



**P. A. COLLEGE OF ENGINEERING AND  
TECHNOLOGY**

**(An Autonomous Institution Affiliated to Anna University)  
POLLACHI - 642 002.**



**DEPARTMENT OF ELECTRICAL AND  
ELECTRONICS ENGINEERING**

**CURRICULA AND SYLLABI  
REGULATION 2019**



**P. A. COLLEGE OF ENGINEERING AND  
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**REGULATION 2019 (CBCS)  
B.E. ELECTRICAL AND ELECTRONICS ENGINEERING  
CURRICULUM AND SYLLABUS**

**SEMESTER I**

S. NO.	COURSE CODE	COURSE TITLE	CAT	CREDITS			
				L	T	P	C
		<b>Induction Programme</b>	MC	0	0	0	0
<b>THEORY</b>							
1	19EEHS101	Communicative English	HS	3	0	0	3
2	19EEBS102	Engineering Mathematics-I	BS	3	1	0	4
3	19EEBS103	Engineering Physics	BS	3	0	0	3
4	19EEES104	Programming for problem solving	ES	3	0	0	3
<b>PRACTICAL</b>							
5	19EEES105	Workshop Practice	ES	0	0	4	2
6	19EEBS106	Physics Laboratory	BS	0	0	3	1.5
7	19EEES107	Programming in C Laboratory	ES	0	0	3	1.5
<b>TOTAL</b>				<b>12</b>	<b>1</b>	<b>10</b>	<b>18</b>

**SEMESTER II**

S. NO.	COURSE CODE	COURSE TITLE	CAT	CREDITS			
				L	T	P	C
<b>THEORY</b>							
1	19EEBS201	Engineering Chemistry	BS	3	0	0	3
2	19EEBS202	Engineering Mathematics-II	BS	3	1	0	4
3	19EEES203	Basics of Civil and Mechanical Engineering	ES	3	0	0	3
4	19EEES204	Engineering Graphics	ES	2	0	4	4
5	19EEPC205	Electric Circuit Analysis	PC	3	1	0	4

<b>PRACTICAL</b>							
6	19EEBS206	Chemistry Laboratory	BS	0	0	3	1.5
7	19EEPC207	Electrical Appliances Laboratory	PC	0	0	3	1.5
<b>TOTAL</b>				<b>14</b>	<b>2</b>	<b>10</b>	<b>21</b>

## **INDUCTION PROGRAMME**

**SEMESTER I**

(Common to all branches)

**Number of Days**

**21 Days**

**Activities:**

- Physical activity
- Creative Arts
- Universal Human Values
- Literary
- Proficiency Modules
- Lectures by Eminent People
- Visits to local Areas
- Familiarization to Dept./Branch & Innovations

**19EEHS101**

**COMMUNICATIVE ENGLISH**  
(Common to all branches)

**SEMESTER I**

**L T P C**

**3 0 0 3**

**COURSE OBJECTIVES:**

The course is intended to:

- Make learners acquire listening skills with correct pronunciation, stress and Intonation.
- Emphasize the development of speaking skills amongst the learners of Engineering.
- Inculcate the habit of reading for effective and efficient communication.
- Equip the learners with writing skills needed for academic as well as work place contexts.
- Enable learners to fine-tune their linguistic skills with appropriate grammatical usage.

**UNIT-I: LISTENING**

**9**

Listening Comprehension, Pronunciation, Intonation, Stress, Pause, Rhythm, Listening to Short & Long Conversations/Monologues- Note -Taking.

**UNIT-II: SPEAKING**

**9**

Self Introduction, Making Oral & Formal Presentation, Communication at Work Place, Mock Interviews, Role Play Activities, Group Discussions, Debates, Delivering Welcome Address, Proposing Vote of Thanks, Introducing the Chief Guest at a function.

**UNIT-III: READING**

**9**

Reading Comprehension, Speed Reading, Interpreting Visual Materials (Signs, Post Cards, Pictures, and Labels Etc), Reading for Specific Information, Reading to identify Stylistic Features (Syntax, Lexis and Sentence Structures), Cloze Test.

**UNIT-IV: WRITING**

**9**

Phrase, Clause and Sentence Structures, Punctuation, Discourse Markers, Coherence, Precision in Writing, Graph & Process Description, Definition, Writing E-mail, Paraphrasing, Note-making, Job Application with Resume, Writing Review of a Book/Movie, Creative Writing.

**UNIT-V: GRAMMAR AND VOCABULARY**

**9**

Word Formation with Prefix and Suffix, Synonyms and Antonyms, Tenses, Parts of Speech, Common Errors in English (Subject-Verb Agreement, Noun-Pronoun Agreement, Prepositions, Articles, Conditional statements, Redundancies, Clichés etc), Voices.

**Contact periods:**

**Lecture:45 Periods    Tutorial: 0 Periods    Practical: 0 Periods    Total: 45 Periods**

**REFERENCES:**

1. Board of Editors, Using English, Orient Black Swan, 2015.
2. Practical English Usage, Michael Swan, OUP 1995.
3. Cambridge BEC Vantage Practice Tests, Self-study Edition, CUP, 2002.

