Semester II (First year)

CD 121	PROBABILITY & STATISTICS	L	P	C
		3	0	3

Course Objectives:

The student who successfully completes this course will have:
1. The ability to understand the basic principles of various probability distributions.
2. The ability to know the sample distributions of the data
3. The basic concepts of testing of hypothesis and their applications for the data.
4. The skill to predict the future behaviour based on time series data.

Course Outcomes:
On completion of this course, students will be able to:

CO1: Apply various formulae to analyze and interpret the data.
CO2: Apply the knowledge of distribution theory to both software and hardware design problems.
CO3: Apply the basic concepts of testing of hypothesis and derive the conclusions for the data.
CO4: Forecast the behavior of the data by various models in time series.

UNIT-I (14 periods) (CO1)

Probability distributions: Random Variables, Binomial distribution, Poisson distribution.
Probability densities: Continuous random variables, Normal distribution, Normal approximation to the Binomial distribution, Uniform distribution, Gamma distribution, Weibull distribution.

UNIT-II (14 periods) (CO2)

Sampling distribution: Population and samples, the sampling distribution of mean (σ known), the sampling distribution of mean (σ unknown), the sampling distribution of variance.
Testing of Hypotheses(Parametric Tests):
Inferences Concerning Means **:**Point estimation, Interval estimation, tests of hypothesis, null hypothesis and tests of hypothesis, hypothesis concerning one mean, inferences concerning two means

UNIT-III (14 periods) (CO3)

Testing of Hypotheses(Parametric Tests) (Contd…):
Inferences Concerning Variances*:* The estimation of variances, hypothesis concerning one variance, hypothesis concerning two variances.
Inferences Concerning Proportions*:* The estimation of proportions, hypothesis concerning one proportion, hypothesis concerning several proportions, The analysis of r×c tables, Goodness of fit.

UNIT-IV (14 periods) (CO4)

Testing of Hypotheses (Non-Parametric Tests): Sign test, Wilcoxon signed rank test, Mann-Whitney test, Run test, Kolmogorov-Smirnov test.
Basics of Time Series Analysis & Forecasting: Method of moving averages, Linear Trend, Non-Linear Trend.

Learning Resources:
Text Book:
1. **Miller &Freund's Probability and Statistics for Engineers – Richard A. Johnson**

Reference Books:

1. U.Dinesh Kumar, Business Analytics: The science of data- driven decision making.
2. S.M Ross, Introduction to Probability and Statistics for Engineers and Scientists.
3. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall.
4. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley.
5. S.C. Gupta and V.K. Kapoor., Fundamentals of Mathematical Statistics, Sultan Chand &Co.

DS 122	Engineering Physics	L	P	C
		3	0	3

Course Objectives:

1. Introducing the concept of electron motion in periodic potentials and classification of solids, band formation by learning the prerequisite quantum physics.
2. Explaining the diode equation and formation of P-N junction from the basics of semiconductors.
3. Understanding the interaction of radiation with bulk semiconductors and the relevant Optoelectronic devices with energy band diagrams.
4. Exploring the applications of devices in low dimensional materials by understanding the density of states and experimental techniques to be used for measurement of transport properties.

Course Outcomes:

After successful completion of the course, the student will be able to understand:

1. Demonstrate the necessity of periodical potentials and conditions for explaining the properties and band formation with the help of quantum physics.
2. Understand the theory of P-N junction diode from the basics of semiconductor concepts.
3. Know the theory and application of Optoelectronic devices.
4. Describe measuring techniques employed in transport phenomena and variation of properties in low dimensions.

Course Content:

UNIT – I CO1 15 Periods

Principles of Quantum Mechanics: Wave nature of particles, de Broglie's hypothesis, Davisson and Germer's experiment, Time dependent and Time independent Schrodinger wave equations, Physical significance of wave function, Uncertainty principle, single slit experiment. Particle in a box and extension to 3D box (qualitative treatment only).

