

**SCHEME OF INSTRUCTION & EXAMINATION**  
**AICTE Model Curriculum**  
**B. E. II – Semester (MECHANICAL ENGINEERING)**  
**(Proposed for the Academic year 2020-2021)**

S. No.	Course Code	Course Title	Scheme of Instructions				Scheme of Examination			Credits
			L	T	P/D	Contact Hours/Week	CIE	SEE	Duration in Hours	
<b>Theory Course</b>										
1	MC802CE	Environmental Science	2	-	-	2	30	70	3	-
2	MC803PY	Essence of Indian Traditional Knowledge	2	-	-	2	30	70	3	-
3	HS101EG	English	2	-	-	2	30	70	3	2
4	BS203MT	Mathematics-II	3	1	-	4	30	70	3	4
5	BS204CH	Engineering Chemistry	3	1	-	4	30	70	3	4
6	ES302CS	Programming for Problem Solving	3	-	-	3	30	70	3	3
<b>Practical / Laboratory Course</b>										
7	HS151EG	English Lab			2	2	25	50	3	1
8	BS252CH	Chemistry Lab			3	3	25	50	3	1.5
9	ES351CS	Programming for Problem Solving Lab			2	2	25	50	3	1
10	ES352ME	Workshop Practice	-	-	6	6	50	50	3	3
<b>Total</b>										<b>19.5</b>

**MC:** Mandatory Course**BS:** Basic Science**ES:** Engineering Science**L:** Lecture**T:** Tutorial**P:** Practical**D:** Drawing**CIE:** Continuous Internal Evaluation**SEE:** Semester End Examination (Univ. Exam)**Note:**

1. Each contact hour is a clock hour
2. The duration of the practical class is two hours, however it can be extended wherever necessary, to enable the student to complete the experiment.

**ENVIRONMENTAL SCIENCE****MC802CE**

Instruction: 2 periods per week

CIE: 30 marks

Credits: Nil

Duration of SEE: 3 hours

SEE: 70 marks

**Objectives:**

1. To create awareness and impart basic knowledge about the environment and its allied problems.
2. To know the functions of ecosystems.
3. To understand importance of biological diversity.
4. To study different pollutions and their impact on environment.
5. To know social and environment related issues and their preventive measures.

**Outcomes:**

After completing this course, the student will be able to:
1. Adopt environmental ethics to attain sustainable development.
2. Develop an attitude of concern for the environment.
3. Conservation of natural resources and biological diversity.
4. Creating awareness of Green technologies for nation's security.
5. Imparts awareness for environmental laws and regulations.

**Unit-I**

**The Multidisciplinary Nature of Environmental Studies:** Definition, scope and importance, need for public awareness.

**Natural Resources:** Water Resources – Use and over utilization of surface and ground water, flood, drought, conflicts over water, Dams: Benefits and Problems. Food Resources –World Food Problems, effects of modern agriculture, fertilizer-pesticides problems, water logging, salinity, Forest Resources –Use and over exploitation, deforestation & its effect on tribal people. Land Resources –Land Degradation, environmental effect of mining, man induced landslides, soil erosion and desertification. Energy Resources –Growing energy needs, Renewable and Non-renewable energy resources.

**Unit-II:**

**Ecosystems:** Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in ecosystem, food chains, ecological pyramids, ecological succession, types of ecosystems (marine, pond, river, forest, grassland, desert)

**Unit-III**

**Biodiversity:** Levels of Biodiversity, Bio-geographical classification of India, Value of biodiversity, Threats to biodiversity, endangered and endemic species of India, Conservation of biodiversity, global and national efforts

**Unit-IV**

**Environmental Pollution:** Definition, Causes, effects and control measures of air pollution, water pollution, soil pollution, noise pollution, thermal pollution, solid waste management.

**Environment Protection Act:** Air, water, forest and wildlife Acts, issues in the enforcement of environmental legislation.

**Unit-V**

**Social Issues and the Environment:** Watershed management and environmental ethics.

Climate change, global warming, acid rain, ozone layer depletion.

**Environmental Disaster Management:** Types of disasters, impact of disasters on environment, infrastructure, and development. Basic principles of disaster mitigation, disaster management, and methodology. Disaster management cycle and disaster management in India.