4. Exercises in Spoken English. Parts 1-II, EFLC, Hyderabad, OUP, 2014.
5. Indlish. Jyothi Sanyal, Viva Books, 2006.
6. Communicative English. J. Anbazhagan Vijay, Global Publishers, Chennai 2018.

**WEB REFERENCES:**

1. [www.cambridgeenglish.org/exams/](http://www.cambridgeenglish.org/exams/)
2. [www.examenglish.com/BEC/BEC\\_Vantage.html](http://www.examenglish.com/BEC/BEC_Vantage.html)
3. [www.splendid-speaking.com/exams/bec\\_speaking.html](http://www.splendid-speaking.com/exams/bec_speaking.html)

**COURSE OUTCOMES:**

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

**CO1:** Listen and comprehend the contexts delivered in English

**CO2:** Speak clearly, confidently, comprehensively and communicate with one or many listeners using appropriate communicative strategies

**CO3:** Read different genres of texts adopting various reading strategies

**CO4:** Write effectively and persuasively to enhance students' employability

**CO5:** Communicate cohesively, coherently and flawlessly avoiding grammatical errors and using a wide vocabulary range in speaking and writing contexts

**19EEBS102**

**ENGINEERING MATHEMATICS I**  
(Common to all branches)

**SEMESTER I**

**L T P C**

**3 1 0 4**

**COURSE OBJECTIVES:**

- To be familiarize with differentiation of single variable and its applications.
- To acquire knowledge of differentiation for more than one variable and its applications.
- To obtain the knowledge of definite and improper integration.
- To acquire the knowledge of multiple integration and related applications.
- To gain methods to solve differential equations with constant and variable coefficients.

**UNIT-I: DIFFERENTIAL CALCULUS**

**9+3**

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules - Maxima and Minima of functions of one variable.

**UNIT -II: FUNCTIONS OF SEVERAL VARIABLES**

**9+3**

Partial differentiation - Homogeneous functions and Euler's theorem - Total derivative - Change of variables - Jacobians - Partial differentiation of implicit functions - Taylor's series for functions of two variables - Maxima and minima of functions of two variables - Lagrange's method of undetermined multipliers.

**UNIT-III: INTEGRAL CALCULUS**

**9+3**

Definite and Indefinite integrals - Substitution rule - Techniques of Integration : Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

**UNIT-IV: MULTIPLE INTEGRALS****9+3**

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

**UNIT-V: DIFFERENTIAL EQUATIONS****9+3**

Higher order linear differential equations with constant coefficients - Method of variation of parameters - Homogenous equation of Euler's and Legendre's type - System of simultaneous linear differential equations with constant coefficients - Method of undetermined coefficients.

**Contact periods:****Lecture: 45 Periods    Tutorial: 15 Periods    Practical: 0 Periods    Total: 60 Periods****REFERENCES:**

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publisher, 43<sup>rd</sup> Edition, 2010.
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015.
3. Anton, H, Bivens, I and Davis, S, "Calculus", Wiley, 10th Edition, 2016.
4. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007.
5. Narayanan, S. and Manicavachagom Pillai, T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2007.
6. Srimantha Pal and Bhunia, S.C, "Engineering Mathematics" Oxford University Press, 2015.
7. Weir, M.D and Joel Hass, "Thomas Calculus", 12th Edition, Pearson India, 2016

**COURSE OUTCOMES:**

Upon completion of this course, the students will be able to

**CO1:** Understand the limit definition and rules of differentiation to differentiate functions**CO2:** Apply differentiation to solve maxima and minima problems**CO3:** Evaluate integrals using techniques of integration, such as substitution, partial fractions and integration by parts**CO4:** Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change of order and change of variables.**CO5:** Apply various techniques in solving differential equations.

**COURSE OBJECTIVES:**

To improve the basic knowledge in Physics and its applications relevant to various streams of Engineering and Technology. Upon completion of this course the students will be familiar with

- Wave optics phenomenon, Huygens' principle and Interference of light.
- Basic principles in lasers, characteristics, types of lasers and its applications.
- Origin of quantum physics, Schrodinger's equation and its applications.
- Free electron theory, density of states in metals, Intrinsic and Extrinsic properties.
- Fiber optic principles and its applications.

**UNIT-I: WAVE OPTICS****9**

Huygens' Principle - superposition of waves and interference of light - Air wedge - Theory - Applications - Testing of flat surfaces - Thickness of a thin sheet of paper - Michelson interferometer - Theory - Applications - Determination of wavelength of monochromatic light.

**UNIT-II: LASER OPTICS****9**

Einstein's theory of matter - radiation interaction and A and B coefficients - amplification of light by population inversion - different types of lasers - gas laser - CO<sub>2</sub> - solid state laser - Neodymium Nd -YAG laser - dye laser - properties of laser beams - monochromaticity - coherence - directionality and brightness - Applications of lasers in cutting, welding and materials processing.

**UNIT-III: INTRODUCTION TO QUANTUM MECHANICS****9**

Limitations of classical Physics - Introduction to Quantum theory - Dual nature of matter and radiation - Properties of matter waves - de Broglie wavelength in terms of voltage, energy, and temperature - Heisenberg's Uncertainty principle - verification - physical significance of wave function - Schrodinger's Time independent and Time dependent wave equations - Particle in a one dimensional potential well.