Electron Theory of Metals: Salient features of Free electron theory, Fermi - Dirac distribution function, Fermi level, Density of States, Bloch wave function, Kronig-Penney model, E-k curves, Brillouin zones, Effective mass, Degrees of freedom, Distinction of metals, semiconductors and insulators. Concept of hole, Energy band formation in solids.

UNIT – II CO2 15 Periods

Semiconductor Physics: Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, drift and diffusion equations, Einstein's relation, P-N junction formation, diode equation, Hall effect and applications.

UNIT – III CO3 15 Periods

Lasers and Optoelectronic Devices: Direct and Indirect band gap semiconductors, Light-semiconductor interaction: Optical transitions in bulk semiconductors: absorption, spontaneous emission, and stimulated emission, Optical loss and gain; Density of states for photons, Semiconducting laser, Homo and Hetero structure lasers with band diagrams, characteristics of laser and LED,PIN diode, Solar cell , working principle and characteristics.

UNIT – IV CO4 15 Periods

Low Dimensional Structures and Measuring Techniques: Density of states in 2D, 1D and 0D (qualitatively). Practical examples of low-dimensional systems such as quantum wells, wires, and dots. Four-point probe and Van der Pauw measurements for carrier density, resistivity and Hall mobility, Hot-point probe measurement, capacitance-voltage measurements, Parameter extraction from Diode I-V characteristics.

Learning Resources:

Text Book:

1. M.N. Avadhanulu, P.G. Kshirasagar - A Text book of Engineering Physics, S. Chand & Company Ltd., 2018.

Reference Book(s):

1. Donald A.Neeman - Semiconductor Physics and Device : Basic Principle (Fourth edition), TMH, 2012.
2. J.Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc. (1995).
3. B.E.A.Saleh and M.C.Teich, Fundamentals of Photonics, John Wiley & Sons, Inc., (2007).
4. S.M.Sze, Semiconductor Devices: Physics and Technology, Wiley (2008).
5. A.Yariv and P.Yeh, Photonics: Optical Electronics in Modern Communications, Oxford University Press, New York (2007).
6. P.Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India (1997).

Web Resources:

1. Online course: "Semiconductor Optoelectronics" by M R Shenoy on NPTEL.
2. Online course: "Optoelectronic Materials and Devices" by Monica Katiyar and Deepak Gupta on NPTEL.

CD 123	Digital Electronics	L	P	C
		3	0	3

Course Objectives:

The main objectives of this course are

1. Know the concepts of different number systems, conversions and functionality of logic gates.
2. To analyse and design combinational logic circuits.
3. To analyse and design sequential logic circuits.
4. Understand programmable logic devices.

Course Outcomes:

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

1. Demonstrate the knowledge in number systems, Boolean algebra, Combinational, sequential circuits, Programmable logic devices and Logic families.
2. Analyse and Design various combinational Circuits.
3. Analyse and Design various sequential Circuits.
4. Implement combinational circuit functionality with Programmable logic devices.

Course Content:

UNIT – I **CO1, CO2, CO3, CO4** 12 Periods

Digital Systems: Digital Systems, Binary Numbers, Number-Base Conversions, Octal and Hexadecimal Numbers, complements, signed binary Numbers. Codes: BCD, excess – 3, Gray.

Boolean Algebra & Logic Gates: Basic Definitions, Axiomatic Definition of Boolean Algebra, Basic theorems and Properties of Boolean Algebra, Boolean functions, Canonical and Standard Forms, Digital Logic gates.

Gate-Level Minimization: The Map Method, Four-Variable K-Map, Five-Variable K-Map, Product of sums simplification, Don't-Care conditions, NAND and NOR implementation.

UNIT – II **CO1, CO2, CO3** 12 Periods

Combinational Logic: Combinational Circuits, Analysis Procedure, Design procedure, Halfadder, Full adder, Half subtractor, Full subtractor, Carry look ahead adder, Magnitude comparator, Encoders, Decoders, Multiplexers, Demultiplexers**.**

UNIT – III **CO1, CO2, CO3** 12 Periods

Synchronous and sequential Logic: Sequential circuits, Latches, Flip-Fops, Analysis of clocked Sequential circuits, State Reduction and Assignment, Design Procedure.

