Pimpri Chinchwad Education Trust's

PIMPRI CHINCHWAD COLLEGE OF ENGINEERING

SECTOR NO. 26, PRADHIKARAN, NIGDI, PUNE 411044

An Autonomous Institute Approved by AICTE and Affiliated to SPPU, Pune

DEPARTMENT OF COMPUTER ENGINEERING

Curriculum Structure and Syllabus

of

SY B Tech Computer Engineering

(Regional Language)

(Course 2021)

Effective from Academic Year 2023-24
(Updated with minor changes)

Institute Vision

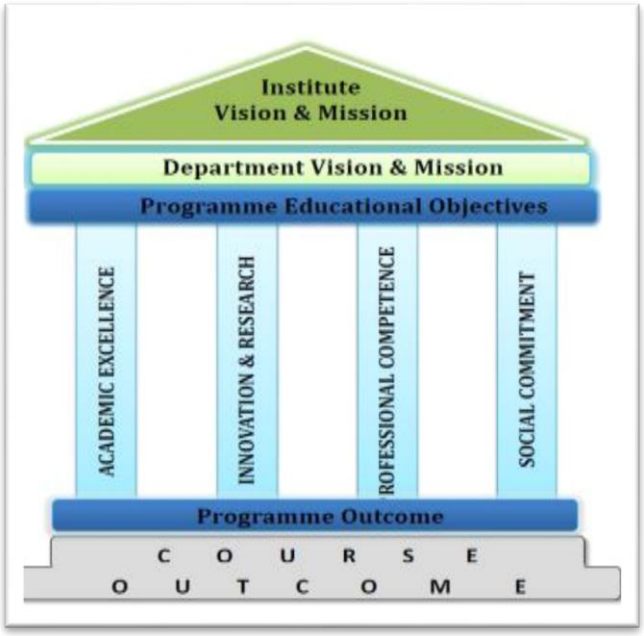
To be one of the top 100 Engineering Institutes of India in coming five years by offering exemplarily Ethical, Sustainable and Value Added Quality Education through a matching ecosystemfor building successful careers.

Institute Mission

1. Serving the needs of the society at large through establishment of a state-of-art Engineering Institute
2. Imparting right Attitude, Skills, Knowledge for self-sustenance through Quality Education
3. Creating globally competent and Sensible engineers, researchers and entrepreneurs with ability to think and act independently in demanding situations.

Quality Policy

We at PCCOE are committed to impart Value Added Quality Education to satisfy the applicable requirements, needs and expectations of the Students and Stakeholders. We shall strive for academic excellence, professional competence and social commitment in fine blend with innovation and research. We shall achieve this by establishing and strengthening state-of-the-art Engineering and Management Institute through continual improvement in effective implementation of Quality Management System.



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	Pimpri Chinchwad Education Trust's **Pimpri Chinchwad College of Engineering**	
Course Approval Summary(Minor Changes)		

A) Board of study - Department of Applied Sciences and Humanities

Sr. No.	Name of the Course	Course Code	Page number	Signature and stamp of BoS
1	Applied Mathematics	BAS3205	10	
2	Numerical Methods	BAS4601	50	
3	Mathematical Optimization	BAS4602	52	
4	Neural Network and Fuzzy Logic Control	BAS4606	60	
5	Professional Skills for Engineers	BHM4101	62	

B) Board of study - Department of Computer Engineering

Sr. No.	Name of the Course	Course Code	Page number	Signature and stamp of BoS
1	Discrete Mathematics	BCE3201	12	
2	Digital Electronics and Computer Organization	BCE3301	14	
3	Digital Electronics Laboratory	BCE3302	16	
4	Data Structures and Algorithms	BCE3401	18	
5	Object Oriented Programming	BCE3402	20	
6	Data Structures & Algorithms Laboratory	BCE3403	22	
7	Project Based Learning – I	BCE3404	24	
8	Microprocessor Architecture	BCE4301	34	
9	Microprocessor Architecture Laboratory	BCE4302	36	
10	Computer Networks	BCE4405	38	
11	Database Management System	BCE4406	40	
12	Software Engineering	BCE4407	43	
13	Computer Networks Laboratory	BCE4408	45	
14	Project Based Learning-II	BCE4409	47	

Approved by Academic Council:

Chairman, Academic Council
Pimpri Chinchwad College of Engineering

Approved by Board of Governors:

Chairman, Board of Governors
Pimpri Chinchwad College of Engineering

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LIST OF ABBREVIATIONS IN CURRICULUM STRUCTURE

SR. NO.	ABBREVATION	TYPE OF COURSE
1.	BSC	Basic Science Course
2.	ECC	Engineering Core/ Science Course
3.	HSMC	Humanities, Social Sciences and Management Course
4.	PCC	Programme / Professional Core Course
5.	PEC	Programme / Professional Elective Course
6.	OEC	Open Elective Course
7.	PROJ	Project
8.	INTR	Internship
9.	AC	Audit Course
10.	MC	Mandatory Course
11.	LS	Life Skill
12.	PFC	Proficiency Course
13.	MO	MOOC Course
14.	L	Lecture
15.	P	Practical
16.	T	Tutorial
17.	H	Hours
18.	Cr	Credits
19.	IE	Internal Evaluation
20.	MTE	Mid Term Evaluation
21.	ETE	End Term Evaluation
22.	TW	Term Work
23.	OR	Oral
24.	PR	Practical

CURRICULUM FRAMEWORK
(A.Y 2020-2021; 2021-2022; 2022-2023; 2023-2024)

The Course and Credit Distribution

SR. NO.	TYPE OF COURSE	NO. OF COURSES	TOTAL CREDITS	
			NO.	%
1.	Basic Science Course (BSC)	**8**	**23**	**14**
2.	Engineering Core/ Science Course (ECC)	**15**	**22**	**14**
3.	Humanities, Social Sciences And Management Course (HSMC)	**6**	**13**	**8**
4.	Professional Core Course (PCC)	**20**	**48**	**30**
5.	Professional Elective Course (PEC)	**9**	**18**	**11**
6.	Open Elective Course (OEC)	**6**	**18**	**11**
7.	Project (PROJ)	**2**	**16**	**10**
8.	Internship (INTR)	**1**	**3**	**2**
9.	Audit Course (AC)	**3**	**0**	**0**
10.	Mandatory Course (MC)	**2**	**0**	**0**
11.	Life Skill (LS)	**4**	**0**	**0**
12.	Proficiency Course (PFC)	**3**	**0**	**0**
13.	MOOC Course	**1**	**0**	**0**
Total		**80**	**161**	**100**

Semester wise Course Distribution

COURSE DISTRIBUTION : SEMESTER WISE										
SR NO	TYPE OF COURSE	NO. OF COURSES/ SEMESTER								TOTAL
		1	2	3	4	5	6	7	8	
1.	Basic Science Course (BSC)	3	3	2	-	-	-	-	-	8
2.	Engineering Core Course (ECC)	5	6	2	2	-	-	-	-	15
3.	Humanities, Social Sciences and Management Course (HSMC)	1	1	1	1	1	1	-	-	6
4.	Professional Core Course (PCC)	-	-	4	5	4	4	3	-	20
5.	Professional Elective Course (PEC)	-	-	-	-	3	3	3	-	9
6.	Open Elective Course (OEC)	-	-	-	1	1	2	2	-	6
7.	Project (PROJ)	1	-	-	-	-	-	-	1	2
8.	Internship (INTR)	-	-	-	-	-	-	-	1	1
9.	Audit Course (AC)	-	-	-	1	1	1	-	-	3
10.	Mandatory Course (MC)	-	-	-	-	1	1	-	-	2
11.	Life Skill (LS)	1	1	1	1	-	-	-	-	4
12.	Proficiency Course (PFC)	-	-	-	1	1	1	-	-	3
13.	MOOC Course	-	-	-	-	-	-	-	1	1
Total		**11**	**11**	**10**	**12**	**12**	**13**	**8**	**3**	**80**

Semester wise Credit Distribution

CREDIT DISTRIBUTION : SEMESTER WISE										
1 Lecture hour = 1 Credit, 2 Lab Hours = 1 Credit, 1 Tutorial Hour = 1 Credit										
SR NO	TYPE OF COURSE	NO. OF CREDITS / SEMESTER								TOTAL
		1	2	3	4	5	6	7	8	
1.	Basic Science Course (BSC)	9	9	5	-	-	-	-	-	**23**
2.	Engineering Core Course (ECC)	7	9	3	3	-	-	-	-	**22**
3.	Humanities, Social Sciences and Management Course (HSMC)	2	2	3	2	2	2	-	-	**13**
4.	Professional Core Course (PCC)	-	-	12	12	8	8	8	-	**48**
5.	Professional Elective Course (PEC)	-	-	-	-	6	6	6	-	**18**
6.	Open Elective Course (OEC)	-	-	-	3	3	6	6	-	**18**
7.	Project (PROJ)	2	-	-	-	-	-	-	14	**16**
8.	Internship (INTR)	-	-	-	-	-	-	-	3	**3**
9.	Audit Course (AC))	-	-	-	-	-	-	-	-	**0**
10.	Mandatory Course (MC)	-	-	-	-	-	-	-	-	**0**
11.	Life Skill (LS)	-	-	-	-	-	-	-	-	**0**
12.	Proficiency Course (PFC)	-	-	-	-	-	-	-	-	**0**
13.	MOOC Course	-	-	-	-	-	-	-	-	**0**
Total		**20**	**20**	**23**	**20**	**19**	**22**	**20**	**17**	**161**

Curriculum structure

S.Y. B. Tech

Computer Engineering

CURRICULUM STRUCTURE

Structure for Second Year B. TECH.(Computer Engineering) Semester – III

Course Code	Course Type	Course Name	Teaching Scheme				Cr	Evaluation Scheme						
			L	P	T	Hrs		IE	MTE	ETE	TW	PR	OR	Total
BAS3205	BSC	Applied Mathematics	3	-	-	3	3	20	30	50	-	-	-	100
BCE3201	BSC	Discrete Mathematics	2	-	-	2	2	20	30	50	-	-	-	100
BCE3301	ECC	Digital Electronics and Computer Organization	2	-	-	2	2	20	30	50	-	-	-	100
BCE3302	ECC	Digital Electronics Laboratory	-	2	-	2	1	-	-	-	25	-	25	50
BCE3401	PCC	Data Structures and Algorithms	4	-	-	4	4	20	30	50	-	-	-	100
BCE3402	PCC	Object Oriented Programming	4	-	-	4	4	20	30	50	-	-	-	100
BCE3403	PCC	Data Structures and Algorithms Laboratory	-	4	-	4	2	-	-	-	25	50	-	75
BCE3404	PCC	Project Based Learning – I	-	4	-	4	2	-	-	-	25	50	-	75
BHM3101	HSMC	HSMC-I Universal Human Values	3	-	-	3	3	30	-	20	-	-	-	50
BHM3939	LS	Life Skills – III	-	2	-	2	0	-	-	-	-	-	-	-
Total			**18**	**12**	**-**	**30**	**23**							**750**

L-Lecture, **P**-Practical, **T**-Tutorial, **H**-Hours, **Cr**-Credits, **CIE**- Continuous Internal Evaluation, **IE**- Internal Evaluation, **MTE**- Mid Term Evaluation, **ETE**- End Term Evaluation, **TW**- Term Work, **OR**- Oral, **PR**- Practical

Semester - III

List of Courses - Life Skills III

Course Code	Course Name	
BHM3939	1. Practicing Meditation 2. Sports	Choose any one
	Performing Arts: Music, Singing, Poetry, Indian Conventional Dancing, Photography, Short Movie Making, Painting/ Sketching/ Drawing, Theatre Arts, Anchoring, Calligraphy etc.	Choose any one

CURRICULUM STRUCTURE

Structure for Second Year B. TECH.(Computer Engineering) Semester – IV

Course Code	Course Type	Course Name	Teaching Scheme				Cr	Evaluation Scheme						
			L	P	T	Hrs		IE	MTE	ETE	TW	PR	OR	Total
BCE4301	ECC	Microprocessor Architecture	2	-	-	2	2	20	30	50	-	-	-	100
BCE4302	ECC	Microprocessor Architecture Laboratory	-	2	-	2	1	-	-	-	25	25	-	50
BCE4405	PCC	Computer Networks	3	-	-	3	3	20	30	50	-	-	-	100
BCE4406	PCC	Database Management System	3	-	-	3	3	20	30	50	-	-	-	100
BCE4407	PCC	Software Engineering	3	-	-	3	3	20	30	50	-	-	-	100
BCE4408	PCC	Computer Networks Laboratory	-	2	-	2	1	-	-	-	25	-	25	50
BCE4409	PCC	Project Based Learning-II	-	4	-	4	2	-	-	-	50	50	-	100
BAS4601-06	OEC	Open Elective Course-I	3	-	-	3	3	20	30	50	-	-	-	100
BHM4101	HSMC	Professional Skills for Engineers	1	2	-	3	2	30	-	20	-	-	-	50
BCE4911-912	PFC	Proficiency Course-I	-	2	-	2	-	-	-	-	-	-	-	-
BHM4940	LS	Life Skills-IV	-	2	-	2	-	-	-	-	-	-	-	-
BHM9962	AC	Audit Course-I Constitution of India	1	-	-	1	-	-	-	-	-	-	-	-
Total			**16**	**14**	**-**	**30**	**20**							**750**

L-Lecture, **P**-Practical, **T**-Tutorial, **H**-Hours, **Cr**-Credits, **CIE**- Continuous Internal Evaluation, **IE**- Internal Evaluation, **MTE**- Mid Term Evaluation, **ETE**- End Term Evaluation, **TW**- Term Work, **OR**- Oral, **PR**- Practical

Semester - IV

List of courses - Open Elective Course-I

Course Code	Course Name	
BAS4601	Numerical Methods	Choose any one
BAS4602	Mathematical Optimization	
BAS4603	Calculus of Variation	
BAS4604	Mathematical Modeling and Simulation	
BAS4605	Financial Mathematics	
BAS4606	Neural Network and fuzzy logic Control	

List of courses - Proficiency Course-I

Course Code	Course Name	
BCE4911	C#.Net	Choose any one
BCE4912	Java Programming	

List of Courses - Life Skills-IV

Course Code	Course Name	
BHM4940	1. Social welfare and Cultural Awareness 2. Transactional Analysis	Choose any one
	Caring and service Hospital Caring, Personal Safety, First Aid, Disaster Management Gardening, Organic farming, Cooking etc.	Choose any one

Course Syllabus

S. Y. B. Tech

Semester-III

Program:	B. Tech. (Computer Engineering)	Semester : III
Course :	Applied Mathematics	Code : BAS3205

Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
3	-	3	3	20	30	50	100

Prior knowledge of

1. Univariate Calculus
2. Multivariate Calculus

is essential.

Course Objectives:

This course aims at enabling students,

1. To get acquainted with Linear differential equations of higher order applicable to electrical circuits.
2. To develop the problem solving skill using Statistical analysis and Probability theory.
3. To understand Del operator and its application to the vector fields.
4. To familiarize with Transform techniques such as Fourier transform, Z-transform and applications to Image processing.

Course Outcomes:

After learning the course, the students should be able to:

1. Calculate current for Electrical circuit's problems using the concepts of higher order linear differential equations.
2. Apply descriptive statistical techniques to find measures of variability of numerical data
3. Analyze the data using probability theory and hypothesis testing.
4. Examine the vector fields using concepts of vector differentiation.
5. Evaluate Fourier transform of functions using properties.
6. Apply Z-Transform to solve Difference equations.

