

People's Education Society's (Mumbai)

P. E. S. COLLEGE OF ENGINEERING

(An Autonomous Institute)

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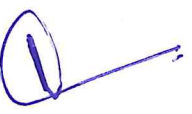
CURRICULUM FOR UNDERGRADUATE PROGRAMME

B. Tech Second Year

Department of Computer Science and Engineering (Data Science)

In line with National Education Policy 2020 Guidelines

[With Effect from the Academic Year 2026-2027]

			13/06/2026	1.00
Chairman Board of Studies	Dean Academics	Chairman Academic Council	Date of Release	Version

Vision Mission of Institute

Vision

To create sound technical manpower with global competitiveness, morality and social sense.

Mission

- To provide the state-of-art technical infrastructure and motivate students to realize their own potential.
- To provide an embellished academic and congenial environment to students for complete learning experience.
- To promote intellectual, moral and social democracy to ensure all round development of the students.

Vision Mission of Department

Vision

To be a leading force in the field of Computer Science and Engineering (Data Science), recognized for developing cutting-edge solutions that advance technology and create meaningful social impact.

Mission

M1: To produce competent computer science engineering students with strong foundations and advanced professional capabilities in data science through quality education and skill-oriented training.

M2: To nurture engineers with deep moral values, social responsibility, and professional ethics, enabling them to contribute responsibly to society and the nation.

M3: To provide modern technological infrastructure and a stimulating learning environment that fosters creativity, innovation, lifelong learning, and global competency.

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Grading and Evaluation Process

- i. Based on the Examinations and Evaluation, students will be awarded letter grades after combining the performance of all evaluations for the respective course. These letter grades will be derived from quantitative and qualitative Evaluation converted into 10-point scale called as grade point for credit courses. The performance with grade points and equivalent letter grades for Absolute grading for admitted batches will be as mentioned in the following table:

Percentage of Marks	Letter Grade	Grade Points
91-100	EX	10.0
86-90	AA	9.0
81-85	AB	8.5
76-80	BB	8.0
71-75	BC	7.5
66-70	CC	7.0
61-65	CD	6.5
56-60	DD	6.0
51-55	DE	5.5
40-50	EE	5.0
0-39	FF	00

- ii. **Class is awarded based on CGPA of all eighth semesters of B. Tech Program.** CGPA for pass is minimum 5.0

CGPA upto <5.50	Pass class
CGPA $\geq$ 5.50 & <6.00	Second Class
CGPA $\geq$ 6.00 & <7.5	First Class
CGPA >7.50	Distinction
[Percentage of Marks =CGPA*10.0]	

- iii. Apart from credit courses, Non credit courses will be awarded with letter grades based on quantitative and qualitative Evaluations as PP (Pass) and NP (Not Passed).


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Passing Criteria:

Students should score a minimum 20 out of 60 in the End Semester Examination.

Passing Percentage: 40 out of 100

*Minimum 50% of total credits should be there to promote the student in the next class or year with maximum three theory and / or two practical/viva/oral subjects remain backlog of a student.

*National / State level sports/ cultural events/ NSS/ NCC/ Yoga etc certificates shall be considered at department level by HOD or Subject teacher for attendance and internal assessment.

*If the student is passed in all subjects of First year then only that student can take admission in the Third year and if the student is passed in all subjects of Second year then only that student can take admission in the Fourth/Final year.

Gracing Rule:

Three marks grace to maximum three subjects(total 09 marks) for every year if the result of the student will change (e.g. fail to pass or pass class to second class or second class to first class or first class to distinction) .

If a student fails in more than three subjects, no grace will be given.

Calculation of SGPA and CGPA:

a. Semester Grade Point Average (SGPA):

The performance of a student in a semester is indicated by Semester Grade Point Average (SGPA) which is a weighted average of the grade points obtained in all the courses taken by the student in the semester and scaled to a maximum of 10. (SGPI is to be calculated up to two decimal places). A Semester Grade Point Average (SGPA) will be computed for each semester as follows:

$$SGPA = \frac{\left[\sum_{i=1}^{i=n} c_i g_i \right]}{\left[\sum_{i=1}^{i=n} c_i \right]}$$

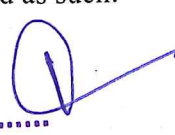
Where;

'n' is the number of subjects for the semester,

'c_i' is the number of credits allotted to a particular subject, and

'g_i' is the grade-points awarded to the student for the subject based on his performance as per the above table.

SGPA will be rounded off to the second place of decimal and recorded as such.

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b. Cumulative Grade Point Average (CGPA):

An up to date assessment of the overall performance of a student from the time he entered the Institute is obtained by calculating Cumulative Grade Point Average (CGPA) of a student. The CGPA is weighted average of the grade points obtained in all the courses registered by the student since s/he entered the Institute. CGPA is also calculated at the end of every semester (upto two decimal places). Starting from the first semester at the end of each semester (S), a Cumulative Grade Point Average (CGPA) will be computed as follows:

$$CGPA = \frac{\left[\sum_{i=1}^{i=m} c_i g_i \right]}{\left[\sum_{i=1}^{i=m} c_i \right]}$$

where,

'm' is the total number of subjects from the first semester onwards up to and including the semesters,

'c_i' is the number of credits allotted to a particular subject, and

'g_i' is the grade-points awarded to the student for the subject based on his/her performance as per the above table.

CGPA will be rounded off to the second place of decimal and recorded as such

It is to be noted that the CGPA is not the average of SGPA

CGPA to equivalent Percentage Conversion

CGPA shall be calculated with the following formula

$$\text{Percentage (\%)} = (\text{CGPA} \times 10.0)$$

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**Illustrative Semester wise Credit Distribution Structure for
Four Year UG Engineering Program - One Major, One Minor**

Sr. No.	Course Category	Semester	I	II	III	IV	V	VI	VII	VIII	Total Credits
1	BSC/ESC	Basic Science Course	7	7	--	--	--	--	--	--	14
2		Engineering Science Course	9	9	--	--	--	--	--	--	18
3	Program Courses	Programme Core Course (PCC)	--	--	11	9	12	10	4	6	52
4		Programme Elective Course (PEC)	--	--	--	--	4	8	2	6	20
5	Multidisciplinary Courses	Multidisciplinary Minor (MDM)	--	--	2	2	4	2	2	2	14
6		Open Elective (OE) Other than a particular program	--	--	4	2	2	--	--	--	8
7	Skill Courses	Vocational and Skill Enhancement Course (VSEC)	2	2	--	2	--	2	--	--	8
8	Humanities Social Science and Management (HSSM)	Ability Enhancement Course (AEC -01, AEC-02)	--	2	--	2	--	--	--	--	4
9		Entrepreneurship/ Economics/ Management Courses (E/Eco/M)	--	--	2	2	--	--	--	--	4
10		Indian Knowledge System (IKS)	2	--	--	--	--	--	--	--	2
11		Value Education Course (VEC)	--	--	1	3	--	--	--	--	4
12	Experiential Learning Courses	Research Methodology	--	--	--	--	--	--	--	4	4
13		Comm. Engg. Project (CEP)/Field Project (FP)	--	--	2	--	--	--	--	--	2
14		Project	--	--	--	--	--	--	--	4	4
15		Internship/ OJT	--	--	--	--	--	--	12	--	12
16	Liberal Learning Courses	Co-curricular Courses (CC)	2	2	--	--	--	--	--	--	4
		Total Credits	22	22	22	22	22	22	20	22	174


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Semester wise Credit Distribution

Sr. No	Semester	L	T	P	CA	MSE	ESE	TOTAL	Credit
1	Semester I	18	0	6	280	110	410	800	22
2	Semester II	19	0	4	270	100	430	800	22
3	Semester III	19	0	6	280	110	410	800	22
4	Semester IV	19	0	4	270	100	430	800	22
5	Semester V	18	0	8	260	110	430	800	22
6	Semester VI	17	0	10	260	110	430	800	22
7	Semester VII	--	--	--	360	60	380	800	20
8	Semester VIII	17	--	10	300	90	410	800	22
Total		127	0	48	2280	790	3330	6400	174

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B.Tech in Computer Science and Engineering (Data Science)
Course Curriculum Aligned with New Education Policy 2020
(Effective from Academic Year 2026 - 2027)

SEMESTER III

Sr. No.	Course Category	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credits
				L	T	P	CA	MSE	ESE	Total	
1	PCC	BTPESDS301T	Probability and Statistics	3	--	--	20	20	60	100	3
2	PCC	BTPESDS302T	Discrete Mathematics and Graph Theory	3	--	--	20	20	60	100	3
3	PCC	BTPESDS303T	Object Oriented Programming	3	--	--	20	20	60	100	3
4	PCC	BTPESDS301L	Object Oriented Programming Lab	--	--	2	30	--	20*	50	1
5	PCC	BTPESDS302L	Python for Data Science	--	--	2	60	--	40*	100	1
6	MDM	BTPESMXXXX	#Multidisciplinary Minor- I	2	--	--	10	10	30*	50	2
7	OE	BTPEOEXXXX	Open Elective - I	4		--	20	20	60	100	4
8	E/Eco./M	BTPESDS304T	Economics and Management	2	--	--	20	20	60	100	2
9	VEC	BTPESCOIT	Constitution of India	1	--	--	50	--	--	50	1
10	CEP/FP	BTPESDS303L	Community Engagement Project	--	--	2	30	--	20*	50	2
Total				19	0	6	280	110	410	800	22

***Practical/Oral evaluation at the end of the semester.**

#Refer to MDM Bucket list of respective Minor Program.

Open Elective I

- A. BTPESOE2T -Business Communication
- B. BTPESOE4T - Digital Marketing and Ecommerce
- C. BTPESOE12T - Development Engineering
- D. BTPESOE13T - Employability and Skills Development


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SEMESTER IV

Sr. No.	Course Category	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credits
				L	T	P	CA	MSE	ESE	Total	
1	PCC	BTPESDS401T	Engineering Mathematics - III	3	--	--	20	20	60	100	3
2	PCC	BTPESDS402T	Data Structures and Algorithms	3	--	--	20	20	60	100	3
3	PCC	BTPESDS403T	Digital Electronics and Computer Architecture	2	--	--	20	20	60	100	2
4	PCC	BTPESDS401L	Data Structures and Algorithms Lab	--	--	2	30	--	20*	50	1
5	MDM	BTPEMXXXX	#Multidisciplinary Minor - II	2	--	--	10	10	30	50	2
6	OE	BTPEOEXXX	Open Elective - II	2	--	--	10	10	30	50	2
7	VSEC	BTPESDS402L	Data Analytics Lab	--	--	2	60	--	40*	100	2
8	AEC	BTPEFL	Foreign Languages - A) Japanese, B) German, C) French, D) Spanish	2	--	--	50	--	50*	100	2
9	E/Eco./M	BTPESDS404T	Agile Project Management	2	--	--	30	--	20*	50	2
10	VEC	BTPEUHVT	Universal Human Values	3	--	--	20	20	60	100	3
Total				19	0	4	270	100	430	800	22

*Practical/Oral evaluation at the end of the semester.

#Refer to MDM Bucket list of respective Minor Program.

Open Elective II

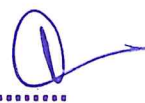
- A. BTPESOE1T - Business Intelligence
- B. BTPESOE3T Consumer Behavior
- C. BTPESOE14T - Educational Leadership

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**MDM Bucket list for Minor in B. Tech Computer Science and Engineering
(Data Science)**

A student wishing to pursue a Minor program in **B. Tech Computer Science and Engineering (Data Science)** needs to complete at least 14 credits from the list of courses.

