

**Gudlavalleru Engineering College:: Gudlavalleru**  
**Department of Electronics and Communication Engineering**

**R20 Curriculum - First Year B.Tech ECE Course Structure and Syllabus**

**1<sup>st</sup> Semester**

Sl. No.	Name of the Course / Laboratory		No. of Hours per week			Total No. of Credits
			L	T	P	
1	Functional English	HSS	3	-	-	3
2	Linear Algebra and Calculus	BS	3	1	-	4
3	Applied Chemistry	BS	3	-	-	3
4	Problem Solving using C*	ES	3	-	2	4
5	Universal Human Values 2: Understanding Harmony	HSS	2	1	-	3
6	Applied Chemistry Lab	BS	-	-	2	1
7	Electronic Workshop	PC	-	-	4	2
8	Functional English Lab	HSS	-	-	2	1
<b>Total :</b>			<b>14</b>	<b>2</b>	<b>10</b>	<b>21</b>
9	Constitution of India (Mandatory Non-Credit Course)		2	-	-	-

\* Integrated theory and practice course

**2<sup>nd</sup> Semester**

Sl. No.	Name of the Course / Laboratory		No. of Hours per week			Total No. of Credits
			L	T	P	
1	Professional Communication	HSS	2	-	-	2
2	Integral Transforms and Vector Calculus	BS	3	1	-	4
3	Linear Electrical Networks	ES	3	-	-	3
4	Solid-State Physics	BS	3	-	-	3
5	Engineering Drawing	ES	1	-	4	3
6	Solid-State Physics Lab	BS	-	-	4	2
7	Professional Communication Lab	HSS	-	-	4	2
<b>Total :</b>			<b>12</b>	<b>1</b>	<b>12</b>	<b>19</b>
8	Environmental Studies (Mandatory Non-Credit Course)		2	-	-	-

# Functional English

I Year – I Semester

Lecture: 3

Credits: 3

Internal Marks: 40

External Marks: 60

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## Course Objectives

- a. To equip the students for their present and future academic pursuits involving the following:
  - listening to (and viewing) classroom lectures and other academic presentations with a reasonable degree of accuracy, understanding, and appreciation, and responding to them appropriately;
  - speaking in academic (e.g. classroom discussions) and social contexts with a fair degree of fluency, accuracy and intelligibility, and with due attention to factors such as purpose, audience, context, and culture;
  - reading a wide range of informational and functional texts, including course books and reference materials, from print and non-print sources and using them for a variety of purposes; and
  - writing for academic purposes (e.g. assignments, examination answers) in an organized way following the rules of discourse and using vocabulary and grammar appropriately and accurately; and
- b. To develop in them the communication strategies and social graces necessary for functioning effectively in social, academic, and other situations in which they may be called upon to use English.

## Course Outcomes

Upon successful completion of Functional English, the students will be able to:

- a. speak with a reasonable degree of fluency using communication strategies (i.e. using language appropriately to carry out functions such as greeting, requesting information, seeking confirmation, disagreeing) as well conventions of politeness and courtesy
- b. speak with a reasonable degree of fluency and accuracy in contexts requiring tasks such as narrating and describing
- c. listen to short audio and video clips
  - in standard Indian accent with understanding of the types listed in D (1) (a) below; and
  - in native English accent (British and American), especially clips in which the speakers or voice actors speak slowly, and gain both understanding of messages and sensitivity to native-speaker accents
- d. read fluently comprehending texts of different kinds using multiple strategies to understand explicitly-stated information as well as underlying meanings

**UNIT -1 (11 PERIODS)**

S. No.	Components	No. of Periods
1.	<b>Listening:</b> Listening Comprehension – Task 1 (IWE - Chapt II)	1
2.	<b>Speaking:</b> Communication Functions – Conversation between Raghu and Sridhar (IWE - Chapt II)	2
3.	<b>Reading:</b> Reading Comprehension – Task 1 (DPM)	2
4.	<b>Vocabulary:</b> (a) GRE Words – 1.1, (b) Collocations – 2.1 (VB)	2
5.	<b>Grammar:</b> Tenses – Simple Present and Present Continuous (IWE - Chapt II)	2
6.	<b>Writing:</b> Paragraph-Writing (IWE - Chapt II)	2

**UNIT -2 (11 PERIODS)**

S. No.	Components	No. of Periods
1.	<b>Listening:</b> Listening comprehension – Task 2 (WR)	1
2.	<b>Speaking:</b> Communication Functions – Exercise (DPM)	2
3.	<b>Reading:</b> Reading Comprehension – Task 2 (DPM)	2
4.	<b>Vocabulary:</b> (a) Words Often Confused – 3.1, (b) One-Word Substitutes – 4.1 (VB)	2
5.	<b>Grammar:</b> (a) Indianism and (b) <i>Have to</i> (IWE - Chapt II)	2
6.	<b>Writing:</b> Paragraph-Writing (IWE - Chapt II)	2

**UNIT -3 (12 PERIODS)**

S. No.	Components	No. of Periods
1.	<b>Listening:</b> Listening Comprehension – Task 3 (IWE - Chapt III)	1
2.	<b>Speaking:</b> Communication Functions – Conversation between Shreya and Kalpana (IWE - Chapt III)	3
3.	<b>Intensive Reading:</b> Reading Comprehension Task – 3 (DPM) <b>Extensive Reading:</b> <i>The Adventures of Huckleberry Finn</i> by Mark Twain	2
4.	<b>Vocabulary:</b> (a) Idioms – 5.1, (b) Phrasal Verbs – 6.1 (VB)	2
5.	<b>Grammar:</b> Tenses – Simple Past and Present Perfect (IWE - Chapt III)	2
6.	<b>Writing:</b> Paragraph-Writing – Coherence (IWE - Chapt III)	2

**UNIT - 4 (12 PERIODS)**

S. No.	Components	No. of Periods
1.	<b>Listening:</b> Listening Comprehension – Task 4 (IWE - Chapt IV)	1
2.	<b>Speaking:</b> Communication Functions – Conversation between professor and Mayur (IWE - Chapt IV)	2
3.	<b>Reading:</b> Reading Comprehension – Task 4 (DPM)	2
4.	<b>Vocabulary:</b> (a) GRE words – 1.2, (b) Collocations – 2.2, (c) Words Often Confused – 3.2 (VB)	3
5.	<b>Grammar:</b> Expressing Futurity (IWE - Chapt IV)	2
6.	<b>Writing:</b> Clutter-Free Writing (IWE - Chapt IV)	2

