive (hkl) planes.

**X- ray diffraction:** Bragg’s law - X-ray Diffractometer – crystal structure determination by Laue’s and powder methods.

**Unit Outcomes:**

**The students will be able to**

- **Classify** various crystal systems (L2)
- **Identify** different planes in the crystal structure (L3)
- **Analyze** the crystalline structure by Bragg’s X-ray diffractometer (L4)
- **Apply** powder method to measure the crystallinity of a solid (L4)



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**Text books:**

1. Engineering Physics – Dr. M.N. Avadhanulu & Dr. P.G. Kshirsagar, S. Chand and Company
2. Engineering physics – D.K. Battacharya and Poonam Tandon, Oxford University press.
3. Engineering Physics by P.K.Palanisamy SciTech publications.

**Reference Books:**

1. Fundamentals of Physics – Halliday, Resnick and Walker, John Wiley & Sons
2. Engineering Physics – M.R.Srinivasan, New Age Publications
3. Engineering Physics – D K Pandey, S. Chaturvedi, Cengage Learning
4. Engineering Physics - Sanjay D. Jain, D. Sahasrambudhe and Girish, University Press



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>METALLURGY &amp; MATERIALS SCIENCE</b>					

**Course Objective:** To understand the basic fundamentals of Material science and Physical metallurgy. The basic concepts to be taught will help for the improvement, proper selection and effective utilization of materials which is essential to satisfy the ever increasing demands of the society.

#### UNIT – I

**Structure of Metals and Constitution of alloys:** Bonds in Solids, Metallic bond, crystallization of metals, Packing Factor - SC, BCC, FCC & HCP-line density, plane density. Grain and grain boundaries, effect of grain boundaries on the Properties of metal / alloys – determination of grain size. Imperfections – point, line, surface and volume- Slip and Twinning.

Necessity of alloying, types of solid solutions, Hume Rotherys rules, intermediate alloy phases, and electron compounds

**Equilibrium Diagrams :** Experimental methods of construction of equilibrium diagrams, Isomorphous alloy systems, equilibrium cooling and heating of alloys, Lever rule, coring miscibility gaps, eutectic systems, congruent melting intermediate phases, peritectic reaction. Transformations in the solid state – allotropy, eutectoid, peritectoid reactions, phase rule, relationship between equilibrium diagrams and properties of alloys. Study of binary phase diagrams such as Cu-Ni and Fe-Fe<sub>3</sub>C.

#### UNIT – II

**Ferrous metals and alloys:** Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheroidal graphite cast iron, Alloy cast irons. Classification of steels, structure and properties of plain carbon steels, Low alloy steels, Hadfield manganese steels, tool and die steels.

**Non-ferrous Metals and Alloys:** Structure and properties of Copper and its alloys, Aluminium and its alloys, Titanium and its alloys, Magnesium and its alloys, Super alloys.

#### UNIT – III

**Heat treatment of Alloys:** Effect of alloying elements on Fe-Fe<sub>3</sub>C system, Annealing, normalizing, hardening, TTT diagrams, tempering, hardenability, surface - hardening methods, Age hardening treatment, Cryogenic treatment of alloys.

#### UNIT – IV

**Powder Metallurgy:** Basic processes- Methods of producing metal powders- milling atomization- Granulation-Reduction-Electrolytic Deposition. Compacting methods – Sintering - Methods of manufacturing sintered parts. Sintering Secondary operations-Sizing, coining, machining -Factors determining the use of powder metallurgy-Application of this process.

#### UNIT – V

**Ceramic and composite materials:** Crystalline ceramics, glasses, cermets, abrasive materials, Classification of composites, various methods of component manufacture of composites, particle – reinforced materials, fiber reinforced materials, metal ceramic mixtures, metal – matrix composites and C - C composites. Nanomaterials – definition, properties and applications.



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**TEXT BOOKS:**

1. Introduction to Physical Metallurgy - Sidney H. Avener - McGrawHill
2. Essential of Materials science and engineering - Donald R. Askeland - Cengage.

**REFERENCES:**

1. Material Science and Metallurgy – Dr. V.D.kodgire- Everest Publishing House
2. Materials Science and engineering - Callister & Baalashubrahmanyam- Wiley Publications
3. Material Science for Engineering students – Fischer – Elsevier Publishers
4. Material science and Engineering - V. Rahghavan-PHI Publishers
5. Introduction to Material Science and Engineering – Yip-Wah Chung CRC Press
6. Material Science and Metallurgy – A V K Suryanarayana – B S Publications
7. Material Science and Metallurgy – U. C. Jindal – Pearson Publications

**Course Outcomes:**

- CO1: Understand the crystalline structure of different metals and study the stability of phases in different alloy systems.
- CO2: Study the behavior of ferrous and non ferrous metals and alloys and their application in different domains
- CO3: Able to understand the effect of heat treatment, addition of alloying elements on properties of ferrous metals.
- CO4: Grasp the methods of making of metal powders and applications of powder metallurgy CO5: Comprehend the properties and applications of ceramic, composites and other advanced methods.



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**DEPARTMENT OF AUTOMOBILE ENGINEERING**

<b>I Year - II Semester</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>BASIC ELECTRICAL AND ELECTRONICS ENGINEERING</b>					

**Preamble:**

This course covers the topics related to analysis of various electrical circuits, operation of various electrical machines and electronic components to perform well in their respective fields.

**Learning Objectives:**

- To learn the basic principles of electrical circuit law's and analysis of networks.
- To understand principle of operation and construction details of DC machines.
- To understand principle of operation and construction details of transformers, alternator and 3-Phase induction motor.
- To study operation of PN junction diode, half wave, full wave rectifiers and OP-AMPs.
- To learn operation of PNP and NPN transistors and various amplifiers.

**Unit - I**

**Electrical Circuits**

Basic definitions – types of network elements – Ohm's Law – Kirchhoff's Laws – inductive networks – capacitive networks – series – parallel circuits – star-delta and delta-star transformations.-Numerical Problems.

**Unit - II**

**DC Machines**

Principle of operation of DC generator – EMF equation – types of DC machines – torque equation characteristics of DC motors – applications – three point starter – speed control methods of DC motor – Swinburne's Test-Brake test on DC shunt motor-Numerical problems.

**Unit – III**

**AC Machines:**

**Transformers** Principle of operation and construction of single phase transformers – EMF equation – Losses – OC & SC tests – efficiency and regulation-Numerical Problems.

**AC Rotating Machines**

Principle of operation and construction of alternators – types of alternators Regulation of alternator by synchronous impedance method – principle of operation of synchronous motor – principle of operation of 3- Phase induction motor – slip-torque characteristics – efficiency – applications- Numerical Problems.



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**Unit IV**

**Rectifiers & Linear ICs**

PN junction diodes – diode applications (half wave and bridge rectifiers). Characteristics of operation amplifiers (OP-AMP) – application of OP-AMPs (inverting, non-inverting, integrator and differentiator)- Numerical Problems.

**Unit V**

**Transistors**

PNP and NPN junction transistor, transistor as an amplifier– frequency response of CE amplifier – Basic concepts of feedback amplifier-Numerical problems.

**Learning Outcomes:**

The student should be able to:

- Analyse various electrical networks.
- Understand operation of DC generators, 3-point starter and DC machine testing by Swinburne's Test and Brake test.
- Analyse performance of single-phase transformer and acquire proper knowledge and working of 3-phase alternator and 3-phase induction motors.
- Analyse operation of half wave, full wave bridge rectifiers and OP-AMPs.
- Understanding operations of CE amplifier and basic concept of feedback amplifier.

**Text Books:**

1. Electrical Technology by Surinder Pal Bali, Pearson Publications.
2. Electronic Devices and Circuits by R.L. Boylestad and Louis Nashelsky, 9<sup>th</sup> edition, PEI/PHI 2006.

**Reference Books:**

1. Electrical Circuit Theory and Technology by John Bird, Routledge Taylor & Francis Group
2. Basic Electrical Engineering by M.S.Naidu and S.Kamakshiah, TMH Publications
3. Fundamentals of Electrical Engineering by Rajendra Prasad, PHI Publications, 2<sup>nd</sup> edition
4. Basic Electrical Engineering by Nagsarkar, Sukhija, Oxford Publications, 2<sup>nd</sup> edition
5. Industrial Electronics by G.K. Mittal, PHI



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		<b>2</b>	<b>0</b>	<b>2</b>	<b>3</b>
<b>ENGINEERING GRAPHICS</b>					

**Course Objective:** Engineering drawing being the principal method of communication for engineers, the objective is to introduce the students, the techniques of constructing the various types of polygons. The objective is also to visualize and represent the 3D objects in 2D planes with proper dimensioning, scaling etc.

### Unit I

**Objective:** To introduce the students to use orthographic projections, projections of points & simple lines. To make the students draw the projections of the lines inclined to both the planes.

**Introduction** to Engineering graphics.

**Orthographic Projections:** Reference plane, importance of reference lines, projections of points in various quadrants, projections of lines, line parallel to both the planes, line parallel to one plane and inclined to other plane.

Projections of straight lines inclined to both the planes, determination of true lengths, angle of inclination and traces.