**UNIT-IV: INTRODUCTION TO SOLIDS AND SEMICONDUCTORS****9**

Quantum theory - Fermi distribution function - effect of temperature - density of energy states in metals - Semiconductors - Properties - elemental and compound semiconductors - Intrinsic and extrinsic semiconductors - properties - Carrier concentration in intrinsic Semiconductor - variation of Fermi level with temperature - extrinsic semiconductors - Carrier concentration in P type and N type semiconductors - variation of Fermi level with temperature and impurity concentration.

**UNIT-V: FIBER OPTICS****9**

Introduction - Basic Principles involved in fiber optics - Total internal reflection - Structure of optical fiber - Propagation of light through optical fiber - Derivation for Numerical Aperture and acceptance angle - fractional index change - Classification of optical fiber based on

materials, refractive index profile and Modes - Fiber optical communication links - Fiber optic sensors - Temperature and displacement.

**Contact Periods:**

**Lecture: 45 Periods    Tutorial: 0 Periods    Practical: 0 Periods    Total: 45 Periods**

**REFERENCES:**

1. Avadhanulu M. N. and Kshirsagar P. G, "A Textbook of Engineering Physics", S.Chand and Company Ltd, New Delhi, 2010.
2. Hecht E, "Optics", McGraw Hill Education, 2012.
3. Griffiths D.J, "Quantum mechanics", Pearson Education, 2014.
4. Neamen, D.A. "Semiconductor Physics and Devices, Times Mirror High Education Group Chicago, 1997.
5. Pain H.J, "The physics of vibrations and waves", Wiley, 2006.
6. Svelto O, "Principles of Lasers", Springer Science & Business Media, 2010.

**COURSE OUTCOMES:**

Upon completion of this course the students will be able to

**CO1:** Study the waves and optics phenomena and their applications

**CO2:** Analyze the construction and working of gas lasers and solid state lasers

**CO3:** Analyze the dual nature of matter using de-Broglie matter waves, Heisenberg's Uncertainty principle, Schrodinger's time independent and dependent wave equations

**CO4:** List and analyze the properties of conducting and Semiconducting materials and devices

**CO5:** Explain fiber optics and classify fibers based on index profiles and modes

**19EES104    PROGRAMMING FOR PROBLEM SOLVING    SEMESTER I**  
(Common to all branches)

**L T P C**  
**3 0 0 3**

**COURSE OBJECTIVES:**

- To develop C Programs using basic programming constructs
- To develop C programs using arrays and strings
- To develop applications in C using functions, pointers, structures and union
- To perform file handling operations in C
- To learn dynamically allocated memory techniques and file operations in C.

**UNIT-I: BASICS OF C PROGRAMMING**

**11**

Generation and Organization of Computers - Number System - Binary - Decimal - Conversion - Problems. Need for logical analysis and thinking - Algorithm - Pseudo code - Flow Chart. Introduction to programming paradigms: Structure of C program - Data Types - Constants - Enumeration Constants - Keywords - Operators and Expressions - Input / Output statements.

## **UNIT-II: ARRAYS AND STRINGS**

**9**

Decision making statements - Switch statement - Looping statements - Arrays - Initialization - Declaration - One dimensional and Two dimensional arrays - String : String operations - String Arrays - Simple programs : Sorting - Searching - Matrix operations.

## **UNIT-III: FUNCTIONS AND POINTERS**

**9**

Introduction to functions: Function prototype, function definition, function declaration, function call, Built-in functions (string functions, math functions) - Recursion - Pointers - Pointer operators - Pointer arithmetic - Arrays and pointers - Array of pointers - Parameter passing: Pass by value, Pass by reference.

## **UNIT-IV: STRUCTURES AND UNION**

**9**

Structure - Nested structures - Pointer and Structures - Array of structures - Example Program using structures and pointers - Self referential structures - Union - Programs using structures and Unions - Enumeration types - Bit fields - typedefs - Dynamic memory allocation - Storage classes.

## **UNIT-V: FILE PROCESSING**

**9**

Files: File opening modes - Types of file processing: Sequential access, Random access - Preprocessor directives - Command line arguments.

### **Contact periods:**

**Lecture: 45 Periods    Tutorial: 0 Periods    Practical: 0 Periods    Total: 45 Periods**

### **REFERENCES:**

1. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
2. Reema Theraja "Fundamentals of Computing and Programming in C", Second Edition, Oxford University Press, 2016
3. Yashavant P. Kanetkar. "Let Us C", BPB Publications, 15<sup>th</sup> revised edition, 2016.
4. Dawn Griffiths, David Griffiths, "Head First C", O'Reilly Publishers, 2012.
5. Paul J. Deitel and Harvey Deitel, "C How to Program", 7th ed., Pearson Education, 2013.
6. <https://www.learn-c.org/>

### **COURSE OUTCOMES:**

Upon completion of this course the students will be able to

**CO1:** Develop simple applications in C using basic constructs

**CO2:** Design and implement applications using arrays and strings

**CO3:** Develop and implement applications in C using functions and pointers

**CO4:** Develop applications in C using structures and union.

**CO5:** Design applications using sequential and random-access file processing.

**19EEES105**

**WORKSHOP PRACTICE**  
(Common to all branches)

**SEMESTER I**

**L T P C**  
**0 0 4 2**

**COURSE OBJECTIVES:**

- To make various basic prototypes in the carpentry trade such as Lap joint, Lap Tee joint, Dove tail joint, Mortise & Tenon and Cross-Lap joint.
- To make various Welding joints such as Lap joint, Lap Tee joint, Edge joint, Butt joint and Corner joint.
- To make various Electrical house wiring with necessary equipments