UNIT – IV **CO1, CO4** 12 Periods

Registers and Counters: Registers, Shift Registers, Ripple Counters, Synchronous Counters. **Programmable Logic Devices:** Programmable Read-Only Memory, Programmable Logic Array, Programmable Array Logic.

Text Books:

1. M. Morris Mano, Digital Design, 3rdEdition, Pearson Education, 2009

Reference Books:

1. Z. Kohavi - Switching and Finite Automata Theory,2nd Edition Tata McGraw Hill.
2. 2. R.P. Jain - Modern digital electronics, 4thEdition, McGraw Hill.

Web Resources:

1. http://nptel.ac.in/courses/117105080/3
2. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-111- introductory

CD 124	Data Structures & Algorithms	L	P	C
		3	0	3

Course Pre Requisite(s): Basic understanding of C programming language Course

Course Objective:

1. To illustrate operations of linear and non-linear data structure
2. To demonstrate computational problems using suitable data structures
3. To familiarize searching and sorting techniques

Course Outcome(s):

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

1. Analyze complexity of algorithms.
2. Implement various data structures and its operations.
3. Compare various sorting and searching methods.
4. Apply data structures in various applications.

Course Content:

UNIT – I Text Books – 1 & 2 15 Periods

Basic Terminologies and Introduction to Algorithm & Data Organization: Algorithm specification, Recursion, Performance analysis, Asymptotic Notation - The Big-O, Omega and Theta notation, Programming Style, Refinement of Coding - Time-Space Trade Off, Testing, Data Abstraction

Linear Data Structure: Array, Stack, Queue, Linked-list and its types, Various Representations, Operations & Applications of Linear Data Structures

UNIT – II Text Books – 1 & 2 13 Periods

Non-linear Data Structure: Trees (Binary Tree, Threaded Binary Tree, Binary Search Tree, B & B+Tree, AVL Tree, Splay Tree) and Graphs (Directed, Undirected), Various Representations, Operations & Applications of Non-Linear Data Structures

UNIT – III Text Book - 2 12 Periods

Searching and Sorting on Various Data Structures: Sequential Search, Binary Search, Comparison Trees, Breadth First Search, Depth First Search Insertion Sort, Selection Sort, Shell Sort, Divide and Conquer Sort, Merge Sort, Quick Sort, Heap sort, Introduction to Hashing

UNIT – IV Text Book – 2 & Reference Book-4 10 Periods

File: Organization (Sequential, Direct, Indexed Sequential, Hashed) and various types of accessing schemes.

Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

Learning Resources:

Text Books:

1. Fundamentals of Data Structures, E. Horowitz, S. Sahni, S. A-Freed, Universities Press.
2. Data Structures and Algorithms, A. V.Aho, J. E.Hopperoft, J. D.UIlman, Pearson.

Reference Books:

1. The Art of Computer Programming: Volume 1: Fundamental Algorithms, Donald E.Knuth.
2. Introduction to Algorithms, Thomas, H. Cormen, Charles E. Leiserson, Ronald L. Rivest,Clifford Stein, The MITPress.
3. Open Data Structures: An Introduction (Open Paths to Enriched Learning), (Thirty FirstEdition), Pat Morin, UBCPress.

CD 125	Python for Data Science	L	P	C
		2	0	2

Course Objectives:

The objectives of the course are to:

1. Introduce the fundamentals of Python Programming language.
2. Teach students processing of files, mutable and immutable data types.
3. Impart knowledge of NumPy and Pandas.

Course Outcomes:

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

1. Explain the fundamentals of Python programming language.
2. Create user defined functions to solve problems
3. Manipulate the data structures lists, tuples, sets and dictionaries
4. Use NumPy and Pandas in solving problems.

Course Content:

UNIT I

Basics of Python programming: Values and types, variables, Variable names and keywords, operators and operands, expressions and statements, interactive mode and script mode, order of operations, string operations, comments and debugging.