### Unit II

**Objective:** The objective is to make the students draw the projections of the plane and solids inclined to both the reference planes.

Projections of planes: Construction of polygons, regular planes perpendicular/parallel to one reference plane and inclined to the other reference plane, plane objects/ inclined to both the reference plane.

Projections of Solids – Prisms, Pyramids, Cones and Cylinders – simple positions.

### Unit III

#### Objective:

The objective is to make the students draw the projections and sections of the various types of solids in different positions inclined to both the planes.

**Projections of Solids** – Prisms, Pyramids, Cones and Cylinders – axis inclined to both the planes.

**SECTIONS OF SOLIDS:** Sections and Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views.

### UNIT-IV

The knowledge of interpenetration of solids and development of surfaces is required in designing and manufacturing of the objects. Whenever two or more solids combine, a definite curve is seen at their intersection.

**INTERPENETRATION OF RIGHT REGULAR SOLIDS:** Intersection of Cylinder Vs Cylinder, Cylinder Vs Prism, Cylinder Vs Cone, Prism Vs Cone.

**DEVELOPMENT OF SURFACES:** Development of Surfaces of Right Regular Solids – Prism, Cylinder, Pyramid, Cone and their parts.

### Unit V

**Objective:** The objective is to represent the object in 3D view through isometric views. The student will be able to represent and convert the isometric view to orthographic view and vice versa.

Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.





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**TEXT BOOKS:**

1. Engineering Drawing by N.D. Bhatt, Chariot Publications
2. Engineering Drawing by Agarwal & Agarwal, Tata McGraw Hill Publishers

**REFERENCE BOOKS:**

1. Engineering Drawing by K.L.Narayana & P. Kannaiah, Scitech Publishers
2. Engineering Graphics for Degree by K.C. John, PHI Publishers
3. Engineering Graphics by P. Varghese, McGrawHill Publishers
4. Engineering Drawing + AutoCad – K Venugopal, V. Prabhu Raja, New Age

**Course Outcomes:**

- CO1. To make the students to draw the attributes and its importance in the fields of design and manufacturing
- CO2. To make the student familiar with the techniques used for drawing various geometric elements used in engineering practice.
- CO3. Making them to understand orthographic projections of points, lines, planes and solids in various positions with respect to different reference planes.
- CO4. Ability to use the concepts of isometric projections to analyze 3D objects by viewing their 2D projections and vice versa.



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		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>
<b>BASIC ELECTRICAL &amp; ELECTRONICS ENGINEERING LABORATORY</b>					

**Learning Objectives:**

- To predetermine the efficiency of dc shunt machine using Swinburne's test.
- To predetermine the efficiency and regulation of 1-phase transformer with O.C and S.C tests.
- To obtain performance characteristics of DC shunt motor & 3-phase induction motor.
- To find out regulation of an alternator with synchronous impedance method.
- To control speed of dc shunt motor using Armature voltage and Field flux control methods.
- To find out the characteristics of PN junction diode & transistor
- To determine the ripple factor of half wave & full wave rectifiers.

**Section A: Electrical Engineering:**

The following experiments are required to be conducted as compulsory experiments:

1. Swinburne's test on D.C. Shunt machine (predetermination of efficiency of a given D.C. shunt machine working as motor and generator).
2. OC and SC tests on single phase transformer (predetermination of efficiency and regulation at given power factors).
3. Brake test on 3-phase Induction motor (determination of performance characteristics)
4. Regulation of alternator by Synchronous impedance method.
5. Speed control of D.C. Shunt motor by
  - a) Armature Voltage control b) Field flux control method
6. Brake test on D.C. Shunt Motor.

**Section B: Electronics Engineering:**

The following experiments are required to be conducted as compulsory experiments:

1. PN junction diode characteristics a) Forward bias b) Reverse bias (Cut in voltage and resistance calculations)
2. Transistor CE characteristics (input and output)
3. Half wave rectifier with and without filters.
4. Full wave rectifier with and without filters.
5. CE amplifiers.
6. OP- amp applications (inverting, non inverting, integrator and differentiator)



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***Learning Outcomes:***

The student should be able to:

- Compute the efficiency of DC shunt machine without actual loading of the machine.
- Estimate the efficiency and regulation at different load conditions and power factors for single phase transformer with OC and SC tests.
- Analyse the performance characteristics and to determine efficiency of DC shunt motor & 3-Phase induction motor.
- Pre-determine the regulation of an alternator by synchronous impedance method.
- Control the speed of dc shunt motor using Armature voltage and Field flux control methods.
- Draw the characteristics of PN junction diode & transistor
- Determine the ripple factor of half wave & full wave rectifiers.



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		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>
<b>ENGINEERING PHYSICS LABORATORY</b>					

(Any 10 of the following listed experiments)

**List of Engineering Physics Experiments**

1. Laser: Determination of wavelength using diffraction grating.
2. Young's modulus of given material by Strain gauge method.
3. Study of variation of magnetic field along the axis of a current carrying circular coil by Stewart & Gee's method.
4. Determination of ultrasonic velocity in given liquid (Acoustic grating).
5. Determination of dielectric constant using charging and discharging method.
6. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
7. Estimation of Planck's constant using photoelectric effect.
8. Rigidity modulus of material of a wire-dynamic method (Torsional pendulum).
9. Determination of numerical aperture and acceptance angle of an optical fiber.
10. Determination of thickness of thin object by wedge method.
11. Determination of radius of curvature of given plano convex lens by Newton's rings.
12. Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.
13. Determination of dispersive power of the prism.
14. Sonometer: Verification of laws of string.
15. Measurement of magnetic susceptibility by Kundt's tube method.

**References:**

1. S. Balasubramanian, M.N. Srinivasan "A Text book of Practical Physics"- S Chand Publishers, 2017.



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		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>
<b>ENGINEERING WORKSHOP &amp; IT WORKSHOP LABORATORY</b>					

**Course Objective:**

To impart hands-on practice on basic engineering trades and skills.

**Note:** At least two exercises to be done from each trade.

**ENGINEERING WORKSHOP:**

**Trade:**

- 1. Carpentry**
  1. T-Lap Joint
  2. Cross Lap Joint
  3. Dovetail Joint
  4. Mortise and Tenon Joint
  
- 2. Fitting**
  1. Vee Fit
  2. Square Fit
  3. Half Round Fit
  4. Dovetail Fit
  
- 3. Black Smithy**
  1. Round rod to Square
  2. S-Hook
  3. Round Rod to Flat Ring
  4. Round Rod to Square headed bolt
  
- 4. House Wiring**
  1. Parallel / Series Connection of three bulbs
  2. Stair Case wiring
  3. Florescent Lamp Fitting
  4. Measurement of Earth Resistance
  
- 5. Tin Smithy**
  1. Taper Tray
  2. Square Box without lid
  3. Open Scoop
  4. Funnel



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**IT WORKSHOP:**

- 1. MATLAB**
- 2. LATEX (Optional)**
- 3. Sensors & Actuators ( Any Two )**
  - a. To study the temperature – resistance & Voltage characteristics of the thermistor.
  - b. To study the characteristics of the pressure cell with respect to bridge voltage.
  - c. To study the response of distance versus voltage & Resistance in Light Dependent Resistors (LDR).
  - d. To study the response of distance versus voltage in photodiode & phototransistor.
  - e. Speed control of DC motor, DC Servo motor & DC Stepper motor
  - f. Circuit development using different relay
- 4. Make use of “Assembly Level Coding” or “ Embedded C Coding to execute the any TWO experiments from the area of Microcontroller**
  - a. Program for blinking LEDs (converge and diverge without overlapping) at any GPIO pins of Microcontroller
  - b. Program for interfacing nxn LED matrix and displaying various patterns Microcontroller
  - c. Program To Display Counter Of 0 To 9999 On Seven Segment Display
  - d. Program for interfacing 16x2 LCD with Microcontroller
  - e. Program To Control The Operation Of Relay And Buzzer
  - f. Program of analog to digital converter for microcontroller
  - g. Program of Real Time Control (RTC)
  - h. Program To Control The Operation Of Stepper Motor
  - i. Program To Control The Operation Of DC Motor
  - j. Program To Control The Operation Of Servo Motor
  - k. Program for displaying hello world message
- 5. Make use of “Ladder Logic Programming” to execute the any TWO experiments from the area of Programmable Logic Control (PLC)**
  - a. Design a PLC ladder diagram to construct an alarm system which operates as follows  
 If one input is on, nothing happens  
 If any 2 inputs are on, red light turns on  
 If any 3 inputs are on, an alarm sirens sound  
 And if all the inputs are on then the fire department is to be notified.