**UNIT -5 (11 PERIODS)**

S. No.	Components	No. of Periods
1.	<b>Listening:</b> Listening comprehension – Task 5 (WR)	1
2.	<b>Speaking:</b> (a) Communication Functions and (b) Telephone Etiquette – Exercises (IWE - Chapt IV)	2
3.	<b>Intensive Reading:</b> Reading Comprehension – Task 5 (DPM) <b>Extensive Reading:</b> <i>More Tales from Shakespeare</i> by Charles and Mary Lamb	2
4.	<b>Vocabulary:</b> (a) One-Word Substitutes – 4.2, (b) Idioms – 5.2, (c) Phrasal verbs – 6.2 (VB)	2
5.	<b>Grammar:</b> Structure – <i>Going to</i> (IWE - Chapt IV)	1
6.	<b>Writing:</b> Technical Report Writing (DPM)	3

- IWE – *Innovate with English* by T Samson (Foundation)
- Chapt – Chapter
- DPM – Department-produced materials (handouts)
- WR – Web-resources
- VB – *Vocabulary Builder for Students of Engineering and Technology* by Vijaya Lakshmi et al (Maruthi)

**Note:**

- 1 To be done in 56-58 periods of 50 minutes each.
- 2 Mid I test to be set on Units 1, 2 and 3 and Mid II test on Units 4 and 5.
- 3 Where a section requires more number of periods than suggested above for one component and fewer for another, adjustments may be made in consultation with the Head of the Department.

# Linear Algebra and Calculus

I Year – I Semester

Lecture: 3 Tutorial: 1  
Credits: 4

Internal Marks : 40  
External Marks : 60

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## Course Objectives

- To develop the basic mathematical skills those are imperative for effective understanding of engineering subjects.
- To equip the students with the methods of solving system of linear equations and the concepts of eigenvalues and eigenvectors useful in various fields of technology.
- To incorporate the knowledge of differential calculus to support their concurrent and subsequent engineering studies.
- To find areas and volumes using integrals.

## Course Outcomes

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

- solve the system of linear equations in various engineering problems.
- use the concepts of eigen values and eigenvectors in all engineering disciplines.
- apply differential calculus to model rate of change in time of any physical phenomena and to solve it.
- apply the techniques of partial differentiation in optimization problems and solve first order partial differential equations.
- compute areas and volumes using double and triple integrals.

## UNIT– I: System of Linear Equations

Rank of a matrix – Echelon form, Normal form, System of equations – consistence and inconsistency, solving non-homogeneous system of equations by Gauss-Elimination method – Gauss-Seidel method.

## UNIT– II: Eigenvalues and Eigenvectors

Eigenvalues and Eigenvectors, Properties of Eigenvalues and Eigenvectors, Cayley –Hamilton theorem –finding inverse and power of a matrix, Singular value decomposition.

## UNIT– III: Ordinary Differential Equations

Exact and non-exact differential equations, Applications – Newton’s Law of cooling, Solving Homogeneous differential equations, solving Non-Homogeneous differential equations when RHS terms are of the form  $e^{ax}$ ,  $\sin ax$ ,  $\cos ax$ ,  $polynomial\ in\ x$ ,  $e^{ax}v(x)$ ,  $xv(x)$  Method of variation of parameters, overview of Cauchy’s and Legendre’s differential equations.

Applications: Electrical circuits.

## UNIT– IV: Partial Differentiation and Equations

Total derivative, chain rule, Jacobians, Application- finding maxima and minima (two & three variables). Overview of formation of PDE using arbitrary constants and arbitrary functions. Solutions of first order linear PDE – Linear (Lagrange’s Equation) and Non-Linear (Charpit’s method).

## UNIT– V: Multiple Integrals

Areas – volumes using double integrals and triple integrals (Both in Cartesian and polar coordinates), Change of Order of integration.

**Text Books:**

1. B.S.Grewal, "Higher Engineering Mathematics", 43<sup>rd</sup> Edition, Khanna Publishers, New Delhi, 2015.(Units I-V)
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 10<sup>th</sup> edition, Maitrey Printech Pvt. Ltd, Noida, 2011.

**Reference Books:**

1. Richard Bronson, "Schaum's Series: Differential Equations", 2<sup>nd</sup> Edition, McGraw-Hill Education.
2. N.P. Bali, Dr. Ch. Srimanarayana Iyengar, "A Text Book of Engineering Mathematics", Laxmi Publications Pvt. Ltd., 2001.

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# Applied Chemistry

I Year – I Semester

Lecture: 3

Credits: 3

Internal Marks: 40

External Marks: 60

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## Course Objectives:

- To impart the knowledge of electrochemical energy systems and advanced materials.
- To impart the knowledge of water quality, treatment methods and spectroscopic techniques.

## Course Outcomes:

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

- explain the electrochemistry of batteries and sensors.
- discuss various techniques used in making thin films, properties and applications of nanomaterials.
- explain the properties and applications of polymers used in making electronic devices.
- solve the numerical problems on hardness of water, discuss boiler troubles and explain water treatment methods and their significance in industry and daily life.
- interpret the spectral data to analyze the structure of simple molecules.

## UNIT–I: Electrochemical Energy Systems and Sensors

**Electrochemical energy systems:** Electrochemistry and applications of lead-acid battery, VRLA technology, lithium ion battery, Zinc-air battery and H<sub>2</sub>-O<sub>2</sub> fuel cell.

**Sensors**– working of an electro chemical sensor –applications – working of glucometer – applications of bio-sensors.

## UNIT–II: Nano materials

Concept of nanomaterials - Classification, synthesis of nano materials –Sol-Gel method, Thin film preparation by Chemical vapour deposition method, Lithography, molecular beam epitaxy– Sputtering Techniques: Direct Current (DC) Sputtering, carbon nano tubes– types, properties and applications, Quantum dots – applications.

## UNIT–III: Polymers

Fibre reinforced plastics – Definition of matrix and reinforcement – Glass Fibres, Carbon fibres, Aramid fibres – properties – applications. Conducting polymers –types, properties, applications- OLED, Bio-degradable polymers–PHBV.

## UNIT–IV: Hard water and boiler troubles

Hardness of water – calculation of hardness, boilers troubles– priming and foaming, sludge and scale formation, caustic embrittlement, boiler corrosion. Treatment of boiler feed water – Ion exchange process – Internal treatment – Calgon conditioning – Potable water–WHO standards– Production of potable water from brackish water by RO method.