**LIST OF EXPERIMENTS**

1. Introduction to use of tools and equipments in Carpentry, Welding, Foundry and Sheet Metal
2. Safety aspects in Carpentry, Welding and Foundry
3. Half lap Joint and Dove tail Joint in Carpentry
4. Welding of Lap joint, Butt joint and T-joint
5. Preparation of Sand mould for cube, conical bush, pipes and V pulley
6. Fabrication of parts like tray, frustum of cone and square box in sheet metal
7. Electrical wiring - simple house wiring
8. Plumbing
9. CNC Machines demonstration and lecture on working principle.
10. Additive manufacturing demonstration and lecture on working principle.

**Contact periods:**

**Lecture: 0 Periods      Tutorial: 0 Periods      Practical: 60 Periods      Total: 60 Periods**

**COURSE OUTCOMES:**

Upon on completion of this course, the student will be able to

**CO1:** Use tools and equipments used in Carpentry, Welding, Foundry and Sheet metal

**CO2:** Make half lap joint and dovetail joint in carpentry and welding

**CO3:** Make different kinds of electrical wiring

**CO4:** Prepare sand mould for cube, conical bush, pipes and pulley

**CO5:** Fabricate parts like tray, frustum of cone and square box in sheet metal

**19EEBS106**

**PHYSICS LABORATORY**  
(Common to all branches)

**SEMESTER I**

**L T P C**  
**0 0 3 1.5**

**COURSE OBJECTIVES:**

Upon completion of this course, the students will be familiar with,

- Physical and thermal properties of matter.
- Calibration of electrical devices, Laser diffraction and parameters of optical fibers.
- Compressibility of liquids and viscosity of liquids.
- Band gap energy of semiconductors and thickness of paper.

- Spectral wavelength and dispersive power of prism.

### LIST OF EXPERIMENTS

1. Young's Modulus - Cantilever Bending - Koenig's Method
2. Torsional pendulum - Determination of Rigidity Modulus & Moment of Inertia
3. Young's Modulus - Non Uniform bending Method
4. Lee's Disc method - Thermal conductivity of a bad conductor
5. Ammeter and Voltmeter Calibration - Low Range
6. a) Laser - Particle size Determination  
b) Optical fiber - Determination of NA & Acceptance angle
7. Ultrasonic Interferometer - Velocity of sound & Compressibility of liquids
8. Poiseuille's method - Determination of Coefficient of viscosity of a liquid
9. Determination of Bandgap Energy of Semiconductor
10. Air Wedge - Determination thickness of a paper
11. Spectrometer - Diffraction Grating - Normal Incidence Method
12. Spectrometer - Determination of Dispersive power of a prism

### Contact periods:

**Lecture: 0 Periods      Tutorial: 0 Periods      Practical: 45 Periods      Total: 45 Periods**

### COURSE OUTCOMES:

Upon completion of the course, the students will be able to

**CO1:** Determine the physical and thermal properties of matter

**CO2:** Calibrate electrical measuring instruments and thereby effectively using it for electronic application and understanding the principle of Laser diffraction and propagation through optical fibers and determine its parameters

**CO3:** Understand the ultrasonic wave propagation in liquids and determine the viscosity of liquids for engineering applications

**CO4:** Determine the band gap energy of semiconductor materials and thickness of paper

**CO5:** Identify the spectral wavelength and determine the dispersive power of prism

**19EEES107**

**PROGRAMMING IN C LABORATORY**

**SEMESTER I**

(Common to all branches)

**L T P C**

**0 0 3 1.5**

### COURSE OBJECTIVES:

- To develop programs in C using basic constructs.
- To develop applications in C using strings, pointers, functions, structures.
- To develop applications in C using file processing.

### LIST OF EXPERIMENTS:

1. Programs using I/O statements and expressions.
2. Programs using decision-making constructs.
3. Write a program to find whether the given year is leap year or Not? (Hint: not every centurion year is a leap. For example 1700, 1800 and 1900 is not a leap year)

4. Design a calculator to perform the operations, namely, addition, subtraction, multiplication, division and square of a number.
5. Check whether a given number is Armstrong number or not?
6. Given a set of numbers like <10, 36, 54, 89, 12, 27>, find sum of weights based on the following conditions:
  - i. 5 if it is a perfect cube.
  - ii. 4 if it is a multiple of 4 and divisible by 6.
  - iii. 3 if it is a prime number.

Sort the numbers based on the weight in the increasing order as shown below  
 <10,its weight>,<36,its weight><89,its weight>

7. Populate an array with height of persons and find how many persons are above the average height.
8. Populate a two dimensional array with height and weight of persons and compute the Body Mass Index of the individuals.
9. Given a string —a\$bcd./fg| find its reverse without changing the position of special characters.