Semester	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credits
			L	T	P	CA	MSE	ESE	Total	
III	BTPESMDS1T	Object Oriented Programming	2	--	--	10	10	30	50	2
IV	BTPESMDS2T	Data Structures and Algorithms	2	--	--	10	10	30	50	2
V	BTPESMDS3T	Fundamentals of Machine Learning	4	--	--	20	20	60	100	4
VI	BTPESMDS4T	Data Analytics	2	--	--	10	10	30	50	2
VII	BTPESMDS5T	Data Science for Engineers (NPTEL)	--	--	--	10	10	30	50	2
VIII	BTPESMDS6T	Big Data Analytics	2	--	--	10	10	30	50	2
Total			12	--	0	70	70	210	350	14


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Open Elective Bucket List

Sem	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credits
			L	T	P	CA	MSE	ESE	Total	
Open Elective - I										
III	BTPESOE2T	Business Communication	4	--	--	20	20	60	100	4
III	BTPESOE4T	Digital Marketing and Ecommerce	4	--	--	20	20	60	100	4
III	BTPESOE12T	Development Engineering	4	--	--	20	20	60	100	4
III	BTPESOE13T	Employability and Skills Development	4	--	--	20	20	60	100	4
Open Elective - II										
IV	BTPESOE1T	Business Intelligence	2	--	--	10	10	30	50	2
IV	BTPESOE3T	Consumer Behavior	2	--	--	10	10	30	50	2
IV	BTPESOE14T	Educational Leadership	2	--	--	10	10	30	50	2
Open Elective - III										
V	BTPESOE8T	Intellectual Property Rights	2	--	--	10	10	30	50	2
V	BTPESOE15T	Sustainable Happiness	2	--	--	10	10	30	50	2
V	BTPESOE26T	Emotional Intelligence	2	--	--	10	10	30	50	2
		Total	8	0	--	40	40	120	200	8


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SEMESTER - III**Probability and Statistics**

BTPESDS301T	Probability and Statistics	PCC	3L- 0T – 0P	3 Credits
Evaluation Scheme	CA-20 Marks MSE-20 Marks ESE-60 Marks			ESE Time Duration 3 Hrs

Course Objectives:	
1	To introduce the fundamental concepts of probability theory and random variables, enabling students to model uncertainty in engineering and real-world problems.
2	To develop understanding of theoretical probability distributions and their properties for analyzing and fitting data in practical scenarios..

Course Outcomes: At the end of this course, the students will be able:		Bloom's Taxonomy Level
CO 1	Apply classical, empirical, and axiomatic definitions of probability and use addition, multiplication, and Bayes theorems to solve probability problems.	K3
CO 2	Define random variables, construct probability distributions, and compute mathematical expectation and variance for discrete and continuous distributions.	K3
CO 3	Apply binomial, Poisson, and normal distributions, fit data to these distributions, and describe their properties and inter-relationships.	K4
CO 4	Measure the degree of association between variables using Karl Pearson's correlation coefficient and Spearman's rank correlation with probable errors.	K4
CO 5	Derive and apply lines of regression, interpret regression coefficients, and analyze the relationship between two variables using linear regression.	K4

Course Contents:
Unit 1 Probability Theory [9 Hours] Definition of probability: classical, empirical and axiomatic approach of probability, Addition theorem of probability, Multiplication theorem of probability, Bayes theorem of inverse probability, Properties of probabilities with proofs, Examples.


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Unit 2 Random Variable and Mathematical Expectation [9 Hours]

Random variables, Probability distributions, Probability mass function, Probability density function, Joint and marginal probability distributions, Properties of expectation and variance with proofs.

Unit 3 Theoretical Probability Distribution [9 hours]

Binomial distribution, Poisson distribution, Normal distribution, Fitting of binomial distributions, Properties of binomial, Poisson and normal distributions, Relation between binomial and normal distributions, Relation between Poisson and normal distributions, importance of Normal Distribution

Unit 4 Correlation [9 hours]

Introduction, Types of correlation, Correlation and causation, Methods of studying correlation, Karl Pearson correlation coefficient, Spearman's rank correlation, Coefficient, Properties of Karl Pearson correlation coefficient and Spearman's rank correlation coefficient, Probable errors.

Unit 5 Linear Regression [9 hours]

Introduction, Linear and non-linear regression, Lines of regression, Derivation of regression lines of y on x and x on y , Angle between the regression lines, Coefficients of regression, Theorems on regression coefficient, Properties of regression coefficient.

Text Books:

1	Fundamentals of Statistics by S. C. Gupta, Himalaya Publishing House, 7th Revised and Enlarged Edition, 2016.
2	Probability and Random Processes by G. V. Kumbhojkar, C. Jamnadas and Co., 14 th Edition, 2010.

Reference Books:

1	Advanced Engineering Mathematics by Erwin Kreyszig, 9th Edition, John Wiley & Sons, 2006.
2	Engineering Mathematics (for semester III) by Veerarajan T., Tata McGraw-Hill, New Delhi, 2010.
3	Probability, Queuing Theory and Reliability Engineering by G. Haribaskaran, Laxmi Publications, 2nd Edition, 2009.
4	Probability and Statistics by Murray Spiegel, John Schiller, R. ALU Srinivasan, Schaum's Outlines, 4th Edition, 2013.
5	Probability, Statistics with Reliability, Queuing and Computer Science Applications by Kishor S. Trivedi, Wiley India Pvt. Ltd, 2nd Edition, 2001.

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SEMESTER - III

Discrete Mathematics and Graph Theory

BTPESDS302T	Discrete Mathematics and Graph Theory	PCC	3L- 0T – 0P	3 Credits
Evaluation Scheme	CA-20 Marks MSE-20 Marks ESE-60 Marks			ESE Time Duration 3 Hrs

Course Objectives:	
1	Introduce the concepts of Mathematical Logic, Sets, Relations, and Functions, and apply Counting Techniques and Combinatorics to solve problems.
2	Understand and apply Generating Functions, Recurrence Relations, and Graph Theory to solve real-world problems.

Course Outcomes: At the end of this course, the students will be able:		Bloom's Taxonomy Level
CO 1	Apply mathematical logic to solve problems.	K3
CO 2	Apply the conceptual background needed and identify structures of algebraic nature	K3
CO 3	Apply basic counting techniques to solve combinatorial problems	K3
CO 4	Apply recurrence relations to formulate and solve real-world mathematical and computational problems.	K3
CO 5	Apply Graph Theory in solving computer science problems	K3

Course Contents:
Unit 1 : Fundamentals of Logic [9 hours] Introduction, Statements and Notation, Connectives, Well-formed formulas, Tautology, Duality law, Equivalence, Implication, Normal Forms, Functionally complete set of connectives, Inference Theory of Statement Calculus, Predicate Calculus, Inference theory of Predicate Calculus.
Unit 2 : Set theory [9 hours] Basic Concepts of Set Theory, Relations and Ordering, The Principle of Inclusion Exclusion, Pigeon hole principle and its application, Functions composition of functions, Inverse Functions, Recursive Functions, Lattices and its properties. Algebraic structures: Algebraic systems-Examples and General Properties, Semi groups and Monoids, groups, sub groups, homomorphism, Isomorphism

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Unit 3 : Elementary Combinatorics [9 hours] Basics of Counting, Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with Repetitions, Enumerating Permutations with Constrained Repetitions, Binomial Coefficients, The Binomial and Multinomial Theorems.
Unit 4 : Recurrence Relations [9 hours] Generating Functions of Sequences, Calculating Coefficients of Generating Functions, Recurrence relations, Solving Recurrence Relations by Substitution and Generating functions, The Method of Characteristic roots, Solutions of Inhomogeneous Recurrence Relations..
Unit 5 : Introduction to Graph Theory [9 hours] Definitions and Examples, Subgraphs-Spanning subgraph, Induced subgraph, Special subgraphs, Complements of a subgraph, and isomorphism, Vertex degree, Euler trails and Circuits, Shortest path. Graph of Trees: Definitions, Properties and Examples, Routed Trees- Binary tree, Balanced tree, Full binary Tree, Sorting-Merge sort, Weighted trees, Optimal tree and Prefix codes

Text Books:	
1	Kenneth H. Rosen, <i>Discrete Mathematics and Its Applications</i> , 9th Edition, McGraw-Hill Education, 2023.
2	Ralph P. Grimaldi, <i>Discrete and Combinatorial Mathematics: An Applied Introduction</i> , 5th Edition, Pearson Education, 2019
3	J.F. Tremblay and R. Manohar, <i>Discrete Mathematical Structures with Applications to Computer Science</i> , Tata McGraw Hill 35TH reprint 2008 ISBN 13:978-0-07-463113-3

Reference Books:	
1	C. L. Liu and D. P. Mohapatra, <i>Elements of Discrete Mathematics</i> , 4th Edition, McGraw-Hill Education, 2017.
2	Narsingh Deo, <i>Graph Theory with Applications to Engineering and Computer Science</i> , Prentice Hall India, 2016 (Reprint Edition)
3	Douglas B. West, <i>Introduction to Graph Theory</i> , 2nd Edition, Pearson Education, 2017 (Reprint).
4	Alan Tucker, <i>Applied Combinatorics</i> , 6th Edition, John Wiley & Sons, 2019. Useful for: Enumeration Techniques and Recurrence Relations .


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SEMESTER - III
Object Oriented Programming

BTPESDS303T	Object Oriented Programming	PCC	3L- OT – OP	3 Credits
Evaluation Scheme	CA-20 Marks MSE-20 Marks ESE-60 Marks			ESE Time Duration 3 Hrs

Course Objectives:	
1	To understand the fundamental concepts of Java programming including OOP principles, control statements, arrays, classes, inheritance, interfaces, packages, multithreading, and exception handling.
2	To develop problem-solving skills by designing and implementing Java programs using object-oriented programming concepts and advanced Java features.

Course Outcomes: At the end of this course, the students will be able:		Bloom's Taxonomy Level
CO1	Explain the fundamental concepts of Object-Oriented Programming, Java environment, data types, operators, and control structures.	K2
CO2	Develop Java programs using classes, objects, constructors, arrays, strings, vectors, and wrapper classes.	K3
CO3	Apply the concepts of inheritance, method overriding, abstract classes, and visibility controls in Java applications.	K4
CO4	Implement interfaces and packages to design modular, reusable, and organized Java programs.	K4
CO5	Analyze and develop multithreaded programs with proper synchronization and exception handling mechanisms for reliable Java applications.	K5

Course Contents:
Unit 1 Fundamentals of JAVA [9 hours] Basic Fundamental concepts of Object Oriented Programming, Java history , Java features, Java and Internet, Java support Systems, Java Environment , Java Program Structure, Java tokens, Java statements, Simple java program, Installing and configuring Java , Java Virtual Machine. Constants, Variables, Data Types, Type Casting, Operators and Expressions, Decision Making and Looping- if Statement, if...Else Statement, Nesting of if... Else Statement, The Else if Ladder, The Switch Statement, while statement, do Statement, for Statement, Jumps in Loops.


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Unit 2 Object and Classes [9 hours] Defining a Class, Fields and Methods Declaration, Creating Objects, Accessing Class Members, Constructors, Method Overloading, Static Members, Nesting of Methods, One-dimensional Arrays, Two-dimensional Arrays, Strings, Vectors, Wrapper Classes.
Unit 3 Inheritance [9 hours] Inheritance - Extending Class, Overriding Methods, Final Classes, Finalizer Methods, Abstract Methods and Classes, and Visibility Controls..
Unit 4 Interface and Packages [9 hours] Interfaces - Defining interfaces, Implementing interfaces, Accessing interface variables and methods, Extending interfaces. Packages - Java API Packages, Using System Packages, Creating accessing and using a package, importing packages, Adding a class to a Package, Hiding classes.
Unit 5 Multithreaded Programming and Exceptional Handling [9 hours] Multithreading - Creating Thread, Extending the Thread Class, Life Cycle of a Thread, Synchronization. Exceptional Handling - Types of Errors, Exceptions, Exceptional Handling Code, Multiple Catch Statement.

Text Books:	
1	E Balagurusamy, "Programming with JAVA", Tata McGraw Hill, 7th Edition.
2	Herbert Schildt, "Java: The complete reference", Tata McGraw Hill, 13th Edition.

Reference Books:	
1	Y. Daniel Liang (2010), "Introduction to Java programming", Pearson Education, India, 7th Edition.
2	T. Budd, "Understanding OOP with Java", Pearson Education, 2nd Updated Edition.
3	Bert Bates, Kathy Sierra, "Head First Java", O'Reilly Media, Inc
4	Deitel & Deitel, "Java: How to Program", PHI.