Conditionals, recursion and Iteration: Modulus operator, Boolean expressions, Logical operators, conditional execution, alternative execution, chained conditionals, nested conditionals, nested conditions, recursion, infinite recursion, keyboard input. Iterations- Multiple assignment, updating variables, the while statement, break, square roots.

UNIT II

Functions: Function calls, type conversion functions, math functions, composition, adding new functions, definitions and uses , flow of execution , parameters and arguments, variables and parameters are local, fruitful functions – return values, incremental development, composition, Boolean functions, more recursion, Leap of faith, checking types, and void functions, Functions advantages.

Strings and Files: A string is a sequence, len, Traversal with a for loop, String slices, Strings are immutable, Searching, Looping and counting, String methods, The in operator, String comparison. Files: Persistence, Reading and writing, Format operator, File names and paths, Catching exceptions, Databases, Pickling, Pipes, Writing modules.

UNIT III

Lists: List sequence, Lists are mutable, Traversing a list, List operations, List slices, List methods, Map, Map, filter and reduce, deleting elements, List and strings , objects and values, Aliasing, List arguments.

Dictionaries and Tuples: A dictionary is a mapping, Dictionary as a collection of counters. Looping and dictionaries, Reverse lookup, Dictionaries and lists, Memos, Global variables. Tuples: Tuples are immutable, Tuple assignment, Tuples as return values, Variable-length argument tuples ,Lists and tuples, Dictionaries and tuples.

UNIT IV

Pandas and NumPy: Numpy Basics - Fast Element wise array functions, Multidimensional Array, Data Processing using arrays, file i/o with arrays;
Pandas - Data Structures, Essential Functionality, Summarizing and Computing Descriptive Statistics, Handling Missing Data, Hierarchical Indexing

Learning Resources:

Text Book:

1. ThinkPython: How to Think Like a Computer Scientist, Allen Downey, Green Tea Press, Version2.0.17
2. Python for Data Analysis, 2nd Edition , by Wes Mckinney Publisher(s): O'Reilly Media, Inc. ISBN: 9781491957660

Reference Books:

1. Introduction to Computer Science Using Python: A Computational Problem-Solving Focus by Dierbach, Wiley
2. Fundamentals of Python Programming: Richard L.Halterman by Southern Adventis tUniversity

DS 161	Engineering Physics Lab	L	P	C
		0	3	1.5

Course Objectives:

The aim and objective of the Lab course on Physics is to introduce the students of B.Tech. class to the formal structure of Physics so that they can use these in Engineering as per their requirement.

1. To familiarize the students with electronic measuring instruments.
2. To measure various parameters of the optical components.
3. Design/problem solving skills, practical experience are developed through laboratory assignments which provide opportunities for developing team in multidisciplinary environments.
4. To understand the general, scientific concepts and a wide idea on various components & instruments required for technology.

Course Outcomes:

At the end of the course, the student will be to draw:

1. Use CRO, Function generator, Spectrometer for making measurements.
2. Test the optical instruments using principles of interference and diffraction.
3. Carrying out precise measurements and handling sensitive equipment.
4. Draw conclusions from data and develop skills in experimental design.

List of Experiments:

1. Lissajous' Figures – Calibration of audio oscillator.
2. Photo Cell – characteristics.
3. Determination of A.C. supply frequency using Sonometer.
4. Newton's rings - Measurement of radius of curvature of plano-convex lens.
5. Determination of Energy band gap of a Semiconductor- Four probe method.
6. Optical fibers – Determination of Numerical Aperture.
7. Diffraction grating - Measurement of wavelength of a given laser source.
8. Photo Voltaic Cell – Determination of fill factor.
9. Series LCR resonance circuit –Determination of Q – factor.
10. Variation of magnetic field along the axis of a circular current carrying coil.

Reference Book:

Physics Lab Manual: RVR & JCCE, Guntur

Note: A minimum of 8(Eight) experiments have to be performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

CD 162	Data Analytics Lab (R-Language)	L	P	C
		0	3	1.5

Course Objectives:

1. Identify the field of data analytics-background and key concepts.
2. Know the basics of statistical analytics.
3. Develop and gain an understanding of probability distributions and hypothesis testing.
4. Discriminate predictive analytics over data.
5. Analyze components and forecast the time series data.