**Field Work:**

- Visit to a local area to document environmental issues- agricultural area/pond/lake/terrestrial ecosystem
- Visit to a local polluted area- market/slum area/Industrial area/traffic area

**Suggested Reading:**

1. A.K. De, <i>-Environmental Chemistry</i> ”, Wiley Eastern Ltd.
2. E.P. Odum, <i>-Fundamentals of Ecology</i> ”, W.B. Saunders Co., USA
3. M.N. Rao and A.K. Datta, <i>-Waste Water Treatment</i> ”, Oxford and IBK Publications.
4. Benny Joseph, <i>-Environmental Studies</i> ”, Tata McGraw Hill, 2005.
5. V.K. Sharma, <i>Disaster Management</i> , National Centre for Disaster Management, IPE, 1999

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

MC803PY

Instruction: 2 periods per week

CIE: 30 marks

Credits: Nil

Duration of SEE: 3 hours

SEE: 70 marks

**Objectives:**

The course will introduce the students to
1. To get a knowledge in Indian Culture
2. To Know Indian Languages and Literature and the fine arts in India
3. To explore the Science and Scientists of Medieval and Modern India

**Outcomes:**

After successful completion of the course the students will be able to
1. Understand philosophy of Indian culture.
2. Distinguish the Indian languages and literature.
3. Learn the philosophy of ancient, medieval and modern India.
4. Acquire the information about the fine arts in India.
5. Know the contribution of scientists of different eras.

<b>Unit-I</b>
<b>Introduction to Culture:</b> Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India.
<b>Unit-II:</b>
<b>Indian Languages, Culture and Literature:</b> Indian Languages and Literature-I: the role of Sanskrit, significance of scriptures to current society, Indian philosophies, other Sanskrit literature, literature of south India. <b>Indian Languages and Literature-II:</b> Northern Indian languages & literature.
<b>Unit-III</b>
<b>Religion and Philosophy:</b> Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (selected movements only).
<b>Unit-IV</b>
<b>Fine Arts in India (Art, Technology &amp; Engineering):</b> Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India.
<b>Unit-V</b>
<b>Education System in India:</b> Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India.

**Suggested Reading:**

1. Kapil Kapoor, <i>-Text and Interpretation: The India Tradition"</i> , ISBN: 81246033375, 2005
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2. <i>-Science in Samskrit</i>   , Samskrita Bharti Publisher, ISBN-13:978-8187276333,2007
3. NCERT, <i>-Position paper on Arts, Music, Dance and Theatre</i> "" , ISBN 81-7450-494-X, 2006
4. S. Narain, <i>-Examination in Ancient India</i>   , Arya Book Depot, 1993
5. Satya Prakash, <i>-Founders of Sciences in Ancient India</i>   , Vijay Kumar Publisher, 1989
6. M.Hiriyanna, <i>-Essentials of Indian Philosophy</i>   , Motilal Banarsidass Publishers, ISBN-13: 978-8120810990,2014

**ENGLISH****HS101EG**

Instruction: 2 periods per week

CIE: 30 marks

Credits: 2

Duration of SEE: 3 hours

SEE: 70 marks

**Objectives:**

To enhance the English language abilities of Engineering students, especially in reading and writing, by
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| 1. using authentic material for language learning      |
| 2. exposing them to a variety of content-rich texts    |
| 3. strengthening their grammar and vocabulary          |
| 4. improving their reading and comprehension skills    |
| 5. honing their writing skills                         |
| 6. encouraging them to think creatively and critically |

**Outcomes:**

On successful completion of the course, the student will be able to
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| 1. read, understand, and interpret a variety of written texts |
| 2. use appropriate vocabulary and correct grammar             |
| 3. Undertake guided and extended writing with confidence.     |

<b>Unit-I</b>	
Reading	: RK Narayan, -A Horse and Two Goats
Vocabulary	: Word formation—Prefixes, Suffixes, Root Words
Grammar	: Articles, Prepositions, Determiners
Writing	: Guided Writing (Expanding the outline/Writing from verbal cues)
<b>Unit-II:</b>	
Reading	: Rudyard Kipling, -If
Vocabulary	: Word formation—Compounding and Blending, Contractions
Grammar	: Transitions, Connectives
Writing	: Paragraph Writing
<b>Unit-III</b>	
Reading	: Martin Luther King Jr., -I Have a dream
Vocabulary	: Synonyms, Antonyms, One Word Substitutes
Grammar	: Voice
Writing	: Letter Writing
<b>Unit-IV</b>	
Reading	: Robert Frost, -Road Not Taken
Vocabulary	: Homophones, Homonyms, Homographs
Grammar	: Narration (Direct-Indirect Speech)
Writing	: Report Writing
<b>Unit-V</b>	
Reading	: George Orwell, -The Sporting Spirit   (Excerpt)
Vocabulary	: Inclusive Language, Euphemisms
Grammar	: Tense
Writing	: SOP