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- b. A conveyor is supposed to have exactly 45 parts on it. You have three indicating lights to indicate the conveyor count status: less than 45, yellow: exactly 45, green: and more than 45, red. The count of parts on the conveyor is set at 45 each morning by an actual count of parts. There are two sensors on the conveyor, one is actuated by parts entering the conveyor, and the other is actuated by parts leaving. Design a PLC program to carry out this process.
- c. In certain process control application when the count reaches 25, a paint spray is to run for 40 seconds. Design, construct, and test PLC circuits for this process.
- d. Design and implement ladder logic to interface analog sensor with PLC.
- e. Design and Implement ladder logic algorithm for a Car Parking System using Sensors

**Resources Required:**

1. Sensors

- a) Temperature
- b) LDR
- c) Load Cell
- d) Piezoelectric
- e) Strain Gauge
- f) Pressure
- g) Proximity

2. Actuators

- a) DC Motor
- b) Servo Motor
- c) Stepper Motor
- d) Relays

3. Microcontroller development board with IDE

4. Any PLC programming software like Rexroth, Allen Bradley, Siemens, Omron etc.



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		<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>CONSTITUTION OF INDIA</b>					

**Course Objectives:**

- To Enable the student to understand the importance of constitution
- To understand the structure of executive, legislature and judiciary
- To understand philosophy of fundamental rights and duties
- To understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of India and election commission of India.
- To understand the central and state relation financial and administrative.

**UNIT-I**

Introduction to Indian Constitution: Constitution meaning of the term, Indian Constitution - Sources and constitutional history, Features - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

**Learning outcomes:**

After completion of this unit student will

- Understand the concept of Indian constitution
- Apply the knowledge on directive principle of state policy
- Analyze the History, features of Indian constitution
- Evaluate Preamble Fundamental Rights and Duties

**UNIT-II**

Union Government and its Administration Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha, The Supreme Court and High Court: Powers and Functions;

**Learning outcomes:-**After completion of this unit student will

- Understand the structure of Indian government
- Differentiate between the state and central government
- Explain the role of President and Prime Minister
- Know the Structure of supreme court and High court

**UNIT-III**

State Government and its Administration Governor - Role and Position - CM and Council of ministers, State Secretariat: Organisation, Structure and Functions

**Learning outcomes:-**After completion of this unit student will

- Understand the structure of state government
- Analyze the role Governor and Chief Minister
- Explain the role of state Secretariat
- Differentiate between structure and functions of state secretariat





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**UNIT-IV**

A. Local Administration - District's Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative - CEO of Municipal Corporation PachayatiRaj: Functions PRI: ZilaPanchayat, Elected officials and their roles, CEO ZilaPanchayat: Block level Organizational Hierarchy - (Different departments), Village level - Role of Elected and Appointed officials - Importance of grass root democracy

**Learning outcomes:-**After completion of this unit student will

- Understand the local Administration
- Compare and contrast district administration role and importance
- Analyze the role of Myer and elected representatives of Municipalities
- Evaluate Zilla panchayat block level organisation

**UNIT-V**

Election Commission: Election Commission- Role of Chief Election Commissioner and Election Commissionerate State Election Commission:, Functions of Commissions for the welfare of SC/ST/OBC and women

**Learning outcomes:-**After completion of this unit student will

- Know the role of Election Commission apply knowledge
- Contrast and compare the role of Chief Election commissioner and Commissionerate
- Analyze role of state election commission
- Evaluate various commissions of viz SC/ST/OBC and women

**References:**

1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt. Ltd.. New Delhi
2. SubashKashyap, Indian Constitution, National Book Trust
3. J.A. Siwach, Dynamics of Indian Government & Politics
4. D.C. Gupta, Indian Government and Politics
5. H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)
6. J.C. Johari, Indian Government andPolitics Hans
7. J. Raj IndianGovernment and Politics
8. M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hallof India Pvt. Ltd.. New Delhi
9. Noorani, A.G., (South Asia Human Rights Documentation Centre), Challenges to Civil Right),Challenges to Civil Rights Guarantees in India, Oxford University Press 2012



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**E-resources:**

1. [nptel.ac.in/courses/109104074/8](https://nptel.ac.in/courses/109104074/8)
2. [nptel.ac.in/courses/109104045/](https://nptel.ac.in/courses/109104045/)
3. [nptel.ac.in/courses/101104065/](https://nptel.ac.in/courses/101104065/)
4. [www.hss.iitb.ac.in/en/lecture-details](http://www.hss.iitb.ac.in/en/lecture-details)
5. [www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution](http://www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution)

**Course Outcomes:**

At the end of the semester/course, the student will be able to have a clear knowledge on the following:

- Understand historical background of the constitution making and its importance for building a democratic India.
- Understand the functioning of three wings of the government i.e., executive, legislative and judiciary.
- Understand the value of the fundamental rights and duties for becoming a good citizen of India.
- Analyze the decentralization of power between central, state and local self-government.
- Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.
  1. Know the sources, features and principles of Indian Constitution.
  2. Learn about Union Government, State government and its administration.
  3. Get acquainted with Local administration and Panchayati Raj.
  4. Be aware of basic concepts and developments of Human Rights.
  5. Gain knowledge on roles and functioning of Election Commission.



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>MATHEMATICS-III</b> <b>(VECTOR CALCULUS, TRANSFORMS AND PDE)</b>					

**Course Objectives:**

- To familiarize the techniques in partial differential equations
- To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications.

**Course Outcomes:** At the end of the course, the student will be able to

- interpret the physical meaning of different operators such as gradient, curl and divergence (L5)
- estimate the work done against a field, circulation and flux using vector calculus (L5)
- apply the Laplace transform for solving differential equations (L3)
- find or compute the Fourier series of periodic signals (L3)
- know and be able to apply integral expressions for the forwards and inverse Fourier transform to a range of non-periodic waveforms (L3)
- identify solution methods for partial differential equations that model physical processes (L3)

**UNIT –I: Vector calculus: (10 hrs)**

Vector Differentiation: Gradient– Directional derivative – Divergence– Curl– Scalar Potential.

Vector Integration: Line integral – Work done – Area– Surface and volume integrals – Vector integral theorems: Greens, Stokes and Gauss Divergence theorems (without proof) and problems on above theorems.

**UNIT –II: Laplace Transforms: (10 hrs)**

Laplace transforms – Definition and Laplace transforms of some certain functions– Shifting theorems – Transforms of derivatives and integrals – Unit step function –Dirac’s delta functionPeriodic function – Inverse Laplace transforms– Convolution theorem (with out proof).

Applications: Solving ordinary differential equations (initial value problems) using Laplace transforms.

**UNIT –III: Fourier series and Fourier Transforms: (10 hrs)**

Fourier Series: Introduction– Periodic functions – Fourier series of periodic function – Dirichlet’s conditions – Even and odd functions –Change of interval– Half-range sine and cosine series.

Fourier Transforms: Fourier integral theorem (without proof) – Fourier sine and cosine integrals – Sine and cosine transforms – Properties (article-22.5 in text book-1)– inverse transforms – Convolution theorem (without proof) – Finite Fourier transforms.

**UNIT –IV: PDE of first order: (8 hrs)**

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solutions of first order linear (Lagrange) equation and nonlinear (standard types) equations.



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**UNIT – V: Second order PDE and Applications:**

**(10 hrs)**

Second order PDE: Solutions of linear partial differential equations with constant coefficients –Non-homogeneous term of the type  $e^{ax+by}$ ,  $\sin(ax + by)$ ,  $\cos(ax + by)$ ,  $x^m y^n$ .

Applications of PDE: Method of separation of Variables– Solution of One dimensional Wave, Heat and two-dimensional Laplace equation.

**Text Books:**

1. **B. S. Grewal**, Higher Engineering Mathematics, 44<sup>th</sup> Edition, Khanna Publishers.
2. **B. V. Ramana**, Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

**Reference Books:**

1. **Erwin Kreyszig**, Advanced Engineering Mathematics, 10<sup>th</sup> Edition, Wiley-India.
2. **Dean. G. Duffy**, Advanced Engineering Mathematics with MATLAB, 3<sup>rd</sup> Edition, CRC Press.
3. **Peter O' Neil**, Advanced Engineering Mathematics, Cengage.
4. **Srimantha Pal, S C Bhunia**, Engineering Mathematics, Oxford University Press.



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>THERMODYNAMICS</b>					

**Course Objectives:**

To impart the knowledge of the thermodynamic laws and principles so as to enable the student to prepare an energy audit of any mechanical system that exchange heat and work with the surroundings.

**UNIT - I**

**Introduction: Basic Concepts :** System, boundary, Surrounding, Universe, control volume, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process - Reversible, Quasi static & Irreversible Processes, cycle, Causes of Irreversibility. Energy in State and in Transition - Types, Work and Heat, Point and Pathfunction.

Zeroth Law of Thermodynamics – Concept of Temperature – Principles of Thermometry –Reference Points – Const. Volume gas Thermometer – Scales of Temperature.

**UNIT - II**

Joule's Experiments – First law of Thermodynamics – Corollaries – First law applied to a Process – applied to a flow system –Energy balance for closed systems-Specific heats- Internal energy, Enthalpy and Specific heats of Solids, liquids and Ideal gases, Some steady flow energy equation applied to Nozzle, Turbine, Compressor and heat exchanger devices,PMM-I.

**UNIT - III**

Limitations of the First Law – Thermal Reservoir, Heat Engine, Heat pump, Parameters of performance, Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements and their Equivalence, Corollaries, PMM of Second kind, Carnot cycle and its specialties, Carnot's theorem, Thermodynamic scale of Temperature.

Clausius Inequality, Entropy, Principle of Entropy Increase, Availability and Irreversibility (Basic definitions) – Thermodynamic Potentials, Gibbs and Helmholtz Functions, Maxwell Relations – Elementary Treatment of the Third Law of Thermodynamics.

