SEMESTER 2

ENGLISH FOR ENGINEERS

L	T	P	C
2	0	1	3

COURSE OBJECTIVES:

- Develop strategies and skills to enhance their ability to read and comprehend texts in engineering and technical contexts
- Foster their ability to write convincing job applications and effective reports
- Develop their speaking skills to make technical presentations, participate in group discussions
- Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialization
- To help learners develop vocabulary, as required in engineering contexts
- To help learners gain the expertise required in grammar for them to function well in engineering contexts

INTRODUCTION: **9**

Listening- Listening to product descriptions, talks mostly of a scientific/technical nature and completing information-gap exercises; Speaking -Describing a product; Asking for and giving directions
Reading - Reading descriptions, short technical texts from journals- newspapers
Writing- purpose statements - extended definitions - writing instructions - checklists- recommendations; note-making and note-taking
Vocabulary Development- technical vocabulary, avoiding jargon
Language Development -subject verb agreement - compound words.

READING AND WRITING TECHNICAL TEXTS: **9**

Listening- Listening to longer technical talks and completing exercises based on them
Speaking- describing a process; making enquiries
Reading - reading longer technical texts- identifying the various transitions in a text- paragraphing
Writing- interpreting charts, graphs; writing formal letters/emails including complaints
Vocabulary Development- vocabulary used in formal letters/emails and reports
Language Development- impersonal passive voice, numerical adjectives.

BECOMING INDEPENDENT USERS OF LANGUAGE FOR TECHNICAL CONTEXTS: 9

Listening- Listening to classroom lectures/ talks on engineering/technology
Speaking - introduction to technical presentations
Reading - longer texts both general and technical, practice in speed reading
Writing-Describing a process, use of sequence words; compare and contrast paragraphs
Vocabulary Development- sequence words- Misspelled words
Language Development- embedded sentences

LANGUAGE FOR JOB-PREPAREDNESS: 9

Listening- Listening to documentaries and making notes
Speaking - mechanics of presentations
Reading - reading for detailed comprehension
Writing- email etiquette - job application - cover letter -Résumé preparation (via email and hard copy)- analytical essays and issue-based essays
Vocabulary Development- finding suitable synonyms-paraphrasing
Language Development- clauses- if conditionals

ADVANCED READING AND WRITING: 9

Listening- TED/Ink talks
Speaking -participating in a group discussion
Reading- reading and understanding technical articles
Writing- Writing reports- minutes of a meeting- accident and survey
Vocabulary Development- verbal analogies
Language Development- reported speech

TOTAL PERIODS: 45

COURSE OUTCOMES:

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

- Read technical texts and write area- specific texts effortlessly
- Listen and comprehend lectures and talks in their area of specialization successfully
- Speak appropriately and effectively in varied formal and informal contexts
- Write reports and winning job applications

TEXT BOOK:

1. Sudarshana, N.P. and Savitha, C, “English for Engineers”, Cambridge University Press, 2018.

PROBABILITY AND STATISTICS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To provide the fundamental concepts of probability and random variable
- To learn different statistical methods needed for data analysis
- To introduce some standard distributions applicable to engineering
- To understand the basic concepts in two dimensional random variables
- To understand the basic concepts of random processes which are widely used in IT fields

PROBABILITY THEORY: **10**

Probability: Axioms, laws of probability, total probability - Bayes' Theorem - random variables - distribution functions: mass and density functions

STATISTICAL AVERAGES: **9**

Mathematical expectation of a random variable - properties of expectation - median - mode - variance - Kurtosis - skewness - moments - Moment Generating function

PROBABILITY DISTRIBUTIONS: **11**

Bernoulli - Binomial - Poisson - Multinomial - Uniform - exponential and Gaussian distributions - central limit theorem (for independent and identically distributed random variables)

TWO-DIMENSIONAL RANDOM VARIABLES: **9**

Joint distribution - marginal distribution - conditional distribution - joint density function - marginal density function - conditional density function - covariance - correlation and regression lines

RANDOM PROCESSES: **6**

Definition - Classification - Stationary Process - Markov Processes and Markov chain

TOTAL PERIODS: 45

COURSE OUTCOMES:

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

- Understand the fundamental concepts of probability and random variable
- Apply the various statistical methods needed to analyze the given data
- Have knowledge of standard distributions which can describe real life phenomenon
- Understand the basic concepts two dimensional random variables and apply in engineering applications
- Apply the concept of random processes in data analysis

TEXT BOOK:

1. Gupta, S.C. and Kapoor, V.K., "Fundamentals of Mathematical Statistics", 11th Edition., (Reprint), Sultan Chand and Sons, 2007.