**Suggested Reading:**

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| 1. Board of Editors. - <i>Language and Life: A Skills Approach</i> ". Orient BlackSwan, 2018. |
| 2. Sudharshana, NP and C Savitha. - <i>English for Engineers</i> ". Cambridge University      |

Press, 2018

3. Kumar, Sanjay and Pushp Lata. *-English Language and Communication Skills for Engineers.*” Oxford University Press, 2018.

**MATHEMATICS-II****BS203MT**

Instruction: 3+1 periods per week

CIE: 30 marks

Credits : 4

Duration of SEE: 3 hours

SEE: 70 marks

**Objectives:**

1. To study matrix algebra and its use in solving system of linear equations and in solving eigen value problems
2. To provide an overview of ordinary differential equations
3. To study special functions like Legendre and Beta Gamma functions
4. To learn Laplace Transforms and its properties

**Outcomes:**

<i>The students will able to</i>
1. Solve system of linear equations and eigen value problems
2. Solve certain first order and higher order differential equations
3. Solve basic problems of Beta Gamma and Legendre's Function.
4. Apply Laplace Transforms; solve ordinary Differential Equations by using it.

**Unit-I**

**Matrices:** Rank of a matrix, Echelon form, System of linear equations, Linearly dependence and independence of vectors, Linear transformation, Orthogonal transformation, Eigen values, Eigenvectors, Properties of eigen values, Cayley - Hamilton theorem, Quadratic forms, Reduction of quadratic form to canonical form by orthogonal transformation, Nature of quadratic forms.

**Unit-II:**

**Differential Equations of First Order:** Exact differential equations, Integrating factors, Linear differential equations, Bernoulli's, Riccati's and Clairaut's differential equations, Orthogonal trajectories of a given family of curves.

**Unit-III**

**Differential Equations of Higher Orders:** Solutions of second and higher order linear homogeneous equations with constants coefficients, Method of reduction of order for the linear homogeneous second order differential equations with variable coefficients, Solutions of non-homogeneous linear differential equations, Method of variation of parameters, solution of Euler-Cauchy equation

**Unit-IV**

**Special Function:** Gamma Functions, Beta Functions, Relation Between Beta and Gamma Function, Error Functions. Power Series Method, Legendre's Differential Equations and Legendre's Polynomial  $P_n(x)$ , Rodrigue's Formula (without proof).

**Unit-V**

**Laplace Transforms:** Laplace Transforms, Inverse Laplace Transforms, Properties of Laplace Transforms and inverse Laplace Transforms, Convolution Theorem (without proof). Solution of ordinary Differential Equations using Laplace Transforms.

**Suggested Reading:**

1. R.K. Jain & S.R.K. Iyengar, <i>-Advanced Engineering Mathematics</i> ", Narosa Publications, 4th Edition, 2014.
2. Erwin Kreyszig, <i>-Advanced Engineering Mathematics</i> ", John Wiley, 9 <sup>th</sup> Edition, 2012.
3. Dr.B.S. Grewal, <i>"Higher Engineering Mathematics"</i> , Khanna Publications, 43rd



Edition,2014.
4. B.V. Ramana, - <i>Higher Engineering Mathematics</i> ”, 23 <sup>rd</sup> reprint, 2015.
5. N. Bali, M. Goyal, A text book of Engineering “ <i>Mathematics</i> ”, Laxmi publications,2010
6. H.K. Dass, Er. Rajnish Varma, - <i>Higher Engineering Mathematics</i> ”, Schand Technical Third Edition.