Detailed Syllabus

Unit	Description	Duration(H)
I	**Linear Differential Equations (LDE):** Introduction of Linear and Nonlinear differential equations, linear differential equation of nth order with constant coefficients, General method, Shortcut methods, Method of Variation of Parameters, Applications of electrical circuits.	8
II	**Statistics:** Measures of Variability: Standard deviation, Coefficient of variation, Moments, Skewness and Kurtosis, Curve fitting, Correlation and Regression.	7
III	**Probability Distributions:** Probability, Theorems on Probability, Mathematical Expectation, Binomial, Poisson, and Normal Distributions. **Hypothesis Test:** p-Test, z-test, t-test, Chi-Square test, ANOVA Test.	7
IV	**Vector Differentiation:** Introduction, Vector differential operators, Gradient, Divergent, Curl, Physical Interpretation of Vector Differentiation, Directional Derivatives, Solenoidal, Irrotational and conservative fields, Scalar Potential.	8

V	**Fourier Transform (FT):** Complex exponential form of Fourier series, Fourier integral theorem, Fourier Sine & Cosine integrals, Fourier transform, Fourier Sine and Cosine transforms and their inverses	**7**
VI	**Z - Transform (ZT):** Introduction, Standard properties, Z Transform of discrete functions and their inverses. Solution of difference equations.	**8**
	Total	**45**

Text Books:

1. B.V. Ramana , "Higher Engineering Mathematics", Tata McGraw-Hill, 34 edition, ISBN 13:9780070634190
2. Erwin Kreyszig, "Advanced Engineering Mathematics" Wiley Eastern Ltd.,10 Edition, ISBN 13: 9780470458365

Reference Books:

1. Peter V. O'Neil, "Advanced Engineering Mathematics", Thomson Learning ,7 Edition, ISBN 13: 9781337274524
2. M. D. Greenberg , "Advanced Engineering Mathematics", Pearson Education, 2 Edition, ISBN 13: 9780486492797
3. S.R.K. Iyengar, Rajendra K. Jain, "Advanced Engineering Mathematics", Alpha Science International, Ltd,4 Edition, ISBN 13: 9781842658468
4. B. S. Grewal , "Higher Engineering Mathematics", Khanna Publication, 42 Edition, ISBN 13: .9788174091955
5. N. P. Bali, Manish Goyal, " A textbook of Engineering Mathematics", 9th Edition, ISBN 16:978-8131808320

Web references:

1. **NPTEL Course lectures links:**
   https://nptel.ac.in/courses/111/105/111105090/ (Probability)
   https://onlinecourses.nptel.ac.in/noc20_ma13/ (Advanced Engineering Mathematics)
2. **V-lab (IIT-Bombay) link**: http://vlabs.iitb.ac.in/vlabs-dev/labs/numerical_lab/labs/explist.php

Program:	B. Tech. (Computer Engineering)					Semester: III	
Course:	Discrete Mathematics					Code:BCE3201	
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
2	-	2	2	20	30	50	100

Prior Knowledge of :
Linear Algebra and Univariate Calculus
is essential.

Course Objectives:

1. To use appropriate set, function and relation models to understand practical examples and interpret the associated operations and terminologies in context.
2. To learn logic and proof techniques to expand mathematical maturity.
3. To interpret set theory, graph theory and algebraic structure.
4. To formulate problems precisely, solve the problems, apply formal proof techniques and explain the reasoning clearly.

Course Outcomes:

After learning the course, students will be able to:

1. Solve real world problems logically using appropriate set and logic.
2. Identify various types of relations, functions and their properties.
3. Use the concept of graphs, trees and related discrete mathematics for problem solving.
4. Comprehend the basic results of group and ring theory.

Detailed Syllabus

Unit	Description	Duration (H)
I	**Set Theory and Logics:** Significance of Discrete Mathematics in Computer Engineering, Application areas in Computer Engineering. **Set Theory:** Introduction to Set, Set Representation, Set Builder Form, Roster Form, Types of Sets, Set Operations, Principle of Inclusion and Exclusion. **Logics and Proofs:** Propositions, Conditional Propositions, Truth Tables, Logical Connectivity, Proposition Calculus, Universal and Existential Quantifiers, Translating English Statements into Propositions, Mathematical Induction.	7
II	**Relation & Function:** **Relation:** Relation Definition, Properties of Binary Relations, Closure of Relations, Warshall‟s Algorithm, Equivalence Relations and Equivalence Classes, Partitions, Partial Ordering Relations, Hasse Diagrams and Lattices, Chains and Anti-chains. **Function:** Function Definition, Composition of Functions, Injective, Surjective and Bijective Function, Inverse of a Function.	7

III	**Graph &Trees:** Basic Terminology and Special Types of Graphs, Paths and Circuits, Hamiltonian and Euler Paths and Circuits, Isomorphic Graphs, Planer Graph, Dijkstra's Shortest Path Algorithm, Case Study: Applications of Graph Theory in Computer Engineering. **Trees**: Trees, Rooted Trees, Prefix Codes, Huffman Algorithm for Optimal Tree, Spanning Trees, Minimum Spanning Trees, Kruskal‟s and Prim‟s Algorithm for Minimum Spanning Tree. Case Study: Applications of Trees in Computer Engineering.	**9**
IV	**Group Theory:** Basic Properties of Group, Semigroup & Monoid, Abelian group, Subgroup, Normal subgroup**,** Groups and Coding**,** Rings, Integral Domain and Field. Case Study: Application of Group Theory in Computer Engineering.	**7**
	Total	**30**

Textbooks:

1. C. L. Liu, “Elements of Discrete Mathematics”, Tata McGraw-Hill, 4th Edition, 2017, ISBN 978- 1259006395.

Reference Books:

1. Kenneth H. Rosen, “Discrete Mathematics and its Applications”, Tata McGraw-Hill, 8th Edition, 2018, ISBN 978-1259676512.
2. Dr. K. D. Joshi, “Foundations of Discrete Mathematics”, New Age International Limited Publishers, 2nd Edition, January 2014, ISBN-13: 978-8122435986.

Program:	B. Tech. (Computer Engineering)					Semester:III	
Course:	Digital Electronics & Computer Organization					Code:BCE3301	
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
2	-	2	2	20	30	50	100

Prior Knowledge of :
Basic Electrical and Electronics Engineering
is essential.

Course Objectives:

1. To get acquainted with the fundamental concepts Digital Electronics circuit design.
2. To develop skills for the design and implementation of combinational logic circuits.
3. To develop skills for the design and implementation of sequential logic circuits.
4. To get acquainted with the basic concept of computer organization.

Course Outcomes:
After learning the course, the students will be able to:

1. Interpret Boolean expressions for designing digital circuits using K-Maps.
2. Design Combinational digital circuits as per the specifications.
3. Compare Synchronous and asynchronous counters to design sequential digital circuits.
4. Demonstrate the basic concepts of computer organization

Detailed Syllabus

Unit	Description	Duration (H)
I	**Logic minimization:** Logic Gates,Representation of truth-table, SOP form, POS form, Simplification of logical functions, Minimization of SOP and POS forms, don"t care conditions Reduction techniques: K-Maps up to 4 variables and Quine-McClusky technique. Arithmetic Operations: - Binary Addition, Subtraction, Multiplication, Division.	8
II	**Design of Combinational Logic:** Code converter - BCD, Excess-3, Gray code, Binary Code, BCD Addition Circuits: Half- Adder, Full Adder, Half Subtractor, Full Subtractor, Binary Adder (IC 7483), BCD adder, Multiplexers (MUX): MUX (IC 74153, 74151), MUX tree, Demultiplexers (DEMUX)- Decoder. (IC 74138, IC 74154). Implementation of SOP and POS using MUX, DMUX, Comparators, Parity generators, and Checker.	8
III	**Design of Sequential Logic:** Flip-Flop: SR, J-K, D, T; Preset &Clear, Master-Slave JK Flip Flops, Truth Tables and Excitation tables, Conversion from one type to another type of Flop- Flop. Registers: SISO, SIPO, PISO, PIPO, Shift Registers, Bidirectional Shift Registers, **Counters**: Asynchronous Counter, Synchronous Counter, BCD Counter, Johnson Counter, Modulus of the counter (IC 7490), Sequence Generators.	8
IV	**Computer Organization:** Introduction: Function and structure of a computer Functional components, Interconnection of components, **Processing Unit:** Organization of a processor - Registers, ALU and Control unit, Data path in a CPU, Instruction cycle, **Input/Output Subsystem:** Access of I/O devices, I/O ports, I/O interfaces - Serial port, Parallel port, PCI bus, SCSI bus, USB bus, I/O peripherals - Input devices, Output devices, Secondary storage devices. **Memory Subsystem:** Memory cells - SRAM and DRAM cells, Internal Organization of a memory chip,	6

	Organization of a memory unit.	
Total		**30**

Textbooks:

1. R.P.Jain, "Modern Digital Electronics", Tata McGraw-Hill, 4th Edition,2010 ISBN 978-0-07-06691-16,
2. Moris Mano , "Digital Logic and Computer Design", 2017,Pearson, ISBN 978-93-325-4252-5.
3. W. Stallings , "Computer Organization & Architecture: Designing for performance", 10th Edition, 2016, Pearso Education/ Prentice Hall of India, ISBN-10: 0-13-410161-8 | ISBN-13: 978-0-13-410161-3

Reference Books:

1. John Yarbrough, "Digital Logic applications and Design", Cengage Learning, 2006, ISBN 13:978-81-315-0058-3.
2. Norman B & Bradley, "Digital Logic and Design Principles", Wiley India Ltd, 2000, ISBN 978-81-265-1258-4.
3. D. Leach, Malvino, Saha, "Digital Principles and Applications", Tata McGraw Hill, 2011, ISBN 13:978-0- 07- 014170-4.

Program:	B. Tech. (Computer Engineering)			Semester: III			
Course:	Digital Electronics Laboratory			Code: BCE3302			
Teaching Scheme				Evaluation Scheme			
Practical	Tutorial	Credit	Hours	TW	PR	OR	Total
2	-	1	2	25	-	25	50

Course Objectives:

1. To get acquainted with the fundamental concepts of Digital Electronics circuit design.
2. To develop skills for the design and implementation of combinational logic circuits.
3. To develop skills for the design and implementation of sequential logic circuits.
4. To get acquainted with the concept of design of counters in sequential logic circuits.

Course Outcomes:

After learning the course, students will be able to:

1. Interpret Boolean expressions to design digital circuits using K-Maps.
2. Design combinational digital circuits as per the specifications.
3. Design sequential digital circuits as per the specifications.
4. Compare synchronous and asynchronous counters to design digital circuits.

Guidelines for Students:

- The laboratory assignments are to be submitted by students in the form of a journal.
- Journal consists of prologue, certificate, table of contents and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, Software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory- Concept, circuit diagram, pin configuration, conclusion/analysis).

Guidelines for Laboratory /TW Assessment:

- Continuous assessment of laboratory work is done based on overall performance and Laboratory performance of students.
- Each Laboratory assignment assessment should assign grade/marks based on parameters with appropriate weightage.
- Suggested parameters for overall assessment as well as each Laboratory assignment assessment include- timely completion, performance, innovation, efficiency, punctuality, and neatness.

Guidelines for Laboratory Conduction:

- Each student must perform at least 4 assignments from group A and 3 assignments from group B and study assignment is compulsory.
- Assignments are mandatory to perform on either on digital trainer kit or online simulator.
- Students are expected to work in group of 3 to 4.

Assignment No.	Suggested List of Assignments
Group A- Assignments based on Combinational Logic Design	
1	Design & Implement Full Adder using Basic Gates and Universal Gates.
2	Design & Implement Full Subtractor using Basic Gates and Universal Gates.
3	Design and Implement Code Converters-Binary to Gray and BCD to Excess-3.
4	Design and Realization of BCD Adder using 4-bit Binary Adder (IC 7483).
5	Design & Realization of Boolean Expression for suitable combinational logic using MUX 74151 / DMUX 74154.
6	Design & Implement Parity Generator using EX-OR.
Group B- Assignments based on Sequential Logic Design	
7	Design and Realization of Flip Flop Conversion.
8	Design of Ripple Counter using suitable Flip Flops, Realization of 3 bit Up/Down Counter using MS JK Flip Flop / D Flip Flop.
9	Design & Realization of Mod -N counter using (7490 and 74193).
10	Case Study on Combination and Sequential digital circuits: Ex. Digital Watch, Traffic Signal, Calculators etc..

Reference Books:

1. John Yarbrough, ―Digital Logic applications and Design‖, Cengage Learning, ISBN – 13:978-81-315-0058-3, 2006.
2. Norman B & Bradley, ―Digital Logic Design Principles, Wiley India Ltd, ISBN:978-81-265-1258-4, 2000.
3. D. Leach, Malvino, Saha, ―Digital Principles and Applications‖, Tata McGraw Hill, ISBN – 13:978-0- 07-014170-4,2011.

Web reference:

1. www.Deldsim.com.

Program:	B. Tech. (Computer Engineering)					Semester: III	
Course:	Data Structures and Algorithms					Code: BCE3401	
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
4	-	4	4	20	30	50	100

Prior Knowledge of :

Decision control structures, loop control structures, arrays, Functions, pointers, structure and union, searching and sorting techniques.

is essential

Course Objectives:

1. To understand the standard and abstract data representation methods.
2. To operate on the various structured data.
3. To build the logic to use appropriate data structure in logical and computational solutions.
4. To understand various data searching and sorting methods with pros and cons.
5. To develop a logic for graphical modelling of real-life problems.

Course Outcomes:

After learning the course, students will be able to:

1. Apply hashing techniques to solve real life problems.
2. Apply linear data structures like linked list to solve various computing problems.
3. Design solution for computing problems using stack and queue data structures.
4. Comprehend nonlinear data structures such as trees to solve various computing problems.
5. Comprehend representations and various algorithms on graph data structures.
6. Analyze various multiway search trees and sorting techniques.

Detailed Syllabus

Unit	Description	Duration (H)
I	**Introduction to Data structures, Hashing:** Types of Data Structures - Linear & Nonlinear, Static & Dynamic, Characteristics of algorithms, Analysis of algorithms – Frequency Count, Time & Space complexity Hashing: Concepts - Hash table, issues in hashing, hash functions- properties of good hash function, division, multiplication, extraction, mid-square, folding and universal, Collision resolution strategies- open addressing and chaining.	10
II	**Linked List:** Dynamic Memory Management, Basics of Linked List, Comparison of sequential and linked organizations, Types of linked list, Singly linked list, Doubly linked list, Circular linked list. Applications: Polynomial Operations. **Case study:** Use of generalized linked list.	10
III	**Stack & Queue:** Fundamentals of stack, Stack representation using array and linked List, Operations on stack.	10

	Applications: Recursion, Validity of parentheses, Expression Conversion. Fundamentals of queue, Queue representation using array and Linked List, Types of queue – Linear Queue, Circular Queue, Double Ended Queue, Priority Queue. Applications: Job Scheduling, Josephus problem. **Case study:** Evaluation of postfix expression using stack.	
IV	**Tree:** Basic terminology, representation using array and linked list, Recursive and Non recursive Tree Traversals, Operations on binary tree: Finding Height, Leaf nodes, counting no of Nodes, Construction of binary tree from traversals, Binary Search tree (BST): Insertion, deletion of a node from BST. Threaded Binary tree (TBT): Creation and traversals on TBT. Height Balanced Tree- AVL tree. **Case study:** Max Heap, Min Heap using binary tree.	**10**
V	**Graph:** Basic Concepts, Storage representation, Adjacency matrix, adjacency list, adjacency multi list, inverse adjacency list. Traversals-depth first and breadth first search, Applications Minimum spanning Tree using Prim‟s and Kruskal‟s Algorithm. **Case study:** Shortest path calculation using graph.	**10**
VI	**Sorting Techniques & Multi way Trees:** Sorting methods- Quick sort and Merge Sort, Radix Sort, Heap sort, Shell sort. Multi way Trees: B tree, B+ tree.	**10**
Total		**60**

Textbooks:

1. Ellis Horowitz, Sartaj Sahni, Dinesh Mehta, “Fundamentals of Data Structures in C++”, University Press(India) Pvt. Ltd., 2nd Edition, 2008, ISBN-10: 8173716064/ ISBN-13:978-8173716065.
2. Varsha H. Patil, "Data Structures using C++", Oxford University Press, 1st Edition, 2012,ISBN-10: 0-19-806623-6/ ISBN-13: 978-0-19-806623-1.