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SEMESTER - III
Object Oriented Programming Lab

BTPESDS301L	Object Oriented Programming Lab	PCC	OL- OT - 2P	1 Credit
Evaluation Scheme	CA-30 Marks	ESE-20 Marks		

Course Objectives:

1.	To introduce students to the basic programming concepts of Java including variables, data types, control structures, and arrays.
2.	To develop object-oriented programming skills using Java concepts such as classes, objects, constructors, inheritance, interfaces, packages, and exception handling.

Course Outcomes:

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

Bloom's Taxonomy Level

CO1	Develop Java programs using fundamental programming constructs such as variables, control statements, arrays, and classes.	K3
CO2	Apply object-oriented programming concepts including inheritance, interfaces, packages, multithreading, and exception handling to solve programming problems.	K4

Minimum- (8-10) experiments are to be performed based on contents from syllabus

Sample List of Experiments:

1.	Write a Java program to demonstrate the use of variables, data types, operators, input/output statements, and type casting.
2.	Write a Java program to demonstrate decision-making and looping constructs such as if, if-else, nested if, else-if ladder, switch case, for loop, while loop, and do-while loop.
3.	Write a Java program to demonstrate the concept of classes, objects, data members, and member functions.
4.	Write a Java program to demonstrate the use of constructors and method overloading.
5.	Write a Java program to demonstrate the implementation and manipulation of one-dimensional and two-dimensional arrays.
6.	Write a Java program to demonstrate inheritance and method overriding.
7.	Write a Java program to demonstrate the implementation of interfaces and multiple inheritance using interfaces.
8.	Write a Java program to demonstrate the creation and use of packages in Java


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9.	Write a Java program to demonstrate exception handling using try, catch, finally, throw, and multiple catch blocks..
10.	Develop a mini application/project integrating the concepts covered in all the above experiments to demonstrate object-oriented programming principles and Java application development.

Text Books:

1	E Balagurusamy, "Programming with JAVA", Tata McGraw Hill, 7th Edition.
2	Herbert Schildt, "Java: The complete reference", Tata McGraw Hill, 13th Edition

Reference Books:

1	Complete reference Java by Herbert Schildt(5th edition)
2	Java 2 programming black books, Steven Horlznern


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SEMESTER - III
Python for Data Science

BTPESDS302L	Python for Data Science	PCC	OL- OT - 2P	Credit-1
Evaluation Scheme	CA-60 Marks	ESE-40 Marks		

Course Objectives:	
1	To understand and apply Python libraries such as NumPy and Pandas for numerical computing, data manipulation, data preprocessing, and handling structured datasets.
2	To develop analytical and visualization skills using Python tools for data analysis, statistical operations, time-series analysis, and exploratory data analysis on real-world datasets.

Course Outcomes: At the end of this course, the students will be able:		Bloom's Taxonomy Level
CO1	Develop Python-based data analysis applications using NumPy, Pandas, and Matplotlib for data manipulation, preprocessing, visualization, statistical analysis, and time-series operations.	K4

Minimum- (8-10) experiments are to be performed based on contents from syllabus

Sample List of Experiments:	
1.	Write a Python program using NumPy to create and perform indexing and slicing operations A) One-dimensional arrays B) Two-dimensional arrays C) Multi-dimensional arrays
2.	Write a Python program using NumPy to demonstrate following operations: A) Array reshaping B) Flattening C) Transpose of matrices
3.	Write a Python program to perform matrix operations using NumPy: A) Matrix addition B) Matrix multiplication C) Determinant D) Inverse of matrix
4.	Write a Python program to create a Pandas Series and perform basic operations on: A) List B) Dictionary C) NumPy array
5.	Write a Python program to create a DataFrame and perform: A) Row selection B) Column selection C) Filtering D) Sorting


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6.	Write a Python program to perform Data importing and Data exporting using CSV and Excel files with Pandas.
7.	Write a Python program for data cleaning and preprocessing techniques: A) Removing duplicate values B) Data type conversion C) String processing D) Data formatting
8.	Write a Python program to remove rows and columns containing missing values.
9.	Write a Python program using Pandas to perform data merging, joining, and concatenation operations on multiple DataFrames and display the combined results.
10.	Write a Python program using Pandas to perform data grouping and aggregation operations on a dataset and create pivot tables for summarized data analysis.
11.	Write a Python program for Exploratory Data Analysis (EDA) using Pandas and Matplotlib to perform: A) Summary statistical analysis of the dataset B) Correlation analysis between attributes C) Data visualization using charts and graphs such as bar charts, histograms, line graphs, and scatter plots.
12.	Write a Python program to sort and rank data based on multiple columns.
13.	Write a Python program to create two DataFrames and perform different types of merging operations using Pandas, including: A) Inner Join B) Outer Join C) Left Join D) Right Join.
14.	Write a Python program to demonstrate time-series data analysis using Pandas by performing: A) Date indexing B) Resampling of time-series data C) Calculation of rolling averages.
15.	Write a Python program to analyze a real-world dataset and perform the following operations: A) Generate summary statistics B) Create and analyze a correlation matrix C) Prepare visual reports using charts and graphs with Matplotlib and Pandas.

Text Books:

1.	Al Sweigart, "Automate the Boring Stuff with Python", 1 st Edition, No Starch Press, 2015.
2.	Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, Green Tea Press, 2015.

Resources:

1.	https://www.learnbyexample.org/python/
2.	https://www.learnpython.org/
3.	https://pythontutor.com/visualize.html#mode=edit

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SEMESTER - III
Economics and Management

BTPESDS304T	Economics and Management	Entrepreneurship/ Economics/ Management Courses	2L- 0T – 0P	2 Credits
Evaluation Scheme	CA-20 Marks MSE-20 Marks ESE-60 Marks			ESE Time Duration 3 Hrs

Course Objectives:	
1.	To impart knowledge, with respect to concepts, principles and practical applications of economics which govern the functioning of a firm/organization.
2.	To help the students to understand the fundamental concepts and principles of management; the basic roles, skills, functions of management and basic knowledge of various functional areas.

Course Outcomes: At the end of this course, the students will be able:		Bloom's Taxonomy Level
CO1	Demonstrate an awareness with respect to concepts, principles and practical applications of economics that governs the functioning of an organization and to evaluate how changes in price of the product affect its demand and supply.	K3
CO2	Relate production function and cost function	K3
CO3	Understand the banking system, monetary policy and fiscal policy and the role they play in the development of the economy.	K2
CO4	Describe the basic principles of management, managerial roles, skills and functions of management.	K2
CO5	Develop an understanding in functional management areas like finance, marketing, human resource and production management.	K3


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Course Contents:	
Unit 1 Introduction to Economics [4 hours]	Definitions, Nature, Scope, Difference between Microeconomics & Macroeconomics Theory of Demand & Supply; meaning, determinants, law of demand, law of supply, equilibrium between demand & supply Elasticity: elasticity of demand, price elasticity, income elasticity, cross elasticity
Unit 2 Production Theory, Costs and Revenue:[5 hours]	Theory of production; production function, meaning, factors of production (meaning & characteristics of Land, Labour, capital & entrepreneur), Law of variable proportions & law of returns to scale Meaning of costs, types of costs and Revenue.
Unit 3 Money and Banking:[7 hours]	Money - Meaning, functions and types.Monetary policy - Meaning, objectives and tools. Fiscal policy - Meaning, objectives and tools. Banking - Meaning, types and functions.Central Bank- RBI and its functions
Unit 4 Introduction to Management : [7 hours]	Meaning and definitions of management, nature, scope, Management & administration, skill and roles of managers. Management Principles - Scientific principles, Administrative principles Function of Management - Planning, Organizing, Staffing, Directing and Controlling - Meaning, nature and importance.Types of Management:Marketing, Finance ,Human Resource,Production,etc
Unit 5 Introduction to Marketing ,Finance,Production and Human Resource Management:[7 hours]	Introduction to Marketing management – Meaning, Marketing concepts, Marketing Mix and Market segmentation . Introduction to Production Management - Meaning, objectives, functions, types of plant layout & factors affecting it Introduction to Finance Management - Meaning, sources and functions. Introduction to Human Resource Management - Meaning, objectives of manpower planning, sources of recruitment and selection process.

Text Books:	
1	Principles of Economics — 10th Edition, 2024, Cengage Learning.
2	Managerial Economics — 9th Edition, 2023, Vikas Publishing House
3	Indian Economy — 17th Edition, 2025, McGraw Hill Education.
4	Marketing Management — 16th Edition, 2022, Pearson Education.
5	Principles and Practice of Management — 9th Edition, 2022, Sultan Chand & Sons.
6	Human Resource Management — 17th Edition, 2024, Pearson Education.


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Reference Books :	
1	Economics — 20th Edition, 2024, McGraw Hill Education.
2	Principles of Marketing — 19th Edition, 2024, Pearson Education.
3	Essentials of Management — 11th Edition, 2023, McGraw Hill Education.
4	Management — 16th Edition, 2022, Pearson Education.
5	Human Resource Management — 18th Edition, 2023, Sultan Chand & Sons
6	Fundamentals of Financial Management — 16th Edition, 2022, Cengage Learning.


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SEMESTER - III
Constitution of India

BTPESDS304T	Constitution of India	VEC	2L- 0T – 0P	1 Credit
Evaluation Scheme	CA - 50 Marks			

Course Objectives:

1.	To familiarize the students with the legacy of India's constitutional development and assist them in comprehending the country's most varied legal text and its underlying philosophy.
2.	To educate students about the Indian Parliamentary System's theoretical and practical features.

Course Outcomes:

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

		Bloom's Taxonomy Level
CO1	Establish and explore the fundamental aspects and procedures of the Indian constitution.	K2
CO2	Compare and relate the operation of India's parliamentary system at the national and state levels.	K2
CO3	Learn about and implement the various laws and rules pertaining to engineering procedures relevant with IPR.	K2

Course Contents:

Unit 1: Introduction and Basic Information about Indian Constitution. [6 hours]
Constitution law and constitutionalism, Historical Background of the Constituent Assembly, Government of India Act-1935 and Indian Independence Act-1947, Enforcement of the Constitution, Indian Constitution and its Salient Features, The Preamble of the Constitution, Fundamental Rights, Fundamental Duties, Directive Principles of State Policy, Parliamentary System, Federal System, Centre-State Relations, Amendment of the Constitutional Powers and Procedure, The historical perspectives of the constitutional amendments in India, Emergency Provisions: National Emergency, President Rule, Financial Emergency, and Local Self Government


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Unit 2: Union Executive and State Executive: .**[9 hours]**

Powers of Indian Parliament, Functions of Rajya Sabha, Functions of Lok Sabha, Powers and Functions of the President, Comparison of powers of Indian President with the United States, Powers and Functions of the Prime Minister, Judiciary – The Independence of the Supreme Court, Appointment of Judges, Judicial Review, Public Interest Litigation, Judicial Activism, LokPal, LokAyukta, The Lokpal and Lokayuktas Act 2013, State Executives – Powers and Functions of the Governor, Powers and Functions of the Chief Minister, Functions of State Cabinet, Functions of State Legislature, Functions of High Court and Subordinate Courts, Intellectual Property Laws- Introduction, Legal Aspects of Patents, Filing of Patent Applications, Rights from Patents, Infringement of Patents, Copyright and its Ownership, Infringement of Copyright, Civil Remedies for Infringement, Regulation to Information- Introduction, Right to Information Act, 2005, Information Technology Act, 2000, Electronic Governance, Secure Electronic Records and Digital Signatures, Digital Signature Certificates, Cyber Regulations Appellate Tribunal, Offences, Limitations of the Information Technology Act

Text Books:

1	Brij Kishore Sharma: Introduction to the Indian Constitution, PHI, New Delhi, latest edition
2	Subhash C. Kashyap: Our Constitution: An Introduction to India's Constitution and Constitutional Law, NBT, 2018.
3	P M Bakshi: The Constitution of India, Latest Edition, Universal Law Publishing.
4	V. K. Ahuja: Law Relating to Intellectual Property Rights (2007)
5	P.Narayan: Intellectual Property Law, Eastern Law House, New Delhi

Reference Books:

1	Granville Austin: The Indian Constitution: Corner stone of a Nation. 1966, Oxford Clarendon Press.
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SEMESTER - III
Community Engagement Project

BTPESDS303L	Community Engagement Project	CEP/FP	OL-OT-2P	2 Credits
Evaluation Scheme	CA-30 Marks ESE-20 Marks			ESE Time Duration 3 Hrs

Course Objectives:	
1.	To develop social responsibility and communication skills among students.
2.	To apply Computer Science and Data Science knowledge for solving real-world community problems.