**ENGINEERING CHEMISTRY****BS204CH**

Instruction: 3+1 periods per week

CIE: 30 marks

Credits : 4

Duration of SEE: 3 hours

SEE: 70 marks

**Objectives:**

1. Correlate the properties of materials with their internal structure and use the for Engineering applications
2. Apply the principals of electrochemistry in storage of electrical energy in batteries.
3. Gains knowledge in causes of corrosion and its prevention.
4. Attains knowledge about the disadvantages of hard water for domestic and industrial purposes. Also learns the techniques of softening of hard water and treatment of water for drinking purpose.
5. Exposed to qualitative and quantitative parameters of chemical fuels.
6. Aware eco friendly materials and processes.

**Outcomes:**

On successful completion of this course, students will be able to:
1. Apply concept of electrode potential in identifying feasibility of electrochemical reaction; illustrate electro analytical techniques and working of batteries.
2. Identify the mechanism of corrosion of materials on basis of electrochemical approach and devise corrosion control methods.
3. Estimate the physical & chemical parameters of quality of water and explain the process of water treatment.
4. Explain the influence of chemical structure on properties of materials and their choice in engineering applications.
5. Classify chemical fuels and grade them through qualitative analysis.
6. Relate the concept of green chemistry to modify engineering processes and materials.

**Unit-I**

**Electrochemistry and Battery Chemistry: Electrochemistry:** Electrochemical cells, Electrolytic and Galvanic cells-notation, cell reaction and cell potentials. Types of electrodes, Calomel Quinhydrone and Glass electrodes. Determination of pH of a solution by using Quinhydrone electrode. Thermodynamics of emf of cells, Nernst equation and its derivation. Applications of Nernst equation to electrode potential and emf of cells. Numerical problems.

**Batteries: Primary batteries:** Zn - Carbon battery. **Secondary batteries:** Pb-Acid battery and Li-Ion battery, Applications. **Flow batteries (Fuel cells):** Methanol-Oxygen fuel cells, Construction, Applications

**Unit-II:**

**Water Chemistry and Corrosion: Water Chemistry:** Hardness of Water-Types and units of hardness, estimation of temporary and permanent hardness of water by EDTA method. Alkalinity of water and its determination. Water softening by Ion exchange and Reverse Osmosis methods. Numerical problems. Specifications of potable water. Sterilization by Chlorination. Break Point Chlorination.

**Corrosion:** Causes and its effects. Types of Corrosion-Dry or Chemical corrosion and Wet or Electrochemical corrosion and their mechanism. Electrochemical corrosion –Waterline and Pitting Corrosion. Factors influencing rate of corrosion.

**Corrosion control methods:** Cathodic protection methods - Sacrificial anodic and

impressed current methods. Surface coating methods: Hot Dipping-Galvanizing
<b>Unit-III</b>
<p><b>Engineering Materials: Polymers:</b> Basics of terms polymers: Monomer and its functionality, Polymers and degree of polymerization. Classification of polymers - Thermoplastics &amp; Thermosetting resins.</p> <p>Types of Polymerization (i) Addition (ii) Condensation (iii) Co-Polymerization. Mechanism of free radical polymerization</p> <p><b>Preparation, Properties &amp; Uses of the following polymers:</b> Plastics - PVC and Bakelite, Fibres - Nylon 6:6, and Kevlar, Elastomers - Buna-S, Butyl and Silicone Rubbers.</p> <p><b>Conducting polymers :</b> Introduction, Classification and Mechanism of conduction in Poly-acetylene, Applications of conducting polymers.</p> <p><b>Biodegradable polymers:</b> Introduction preparation, properties and applications of polylactic acid</p>
<b>Unit-IV</b>
<p><b>Chemical Fuels: Classification of fuels:</b> Introduction, definition and classification of chemical fuels- Primary and secondary fuels. Solid, liquid and gaseous fuels. Requirements of a good fuel. Calorific Value – HCV and LCV. Theoretical calculations of calorific value by Dulong’s formula – Numerical problems.</p> <p><b>Solid Fuels:</b> Coal and its Ranking. Analysis of coal - Proximate and Ultimate analysis.</p> <p><b>Liquid Fuels:</b> Fractionation of Petroleum. Composition and uses of Gasoline, Diesel and Kerosene. Cracking &amp; its Significance- Catalytic cracking by moving bed method, Knocking. Fuel rating – Octane and Cetane numbers.</p> <p><b>Gaseous Fuels:</b> LPG, CNG -Composition and Uses.</p> <p><b>Combustion:</b> Ignition temperature of a fuel, calculation of air quantities by weight and volume required for combustion of a fuel- Numerical problems.</p>
<b>Unit-V</b>
<p><b>Green Chemistry and Composites: Green Chemistry:</b> Concept, Principles of green chemistry – Atom Economy, Catalysis. and examples of clean technology.</p> <p><b>Biodiesel:</b> Sources, Concept of Trans esterification and carbon neutrality. Properties and significance</p> <p><b>Composites:</b> Introduction to composites, composition and characteristic properties of composites. Classification of composites based on matrix, reinforcement and ply. Applications of composites.</p>