**UNIT -IV**

Pure Substances, P-V-T- surfaces, T-S and h-s diagrams, Mollier Charts, Phase Transformations – Triple point and critical point, properties during change of phase, Dryness Fraction – Clausius – Clapeyron Equation, Property tables. Various Thermodynamic processes and energy Transfer – Steam Calorimetry.

**UNIT - V**

Ideal Gas equation of state- Compressibility factor- Van der Waals equation of state- Beattie-Bridgeman equation of state- Benedict-Webb-Rubin equation of state- Viral equation of state-compressibility charts – variable specific heats .

Mixtures of perfect Gases – Dalton's Law of partial pressure, Avogadro's Laws of additive volumes-Equivalent Gas constant and Molecular Internal Energy, Enthalpy, Specific Heat and Entropy of Mixture of Perfect Gases and Vapour.

Psychrometric Properties – Dry bulb Temperature, Wet Bulb Temperature, Dew point Temperature, Thermodynamic Wet Bulb Temperature, Specific Humidity, Relative Humidity, Saturated Air, Vapour pressure, Degree of saturation – Adiabatic Saturation , Carrier's Equation – Psychrometric chart.



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**TEXT BOOKS:**

1. Engineering Thermodynamics, PK Nag 6<sup>th</sup>Edn , McGrawHill.
2. Fundamentals of Thermodynamics – Sonntag, Borgnakke, Van Wylen, 6<sup>th</sup> Edn, Wiley

**REFERENCES:**

1. Thermodynamics by Prasanna Kumar, PearsonPublishers
2. Engineering Thermodynamics – Jones & DuganPHI
3. Thermodynamics, an Engineering Approach, Yunus A Cengel, Michael A Boles, 8<sup>th</sup>Edn inSI Units, McGrawHill.
4. Thermodynamics – J.P.Holman ,McGrawHill
5. An Introduction to Thermodynamics - Y.V.C.Rao – Universitiespress.
6. Thermodynamics – W.Z.Black& J.G.Hartley, 3<sup>rd</sup> Edn Pearson Publ.
7. Engineering Thermodynamics – D.P.Misra, CengagePubl.
8. Engineering Thermodynamics – P.Chattopadhyay – Oxford Higher EdnPubl.

**COURSE OUTCOMES:**

After undergoing the course the student is expected to learn

CO1: Basic concepts of thermodynamics

CO2: Laws of thermodynamics

CO3: Concept of entropy

CO4: Property evaluation of vapors and their depiction in tables and charts

CO5: Evaluation of properties of perfect gas mixtures.



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>MECHANICS OF SOLIDS</b>					

**Objective:** The students completing this course are expected to understand the basic terms like stress, strain, Poisson's ratio...etc and different stresses and deflections induced in beams, thin cylinders, thick cylinders, and columns. Further, the student shall be able to understand the shear stresses due to torsion in circular shafts.

**UNIT – I**

**SIMPLE STRESSES & STRAINS :** Elasticity and plasticity – Types of stresses & strains–Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio & volumetric strain – Bars of varying section – composite bars – Temperature stresses- Complex Stresses

- Stresses on an inclined plane under different uniaxial and biaxial stress conditions - Principal planes and principal stresses - Mohr's circle - Relation between elastic constants, Strain energy – Resilience – Gradual, sudden, impact and shockloadings.

**UNIT – II**

**SHEAR FORCE AND BENDING MOMENT :** Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, u.d.l, uniformly varying loads and combination of these loads

– Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.

**UNIT – III**

**FLEXURAL STRESSES :** Theory of simple bending – Assumptions – Derivation of bending equation:  $M/I = f/y = E/R$  Neutral axis – Determination bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections – Design of simple beam sections.

**SHEAR STRESSES:** Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T angle sections.

**UNIT – IV**

**DEFLECTION OF BEAMS :** Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams subjected to pointloads,

- U.D.L uniformly varying load. Mohr's theorems – Moment area method – application to simple cases including overhanging beams, Statically indeterminate Beams and solution methods.

**TORSION:** Introduction-Derivation- Torsion of Circular shafts- Pure Shear-Transmission of power by circular shafts, Shafts in series, Shafts in parallel.



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**UNIT – V**

**THIN AND THICK CYLINDERS:** Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and Volumetric strains – changes in dia, and volume of thin cylinders – Riveted boiler shells – Thin spherical shells. Wire wound thin cylinders. Lamé’s equation – cylinders subjected to inside & outside pressures – compound cylinders.

**COLUMNS:**

Buckling and Stability, Columns with Pinned ends, Columns with other support Conditions, Limitations of Euler’s Formula, Rankine’s Formula,

**TEXT BOOK:**

1. Strength of materials /GH Ryder/ Mc Millan publishers India Ltd.
2. Strength of materials by B.C. Punmia-lakshmi publications pvt.Ltd, New Delhi.

**REFERENCES :**

1. Mechanics of Materials by Gere & Timoshenko
2. Strength of Materials -By Jindal, Umesh Publications.
3. Strength of Materials by S.Timoshenko- D. VAN NOSTRAND Company- PHI Publishers
4. Strength of Materials by Andrew Pytel and Ferdinand L. Singer Longman-Harpercollins College Division
5. Solid Mechanics, by Popov-
6. Mechanics of Materials/Gere and Timoshenko, CBS Publishers

**COURSE OUTCOMES:**

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

- CO1: Model & Analyze the behavior of basic structural members subjected to various loading and support conditions based on principles of equilibrium.
- CO2: Understand the application of the concept of stress and strain to analyze and design structural members and machine parts under axial, shear and bending loads, moment and torsional moment.
- CO3: Students will learn all the methods to analyze beams, columns, frames for normal, shear, and torsion stresses and to solve deflection problems in preparation for the design of such structural components. Students are able to analyze beams and draw correct and complete shear and bending moment diagrams for beams.
- CO4: Students attain a deeper understanding of the loads, stresses, and strains acting on a structure and their relations in the elastic behavior
- CO5: Design and analysis of Industrial components like pressure vessels.





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<b>II Year - I Semester</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>FLUID MECHANICS AND HYDRAULIC MACHINES</b>					

**Course Objectives:** The students completing this course are expected to understand the properties of fluids, its kinematic and dynamic behavior through various laws of fluids like continuity, Euler's, Bernoulli's equations, energy and momentum equations. Further, the student shall be able to understand the theory of boundary layer, working and performance characteristics of various hydraulic machines like pumps and turbines.

### **UNIT I**

**Objective:** After studying this unit student will know the concept of fluid and its properties, manometry, hydrostatic forces acting on different surfaces and also problem solving techniques.

**Fluid statics:** Dimensions and units: physical properties of fluids - specific gravity, viscosity and its significance, surface tension, capillarity, vapor pressure. Atmospheric, gauge and vacuum pressure, Measurement of pressure – Manometers - Piezometer, U-tube, inverted and differential manometers. Pascal's & hydrostatic laws.

**Buoyancy and floatation:** Meta center, stability of floating body. Submerged bodies. Calculation of metacenter height. Stability analysis and applications.

### **UNIT II**

**Objective:** In this unit student will be exposed to the basic laws of fluids, flow patterns, viscous flow through ducts and their corresponding problems.

**Fluid kinematics:** Introduction, flow types. Equation of continuity for one dimensional flow, circulation and vorticity, Stream line, path line and streak lines and stream tube. Stream function and velocity potential function, differences and relation between them. Condition for irrotational flow, flow net, source and sink, doublet and vortex flow.

**Fluid dynamics:** surface and body forces – Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its applications, force on pipe bend.

**Closed conduit flow:** Reynold's experiment- Darcy Weisbach equation- Minor losses in pipes- pipes in series and pipes in parallel- total energy line-hydraulic gradient line.

### **UNIT III**

**Objective:** At the end of this unit student will be aware of the concepts related to boundary layer theory, flow separation, basic concepts of velocity profiles, dimensionless numbers and dimensional analysis.

**Boundary Layer Theory:** Introduction, momentum integral equation, displacement, momentum and energy thickness, separation of boundary layer, control of flow separation, Stream lined body, Bluff body and its applications, basic concepts of velocity profiles.

**Dimensional Analysis:** Dimensions and Units, Dimensional Homogeneity, Non dimensionalization of equations, Method of repeating variables and Buckingham Pi Theorem.



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**UNIT IV**

**Objective:** In this unit student will know the hydrodynamic forces acting on vanes and performance evaluation of hydraulic turbines.

**Basics of turbo machinery:** hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes.

**Hydraulic Turbines:** classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design – draft tube- theory- functions and efficiency.

**UNIT V**

**Objective:** After studying this unit student will be in a position to understand the characteristic curves of hydraulic turbines and also evaluate the performance characteristics of hydraulic pumps.

**Performance of hydraulic turbines:** Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer. Hydraulic systems- hydraulic ram, hydraulic lift, hydraulic coupling. Fluidics – amplifiers, sensors and oscillators. Advantages, limitations and applications.

**Centrifugal pumps:** classification, working, work done – manometric head- losses and efficiencies- specific speed- pumps in series and parallel-performance characteristic curves, cavitation & NPSH. **Reciprocating pumps:** Working, Discharge, slip, indicator diagrams.