Reference Books:

1. G.A.V. PAI, “Data Structures and Algorithms, Concepts, Techniques and Applications”, Tata McGraw-Hill, Volume1 1st Edition, 2017. ISBN-10: 0070667268/ ISBN-13: 978-0070667266.
2. Richard F. Gilberg& Behrouz A. Forouzan, “Data Structures, Pseudo code Approach with C”, Cengage Learning India Edition, 2nd Edition, 2007, ISBN 10: 8131503143 ISBN 13: 9788131503140.
3. Y. Langsam, M. Augenstin and A. Tannenbaum, “Data Structures using C”, Pearson Education Asia, First Edition, 2002, ISBN 978-81-317-0229-1.
4. Sartaj Sahni, Ellis Horowitz, “Fundamentals of Data Structures in C”, Orient blackswan, 2nd Edition, 2010, ISBN 81-7515-257-5.
5. Y. Langsam, M. Augenstinand, A. Tannenbaum,“Data Structures using C & C++”,Pearson Education India, Second Edition,2015, ISBN 10: 9332549311, ISBN 13: 978-9332549319.

Web Reference:

1. https://www.cs.usfca.edu/~galles/visualization/Algorithms.html

Program:	B. Tech. (Computer Engineering)						Semester: III
Course:	Object Oriented Programming						Code: BCE3402
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
4	-	4	4	20	30	50	100

Prior Knowledge of:
Computer programming and problem solving
is essential.

Course Objectives:

1. To explore the principles of Object-Oriented Programming (OOP).
2. To understand object-oriented concepts such as data abstraction, encapsulation, inheritance, dynamic binding, and polymorphism.
3. To use the object-oriented paradigm in program design.
4. To provide a foundation for advanced programming.
5. To provide programming insight using OOP constructs.

Course Outcomes:

After learning the course, students will be able to:

1. Extrapolate the concept of object-oriented programming.
2. Apply various object-oriented features for problem-solving.
3. Explore an application using inheritance and polymorphism.
4. Use the file handling concepts in the OOP application.
5. Use exception handling and generic programming in the application.
6. Articulate the concept of the standard template library.

Detailed Syllabus:

Unit	Description	Duration (H)
I	**Introduction to Object Oriented Programming:** Introduction, Role of programming languages, need to study programming languages, Characteristics of good programming languages. Introduction to various programming paradigms: Procedural, object-oriented, logical and functional, Features of OOP. Data Types: variables and constants, Class – Data members, Member Functions, and class as abstract data type, Object Visibility Modes, Constructor & Types of Constructors, Destructor, Binding – static & dynamic, Inline Function, Static Members, Static Function, Friend Function, Friend Class, Array of Objects. Case Study: Demonstrate Student Database application using classes, objects, constructor, destructor, friend function in C++.	10
II	**Inheritance using C++:** Derived class & base class Public, Protected and Private Inheritance, Types of	10

	inheritance, Ambiguity in multiple inheritance & multipath inheritance, Constructor & Destructor in Inheritance, Order of Constructor and Destructor Call. Case Study: Know about Firefox and Thunderbird as one of the popular softwares developed using C++.	
III	**Polymorphism using C++:** Introduction: Function overloading & Operator overloading: Overloading unary & binary operators, Data conversion, Pointers to Objects, this pointer, Up-casting, down-casting, Virtual function, Pure virtual function, Abstract class. Case Study: Demonstrate Polymorphism for Online Railway Reservation System using C++.	**10**
IV	**Generic Programming & Exception Handling using C++:** **Generic Programming -** Function Template Class templates Template with multiple parameters **Exception Handling -** Exception Handling: Fundamentals multiple catching nested try statements uncaught exceptions throw and rethrow Stack unwinding. Case Study : Study about use of exception handling in Symbian Operating system that was developed using C++	**10**
V	**File Handling:** Classes for file stream operation, Opening and closing a file - File mode, Error Handling functions in file, File Pointers and Their Manipulation, File Operations on Characters, File Operations on Binary Files – Variables, Class Objects, Sequential File Organization, Direct Access Files, Indexed sequential File organization, Linked Organization. Case Study: Demonstrate an application to maintain employee database using file handling	**10**
VI	**Standard Template Library:** **Standard Template Library (STL),** components of STL: Containers, algorithms and iterators, Containers- Sequence container, associative containers, container adapters, Iterators- input, output, forward, bidirectional and random access, Algorithms- basic searching and sorting algorithms, min-max algorithm, set operations Case Study**:** Demonstrate an application for managing Person Record (Name, birth date, telephone no). Perform operations – add, display, search, delete, and update using STL map.	**10**
Total		**60**

Textbooks:

1. E. Balagurusamy, "Object -Oriented Programming with C++", McGraw Hill Education, Eighth Edition, Sept. 2020, ISBN-13 : 978-9389949186.
2. Ivor Horton, Peter Van Weert, "Beginning C++20" , Novice Professional, Sixth Edition, 2020, ISBN-13: 978-1484258835 (ISBN-10: 1484258835)
3. Robert Lafore, "OOP in C++", Pearson Publishing, 4th Edition, 2001, ISBN:0672323087 (ISBN 13: 9780672323089).

Reference Books:

1. Bjarne Stroustrup, The C++ Programming language, Third edition, 2008, Pearson Education. ISBN 9780201889543.
2. Deitel, C++ How to Program, 4 th Edition, Pearson Education,2002, ISBN:81-297-0276-2.
3. Herbert Schildt, C++ The complete reference, Eighth Edition, McGraw Hill Professional, 2011, ISBN:978-00-72226805.

Program:	B. Tech. (Computer Engineering)					Semester: III	
Course:	Data Structures & Algorithms Laboratory					Code: BCE3403	
Teaching Scheme				Evaluation Scheme			
Practical	Tutorial	Credit	Hours	TW	PR	OR	Total
4	-	2	4	25	50	-	75

Course Objectives:

1. To implement linear data structures using C++.
2. To implement nonlinear data structures using C++.
3. To apply various sorting and searching techniques.
4. To build an efficient program using online platforms/judges.

Course Outcomes:

After learning the course, students will be able to:

1. Develop logic building skills to solve real life problems using data structures and algorithms.
2. Implement linear data structures to solve various computing problems.
3. Implement hashing and sorting techniques to solve real life problems.
4. Develop an application using nonlinear data structures such as tree and graph.
5. Implement data structure concepts to build efficient applications using online judge platform.

Guidelines for Laboratory Conduction:

- Assignments on all concepts covered in Group A are mandatory.
- Assignments on all concepts covered in Group B are mandatory and should be implemented on coding platforms such as HackerRank, CodeChef.
- Encourage students for appropriate use of Hungarian notation, proper indentation and comments.
- Use of open-source software is to be encouraged.
- Operating System recommended: - 64-bit Open-source Linux or its derivative.
- Programming tools recommended: - G++/GCC, Eclipse.

Guidelines for Students:

- The laboratory assignments are to be submitted by students in the form of a journal.
- Journal consists of prologue, certificate, table of contents and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, Date of Completion, Assessment grade/marks and assessor's sign, Theory-Concept, algorithm, time complexity, sample input and expected output, conclusion).

Guidelines for Laboratory /TW Assessment:

- Continuous assessment of laboratory work is done based on overall performance and Laboratory performance of students.
- Each Laboratory assignment assessment should assign grade/marks based on parameters with appropriate weightage.
- Suggested parameters for overall assessment as well as each Laboratory assignment assessment include- timely completion, performance, innovation, efficiency, punctuality and neatness.

Assignment No.	Suggested List of Assignments
Group A	
1	Consider an employee database of N employees. Make use of a hash table implementation toquickly look up the employee‟s id number.
2	Write a C++ program to implement a singly link list and perform operations such as insert,delete, display, search element from it and reverse the list.
3	Write a C++ program to perform infix to postfix conversion using stack.
4	Write a C++ program to implement the following data structures and its operations using linked list: i) Stack ii) Queue.
5	Write a C++ program to implement a threaded binary tree and its traversal.
6	Write a C++ program to perform the following operations on a height balanced tree: i) Insert a node ii) Search a node iii) Display it in ascending order.
7	Write a C++ program for the implementation of BFS and DFS for a given graph.
8	Write a C++ program to find the minimum spanning tree of a given undirected graph.
9	Write a C++ program to store the monthly salary of an employee in an array. Sort array of numbers in ascending order using Merge sort and Display details of top five employees with the highest salary.
Group B	
10	Write a C++ program to implement a doubly linked list and perform operations such as insert, delete, display and search element from it.
11	Write a C++ program to construct a binary search tree and perform insertion, deletion, searching of a node and its traversal.
12	Write a C++ program to store the monthly salary of an employee in an array. Sort array of numbers in ascending order using Quick sort and Display details of top five employees with the highest salary.

Reference Books:

1. Richard F. Gilberg& Behrouz A. Forouzan, “Data Structures, Pseudo code Approach with C”, Cengage Learning India Edition, 2nd Edition, 2007, ISBN 10: 8131503143 / ISBN 13: 9788131503140.
2. Y. Langsam, M. Augenstin and A. Tannenbaum, “Data Structures using C”, Pearson Education Asia, First Edition, 2002, ISBN 978-81-317-0229-1.
3. G.A.V. PAI, “Data Structures and Algorithms, Concepts, Techniques and Applications”, Tata McGraw-Hill, Volume1 1st Edition, 2017. ISBN-10: 0070667268/ ISBN-13: 978-0070667266.
4. Y. Langsam, M. Augenstinand, A. Tannenbaum,“Data Structures using C & C++”,Pearson Education India, Second Edition,2015, ISBN 10: 9332549311, ISBN 13: 978-9332549319.

Program:	B. Tech. (Computer Engineering)					Semester: III	
Course:	Project Based Learning – I					Code: BCE3404	
Teaching Scheme				Evaluation Scheme			
Practical	Tutorial	Credit	Hours	TW	PR	OR	Total
4	-	2	4	25	50	-	75

Course Objectives:

1. To develop critical thinking and problem-solving ability by exploring and proposing solutions to real life application.
2. To provide every student the opportunity to work in a team to inculcate professionalism.
3. To choose and implement appropriate data structure for real life application.
4. To apply appropriate Object-Oriented features for various applications.

Course Outcomes:

After learning the course, students will be able to:

1. Identify the technical aspects of the chosen project with a comprehensive and systematic approach.
2. Select appropriate data structure for implementation of chosen application.
3. Design solution to the real-life problem.
4. Develop an application using object-oriented and data structure features.
5. Explore the implemented solutions in a team

Guidelines for Instructor for Laboratory Conduction:

- Instructor must regularly monitor and mentor students for successful completion of the project throughout semester as per instructions given in list of assignments.
- Instructor is expected to form assignments from the set of suggested assignment list provided in groups- A, B, C, D.
- Instructor is expected to form 9 assignments from group A (covering all concepts Inheritance, Polymorphism, exception handling, generic programming, file handling, STL), 2 assignments from group B, 2 assignments from group C and 1 mini project from group D.
- Instructor is expected to encourage students for appropriate use of Hungarian notation, proper indentation and comments.
- Instructor is expected to encourage use of open-source software.

Guidelines for Students:

- Students are expected to choose real time application in group of 3-4 students and formulate a problem statement
- Students are expected to work on project throughout the semester.
- Throughout the PBL process, students must define and analyze the problem, generate learning issues and apply what they have learned to solve the problem.
- Each student must perform at least 13 assignments and 01 mini-project. All 9 assignments from group A (covering all concepts Inheritance, Polymorphism, exception handling, generic programming, file handling, STL), 2 assignments from group B, 2 assignments from group C, 1 mini project from group D.
- Assignments from Group C should be implemented on coding platforms such as HackerRank, CodeChef etc.
- At the end of each assignment content of OOP and Data structure is to be applied in the Project.
- Assignments should be implemented in C++ language.
- Operating System recommended: - 64-bit Open source Linux or its derivative.
- Programming tools recommended: - G++/GCC, Eclipse.

Assignment No.	Suggested List of Assignments
GROUP - A (Object Oriented Programming using C++)	
1	Define a class to represent a bank account which includes the following members as: Data members: a. Name of the depositor b. Account Number c. Withdrawal amount d. Balance amount in the account Member Functions: e. To assign initial values f. To deposit an amount g. To withdraw an amount after checking the balance h. To display name and balance. Implement the program by using features of OOP in C++. Note: I Instructor will suggest students to identify and implement classes for their application to be developed as a part of PBL-I project.
2	Write a program using C++ to create a student database system containing the following information: Name, roll number, Class, division, Date of Birth, Blood group, Contact address, telephone number. Use Class, object, inline function. Use static variables and static functions to maintain count of the number of students. Use constructor and destructor. Note: I Instructor will suggest students to identify the use of inline function, static variables and static functions for their application to be developed as a part of PBL-I project. II Instructor will suggest students to implement identified OOP features for their application to be developed as a part of PBL-I project. III Instructor will suggest students to implement Constructor and Destructor in all classes of their selected applications.
3	Consider we want to store the information of different vehicles. Create a class named Vehicle with two data member named mileage and price. Create its two subclasses: *Car with data members to store ownership cost, warranty (by years), seating capacity and fuel type (diesel or petrol). *Bike with data members to store the number of cylinders, number of gears, cooling type(air, liquid or oil), wheel type(alloys or spokes) and fuel tank size(in inches). Make another two subclasses Audi and Ford of Car, each having a data member to store the model type. Next, make two subclasses Bajaj and TVS, each having a data member to store the make-type. Now, store and print the information of an Audi and a Ford car (i.e. model type, ownership cost, warranty, seating capacity, fuel type, mileage and price.). Note: Instructor will suggest students to implement reusability feature of OOP using inheritance in their application to be developed as a part of PBL-I project.
4	Implement a class Complex which represents the Complex Number data type. Implement the following operations: a. Constructor (including a default constructor which creates the complex number 0+0i). b. Overloaded operator + to add two complex numbers. c. Overloaded operator * to multiply two complex numbers. d. Overloaded << and >> to print and read Complex Numbers.
	Write a C + + program to read and display all project information using Operator Overloading. Note: I Instructor will suggest students to identify the use of function overloading and operator overloading for their application to be developed as a part of PBL-I project. II Instructor will suggest students to implement identified function overloading and operator overloading for their application to be developed as a part of PBL-I project.