## **UNIT-V: Spectroscopic techniques and applications**

Basic concepts of spectroscopy – Beer Lambert's Law. UV-visible spectroscopy– types of electronic transitions. Applications of UV-visible spectroscopy. <sup>1</sup>H NMR spectroscopy - Principle, chemical shift, prediction of number of signals in NMR spectra of simple molecules, interpretation of NMR spectra of methanol, ethanol and simple haloalkanes.

### **Text Books:**

1. Shikha Agarwal, "Engineering Chemistry - Fundamentals and Application", 1<sup>st</sup> Edition, Cambridge University Press, New Delhi, 2015. (Units - I, II, IV, V)
2. Dr. Bharathi Kumari Yalamanchili, "A Text book of Engineering Chemistry", 6<sup>th</sup> Edition, VGS Techno series, 2019. (Unit-III)

### **Reference Books:**

1. Sunita Rattan, "A Textbook of Engineering Chemistry", 1<sup>st</sup> Edition, S.K. Kataria and Sons, New Delhi, 2012.
2. Jain & Jain, "Text book of Engineering Chemistry", 16<sup>th</sup> Edition, Dhanpat Rai Publishing Company, 2015.
3. B.S. Bahl, G. D. Tuli and ArunBahl, "Essentials of Physical Chemistry", S. Chand and Company Limited, New Delhi, 2000.
4. Robert M. Silverstein, "Spectroscopic identification of organic compounds", 6<sup>th</sup> Edition, Wiley, 2005.
5. Peter Atkins, "Physical chemistry", 10<sup>th</sup> Edition, Oxford University Press, 2014.

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## Problem Solving using C

(Integrated Theory and Laboratory Course)

I Year – I Semester

Lecture: 3 Practical: 2

Internal Marks: 40

Credits: 4

External Marks: 60

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### Course Objectives

- To emphasize the use of flowcharts and pseudo code in problem solving.
- To apply C Programming in problem solving.

### Course Outcomes

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

- Outline problem solving steps and solve sample problems.
- Use control statements for writing the programs.
- Apply the concepts of arrays, strings and pointers in problem solving.
- Decompose a problem into functions to develop modular reusable code.
- Use structures and files for efficient handling of data.

### UNIT – I: Problem Solving Steps and Introduction to C

**Problem Solving Steps** – Understanding problem, developing algorithm, flow chart, coding, debugging and testing.

**Introduction to C** – General form of a C program, variable declaration, C tokens, basic data types, type conversion, console i/o statements, expressions precedence and associativity, order of evaluation.

**Problem solving:** Sample Problems such as evaluating expressions, to calculate area of geometrical shapes.

**Programs:** Write a C program

1. To calculate the area of triangle using the formula  $\text{area} = (s(s-a)(s-b)(s-c))^{1/2}$  where  $s = (a+b+c)/2$ .
2. To find the Largest Number (integer) and Smallest among three numbers (integers) using ternary operator.

### UNIT – II: Control Statements

**Selection-Making Decisions** – single-way, two-way selection, multi-way selection statements and conditional operator.

**Iteration Statements** – concept of loops, pre-test and post-test loops in C.

**Jump Statements** – return, goto, break, exit and continue.

**Problem Solving:** Calculate the sum of first N numbers, check the given number is prime, and generate fibonacci series.

**Programs:** Write a C program

1. Design and develop a flowchart or an algorithm that takes three coefficients (a, b, and c) of a quadratic equation ( $ax^2+bx+c=0$ ) as input and computes all possible roots. An equation is quadratic only if a is non zero. If a is zero and b is non zero in the above equation then it becomes a linear equation ( $bx + c = 0$ ). If a and b are zeros then the it becomes a constant equation. Implement a C program for the developed flowchart/algorithm and execute the same to output the possible roots for a given set of coefficients with appropriate messages.
2. Read two integer operands and one operator form the user, perform the operation and then print the result (Consider the operators +, -, \*, /, % and use Switch Statement).

3. Write a C program to find the sum of n natural numbers and sum of squares of n natural numbers.
4. Read a number from the user input, print all the prime numbers up to that number and print their sum.
5. 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".

### **UNIT – III: Arrays and Strings**

**Arrays**– Declaring, initializing, accessing and display of one dimensional and two dimensional arrays.

**Strings** – String Input /Output functions, array of strings, string manipulation functions.

**Problem Solving:** Perform addition and multiplication of two matrices, C programs using string handling functions.

**Programs:** Write a C program

1. To search whether the given element is in the array.
2. To perform addition and multiplication of two matrices.
3. Find whether the given string is palindrome or not with and without string handling functions.

### **UNIT – IV: Pointers and Functions**

**Pointers** – Declaration, initialization and operations of pointers.

**Functions** – General form of functions, categories of functions, types of functions, passing parameters by value and by address, recursive functions, dynamic memory allocation functions, arrays of pointers, pointers and strings.

**Problem Solving:** Programs on pointer arithmetic's, fibonacci calculation with and without recursion.

**Programs:** Write a C program

1. To add two numbers using pointers.
2. To find the factorial of a given integer using recursive function.
3. To exchange (Swap) values of two integers using call by reference.

### **UNIT – V: Structures and File Handling**

**Structures and Unions** –Definition, declaration, initialization, accessing members of structures and unions, nested structures, array of structures, array within structures, union within structure.

**File Handling** – Text and binary files, file operations, file handling functions, random access to files.

**Problem Solving:** Implement a structure to read and display the Name, date of Birth and salary of an Employee. Programs to access file content.

**Programs:** Write a C program

1. Using arrays of structures to read the Name, date of Birth, 5 subject marks of n students. And display all the details of students along with calculated CGPA of each student.
2. To append multiple lines at the end of a text file.
3. To count the number of lines, words and characters in a file.

**Text Books**

1. Forouzan, Gilberg, Prasad, “C Programming, A Problem Solving Approach”, Cengage Learning, 2011.
2. Pradip Dey, Manas Ghosh, “Programming in C”, 2<sup>nd</sup> Edition, Oxford Higher Education.

**Reference Books**

1. Reema Thareja, “Programming in C”, Oxford Higher Education, 2016.
2. E Balaguruswamy, “C Programming”, 3<sup>rd</sup> Edition, Tata McGraw-Hill Publishing Company Limited.
3. Yashvant Kanetkar, “Let Us C”, 17<sup>th</sup> Edition, BPB publications.