(Example input:a@gh%;j and output:j@hg%;a)

10. Convert the given decimal number into binary, octal and hexadecimal numbers using user defined functions.
11. From a given paragraph perform the following using built-in functions:
  - a. Find the total number of words.
  - b. Capitalize the first word of each sentence.
  - c. Replace a given word with another word.
12. Solve towers of Hanoi using recursion.
13. Sort the list of numbers using pass by reference.
14. Generate salary slip of employees using structures and pointers.
15. Compute internal marks of students for five different subjects using structures and functions.
16. Insert, update, delete and append telephone details of an individual or a company into a telephone directory using random access file.
17. Count the number of account holders whose balance is less than the minimum balance using sequential access file.
18. **Mini project**  
 Create a - Railway reservation system with the following modules
  - Booking
  - Availability checking
  - Cancellation
  - Prepare chart

**Contact periods:**

**Lecture: 0 Periods      Tutorial: 0 Periods      Practical: 45 Periods      Total: 45 Periods**

**COURSE OUTCOMES:**

Upon completion of this course- the students will be able to

**CO1:** Develop C programs for simple applications making use of basic constructs, arrays and strings.

**CO2:** Develop C programs involving functions, recursion, pointers, and structures.

**CO3:** Design applications using sequential and random access file processing.

**19EEBS201**

**ENGINEERING CHEMISTRY**  
(Common to CSE, ECE and EEE)

**SEMESTER II**

**L T P C**  
**3 0 0 3**

**COURSE OBJECTIVES:**

- To understand the principles of electrochemical reactions, electrode potential and applications of EMF measurements.
- To accustom the student about the principles and generation of energy in different types of batteries.
- To obtain the knowledge on concepts of electrochemical reactions, redox reactions in corrosion of materials and methods for corrosion prevention and protection of materials.
- To acquaint the student with the concepts of important photophysical and photochemical processes and elemental analysis using spectroscopy.
- To develop the advanced engineering materials by using silicon wafer techniques.

**UNIT-I: ELECTROCHEMICAL CELLS** **9**

Galvanic cells - redox reactions - electrodes metal and metal ion, hydrogen electrode and calomel electrode - electrode potentials-standard oxidation and reduction potentials - Nernst equation and problems - EMF series and significance - Application of EMF measurements - pH measurement using glass electrode and fluoride measurement by ISE.

**UNIT-II: BATTERIES** **9**

Batteries - components, characteristics - voltage, current, current capacity, power density, energy density, cycle life, shelf life and self discharge. Types of batteries - Primary - Zn/MnO<sub>2</sub>, Zn/HgO, Zn/Ag<sub>2</sub>O, Li/SOCl<sub>2</sub>, construction, function and performance comparison - Secondary lead acid, nickel cadmium and lithium ion battery - construction, function and performance comparison.

**UNIT-III: CORROSION** **9**

Corrosion - spontaneity - chemical corrosion - mechanism, nature of oxides – Pilling - Bedworth rule - electrochemical corrosion - mechanism-galvanic series and importance - prevention methods - design of materials, cathodic protection techniques(sacrificial anode and impressed current cathode), inhibitors - Protective coatings - inorganic coating - electroplating - surface preparation and plating method applied to Cr and Ni and galvanizing - organic coating - paints - constituents and functions.

**UNIT-IV: SPECTROSCOPIC TECHNIQUES AND APPLICATIONS** **9**

Beer-Lambert's law - UV Visible spectroscopy and IR spectroscopy – principles - instrumentation (block diagram only) - Flame photometry-principles - instrumentation

(block diagram only) - estimation of sodium by flame photometry - atomic absorption spectroscopy - principles instrumentation(block diagram only)-estimation of Ni by atomic absorption spectroscopy.

#### **UNIT-V: SILICON WAFER TECHNOLOGY**

**9**

Silicon for IC chips - single crystal - preparation by czechralsky and float zone processes - wafer preparation, P-N junction formation - ion implantation, diffusion and epitaxial growth techniques - insulator layer by oxidation - printing of circuits by photolithography - masking and electron beam methods - etching by chemical and electrochemical methods.

#### **Contact periods:**

**Lecture: 45 Periods    Tutorial: 0 Periods    Practical: 0 Periods    Total: 45 Periods**

#### **REFERENCES:**

1. Jain P.C. and Monica Jain, "Engineering Chemistry", Dhanpat Rai Publications Pvt. Ltd, New Delhi, 16<sup>th</sup> Edition, 2017.
2. Dara S.S, Umarae, "Text book of Engineering Chemistry", S. Chand Publications, 2004.
3. Agarwal, C.V, "Chemistry of Engineering Materials", 9<sup>th</sup> Edition, B.S. Publications, 2006.
4. Kuriakose J.C, and Rajaram J, "Chemistry in Engineering and Technology", vol.1 & I, Tata McGraw Hill Publishing company Pvt. Ltd, New Delhi, 2001.
5. Sharma Y.R, "Elementary Organic Spectroscopy", S. Chand Publications, 2013.
6. Tyagi M.S., "Introduction to semiconductor materials and devices", Wiley India 2012.
7. Puri B.R, Sharma L.R and Pathania M.S, "Principles of Physical chemistry", S.Nagin Chand and Co. 2017.