5	Create a base class called 'SHAPE' having-two data members of type double -member function get-data( )to initialize base class data members - pure virtual member function display-area( )to compute and display the area of the geometrical object. Derive two specific classes 'TRIANGLE' and 'RECTANGLE' from the base class Using these three classes, design a program that will accept the dimension of a triangle / rectangle interactively and display the area. Implement using C++. Note: I Instructor will suggest students to identify the use of function overloading and operator overloading for their application to be developed as a part of PBL-I project. II Instructor will suggest students to implement identified function overloading and operator overloading for their application to be developed as a part of PBL-I project.
6	Implement matrix class as ADT. Write a program to perform matrix addition, subtraction, and multiplication. In read matrix function, raise an exception if any attempt is made to have rows and columns beyond the array size. Raise an exception if any attempt is made to perform matrix operations on matrices which does not satisfy the matrix order criteria. Implement using C++. Note: I Instructor will suggest students to identify the use of exception handling for their application to be developed as a part of PBL-I project. II Instructor will suggest students to implement identified exception handling for their application to be developed as a part of PBL-I project.
7	Write a class template to represent a generic vector. Include member functions to perform the following tasks: a To create the vector. b To modify the value of a given element. c To multiply the vector by a scalar value. d To display the vector in the form (10, 20, 30) Note: I Instructor will suggest students to identify the use of generic programming for their application to be developed as a part of PBL-I project. II Instructor will suggest students to implement identified generic programming handling for their application to be developed as a part of PBL-I project.
8	Write a program to maintain an employee database in binary file with employee information such as empId, name, age, department, post and salary. Write function for adding new record, displaying all records, searching for a particular employee, updating employee salary and post. Note: I Instructor will suggest students to identify the use of file handling for their application to be developed as a part of PBL-I project. II Instructor will suggest students to implement identified file handling for their application to be developed as a part of PBL-I project.
9	a. Write C++ program using STL to add binary numbers (assume one bit as one number); use STL stack. b. Write C++ program using STL map for managing Person Record (Name, birth date, telephone no). Perform operations – add, display, search, delete, and update. Note: I Instructor will suggest students to identify and use STL for their application to be developed as a part of PBL- I project.
GROUP - B (Data structures using C++)	

10	Set A of customers like pizza and set B of customers like a burger. Write a C + +program to store two sets using an array. compute and display- a. Set of customers who like either pizza or burger or both b. Set of customers who like both pizza and burger. c. Set of customers who like only pizza, not burger. d. Set of customers who like only burger not pizza. e. Number of customers who like neither pizza nor burger. Note: I Instructor will suggest students to identify suitable data structure for their application to be developed as a part of PBL-I project. II Instructor will suggest students to implement identified data structure for their application to be developed as a part of PBL-I project.
11	The ticket booking system of Cinemax theatre has to be implemented using C++ program. There are 15 rows and 10 seats in each row. Doubly linked lists have to be maintained to keep track of free seats in rows. Assume some random booking to start with. Use an array to store pointers (Head pointer) to each row. On demand a. The list of available b. seats is to be displayed c. The seats are to be booked d. The booking can be cancelled Note: I Instructor will suggest students to identify suitable data structure for their application to be developed as a part of PBL-I project. II Instructor will suggest students to implement identified data structure for their application to be developed as a part of PBL-I project.
12	A Dictionary stores keywords & its meaning. Provide facility for adding new keywords, deleting keywords, updating values of any entry. Provide a facility to display whole data sorted in ascending/ Descending order. Also find how many maximum comparisons may require for finding any keyword. Use Binary SearchTree for implementation. Note: I Instructor will suggest students to identify suitable data structure for their application to be developed as a part of PBL-I project. II Instructor will suggest students to implement identified data structure for their application to be developed as a part of PBL-I project.
GROUP – C (C++ on Online Judge Platform)	
13	Write a C++ program to print all the repeated numbers with their frequency in an array in minimum time complexity
14	Write a C++ program to sort N names in alphabetical order.
15	Write a C++ Program to Check Character is Uppercase, Lowercase, Digit or Special Character.
GROUP - D (Mini project)	

16	Develop a Mini project using Object Oriented Programming and appropriate Data structure Concepts: (The sample list of statements is provided as below, but not limited to) a. Student Management System b. Library Management System c. Airline Reservation System d. Hospital Management System e. Hotel Management System f. Billing System g. Bus / Railway Reservation System h. Build a Snakes & Ladders game i. Sudoku Solver j. Maze generator k. Dictionary implementation

Reference Books:

1. Richard F. Gilberg& Behrouz A. Forouzan, "Data Structures, Pseudo code Approach with C", Cengage Learning India Edition, 2nd Edition, 2007, ISBN 10: 8131503143 / ISBN 13: 9788131503140.
2. Herbert Schildt, "C++: The Complete Reference", McGraw Hill Education, 4th Edition, July 2017, ISBN-10 : 007053246X (ISBN-13 : 978-0070532465).
3. Y. Langsam, M. Augenstin and A. Tannenbaum, "Data Structures using C", Pearson Education Asia, First Edition, 2002, ISBN 978-81-317-0229-1.
4. Bjarne Stroustrup, "The C++ Programming language" , Pearson Education , Third edition, 2008, ISBN 9780201889543.

Program:	B. Tech. (Computer Engineering)			Semester : III					
Course :	Universal Human Values (HSMC-I)			Code: BHM3101					
Teaching Scheme				Evaluation Scheme					
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	TW	PR	Total
3	-	3	3	30	-	20	-	-	50

Prior knowledge: Nil

Course Objectives:

1. To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

Course Outcomes:
After learning the course, the students will be able to:

1. Understand the relevance of Universal Human Values.
2. Interpret the concept of 'Self' & 'Body'.
3. Develop harmony in the family based on nine Universal Human Values.
4. Apply the sense of Harmony in society.
5. Take part in maintaining coexistence with Nature.
6. Integrate Universal Human Values in personal and professional life.

Detailed Syllabus

Unit	Description	Duration (H)
I	**Introduction to Value Education:** Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Right Understanding, Relationship and Physical Facility, Happiness and Prosperity – Current Scenario, Method to fulfill the Basic Human Aspirations	**06**
	Practice Session: Sharing about Oneself, Exploring Human Consciousness, Exploring Natural Acceptance	**03**
II	**Harmony in the Human Being:** Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health	**06**
	Practice Session: Exploring the difference of Needs of Self and Body, Exploring Sources of Imagination in the Self, Exploring Harmony of Self with the Body	**03**
III	**Harmony in the Family:** Harmony in the Family – the Basic Unit of Human Interaction, Values in Human-to-Human Relationship, Nine universal values in relationships viz. Trust, Respect, Affection, Care, Guidance,	**04**

	Reverence, Glory, Gratitude, Love	
	Practice Session: Exploring the Feeling of Trust, Exploring the Feeling of Respect	**03**
IV	**Harmony in Society:** Understanding Harmony in the Society, Vision for the Universal Human Order, Human Order Five Dimensions	**03**
	Practice Session: Exploring Systems to fulfill Human Goal	**02**
V	**Harmony in the Nature/Existence:** Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature, Realizing Existence as Coexistence at All Levels, The Holistic Perception of Harmony in Existence	**03**
	Practice Session: Exploring the Four Orders of Nature, Exploring Co-existence in Existence	**02**
VI	**Implications of the Holistic Understanding – a Look at Professional Ethics:** Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession	**04**
	Practice Session: Exploring Ethical Human Conduct, Exploring Humanistic Models in Education, Exploring Steps of Transition towards Universal Human Order	**06**
Total		**45**

Text Books

1. A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. Teachers" Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books

1. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
4. On Education - J Krishnamurthy
5. Rediscovering India - by Dharampal
6. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi

Web references:

http://madhyasth-darshan.info/postulations/knowledge/knowledge-of-humane-conduct/
https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw
https://youtu.be/OgdNx0X923I

Program:	B. Tech. (Computer Engineering)									Semester: III
Course :	Life Skills-III									Code : BHM3939
Teaching Scheme				Evaluation Scheme						
Practical	Tutorial	Credit	Hours	IE	MTE	ETE	TW	PR	OR	Total
2	-	-	2	-	-	-	-	-	-	-

Prior knowledge: Nil

Course Objectives:

1. To attain mental, emotional balance and spiritually to achieve self-realization and enlightenment to help better understanding of the inner personality & its establishment of harmony with the external demands.
2. To learn to build team spirit and adapt to the various skills required in various sports activities.
3. To provide a platform to express their mind, body, and emotions through performing arts.

Course Outcomes:

After completing the course, the students should be able to:

1. Achieve a balanced state of mind and enjoy improved mental, physical, emotional, and spiritual wellbeing.
2. Apply sportsmanship skills in the context of leadership, sports management etc.
3. Demonstrate the ability to think critically about a variety of visual and performing arts.

Detailed Syllabus:

Unit	Description	Duration(H)
I	**Practicing Meditation** Pranayama and Breathing exercises, Meditation Technique, Thoughtless Awareness : Through Patanjali /Sahajayoga/Vipassana /Madhyastha Darshan/ Art of Living etc., or **Sports**: Indoor Games / Outdoor Games	12
II	**Performing arts** Music, Singing, Poetry, Indian Conventional Dancing, Photography, Short Movie Making, Painting/ Sketching/ Drawing, Theatre Arts, Anchoring, Calligraphy etc.	12
	Total	24

Reference Books:

1. Vishnu Devananda, “Meditation and Mantras” ,1978.
2. Swami Vivekananda, “Patanjali‟s Yoga Sutras”, 1 Jan 2012.
3. Shri Mataji Nirmala Devi, “Sahajayoga an Introduction”
4. William Hart , S. N. Goenka, “The Art of Living”, 4 August 2009.
5. Dennis Hill, “Meditation Deep Peace”, Trafford Publishing, 7 August 2014.
6. Boria Majumdar, Sachin Tendulakar, “Sachin Tendulkar – Playing It My Way”, Hodder & Stoughton, Hachette Livre publishing, 6 November 2014.
7. Milkha Singh, “The Race of My Life”, 2013.

8. Sfurti Sahare, “Think and Win like Dhoni”, 3 July 2016.
9. Dina Serto and Mary Kom, “Unbreakable”, 19 November 2013.
10. Ronojoy Sen, “Nation at Play: A History of Sport in India”, 2015.
11. Andre Agassi, “Open”, 2009.
12. Dr. Monica Hiten Shah, “Sangeet Aradhana”, Aradhana Sangeet Academy Ahmedabad, Edition 2018.
13. Kishori Amonkar , “Recreating A Dream”, Standard Edition .
14. Veejay Sai & foreward by Girish Karnad, “Drama Queens – Women who created history on Stage”, Roli Books publication.
15. Jiwan Pani, “Back to the roots – Essays on Performing Arts of India”, 1 January 2004.

Course Syllabus
S. Y. B. Tech
Semester-IV

Program:	B. Tech. (Computer Engineering)					Semester: IV	
Course:	Microprocessor Architecture					Code: BCE4301	
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
2	-	2	2	20	30	50	100

Prior Knowledge of:
Digital Electronic and Computer Organization.
is essential.

Course Objectives:

1. To understand basic architectural features of processor.
2. To learn and distinguish the architecture and programmer's model of 80386DX processor.
3. To identify the system level features and processes of processor.
4. To acquaint the learner with application instruction set and logic to build Assembly Language Programs (ALP).

Course Outcomes:

On completion of the course, students will be able to–

1. Elaborate the architectural components of 80386dx microprocessor.
2. Explain different instructions of 80386dx instruction set.
3. Describe advanced features of 80386dx microprocessor.
4. Discuss the different elements of cache memory.

Detailed Syllabus

Unit	Description	Duration (H)
I	**Processor Organization :** Brief History of Intel Processors, Evolution of Intel processor architecture- 4 bit to 64 bit performance assessment. Introduction to 80386dx Processor - 80386dx Features and Architecture. **Basic Programming Model:** Memory Organization and Segmentation, Operating modes. Registers - General Registers , Segment Registers ,Flags Register Operand Selection-Immediate Operands, Register Operands, Memory Operands Segment Selection Effective-Address Computation Addressing modes and Formats- Immediate, Direct, Indirect, Register, Register indirect, Displacement and stack Case Study-80386 all addressing modes.	9
II	**Instruction Set:** Data Movement Instructions, Binary Arithmetic Instructions, Decimal Arithmetic Instructions, Logical Instructions, Control Transfer Instructions, String and character translation Instructions, Flag Control Instructions. **Case Study-** Intel 8086/80386dx Instruction Set Systems Architecture- Systems Registers (Systems flags, Memory Management registers, Control registers, Debug registers, Test registers),System Instructions.	8

III	Global Descriptor Table, Local Descriptor Table, Interrupt Descriptor Table, GDTR, LDTR, IDTR. Formats of Descriptors and Selector, Segment Translation, Page Translation, Combining Segment and Page translation. **Memory management unit –** Concept of virtual memory, Address translation, Hardware support for memory management. Introduction to Multicore Architecture	**8**
IV	**Cache memory unit –** Concept of cache memory, Mapping methods, Replacement Algorithms, Fetch and write mechanisms,Organization of a cache memory unit.	**5**
	Total	**30**

Textbooks:

1. Douglas Hall, "Microprocessors & Interfacing", McGraw Hill, Revised 2nd Edition, 2014 ISBN 0-07-100462-9.
2. A. Ray, K. Bhurchandi, "Advanced Microprocessors and peripherals: Arch, Programming & Interfacing", Tata McGraw Hill, 2016, ISBN 0-07-463841-6.
3. James Turley, "Advanced 80386 Programming Techniques", McGraw-Hill, 3rd edition , 2015 ISBN 10:0078813425, 13:978-0078813429.
4. Introduction to 64 bit Intel Assembly Language Programming for Linux, 2nd Edition, 2012, Ray Seyfarth, ISBN10:1478119209, ISBN-13: 9781478119203

Reference Books:

1. Ray Seyfarth, "Introduction to 64-bit Intel Assembly Language Programming for Linux", 2nd Edition, 2014, ISBN 10: 1478119209, ISBN-13: 9781478119203.
2. Jeff Duntemann, "Assembly Language Step-by-step: Programming with Linux", Wiley, 3rd Edition, 2009, ISBN 10 0470497025, ISBN-13: 978-0470497029.
3. Chris H. Pappas, William H. Murray, "80386 Microprocessor Handbooks", McGraw-Hill Osborne Media,2nd edition 2010 ISBN-10: 0078812429, 13: 978-0078812422.
4. Mohammad Rafiquzzaman, "Microprocessors: Theory and Applications: Intel and Motorola", 2nd edition 2013 Prentice Hall, ISBN 10:0966498011, 13:978:0966498011

Web references:

1. http://intel80386.com/386htm/toc.html
2. Intel 80386 Programmer's Reference Manual :https://css.csail.mit.edu/6.858/2014/readings/i386.pdf

Program:	B. Tech. (Computer Engineering)			Semester: IV			
Course:	Microprocessor Architecture Laboratory			Code: BCE4302			
Teaching Scheme				Evaluation Scheme			
Practical	Tutorial	Credit	Hours	TW	PR	OR	Total
2	-	1	2	25	25	-	50

Course Objectives:

1. To provide practical exposure to the students for Microprocessor coding knowledge.
2. To understand basic architectural features of processor.
3. To identify the system level features and processes of processor.
4. To acquaint the learner with application instruction set and logic to build Assembly Language Programs (ALP).

Course Outcomes:

On completion of the course, students will be able to–

1. Apply appropriate instructions of 80x86 processor for assembly language programming.
2. Apply different system features of 80x86 processor for assembly language programming.
3. Demonstrate assembly language program to detect processor's operating modes.
4. Describe processor's different hardware components.

Guidelines:

- Continuous assessment of laboratory work is based on overall performance and Laboratory assignments performance of student.
- Each Laboratory assignment assessment will assign grade/marks based on parameters with appropriate weightage.
- Suggested parameters for overall assessment as well as each Laboratory assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness.
- Operating System: 64-bit Open source Linux or its derivative.
- Programming Tools: Preferably using Linux equivalent or MASM/TASM/NASM/FASM.

Detailed Syllabus:

Assignment No.	Suggested List of Assignments
1	Write X86/64 Basic ALP for understanding Macro, syscall , data section and text section.
2	Write X86/64 ALP to accept a string and to display its length.
3	Write an X86/64 ALP to count number of positive and negative numbers from the array.
4	Write X86/64 ALP to convert 4-digit Hex number into its equivalent BCD number. HEX to BCD Display proper strings to prompt the user while accepting the input and displaying the result. (Wherever necessary, use 64-bit registers).
5	Write X86/64 ALP to convert 5- digit BCD number into its equivalent HEX number. BCD to HEX Display proper strings to prompt the user while accepting the input and displaying the result. (Wherever necessary, use 64-bit registers).