# Applied Chemistry Lab

I Year – I Semester

Practical: 2

Credits : 1

Internal Marks: 40

External Marks: 60

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## Course objectives:

- To develop the skill on chemical and instrumental methods of analysis.
- To acquire the skill in preparation of synthetic materials.

## Course outcomes:

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

- perform quantitative analysis by using chemical and instrumental methods.
- operate the pH meter, conductivity meter for analyzing the water quality.
- analyze the corrosion rate of a given metal in a given environment by gravimetric method.
- prepare printed circuit board by electroless plating.
- synthesize polymers and obtain cell potential by construction of an electrochemical cell.

## List of Experiments:

Introduction to Chemistry Lab (the teachers are expected to teach fundamentals like Primary, Secondary Standard Solutions, Normality, Molarity, Molality etc. and laboratory ware used, error, accuracy, precision, Theory of indicators, use of volumetric titrations).

1. Practice experiment-Determination of the amount of HCl using standard  $\text{Na}_2\text{CO}_3$ .
2. Determination alkalinity of water sample.
3. Determination of acidity of water sample.
4. Determination of total hardness of the water sample by EDTA method.
5. (a) Determination of pH of different water samples by using pH meter.  
(b) Determination of conductivity of different water samples by using conductivity meter.
6. Determination of concentration of the given acid by using standard base conductometrically.
7. Construction of an Electrochemical cell and determination of EMF.
8. Determination of rate of corrosion of carbon steel metal in acid medium in the absence and presence of Thiourea inhibitor by gravimetric method.
9. Preparation of polyaniline.
10. (a) Preparation of Printing Circuit Board by electroless plating.  
(b) Preparation of Phenol - Formaldehyde resin.
11. Determination of concentration of Ferric Iron in a given solution spectro photometrically.

**Note: Perform any 10 out of 11 Experiments**

## Reference Books:

1. Arthur Israel Vogel, John Mendham, R. C. Denney, J. D. Barnes, "Vogel's Textbook of Quantitative Chemical Analysis", 5<sup>th</sup> Edition, John Wiley & Sons, Inc., New York.
2. Muhammed Arif, Annette Fernandez, Kavitha P. Nair "Engineering Chemistry", Owl Books, 2019.
3. Srinivasulu, "Engineering Chemistry Laboratory Manual and Record" D. Parshva publications.
4. K.Mukkanti, "Engineering Chemistry Lab Manual", B.S publications, 2009.

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# Electronic Workshop

I Year – I Semester

Practical: 4

Credits: 2

Internal Marks: 40

External Marks: 60

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## Course Objectives

- Hands-on training with identification, specification, testing of Passive and Active components
- Use of the various tools and electronic lab instruments
- Soldering practice and developing the PCB Layout.

## Course Outcomes

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

- identify, test various passive and active electronic components.
- assemble, test and troubleshoot the circuits using various tools and instruments.
- simulate the circuits using software tools.
- perform the experiments using virtual laboratory.

## List of Exercises/Experiments

1. Identification, circuit symbols, test of passive components with specification and application (Resistors, Capacitors, Transformers, Relays, Switches, potentiometers, cables)
2. Identification, circuit symbol, test of active components, interpretation of data sheets, precautions to be taken (Diodes-PN junction diode, Zener, LED, Photo diode, BJT, FET, MOSFET)
3. Identification of various package types, interpretation of data sheets for ICs and SMD components.
4. Demonstrate the operation of following electronic lab instruments: Multimeter (Analog and Digital), and DC Regulated Power Supply.
5. Demonstrate the operation of following electronic lab instruments: Cathode Ray Oscilloscope (CRO), and Function Generator.

6. Inter-connection methods using Breadboard. Assembling of electronic circuits on Breadboard and measure various circuit and signal parameters using instruments.
7. Identification of Hardware tools used in electronics lab and Soldering practice.
8. Simulation of any simple electronic circuit using tools like Multisim.
9. Study virtual instruments, concept of virtual laboratory, and perform simple experiment using virtual laboratory.
10. Identification of PCB layout tools and making of PCB layout.

**Reference Books:**

1. Robert L Boylested and Louis Nashelsky, "Electronic Devices and Circuit Theory", 10<sup>th</sup> Edition, PHI, 2009.
2. K. A. Navas, "Electronics Lab Manual Volume I", 5<sup>th</sup> Edition, PHI Publication, 2015.
3. R S Khandpur, "Printed Circuit Boards- Design Fabrication, Assembly and Testing", 1<sup>st</sup> Edition, Tata McGraw-Hill Publishing Company Limited, 2008.

# Functional English Lab

I Year – I Semester

Practical: 2

Credits: 1

Internal Marks: 40M

External Marks: 60M

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## Course Objectives

- a. Functional English (Lab) seeks to develop in the students the communication strategies and social graces necessary in order to function effectively in social and other situations in which they may be called upon to speak in English; and
- b. It seeks to develop in them a greater awareness of English pronunciation and provides for focused practice with the sounds of English and intonation patterns improve their pronunciation skills and to enable them to speak with a reasonable degree of intelligibility.

## Course Outcomes

Upon successful completion of Functional English (Lab), the students will be able to:

- a. give short impromptu speeches with confidence and fluency.
- b. take part in conversations in different functional contexts using English following appropriate communication strategies.
- c. use conventions of politeness and courtesy in speech and enhance the effectiveness of their communication in English.
- d. articulate the sounds of English (vowels, consonants, and diphthongs) with accuracy.
- e. check the pronunciation of words in a dictionary using their knowledge of phonemic symbols.
- f. pause at appropriate places in their speech in English, enhancing thereby the comprehensibility of their communication.
- g. speak English with adequate attention to stress, rhythm, and intonation.
- h. speak without their pronunciation being marred by regional peculiarities, achieving thereby greater intelligibility in their communication with non-Telugu speakers of English.
- i. read out texts of different kinds fluently with appropriate pauses, stress, and intonation.