#### **COURSE OUTCOMES:**

Upon completion of this course, the student will be able to

- CO1:** Understand the principles of electrochemical cells, EMF measurements and electrode potentials which makes them to apply in experimental instrumentation techniques.
- CO2:** Know the knowledge about different types of batteries with their functions which is useful for various engineering fields.
- CO3:** Be familiar with corrosion of the instruments and equipments they use in their field and also to learn the mechanisms and the preventive measures by various techniques.
- CO4:** Know about the different types of spectroscopic techniques and applications.
- CO5:** Gain the knowledge about the silicon chips and their fabrication methods and to apply in preparation of electrical and electronics instruments.

**COURSE OBJECTIVES:**

- To obtain the knowledge of Eigen values and diagonalization of a matrix.
- To gain the knowledge of vector differentiation, integration and related applications.
- To be known about analytic functions with properties, construction of analytic function and the knowledge of conformal transformation.
- To obtain the knowledge of Cauchy's integral theorem, calculus of residues and complex integration around unit circle and semicircle.
- To be familiar with techniques of Laplace and Inverse Laplace transformation.

**UNIT-I: MATRICES****9+3**

Eigen values and Eigenvectors of a real matrix - Characteristic equation - Properties of Eigen values and Eigenvectors - Cayley-Hamilton theorem - Diagonalization of matrices - Reduction of a quadratic form to canonical form by orthogonal transformation - Nature of quadratic forms

**UNIT-II: VECTOR CALCULUS****9+3**

Gradient and directional derivative - Divergence and curl - Vector identities - Irrotational and Solenoidal vector fields - Line integral over a plane curve - Surface integral - Area of a curved surface - Volume integral - Green's, Gauss divergence and Stoke's theorems - Verification and application in evaluating line, surface and volume integrals

**UNIT-III: ANALYTIC FUNCTIONS****9+3**

Analytic functions - Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates - Properties - Harmonic conjugates - Construction of analytic function - Conformal mapping - Mapping by functions  $w = z + c$ ,  $cz$ ,  $\frac{1}{z}$ ,  $z^2$  - Bilinear transformation.

**UNIT-IV: COMPLEX INTEGRATION****9+3**

Line integral - Cauchy's integral theorem - Cauchy's integral formula - Taylor's and Laurent's series - Singularities - Residues - Residue theorem - Application of residue theorem for evaluation of real integrals - Use of circular contour and semicircular contour.

**UNIT-V: LAPLACE TRANSFORMS****9+3**

Existence conditions - Transforms of elementary functions - Transform of unit step function and unit impulse function - Basic properties - Shifting theorems - Transforms of derivatives and integrals - Initial and final value theorems - Inverse transforms - Convolution theorem - Transform of periodic functions - Application to solution of linear second order ordinary differential equations with constant coefficients.

**Contact periods:****Lecture: 45 Periods    Tutorial: 15 Periods    Practical: 0 Periods    Total: 60 Periods****REFERENCES:**

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, 43<sup>rd</sup> Edition, 2015.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 10<sup>th</sup> Edition, John Wiley & Sons, 2016.
3. Bali N.P , Manish Goyal v and Watkins C., "Advanced Engineering Mathematics", Firewall Media, New Delhi, 7th Edition, 2009.
4. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi , 3rd Edition, 2007.
5. O'Neil, P.V. "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, New Delhi, 2007.
6. Sastry, S.S, "Engineering Mathematics", Vol. I & II, PHI Learning Pvt. Ltd, 4th Edition, New Delhi, 2014.
7. Wylie, R.C. and Barrett, L.C., "Advanced Engineering Mathematics" Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

**COURSE OUTCOMES:**

Upon completion of this course, the students will be able to

**CO1:** Understand the concept of Eigen values and eigenvectors, diagonalization of a matrix, symmetric matrices, positive definite matrices and similar matrices

**CO2:** Acquire knowledge in Gradient, divergence and curl of a vector point function and related identities

**CO3:** Understand the properties and formation of analytic function, mappings of standard functions and Bilinear transformation

**CO4:** Understand calculus of residues to evaluate contour integration

**CO5:** Understand Laplace transform and inverse transform of simple functions, various related theorems and application to differential equations with constant coefficients

**19EEES203****BASIC CIVIL AND MECHANICAL  
ENGINEERING****SEMESTER II****L T P C****3 0 0 3****COURSE OBJECTIVES:**

- To impart basic knowledge on Civil and Mechanical Engineering.
- To familiarize the materials and measurements used in Civil Engineering.
- To provide the exposure on the fundamental elements of civil engineering structures.
- To enable the students to distinguish the components and working principle of power Plant units, IC engines.
- To enable the students to working principle of R & AC system.

**UNIT-I : OVERVIEW OF CIVIL AND MECHANICAL ENGINEERING 9**

Overview of Civil engineering – Surveying - Different classification of surveying - measurements of distances-determination of land areas - Building floor area, carpet area and floor space index. Overview of Mechanical Engineering - Specialized sub disciplines in Mechanical Engineering - Production, Automobile, Energy Engineering.

**UNIT-II: BUILDING MATERIALS AND CONSTRUCTION 9**

Classification and Characteristics of building stones, bricks, sand, cement, concrete, steel and timber. Foundation - types of foundation - Bearing capacity and settlement - Requirement of good foundations. Brickmasonry - stonemasonry-plastering and pointing.