6	Write X86/64 ALP to perform non-overlapped block transfer without string specific instructions. Block containing data can be defined in the data segment.
7	Write X86/64 ALP to perform overlapped block transfer with string specific instructions Block containing data can be defined in the data segment
8	Write X86/64 ALP to detect protected mode and display the values of GDTR, LDTR, IDTR,TR and MSW Registers
9	Study assignment - Assembling and disassembling of computer system and Identify Describe deatils of Internal Components such as motherboard, RAM, Expansion Card,Power Supply,Internal Memory,Serial Port,Parallel Ports,Pheripherals etc.

Textbooks:

1. Douglas Hall, "Microprocessors & Interfacing", McGraw Hill, Revised 4th Edition, 2018 .
2. A. Ray, K. Bhurchandi, "Advanced Microprocessors and peripherals: Arch, Programming & Interfacing", Tata McGraw Hill, 2016.
3. James Turley, "Advanced 80386 Programming Techniques", McGraw-Hill, 3rd edition , 2015
4. Ray Seyfarth, "Introduction to 64-bit Intel Assembly Language Programming for Linux", 2nd Edition, 2012, ISBN 10: 1478119209, ISBN-13: 9781478119203.

Reference Books:

1 Jeff Duntemann, "Assembly Language Step-by-step: Programming with Linux", Wiley, 3rd Edition, 2009, ISBN 10 0470497025, ISBN-13: 978-0470497029.
2 Brey, Barry B, "8086/8088, 80286, 80386 and 80486 Assembly Language Programming", 3rd edition 2005 Prentice Hall,ISBN: 13: 9780023142475.
3 Chris H. Pappas, William H. Murray, "80386 Microprocessor Handbooks", McGraw-Hill Osborne Media,2nd edition 2004 ISBN-10: 0078812429, 13: 978-0078812422.
4 Mohammad Rafiquzzaman, "Microprocessors: Theory and Applications: Intel and Motorola", 2nd edition 2007 PrenticeHall, ISBN 10:0966498011, 13:978:0966498011.

Intel 80386 Programmer's Reference Manual:

1 http://intel80386.com/386htm/toc.html
2 https://css.csail.mit.edu/6.858/2014/readings/i386.pdf

Program:	B. Tech. (Computer Engineering)					Semester: IV	
Course:	Computer Networks					Code: BCE4405	
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
3	-	3	3	20	30	50	100

Prior Knowledge of:
Digital Electronics.
is essential.

Course Objectives:

1. To understand the fundamental concepts of networking standards, protocols and technologies.
2. To learn different techniques for framing, error control, flow control and routing.
3. To learn the role of protocols at various layers in the protocol stacks.
4. To learn network programming.
5. To develop an understanding of modern network architectures from a design and performance perspective.

Course Outcomes:

After learning the course, the students should be able to:

1. Comprehend various transmission medium and networking devices.
2. Compare various networking protocols and algorithms.
3. Illustrate layered architecture from the perspective of wired and wireless networking principles.
4. Determine various error control techniques in layered architecture.
5. Determine various flow control techniques in layered architecture.
6. Distinguish various addressing mechanisms of different layers of TCP/IP model.

Detailed Syllabus

Unit	Description	Duration (H)
I	**Physical Layer:** Introduction of LAN; MAN; WAN; PAN, Ad-hoc Network, OSI Model, TCP/IP Model, Topologies: Star and Hierarchical; Transmission Mediums: CAT5, 5e, 6, OFC and Radio Spectrum, Network Devices: Bridge, Switch, Router, Brouter and Access Point, Spread Spectrum: Frequency Hopping (FHSS) and Direct Sequence (DSSS).	8
II	**Logical Link Control Layer:** Design Issues: Services to Network Layer, Framing, Error Control and Flow Control. Error Control: Parity Bits and CRC. Flow Control Protocols: Unrestricted Simplex, Stop and Wait, Sliding Window Protocol, WAN Connectivity: HDLC	8
III	**Medium Access Control Layer:** Channel allocation: Static and Dynamic, Multiple Access Protocols: CSMA, WDMA, IEEE 802.3 Standards and Frame Formats: CSMA/CD, Binary Exponential Back -off algorithm, Fast Ethernet, Gigabit Ethernet, IEEE 802.11a/b/g/n Frame formats, CSMA/CA.	8
IV	**Network Layer:** Switching techniques, IP Protocol, IPv4 and IPv6 addressing schemes, Subnetting, NAT, CIDR, ICMP,	7

	Routing Protocols: Distance Vector, Link State, Routing in Internet: RIP, OSPF, BGP, Congestion control, MPLS, Mobile IP	
V	**Transport Layer:** Services, Berkley Sockets, Addressing, Connection establishment, Connection release, Flow control and buffering, Multiplexing, TCP, TCP Congestion Control, Real Time Transport protocol (RTP), Stream Control Transmission Protocol (SCTP), Quality of Service (QoS), Differentiated and Integrated services.	**7**
VI	**Application Layer:** Network Architectures: Client-Server; Peer To Peer, Domain Name System (DNS), Hyper Text Transfer Protocol (HTTP), Email: SMTP, MIME, POP3, Webmail, FTP, TELNET, Dynamic Host Control Protocol (DHCP), Simple Network Management Protocol (SNMP).	**7**
Total		**45**

Textbooks:

1. Andrew S. Tanenbaum, “Computer Networks”, Pearson Education India,6th Edition, 2021 ISBN: 9780136764052, 0136764053.
2. Fourauzan B., "Data Communications and Networking", 5th Edition, Tata McGraw- Hill Publications, 2013 ISBN: 1259064751 · 9781259064753.

Reference Books:

1. Kurose, Ross , “Computer Networking a Top-Down Approach Featuring the Internet”, 8/E, 2021, ISBN-10: 0136681557, ISBN-13: 9780136681557, 2021, Pearson.
2. Matthew S. G, “802.11 Wireless Networks”, O,,Reilly publications,3rd Edition, 2017, ISBN: 81-7656-992-5.

Program:	B. Tech. (Computer Engineering)					Semester: IV	
Course:	Database Management System					Code: BCE4406	
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
3	-	3	3	20	30	50	100

Prior Knowledge of:
1. Discrete Mathematics
2. Data Structure and algorithms

is essential.

Course Objectives:

1. To understand the fundamental concepts of database management. These concepts include aspects of database design, database languages, and database system implementation.
2. To provide a strong formal foundation in database concepts, technology, and practice.
3. To give systematic database design approaches covering conceptual design, logical design and an overview of physical design.
4. To make students familiar with the basic issues of transaction processing and concurrency control.
5. To learn a powerful, flexible, and scalable general-purpose database to handle big data.
6. To learn and understand Advances in Databases and Applications.

Course Outcomes:

After learning the course, students will be able to:

1. Design a relational database including developing a conceptual data model and creating a logical database schema.
2. Translate schema in appropriate normal form considering actual requirements. (L2)
3. Write SQL queries for given requirements, using different SQL Concepts
4. Write PL/SQL Code blocks for given requirements, using different SQL and PL/SQL concepts.
5. Apply different concurrency control and recovery methods in real time situations.
6. Use advanced database Programming concepts like mongoDB.

Note: Case studies mentioned in Unit IV & Unit V are just to get understanding to students, will not be considered for evaluation

Detailed Syllabus

Unit	Description	Duration (H)
I	**Introduction to Database System and ER Modeling:** Introduction to Database Management Systems, Purpose of Database Systems, Database-System Applications, View of Data, Database Languages, Database System Structure, Data Models, Database Design and ER Model: Entity, Attributes, Relationships, Constraints, Keys, Design Process, Entity Relationship Model, ER Diagram, Design Issues, Extended E-R Features, converting E-R & EER diagram into tables. **Case Study:** Design ER Model for any real time application and convert the same into tables on paper.	7

II	**SQL :** SQL: Characteristics and advantages, SQL Data Types and Literals, DDL, DML, DCL, TCL, SQL Operators, Tables: Creating, Modifying, Deleting, Updating, SQL DML Queries: SELECT Query and clauses, Index and Sequence in SQL, Views: Creating, Dropping, Updating using Indexes, Set Operations, Predicates and Joins, Set membership, Tuple Variables, Set comparison, Ordering of Tuples, Aggregate Functions, SQL Functions, Nested Queries, **Case Study:** Implementation of unit 1 case study using SQL.	**8**
III	**PL/SQL :** PL/SQL code Block, exception handlling, concept of Stored Procedures & Functions, Cursors, Triggers, **Case Study:** Implementation of unit 1 case study using SQL/PLSQL.	**8**
IV	**Relational Database Design:** Relational Model: Basic concepts, Attributes and Domains, CODD's Rules, Relational Integrity: Domain, Referential Integrities, Enterprise Constraints, Database Design: Features of Good Relational Designs, Normalization, Atomic Domains and First Normal Form, Decomposition using Functional Dependencies, Algorithms for Decomposition, 2NF, 3NF, BCNF. **Case Study:** Convert ERD of Unit 1 to Relational Database and apply Normalization.	**8**
V	**Database Transaction Management:** Transaction concept, Transaction states, ACID properties, Concept of Schedule, Serial Schedule, Serializability: Conflict and View, Cascaded Aborts, Recoverable and Non-recoverable Schedules, Concurrency Control: Lock-based, Time-stamp based Deadlock handling, Recovery methods: Shadow-Paging and Log-Based Recovery, Checkpoints. **Case Study:** Study of transaction Management in Postgre SQL.	**8**
VI	**NoSQL Databases:** Introduction to Distributed Database System- Advantages, disadvantages, CAP Theorem. Types of Data: Structured, Unstructured data & Semi-Structured Data; NoSQL Database: Introduction, need, Features, Types of NoSQL Databases: Key-value store, document store, graph, wide column stores; BASE Properties, Data Consistency model ACID Vs BASE, Comparative study of RDBMS and NoSQL, MongoDB (with syntax and usage): CRUD Operations, Indexing, Aggregation, MapReduce, Replication, Sharding. **Case Study-**Use of NoSQL databases for processing unstructured data from social media.	**6**
Total		**45**

Textbooks:

1. Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", McGraw Hill Publishers, 7th Edition, 2020 ISBN 978-0-07-802215-9.
2. Ivan Bayross, "SQL, PL/SQL the Programming Language of Oracle", BPB Publications, 2014 ISBN: 9788176569644.
3. Connally T, Begg C., "Database Systems- A Practical Approach to Design, Implementation and Management", Pearson Education, 5th Edition, 2010, ISBN 81-7808-861-4.
4. Pramod J. Sadalage and Martin Fowler, "NoSQL Distilled", Addison Wesley, ISBN 10: 0321826620, 2013, ISBN 13: 978-0321826626.

Reference Books:

1. C. J. Date, "An Introduction to Database Systems", Addison-Wesley, 8th Edition, 2004, ISBN 0321189566.
2. S. K. Singh, "Database Systems: Concepts, Design and Application", Pearson Education, 2009,ISBN 9788177585674.
3. Kristina Chodorow, Michael Dierolf, "MongoDB: The Definitive Guide", O‟Reilly Publications, 3rd Edition, 2019 ISBN 9781491954461.
4. Kevin Roebuck, "Storing and Managing Big Data - NoSQL, HADOOP and More", Emereo Pty Limited, 2011,ISBN 1743045743, 9781743045749.

Program:	B. Tech. (Computer Engineering)			Semester: IV			
Course:	Software Engineering			Code: BCE4407			
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
3	-	3	3	20	30	50	100

Prior Knowledge of :

1. Computer Programming and Problem Solving
2. Computer Programming and Problem Solving

is essential.

Course Objectives:

1. To comprehend the principles of Software Engineering
2. To apply appropriate process model for specific software project development
3. To be acquainted with methods of capturing, specifying, and analysing software requirements.
4. To apply Design principles to software project development
5. To comprehend the UML diagrams
6. To be acquainted with agile process model.

Course Outcomes:

After learning the course, students will be able to:

1. Comprehend the principles of Software Engineering.
2. Apply appropriate process model for specific software project development.
3. Get acquainted with methods of capturing, specifying, and analysing software requirements.
4. Apply Design principles to software project development.
5. Comprehend the UML diagrams.
6. Get acquainted with the agile process model.

Detailed Syllabus

Unit	Description	Duration (H)
I	**Introduction:** What is Software Engineering, Software Myth, Software engineering Knowledge-core Principles-Principles that guide each framework Activity, Software Development Life-cycle Requirement analysis, software design, coding, software testing, software maintenance, types of software maintenance. Case Study: Introduction to Safe Home.	8
II	**Unified process:** Software process Models. Generic process model-Prescriptive process model-Waterfall, Waterfall with Feedback-Incremental Process Model, Rapid Application Development (RAD) Process Model, Prototyping Process Model, Spiral Process Model, Comparison of Process Models for selection of appropriate process model for software development. The Unified Process Case Study: Safe Home.	7
III	**Software Requirement Specification:** Requirements Engineering- Problem analysis, Establishing the Groundwork-Eliciting Requirements- Developing use cases-Building the requirements model-Negotiating, validating Requirements-Requirements Analysis-Requirements Modeling Strategies, Case Study: Safe Home.	8

IV	**Agile development:** Agile Process-Extreme Programming in agile development, Pair Programming in agile development Agile software development process Models: SCRUM, Sprint Cycle, Sprint Cycle stages, SCRUM master, Kanban Boards and Methodology, Comparison of Agile with Conventional process models.	**8**
V	**Design Concepts:** Design within the context of Software Engineering, The Design Process Design concepts: The Design Model WebApp Design: WebApp Design Quality, Design Goals, A Design Pyramid for WebApps, WebApp Interface Design, Aesthetic Design, Content Design, Architecture Design, Navigation Design	**7**
VI	**Modelling with UML:** Modelling Concepts and Diagrams - Use Case Diagrams - Class Diagrams - Interaction Diagrams - State chart Diagrams - Activity Diagrams - Package Diagrams - Component Diagrams – Deployment Diagrams - Diagram Organization- Diagram Extensions. Case Study: Safe Home.	**7**
	Total	**45**

Textbooks:

1. Roger S Pressman, "Software Engineering – A Practitioner‟s Approach", Pearson Education, 8th Edition, 2019.
2. Ian Sommerville, "Software Engineering", 9th edition, 2011.
3. Unified Modeling Language User Guide, The (2nd Edition) (Addison-Wesley Object Technology Series), May 2005.

Reference Books:

1. Carlo Ghezzi, "Fundamentals of Software Engineering", Prentice Hall India, ISBN 10: 0133056996, 2002.
2. Rajib Mall, "Fundamentals of Software Engineering", Prentice Hall India, ISBN 13: 978-8120348981, 2014.
3. Pankaj Jalote, "An Integrated Approach to Software Engineering", Springer, ISBN 13: 9788173192715, 2010.

Program:	B. Tech. (Computer Engineering)					Semester: IV	
Course:	Computer Networks Laboratory					Code: BCE4408	
Teaching Scheme				Evaluation Scheme			
Practical	Tutorial	Credit	Hours	TW	PR	OR	Total
2	-	1	2	25	-	25	50

Course Objectives:

1. To establish communication among the computing nodes in various networking architectures.
2. Configure the computing nodes with understanding of protocols and technologies.
3. Use different communicating modes and standards for communication.
4. Use modern tools for network traffic analysis.
5. To learn network programming.

Course Outcomes:

After learning the course, the students will be able to:

1. Understand working and architecture of college/ organization network.
2. Design network application by using various concepts of layered architecture.
3. Write program to analyze working of various protocols and packets.
4. Demonstrate LAN and WAN protocol behavior using Modern Tools.
5. Justify the working of error control and error detection mechanism using a program.
6. Write a program to study the various header formats of protocols.

Guidelines for Student Journal

- The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Prologue, Certificate, Table of Contents, and Handwritten Write-up of each assignment (Title, Objectives, Theory- Concept in brief, Algorithm, Flowchart, Test cases, Date of Completion, Assessment grade/marks and assessor's sign, Conclusion).
- Program codes with sample output of all performed assignments are to be submitted as softcopy.
- As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal may be avoided. Use of DVD containing student's programs maintained by lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.