Unit No.	Components	No. of Periods
1	(A) Using expressions for : a. Greeting others b. Taking leave c. Introducing	6
	(B): Pure vowels (identifying and pronouncing vowel sounds)	3
2	(A) Using expressions for : a. Asking for information and b. Giving information	3
	(B): Diphthongs (identifying and pronouncing diphthongs)	3
3	(A) Using expressions for : a. Inviting b. Accepting and declining invitations	6
	(B): Consonants (identifying and pronouncing consonants)	3
4	(A) Using expressions for : a. Giving commands or instructions b. Requesting	3
	(B): Accent and rhythm (speaking rhythmically)	6
5	(A) Using expressions for : a. Giving suggestions b. Expressing opinions	3
	(B): Intonation (using different tones in connected speech)	6

### Lab Manual

M.Hari Prasad, J. Salivendra Raju, G. Suvarna Lakshmi, "Strengthen Your Communication Skills", Maruthi Publications, Hyderabad, 2013.

### Software used:

1. "Multimedia Language Lab", K-Van Solution, Hyderabad
2. "Foundation Course in Communication Skills", Andhra Pradesh State Council of Higher Education (APSCHE)

### Note:

- To be done in 56-58 periods.
- Each laboratory session consists of 2 periods of 50 minutes each; there are two lab sessions in a week.
- Where a section requires more number of periods than suggested above for one component and fewer for another, adjustments may be made in consultation with the Head of the Department.

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# Professional Communication

I Year – II Semester

Lecture: 2

Credits: 2

Internal Marks: 40M

External Marks: 60M

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## Course Objectives

- a. To equip the students with common employability skills (the skills required for gaining employment and performing successfully in different careers) which can enable them to perform communication tasks of increasing length and complexity.
- b. To develop in them the interactional communication strategies and social graces which have the potential to add to the effectiveness of professional communication

## Course Outcomes

Upon successful completion of Professional Communication, the students will be able to:

- a. speak with a reasonable degree of fluency and accuracy in professional communication situations (such as arriving at a consensus through discussion, making a presentation, and taking part in a telephone conversation).
- b. add to the effectiveness of their oral communication by using communication strategies, conventions of politeness and courtesy, and stress and intonation.
- c. listen to short audio and video clips in native English accent (British and American), and gain both understanding of messages and sensitivity to native-speaker accents.
- d. read fluently, comprehending texts of different kinds using multiple strategies and higher-order skills
- e. produce written discourses of different kinds (e.g. texts expressing opinions and making a convincing case for one's standpoint, professional emails, and summaries of lengthy texts) with attention to elements of writing such as content, organization, language, style, and mechanics.
- f. guard against grammatical errors Indians typically make in their speech and writing in English.

## UNIT - 1 (09 PERIODS)

S. No.	Components	No. of Periods
1.	<b>Listening:</b> Listening comprehension – Task 1 (IWE – Chapt VII)	1
2.	<b>Speaking:</b> Communication Strategies: Conversation Amith& Mahesh (IWE – Chap VII)	2
3.	<b>Reading:</b> Reading Comprehension – Task 1 (IWE – Chapt VII)	1
4.	<b>Vocabulary:</b> (a) GRE words – 1.3, (b) Collocations – 2.3 (VB)	2
5.	<b>Grammar:</b> <i>If</i> Clause (IWE – Chapt VII)	2
6.	<b>Writing:</b> Email writing (IWE – Chapt VII)	1

**UNIT - 2 (08 PERIODS)**

S. No.	Components	No. of Periods
1.	<b>Listening:</b> Listening comprehension – Task 2 (WR)	1
2.	<b>Speaking:</b> Exercise on Communication Strategies (IWE – Chapt VII)	1
3.	<b>Reading:</b> Reading Comprehension – Task 2 (DPM)	1
4.	<b>Vocabulary:</b> Words often confused – 3.3, One-word substitutes – 4.3 (VB)	2
5.	<b>Grammar:</b> Modal verbs (IWE – Chap VII)	1
6.	<b>Writing:</b> Email writing and Argumentative Essay (IWE – Chapt VII)	2

**UNIT - 3 (09 PERIODS)**

S. No.	Components	No. of Periods
1.	<b>Listening:</b> Listening comprehension – Task 3 (WR)	1
2.	<b>Speaking:</b> Communication Strategies – Exercise (DPM)	1
3.	<b>Intensive Reading:</b> Reading Comprehension – Task 3 (DPM) <b>Extensive Reading:</b> <i>Pride and Prejudice</i> by Jane Austen	2
4.	<b>Vocabulary:</b> (a) Idioms – 5.3, (b) Phrasal verbs – 6.3 (VB)	2
5.	<b>Grammar:</b> Indianism (IWE – Chapt VII)	1
6.	<b>Writing:</b> Argumentative Essay (DPM)	2

**UNIT - 4 (09 PERIODS)**

S. No.	Components	No. of Periods
1.	<b>Listening:</b> Listening comprehension – Task 4 (IWE – Chapt VIII)	1
2.	<b>Speaking:</b> Communication Strategies and Presentation: Conversation between Suchitra, Lakshmi, Guhan and Karan ((IWE – Chapt VIII)	2
3.	<b>Reading:</b> Reading Comprehension – Task 4 (DPM)	1
4.	<b>Vocabulary:</b> (a) GRE Words – 1.4, (b) Collocations – 2.4, (c) Words Often Confused – 3.4 (VB)	3
5.	<b>Grammar:</b> Indefinite Articles (IWE – Chapt VIII)	1
6.	<b>Writing:</b> Presentation – Analysis (DPM)	1

## UNIT - 5 (08 PERIODS)

S. No.	Components	No. of Periods
1.	<b>Listening:</b> Listening comprehension – Task 5 (WR)	1
2.	<b>Speaking:</b> Communication Strategies – Exercise (IWE – Chapt VIII)	1
3.	<b>Intensive Reading:</b> Reading Comprehension Task – 5 (DPM) <b>Extensive Reading:</b> <i>Gulliver's Travels</i> by Jonathan Swift	2
4.	<b>Vocabulary:</b> (a) One-Word Substitutes – 4.4, (b) Idioms – 5.4, (c) Phrasal verbs – 6.4 (VB)	2
5.	<b>Grammar:</b> Definite Articles (IWE – Chapt VIII)	1
6.	<b>Writing:</b> Presentation – Rewriting	1

- IWE – *Innovate with English* by T Samson (Foundation)
- Chapt - Chapter
- DPM – Department-produced materials (handouts)
- WR – Web-resources
- VB– *Vocabulary Builder for Students of Engineering and Technology* by Vijaya Lakshmi et al (Maruthi)

### Note:

- 1 To be done in 43-45 periods of 50 minutes each.
- 2 Mid I test to be set on Units 1, 2 and 3 and Mid II test on Units 4 and 5.
- 3 Where a section requires more number of periods than suggested above for one component and fewer for another, adjustments may be made in consultation with the Head of the Department.