**Suggested Reading:**

1. -Principles of Physical Chemistry by Puri, Sharma and Pathania S.N. Chand & Co. New Delhi (Latest edition).
2. -Engineering Chemistry by P C Jain and M Jain Dhanpat Rai & Sons (15th Edn), New Delhi.
3. -Chemistry in Engineering and Technology by J C Kuriacose and J Rajaram, TMH, New Delhi.
4. -Engineering Chemistry by O G Palanna, TMH, and New Delhi.
5. -Engineering Chemistry by S S Dara, S Chand & Sons, New Delhi.
6. -Engineering Chemistry by Sashi Chawla. Dhanpat Rai & Sons, New Delhi.
7. -Engineering Chemistry by Shikha Agrawal, Cambridge, New Delhi.
8. -Engineering Chemistry by Prasanta Rath, Cengage Learning India Pvt. Ltd.

**PROGRAMMING FOR PROBLEM SOLVING****ES302CS**

Instruction: 3 periods per week

CIE: 30 marks

Credits : 3

Duration of SEE: 3 hours

SEE: 70 marks

**Objectives:**

1. To introduce the basic concepts of Computing environment, number systems and flowcharts
2. To familiarize the basic constructs of C language – data types, operators and expressions
3. To understand modular and structured programming constructs in C
4. To learn the usage of structured data types and memory management using pointers
5. To learn the concepts of data handling using pointers

**Outcomes:**

The students will able to
1. Formulate simple algorithms for arithmetic and logical problems.
2. Translate the algorithms to programs (in c language).
3. Test and execute the programs and correct syntax and logical errors.
4. Implement conditional branching, iteration and recursion.
5. Decompose a problem into functions and synthesize a complete program using divide and conquer approach.
6. Use arrays, pointers and structures to formulate algorithms and programs.
7. Apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
8. Apply programming to solve simple numerical method problems, namely root finding of function, differentiation of function and simple integration.

**Unit-I**

**Introduction to Programming:** Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.).

**Idea of Algorithm:** steps to solve logical and numerical problems.

**Representation of Algorithm:** Flowchart / Pseudocode with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code.

**Unit-II:**

**Control Structures:** Arithmetic expressions and precedence, Conditional Branching and Loops, Writing and evaluation of conditionals and consequent branching.

**Arrays:** Arrays (1-D, 2-D), Character arrays and Strings

**Unit-III**

**Basic Algorithms:** Searching, Basic Sorting Algorithms (Bubble and Selection), Finding roots of Equations. **Functions:** Functions (including using built in libraries), Parameter passing in functions, call by value. **Passing arrays to functions:** idea of call by reference

**Unit-IV**

**Recursion:** Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series. **Structure:** Structures, Defining structures and Array of Structures

<b>Unit-V</b>
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<i>Pointers</i> - Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation), Introduction to File Handling.
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**Suggested Reading:**

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|---|
| 1. Byron Gottfried, - <i>Schaum's Outline of Programming with C</i> ", McGraw-Hill  |
| 2. A.K. Sharma, - <i>Computer Fundamentals and Programming in C</i> ", Universities Press, 2 <sup>nd</sup> Edition, 2018. |
| 3. E. Balaguruswamy, - <i>Programming in ANSI C</i> ", Tata McGraw-Hill   |
| 4. Brian W. Kernighan and Dennis M. Ritchie, - <i>The C Programming Language</i> ", Prentice Hall of India.               |

**ENGLISH LAB****HS151EG***Instruction: 2 periods per week**CIE: 25 marks**Credits : 1**Duration of SEE: 3 hours**SEE: 50 marks***Objectives:**