**TEXT BOOKS:**

1. Fluid Mechanics- Fundamentals and Applications by Y.A. Cengel, J.M.Cimbala, 6<sup>th</sup>Edn, McGrawHill
2. Fluid Mechanics - Dixon, 7<sup>th</sup>Edn, Elsevier

**REFERENCE BOOKS:**

1. Hydraulics, fluid mechanics and Hydraulic machinery- Modi and Seth
2. Fluid Mechanics and Hydraulic Machines - RK Bansal- Laxmi Publications (P)Ltd.
3. Fluid Mechanics and Hydraulic Machines -Rajput
4. Fluid Mechanics and Fluid Power Engineering - D.S. Kumar, Kotaria&Sons.
5. Fluid Mechanics and Machinery - D. Rama Durgaiyah, New Age International.

**COURSE OUTCOMES:**

From this course the student is expected to learn

- CO1: The basic concepts of fluid properties.
- CO2: The mechanics of fluids in static and dynamic conditions.
- CO3: Boundary layer theory, flow separation and dimensional analysis.
- CO4: Hydrodynamic forces of jet on vanes in different positions.
- CO5: Working Principles and performance evaluation of hydraulic pump and turbines.



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	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>COMPONENTS OF AUTOMOBILE CHASSIS</b>				

***COURSE OBJECTIVES:***

- i. To understand the basic knowledge about various vehicle frames, front axles, steering systems and understand the conditions for true rolling motion of wheels during steering.
- ii. To recognize the construction and working principle of drive line, final drive and differential systems
- iii. To review the knowledge about the constructional feature of rear axle, wheels and tyres.
- iv. To evaluate the working principles of both conventional and independent suspension system.
- iv. To demonstrate working principle of braking system used in automobile.

***UNIT I***

**INTRODUCTION, FRAME, CLUTCHES & GEAR BOX**

Types of Chassis layout, with reference to Power Plant location and drive, various types of frames, Loads acting on vehicle frame, Constructional details and materials for frames, Testing of frames. Importance of Clutch, types and Applications. Requirement of Gear Box, Manual types of Gear Boxes including Synchromesh and its Applications

***UNIT II***

**PROPELLER SHAFT AND FINAL DRIVE**

Effect of Driving Thrust, torque reactions and side thrust, Hotchkiss drive, torque tube drive, radius rods and stabilizers, Propeller Shaft, Universal Joints, Constant Velocity Universal Joints, Front Wheel drive, Final drive, different types, Double reduction and twin speed final drives, Multi-axled vehicles, Differential principle and types, Differential housings, limited speed differential, Differential locks.

***UNIT III***

**AXLES AND TYRES**

Construction and Design of Drive Axles, Types of Loads acting on drive axles, Full – Floating, Three-Quarter Floating and Semi-Floating Axles, Axle Housings and Types – Lift axle, Dead axle, Types and Constructional Details of Different Types of Wheels and Rims, Different Types of Tyres and their constructional details.

***UNIT IV***

**STEERING & SUSPENSION SYSTEM**

Steering System: Types of Front Axles and Stub Axles, Front Wheel Geometry, Condition for True Rolling Motion of Wheels during Steering, Ackerman's and Davis Steering Mechanisms, Steering Error Curve, Steering Linkages, Different Types of Steering Gears, Slip Angle, Over-Steer and Under-Steer, Reversible and Irreversible Steering, EPAS.

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



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**UNIT V**

**BRAKING SYSTEM**

Theory of Automobile Braking, Stopping Distance Time and Braking Efficiency, Effect of Weight Transfer during Braking, Theory of Drum Brakes, Loading and Trailing Shoes, Braking Torque, Constructional Details of Drum Brake and its Activators, Disc Brake Theory, Types and Construction, Hydraulic Braking System, Mechanical Braking System, Pneumatic Braking System, Power–Assisted Braking System, Anti–Lock Braking System, Constructional Details.

**TEXT BOOKS:**

1. Kirpal Singh, Vol- I, Automobile Engineering, Standard Publisher, New Delhi ,2017
2. K.K.Ramalingam, “Automobile Engineering”, scitech publication (India),2011.
3. R.K. Rajput, A Text–Book of Automobile Engineering, Laxmi Publications Private Limited,2015

**REFERENCES:**

1. Heinz Hazler, Modern Vehicle Technology, Butterworth, London,2005.
2. HeldtP.M., Automotive Chassis, Chilton Co., New York,1990
3. Newton Steeds and Garret, Motor Vehicles, 13th Edition, Butterworth, London, 2005.
4. N.K. Giri, Automotive Mechanics, Kanna Publishers,2007
5. William. H. Crows – Work shop Manuel –2005

**COURSE OUTCOMES**

At the end of this course the student will be able to

- i. Identify the different types of frame and chassis used inAutomotive.
- ii. Relate different types of drive lines and drives used inAutomotive.
- iii. Acquire knowledge about different types of front axle and rear axles used in motorvehicles.
- iv. Examine the working principle of conventional and independent suspensionsystems.
- v. Apply knowledge on working principles of brake and itssubsystems.



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<b>II Year - I Semester</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>
<b>MECHANICS OF SOLIDS AND METALLURGY LAB</b>					

**Course Objective:** To impart practical exposure on the microstructures of various materials and their hardness evaluation. Also to impart practical knowledge on the evaluation of material properties through various destructive testing procedures.

**NOTE:** Any 6 experiments from each section A and B.

**(A) MECHANICS OF SOLIDS LAB:**

1. Direct tension test
2. Bending test on
  - a) Simple supported
  - b) Cantilever beam
3. Torsion test
4. Hardness test
  - a) Brinell's hardness test
  - b) Rockwell hardness test
5. Test on springs
6. Compression test on cube
7. Impact test
8. Punch shear test

**(B) METALLURGY LAB:**

1. Preparation and study of the Micro Structure of pure metals like Iron, Cu and Al.
  2. Preparation and study of the Microstructure of Mild steels, low carbon steels, high – C steels.
  3. Study of the Micro Structures of Cast Irons.
  4. Study of the Micro Structures of Non-Ferrous alloys.
  5. Study of the Micro structures of Heat treated steels.
  6. Hardenability of steels by Jominy End Quench Test.
- To find out the hardness of various treated and untreated steels.



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<b>II Year - I Semester</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>
<b>AUTOMOBILE CHASSIS LAB</b>					

***COURSE OBJECTIVES:***

- i. To assemble and disassemble the parts of an IC engine.
- ii. To identify the various component of an IC engine.
- iii. To identify the various components in transmission systems of an automobile.
- iv. To assemble and disassemble the various components of transmission system.
- v. To study all the functions of automobile components

***LIST OF EXPERIMENTS***

1. To study constructional and working principle of clutch.
2. Assembly & Disassembly of Gear Box.
- 5 Assembly & Disassembly of Transfer case.
6. Assembly & Disassembly of Differential & rear axle.
7. Assembly & Disassembly of Stub Axle Assembly.
8. To assemble and disassemble Transfer case
9. To assemble and disassemble Differential, Rear axle
10. To assemble and disassemble Front axle.
11. To Study different chassis layouts
12. To Study braking system
13. To Study Steering system
14. To Study Suspension system

***COURSE OUTCOMES:***

- i. Understand working of braking, steering, clutch, transmission, Suspension systems.
- ii. Differentiate various subsystems of two, three & Four wheel vehicles
- iii. Develop skills in Dismantling and assembling of chassis components.



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II Year - I Semester		L	T	P	C
		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>
<b>FLUID MECHANICS &amp; HYDRAULIC MACHINERY LAB</b>					

**Course Objective:** To impart practical exposure on the performance evaluation methods of various flow measuring equipment and hydraulic turbines and pumps.

1. Impact of jets on Vanes.
2. Performance Test on Pelton Wheel.
3. Performance Test on Francis Turbine.
4. Performance Test on Kaplan Turbine.
5. Performance Test on Single Stage Centrifugal Pump.
6. Performance Test on Multi Stage Centrifugal Pump.
7. Performance Test on Reciprocating Pump.
8. Calibration of Venturimeter.
9. Calibration of Orificemeter.
10. Determination of friction factor for a given pipeline.
11. Determination of loss of head due to sudden contraction in a pipeline.
12. Turbine flowmeter.



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<b>II Year - I Semester</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>
<b>COMPUTER AIDED DRAFTING AND MODELLING LAB</b>					

- 1. DRAFTING:** Development of part drawings for various components in the form of orthographic and isometric. Representation of dimensioning and tolerances, Study of DXE, IGES files.
- 2. SURFACE MODELING** - Generation of various Surfaces using surface modeling.
  - A) DRAFTING:** Development of part drawings for various components in the form of orthographic and isometric. Representation of dimensioning and tolerances, Study of DXE, IGES files.
  - B) SURFACE MODELING** - Generation of various Surfaces using surface modeling.
  - C) The following contents to be done by any 3D software package:**
    - (i) PART MODELING:** Generation of various 3D models through Pad, revolve, shell, sweep, parent child relation, Boolean operations and various standard translators.
    - (ii) Assembly drawings:** (Any four of the following using solid model software) Generation of various Parts/assemblies: like Screw Jack, Oldham's Coupling, Foot step bearing, Couplings, knuckle and cotter joints, Crankshaft, Connecting Rod, Piston and Cylinder.