Guidelines for Assessment

- Continuous assessment of laboratory work is done based on overall performance and lab assignments performance of student. Each lab assignment assessment will assign grade/marks based on parameters with appropriate weightage.
- Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness.

Guidelines for Laboratory Conduction

- Set of suggested assignment lists is provided in groups- A, B, C and D. Each student must perform at least 3 assignments from group A, 2 from group B, 2 from group C and 3 from group D.
- Operating System recommended: - 64-bit Open-source Linux or its derivative.
- Programming tools recommended: - Open-Source C, C++, JAVA and PYTHON.

Programming tools like G++/GCC, Wireshark, Etheral and Packet Tracer.

Assignment No.	Suggested List of Assignments
	GROUP A (Any 3)
1	Study the college / organization network, networking devices and its working in detail. Study the college/organization Server functioning and security parameters. (If possible, plan visit to the server room)

2	Study of Networking commands. 1. ping 2. ipconfig/ifconfig 3. Tracert 4. Netstat 5. NSLookup
3	Setup a wired LAN using Layer 2 Switch and then IP switch of minimum four computers. It includes preparation of cable, testing of cable using line tester, configuration machine using IP addresses, testing using PING utility and preparing server to send file to client. Demonstrate the PING packets captured traces using Wireshark Packet Analyzer Tool.
4	Write a program for error detection and correction for 7/8 bits ASCII codes using CRC.
GROUP B (Any 2)	
5	Write a program to demonstrate subnetting and find the subnet masks.
6	Write a program to prepare TCP and UDP packets using header files and send the packets to the destination machine in peer-to-peer mode.
7	Write a program using TCP sockets for wired network to implement peer to Peer Chat (Use JAVA/PYTHON)
GROUP C (Any 2)	
8	Write a program using UDP sockets for wired network to implement: a Peer to Peer Chat (Use JAVA/PYTHON)
9	Write a program to simulate Go back N and Selective Repeat Modes of Sliding Window Protocol in peer-to-peer mode.
10	Write a program to capture and analyze following packet formats for wired network. 1. Ethernet 2. IP 3.TCP 4. UDP
GROUP D (Any 3)	
11	Configure RIP/OSPF/BGP using packet Tracer.
12	Write a program for DNS lookup. Given an IP address input, it should return URL and vice-versa.
13	Installing and configure DHCP server.
14	Write a program to simulate the behaviour of link state routing protocol to find suitable path for transmission.

Reference Books:

1. Kurose, Ross, “Computer Networking a Top-Down Approach Featuring the Internet”, 8/E, 2021, ISBN-10: 0136681557, ISBN-13: 9780136681557, 2021, Pearson.
2. Andrew S. Tanenbaum, “Computer Networks”, Pearson Education India, 6th Edition, 2021 ISBN: 9780136764052, 0136764053.
3. Fourauzan B., "Data Communications and Networking", 5th Edition, Tata McGraw- Hill Publications, 2013 ISBN: 1259064751 • 9781259064753.

Web references:

1. https://www.w3schools.com/java

Program:	B. Tech. (Computer Engineering)					Semester: IV	
Course:	Project Based Learning- II					Code: BCE4409	
Teaching Scheme				Evaluation Scheme			
Practical	Tutorial	Credit	Hours	TW	OR	PR	Total
4	-	2	4	50	-	50	100

Course Objectives:

1. To understand the fundamental concepts of database management. These concepts include aspects of database design, database languages, and database system implementation.
2. To provide a strong formal foundation in database concepts, technology, and practice.
3. To give systematic database design approaches covering conceptual design, logical design and an overview of physical design.
4. To learn a powerful, flexible and scalable general purpose database to handle big data.
5. To understand the systematic process of developing software applications for given requirements.

Course Outcomes:

After learning the course, students will be able to:

1. Design and develop Application considering requirements and using Database concepts
2. Apply Software Development Life cycle to develop Application considering requirements
3. Design a relational database including developing a conceptual data model and creating a logical database schema.
4. Translate schema in appropriate normal form considering actual requirements
5. Write SQL queries and PL/SQL Code block for given requirements, using different SQL and PL/SQL concepts
6. Use advanced database Programming concepts like MongoDB.

Guidelines for Instructor for Laboratory Conduction:

- Instructor must frame assignments on all concepts covered in Group A and Group B.

Assignment No.	Suggested List of Assignments
	GROUP A - SQL & PL/SQL
1	Decide a case study related to real time application in group of 2-3 students and formulate a problem statement for application to be developed. Propose a Conceptual Design using ER features using tools like ERD plus, ER Win etc. (Identifying entities, relationships between entities, attributes, keys, cardinalities, generalization, specialization etc.) Convert the ER diagram into tables on paper and propose a normalize Relational data model. Note: Student groups are required to continue same problem statement throughout all the assignments to design and develop an application as a part Mini Project. Further assignments will be useful for students to develop backend for system. To design front end interface students should use the different concepts learnt in the othe subjects also.

2	a Design and Develop SQL DDL statements which demonstrate the use of SQL objects such as Table, View, Index, Sequence, Synonym, different constraints etc. b Write at least 10 SQL queries on the suitable database application using SQL DML statements. Note: I Instructor will design the queries which demonstrate the use of concepts like Insert, Select, Update,delete with operators, functions, and set operator etc. II Instructor will suggest students to write similar queries for their application to be developed a part from assignment framed.
3	Write at least 10 SQL queries for suitable database application using SQL DML statements. Note: I Instructor will design the queries which demonstrate the use of concepts like all types of Join, Sub-Query and View II Instructor will suggest students to write similar queries for their application to be developed apart from assignment framed.
4	**Unnamed PL/SQL code block: Use of Control structure and Exception handling is mandatory.** Suggested Problem statement: Consider Tables: 1 Borrower (Roll_no, Name, DateofIssue, NameofBook, Status) 2 Fine (Roll_no,Date,Amt) Accept roll_no & name of book from user. ● Check the number of days (from date of issue), ● If days are between 15 to 30 then fine amount will be Rs 5per day. ● If no. of days>30, per day fine will be Rs 50 per day & for days less than 30, Rs. 5 per day. ● After submitting the book, status will change from I to R. ● If condition of fine is true, then details will be stored into fine table. ● Also handles the exception by named exception handler or user define exception handler. Note: I Instructor will Frame the problem statement for writing PL/SQL block in line with above Statement**.** II Instructor will suggest students to write similar block for their application to be developed If required.
5	**Named PL/SQL Block: PL/SQL Stored Procedure and Stored Function.** Write a Stored Procedure namely proc_Grade for the categorization of student. If marks scored by students in examination is <=1500 and marks>=990 then student will be placed in distinction category if marks scored are between 989 and900 category is first class, if marks 899 and 825category is Higher Second Class Write a PL/SQL block to use procedure created with above requirement. Stud_Marks(name, total_marks) Result(Roll,Name, Class) Note: **I** Instructor will Frame the problem statement for writing stored procedure & Function in line with above statement**.** II Instructor will suggest students to write similar named block for their application to be developed if required
6	**Cursors: (All types: Implicit, Explicit, Cursor FOR Loop, Parameterized Cursor)** Write a PL/SQL block of code using parameterized Cursor that will merge the data available in the newly created table N_RollCall with the data available in the table O_RollCall. If the data in the first table already exist in the second table, then that data should be skipped. Note: **I** Instructor will Frame the problem statement for writing PL/SQL block using all types of Cursors inline with above statement**.** II Instructor will suggest students to write similar block for their application to be developed if required

7	**Database Trigger (All Types: Row level and Statement level triggers, Before and After Triggers).** Write a database trigger on Library table. The System should keep track of the records that are being updated or deleted. The old value of updated or deleted records should be added in Library Audit table. Note: **I** Instructor will Frame the problem statement for writing PL/SQL block for all types of Triggers inline with above statement**.** II Instructor will suggest students to write similar block for required types of triggers for their application to be developed.
GROUP B - NoSQL Database	
8	Design and Develop MongoDB Queries using CRUD operations. (Use CRUD operations, SAVE method,logical operators etc)
GROUP C - Mini Project	
9	Using the database concepts covered in Group A & Group B assignments, DBMS Theory course and using concepts in Proficiency Course-1 & Software Engineering, develop application with following details: ● Follow the same Problem statement decided in Assignment -1 of Group-AF Follow the Software Development Life cycle and other concepts learnt in Software Engineering Course throughout the implementation. ● Prepare a Software Requirement Specification Document (SRS) for your application. (to be completed as case study in Software Engineering course for the problem statement decided in Assignment -1 of Group A) ● Design & demonstrate the system using some UML Diagrams. (to be completed as case study in Software Engineering course for the problem statement decided in Assignment -1of Group A) ● Develop application considering: o Front End: Java/Perl/PHP/Python/Ruby/.net/any other language learnt in ProficiencyCourse-1 o Backend: MongoDB/MYSQL/Oracle (to be kept ready parallel while executing assignments of Group A & Group B) ● Test and validate application using Manual/automation testing ● Student should develop application in group of 2-3 students and submit the Project Report which will consist of documentation related to different phases of Software Development Life Cycle: ● Title of the Project, Abstract, Introduction ● Software Requirement Specification ● Conceptual Design using ER features, Relational Model in appropriate Normalize Form. ● UML Design ● Graphical User Interface, Source Code ● Testing document Conclusion **Note:** o Instructor should maintain progress report of all assignments in group A, Group B and mini project throughout the semester from project group and assign marks as a part of the term work o Practical examination will be on assignments given in Group A & Group B only. Mini Projects in this course should facilitate Project Based Learning among students.

Reference Books:

1. Ivan Bayross, "SQL, PL/SQL the Programming Language of Oracle", BPB Publications, 2014 ISBN: 9788176569644.
2. Pramod J. Sadalage and Martin Fowler, "NoSQL Distilled", Addison Wesley, ISBN 10: 0321826620, 2013, ISBN 13: 978-0321826626.
3. Kristina Chodorow, Michael Dierolf, "MongoDB: The Definitive Guide", O‟Reilly Publications, 3rd Edition, 2019 ISBN 9781491954461.
4. Roger Pressman, "Software engineering: a practitioner's approach", McGraw Hill Education,2017, 7th Edition ISBN: 978–0–07–337597–7.

Program:	B. Tech. (Computer Engineering)					Semester : IV	
Course :	Numerical Methods (Open Elective – I)					Code : BAS4601	
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
3	-	3	3	20	30	50	100

Prior Knowledge of:

1. Univariate Calculus
2. Multivariate Calculus

is essential.

Course Objectives:

This course aims at enabling students to get acquainted with,

1. Concepts and techniques of Numerical Methods to solve systems of linear equations.
2. Numerical techniques to solve differentiation, integration, ordinary and partial differential equations, and their applications.
3. Open-source software to perform numerical techniques.

Course Outcomes:

After learning the course, the students will be able to:

1. Understand and perform the numerical methods to solve the systems of linear equations
2. Evaluate differentiation and integration using different Numerical methods.
3. Understand basic operators, packages, syntax of open-source software and develop a program for systems of linear equations, differentiation and Integration using.
4. Solve ordinary differential equations of first order using single & multistep numerical methods..
5. Apply explicit and implicit methods to solve the partial differential equations viz One-dimensional Heat equation, Wave equation and Laplace equations.
6. Analyze the solution of ODE & PDE using open-source software.

Detailed Syllabus

Unit	Description	Duration (H)
I	**System of linear equations:** Gauss elimination method by pivoting, Gauss-Jordan method, LU decomposition, Cholesky method, Relaxation method: Jacobi and Gauss-Seidel iterative methods.	7
II	**Numerical Integration:** Difference formulae for numerical differentiation, Boole's rule, Romberg integration and Gauss quadrature for double & triple integration.	8
III	**Problem Solving-I:** Solutions of systems of linear equations, Differentiation and Integration using open source software.	8
IV	**Ordinary differential equations:** Euler's method, Modified Euler's method, Runge-Kutta 4th order methods, predictor corrector method.	7
V	**Partial Differential Equations:** Explicit and Implicit method, Stability of finite difference method, Applications of finite difference analysis in boundary value problems: one dimensional diffusion equation, Wave equation, Laplace equation.	7

VI	**Problem Solving-II:** Solutions of ordinary and partial differential equations using open source software.	**8**
	Total	**45**

Text Books:

1. S.S. Sastry, "Introductory Methods of Numerical Analysis", PHI learning Pvt Ltd, 5th Edition, ISBN 10: 9788120345928
2. B. S. Grewal, "Numerical Methods in Engineering & Science", Khanna Publishers, 43rd Edition, ISBN 13: 9788174092489

Reference Books:

1. S.R.K. Iyengar, Rajendra K. Jain, "Advanced Engineering Mathematics", Alpha Science International, Ltd,4th Edition, ISBN 13: 9781842658468
2. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw-Hill, 34 edition, ISBN 13:9780070634190.
3. Abhishek K Gupta," Numerical Methods using MATLAB", Springer, First Edition, ISBN 13: 9781484201541
4. Victor A. Bloomfield, "Using R for Numerical Analysis in Science and Engineering", CRC Press, First Edition, ISBN: 9781315360492

Web references:

1. **NPTEL Course lectures links:**
   https://nptel.ac.in/courses/127/106/127106019/ (Methods of root finding)
   https://nptel.ac.in/courses/115/103/115103114/ (NM & Simulation)
   https://nptel.ac.in/courses/122/106/122106033/ (N.M. with programming)
2. **V-lab (IIT-Bombay) link**: http://vlabs.iitb.ac.in/vlabs-dev/labs/numerical_lab/labs/explist.php

Program:	B. Tech. (Computer Engineering)			Semester : IV			
Course::	Mathematical Optimization (Open Elective-I)			Code : BAS4602			
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
3	-	3	3	20	30	50	100

Prior Knowledge of:

1. Linear Algebra & Univariate Calculus
2. Multivariate Calculus
3. Applied Mathematics.

Is essential

Course Objectives:

This course aims at enabling students to

1. Develop a practical approach to mathematical problem solving.
2. Get familiar with many commonly used tools and techniques in numerical work.
3. Understand the different mathematical approaches for optimization.

Course Outcomes:

After learning the course, the students will be able to:

1. Formulate and solve linear programming models using basic theoretical principles.
2. Apply variants of Simplex methods and duality to find optimal solutions for constrained and unconstrained problems.
3. Understand basic operators, packages, syntax of software to develop programs to optimize Linear Programming Problems.
4. Solve transportation and assignment problems using optimization techniques.
5. Analyze the project network and nonlinear problems using different methods to optimize models.
6. Develop programs for transportation and assignment problems and Nonlinear Programming problems

Detailed Syllabus:

Unit	Description	Duration (H)
I	**Linear Programming(LP)-I:** Introduction, formulation of Linear Programming problems, Graphical solution method, alternative or multiple optimal solutions, Unbounded solutions, Infeasible solutions, Maximization–Simplex Method,	7
II	**Linear Programming (LP)-II:** Minimization – Simplex method, Simplex Algorithm using Big-M method, Two phase method, Unrestricted variables, Degeneracy, Types of linear programming solutions.	8
III	**Duality:** Duality in linear programming, Formulation of Dual Linear programming problems. **Problem Solving-I:** Solutions of LPP using software.	8
IV	**Transportation Problems:** Introduction, Mathematical model of transportation problem, transportation algorithm, Methods of finding initial solutions: North-west Corner rule, Least cost method, VOGEL"s approximation method, Optimality of initial solution using MODI Method. Assignment Problems: Introduction, Mathematical model of Assignment problem, solutionstoAssignmentproblemsusingHungarianmethod,variationsinAssignment problems	7
V	**Network Analysis:** Network diagram, Project management: PERT and CPM, Critical path analysis, Project scheduling with	8

	uncertain activity time, Project time-cost, trade- off.	
VI	**Nonlinear programming:** Introduction, General nonlinear programming problem, Graphical solution method, Quadratic programming: Kuhn-Tucker conditions. **Problem Solving-II:** Solutions of Assignments and Transportation problems and nonlinear optimization problems using software.	**7**
Total		**45**

Text Books:

1. RaoSS,EngineeringOptimizationtheoryandPractice,WillyEasterLtd.4thEdition,ISBN: 978-0-470- 18352-6
2. TahaHamdy,OperationResearch:AnIntroduction,PearsonEducation,9thEdition,ISBN:0134444019

Reference Books:

1. SharmaS.D.OperationResearch,KadarNathRamNath&Co.Edition,ISBN: 9380803389
2. MatteoFischetti,"Introductiontomathematicaloptimization",FirstEdition,ISBN:9781692792022
3. JudithL.Gersting,"MathematicalStructuresforComputerScience",FreemanCo,4Edition,ISBN: 9780716783060
4. PeterV.O'Neil,"AdvancedEngineeringMathematics",ThomsonLearning,7Edition,ISBN13: 9781337274524
5. HiraandGupta,"Operationresearch",S.Chandpublication,ISBN(13): 9788121909686.
6. SharmaJ.K."OperationsResearch-TheoryandApplications",TrinityPress,6Edition,ISBN:9789385935145

Web references:

1. NPTELCourselectureslinks:

https://nptel.ac.in/courses/111/102/111102012/(LPP)
https://nptel.ac.in/courses/110/106/110106059/(Transportation&AssignmentsProblems)

Program:	B. Tech. (Computer Engineering)	Semester : IV
Course :	Calculus of Variation (Open Elective- I)	Code : BAS4603

Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
3	-	3	3	20	30	50	100

Prior knowledge of

1. Linear Algebra & Univariate Calculus
2. Multivariate Calculus

is essential.