Course Outcomes:

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

1. **Interpolate the role of data analytics**. [Action Verb – Interpolate, Student Achievement – Inferring, Bloom's Taxonomy Level - 2]
2. **Compute statistical methods to data for inferences.** [Action Verb – Compute, Student Achievement –Executing, Bloom's Taxonomy Level - 3]
3. **Examine statistical models like probability distributions and hypothesis testing** [Action Verb – Examine, Student Achievement –Differentiating, Bloom's Taxonomy Level - 4].
4. **Perform predictive analytics over data**. [Action Verb – Perform, Student Achievement – Critiquing, Bloom's Taxonomy Level - 5].
5. **Diagnose and forecast the time series data.** [Action Verb – Diagnose, Student Achievement – Analysing, Bloom's Taxonomy Level - 5].

List of experiments/demonstrations:

1. Introduction to R: Installing R in windows, R Console (R window to edit and execute R Commands), Commands and Syntax (R commands and R syntax), Packages and Libraries (Install and load a package in R), Help In R, Workspace in R.

2. Familiarity of Data Structures in R: Introduction to Data Types (Why Data Structures?, Types of Data Structures in R), Vectors, Matrices, Arrays, Lists, Factors, Data Frames, Importing and Exporting Data.

3. Graphical Analysis: Creating a simple graph (Using plot() command), Modifying the points and lines of a graph (Using type, pch, font, cex, lty, lwd, col arguments in plot() command), Modifying Title and Subtitle of graph (Using main, sub, col.main, col.sub, cex.main, cex.sub, font.main, font.sub arguments in plot() command).

4. Graphical Analysis: Modifying Axes of a Graph (Using xlab, ylab, col.lab, cex.lab, font.lab, xlim, ylim, col.axis, cex.axis, font.axis arguments and axis() command), Adding Additional Elements to a Graph (Using points(), text(), abline(), curve() commands), Adding Legend on a Graph (Using legend() command), Special Graphs (Using pie(), barplot(), hist() commands), Multiple Plots (Using mfrow or mfcol arguments in par() command and layout command).

5. Descriptive Statistics: Measure of Central Tendency (Mean, Median and Mode), Measure of Positions (Quartiles, Deciles, Percentiles and Quantiles), Measure of Dispersion (Range, Median, Absolute deviation about median, Variance and Standard deviation), Measure of Distribution (Skewness and Kurtosis), Box and Whisker Plot (Box Plot and its parts, Using Box Plots to compare distribution).

6. Comparing Population: Test of Hypothesis (Concept of Hypothesis testing, Null Hypothesis and Alternative Hypothesis), Cross Tabulations (Contigency table and their use, Chi-Square test, Fisher's exact test),

7. One Sample t test (Concept, Assumptions, Hypothesis, Verification of assumptions, Performing the test and interpretation of results),.
8. Independent Samples t test (Concept, Type, Assumptions, Hypothesis, Verification of assumptions, Performing the test and interpretation of results), Paired Samples t test (Concept, Assumptions, Hypothesis, Verification of assumptions, Performing the test and interpretation of results).
9. One way ANOVA (Concept, Assumptions, Hypothesis, Verification of assumptions, Model fit, Hypothesis testing, Post hoc tests: Fisher's LSD, Tukey's HSD).
10. Perform Time series analysis on the given data set and identify the pattern in it for forecasting.

CD 163	Data Structures & Algorithms Lab	L	P	C
		0	3	1.5

Course Description and Objectives:

The course is designed to develop skills to design and analyze simple linear and nonlinear data structures. It strengthens the ability to the students to identify and apply the suitable data structure for the given real world problem. It enables them to gain knowledge in practical applications of data structures.

Course Outcomes:

At the end of this lab session, the student will
CO1. Be able to design and analyze the time and space efficiency of the data structure.CO2. Be capable to identity the appropriate data structure for given problem.
CO3. Have practical knowledge on the applications of data structures.
CO4. Have practical knowledge on handling data structures with files.