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**DEPARTMENT OF AUTOMOBILE ENGINEERING**

II Year - I Semester		L	T	P	C
		2	0	0	0
<b>ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE</b>					

**Course Objectives:**

To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system

- The course aim of the importing basic principle of third process reasoning and inference sustainability is at the course of Indian traditional knowledgesystem
- To understand the legal framework and traditional knowledge and biological diversity act 2002 and geographical indication act2003
- The courses focus on traditional knowledge and intellectual property mechanism of traditional knowledge andprotection
- To know the student traditional knowledge in differentsector

**Course Outcomes:**

After completion of the course, students will be able to:

- Understand the concept of Traditional knowledge and itsimportance
- Know the need and importance of protecting traditionalknowledge
- Know the various enactments related to the protection of traditionalknowledge
- Understand the concepts of Intellectual property to protect the traditionalknowledge

**UNIT I**

Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal knowledge

**UNIT II**

Protection of traditional knowledge: the need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.

**UNIT III**

Legal framework and TK: A: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmers Rights Act, 2001 (PPVER Act);B:The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016.Geographical indications act 2003.

**UNIT IV**

Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, global legal FORA for increasing protection of Indian Traditional Knowledge.



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***UNIT V***

Traditional knowledge in different sectors: Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK.

**REFERENCE BOOKS:**

- 1) Traditional Knowledge System in India, by Amit Jha, 2009.
- 2) Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh, PratibhaPrakashan 2012.
- 3) Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002
- 4) "Knowledge Traditions and Practices of India" Kapil Kapoor, Michel Danino

***e-Resources:***

- 1) <https://www.youtube.com/watch?v=LZP1StpYEPM>
- 2) <http://nptel.ac.in/courses/121106003/>



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<b>II Year - II Semester</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>APPLIED THERMODYNAMICS</b>				

**Course objectives:**

This course is intended to study the thermodynamic analysis of major components of Rankine cycle, refrigeration cycles and compressible fluids and to analyze the energy transfers and transformations in these components including individual performance evaluation.

**UNIT –I**

**VAPOUR POWER CYCLES:** Carnot, Rankine cycle - schematic layout, thermodynamic analysis, concept of mean temperature of heat addition, methods to improve cycle performance – regeneration & reheating.

**UNIT II**

**COMBUSTION:** Fuels and combustion, concepts of heat of reaction, adiabatic flame temperature, Stoichiometry, flue gas analysis.

**BOILERS :**Classification – working principles of L.P & H.P boilers with sketches – mountings and accessories – working principles, boiler horse power, equivalent evaporation, efficiency and heat balance – Draught: classification – height of chimney for given draught and discharge, condition for maximum discharge, efficiency of chimney – artificial draught, induced and forced.

**UNIT – III**

**STEAM NOZZLES:** Function of a nozzle – applications - types, flow through nozzles, thermodynamic analysis – assumptions -velocity of fluid at nozzle exit-Ideal and actual expansion in a nozzle, velocity coefficient, condition for maximum discharge, critical pressure ratio, criteria to decide nozzle shape: Super saturated flow - its effects, degree of super saturation and degree of under cooling, Wilsonline.

**STEAM TURBINES:** Classification – impulse turbine; mechanical details – velocity diagram – effect of friction – power developed, axial thrust, blade or diagram efficiency – condition for maximum efficiency. De-laval turbine - methods to reduce rotor speed-velocity compounding, pressure compounding and velocity & pressure compounding, velocity and pressure variation along the flow – combined velocity diagram for a velocity compounded impulse turbine, condition for maximum efficiency

**UNIT - IV**

**REACTION TURBINE:** Mechanical details – principle of operation, thermodynamic analysis of a stage, degree of reaction –velocity diagram – Parson's reaction turbine – condition for maximum efficiency – calculation of blade height.

**STEAM CONDENSERS:** Requirements of steam condensing plant – classification of condensers – working principle of different types – vacuum efficiency and condenser efficiency – air leakage, sources and its affects, air pump, cooling water requirement.



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**UNIT – V**

**COMPRESSORS** – Classification – fan, blower and compressor - positive displacement and non positive displacement type – reciprocating and rotary types.

**Reciprocating:** Principle of operation, work required, Isothermal efficiency, volumetric efficiency and effect of clearance, multi stage compression, saving of work, minimum work condition for two stage compression.

**Rotary (Positive displacement type) Roots Blower, vane sealed compressor, Lysholm compressor – mechanical details and principle of working – efficiency considerations.**

**Rotary (non positive displacement type)**

**Centrifugal compressors:** Mechanical details and principle of operation – velocity and pressure variation. Energy transfer-impeller blade shape-losses, slip factor, power input factor, pressure coefficient and adiabatic coefficient – velocity diagrams – power.

**TEXT BOOKS:**

1. Heat Engineering (MKS and SI units), VP Vasandani, DS Kumar, Metropolitanbooks
2. Basics & Applied Thermodynamics- P.K.Nag – 4<sup>th</sup> edition- McGrawHill

**REFERENCES:**

1. Thermal Engineering- Mahesh Rathore, TataMcGrawHill
2. Applied Thermodynamics by RYadhav
3. Applied Thermodynamics by Eastop&McConkey, 5<sup>th</sup>Edn, Pearson
5. Fluid Mechanics Fundamentals and Applications by Y.A.Cengel, J.M.Cimbala, McGrawHill
6. Thermal Engineering-M.L.Marthur& Mehta/Jain bros.Publishers
7. Thermal Engineering / RK Rajput/ LakshmiPublications

**Course outcomes:**

- CO1: Expected to learn the working of steam power cycles and also should be able to analyze and evaluate the performance of individual components
- CO2: Student is able to learn the principles of combustion ,stoichiometry and flue gas analysis
- CO3: Students will be able to design the components and calculate the losses and efficiency of the boilers, nozzles, turbines and condensers.
- CO4: Student is able to learn various types of compressors, principles of working and their performance evaluation.



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>COMPLEX VARIABLES AND STATISTICAL METHODS</b>					

**Course Objectives:**

- To familiarize the complex variables.
- To familiarize the students with the foundations of probability and statistical methods.
- To equip the students to solve application problems in their disciplines.

**Course Outcomes:** At the end of the course students will be able to

- apply Cauchy-Riemann equations to complex functions in order to determine whether a given continuous function is analytic (L3)
- find the differentiation and integration of complex functions used in engineering problems (L5)
- make use of the Cauchy residue theorem to evaluate certain integrals (L3)
- apply discrete and continuous probability distributions (L3)
- design the components of a classical hypothesis test (L6)
- infer the statistical inferential methods based on small and large sampling tests (L4)

**UNIT – I: Functions of a complex variable and Complex integration: (10 hrs)**

Introduction – Continuity – Differentiability – Analyticity – Cauchy-Riemann equations in Cartesian and polar coordinates – Harmonic and conjugate harmonic functions – Milne – Thompson method.  
 Complex integration: Line integral – Cauchy's integral theorem – Cauchy's integral formula – Generalized integral formula (all without proofs) and problems on above theorems.

**UNIT – II: Series expansions and Residue Theorem: (10 hrs)**

Radius of convergence – Expansion in Taylor's series, Maclaurin's series and Laurent series.  
 Types of Singularities: Isolated – Essential – Pole of order m – Residues – Residue theorem (without proof) – Evaluation of real integral of the types  $\int_{-\infty}^{\infty} f(x)dx$  and  $\int_c^{c+2\pi} f(\cos\theta, \sin\theta)d\theta$ .

**UNIT – III: Probability and Distributions: (10 hrs)**

Review of probability and Baye's theorem – Random variables – Discrete and Continuous random variables – Distribution functions – Probability mass function, Probability density function and Cumulative distribution functions – Mathematical Expectation and Variance – Binomial, Poisson, Uniform and Normal distributions.

**UNIT – IV: Sampling Theory: (8 hrs)**

Introduction – Population and Samples – Sampling distribution of Means and Variance (definition only) – Central limit theorem (without proof) – Representation of the normal theory distributions – Introduction to t,  $\chi^2$  and F-distributions – Point and Interval estimations – Maximum error of estimate.

**UNIT – V: Tests of Hypothesis: (10 hrs)**

Introduction – Hypothesis – Null and Alternative Hypothesis – Type I and Type II errors – Level of significance – One tail and two-tail tests – Tests concerning one mean and two means (Large and Small samples) – Tests on proportions.



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**Text Books:**

1. **B. S. Grewal**, Higher Engineering Mathematics, 44<sup>th</sup> Edition, Khanna Publishers.
2. **Miller and Freund's**, Probability and Statistics for Engineers, 7/e, Pearson, 2008.