Course Objectives:

After completion of the course, students will have adequate background, conceptual clarity and knowledge of mathematical principles related to:

1. Formulation of variational problems and analysis of key properties of system behavior.
2. Construction of variational problem for multivariate functional and it's solution
3. Application of mathematical methods of calculus of variation to construct finite element structure for several engineering problems

Course Outcomes:

After learning the course, the students should be able to:

1. Solve variational problems to optimize constrained and unconstrained functional.
2. Apply Euler-Lagrange's equation to determine stationary paths of a multivariable functional.
3. Understand basic operators, packages, syntax of software to develop programs to optimize functional.
4. Apply theory & techniques of calculus of variation for boundary value problems.
5. Discuss finite element models for ordinary differential equations.
6. Analyze the solution and FEM models of ordinary differential equations using open-source software.

Detailed Syllabus:

Unit	Description	Duration (H)
I	**The foundations of calculus of variations** Introduction, The Euler-Lagrange differential equation, Minimal path problems, opens boundary variational problems. **Constrained variational problems.** Algebraic boundary conditions, Lagrange"s solution, Isoperimetric problems, Closed-loop integrals,	7
II	**Multivariate functional** Variational problems in parametric form, Functional with two independent variables, Minimal surfaces, Functional with three independent variables (only conversion). **Higher order derivatives** The Euler-Poisson equation, The Euler-Poisson system of equations, Algebraic constraints on the derivative.	8
III	**Problem Solving-I:** Solutions of constrained and unconstrained variational problems using open source software.	8
IV	**Approximate methods** Euler's method, Rayleigh-Ritz method, Galerkin's method	7
V	**Finite Element Methods** Boundary integral method, Finite element method, Case Studies.	8

VI	**Problem Solving-II:** Solutions of Approximate and FEM models using open source software.	**7**
Total		**45**

Text Books:

1. Mark Kot, “A First Course in the Calculus of Variations”, AMS, ISBN: 978-1-4704-1495-5
2. A.S. Gupta , “Calculus of Variation with applications” , PHI Learning PVT LTD, ISBN: 978-8120311206

Reference Books:

1. L.Elsgolts, “Differential equations and calculus of variations”, MIR Publications, ISBN 13: 978-1410210678
2. B. S. Grewal , “Higher Engineering Mathematics”, Khanna Publication, 42 Edition, ISBN 13: .9788174091955
3. Krishnamoorthy C. S., “Finite element analysis: theory and programming”, Mcgraw hill education (India) pvt. Ltd., 2 Edition, ISBN 13: 9780074622100
4. Moaveni, Saeed, “Finite element analysis: theory and application with ansys” Pearson education pvt.. ltd, 2 Edition, ISBN: 0137850980

Web references:

1. **NPTEL Course lectures links:**
   https://nptel.ac.in/courses/111/104/111104025/ (Functional)
   https://nptel.ac.in/courses/112/104/112104193/ (FEM)

Program:	B. Tech. (Computer Engineering)			Semester : IV			
Course :	Mathematical Modeling and Simulation (Open Elective-I)			Code : BAS4604			
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
3	-	3	3	20	30	50	100

Prior knowledge of

1. Linear Algebra & Univariate Calculus
2. Multivariate Calculus
3. Higher order of differential equations.

is essential.

Course Objectives:

After completion of the course, students will have adequate background, conceptual clarity and knowledge of mathematical principles related to:

1. Mathematical Modeling and its uses in different engineering disciplines.
2. Mathematical techniques that can be used to build a proper mathematical model for a given engineering problem.
3. Simulation of mathematical models using open source software.

Course Outcomes:

After learning the course, the students will be able to:

1. Identify the types of mathematical modeling according to the real life problem.
2. Build a simple mathematical model.
3. Understand basic operators, packages, syntax of software to develop programs for analytical solutions of ordinary and partial differential equations.
4. Apply Explicit and Implicit methods to partial differential equations for analyzing heat, wave and Laplace equations.
5. Predict the performance of the mathematical model.
6. Develop programs for Numerical Solutions of ordinary and partial differential equations using open-source software.

Detailed Syllabus:

Unit	Description	Duration (H)
I	**Basics of Mathematical Modeling:** Introduction, open and closed systems, advantages and limitations, properties, needs and techniques used, discussion on non-uniqueness of models. Classification of mathematical models: Classical and Continuous models, Deterministic, Probabilistic and Stochastic models, Areas of applications.	7
II	**Procedure and Techniques of Mathematical Modeling:** Procedure: Introduction, Identification of parameters, significant parameters, reduction of an open problem to a closed form, Techniques: Analytical Methods, Numerical Methods, Computer simulation, physical interpretation, case studies.	8
III	**Problem Solving-I:** Analytical Solutions of ordinary and partial differential equations using open source software.	8

IV	**Numerical Methods:** Explicit and Implicit finite difference scheme, Stability of finite difference method, Applications of finite difference analysis in boundary value problems: one dimensional diffusion equation, Wave equation, Laplace equation.	**7**
V	**Prediction of Performance:** Steps involved in a computer model, predict performance of an experimental system, Numerical Simulation and its Validation, Multiscale modeling, Sensitivity analysis.	**7**
VI	**Problem Solving-II:** Numerical Solutions of ordinary and partial differential equations using open source software.	**8**
	Total	**45**

Text Books:

1. Frank Severance,System Modeling and Simulation: An Introduction", John Wiley & Sons limited,2001, ISBN:978-8126519606
2. S.S. Sastry, "Introductory Methods of Numerical Analysis", PHI learning Pvt Ltd, 5th Edition, ISBN 10: 9788120345928
3. Erwin Kreyszig, "Advanced Engineering Mathematics" Wiley Eastern Ltd.,10 Edition, ISBN 13: 9780470458365

Reference Books:

1. Averill Law, "Simulation modeling and analysis" , Mc-graw Hill Publication, 5 Edition, ISBN: 9780073294414
2. Abhishek K "Gupta, Numerical Methods using MATLAB", Springer, First Edition, ISBN 13: 9781484201541
3. John A Sokolowski and Catherine M Banks ,"Principles of Modeling and Simulation", John Wiley, First Edition, ISBN:9780470289433

Web references:

1. **NPTEL Course lectures links:**
   https://nptel.ac.in/courses/111/107/111107113/ (Mathematical Modelling)
   https://nptel.ac.in/courses/115/103/115103114/ (NM & Simulation)
   https://nptel.ac.in/courses/122/106/122106033/ (N.M. with programming)

2. **V-lab (IIT-Bombay) link**: http://vlabs.iitb.ac.in/vlabs-dev/labs/numerical_lab/labs/explist.php

Program:	B. Tech. (Computer Engineering)			Semester: III			
Course:	Financial Mathematics (Open Elective – I)			Code: BAS4605			
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
3	-	3	3	20	30	50	100

Prior knowledge of:

1. Basic Mathematics
2. Probability

is essential.

Course Objectives:

The course aims at:

1. Address issues related to globalization of financial markets,
2. Development and Feasibility of financial transactions,
3. Provide the students with knowledge of a range of mathematical and computational techniques that are required for a wide range of quantitative positions in the financial sector
4. Forecasting market developments.

Course Outcomes:

After learning the course, the students will be able to:

1. Demonstrate knowledge of the fundamental concepts of financial mathematics
2. Identify various types of cash flow patterns, Compute the future value and the present value of different cash flow streams.
3. Understand types of Options and apply it to hedge against risks in existing investments.
4. Understand the characteristics of different financial assets such as money market instruments, bonds, and stocks, and how to buy and sell these assets in financial markets.
5. Describe and to analyze the investment environment, different types of investment vehicles;
6. Analyze the degree of risk for its effective management

Detailed Syllabus:

Unit	Description	Duration (H)
I	**Fundamentals of Financial Mathematics I:** Introduction of Financial Mathematics and its application in real life, Sources of Finance; Short term finance and Long term Funds (basics), Rate of interest, simple interest, compound interest.	7
II	**Fundamentals of Financial Mathematics II:** The time value of money, annuities and cash flows, loans, general cash flows and portfolios, derivatives, swaps, and hedging.	8
III	**Basics of Options :** Options; (call option and put options), payoffs call and put options, speculation (call or put) and its application (option).	8
IV	**Stocks and bonds:** Stocks and bonds, Valuation of stocks and bonds, Mutual funds, Cost of capital and ratio analysis.	7

V	**Basics of Investment:** Investment return. Uneven cash flows Compounding frequency of interest, Economic equivalence. Portfolio diversification	**7**
VI	**Risk & uncertainty:** Decision under risk & uncertainty, Risk premium, Portfolio diversification, Life Insurance, Endowment	**8**
Total		**45**

Text Books:

1. Marek Capinski and Tomasz Zastawniak, "Mathematics for Finance", Springer 2nd Edition, ISBN 13:978-0857290816.
2. Ambad Nazri Wahidudin, "Financial Mathematics and its Applications", Ventus Publishing ApS, ISBN 978-8776819286

Reference Book:

1. Giuseppe Campolieti Roma M. Makarov "Financial mathematics a Comprehensive treatment", CRC Press Taylor and francis Group, 1st Edition, ISBN 978-1439892428

Web references:

1. **NPTEL Course lectures links:**
   https://nptel.ac.in/courses/112/107/112107260/

Program:	B. Tech. (Computer Engineering)			Semester : IV			
Course :	Neural Network and Fuzzy Logic Control (Open Elective-I)			Code : BAS4606			
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
3	-	3	3	20	30	50	100

Prior Knowledge: Nil

Course Objectives:

This course aims at enabling students to get acquainted with,

1. Knowledge of Neural Networks and its use for controlling real time systems.
2. Knowledge about fuzzy set theory to solve various engineering problems.
3. Open-source software to perform NN toolbox and Fuzzy Logic Toolbox

Course Outcomes:

After learning the course, the students will be able to:

1. Understand the architecture of Neural networks and types of Neural Networks.
2. Apply backpropagation and optimizers algorithms to update weights of Neural Network.
3. Understand basic operators, packages, syntax of software and Train the neural networks using MATLAB toolbox.
4. Understand the various fuzzification and defuzzification methods.
5. Apply a fuzzy logic control system to handle uncertainty and solve engineering problems.
6. Implement a fuzzy logic toolbox in fuzzy control system.

Detailed Syllabus

Unit	Description	Duration(H)
I	**Architecture of Neural Network:** Introduction,Biological neuron, Artificial neuron, Neuron modeling, Activation Function, Learning Techniques, Basic learning rules, Types of Neural Network: Single layer feedforward, Multi-layer feed forward network, Recurrent Neural Network.	7
II	**Neural Networks For Control:** Loss function, Weight initialization, Back propagation Neural Network, Optimizers algorithms, Feedback networks, Associative Memory Network and it‟ types, Discrete time hop field networks.	8
III	**Problem Solving-I:** Neural Network (NN) Toolbox, NN Simulink Demos, Neural Network (ANN) implementation, NN Tool Artificial Neural Network (ANN) implementation, Case studies-	7
IV	**Fundamental of Fuzzy Logic:** Fundamental of Fuzzy Logic: Classical sets, Fuzzy Sets, Membership function, Cardinality of fuzzy set, Fuzzy complement, Fuzzy Composition, properties and operation on Fuzzy sets, Fuzzy Relation, Fuzzification, Defuzzification	8
V	**Fuzzy Logic Control:** Fuzzy Rule, Decision making Logic, Linguistic variables, Inferences, Fuzzy Inference system: Mamdani FIS, Sugeno FIS, Designing Fuzzy Controller, Fuzzy optimization, Introduction to generate a genetic algorithm, Applications of FIS.	7

VI	**Problem Solving-II:** Fuzzy Logic Toolbox, Fuzzy Logic Simulink Demos, Fuzzy Logic Controller (FLC) implementation, Simulink Fuzzy Logic Controller (FLC) implementation, Applications of FLC to Control System.	**8**
Total		**45**

Text Books:

1. Kosko, B, "Neural Networks and Fuzzy Systems: A Dynamical Approach to Machine Intelligence", PrenticeHall, NewDelhi, 2004.
2. Ross T. J. , "Fuzzy logic with engineering applications (Vol. 2)", New York: Wiley, 2004, ISBN: 9783030375478

Reference Books:

1. Jack M. Zurada, "Introduction to Artificial Neural Systems", PWS Publishing Co., Boston, 2002.
2. Zimmerman H.J., "Fuzzy set theory and its Applications", Kluwer Academic Publishers Dordrecht, 2001.
3. Driankov,Hellendroonb, "Introduction to fuzzy control", Narosa Publishers,2001.
4. G Klir, B Yuan, "Fuzzy sets and fuzzy logic : Theory and application", PHI, ISBN:
5. LauranceFausett, Englewood cliffs, N.J., "Fundamentals of Neural Networks", PearsonEducation, New Delhi, 2008.
6. B Yegnanarayana : Artificial Neural Networks for pattern recognition ,PHI Learning Pvt. Ltd., 14-Jan-2009

Web references:

1. Online course "Fuzzy logic and Neural Network" by Prof. Dilip Kumar Pratihar, IIT Kharagpur. https://nptel.ac.in/courses/127/105/127105006/

Program:	B. Tech. (Computer Engineering)			Semester : IV					
Course :	Professional Skills for Engineers			Code : BHM4101					
Teaching Scheme				Evaluation Scheme					
Lecture	Practical	Credit	Hours	IE	MTE	ETE	TW	PR	Total
1	2	2	3	30	-	20	-	-	50

Prior Knowledge :
1. Basic Language Skills

Is essential

Course Objectives:

This course aims at enabling students:
1. To introduce students to the fundamentals of effective communication
2. To introduce students to the skills to prepare and deliver effective presentations and learn techniques of mastering group discussions.
3. To introduce students to interview skills and corporate etiquettes
4. To introduce students to professional ethics and organizational skills

Course Outcomes:

After learning the course, the students will be able to
1. Understand the nuances of effective communication skills at the workplace.
2. Demonstrate presentation skills and group discussions skills to excel in the professional environment.
3. Apply interview skills and corporate etiquettes effectively to hone the opportunities of employability.
4. Analyze career management skills that can lead to improved employment.