Course Outcomes: At the end of this course, the students will be able:		Bloom's Taxonomy Level
CO1	Identify community problems and collect relevant information using surveys, questionnaires, and observation methods.	K4
CO2	To help the students transform their mindset and cultivate societal awareness, sensitivity, accountability, and responsibility by preparing informative materials.	K3
CO3	Prepare and present a Community Exit Report with proper documentation, observations and outcomes of the activities conducted.	K6

Course Contents:
UNIT 1: Preliminary Survey [10 hours] - Visit a selected community or organization or different habitations or rural/urban areas. - Interact with people and observe real-life problems and needs in any area (social, digital, environmental, educational, health etc.) - Collect basic information in a structured way using tools such as Google Forms, questionnaires, surveys form, or interview forms for problem identification and data collection. - Identify key problems based on observations. - OR Coordinate with Government agencies, municipal authorities, village offices, NGOs, or other organizations if required for conducting surveys and collecting information Based on topic.


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Unit 2: Community Interaction & Awareness Support [10 hours]

- Identify community needs and interact with people to understand awareness levels about the selected topic.
- Prepare awareness materials such as posters, presentations, pamphlets, videos, surveys, or social media content in simple language.
- Conduct and coordinate awareness activities on topics such as cyber security, digital literacy, health, or environmental protection or any other topic with support from faculty members or local authorities.
- Coordinate with local authorities, NGOs, or community leaders whenever support or permission is required.

Unit 3: Community Exit Report [10 hours]

- Record all activities, observations, and community interactions conducted during the awareness campaign.
- Organize survey responses, feedback, photographs, and collected information in a proper format.
- Prepare a simple Community Exit Report including objectives, activities conducted, outcomes, and community response.
- Present the report and findings to the faculty mentor using presentations, charts, or summary documents

Guidelines for Community Engagement Project

- Students may work in groups of 4 or 6 members for conducting community engagement activities.
- The assigned area, habitation, village, or municipal ward should preferably be near the students place of stay for easy commuting.
- Students should maintain proper documentation including surveys, photographs, observations, attendance, and activity reports.
- Google Forms, questionnaires, surveys, or interview forms may be used for collecting community information and feedback.
- Coordination with Government offices, municipal authorities, NGOs, or local organizations may be done if required.
- The final report and documentation must be countersigned by the concerned Mentor and HoD before submission.
- Throughout the Community Engagement Project, a daily activity-book needs to be maintained by the students' group, which shall be countersigned by the governmental agency representative, NGO in charge, or the concerned authority and the teacher-mentor, who is required to periodically visit the students and guide them.

Continues Assessment:

The Continuous Assessment for this head will consist of a report written in a technical reporting format, and the execution of the project will be assessed by the concerned department of the institution

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SEMESTER IV
Engineering Mathematics - III

BTPESDS401T	Engineering Mathematics - III	PCC	3L- 0T – 0P	3 Credits
Evaluation Scheme	CA-20 Marks MSE-20 Marks ESE-60 Marks			ESE Time Duration 3 Hrs

Course Objectives:	
1	To equip students with the knowledge of integral transforms (Laplace and Fourier) and develop their ability to apply these transforms as tools for solving differential equations and evaluating complex integrals arising in engineering problems.
2	To introduce students to partial differential equations, their formation, and solution techniques, enabling them to model and analyze physical phenomena such as heat conduction and wave propagation in one dimension.

Course Outcomes: At the end of this course, the students will be able:		Bloom's Taxonomy Level
CO 1	Apply Laplace transforms and their properties to evaluate integrals and solve problems involving special functions.	K3
CO 2	Find inverse Laplace transforms using partial fractions and convolution theorem to solve linear differential equations.	K3
CO 3	Compute Fourier transforms and apply their properties including Parseval's identity to engineering problems..	K3
CO 4	Form and solve partial differential equations and apply separation of variables to heat and wave equations.	K4
CO 5	Analyze free, forced, and damped oscillations in mechanical and electrical systems using higher-order differential equations.	K4

Course Contents:
Unit 1 Laplace Transform [9 Hours] Definition – conditions for existence ; Transforms of elementary functions ; Properties of Laplace transforms -Linearity property, first shifting property, second shifting property, transforms of functions multiplied by t^n , scale change property, transforms of functions divided by t , transforms of integral of functions, transforms of derivatives ;Evaluation of integrals by using Laplace transform ; Transforms of some special functions- periodic function, Heaviside-unit step function, Dirac delta function.


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Unit 2 Inverse Laplace Transform [9 hours]

Introductory remarks ; Inverse transforms of some elementary functions ; theorems of finding inverse transforms ; Partial fraction method and Convolution Theorem for finding inverse Laplace transforms ; Applications to find the solutions of linear differential equations and simultaneous linear differential equations with constant coefficients.

Unit 3 Fourier Transform [9 hours]

Definitions – integral transforms ; Fourier integral theorem (without proof) ; Fourier sine and cosine integrals ; Complex form of Fourier integrals ; Fourier sine and cosine transforms ; Properties of Fourier transforms ; Parseval's identity for Fourier Transforms.

Unit 4 Partial Differential Equations and Their Applications [9 hours]

Formation of Partial differential equations by eliminating arbitrary constants and functions; Equations solvable by direct integration; Linear equations of first order (Lagrange's linear equations); Method of separation of variables applications to find solutions of one dimensional heat flow equation () and one dimensional wave equation ().

Unit 5 Applications of Linear Differential Equations (Higher order) [9 hours]

To Electrical circuits & to mechanical system (Analogous study of two systems) Free oscillations / vibrations, Forced oscillations / vibrations, Damped Free oscillations / vibrations, Damped Forced oscillations / vibrations, Applications of civil engineering.

Text Books:

1	Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers, New Delhi.
2	Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons, New York..
3	A Text Book of Applied Mathematics (Volume-I & II) by P. N. Wartikar and J. N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.
4	Higher Engineering Mathematics by H. K. Das and Er. Rajnish Verma, S. Chand & CO. Pvt. Ltd., New Delhi.

Reference Books:

1	Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publications, New Delhi.
2	A Text Book of Engineering Mathematics by Peter O' Neil, Thomson Asia Pte Ltd., Singapore.
3	Advanced Engineering Mathematics by C. R. Wylie & L. C. Barrett, Tata McGraw-Hill Publishing Company Ltd., New Delhi.
4	Integral Transforms and Their Engineering Applications by Dr. B. B. Singh, Synergy. Knowledge ware, Mumbai.
5	A text Book of Engineering Mathematics by N. P. Bali, Dr. Manish Goyal, 8 th edition, Laxmi Publications.
6	Integral Transforms by I. N. Sneddon, Tata McGraw-Hill, New York.

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SEMESTER - IV
Data Structures and Algorithms

BTPESDS402T	Data Structures and Algorithms	PCC	3L- 0T – 0P	3 Credits
Evaluation Scheme	CA-20 Marks MSE-20 Marks ESE-60 Marks			ESE Time Duration 3 Hrs

Course Objectives:	
1.	To introduce students to fundamental and advanced data structures along with algorithm analysis techniques for efficient problem solving..
2.	To develop understanding of algorithm design paradigms such as recursion, greedy methods, graph algorithms, and dynamic programming.
3	To enhance analytical and programming skills for designing optimized computational solutions using suitable data structures and algorithms.

Course Outcomes: At the end of this course, the students will be able:		Bloom's Taxonomy Level
CO1	Apply time and space complexity concepts along with searching and sorting techniques using appropriate data structures.	K3
CO2	Apply linear data structures such as arrays, linked lists, stacks, and queues along with recursive and backtracking techniques.	K3
CO3	Apply non-linear data structures including trees, heaps, and hashing for efficient data storage and retrieval.	K3
CO4	Apply graph traversal, shortest path, minimum spanning tree, and greedy algorithms for solving graph-based and optimization problems.	K3
CO5	Apply dynamic programming, string algorithms, and bit manipulation techniques for computational problem solving.	K3

Course Contents:
UNIT 1: Introduction, Complexity Analysis, Arrays & Sorting (9 Hours) Introduction to Data Structures and Algorithms : Types of Data Structures, Abstract Data Types (ADT), Complexity Analysis : Time Complexity, Space Complexity, Best, Average, Worst Case, Big O, Omega, Theta notation Arrays : 1D and 2D Arrays, Traversal, Insertion, Deletion, Linear Search, Binary Search, Prefix Sum, Sliding Window, Two Pointer Technique Sorting Algorithms : Bubble Sort, Selection Sort, Insertion Sort, Merge Sort, Quick Sort, Counting Sort


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UNIT 2: Linked List, Stack, Queue & Recursion (9 Hours)

Linked List: Singly Linked List, Doubly Linked List, Circular Linked List, Insertion and Deletion, Reversal of Linked List

Stack : Stack Operations, Stack using Array and Linked List, Applications of Stack, Balanced Parentheses, Infix, Prefix, Postfix

Queue : Linear Queue, Circular Queue, Double Ended Queue, Priority Queue

Recursion and Backtracking : Recursive Functions, Tail Recursion, Subsets and Permutations, Introduction to Backtracking

UNIT 3: Trees, Heap & Hashing (9 Hours)

Trees : Tree Terminology, Binary Tree, Binary Search Tree, Tree Traversals,

Heap : Min Heap, Max Heap, Heap Operations, Heap Sort, Priority Queue

Hashing : Hash Functions, Collision Handling, Chaining, HashMap and HashSet

UNIT 4: Graph Algorithms & Greedy Techniques (9 Hours)

Graph Fundamentals: Graph Representation, Directed and Undirected Graphs, Weighted Graphs

Graph Traversal : Breadth First Search (BFS), Depth First Search (DFS), Shortest Path Algorithms, Dijkstra's Algorithm, Bellman-Ford Algorithm

Minimum Spanning Tree : Prim's Algorithm, Kruskal's Algorithm, Disjoint Set Union (DSU),

Greedy Algorithms : Activity Selection, Fractional Knapsack, Huffman Coding

UNIT 5: Dynamic Programming, Strings (9 Hours)

Dynamic Programming : Memorization, Tabulation, State Transition, Optimization Techniques

Classical DP Problems : Fibonacci, 0/1 Knapsack, Longest Common Subsequence, Coin Change, Longest Increasing Subsequence

String Algorithms : KMP Algorithm, Rabin-Karp Algorithm, Palindrome Problems

Bit Manipulation : XOR Operations, Bit Masking, Set Bits Counting

Text Books:

- | | |
|----|---|
| 1. | Data Structures and Algorithms Made Easy - Narasimha Karumanchi, 5th Edition, CareerMonk Publications, 2020. |
| 2. | Introduction to Algorithms -Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, 4th Edition, MIT Press, 2022. |
| 3 | Algorithms - Robert Sedgewick and Kevin Wayne, 4th Edition, Addison-Wesley Professional, 2011. |

Reference Books:

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|----|---|
| 1. | Fundamentals of Data Structures in C - Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, 2nd Edition, 2008 |
| 2. | Data Structures Using C and C++ - Yedidyah Langsam, Moshe J. Augenstein, Aaron M. Tenenbaum, 2nd Edition, Pearson Education, 2018 |
| 3. | Data Structures and Algorithms in Python - Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, 2nd Edition, 2024 |
| 4. | Algorithm Design - Jon Kleinberg and Éva Tardos, 1st Edition, 2006 |
| 5 | The Algorithm Design Manual - Steven S. Skiena , 3rd Edition, 2020 |



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SEMESTER - IV
Digital Electronics and Computer Architecture

BTPESDS403T	Digital Electronics and Computer Architecture	PCC	2L- 0T – 0P	2 Credits
Evaluation Scheme	CA-20 Marks MSE-20 Marks ESE-60 Marks			ESE Time Duration 3 Hrs

Course Objectives:	
1	Understand digital logic, number systems, and basic computer components.
2.	Apply logic simplification and analyze instruction sets, addressing modes, and architectures (RISC vs CISC).