ENGINEERING PHYSICS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

Enable the students to

- Understand the characteristics of sound; production and applications of ultrasound
- Develop an understanding of quantum mechanical concepts and their theories
- Explain the theories of physics of semiconductors
- Describe the principle of laser action and their production
- Analyse the propagation of light through optical fibres and losses in fibre optic communication

ACOUSTICS: 4

Classification: Music & Noise - Characteristics of Sound Pitch/Frequency, Loudness/Intensity - decibel scale - Weber-Fechner law - Loudness Curves - Quality/Timbre

ULTRASONICS: 5

Production: Magnetostriction and Piezoelectric methods - Detection: Piezoelectric, Acoustic grating - Non-Destructive Testing - Pulse echo system - Reflection and transmission modes - Modes of data presentation - A, B and C scan displays - Sonogram

QUANTUM PHYSICS: **9**

Planck's theory (derivation) - Deduction of Wien's displacement law and Rayleigh-Jeans law from Planck's theory - Properties of Matter waves - wave particle duality - Schrödinger's wave equation - Time-independent and time-dependent equations - Physical significance of wave function - Particle in a one dimensional box and extension to three dimensional box - Degeneracy of electron energy states - Quantum free electron theory - Density of states - Fermi-Dirac statistics - Free electron concentration in metals

SEMICONDUCTORS: **9**

Classification of semiconductors based on doping and band gap - Intrinsic semiconductor - Concept of hole - Carrier concentration derivation - Fermi level and its variation with temperature

- Electrical conductivity - Band gap determination - Extrinsic semiconductors - Carrier concentration derivation in n-type and p-type semiconductors - Variation of Fermi level with temperature and impurity concentration

LASERS: 9

Interaction of Radiation with Matter - Spontaneous and stimulated emissions - Einstein's A and B coefficients - Conditions for Laser action - Population inversion - Active medium - pumping schemes - Optical resonant cavity - Light Amplification -Types of lasers - Nd: YAG, CO_2 and Semiconductor lasers - Homo junction & hetero junction laser

FIBRE OPTICS: 9

Principle and propagation of light in optical fibres - Numerical aperture and Acceptance angle, Types of optical fibres (material, mode & refractive index) - Losses in fibres - Attenuation, dispersion - Fibre Optical Communication system (Block diagram) - Active and passive sensors - pressure, strain, displacement

TOTAL PERIODS: 45

COURSE OUTCOMES:

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

- Describe the characteristics of sound and Ultrasonics production and applications
- Explain the basic quantum mechanical concepts and their applications
- Analyse the physics of semiconductors
- Elucidate the principle and working of different type of lasers
- Explicate the principle, propagation and losses in fibre optic communication

TEXT BOOK:

1. M. N. Avadhanulu, P. G. Kshirsagar , "A text book of Engineering Physics" , S. Chand & Co. Ltd. Revised Edition 2014

COMPUTER ORGANIZATION AND ARCHITECTURE

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To make students understand the basic structure and operation of digital computer
- To understand the hardware-software interface
- To familiarize the students with arithmetic and logic unit and implementation of fixed point and floating-point arithmetic operations
- To expose the students to the concept of pipelining
- To familiarize the students with hierarchical memory system including cache memories and virtual memory
- To expose the students with different ways of communicating with I/O devices and standard I/O interfaces

PROCESSOR FUNDAMENTALS: **9**

Computer Components - Performance Metrics - Instruction set architecture - Various addressing modes - Instruction execution in ALU - Simple data path