To enhance the listening and speaking skills of students by
1. Giving them sufficient practice in listening with comprehension
2. Providing them ample opportunities to improve their public speaking skills
3. Training them in the use of correct pronunciation, stress, and intonation
4. Sensitizing them to the use of verbal and non-verbal communication appropriate to the context
5. Encouraging them to learn the art of conversation to suit formal and informal situations
6. Preparing them to make formal presentations and face interviews

**Outcomes:**

On successful completion of the course, students will be able to
1. Listen, understand, and interpret formal and informal spoken language
2. Speak English with acceptable pronunciation, stress, and intonation
3. Present themselves with confidence in formal situations
4. Participate in individual and group activities with relative ease

List of Experiments:
1. Listening for Comprehension
2. Pronunciation, Intonation, Stress, and Rhythm
3. Conversation Skills
4. Introducing Oneself and Others
5. Asking for and Giving Information
6. Making Requests and Responding to them Appropriately
7. Giving Instructions and Responding to them Appropriately
8. Making Formal Announcements and Emceeing
9. Group Discussions
10. JAM
11. Role Play
12. Debate
13. Public Speaking Skills and Body Language
14. Interviews
15. Formal Presentations

**Suggested Reading:**

1. Board of Editors. Language and Life: A Skills Approach. Orient Black Swan, 2018.
2. Balasubramanian, T. A Textbook of English Phonetics for Indian Students. Macmillan, 1981.
3. CIEFL. Exercises in Spoken English. Parts. I-III. Oxford University Press.
4. Pillai, Radhakrishna G. Spoken English For You - Level II. 8th Edition. Emerald Publishers, 2014.
5. Sethi, J and PV Dhamija. A Course in Phonetics and Spoken English. 2nd Edition, Prentice Hall India Learning Private Limited, 1999.

**CHEMISTRY LAB****BS252CH**

Instruction: 3 periods per week

CIE: 25 marks

Credits : 1.5

Duration of SEE: 3 hours

SEE: 50 marks

**Objectives:**

1. Conduct experiments, take measurements and analyze the data through hands-on experience in order to demonstrate understanding of the theoretical concepts of quantitative Analysis while working in small group.
2. Interpret the electro analytical principles with experimental results graphically
3. Demonstrate writing skills through clear laboratory reports

**Outcomes:**

On successful completion of this course, students will be able to:
1. Apply the principles of Colourimetry and Electrochemistry in quantitative estimations.
2. Estimate the rate constants of reactions from concentration of reactants/ products as a function of time.
3. Synthesize small drug molecules.

**List of Experiments:**

1. Introduction to Chemical Analysis. 2. Techniques of Weighing.
<b><u>Volumetric Analysis:</u></b> 3. Preparation of Standard Mohr's salt solution, Standardization of $\text{KMnO}_4$ and estimation ferrous ion. 4. Estimation Iron(II) by Dichromatometry
<b><u>Water Analysis:</u></b> 5. Preparation of Standard Magnesium sulphate solution, standardization of EDTA and Estimation of Total Hardness. 6. Preparation of Standard Sodium Carbonate Solution, Standardization of HCl and Estimation of Carbonate and Bicarbonate Alkalinity.
<b><u>Conductometry:</u></b> 7. Estimation of HCl 8. Estimation of $\text{CH}_3\text{COOH}$ and mixture of acids
<b><u>Potentiometry</u></b> 9. Estimation of HCl 10. Estimation of Iron
<b><u>pH Metry:</u></b> 11. Estimation of HCL
<b><u>Colorimetry:</u></b> 12. Verification of Beer-Lambert's law and estimation of Manganese
<b><u>Chemical Kinetics:</u></b> 13. Determination of rate constant of acid catalyzed hydrolysis of methyl acetate. <b><u>Drug Synthesis</u></b> Preparation of Aspirin

**Note:** Minimum ten experiments should be conducted in the semester**Suggested Reading:**

a. "Senior Practical Physical Chemistry", B.D. Khosla, A. Gulati and V.Garg (R. Chand & Co., Delhi)
b. "An Introduction to Practical Chemistry", K. K. Sharma and D.S. Sharm (Vikas publishing, N. Delhi)