Laboratory

1. Towers of Hanoi using user defined stacks.
2. Reading, writing, and addition of polynomials.
3. Line editors with line count, word count showing on the screen.
4. Trees with all operations.
5. All graph algorithms.
6. Saving / retrieving non-linear data structure in/from a file

CD 164	Python for Data Science Lab	L	P	C
		0	2	1

Course Objectives:

The objectives of the course are:
1. To introduce the fundamentals of Python Programming language.
2. To make the students process files, mutable and immutable data.
3. To impart knowledge of Numpy and pandas libraries.

Course Outcomes:

After successful completion of the course, the students will be able to:
1. Illustrate the fundamentals of Python programming language.
2. Create user defined functions to solve problems
3. Write programs to manipulate the data structures lists, tuples, sets and dictionaries
4. Use numpy and pandas libraries for solving real-world problems.

List of Exercises / Activities:

[The laboratory should be preceded or followed by a tutorial to explain the approach or Algorithm to be implemented for the problem given.]

Lab1 Simple Programs to demonstrate Input - Output operations.
Lab2 Programs to demonstrate the behavior and use of various operators.
Lab3 Programs to emphasize the usage of Conditional Control Statements.
Lab4 Programs to emphasize the usage of Iterative control statements.
Lab5 Programs on the usage of Built-in functions.
Lab6 Programs to demonstrate the creation and usage of User Defined Functions.
Lab7 Programs to demonstrate Recursion.
Lab8 Programs on creation and importing of modules.
Lab9 Programs on Lists and its operations
Lab10 Programs on List Processing. (Sorting, Searching, Permutations...)
Lab11 Programs to demonstrate Numpy.
Lab12 Programs to demonstrate pandas.

Note: A minimum of 10(Ten) experiments have to be Performed and recorded by the Candidate to attain eligibility for Semester End Practical Examination.

CD MC02	Constitution of India	L	P	C
		2	0	0

Course Objective:

To provide basic information about Indian Constitution.

Course Outcomes:

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

1. Understand the significance of many provisions of the Constitution as well as to gain insight into their back ground. They will also understand number of fundamental rights subject to limitations in the light of leading cases.
2. Study guidelines for the State as well as for the Citizens to be followed by the State in the matter of administration as well as in making the laws. It also includes fundamental duties of the Indian Citizens in Part IV A (Article 51A).
3. Understand administration of a State, the doctrine of Separation of Powers.
4. Know how the State is administered at the State level and also the powers and functions of High Court.
5. Understand special provisions relating to Women empowerment and also children. For the stability and security of the Nation, Emergency Provision are Justified.
6. Understand election commission as an independent body with enormous powers and functions to be followed both at the Union and State level. Amendments are necessary, only major few amendments have been included.

Course Content:

UNIT – I 10 Periods

Preamble to the Constitution of India Domicile and Citizenship. Fundamental rights under Part III, Leading Cases. Relevance of Directive Principles of State Policy under Part-IV, IV-A Fundamental duties.

UNIT – II 10 Periods

Union Executive - President, Vice-President, Prime Minister, Union Legislature - Parliament and Union Judiciary - Supreme Court of India. State Executive - Governors, Chief Minister, State Legislature and High Court.

UNIT – III 10 Periods

Special Constitutional Provisions for Scheduled Casters and Tribes, Women and Children and Backward Classes, Emergency Provisions.

UNIT – IV 10 Periods

Electoral process, Centre State Relations (Amendment Procedure, 42nd, 44th, 74th, 76th, 86th and 91st Constitutional amendments).

Learning Resources:

Text Book:

1. Durga Das Basu, Introduction to the Constitution of India" (student edition) Prentice - Hall EEE,19th/20th Edition, 2001.

Reference Books:

1. M.V. Pylee, "An Introduction to Constitution of India", Vikas Publishing, 2002.

2. Brij Kishore Sharma, "Introduction to the Constitution of India", PHI, Learning Pvt.Ltd.,New Delhi,2011.