COMPUTER ARITHMETIC: **12**

Representing unsigned and signed integer numbers - Floating point system - Integer addition and subtraction - Adders: Ripple carry adder, Carry Look Ahead adders - Integer multiplication and division - High-Radix Multipliers and High-Radix Dividers - Redundant number systems - Residue number systems

MEMORY SYSTEMS: **9**

Memory hierarchy - Cache Memory: Organization, Design - Virtual Memory concepts

INTERCONNECTIONS AND PERIPHERALS: **6**

Interconnection structures, Bus - PCI, Mesh, Hyper cube, Ring, Star - I/O Interface Systems: Keyboard, Monitor, Mouse, Bluetooth, USB, Flash

ILP ARCHITECTURES: **9**

Pipelining - Hazards in pipelining - Super pipelining - Super scalar - VLIW - Combining super scalar and VLIW with pipelining

TOTAL PERIODS: 45

COURSE OUTCOMES:

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

- Explain processor fundamentals
- Design arithmetic and logic unit
- Evaluate performance of memory systems
- Extend the learning to parallel processing architectures
- Explain interconnection structures

TEXT BOOK:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, “Computer Organization”, McGraw Hill Education, Fifth Edition, 2011.

INTRODUCTION TO INTERNET OF THINGS + LAB

L	T	P	C
3	0	2	4

COURSE OBJECTIVES:

- Introduce evolution of internet technology and need for IoT
- Understand IoT architecture and various protocols and software
- Train the students to build IoT systems using sensors, single board computers and open source IoT platforms

INTRODUCTION: **10**

Introduction to Internet of Things - Definitions and characteristics of IoT - Physical Design of IoT - Things in IoT - Logical Design of IoT - IoT Functional Blocks - IoT Communication Models - IoT Communication APIs

EMBEDDED SYSTEMS: **7**

Components of Embedded Systems - Micro-Controller Architecture and Properties - Installing and Setting up the Arduino development environment - Blinky Sketch - A walk through -Arduino Sketches - Classes - Sketch Structure - Pins

ARDUINO: **10**

Arduino Shields - Hands-on working with GPIOs: Analog I/O - Memory Usage - Micro controller peripherals usage - Timers - Counters - Interrupts and its sources - Communication protocols I : UART SPI, I2C, CAN - Interfacing IoT sensors and Actuators - Debug applications using Arduino IDE

RASPBERRY PI: **10**

Overview of Raspberry Pi (RPi) hardware platform - Peripherals on RPi - Setup and Install Raspbian OS on RPi - Overview of Linux OS and its sub-systems - Process - Memory Management - Multi-Threading - IPC - Linux CLI and important commands

IOT IN INDIAN SCENARIO: **8**

IoT in Indian scenario - IoT and Aadhar - IoT and health services - IoT for financial inclusion - IoT for rural empowerment - Challenges in IoT applications - Connectivity challenges - Mission Critical applications

TOTAL PERIODS: 60

SUGGESTIVE LIST OF EXPERIMENTS:

1. Explore different communication methods with IoT devices
2. Develop simple application - testing infrared sensor - IoT Applications - using Arduino
3. Develop simple application - testing temperature, light sensor - IOT Application - using open platform/Raspberry Pi
4. Deploy IOT applications using platforms

TOTAL PERIODS: 15

COURSE OUTCOMES:

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

- Explain the application areas of IOT
- Understand the IoT Architecture, software and hardware requirements
- Deploy IoT applications on hardware platforms.

TEXT BOOK:

1. Arshdeep Bahga, Vijay Madisetti, “Internet of Things: A Hands-On Approach”, Orient Blackswan Private Limited, First Edition, 2015.