**UNIT-III: CIVIL ENGINEERING STRUCTURES 9**

Components of building - beams - columns - lintels – roofing - flooring - Types of Bridges and Dams - water supply - sources and quality of water - Rain water harvesting - introduction to high way and rail way.

**UNIT-IV: POWER PLANTS AND INTERNAL COMBUSTION ENGINES 9**

Classification of Power Plants - Working principle of steam, Gas, Diesel, Hydro - electric and Nuclear Power plants - Internal combustion engines as automobile power plant - Working principle of Petrol and Diesel Engines - Four stroke and two stroke cycles - Comparison of four stroke and two stroke engines - working principle of Boilers, Turbines, Reciprocating Pumps (single acting and double acting) and Centrifugal Pumps

**UNIT-V: REFRIGERATION AND AIR CONDITIONING SYSTEM 9**

Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system - Layout of typical domestic refrigerator - Window and Split type room Air conditioner.

**Contact periods:**

**Lecture: 45 Periods    Tutorial: 0 Periods    Practical: 00 Periods    Total: 45 Periods**

**REFERENCES:**

1. Ramamrutham S., “Basic Civil Engineering”, Dhanpat Rai Publishing Co.(P) Ltd. 2013
2. Bhavikaati S.S, “Basic Civil Engineering and Engineering Mechanics”, New Age International Publishers, New Delhi, 2011.
3. Kilbert C., “Sustainable Construction: Green building design and delivery”, John wiley & sons, 2005.
4. Jagadish K.S, Venkataraman Reddy B.V. and K.S. Nanjunda Rao “Alternative Building Materials and Technologies” New Age International (P) Ltd. Publishers, New Delhi.
5. Nagpal G.R, “Power Plant Engineering” Khanna Publishers, New Delhi, 2002.
6. Jain R.K ,“Production Technology” Khanna Publishers, New Delhi, 2004
7. Shanmugam.G ,“Basic Mechanical Engineering” McGraw Hill Education (India) Pvt. Ltd, New Delhi, 4" Edition, 2013.

## **COURSE OUTCOMES:**

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

**CO1:** Appreciate the Civil and Mechanical Engineering components.

**CO2:** Explain the usage of construction material and proper selection of construction materials.

**CO3:** To identify various structures sources of water, rain water harvesting, modes of transport and sewage disposal methods.

**CO4:** Identify the components used in power plant cycle and demonstrate working principles of petrol and diesel engine.

**CO5:** Elaborate the components of refrigeration and Air conditioning cycle.

**19EEES204**

**ENGINEERING GRAPHICS**  
(Common to all branches)

**SEMESTER II**

**L T P C**  
**2 0 4 4**

## **COURSE OBJECTIVES:**

- Geometrical constructions
- Orthographic projection
- Performing section of solids and development of the same
- Pictorial view of solids
- Familiarization of CAD packages

### **UNIT-I: GEOMETRICAL CONSTRUCTIONS**

**6+12**

Dimensioning - Lettering - Types of Lines - Scaling conventions - Dividing a given straight line in to any number of equal parts - Bisecting a given angle - Drawing a regular polygon given one side - Special methods of constructing a pentagon and hexagon.

### **UNIT-II: ORTHOGRAPHIC PROJECTIONS**

**6+12**

Introduction to Orthographic projections - Projection of points - Projection of straight lines with traces – conversion of pictorial views to orthographic views - Projection of solids

### **UNIT-III: SECTION OF SOLIDS AND DEVELOPMENT**

**6+12**

Sectioning of solids - Development of surfaces

### **UNIT-IV: PICTORIAL VIEW**

**6+12**

Isometric Projections – Conversion of orthographic views to Pictorial views (simple objects)

### **UNIT-V: COMPUTER AIDED DRAFTING**

**6+12**

Introduction to computer aided drafting package to make 2-D Drawing. Object Construction - page layout - Layer and Line type - Creating, Editing and selecting the Geometric Objects - Mechanics - Viewing, Annotating, Hatching and Dimensioning the drawing - Creating Blocks and Attributes, Drafting - Create 2D drawing. A Number of chosen problems will be solved to illustrate the concepts clearly. (Demonstration purpose only, not be included in examinations)

**Contact periods:****Lecture: 30 Periods    Tutorial: 0 Periods    Practical: 60 Periods    Total: 90 Periods****REFERENCES:**

1. Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.
2. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.
3. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
4. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 50<sup>th</sup> Edition, 2010.
5. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
6. Luzzader, Warren.J. and Duff, John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
7. Parthasarathy N.S and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
8. Shah M.B. and Rana B.C., "Engineering Drawing", Pearson, 2nd Edition, 2009.

**COURSE OUTCOMES:**

Upon on completion of the course, the student will be able to

**CO1:** Represent solids as per international standards.

**CO2:** Generate and interpret multiple views through development, interpretation and sectional views

**CO3:** Generate and interpret orthographic views.

**CO4:** Generate and interpret pictorial views.

**CO5:** Towards the end of the course it is expected that the students would be matured to visualize the engineering components.