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# Integral Transforms and Vector Calculus

I Year – II Semester

Lecture: 3 Tutorial: 1  
Credits: 4

Internal Marks: 40  
External Marks: 60

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## Course Objectives

- To develop the knowledge of Laplace transforms and inverse Laplace transforms.
- To become familiar with the concepts of Fourier series and Fourier transforms
- To understand the vector differentiation concepts gradient, divergence, curl and vector integral theorems.

## Course Outcomes

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

- Analyze and solve engineering problems using Laplace transforms.
- Compute the solutions of initial and boundary value problems using inverse Laplace transforms.
- Find the Fourier series representation of a function of one variable.
- Apply Fourier transform in communication theory and signal analysis, image processing and filters, data processing and analysis.
- Evaluate integrals of functions or vector-related quantities over curves, surfaces, and domains in two- and three-dimensional space.

## Course Content

### UNIT–I: Laplace Transforms

Laplace transforms of some standard functions – Shifting Theorems – Change of scale property - Multiplication and division by  $t$ , Laplace transforms of derivatives and integrals, Unit step function – Dirac Delta function, Laplace transforms for Periodic functions.

Application: Evaluation of Improper Integrals

### UNIT– II: Inverse Laplace Transforms

Inverse Laplace transforms – by partial fractions –Convolution theorem (without proof).

Application: Solution of Initial value problems and Boundary value problems.

### UNIT–III: Fourier Series

Determination of Fourier coefficients (without proof) – Fourier series – Fourier series in an arbitrary interval– Half-range sine and cosine series.

### UNIT– IV: Fourier Transforms

Fourier integral theorem (only statement) – Fourier transforms – sine and cosine transforms – properties (without proofs) – inverse Fourier transforms.

### UNIT–V: Vector Differentiation & Vector Integration

Vector Differentiation: Gradient- Divergence - Curl - related problems.

Vector Integration: Line, surface and volume integrals. Integral theorems: Greens - Stokes - Gauss Divergence Theorems (Without proof) and related problems.

Applications: Work done, flux across the surface.

## Text Books:

1. B.S.Grewal, “Higher Engineering Mathematics”, 43<sup>rd</sup> Edition, Khanna Publishers, New Delhi, 2015.(Units I-V)

2. Erwin Kreyszig, “Advanced Engineering Mathematics”, 10<sup>th</sup> edition, Maitrey Printech Pvt. Ltd, Noida, 2011.

**Reference Books:**

1. Richard Bronson, “Schaum’s Series: Differential Equations”, 2<sup>nd</sup> Edition, McGraw-Hill Education.
2. N.P. Bali, Dr. Ch. Srimanarayana Iyengar, “A Text Book of Engineering Mathematics”, Laxmi Publications Pvt. Ltd., 2001.

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# Linear Electrical Networks

I Year – II Semester

Lecture: 3

Credits: 3

Internal Marks: 40

External Marks:60

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## Course Objectives

- To impart with basic laws and theorems of Electrical circuits.
- To familiarize with the steady state behavior of DC and single phase AC circuits.
- To familiarize the concepts of electrical resonance.
- To impart with two port networks.

## Course Outcomes

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

- apply various circuit laws to analyze the electrical circuits.
- analyze the steady state behavior of DC and AC circuits.
- apply network theorems to analyze the electrical circuits.
- analyze the behavior of electrical resonance
- evaluate different two port network parameters.

## Course Content

### UNIT–I: Introduction To Electrical Engineering

Network elements classification, Circuit concepts –Resistor(R) - Inductor(L) - Capacitor(C) - Voltage and Current Sources (Ideal and Non-Ideal)- Independent and Dependent Sources- Voltage - Current relationship for passive elements.

### UNIT–II: Methods Of Analysis

Ohm's law - Kirchhoff's laws – Source transformation - Network reduction techniques series, parallel, series parallel, star-to-delta or delta-to-star transformation, Nodal analysis, mesh analysis, super node and super mesh for D.C excitations.

**UNIT–III: Single Phase Ac Circuits** Generation of alternating sinusoidal quantities - R.M.S, Average values and form factor – Phase and Phase difference – Complex and polar forms of representations, J notation.

Steady state analysis of R, L and C (in series, parallel and series parallel combinations) with sinusoidal excitation-Concept of Reactance, Impedance, Susceptance and Admittance-

**UNIT–IV: Resonance and Network Theorems** Resonance - series, parallel circuits, concept of band width and Q factor. Superposition, Reciprocity, Thevenin's, Norton's, Maximum Power Transfer, for D.C and sinusoidal excitations.

**UNIT–V: Two Port Networks**

Two port network parameters – Z, Y, ABCD, hybrid, Inverse transmission and inverse hybrid parameters and their relations, Cascaded networks.

**Text Books:**

1. William Hayt , Jack E. Kemmerley, “Engineering Circuit Analysis”, 6<sup>th</sup> Edition, McGraw Hill Company.
2. Joseph A Edminister, “Theory & Problems of Electric Circuits”, 6<sup>th</sup> Edition, Schaum Series.
3. Alexander, Sadiku, “Fundamentals of Electric Circuits “, 2<sup>nd</sup> Edition, McGraw Hill Education.

**Reference Books:**

1. Van Valkenburg , “Network Analysis”, 8<sup>th</sup> Edition, Prentice-Hall of India Private Ltd.
2. Kuo, F.Franklin, “Network Analysis and Synthesis”, 2<sup>nd</sup> edition, John Wiley Publishers.

# Solid State Physics

I Year – II Semester

Lecture: 3

Credits: 3

Internal Marks: 40

External Marks: 60

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## Course Objectives

- To comprehend the basic principles of coherent light source.
- To study an advanced communication system by using Optical Fiber.
- To impart the knowledge of solid state materials with characteristic utility in various engineering applications.

## Course Outcomes

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

- explain construction and working of laser
- relate the principles of light propagation in optical fibers for communication applications
- differentiate classical, quantum free electron theories
- identify conductivity mechanism in semiconductors
- Interpret polarization in dielectrics and magnetic properties of materials

## Course Content

### UNIT– I: Laser

Introduction- Basic characteristics -Spontaneous and stimulated emission - Einstein's coefficient and their relations - Pumping Schemes - Ruby laser – He-Ne Laser - Semiconductor laser – Application of LASER.