**PROGRAMMING FOR PROBLEM SOLVING LAB****ES351CS**

Instruction: 2 periods per week

CIE: 25 marks

Credits : 1

Duration of SEE: 3 hours

SEE: 50 marks

**Objectives:**

1. Understand the fundamentals of programming in C Language.
2. Write, compile and debug programs in C.
3. Formulate solution to problems and implement in C.
4. Effectively choose programming components to solve computing problems

**Outcomes:**

<i>The students will able to</i>
1. Choose appropriate data type for implementing programs in C language.
2. Design and implement modular programs involving input output operations, decision making and looping constructs.
3. Implement search and sort operations on arrays.
4. Apply the concept of pointers for implementing programs on dynamic memory management and string handling.
5. Design and implement programs to store data in structures and files

**Programming Exercise:**

1. Finding maximum and minimum of given set of numbers, finding roots of quadratic equation.
2. Sin x and Cos x values using series expansion.
3. Conversion of binary to decimal, octal, hexadecimal and vice versa.
4. Generating Pascal triangle, pyramid of numbers.
5. Recursion: factorial, Fibonacci, GCD.
6. Matrix addition and multiplication using arrays, linear search and binary search using recursive and non-recursive procedures.
7. Bubble sort and selection sort.
8. Programs on pointers: pointer to arrays, pointer to functions.
9. Functions for string manipulations.
10. Programs on structures and unions.
11. Finding the number of characters, words and lines of given text file.
12. File handling programs

**Suggested Reading:**

1. Byron Gottfried, - <i>Schaum's Outline of Programming with C</i> ", McGraw-Hill
2. A.K. Sharma, - <i>Computer Fundamentals and Programming in C</i> ", Universities Press, 2018.
3. E. Balaguruswamy, - <i>Programming in ANSI C</i> ", Tata McGraw-Hill
4. Brian W. Kernighan and Dennis M. Ritchie, - <i>The C Programming Language</i> ", Prentice Hall of India.



**WORKSHOP PRACTICE****ES352ME**

Instruction: 2X3 periods per week

Duration of SEE: 3 hours

CIE: 50 marks

SEE: 50 marks

Credits : 3

**Objectives:**

1. Identify and use marking out tools, hand tools, measuring equipment and to work to prescribed tolerances.
2. To provide hands on experience about use of different engineering materials, tools, equipments and processes those are common in the engineering field.
3. To gain a good basic working knowledge required for the production of various engineering products.
4. To Study different hand operated power tools, uses and their demonstration.
5. Adopt safety practices while working with various tools

**Outcomes:**

<i>The students will able to</i>
1. Demonstrate an understanding of and comply with workshop safety regulations.
2. Identify and apply suitable tools for different trades of Engineering processes including drilling, material removing, measuring, chiseling.
3. Study and practice on machine tools and their operations
4. Undertake jobs connected with Engineering Workshop trades including fitting, carpentry, sheet metal, house wiring, welding, smithy and foundry.
5. Apply basic electrical engineering knowledge for house wiring practice

<b>A. TRADE FOR EXERCISES:</b>
1. Carpentry
2. Fitting
3. House wiring
4. Sheet metal working
5. Smithy
6. Welding
7. Plumbing
<b>B. TRADES FOR DEMONSTRATION AND EXPOSURE:</b>
1. Machining (Lathe & Drilling)
2. Injection molding
3. Mould making and casting
4. Basic Electronics lab instruments
<b>C. PRESENTATIONS AND VIDEO LECTURES</b>
1. Manufacturing Methods
2. Rapid Prototyping
3. Glass Cutting
4. 3D printing
5. CNC LATHE
<b>D. IT WORKSHOP:</b> Computer hardware, identification of parts, Disassembly, Assembly of computer to working condition, operating system installation.

**Suggested Reading:**

1. Venugopal, K, "Workshop manual", Anuradha Publications, Kumbakonam, TN, 2012
2. K.C. John, "Mechanical Workshop" 2 <sup>nd</sup> Edn., PHI, 2010.

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| 3. Hajra Choudary, " <i>Elements of Workshop Technology</i> " Vol. 1, Asian Publishers, Edn., 1993.                             |
| 4. G.S. Sawhney, " <i>Mechanical Experiments and Workshop Practice</i> ", I.K. International Publishing House, New Delhi, 2009. |

**Note:** At least two exercises from each trade.