**Reference Books:**

1. **J. W. Brown and R. V. Churchill**, Complex Variables and Applications, 9<sup>th</sup> edition, Mc-Graw Hill, 2013.
2. **S.C. Gupta and V.K. Kapoor**, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012.
3. **Jay I. Devore**, Probability and Statistics for Engineering and the Sciences, 8<sup>th</sup> Edition, Cengage.
4. **Shron L. Myers, Keying Ye, Ronald E Walpole**, Probability and Statistics Engineers and the Scientists, 8<sup>th</sup> Edition, Pearson 2007.
5. **Sheldon, M. Ross**, Introduction to probability and statistics Engineers and the Scientists, 4<sup>th</sup> Edition, Academic Foundation, 2011



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>AUTOMOBILE ENGINES</b>					

**UNIT-I:**

**Actual Cycles and Engine Construction:** Introduction, Comparison of Air Standard and Actual Cycles, Time Loss Factor, Heat Loss Factor, Exhaust Blow down-Loss due to Gas exchange process, Volumetric Efficiency. Loss due to Rubbing Friction, Actual and Fuel-Air Cycles of CI Engines; Constructional Details of Four Stroke SI and CI Engines, Working Principle, Actual Indicator Diagram, Two Stroke Engine Construction and Operation, Comparison of Four Stroke and Two Stroke Engine Operation, Firing Order and Its Significance.

**UNIT-II:**

**ENGINE TESTING & PERFORMANCE**

Engine Performance Testing & Numerical- methods and Performance Characteristics; Testing and measurement equipment- dynamometers, Air & Fuel consumption, temperature, etc. Variables Affecting Engine Performance, Performance Maps. Lubrication and Cooling systems, Introduction to Supercharging and Turbocharging

**UNIT-III:**

**SI ENGINE FUELING & COMBUSTION**

Carburetor Working Principle, Requirements of an Automotive Carburetor, and types, Fuel Injection Systems; Pre-mixed charge combustion, SI Engine Combustion Conceptual models, Thermodynamic Analysis of Combustion, Cycle-to-Cycle Combustion variations and Knocking Combustion

**UNIT-IV:**

**CI ENGINE FUELING & COMBUSTION**

Fuel Injection and Spray Structure: Fuel Atomization and Droplet size distribution, Sauter Mean Diameter, Spray Penetration. Types of Combustion Chambers, CI Engine Combustion Conceptual Models: Conventional and Dec's Combustion Models. Diesel Combustion Process Characterization: Ignition Delay, Effect of Engine and Operational Parameters on Delay, Pre-mixed Combustion, Mixing Controlled Combustion. Thermodynamic Analysis. Multi Pulse Injections, Introduction to Low Temperature Combustion Like: Homogeneous Charge Compression Ignition(HCCI), Fuel Stratified Charge combustion/ Reactivity Controlled Compression Ignition (RCCI) Technologies, Pre-mixed Charge Compression (PCCI) and Dual fuel technologies



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**UNIT-V:**

**FORMATION OF ENGINE EMISSIONS & CONTROL TECHNOLOGIES (SI & CI)**

Emission Effects on Health & Environment: Sources of Engine emissions: Formation of CO, NO, UBHC, Soot and Particulate Matter. Diesel NO<sub>x</sub>-Particulate Trade off: Effect of SI Design and operating variables: Effect of Diesel Engine Design and operating Variables. SI Engine Emission Control Technology: Add-on systems for treatment of Emissions with in Engine, Exhaust After treatment. CI Engine Emission Control Technology: Application of EGR, Exhaust after treatment and new engine technologies for emission control.

**Text Books:**

1. IC Engines, M.L. Mathur & R.P. Sharma, DhanpathRai& Sons
2. Engine Emissions, Pollutant Formation and Advances in Control Technology, B.P. Pundir, Narosa Publishing House

**Reference Books:**

1. IC Engines Fundamentals, John B. Heywood, Mc Graw Hill Publications
2. Engineering Fundamentals of I C Engines, WiliardW.Pulkrabek, Prentice Hall Publications
3. Mixture Formation in Internal Combustion Engines, CarstenBaumgarten, Springer Pub
4. Thermal Engineering, PL Ballaney, Khanna Publishers, 25th Edition.

**Web Links:**

1. <http://nptel.ac.in/courses/112105123/>
2. <http://nptel.ac.in/courses/112108148/>
3. <http://nptel.ac.in/courses/112104113/>
4. <http://nptel.ac.in/courses/112104033/>





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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>AUTOMOBILE ELECTRICAL AND ELECTRONICS</b>					

**UNIT-I**

**Batteries and Accessories:**

Principle and Construction of Lead Acid Battery, Characteristics of battery, rating capacity and Efficiency of Batteries, Various Tests on Batteries, Maintenance and Charging. Lighting System: Insulated and Earth Return System, Details of Head Light and Side Light, LED Lighting System, Head Light Dazzling and Preventive Methods – Horn, Wiper System and Trafficator.

**UNIT-II**

**Starting System**

Condition at Starting, Behavior of Starter during Starting, Series Motor and its Characteristics, Principle and Construction of Starter Motor, Working of Different Starter Drive Units, Care and Maintenances of Starter Motor, Starter Switches.

**UNIT-III**

**Charging System**

Generation of Direct Current, Shunt Generator Characteristics, Armature Reaction, Third Brush Regulation, Cutout. Voltage and Current Regulators, Compensated Voltage Regulator, Alternators Principle and Constructional Aspects and Bridge Rectifiers, New Developments.

**UNIT-IV**

**Fundamentals of Automotive Electronics**

Current Trends in Automotive Electronic Engine Management System, Electro Magnetic Interference Suppression, Electromagnetic Compatibility, Electronic Dashboard Instruments, Onboard Diagnostic System, Security and Warning System.

**UNIT-V**

**Sensors & Actuators:**

Types of Sensors: Sensor for Speed, Throttle Position, Exhaust Oxygen Level, knock, Manifold Pressure, Crankshaft Position, Coolant Temperature, Exhaust Temperature, Impact sensor, Air Mass Flow for Engine Application. Solenoids, Stepper Motors, Relay.

**Text Books**

1. Young A.P. & Griffiths. L. “Automotive Electrical Equipment”, ELBS & NewPress-1999.
2. William B.Riddens “Understanding Automotive Electronics”, 5th edition - Butter worth Heinemann Woburn,1998.

**References**

1. Bechhold “Understanding Automotive Electronics”, SAE,1998.
2. Crouse, W.H “Automobile Electrical Equipment”, McGraw-Hill Book Co., Inc., New York, 3rd edition, 1986.
3. Judge A.W “Modern Electrical Equipment of Automobiles”, Chapman & Hall, London,1992.
4. Kholi.P.L “Automotive Electrical Equipment”, Tata McGraw-Hill Co., Ltd., New Delhi,1975.
5. Robert Bosch “Automotive Hand Book”, SAE (5th Edition),2000.



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II Year - II Semester		L	T	P	C
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>OPERATIONS RESEARCH</b>					

**Course Objectives:**

The objective of the course is to understand the availability of resources and constraints in an industry and optimize them through the applications of appropriate resource management tools.

**UNIT – I**

Development – definition– characteristics and phases – operation research models – applications.

**LINEAR PROGRAMMING:** problem formulation – graphical solution – simplex method – artificial variables techniques -two–phase method, big-M method – duality principle.

**UNIT – II**

**TRANSPORTATION PROBLEM:** Formulation – optimal solution, unbalanced transportation problem – degeneracy, assignment problem – formulation – optimal solution - variants of assignment problem- traveling salesman problem.

**SEQUENCING** – Introduction – flow –shop sequencing –  $n$  jobs through two machines –  $n$  jobs through three machines – job shop sequencing – two jobs through ‘ $m$ ’ machines.

**UNIT –III**

**REPLACEMENT:** Introduction – replacement of items that deteriorate with time – when money value is not counted and counted – replacement of items that fail completely, group replacement.

**UNIT –IV**

**THEORY OF GAMES:** Introduction to decision theory – mini. max (max. mini) – criterion and optimal strategy – solution of games with saddle points – rectangular games without saddle points –  $2 \times 2$  games – dominance principle –  $m \times 2$  &  $2 \times n$  games -graphical method.

**WAITING LINES:** Introduction to Kendall's notation–classification of queuing models, single channel – with infinite population and finite population models– multichannel – with infinite population.

**UNIT – V**

**Network Analysis:** Project planning, scheduling and controlling – tools for project management – critical path method – programme evaluation and review technique (PERT) – cost analysis and crashing – resource leveling – updating.

**TEXT BOOKS:**

1. Operations Research-An Introduction/Hamdy A Taha/Pearson publishers
2. Operations Research –Theory & publications / S.D.Sharma-Kedarnath/McMillan publishers India Ltd



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**REFERENCES:**

1. Introduction to O.R/Hiller &Libermann/TMH
2. Operations Research /A.M.Natarajan,P.Balasubramani,A. Tamilarasi/PearsonEducation.
3. Operations Research: Methods & Problems / Maurice Saseini, ArhurYaspan& Lawrence Friedman/Wiley
4. Operations Research / R.Pannerselvam/ PHI Publications.
5. Operations Research / Wagner/ PHIPublications.
6. Operation Research /J.K.Sharma/MacMilanPubl.
7. Operations Research/ Pai/ OxfordPublications
8. Operations Research/S Kalavathy / VikasPublishers
9. Operations Research / DS Cheema/University Science Press
- 10.Operations Research / Ravindran, Philips, Solberg / Wileypublishers

**Course Outcomes:**

After studying the course, the students are able to

1. Formulate the resource management problems and identify appropriate methods to solvethem
2. Apply LPP, transportation and assignment models to optimize the industrialresources
3. Solve decision theory problems through the application of gametheory
4. Apply the replacement and queuing models to increase the efficiency of thesystem
5. Model the project management problems through CPM andPERT



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		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>
<b>AUTOMOBILE ASSEMBLY DRAWING</b>					

**Course Objective:** The student will acquire a knowledge of fastening arrangements such as welding, riveting the different styles of attachment for shaft. The student also is enabled to prepare the assembly of various machine or engine components and miscellaneous machine components.