Course Outcomes: At the end of this course, the students will be able:		Bloom's Taxonomy Level
CO1	Understand number systems, binary arithmetic, digital codes, and logic gate operations used in digital electronics.	K2
CO2	Apply and Design Boolean algebra laws and Karnaugh map techniques to simplify Boolean expressions and design combinational logic circuits	K3
CO3	Analyze and Develop the working of different flip-flops and sequential circuits including registers, shift registers, ripple counters, modulus counters, and synchronous counters	K3
CO4	Understand CPU structure, functions, and system interconnections.	K2
CO5	Analyze instruction execution, machine state, and compare RISC and CISC architectures.	K3

Course Contents:
Unit 1 Number Systems [8hours]: Introduction to Number Systems-Decimal, Binary, Octal, Hexadecimal, Conversion of number system, 1's complement and 2's complement. Binary Arithmetic: Binary addition, Binary subtraction, Subtraction using 1's complement and 2's complement. Codes: BCD, Gray and Excess-3 codes- code conversions. Logic Gates: Logical Operators, Logic Gates-Basic Gates, Universal Gates, realization of other gates using universal gates. Unit 2 Methods for Simplifying Boolean Functions and Combinational Logic Design [8hours] Boolean algebra: laws, theorems, and simplification, Boolean functions- canonical and standard forms. Karnaugh Map (K-map): Combinational Logic Circuits: Sum-of-Products Method, Truth Table to Karnaugh Map, Pairs Quads, and Octets, Karnaugh Simplifications, Don't care Conditions, Product-of-sums Method, Product-of-sums simplifications, (Up to 4 Variable) Binary adders: half adder, full adder, Binary subtractor: half subtractor, full subtractor, Design of Multiplexers, Demultiplexers, encoders, decoders.


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Unit 3 Flip-flops [8hours] :

SR, JK, D, T types of flip flop, Truth tables. Conversion from one type to another type of Flip Flop. Application of Flip flops: Registers, Shift registers, Asynchronous / Ripple Counter, Modulus Counter, Synchronous Counters

Unit4 Introduction to Computer Architecture [3hours]:

Introduction: Concept of computer organization and architecture, Fundamental unit, Computer functional interconnection, Instruction Sets: Characteristics, Types of operands, Types of operations, Assembly language, Addressing modes, Instruction format, Types of instruction, Instruction execution.

Unit 5 Memory Organization And Control Unit: [3hours]

Memory Organization: Internal Memory: Semiconductor main memory, Error correction, Advanced DRAM Organization, Virtual memory systems and cache memory systems, Magnetic tape, Control Unit: Control unit operation: Micro-operations, Control of the processor, Hardwired implementation, Micro-programmed Control Unit.

Text Books:

1	Computer Organization and Architecture: Designing for Performance, William Stallings, Pearson Publication, 11th Edition, 2018.
2	Modern Digital Electronics, R. P. Jain, McGraw-Hill Education, 5th Edition, 2021.

Reference Books:

1	Computer Architecture and Organization, John P. Hayes, McGraw-Hill Publication, 3rd Edition, 2012.
2	Computer Organization, S. G. Zaky, McGraw-Hill Publication, 5th Edition, 2011.
3	Fundamentals of Digital Circuits, Anand Kumar, Prentice Hall of India, 3rd Edition, 2014.
4	Digital Logic and Computer Design, M. Morris Mano, Prentice Hall of India, 4th Edition, 2013.

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SEMESTER - IV
Data Structures and Algorithms Lab

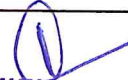
BTPESDS401L	Data Structures and Algorithms Lab	PCC	0L- 0T - 2P	1 Credit
Evaluation Scheme	CA-30 Marks	ESE-20 Marks		

Course Objectives:	
1.	To understand fundamental concepts of data structures, algorithms, complexity analysis, searching, sorting, recursion, and problem-solving techniques.
2.	To develop programming skills for implementing linear and non-linear data structures such as linked lists, stacks, queues, trees, heaps, graphs, and hashing techniques.
3.	To apply algorithmic paradigms including divide and conquer, greedy method, backtracking, and dynamic programming for solving computational problems efficiently.

Course Outcomes: At the end of this course, the students will be able:		Bloom's Taxonomy Level
CO1	Implement and analyze searching, sorting, linear and non-linear data structures, graph algorithms, recursion, hashing, and dynamic programming techniques to solve computational problems efficiently.	K3

Minimum- (8-10) experiments are to be performed based on contents from syllabus

Sample List of Experiments:	
1.	Implementation and analysis of Linear Search and Binary Search.
2.	Implementation of sorting algorithms: • Bubble Sort • Selection Sort • Insertion Sort
3.	Implementation of Divide and Conquer sorting algorithms: • Merge Sort • Quick Sort
4.	Programs based on Sliding Window and Prefix Sum techniques.
5.	Implementation of Singly Linked List operations.
6.	Implementation of Doubly Linked List and Circular Linked List operations.
7.	Stack implementation using Array and Linked List.
8.	Applications of Stack: • Balanced Parentheses • Infix to Postfix Conversion
9.	Queue and Circular Queue implementation.


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10	Recursive and Backtracking programs: • Fibonacci • Tower of Hanoi • Subset Generation
11	Binary Tree creation and tree traversal techniques.
12	Binary Search Tree operations and Heap implementation.
13	Hashing applications using HashMap and HashSet.
14	Graph representation and traversal using BFS and DFS.
15	Dynamic Programming problems: • 0/1 Knapsack • Longest Common Subsequence • Coin Change Problem

Text Books:	
1.	Data Structures and Algorithms Made Easy - Narasimha Karumanchi, 5th Edition, 2020
2.	Data Structures Using C and C++ - Yedidyah Langsam, Moshe J. Augenstein, Aaron M. Tenenbaum, 2nd Edition, Pearson Education, 2018
3	Data Structures and Algorithms Using Java - Yedidyah Langsam, Moshe J. Augenstein, Aaron M. Tenenbaum , 2nd Edition, Pearson Education, 2018
4	Data Structures and Algorithms in Python - Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, 2nd Edition, 2024

Reference Books:	
1.	Fundamentals of Data Structures in C - Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, 2nd Edition, 2008
2.	Algorithm Design - Jon Kleinberg and Éva Tardos, 1st Edition, 2006
3	The Algorithm Design Manual- Steven S. Skiena, 3rd Edition, 2020
4	Java Foundations: Introduction to Program Design and Data Structures - John Lewis, Peter DePasquale, Joseph Chase, 5th Edition, 2020
5	Problem Solving with Algorithms and Data Structures Using Python - Bradley N. Miller and David L. Ranum, Revised Edition, 2019


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SEMESTER - IV
Data Analytics Lab

BTPESDS402L	Data Analytics Lab	VSEC	OL- OT – 2P	2 Credits
Evaluation Scheme	CA-60 Marks	ESE-40 Marks		

Course Objectives:

1.	To understand basic concepts of data and data visualization techniques.
2.	To develop skills for creating simple visualizations using Excel, Tableau and Power BI

Course Outcomes:

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

Bloom's Taxonomy Level

CO1	Implement basic concepts of data visualization and different tools like Excel, Tableau, and Power BI.	K3
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Sample List of Experiments:

1.	Study of Various Data visualization Tools
2.	To Create different charts in Excel
3.	To design an interactive dashboard using charts, slicers, and pivot tables in MS Excel.
4.	To study and demonstrate Introduction to Tableau and Installation
5.	To study the features of Tableau and perform Tableau installation and setup.
6.	To study the Data Visualizations in Tableau
7.	To study and demonstrate introduction to Power BI and Installation
8.	To connect Power BI with datasets and perform data transformation
9.	To study basic charts in Power BI
10.	To design an interactive dashboard using multiple visualizations and filters in Power BI.


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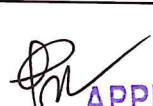

SEMESTER - IV
Foreign Languages- A) Japanese,
FOREIGN LANGUAGE COURSE – LEVEL I

BTPESFLA	JAPANESE	AEC	2L- OT – OP	2 Credits
Evaluation Scheme	CA-50 Marks ESE-50 Marks			ESE (Practical/Oral evaluation at the end of the semester)

Course Objectives:	
1.	Develop basic communication skills in an international language
2.	Enhance employability and global industry readiness.
3.	Build confidence in multicultural communication.
4.	Prepare students for higher studies, internships, and placements abroad.
5.	Develop understanding of international workplace culture and etiquette.

Course Outcomes: At the end of this course, the students will be able:		Bloom's Taxonomy Level
CO1	Understand and use basic greetings and expressions.	K2
CO2	Communicate simple personal and professional information.	K2
CO3	Read and write basic words and short conversations.	K3
CO4	Develop listening and pronunciation skills.	K3
CO5	Understand basic cultural etiquette and workplace communication.	K2

Course Contents:
Unit I: Introduction to Japanese Language [6 hours] - Hiragana and Katakana basics - Greetings and introductions - Numbers and time - Classroom expressions - Pronunciation practice
Unit II: Vocabulary & Daily Expressions [6 hours] - Family and occupations - Colors and places - Daily routine vocabulary - Asking simple questions - Common expressions


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Unit III: Grammar Fundamentals [6 hours] • Particles and sentence patterns • Verb forms • Pronouns and nouns • Present tense usage • Basic sentence construction
Unit IV: Practical Communication [6 hours] • Travel communication • Asking directions • Shopping conversations • Workplace etiquette • Role play practice
Unit V: Reading, Writing & Culture [6 hours] • Reading basic Japanese sentences • Writing practice • Listening comprehension • Japanese culture and discipline • Industry-oriented communication

Text Books:	
1.	Minna no Nihongo I
2.	Genki I
3.	JLPT N5 Material


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SEMESTER - IV
Foreign Languages- B) GERMAN
FOREIGN LANGUAGE COURSE – LEVEL I

BTPEFLB	GERMAN	AEC	2L- OT – OP	2 Credits
Evaluation Scheme	CA-50 Marks ESE-50 Marks			ESE (Practical/Oral evaluation at the end of the semester)

Course Objectives:	
1.	Develop basic communication skills in an international language
2.	Enhance employability and global industry readiness.
3.	Build confidence in multicultural communication.
4.	Prepare students for higher studies, internships, and placements abroad.
5.	Develop understanding of international workplace culture and etiquette.

Course Outcomes: At the end of this course, the students will be able:		Bloom's Taxonomy Level
CO1	Understand and use basic greetings and expressions.	K2
CO2	Communicate simple personal and professional information.	K2
CO3	Read and write basic words and short conversations.	K3
CO4	Develop listening and pronunciation skills.	K3
CO5	Understand basic cultural etiquette and workplace communication.	K2

Course Contents:
Unit 1 Introduction to German Language [6 hours] • German alphabets and pronunciation • Greetings and introductions • Numbers and basic expressions • Days, months, and time • Classroom vocabulary
Unit 2 Basic Vocabulary & Communication [6 hours] • Family and professions • Colors and nationalities • Daily routine expressions • Asking simple questions • Basic conversational phrases
Unit 3 Basic Vocabulary & Communication [6 hours] • Family and professions • Colors and nationalities • Daily routine expressions • Asking simple questions • Basic conversational phrases

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Unit 4 Practical Communication [6 hours] • Shopping conversations • Asking directions • Restaurant communication • Workplace vocabulary • Role play activities
Unit 5 Reading, Writing & Culture [6 hours] • Reading simple passages • Writing short emails/messages • Listening practice • German culture and etiquette • Industry communication basics

Text Books:	
1.	Netzwerk AI
2.	Alliance Française Material
3.	Goethe Institute Material


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SEMESTER - IV
Foreign Languages- C) FRENCH
FOREIGN LANGUAGE COURSE – LEVEL I

BTPEFSLC	FRENCH	AEC	2L- 0T – 0P	2 Credits
Evaluation Scheme	CA-50 Marks ESE-50 Marks			ESE (Practical/Oral evaluation at the end of the semester)

Course Objectives:	
1.	Develop basic communication skills in an international language
2.	Enhance employability and global industry readiness.
3.	Build confidence in multicultural communication.
4.	Prepare students for higher studies, internships, and placements abroad.
5.	Develop understanding of international workplace culture and etiquette.