### UNIT– II: Fiber Optics

Introduction to optical fibers - Principle of light propagation in fiber-Total Internal Reflection- Numerical aperture- Types of fibers- fiber optic communication system- applications.

### UNIT– III: Free electron and band theory of metals

Classical free electron theory - Drawbacks of classical free electron theory – Fermi level and Fermi Dirac energy distribution function -Density of states-Expression for Fermi energy in conductors. Quantum free electron theory – Band theory of solids-Bloch Theorem- Kronig -penney model(qualitative) -Effective mass of electron - concept of hole.

### UNIT– IV: Semiconductors

Introduction- intrinsic and Extrinsic semiconductors- density of charge carries- Fermi energy- Electrical conductivity - Dependence of Fermi energy on carrier concentration and temperature- direct and indirect band gap semiconductors- Hall effect- Drift and diffusion currents- applications - LED and LCD and its applications.

### UNIT– V: Dielectrics& Magnetic materials

Introduction- Types of polarization in Dielectrics- Frequency and temperature dependence of Polarization- Internal field in a dielectrics- Ferro and Piezo electricity and its applications- Claussius and Mosotti equation.

#### Magnetic materials

Classification of magnetic materials -Weiss theory of Ferro magnetism- Soft and hard magnetic materials- Ferrites and its applications.

### **Text Books**

1. Dr.M.N. Avadhanulu, Dr. P.G. Kshirsagar, “Engineering Physics”, 9<sup>th</sup> Edition, S. Chand Publications.
2. R.K Gaur, SL Gupta, “Engineering Physics”, Dhanapat Rai publications, 2012.

### **Reference Books**

1. A.J. Dekker, “Solid state physics”, Macmillan India, 1969.
2. Charles Kittel, “Introduction to solid state physics”, Wiley India Pvt. Ltd., 2007.
3. B.B. Laud, “Laser and Non-Linear Optics”, New Age International Publishers, 2011.
4. P.K. Palanisamy, “Engineering Physics”, SciTech Publications, 2009.

# Engineering Drawing

I Year – II Semester

Lecture : 1 Practical: 4

Credits : 3

Internal Marks : 40

External Marks: 60

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## Course Objectives

- To highlight the significance of universal language of engineers.
- To introduce the concepts of drawing 3-D objects in 2-D planes

## Course Outcomes

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

- construct polygons and conic sections.
- draw projections of points , lines, planes and solids in different positions.
- draw orthographic and isometric views of different parts.

## UNIT – I:

**Geometrical Constructions:** Bisecting a line and arc, dividing a circle, construction of polygons

**Conic Sections:** Construction of ellipse, parabola, hyperbola using general method.

**Orthographic Projections:** Principles of orthographic projections, projections of points in various quadrants

## UNIT – II:

### Projections of Straight Lines

Lines parallel to both planes, parallel to one and inclined to other plane, straight lines inclined to both planes

## UNIT – III: Projections of Planes

Regular planes perpendicular / parallel to one reference plane and inclined to other reference plane, planes inclined to both the reference planes

## UNIT – IV: Projections of Solids

Regular solids with axis perpendicular to one reference plane, solids with axis inclined to one reference plane and perpendicular to other reference plane.

## UNIT – V: Isometric Projections

Isometric drawing of plane figures, prisms, pyramids, cylinders and cones

Conversion of isometric views to orthographic views and vice versa.

## Text Books

1. N.D. Bhatt, “Engineering Drawing”, 53<sup>rd</sup> Edition, Chariot Publications.

2. K.Venu Gopal, V. Prabhu Raja, “Engineering Drawing with AutoCAD, 5<sup>th</sup> Edition, New Age International Publishers.

### **Reference Books**

1. B.V.R.Gupta and M.Raja Roy, “Engineering Drawing with AutoCAD”, 3<sup>rd</sup> Edition, I.K. Publishers
2. M. B. Shah and B. C. Rana, “Engineering Drawing”, 2<sup>nd</sup> edition, Pearson Education.
3. Dhanunjay A Jolhe, “Engineering Drawing”, 2<sup>nd</sup> edition, McGraw-Hill Education.

# Solid State Physics Lab

I Year – II Semester

Practical: 4

Credits: 2

Internal Marks: 40

External Marks: 60

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## Course Objectives

- To draw the relevance between the theoretical knowledge and to imply it in a practical manner with respect to analyze various electronic circuits and its components.
- To demonstrate an ability to make physical measurements and understand the limits of precision in measurements.
- To create a graph from a series of data points.

## Course Outcomes

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

- identify the semiconductor from the obtained energy gap and Hall coefficient
- draw characteristic curves to estimate thermal coefficient of a thermistor.
- verify magnetic field along the axis of a circular coil.
- recognize the coercivity and retentivity from B-H curve
- determine dielectric constant of a dielectric material
- calculate light gathering power of optical fiber and bending losses
- estimate wavelength of unknown light source.
- examine working of various sensors

## List of Experiments

1. Calculate the bending losses in optical fiber.
2. Determination of numerical aperture of an optical fiber.
3. Evaluate the energy band gap of a semiconductor.
4. Determination of thermal resistance by thermistor.
5. Evaluate the magnetic field along the axis of circular coil by using Stewart and Gee's Apparatus.
6. Estimate the Hall coefficient by Hall Effect.
7. Draw Hysteresis curve of a Ferro magnetic material.
8. Determine the dielectric constant of a dielectric material.
9. Determination of Magnetic susceptibility by Quinke's method.
10. Estimate the wave length of laser source by means of diffraction grating
11. Laser beam divergence and spot size determination.
12. Characterize the temperature sensor (RTD)
13. Simulate the performance of a bio-sensor
14. Measurement of level in a tank using capacitive type level probe
15. Characterize the LVDT
16. Design an orifice plate for a typical application
17. Simulate the performance of a chemical sensor

18. Characterize the strain gauge sensor
19. Characterize the temperature sensor (Thermocouple)
20. Characterization of LED

**Note: Perform any 10 Physical Lab Experiments and 4 Virtual lab Experiments.**

### **Reference Books**

1. Vijay Kumar, T. Radha Krishna, "Practical Physics for engineering students", 2<sup>nd</sup> Edition, S M Enterprises, 2014.
2. Dr. Y. Aparna, Dr. K. Venkateswara Rao, "Lab manual of Engineering Physics", VGS Books links, Vijayawada.
3. R. Jayaraman, V. Umadevi, S. Maruthamuthu, B. Saravana Kumar, "Engineering Physics laboratory manual", 1<sup>st</sup> edition, Pearson publishers.