**(Production Drawing to be included)**

**Machine Drawing Conventions:**

Need for drawing conventions – introduction to ISconventions

- a) Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs.
- b) Types of sections – selection of section planes and drawing of sections and auxiliary sectional views. Parts not usually sectioned.
- c) Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and tapered features.
- d) Title boxes, their size, location and details - common abbreviations & their liberal usage
- e) Types of Drawings – working drawings for machine parts.

**I. Drawing of Machine Elements and simple parts**

**Objective:** To provide basic understanding and drawing practice of various joint, simple mechanical parts Selection of Views, additional views for the following machine elements and parts with every drawing proportions.

- a) Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, setscrews.
- b) Keys, cottered joints and knuckle joint.
- c) Rivetted joints for plates
- d) Shaft coupling, spigot and socket pipe joint.
- e) Journal, pivot and collar and foot step bearings, Cam profiles and Mechanisms.

**II. Assembly Drawings:**

**Objective:** The student will be able to draw the assembly from the individual part drawing. Drawings of assembled views for the part drawings of the following using conventions and easy drawing proportions.

- a) Engine parts – Gear pump, Fuel pump Petrol Engine connecting rod, piston assembly.
- b) Other machine parts – stub axial assembly, steering gear box assembly, differential assembly and clutch assembly.
- c) Valves : spring loaded safety valve, feed check valve and air cock, Control valves

**NOTE:** First angle projection to be adopted. The student should be able to provide working drawings of actual parts.

**TEXT BOOKS:**

1. Machine Drawing – N.Siddeswar, K.Kannaiah & V.V.S.Sastry -TMH
2. Machine Drawing – K.L.Narayana, P.Kannaiah & K. Venkata Reddy / New Age/Publishers



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***REFERENCES:***

1. Machine Drawing –P.S.Gill,
2. Machine Drawing –Luzzader
3. Machine Drawing –Rajput
4. Machine Drawing – N.D. Junnarkar,Pearson
5. Machine Drawing – Ajeeth Singh, McGrawHill
6. Machine Drawing – KC John,PHI
7. Machine Drawing – B Battacharya,Oxford
8. Machine Drawing – Gowtham and Gowtham,Pearson



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		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>
<b>AUTOMOBILE ENGINES AND FUELS LAB</b>					

**Course Objectives:** To study the characteristics of the fuels and lubricants used in automobile and get practical knowledge in assembly & dismantling of engine components.

**ENGINES LAB**

**LIST OF EXPERIMENTS**

1. Draw the Valve and Port Timing Diagrams for 4S and 2S engines and compare with ideal cycle
2. Evaluate the Performance and Emissions from 4S Petrol Engine
3. Evaluate the Performance and Emissions from 4S Diesel Engine
4. Evaluation of Frictional Power from the Mores Test on a 4-Stroke Multi Cylinder Engine
5. Determination of Frictional Power by the retardation and Motoring Test on IC Engine
6. Draw the Heat Balance Sheet for a 4-Stroke Petrol or Diesel Engine
7. Analysis of Combustion Characteristics like ; P- $\theta$ , Differential Heat Release Rate, Integral Heat Release Rate and Ignition Delay of diesel engine
8. Calculation of Stiochiometric Air- Fuel mixtures of Conventional fuels through oxidation Equation and compare with Spectrometric analysis
9. Calculate the Volumetric Efficiency of a conventional fuel and compare with Gas based Dual Fuel Operation, when secondary fuel is inducted through inlet manifold
10. Dismantle and Assemble of Agriculture single Cylinder and Multi- Cylinder Automotive Engines

**FUELS LAB**

**LIST OF EXPERIMENTS**

1. ASTM distillation test of liquidfuels.
2. Gas Chromatograph with Mass Spectrometry
3. FTIR analysis
4. NMR Analysis C13/H1
5. HPLC Analysis
6. Calorific value of liquid and gaseousfuel.
7. Flash and Fire points of petrol and diesel. (closed and opentype)
8. Temperature dependence of viscosity of lubricants & Fuels by RedwoodViscometer.
9. Viscosity index of lubricants & Fuels by SayboltViscometer.
10. Ash content and Carbon ResidueTest.
11. Drop point of grease and mechanical penetration ingrease.
12. Cloud and Pour pointTest.

**Course outcomes:**

Attending the laboratory the students shall be able to :

1. The student after undergoing this course is expected to know the principles in assembly & dismantling of enginecomponents
2. At the end of the lab learn characteristics of the fuels and lubricants used in automobile



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II Year - II Semester		L	T	P	C
		0	0	3	1.5
<b>AUTOMOBILE ELECTRICAL AND ELECTRONICS LAB</b>					

**Note :Any 5 Experiments from each stream and rest can be considered as extra experiments**

**Automotive Electrical**

1. Experiment on testing and study of different types of Batteries and constructions.
2. Testing, dismantling and assembling of starter motor used in automobile.
3. Testing, dismantling and assembling of alternator used in automobile.
4. Study of different colour code system used in automotive wiring system.
5. Demonstration and study of Battery Ignition System and their parts used in Automobile Vehicles.
6. Study of different Electrical Equipment's & Accessories (Speedometer, Warning lights, Electric Horn, Wind shield wiper system).
7. Study of different sensor used in modern automotive system.
8. Study of various electronics system (Electronic fuel injection system, Electronic ignition system, Air bag, ABS, Electronic fuel injector cleaner).
9. Demonstration and experiment on lighting system of two wheeler and Four Wheeler.
10. Demonstration, experiment and diagnosis on ignition system.

**Automotive Electronics:**

1. Verification of truth table of Logic Gates.
2. Verification of truth table of Adder, Subtractor & Flip-Flops.
3. Characteristics of rectifiers – Half wave & Full wave.
4. Timer – 555
5. Characteristics of SCR.
6. D/A and A/D converters.
7. Interfacing stepper motor control and CRT terminal
8. Assembly language programming exercise.
9. Interfacing A/D converter and simple data acquisition
10. Microcontroller Programming and Interfacing
11. EPROM Interfacing

**Text Books:**

1. Allan Bonnick, “Automotive Computer Controlled Systems”, 2011.
2. Tom Weather Jr and Clad C. Hunter, “Automotive Computers and Control System”, Prentice Hall Inc., New Jersey.
3. Young A. P & Griffiths L, “Automobile Electrical and Electronic Equipments”, English Languages Book Society & New Press, 1990



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**Reference Books:**

1. Santini AI, “*Automotive Electricity and Electronics*”, Cengage Learning, 2012.
2. Tom Denton, “*Automotive Electrical and Electronic System*”, SAE International, 2004.
3. William B. Ribbens, “*Understanding Automotive Electronics*”, 6th Edition, Newnes, 2003.  
BOSCH, “*Automotive Handbook*”, 8th Edition, BENTLEY ROBERT Incorporated, 2011.
4. Norm Chapman, “*Principles of Electricity and electronics for the Automotive Technician*”,  
Delmar Cengage Learning, 2008.
5. Judge A.W, “*Modern Electrical Equipment of Automobiles*”, Chapman & Hall, London, 1992.





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		<b>1</b>	<b>0</b>	<b>2</b>	<b>2</b>
<b>MACHINE TOOLS AND METROLOGY LAB</b>					

*Note: minimum of 6 experiments from each section*

**Course Objective:** This practical course covers the topics related to precision measuring instruments and the working and operations of various machinetools.

**Section-I**

**METROLOGY LAB**

1. Measurement of lengths, heights, diameters by vernier calipers, micrometers etc.
2. Measurement of bores by internal micrometers and dial bore indicators.
3. Use of gear tooth vernier calipers and checking the chordal thickness of spur gear.
4. Machine tool alignment test on the lathe.
5. Machine tool alignment test on milling machine.
6. Angle and taper measurements by bevel protractor, Sine bars, etc.
7. Use of spirit level in finding the straightness of a bed and flatness of a surface.
8. Thread measurement by two wire/ three wire method & tool makers microscope.
9. Surface roughness measurement by Talysurf.

**Section-II**

**MACHINE TOOLS LAB**

1. Introduction of general purpose machines - lathe, drilling machine, milling machine, shaper, planing machine, slotting machine, cylindrical grinder, surface grinder and tool and cutter grinder.
2. Step turning and taper turning on lathe machine
3. Thread cutting and knurling on lathe machine.
4. Drilling and tapping
5. Shaping and planing
6. Slotting
7. Milling
8. Cylindrical surface grinding
9. Grinding of tool angles.

**Course Outcome:** After completing the course the student will be able to operate various precision measuring instruments and working and operations of various machines tools.