Course Outcomes: At the end of this course, the students will be able:		Bloom's Taxonomy Level
CO1	Understand and use basic greetings and expressions.	K2
CO2	Communicate simple personal and professional information.	K2
CO3	Read and write basic words and short conversations.	K3
CO4	Develop listening and pronunciation skills.	K3
CO5	Understand basic cultural etiquette and workplace communication.	K2

Course Contents:
Unit I: Introduction to French Language [6 hours] • French alphabets and pronunciation • Greetings and introductions • Numbers and dates • Time expressions • Classroom vocabulary
Unit II: Basic Vocabulary & Daily Communication [6 hours] • Family vocabulary • Professions and nationalities • Colours and objects • Daily routine expressions • Asking and answering questions

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Unit III: Grammar Fundamentals [6 hours] - Articles and gender - Pronouns and verbs - Sentence construction - Singular and plural forms - Basic tense usage
Unit IV: Practical Communication [6 hours] - Travel communication - Shopping dialogues - Restaurant communication - Asking directions - Role play sessions
Unit V: Reading, Writing & Culture [6 hours] - Reading simple French passages - Writing emails and paragraphs - Listening exercises - French culture and etiquette - Professional communication basics

Text Books:	
1	Alter Ego A1
2	Saison A1
3	Alliance Française Material


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SEMESTER - IV
Foreign Languages- D) SPANISH
FOREIGN LANGUAGE COURSE – LEVEL I

BTPEFLD	SPANISH	AEC	2L- OT – OP	2 Credits
Evaluation Scheme	CA-50 Marks ESE-50 Marks			ESE (Practical/Oral evaluation at the end of the semester)

Course Objectives:	
1.	Develop basic communication skills in an international language
2.	Enhance employability and global industry readiness.
3	Build confidence in multicultural communication.
4	Prepare students for higher studies, internships, and placements abroad.
5	Develop understanding of international workplace culture and etiquette.

Course Outcomes: At the end of this course, the students will be able:		Bloom's Taxonomy Level
CO1	Understand and use basic greetings and expressions.	K2
CO2	Communicate simple personal and professional information.	K2
CO3	Read and write basic words and short conversations.	K3
CO4	Develop listening and pronunciation skills.	K3
CO5	Understand basic cultural etiquette and workplace communication.	K2

Course Contents:
Unit I: Introduction to Spanish Language [6 hours] - Spanish alphabets and pronunciation - Greetings and introductions - Numbers and dates - Time expressions - Classroom vocabulary
Unit II: Vocabulary & Daily Communication [6 hours] - Family and professions - Nationalities and colors - Daily use expressions - Asking questions - Basic conversation skills


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Unit III: Grammar Fundamentals [6 hours] • Articles and pronouns • Verb conjugation basics • Sentence structure • Singular and plural forms • Present tense basics
Unit IV: Practical Communication [6 hours] • Shopping conversations • Travel communication • Asking directions • Restaurant communication • Role plays
Unit V: Reading, Writing & Culture [6 hours] • Reading simple passages • Writing short emails/messages • Listening activities • Spanish culture and etiquette • Workplace communication basics

Text Books:	
1.	Aula Internacional A1
2	Español en Marcha A1
3	DELE A1 Preparation Material


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SEMESTER - IV**Agile Project Management**

BTPESDS404T	Agile Project Management	E/Eco./M	2L- OT – OP	2 Credits
Evaluation Scheme	CA-30 Marks ESE-20 Marks			ESE Time Duration 3 Hrs

Course Objectives:	
1.	To understand Agile principles, Agile methodologies, value driven delivery, and Agile planning techniques used in modern project management environments.
2.	To develop knowledge of Agile leadership, team performance, stakeholder engagement, communication skills, and continuous improvement practices for successful project execution.

Course Outcomes: At the end of this course, the students will be able:		Bloom's Taxonomy Level
CO1	Understand Agile principles, Agile Manifesto, Agile methodologies, and value driven delivery concepts including MVP and prioritization techniques.	K2
CO2	Apply Agile leadership, team building, planning, sizing, estimation, release planning, and iteration planning techniques in Agile projects.	K3
CO3	Analyze continuous improvement methodologies, stakeholder engagement strategies, shared vision development, and communication practices in Agile environments.	K3

Course Contents:
Unit 1 Agile Principles and Mindset And Value Driven Delivery : [10hours] Why use Agile The Agile Manifesto , Agile Methodologies, What is value driven delivery,How do you assess and prioritize value ,MVP.
Unit2 Leadership and team performance With Adaptive Planning: [10 hours] Agile Leadership ,How to build an Agile team, Agile Planning ,Sizing and Estimating Release Planning , Iteration Planning.
Unit 3 Continuous Improvement And Stakeholder Engagement:[10 hours] Methodologies for continuous improvement, Process, product and people, Who is a stakeholder, How to establish a shared vision , How to communicate with a stakeholder , Critical communication skills.


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Text Books:	
1	Agile Practice Guide, Project Management Institute and Agile Alliance, Agile Practice Guide, Newtown Square, Pennsylvania, 2017.
2.	Agile Project Management with Scrum, Ken Schwaber, Microsoft Press, 2004.

Reference Books:	
1	Scrum: The Art of Doing Twice the Work in Half the Time, Jeff Sutherland, Crown Business, 2014.
2	User Stories Applied: For Agile Software Development, Mike Cohn, Addison-Wesley Professional, 2004.
3	Essential Scrum: A Practical Guide to the Most Popular Agile Process, Kenneth S. Rubin, Addison-Wesley Professional, 2012.
4	Agile Estimating and Planning, Mike Cohn, Pearson Education, 2005.


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SEMESTER IV

Universal Human Value

BTPESUHVT	Universal Human Values	VEC	3L- 0T - 0P	3 Credits
Evaluation Scheme	CA-20 Marks	MSE-20 Marks	ESE-60 Marks	ESE Time Duration- 3 Hrs

Course Objectives:

- | | |
|----|---|
| 1. | To develop right understanding through self-exploration and cultivate harmony with self, society, and nature, enabling students to apply universal human values and ethical principles in personal and professional life. |
|----|---|

Course Outcomes:

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

		Bloom's Taxonomy Level
CO1	Analyse self and surroundings to understand personal and societal harmony.	K2
CO2	Evaluate human aspirations and happiness to enhance well-being.	K2
CO3	Assess universal values in relationships and design strategies for trust, respect, and justice.	K2
CO4	Analyse human impact on nature and propose sustainable practices.	K3
CO5	Evaluate eco-friendly systems and develop strategies for sustainable technologies.	K2

Course Contents:

Unit 1 – Introduction (9 Hours)

Purpose and motivation for the course. Self-Exploration, 'Natural Acceptance' and Experiential Validation. Continuous Happiness and Prosperity. Right understanding, Relationship and Physical Facility. Understanding Happiness and Prosperity correctly. Understanding and living in harmony at various levels.

Unit 2 Understanding Harmony (9 Hours)

Understanding human beings as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer). Understanding the characteristics and activities of 'I' and harmony in 'I'. Understanding the harmony of I with the Body: Sanyam and Health, correct appraisal of Physical needs. Prosperity in detail, Programs to ensure Sanyam and Health.


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Unit 3 Values in relationships (9 Hours)

Understanding nine universal values in human-human relationship. Justice and program for its fulfilment to ensure mutual happiness. Trust and Respect as the foundational values of relationship, difference between intention and competence, respect and differentiation. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Unit 4 Co-existing with nature (9 Hours)

Understanding the harmony in Nature, Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature. Understanding Existence as Coexistence of mutually interacting units in all-pervasive space. Holistic perception of harmony at all levels of existence. Human beings are the cause of imbalance in nature, pollution, depletion of resources and role of technology etc.

Unit 5 Holistic approach for Engineers (9 Hours)

Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education. Humanistic Constitution and Humanistic Universal Order
Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order. b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems. c. Ability to identify and develop appropriate technologies and management patterns for above production systems. Case studies of typical holistic technologies, management models and production systems. Strategy for transition from the present state to Universal Human Order: a. At the level of individuals: as socially and ecologically responsible engineers, technologists and managers. b. At the level of society: as mutually enriching institutions and organizations

Text Books:

- | | |
|----|--|
| 1. | Human Values and Professional Ethics, Gaur, Sangal, Bagaria, 2010, Excel Books, New Delhi. |
|----|--|

Reference Books:

- | | |
|----|---|
| 1. | Jeevan Vidya: Ek Parichaya, A. Nagaraj, 1999, Jeevan Vidya Prakashan, Amarkantak |
| 2. | Human Values, A.N. Tripathi, 2004, New Age Intl. Publishers, New Delhi |
| 3. | The Story of My Experiments with Truth, M.K.Gandhi, 2009, Fingerprint Publishers. |

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SEMESTER - III
Business Communication

BTPESOE2T	Business Communication	OE	4L- 0T – 0P	4 Credits
Evaluation Scheme	CA-20 Marks MSE-20 Marks ESE-60 Marks			ESE Time Duration 3 Hrs

Course Objectives:

1. To build up comprehensive understanding of business correspondence and conditions
2. To create influential oral, written and practical skills among students

Course Outcomes:

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

Bloom's Taxonomy Level

CO1	Explain the meaning, scope, importance, and characteristics of business communication.	K2
CO2	Demonstrate an understanding of intercultural communication, including key concepts, non-verbal communication, body language, and the relationship between language, thought, and speech in a business context.	K2
CO3	Explain different barriers to effective communication and listening, and demonstrate the communication principles such as the Four S's and Ten Golden Rules for effective interaction.	K3
CO4	Demonstrate professional business correspondence skills by drafting business letters, emails, job application letters, resumes, and business proposals using proper structure and language.	K3
CO5	Apply group communication skills in practical situations such as group discussions, interviews, meetings, conferences, and public relations, incorporating soft skills like teamwork, emotional intelligence, and problem-solving.	K3

Course Contents:

Unit 1 Introduction of Business Communication [10 hours]

Meaning and Scope of Business Communication, Characteristics of Business Communication, Business Communication Need of Time, Five Ways to Improve your Business Communication Skills, Elements of Communication Process, Stages in Communication Process, Types of Business Communication along with example, Methods of Business Communication, Process of Characteristics of Business Communication.

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Unit 2 Intercultural Communication [12 hours] Key Terms of Intercultural Communication, Importance of Intercultural Communication in Business, Non- Verbal Communication - Introduction to Non Verbal Communication, Aspects of Body Language, Non- Verbal Communication Codes, Thought and Speech - Introduction to Thought and Speech, Language is Ability.
Unit 3 Conceptual Barrier to Effective Communication [12 hours] Introduction and Types of Barriers, Physical Barriers, Mechanical Barrier, Psychological Barrier, Listening - Introduction and Definitions to Listening, Types of Listening , Barriers to Listening, Communication Rules - Simple Rules for Better Communicator, Four S's of Communication, Ten Golden Rules of Communication Case Study on Effective Communication
Unit 4 Business Correspondence [12 hours] Business Correspondence - Theory of Business Letter Writing Parts, Structure, Layouts, Principles of Effective Letter Writing, Principles of effective E - mail Writing Personnel Correspondence - Job Application Letter and Resume, Letter of Acceptance of Job Offer, Letter of Resignation. Language and Writing Skill - Paragraph Writing, Business Proposals, Oral and Written Vocabulary in Communication, Common Errors. Case Study on Report Writing.
Unit 5 Group Communication [12 hours] Group Discussions – Process of GD, Skills tested in GD. Interviews - Preparing for an Interview, Types of Interviews – Selection, Appraisal, Grievance, Exit, Online. Soft Skills – Emotional Intelligence, Conflict Management, Teamwork, Problem-Solving. Meetings - Types of Meetings, Agenda and Resolutions. Committees & Conferences. Public Relations - Meaning and Functions of Public Relations (PR), External and Internal Measures of Promoting PR, Crisis Management

Text Books:	
1.	Kaul, Asha, Business Communication, Prentice-Hall of India, Delhi.