**19EEPC205****ELECTRIC CIRCUIT ANALYSIS****SEMESTER II****L T P C****3 1 0 4****COURSE OBJECTIVES:**

- To introduce electric circuits and its analysis
- To impart knowledge on solving circuits using network theorems
- To introduce the phenomenon of resonance in coupled circuits.
- To educate on obtaining the transient response of circuits.
- To introduce phasor diagrams and analysis of three phase circuits

**UNIT-I: BASIC CIRCUITS ANALYSIS****9+3**

Ohm's Law - Kirchoff's laws - DC and AC Circuits - Resistors in series and parallel circuits - Mesh current and node voltage method of analysis for D.C and A.C. circuits - Phasor diagram - Power, Power Factor and Energy

**UNIT-II: NETWORK REDUCTION AND NETWORK THEOREMS FOR DC AND AC CIRCUITS** **9+3**

Network reduction: voltage and current division, source transformation - star delta conversion. Thevenin's and Norton's Theorem - Superposition Theorem - Maximum power transfer theorem - Reciprocity Theorem.

**UNIT-III: RESONANCE AND COUPLED CIRCUITS** **9+3**

Series and parallel resonance - their frequency response - Quality factor and Bandwidth - Self and mutual inductance - Coefficient of coupling - Tuned circuits - Single tuned circuits.

**UNIT-IV: TRANSIENT RESPONSE FOR DC CIRCUITS** **9+3**

Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. with sinusoidal input - Characterization of two port networks in terms of Z, Y and h parameters.

**UNIT-V: THREE PHASE CIRCUITS** **9+3**

Three phase balanced / unbalanced voltage sources - analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & unbalanced - phasor diagram of voltages and currents - power and power factor measurements in three phase circuits.

**Contact periods:**

**Lecture: 45 Periods    Tutorial: 15 Periods    Practical: 0 Periods    Total: 60 Periods**

**REFERENCES:**

1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", Tata Mc Graw Hill publishers, New Delhi (2013).
2. Joseph A. Edminister, Mahmood Nahri, "Electric circuits", Schaum's series, Tata Mc Graw-Hill, New Delhi (2010).
3. Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", Tata Mc Graw Hill (2015).
4. Chakrabati A, "Circuits Theory (Analysis and synthesis), Dhanpath Rai & Sons, New Delhi, Seventh - Revised edition (2018)
5. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", Second Edition, Mc Graw Hill (2013).

**COURSE OUTCOMES:**

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

- CO1:** Analyse electrical circuits
- CO2:** Apply circuit theorems
- CO3:** Analyse resonance circuits
- CO4:** Analyse transient response
- CO5:** Analyse three phase circuits

**COURSE OBJECTIVES:**

- To make the student to acquire practical skills in the determination of water quality parameters through volumetric analysis.
- To provide exposure to the students with hands on experience on the determination of chemical substances present in solution by conductometric and potentiometric experiments.
- To quantify the Copper content by Iodometric method.
- To expose the students to test the Saponification value of an oil.
- To equip the students with the principles of rate constant of a chemical reaction.

**LIST OF EXPERIMENTS:**

1. Estimation of hardness by EDTA method.
2. Estimation of chloride by Argentometric method.
3. Conductometric titration of mixture of acids and strong base.
4. Estimation of iron content of the given solution using Potentiometer.
5. Determination of Saponification value of oil.
6. Estimation of Iron by Spectrophotometry.
7. Estimation of HCl by pH titration.
8. Determination of the rate constant of reaction.
9. Estimation of Dissolved Oxygen by Iodometry.
10. Conductometric titration of strong acid and strong base.
11. Conductometric precipitation titration using  $\text{BaCl}_2$  and  $\text{Na}_2\text{SO}_4$ .
12. Estimation of copper content of the given solution by Iodometry.

**Contact periods:**

**Lecture: 0 Periods    Tutorial: 0 Periods    Practical: 45 Periods    Total: 45 Periods**

**COURSE OUTCOMES:**

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

- CO1:** Outfit with hands-on knowledge in the quantitative chemical analysis of water quality related parameters
- CO2:** Apply the EMF and conductometric measurements in quantitative analysis of substances
- CO3:** Equip with the methods and techniques involved in the Saponification process
- CO4:** Comprehend the rate constant of a chemical reaction with respect to time
- CO5:** Quantify the metal ion concentration of the given sample

**COURSE OBJECTIVES:**

- To gain the knowledge of electrical measuring equipments
- To assemble and test different electrical appliances
- To learn inverter connection and battery charging

**LIST OF EXPERIMENTS:**

1. Measurement of energy using single phase energy meter
2. Determination of winding resistance and insulation resistance
3. Assembling and testing of Mixer and Wet Grinder
4. Assembling and testing of ceiling fan
5. Inverter connection for domestic wiring
6. Assembling of 15 watts LED circuit
7. Battery charging through solar panel
8. Assembling and testing of Induction Heater
9. Assembling and testing of Microwave oven
10. Measurement of earth resistance
11. Study of UPS and SMPS
12. Study of protective devices

**Contact periods:****Lecture: 0 Periods****Tutorial: 0 Periods****Practical: 45 Periods****Total: 45 Periods****COURSE OUTCOMES:**

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

**CO1:** Apply the electrical measuring equipments**CO2:** Assemble and test domestic electrical appliances**CO3:** Apply battery charging with solar panel**CO4:** Design UPS and SMPS**CO5:** Employ protective devices in electrical circuits