# Professional Communication Lab

I Year – II Semester

Practical: 4  
Credits: 2

Internal Marks: 40  
External Marks: 60

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## Course Objectives

Professional Communication (Lab) is a career-oriented programme. It seeks to develop in the students the competence required to perform professional communication tasks of increasing length and complexity, which can help them secure employment and perform successfully in their careers.

## Course Outcomes

Upon successful completion of Professional Communication (Lab), the students will be able to:

- a. enhance the effectiveness of their communication through body language;
- b. take part in interactional communication (i.e. communication that serves the purpose of social interaction or small talk) with fluency.
- c. take part in transactional communication (i.e. communication that serves the purpose of carrying out functions such as giving directions, complaining, and apologizing) with fluency.
- d. speak professionally in telephone conversations;
- e. make effective presentations using a range of strategies, including a good organization of the content, impressive opening and closing, the use of suitable visual aids, the use of stories/anecdotes to illustrate a point, effective use of body language, and good handling of the question-and-answer session;
- f. take part in group discussions and debates successfully;
- g. answer questions at an elementary level in job interviews (e.g. *Can you tell us something about yourself? What kinds of things do you worry about? What are your key skills? What skills do you need to improve? What do you see as your strengths? What do you like doing in your spare time? How would you describe the way you work? Tell us about a time when you showed strong leadership skills. Tell us about a time when you had to make a difficult decision. How do you see yourself in five years' time?*);and
- h. use team-building skills with impact in different situations.

Unit no.	Components	No. of Periods
1	<b>Body Language</b> a. Knowing how to use body language in communication b. Interpreting non-verbal symbols	4
2	<b>Dialogues</b> a. Starting a conversation b. Useful functions c. Telephone etiquette d. Making small talk	8
3	<b>Presentation Skills</b> a. Presentation: Learning the dynamics b. Individual presentations (oral) c. Group presentations using PPTs	4 + 4 + 4
4	<b>Group Discussion</b> a. Group discussion: Learning the dynamics b. Performing: Guided group discussion c. Performing: Free group discussion	2 + 4 + 4
5	<b>Interviews</b> a. Learning various types of interviews & answering some frequently asked questions b. Participating in mock interviews c. Participating in telephonic Interviews	4 + 4 + 4
6	<b>Debates</b> a. Debating: Learning the dynamics b. Participating in guided debates c. Participating in free debates	2 + 4 + 4

**Lab Manual:**

M.Hari Prasad, J. Salivendra Raju, G. Suvarna Lakshmi, “Strengthen Your Communication Skills”, Maruthi Publications, Hyderabad, 2013.

**Software used:**

1. “Multimedia Language Lab”, K-Van Solution, Hyderabad
2. “Foundation Course in Communication Skills”, Andhra Pradesh State Council of Higher Education (APSCHE)

**Note:**

- To be done in 56-58 periods.
- Each laboratory session consists of 2 periods of 50 minutes each; there are two lab sessions in a week.
- Where a section requires more number of periods than suggested above for one component and fewer for another, adjustments may be made in consultation with the Head of the Department.

# Environmental Studies

I Year – II Semester

Lecture: 2

Credits: 0

Internal Marks: 40

External Marks: 60

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## Course Objectives

- To impart the basic knowledge about the environment and ecology.
- To develop an attitude of concern for biodiversity and its conservation.
- To create awareness on environmental pollution and waste management.

## Course Outcomes

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

- create awareness among the people in protection of environment.
- analyze structure and functional attributes of an ecosystem.
- explain the values of biodiversity.
- identify the sources of environmental pollution, assess their effects and suggest suitable control measures.
- adopt sustainable waste management practices.

## UNIT - I: Multidisciplinary Nature of Environmental Studies

Definition – Scope – Importance – Need for Public Awareness – Awareness activities- Multidisciplinary nature of Environmental Studies – Role of a citizen in protection of environment.

## UNIT - II: Ecosystem

Concept of an ecosystem – Structural features of an ecosystem – Functional attributes of an ecosystem: Trophic structure – Food Chains – Food Web – Ecological Pyramids – Energy Flow– Biogeochemical Cycles – Ecological Succession.

## UNIT - III: Biodiversity & Its Conservation

Definition – Levels of Biodiversity – Bio-geographical zones of India – Values of biodiversity (Consumptive use value, Productive use value, Social value, Ethical value, Aesthetic value, Option values, Ecosystem service values) – India as a mega diversity nation–Hot spots of biodiversity- Threats to biodiversity – Endangered & Endemic species of India – Conservation of biodiversity.

## UNIT - IV: Environmental Pollution

Definition, causes, effects & control measures of: Air pollution – Water pollution – Noise pollution- Soil pollution. Global climatic issues: IPCC-Introduction – Role of IPCC-Global warming – Acid rains – Ozone layer depletion.

## UNIT - V: Waste Management

Waste water treatment – Municipal solid waste management – Biomedical waste management – Hazardous waste management – E-waste management – Environmental legislations: Wild life (Protection) Act, 1972 – Water (Prevention and Control of Pollution) Act, 1974 – Forest (Conservation) Act, 1980 – Air (Prevention and Control of Pollution) Act, 1981 – Environmental (Protection) Act, 1986.

## **Text Books**

1. Anubha Kaushik, C.P. Kaushik , “Environmental Studies”, 4<sup>th</sup> Edition, New Age International Publishers. (Unit-I, II, III, IV)
2. P.Anandan, R.Kumaravelan, “Environmental Science & Engineering”, Scitech Publications India Pvt. Ltd., 2006. (Unit-I, V).

## **Reference Books**

1. Shashi Chawala , “A Textbook of Environmental Studies”, Tata McGraw-Hill Education Private Limited, 2012.
2. Deeksha Dave, P. UdayaBhaskar, “Textbook of Environmental Studies”, Cengage Learning, 2011.
3. Dr.Suresh, K.Dhameja, “Society and Environment”, English publisher, S.K. Kataria and Sons, 2013.
4. Benny Joseph, “Environmental studies”, 2<sup>nd</sup> Edition, Tata McGraw-Hill Publishing Company Limited.

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