Reference Books:	
1.	Mary Ellen Guffey, Essentials of Business Communication, Sixth Edition, South-Western College Publishing.
2.	Monippally, Matthukutty M. Business Communication Strategies. Tata McGraw-Hill Publishing Company Ltd., New Delhi
3.	Bahl, J.C. and Nagamia, S.M. (1974) Modern Business Correspondence and Minute Writing
4.	Bovee Courtland, L and Thrill, John V (1989) Business Communication, Today McGrawHill, New York, Taxman Publication.


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SEMESTER - III
Digital Marketing and Ecommerce

BTPEOE4T	Digital Marketing and Ecommerce	OE-I	4L- 0T – 0P	4 Credits
Evaluation Scheme	CA-20 Marks MSE -20 ESE-60 Marks			ESE Time Duration 3 Hrs

Course Objectives:	
1	To introduce students to the fundamentals of Digital Marketing and E-Commerce systems.
2	To develop understanding of online business models, digital consumer behavior, and marketing strategies.

Course Outcome: At the end of this course, the students will be able to:		Bloom's Taxonomy Level
CO1	Describe the fundamentals of Digital Marketing and E-Commerce ecosystems..	K2
CO2	Use SEO, SEM, email, and social media marketing techniques in online business platforms.	K3
CO3	Differentiate digital consumer behavior and various e-commerce business models	K4
CO4	Design simple digital marketing strategies using analytics and online tools	K4
CO5	Explain security, ethical, legal, and emerging trends in e-commerce and digital business.	K5

Course Contents:
Unit 1: Introduction to Digital Marketing: [10 hours] Fundamentals of Marketing and Digital Marketing ,Traditional Marketing vs Digital Marketing ,Digital Marketing Ecosystem ,Digital Business Models ,Consumer Behavior in Digital Environment ,Website Basics and Content Management Systems ,Introduction to Google Ads and Digital Platforms.
Unit 2 : Search Engine and Social Media Marketing: [12 hours] Search Engine Optimization ,On-page and Off-page ,Search Engine Marketing ,Pay Per Click , Advertising ,Social Media Marketing (Facebook, Instagram, LinkedIn, YouTube) ,Influencer Marketing ,Online Brand Building.
Unit 3 : E-Commerce Fundamentals: [12 hours] Introduction to E-Commerce ,Types of E-Commerce: B2B, B2C, C2C, C2B ,E-Commerce Business Models ,Electronic Payment Systems ,Digital Wallets and Payment Gateways ,E-Commerce Website Design ,Supply Chain and Logistics in


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E-Commerce.

Unit 4: Digital Analytics and Online Advertising: [12 hours]

Web Analytics and Google Analytics ,Metrics and KPIs in Digital Marketing ,Email Marketing ,Affiliate Marketing ,Mobile Marketing ,Content Marketing Strategies ,Online Advertising and Campaign Management.

Unit 5 : Security, Ethics, and Emerging Trends: [12 hours]

Cyber Security in E-Commerce ,Privacy and Data Protection ,Ethical Issues in Digital Marketing ,Legal Aspects of E-Commerce ,Artificial Intelligence in Digital Marketing ,Chatbots and Automation ,Future Trends in E-Commerce and Digital Business .

Text Book

1	Seema Gupta, Digital Marketing, 3rd Edition, McGraw Hill Education, 2022.
2	Kenneth C. Laudon and Carol Guercio Traver, E-Commerce: Business, Technology, Society, 16th Edition, Pearson Education, 2021.
3	Simon Kingsnorth, Digital Marketing Strategy: An Integrated Approach to Online Marketing, 2nd Edition, Kogan Page, 2022.
4	Dave Chaffey, E-Business and E-Commerce Management, 7th Edition, Pearson Education, 2019.

Reference Book

1	Philip Kotler, Hermawan Kartajaya and Iwan Setiawan, Marketing 4.0: Moving from Traditional to Digital, 1st Edition, Wiley, 2017.
2	Tracy L. Tuten and Michael R. Solomon, Social Media Marketing, 4th Edition, Sage Publications, 2020.
3	Gary P. Schneider, Electronic Commerce, 12th Edition, Cengage Learning, 2017.
4	Ryan Deiss and Russ Henneberry, Digital Marketing for Dummies, 2nd Edition, Wiley, 2020.

NPTEL Link

1	https://nptel.ac.in/courses/110105083
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SEMESTER III**Development Engineering**

BTPESOE12T	Development Engineering	B-Tech	4L- 1T – 0P	4 Credits
Evaluation Scheme	CA-20 Marks MSE-20 Marks ESE-60 Marks			ESE Time Duration 3 Hrs

Course Objectives:	
1.	Understand foundational concepts of Development Engineering
2.	Analyze global and national poverty issues

Course Outcomes: At the end of this course, the students will be able:		Bloom's Taxonomy Level
CO1	Improve and demonstrate skills in Development Engineering.	K3
CO2	Explain and analyze the concepts of world poverty and development.	K2
CO3	Describe and interpret the principles of social justice.	K2
CO4	Apply appropriate development strategies to real-world problems.	K3
CO5	Explain and implement engineering approaches for sustainable community development.	K4

Course Contents:
Unit 1 Introduction [10 hours] Introduction, Various Definitions of Development Engineering
Unit 2 World Poverty and Development [12 hours] World Poverty and Development, Poverty in the India, Sustainable Development, Culture and Global Competence, The Engineer's Role
Unit 3 Social Justice [12 hours] Social Justice, Social Justice and Engineering, Religious Perspectives, Secular Perspectives
Unit 4 Development Strategies [12 hours] Development Strategies: Society, Technological Change, and Development, Development Economists' Perspectives, Global Health Perspective, International Education Perspective, Social Business Perspectives.
Unit 5 Engineering for Sustainable Community Development [12 hours] The Engineer as a Helper Participatory Community Development, Teamwork and Project Management, Community Assessment: Learning About a Community, Project Selection, Humanitarian Technology, Participatory Technology Development, Humanitarian STEM Education. ICT for Development, AI for Humanitarian purposes, Blockchain and Social Development.


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Text Books:	
1	Advancing Technology for Sustainable Development by Kevin M. Passino, Humanitarian Engineering: 3rd Edition ,2016, Publisher: Bede Publishing, Columbus, Ohio ISBN-13: 978-0692394229

Reference Books:	
1	<i>Introduction to Development Engineering: A Framework with Applications from the Field</i> — Temina Madon, Ashok J. Gadgil, Richard Anderson, et al. st Edition Publication Year: 2022 (Hardcover/eBook); Softcover released in 2023 Publisher: Springer ISBNs: Hardcover: 978-3-030-86064-6 ,eBook: 978-3-030-86065-3,Softcover: 978-3-030-86067-7
2.	<i>Engineering and Sustainable Community Development</i> — Juan Lucena, Jen Schneider & Jon A. Leydens 2nd Edition ,2024 Publisher: Springer ISBNs: Hardcover: 978-3-031-48523-7 eBook: 978-3-031-48524-4 Softcover: 978-3-031-48526-8


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SEMESTER III**Employability and Skill Development**

BTPEOE13T	Employability and Skill Development	OE-I	4L- 0T - 0P	4 Credits
Evaluation Scheme	CA-20 Marks MSE -20 ESE-60 Marks			ESE Time Duration 3 Hrs

Course Objectives:

1.	Develop employability skills among mechanical engineering students and enhance communication, teamwork, and professional ethics.
2.	Build technical aptitude related to manufacturing, maintenance, quality; and industrial practices.

Course Outcomes:

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

Bloom's Taxonomy Level

CO1	Demonstrate effective communication and interpersonal skills in professional settings.	K2
CO2	Apply aptitude, analytical, and problem-solving skills for employment opportunities.	K3
CO3	Understand industrial practices, workplace safety, and engineering ethics.	K2
CO4	Develop technical employability skills relevant to mechanical engineering industries.	K2
CO5	Demonstrate entrepreneurship, leadership, and lifelong learning abilities.	K2

Course Contents:**UNIT-1: Communication Skills and Personality Development (10 Hours)**

Fundamentals of professional communication, Verbal and non-verbal, communication Technical communication and workplace etiquette ,Group discussion techniques Presentation skills and public speaking ,Resume writing and cover letter preparation ,Interview skills and mock interview practices, Personality development and confidence building.

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UNIT-2: Quantitative Aptitude and Problem-Solving Skills (12 Hours)

Quantitative aptitude fundamentals ,Numerical ability and logical reasoning ,Analytical thinking and decision making ,Basic data interpretation, Engineering problem-solving techniques, Time management and critical thinking, Introduction to psychometric and aptitude tests for placements .

UNIT-3: Industrial Skills, Safety and Professional Ethics (12 Hours)

Industrial work culture and organizational behaviour , Basics of industrial safety practices, Occupational health and hazard identification, Safety standards in mechanical workshops, Introduction to quality concepts (5S, Kaizen, Lean Manufacturing), Professional ethics and workplace discipline ,Engineering ethics and sustainable practices.

UNIT-4: Technical Employability Skills (12 Hours)

Automation and Smart Manufacturing, Internet of Things (IoT) Basics, Green Engineering and Sustainable Technologies, Artificial Intelligence basics. Industrial automation and Industry 4.0 overview, Preventive and predictive maintenance concepts , Quality control tools and inspection techniques ,Documentation and report writing.).

UNIT-5: Entrepreneurship, Innovation and Career Development (12 Hours)

Concept and Meaning of Entrepreneurship, Characteristics and Types of Entrepreneurs, Entrepreneurship development, Role of Entrepreneurship in Economic Development Start-up ecosystem and innovation, Career planning and higher education opportunities , Professional networking and digital platforms, Leadership and teamwork skills ,Internship and project management basics.

Text Books:

1.	Sanjay Kumar & Pushp Lata, Communication Skills –Oxford University Press.
2.	S. P. Dhanavel, Soft Skills – Orient Black Swan.
3.	R. S. Aggarwal, S. Chand., Quantitative Aptitude for Competitive Examinations.
4.	Charles E. Harris Jr., Engineering Ethics –Cengage Learning.
5.	S. S. Khanka, S. Chand..Entrepreneurship Development.

Reference Books:

1.	Barun K. Mitra , Personality Development and Soft Skills –,Oxford University Press.
2.	Dr. M. Sen Gupta.Skills for Employability.
3.	L. M. Deshmukh.,Industrial Safety Management .
4.	Stephen R. Covey The 7 Habits of Highly Effective People.

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OPEN ELECTIVE II**SEMESTER IV****Business Intelligence**

BTPESOE1T	Business Intelligence	OE-II	2L- OT – OP	2 Credits
Evaluation Scheme	CA-10 Marks MSE- 10 Marks ESE-30 Marks			ESE Time Duration 3 Hrs

Course Objectives:	
1.	To provide foundational knowledge of Business Intelligence systems and architecture.
2.	To understand data warehousing concepts and ETL processes.