Detailed Syllabus

Unit	Description	Duration (H)
I	**Introduction and Fundamentals of Communication:** Need for effective communication, Functions of Communication, Organizational Communication, Verbal-Oral and Written communication, Non-verbal communication, Barriers to Effective Communication	11
II	**Presentation Skills:** 4Ps (Planning, Preparation, Practice, Presentation), guidelines for developing PPT, Outlining, Effective use of A/V aids and Modes of Delivery **Mastering Group Discussion skills:** Skills evaluated in Group discussion, Types of Group discussion- Factual, Abstract, Controversial and Case studies, Do's and Don'ts in Group Discussion	12
III	**Interview Skills:** Interview Process, Types of Interview: Job interview, Appraisal Interview, Exit, Interview, Panel Interview; Self Introduction, Pre and Post interview activities, Skills evaluated in interview, Do's and Don'ts during Interview **Cover letter & Resume**: Job Application letter, Difference between CV and Resume Writing skills, Resume writing, Writing SOPs	11

	Corporate Etiquettes: Dressing Etiquettes, Dining Etiquettes, Telephonic etiquette, Business card Etiquettes, Email etiquettes	
IV	**Professional Ethics:** Integrity, Objectivity, Professional competence and due care, Confidentiality Professional behavior. **Organizational Skills:** Physical Organization, Digital Organization, Planning, Time management & Communication	**11**
Total		**45**

Text Book:

1. R.Gajendra Singh Chauhan and Sangeeta Sharma, Soft Skills-An Integrated Approach to Maximize Personality, Wiley Publication, ISBN: 987-81-265-5639-7

Reference Books:

1. Muralikrishna C., Sunita Mishra, Communication Skills for Engineers 2nd edition, Pearson, 2. New Delhi 2010
2. Indrajit Bhattacharya, An Approach to Communication Skills, DhanpatRai, Delhi, 2008 4.
3. Simon Sweeney, English for Business Communication, Cambridge University Press.
4. Sanjay Kumar and Pushpa Lata, Communication Skills, Oxford University Press.
5. Barun K.Mitra, Personality Development & Soft Skills, Oxford University Press, 2012 New Delhi.

Web references:

1. https://nptel.ac.in/courses/109107121
2. https://nptel.ac.in/courses/122106031https://www.coursera.org/learn/principles-of-management (Ethics)

Program:	B. Tech. (Computer Engineering)					Semester: IV	
Course:	C# .Net (Proficiency Course -I)					Code: BCE4911	
Teaching Scheme				Evaluation Scheme			
Practical	Tutorial	Credit	Hours	TW	PR	OR	Total
2	-	-	2	-	-	-	-

Prior Knowledge of:

Decision control structures, loop control structures, arrays, Functions, pointers, structure and union, searching and sorting techniques.

is essential.

Course Objectives:

1. To understand the MS.NET Framework.
2. To understand basic of c# programming.
3. To learn object-oriented Programing using c#.
4. To learn and understand Database Programming Using ADO.NET.

Course Outcomes:

After learning the course, the students will be able to:

1. Understand the use of Microsoft .Net Framework.
2. Write the basic programs using C# programming.
3. Demonstrate OOP concepts using C#.
4. Understand assemblies & deployment in .Net.
5. Develop GUI based applications using C# components.
6. Demonstrate the concepts of Database connectivity using ADO .Net concepts.

Guidelines:

- The laboratory assignments are to be submitted by students in the form of a journal.
- Journal consists of prologue, Certificate, table of contents, and handwritten write-up of each assignment.
- Each assignment write-up should have Title, Objectives, Out comes, Theory- Concept in brief, Algorithm, Flowchart, Testcases, Conclusion, Assessment grade/marks and assessor's sign.
- Program codes with sample output of all performed assignments are to be submitted as softcopy.

Assignment No.	Suggested List of Assignments
1	**Assignment will be conducted based on following topics.** **MS.NET Framework Introduction:** The .NET Framework an Overview, Framework Components, Framework Versions, Types of Applications which can be developed using MS.NET, MS.NET Base Class Library, MS.NET Namespaces, The Common Language Runtime (CLR) ,MS.NET Memory Management / Garbage Collection.

2	**Assignment will be conducted based on following topics.** **C # Language Syntax:** Why Datatypes Global, Stack and Heap Memory, Common Type System, Reference Type and Value Type, Datatypes & Variables Declaration, Implicit and Explicit Casting, Checked and Unchecked Blocks, Overflow Checks.
3	**Assignment will be conducted based on following topics.** **C # Language Syntax**: Enum and Constant, Operators, Control Statements, Working with Arrays, Working with Methods, Pass by value and by reference and out parameters.
4	**Assignment will be conducted based on following topics**. **OOPs-Concept:** Learning about Class, Object, Component, Encapsulation, Inheritance, Polymorphism & Object Creation and Instantiation, programming Encapsulation, Inheritance, Interface & Polymorphism, What is a DLL and how is it different from EXE.
5	**Assignment will be conducted based on following topics.** **Developing GUI Application:** Basic Controls, Panel & Layouts, Drawing and GDI Devices, MenuStrip, Toolbar Strip and ContextMenuStrip, Multiple Document Interface (MDI), Building Login Form, Using Components like Timer, Filesystem Watcher, Process, Background Worker, Working with Advanced Controls like TreeView and ListView.
6	**Assignment will be conducted based on following topics.** **Database Programming Using ADO.NET:** Introduction and Evolution of ADO.NET, How to implement Login facility with database, Writing Provider Independent Code.

Textbooks:

1. Arthur Gittleman, "Computing with C# and the .Net Framework", Jones and Bartlett Publishers, 2nd Edition, 2011, ISBN 13: 978-1449615505.
2. Joyce Farretlhl "Microsoft Visual C#: An Introduction to Object-Oriented Programming (Looseleaf)", Cengage Learning, 7 Edition, 2018, ISBN 13: 9781337685771.

Reference Books:

1. Ben Albahari, Peter Drayton & Brad Merrill, "C# Essentials", O'Reilly, 2nd Edition, 2002, ISBN-13 978-0596003159.
2. Joseph Albahari & Ben Albahari, "C# 5.0 In a Nutshell: The Definitive Reference", O'Reilly, 5th Edition, 2006, ISBN-13 978-1449320102.

Program:	B. Tech. (Computer Engineering)			Semester: IV			
Course:	Java Programming (Proficiency Course -I)			Code: BCE4912			
Teaching Scheme				Evaluation Scheme			
Practical	Tutorial	Credit	Hours	TW	PR	PR	Total
2	-	-	2	-	-	-	-

Prior Knowledge of:

Decision control structures, loop control structures, arrays, Functions, pointers, structure and union, searching and sorting techniques.

is essential.

Course Objectives:

1. To understand the basic concepts of Java.
2. To learn object-oriented programming using Java.
3. To learn and understand exception handling and wrapper classes.
4. To learn and understand I/O packages and threading in Java.
5. To learn front end design using SWING and JavaFX.

Course Outcomes:

After learning the course, students will be able to:

1. Compare various data types, conditional and looping constructs in Java.
2. Demonstrate Java classes, various overloading and overriding methods in Java
3. Apply concepts of inheritance and polymorphism for applications.
4. Illustrate interfaces of data structure in JAVA
5. Apply multithreading concepts for concurrent execution of the program.
6. Justify real-time applications on Java Platform .

Guidelines:

- The laboratory assignments are to be submitted by students in the form of a journal. Journal consists of prologue, Certificate, table of contents, and handwritten write-up of each assignment.
- Each assignment write-up should have Title, Objectives and Outcomes, Theory- Concept in brief, Algorithm, Flowchart, Testcases, Conclusion, Assessment grade/marks and assessor's sign.
- Program codes with sample output of all performed assignments are to be submitted as softcopy.

Assignment No.	Suggested List of Assignments
1	**Assignment will be conducted based on following topics.** **Introduction to Java programming:** The Java Virtual Machine, Variables and data types, Conditional and looping constructs, Arrays.
2	**Assignment will be conducted based on following topics.** **Object-oriented programming with Java Classes and Objects:** Fields and Methods, Constructors, Overloading methods, Garbage collection, Nested classes.
3	**Assignment will be conducted based on following topics.** **Inheritance:** Overriding methods, Polymorphism, Making methods and classes final, Abstract classes and methods, Interfaces. Exception handling with try-throw-catch-finally constructs: The Exception class, The Object class: Cloningobjects, The JDK Linked List class, Strings, Strings Conversions.

4	**Assignment will be conducted based on following topics.** **Collection Framework:** List, Set & Map interfaces, Vector, ArrayList, LinkedList, Hashtable, HashMap, TreeMap, Iterator, Enumerator,Que, Deque, SortedQue, HashSet, TreeSet, LinkedHashSet, Compare and Comparable. Introduction of Generics. Working with types: Wrapper classes, Enumeration interface Packages Package access, Documentation comments.
5	**Assignment will be conducted based on following topics.** **The I/O Package:** InputStream and OutputStream classes, Reader and Writer classes, Threads: Synchronization
6	**Assignment will be conducted based on the following topics. SWING (JFC):** Introduction Diff B/W AWT and SWING, Components hierarchy, Panes,Individual Swings components J Label, JButton, JTextField, JTextAres. JavaFX: JavaFX Architecture, JavaFX Program Structure, Shapes, Effects, LayoutComponents, Properties and Bindings, Basic UI Controls, Graphics and Animation.

Textbooks:

1. Herbert Schildt,"Java - The Complete Reference", The McGraw-Hill Education,11th Edition,2018, 978-9390491629.
2. E. Balagurusamy, "Programming with Java" McGraw Hill Education India, 6th Edition, 2019, 9789353162337.

Reference Books:

1. D.T. Editorial Services, "Java 8 Programming Black Book", Dreamtech Press India Pvt. Ltd., Paperback, 2015, 9789351197584.
2. Ken Arnold, James Gosling and David Holmes, "The Java Programming Language", Addison-Wesley, 4th Edition, 2005, 0321349806.

Program:	B. Tech. (Computer Engineering)	Semester: IV
Course :	Life Skills-IV	Code : BHM4940

Teaching Scheme				Evaluation Scheme						
Practical	Tutorial	Credit	Hours	IE	MTE	ETE	TW	PR	OR	Total
2	-	-	2	-	-	-	-	-	-	-

Prior knowledge: Nil

Course Objectives:

1. To learn about the social functioning and diverse culture in the country.
2. To be aware and improve interpersonal behavioural patterns.
3. To inculcate caring and serving qualities towards family, society and environment at large.

Course Outcomes:

After Successfully completing the course the students should be able to:

1. Apply social work practices in the context of diverse cultures.
2. Develop a broad understanding of Indian culture through various art forms.
3. Apply effective ways of interpersonal behavioural patterns eliminating their unhelpful thoughts, feelings and actions.
4. Develop skills which are necessary to initiate ideas and pursue them for holistic development of the individual.

Detailed Syllabus

Unit	Description	Duration (H)
I	**Social Welfare:** Environment awareness such as Tree Plantation, Natural resources awareness etc, Donation Camp, Visit to Orphanage, Old Age home and Villages, Contribution in social activity like Pani Foundation, Swaccha Bharat Abhiyan, Save Girl Child/Animals/Birds/Trees etc., Activity based on societal projects / Project Exhibitions etc. **Cultural Awareness** Divisions of Indian classical music: Hindustani and Carnatic, Dances of India, Various Dance forms: Classical and Regional, Rise of modern theatre and Indian cinema. **OR** **Transaction Analysis:** Introduction to TA, Basic Assumptions of TA, Theory of Personality Ego States, Strucural and Functional, Ego States Diagnosis, Egogram, Structural Pathology, Contamination, Theory of Communication, Types of Transactions, Strokes, Stroke Economy, Theory of Life Positions, Injunctions	12
II	**Caring and service:** Hospital Caring, Personal Safety, First Aid, Disaster Management Gardening, Organic farming, Cooking, etc	12
Total		**24**

Reference Books:

1. K. Singh, “An introduction to Social Work”, 14 April 2011.
2. Bishnu Mohan Dash, Mithilesh Kumar, D. P. Singh, Siddheshwar Shukla, “Indian Social Work”, 1 October 2020.

3. Martin Davies, “Social work with Children and Families”, 20 March 2012.
4. Anita Kainthla, “Baba Amte – A Biography”, 1 January 2006.
5. Aroup Chatterjee , “Mother Teresa – The untold story”, 1 January 2006.
6. Improving Behaviour and Raising Self-Esteem in the Classroom, A Practical Guide to Using Transactional Analysis, Giles Barrow, Emma Bradshaw, Trudi Newton, David Fulton Publishers, 1 October 2001.
7. Transactional Analysis, 100 Key Points and Techniques, Mark Widdowson, 8 September 2009.
8. Benjamin Colodzin, “Helping ourselves by Helping Others”, 3 August 2020.
9. Smith Mark K. “The Art of Helping Others”, Jessica Kingsley Publishers,15 April 2008.
10. Chip Heath, “Decisive: How to Make Better Choices in Life and Work”, March 26, 2013.

Program:	B. Tech. (Computer Engineering)					Semester: IV	
Course :	Constitution of India (Audit Course- I)					Code : BHM9962	
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
1	-	-	1	-	-	-	-

Prior knowledge: Nil

Course Objectives:

1. To enable the student to understand the importance of constitution
2. To identify individual role and ethical responsibility towards nation.
3. To understand human rights and its implications
4. To know about central and state government functionalities in India.

Course Outcomes:

After learning the course, the students will be able to:

1. Understand the functions of the Indian government and get acquainted with knowledge of Constitutional Amendments.
2. Identify and explore the basic features, modalities about Indian constitution and assessment of the Parliamentary System in India.
3. Differentiate and relate the functioning of Indian Political system at the Central and State level.
4. Comprehend the fundamental rights and abide the rules of the Indian constitution.

Detailed Syllabus

Unit	Description	Duration (H)
I	**Introduction to Constitution:** Meaning of the constitution law and constitutionalism, making of constitution, Salient features and characteristics of the Constitution of India, Preamble, Fundamental Rights, Directive Principles of State Policy, Fundamental Duties and it‘s legal status, Citizenship.	3
II	**System of Government- Center & State level and local level** Structure and Function of Central Government, President, Vice President, Prime Minister, Cabinet, Parliament, Supreme Court of India, Judicial Review, Federal structure and distribution of legislative and financial powers between the Union and the States, local self-government	3
III	**Judiciary:** Governor, Chief Minister, Cabinet, State Legislature Judicial System in States, High Courts and other Subordinate Courts,Parliamentary Form of Government in India.	3
IV	Constitution Functions: Indian Federal System and it‘s characteristics, Center& State Relations, President‘s Rule, ConstitutionalAmendmentsandpowers, Constitutional Functionaries,Emergency Provisions, Assessment of working of the Parliamentary System in India	3

Total		**12**

Text Books:

1. Durga Das Basu, ―Introduction to the Constitution of India ―, Prentice Hall of India, New Delhi,24th edition, 2020, ISBN-109388548868
2. Clarendon Press, Subhash C, Kashyap, ―Our Constitution: An Introduction to India‘s Constitution and constitutional Law‖, NBT, 5th edition, 2014, ISBN-97811070346

Reference Books:

1. Maciver and Page, ―Society: An Introduction Analysis ―, Laxmi Publications, 4th edition, 2007, ISBN-100333916166
2. PM Bhakshi, ―The constitution of India‖, Universal Law Publishing - An imprint of Lexis Nexis, 14th edition, 2017, ISBN-108131262375

Vision and Mission of Computer Engineering Department

Vision

To be a premier Computer Engineering program by achieving excellence in Academics and Research for creating globally competent and ethical professionals.

Mission

M1: To develop technologically competent and self-sustained professionals through contemporary curriculum.

M2: To nurture innovative thinking and collaborative research, making a positive impact on society.

M3: To provide state-of-the art computing environment and learning opportunities through Center of Excellence.

M4: To foster leadership skills and ethics with holistic development.