PROGRAMMING IN PYTHON

L	T	P	C
2	0	0	2

COURSE OBJECTIVES:

- To solve algorithmic problems
- To compose programs in Python using iteration and recursion
- To construct programs in Python using functions
- To handle file operations using Python

DATA, EXPRESSIONS, STATEMENTS, CONDITIONALS: 8

Data and types: int, float, boolean, string, list - variables - expressions - statements - simultaneous assignment - precedence of operators - comments - in-built modules and functions - Conditional: boolean values and operators, conditional (if), alternative (if-else), case analysis (if-elif-else)

ITERATION, FUNCTIONS, STRINGS: 8

Iteration: while, for, break, continue, pass - Functions: function definition, function call, flow of execution, parameters and arguments, return values, local and global scope, recursion - Strings: string slices, immutability, string functions and methods, string module

CONTAINERS: 8

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters, nested lists, list comprehension - Dictionaries: operations and methods, looping and dictionaries, reverse lookup, dictionaries and lists, dictionary comprehension - Tuples: tuple assignment, tuple as return value, tuple operations

FILES AND EXCEPTION HANDLING: 6

Files: Text files, reading and writing files, format operator, file names and paths - command line arguments - Exceptions: try-catch, types of exception handling

TOTAL PERIODS: 30

COURSE OUTCOMES:

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

- Think logically to solve programming problems using Python
- Understand and develop simple Python programs using conditionals and loops
- Decompose a program into functions
- Represent compound data using Python lists, tuples, dictionaries
- Perform input/output with files

TEXT BOOK:

1. Allen B. Downey, “Think Python: How to Think Like a Computer Scientist”, Shroff/O'Reilly; 2nd edition, 2016.

ENGINEERING PHYSICS LAB

L	T	P	C
0	0	4	2

COURSE OBJECTIVE:

• To determine the physical, electrical and optical properties of materials

LIST OF EXPERIMENTS:

1. Determination of velocity and compressibility of the given liquid - Ultrasonic interferometer
2. Determination of Planck's Constant
3. Determination of specific resistance of the given wire - Carey Foster Bridge
4. Determination of Energy bandgap of the given semiconductor - Band Gap of Semi-Conductor
5. Determination of grating element / average size of the particles of a given powder sample using laser
6. Determine the numerical aperture, acceptance angle & losses in fibres of the given optical fibre cable

TOTAL PERIODS: 30

COURSE OUTCOMES:

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

- Determine ultrasonic velocity in a medium and associated material properties
- Use principles of dual nature of light to determine universal constants and observe photoelectric effects
- Determine electrical properties of metals and semiconductors like specific resistance of a conductor and bandgap of semiconductors
- Determine Wave length of Semiconductor Lasers or size of grating elements
- Characteristics of Optical Fibres like Numerical Aperture and Acceptance Angle

PROGRAMMING IN PYTHON LAB

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

- To solve problems using algorithms and flowcharts
- To write, test, and debug simple Python programs
- To develop and execute programs using Python programming constructs

SUGGESTIVE LIST OF EXERCISES:

1. Use Linux shell commands, use Python in interactive mode, and an editor
2. Write simple programs (area of a geometric shape, simple interest, solve quadratic equation, net salary)
3. Write programs using conditional statements (leap year, maximum of 2 numbers, maximum of 3 numbers, simple calculator, grade of the total mark)
4. Develop programs using loops and nested loops (gcd, prime number, integer division, sum of digits of an integer, multiplication table, sum of a series, print patterns, square root using Newton's method)
5. Develop programs using functions (sine and cosine series, Pythagorean triplets)
6. Develop programs using recursion (efficient power of a number, factorial, Fibonacci number)
7. Develop programs using strings (palindrome, finding substring) without using in-built functions
8. Develop programs using lists and tuples (linear search, binary search, selection sort, insertion sort, quicksort)
9. Develop programs using nested lists (matrix manipulations)
10. Develop simple programs using dictionaries (frequency histogram, nested dictionary)
11. Develop programs using Files (read and write files)
12. Develop programs to perform any task by reading arguments from the command line

TOTAL PERIODS: 30

COURSE OUTCOMES:

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

- To write, test, and debug simple Python programs
- To implement Python programs with conditionals and loops
- Use functions for structuring Python programs
- Represent compound data using Python lists, tuples, and dictionaries
- Read and write data from/to files in Python