Course Outcomes: At the end of this course, the students will be able:		Bloom's Taxonomy Level
CO1	Understand BI concepts and architecture	K2
CO2	Illustrate data warehousing and ETL processes	K3
CO3	Apply data mining and analytics techniques	K3

Course Contents:
Unit 1: Introduction to Business Intelligence [10 Hours] Meaning, Evolution and Importance of BI, BI Architecture and Components Operational Systems vs Analytical Systems OLTP vs OLAP ,BI Applications in Functional Areas (Finance, Marketing, HR, SCM) Role of BI in Competitive Advantage.
Unit 2: Data Warehousing Concepts [10 Hours] Data Warehouse: Characteristics and Objectives Data Warehouse Architecture ETL (Extract, Transform, Load) Process Data Marts Star Schema and Snowflake Schema Metadata and Data Quality Issues
Unit 3: Data Analytics and Data Mining [10 Hours] Introduction to Data Mining Classification Techniques Clustering Techniques Association Rule Mining Regression and Forecasting Predictive vs Descriptive Analytics


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Text Books:	
1	Business Intelligence and Analytics – Efraim Turban, Ramesh Sharda, Dursun Delen 10 th Edition 2015, Publisher: Pearson
2	<i>The Data Warehouse Toolkit</i> - The Definitive Guide to Dimensional Modeling by Wiley. Kimball, R., & Ross, 3 rd Edition 2013, Publisher: Wiley
3	Business Intelligence Guidebook: From Data Integration to Analytics – Rick Sherman 1 st Edition 2014 Publisher: Morgan Kaufmann / Elsevier

Reference Books:	
1	The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling– Ralph Kimball & Margy Ross 3 rd Edition 2013, Publisher: Wiley
2.	Successful Business Intelligence – Cindi Howson 2 nd Edition 2013, Publisher: McGraw Hill
3.	Information Dashboard Design – Stephen Few 2 nd Edition 2013, Publisher: Analytics Press


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SEMESTER - IV
Consumer Behavior

CBTPESOE3T	Consumer Behavior	OE-II	2L- 0T – 0P	2 Credits
Evaluation Scheme	CA-10 Marks MSE- 10 Marks ESE-30 Marks			ESE Time Duration 3 Hrs

Course Objectives:	
1.	To develop an understanding of consumer behavior concepts, theories, and models and examine their relationship with marketing and market research.
2.	To analyze consumer decision-making processes and influencing factors, including psychological, sociological, cultural, and economic determinants of buying behavior.

Course Outcomes: At the end of this course, the students will be able:		Bloom's Taxonomy Level
CO1	Study of Consumer Behavior	K2
CO2	Get Market Segmentation and Decision Making Process.	K2
CO3	Analyze Models of Consumer Behavior..	K4

Course Contents:
Unit 1 Introduction to the Study of Consumer Behavior [10 hours] Defining Consumer Behavior, Scope and Application of Consumer Behavior, Why Study Consumer Behavior, Evolution of Consumer Behavior as a Field Of Study and its relationship with Marketing: Behavioral Dimension, The Interdisciplinary Nature of Consumer Behavior. Market Research and Consumer Behavior, Relevance of Market Research with Consumer Behavior, Approaches to Consumer Behavior Research, Quantitative Research, Qualitative Research.
Unit 2 Market Segmentation and Decision Making Process [10 hours] Market Segmentation, Basis for Segmentation, Alternatives available for Segmentation, The Consumer Decision Making Process: Buying Motives, Buying Roles, Levels of Consumer Decision Making, Perspectives to Consumer Decision Making, Organizational Buying: Buying Decisions in Organizational Buying Process, Differences between Industrial Markets and Consumer Markets, Differences between Organizational and Consumer Buying.
Unit 3 Models of Consumer Behavior [10 hours] The Economic model, Learning model, Psychoanalytic model, The sociological model. The Howard Sheth model of Buying Behaviors, The Nicosia model, The Engel - Kollat - Blackwell Model, Engel, Blackwell and Miniard (EBM) model.


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Text Books:	
1	Consumer Behavior, Schiffman, L.G. and Kanuk L.L., Prentice Hall, India. 12th Edition Publisher: Pearson India ISBN-13: 978935394380 12 th Edition 2020

Reference Books:	
1.	Consumer Behavior, Concepts and Applications, Loudon, D.L. and Bitta, A.J.D, TatacGrawHill. 4 th Edition 1993
2.	Consumer Behavior and Marketing Strategy, Peter, J.P. and Olson, J.C., Schiffman, L.G. and Kanuk L.L., Prentice Hall, India. 9th Edition 2010


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SEMESTER - IV
Educational Leadership

BTPESOE14T	Educational Leadership	OE-II	2L- OT – OP	2 Credits
Evaluation Scheme	CA-10 Marks MSE- 10 Marks ESE-30 Marks			ESE Time Duration 3 Hrs

Course Objectives:	
1.	To develop understanding of leadership theories and models in educational settings.
2.	To familiarize students with administrative structures of school and higher education in India.

Course Outcomes: At the end of this course, the students will be able:		Bloom's Taxonomy Level
CO1	Explain major leadership theories and styles in education	K2
CO2	Analyze administrative structures and governance models	K4
CO3	Apply leadership strategies in institutional contexts	K3

Course Contents:
Unit 1: Conceptual Foundations of Educational Leadership [10 Hours] Meaning, Nature and Scope of Educational Leadership, Management and Administration – Distinction Evolution of Leadership Theories Trait Theory Behavioral Theory Situational & Contingency Theories Leadership in Indian Educational Context
Unit 2: Models and Styles of Leadership [10 Hours] Authoritarian, Democratic and Laissez-faire Leadership Transformational and Transactional Leadership Instructional Leadership Distributed Leadership Servant Leadership in Education
Unit 3: Educational Administration and Governance [10 Hours] Structure of School Education in Maharashtra Role of Principal/Headmaster as Institutional Leader Educational Planning and Decision Making Regulatory Bodies: UGC, NCTE, NAAC Decentralization and Participative Management

Text Books:	
1.	Bush, T. (2011). <i>Theories of Educational Leadership and Management</i> . Sage Publications.
2.	Northouse, P. G. (2018). <i>Leadership: Theory and Practice</i> . Sage Publications.


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Reference Books:	
1.	Sergiovanni, T. J. (2009). <i>The Principal ship: A Reflective Practice Perspective</i> .
2.	Fullan, M. (2014). <i>The Principal: Three Keys to Maximizing Impact</i> .
3.	Government of India. <i>National Education Policy 2020</i> .
4.	NCTE Regulations (Latest Edition).


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Multidisciplinary Minor 1**SEMESTER - III****Object Oriented Programming**

BTPESMDS1T	Object Oriented Programming	MDM	2L- 0T – 0P	2 Credits
Evaluation Scheme	CA-10 Marks MSE-10 Marks ESE-30 Marks			ESE Time Duration 2 Hrs

Course Objectives:	
1.	Explain the fundamental concepts of Object-Oriented Programming, Java programming structure, data types, operators, control statements, classes, objects, inheritance, and interfaces required for developing Java applications
2.	Develop Java programs using packages, multithreading, exception handling, arrays, strings, constructors, and inheritance concepts to solve real-world programming problems.

Course Outcomes: At the end of this course, the students will be able:		Bloom's Taxonomy Level
CO1	Explain the fundamental concepts of Object-Oriented Programming, Java program structure, data types, operators, control statements, and Java execution environment.	K2
CO2	Develop Java programs using classes, objects, constructors, arrays, strings, inheritance, method overloading, and overriding concepts.	K3
CO3	Implement interfaces, packages, multithreading, and exception handling mechanisms in Java applications.	K3

Course Contents:
Unit 1 Fundamentals of JAVA [10 hours] Basic Fundamental concepts of Object Oriented Programming, Java history , Java features, Java and Internet, Java support Systems, Java Environment , Java Program Structure, Java tokens, Java statements, Simple java program, Installing and configuring Java , Java Virtual Machine. Constants, Variables, Data Types, Type Casting, Operators and Expressions; Decision Making and Looping- if Statement, if...Else Statement, Nesting of if... Else Statement, The Else if Ladder, The Switch Statement, while statement, do Statement, for Statement, Jumps in Loops.
Unit 2 Object, Classes and Inheritance [10 hours] Defining a Class, Fields and Methods Declaration, Creating Objects, Accessing Class Members, Constructors, Method Overloading, Static Members, Nesting of Methods, One-dimensional Arrays, Two-dimensional Arrays, Strings, Vectors, Wrapper Classes. Inheritance - Extending Class, Overriding Methods, Final Classes, Finalizer Methods, Abstract Methods and Classes, and Visibility Controls..


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Unit 3 Interface, Packages, Multithreaded Programming and Exceptional Handling [10 hours]

Interfaces - Defining interfaces, Implementing interfaces, Accessing interface variables and methods, Extending interfaces. Packages - Java API Packages, Using System Packages, Creating accessing and using a package, importing package. Creating Thread, Extending the Thread Class, Life Cycle of a Thread, Synchronization. Exceptional Handling - Types of Errors, Exceptions, Exceptional Handling Code, Multiple Catch Statement.

Text Books:

1.	E Balagurusamy, "Programming with JAVA", Tata McGraw Hill, 7th Edition.
2.	Herbert Schildt, "Java: The complete reference", Tata McGraw Hill, 13th Edition.

Reference Books:

1.	Y. Daniel Liang (2010), "Introduction to Java programming", Pearson Education, India, 7th Edition.
2.	T. Budd, "Understanding OOP with Java", Pearson Education, 2nd Updated Edition.
3.	Bert Bates, Kathy Sierra, "Head First Java", O'Reilly Media, Inc
4.	Deitel & Deitel, "Java: How to Program", PHI.


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SEMESTER - IV
Data Structures and Algorithms

BTPESMDS2T	Data Structures and Algorithms	MDM	2L- 0T – 0P	2 Credits
Evaluation Scheme	CA-10 Marks MSE-10 Marks ESE-30 Marks			ESE Time Duration 3 Hrs

Course Objectives:	
1.	To introduce the fundamentals of algorithms, data structures, and complexity analysis
2.	To develop understanding of linear and non-linear data structures with basic applications.
3	To apply algorithmic techniques for solving simple computational problems efficiently.

Course Outcomes: At the end of this course, the students will be able:		Bloom's Taxonomy Level
CO1	Apply searching, sorting, and linear data structures for solving computational problems.	K3
CO2	Apply trees, graphs, recursion, and dynamic programming techniques for problem solving.	K3
CO3	Apply basic hashing and greedy techniques for efficient data processing and optimization problems.	K3


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Course Contents:	
UNIT 1: Introduction to Algorithms, Arrays & Sorting (10 Hours) Introduction to Algorithms and Data Structures Characteristics of Algorithms, Time and Space Complexity, Big Oh ,Omega,Theta notation Arrays: 1D Arrays, Traversal, Insertion, Deletion Searching Techniques: Linear Search, Binary Search Sorting Techniques: Merge sort, Bubble Sort, Selection Sort, Insertion Sort	
UNIT 2: Linked List, Stack, Queue & Recursion (10 Hours) Linked List: Singly Linked List and basic operations Stack: Stack Operations and Applications Queue: Queue Operations and Applications Linear Queue and Circular Queue Recursion: Recursive Functions and simple applications Introduction to Backtracking	
UNIT 3: Trees, Graphs & Dynamic Programming (10 Hours) Binary Tree and Binary Search Tree, Tree Traversals Introduction to Heap and Hashing Graph Traversal: BFS and DFS Greedy Algorithm: Activity Selection Dynamic Programming: Fibonacci and 0/1 Knapsack	

Text Books:	
1	Data Structures and Algorithms Made Easy - Narasimha Karumanchi, 5th Edition, CareerMonk Publications, 2020.
2	Data Structures Using C — Reema Thareja, 3rd Edition, Oxford University Press, 2023.
3	Algorithms - Robert Sedgewick and Kevin Wayne, 4th Edition, Addison-Wesley Professional, 2011.

Reference Books:	
1.	Fundamentals of Data Structures in C - Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, 2nd Edition, 2008
2.	Data Structures Using C and C++ - Yedidyah Langsam, Moshe J. Augenstein, Aaron M. Tenenbaum, 2nd Edition, Pearson Education, 2018
3.	Data Structures and Algorithms in Python - Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, 2nd Edition, 2024
4.	Algorithm Design - Jon Kleinberg and Éva Tardos, 1st Edition, 2006
5	The Algorithm Design Manual - Steven S. Skiena , 3rd Edition, 2020


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