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

Curriculum Structure and Syllabus

S.Y.B.Tech Information Technology

(Course 2020)

Department of Information Technology

Effective from Academic Year 2022-23
(Updated with Minor Changes)

VISION AND MISSION OF INSTITUTE

Institute Vision

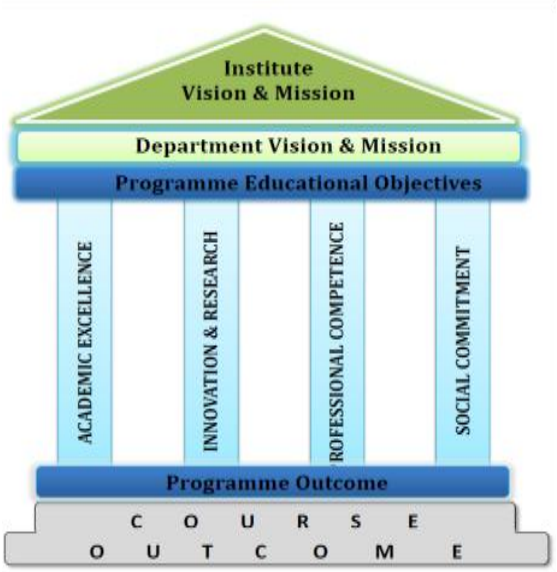
To Serve the Society, Industry and all the Stakeholders through the **Value-Added Quality Education.**

Institute Mission

To serve the needs of society at large by establishing State-of-the-Art Engineering, Management and Research Institute and impart attitude, knowledge and skills with quality education to develop individuals and teams with ability to think and analyze right values and self-reliance.

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.



	Pimpri Chinchwad Education Trust's **Pimpri Chinchwad College of Engineering**	
Course Approval Summary		

A) Board of Study-Information Technology

Sr. No.	Name of the Course	Course Code	Page number	Signature and Stamp of BoS
1	Logic Design and Computer Organization	BIT3301	9	
2	Discrete Mathematics	BIT3401	11	
3	Fundamentals of Data Structures	BIT3402	13	
4	Data Communication and Computer Networks	BIT3403	15	
5	Logic Design and Computer Organization-Lab	BIT3302	17	
6	Fundamentals of Data Structures –Lab	BIT3404	19	
7	Data Communication and Computer Networks Lab	BIT3405	22	
8	Microprocessors and Microcontrollers	BIT4301	28	
9	Data Structures & Algorithms	BIT4401	30	
10	Object Oriented Programming with JAVA	BIT4402	32	
11	Automata Theory	BIT4403	34	
13	Microprocessors and Microcontrollers –Lab	BIT4302	36	
14	Data Structures & Algorithms-Lab	BIT4404	38	
15	Object Oriented Programming-Lab	BIT4405	40	
16	Python Programming	BIT4911	56	
17	Web Development	BIT4912	58	

B) Board of Study-Applied Sciences and Humanities

Sr. No.	Name of the Course	Course Code	Page number	Signature and stamp of BoS
1	Applied Mathematics	BAS3205	5	
2	Data Analysis using R	BAS3206	7	
3	Universal Human Values	BHM3101	24	
4	Professional Skills for Engineers	BHM4101	54	
5	Life Skill-III	BHM3939	26	
6	Numerical Methods	BAS4601	42	
7	Mathematical Optimization	BAS4602	44	
8	Calculus of Variation	BAS4603	46	
9	Mathematical Modelling and Simulation	BAS4604	48	
10	Financial Mathematics	BAS4605	50	
11	Neural Network and fuzzy logic Control	BAS4606	52	
12	Life Skill-IV	BHM4940	60	
13	Environmental Science	BHM9961	62	

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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Curriculum Framework for B.Tech IT

Sr. No.	Type of course	Abbreviations
1	Basic Science Course	**BSC**
2	Engineering Core/Science Course	**ECC**
3	Humanities, Social Sciences and Management Course	**HSMC**
4	Professional Core Course	**PCC**
5	Professional Elective Course	**PEC**
6	Open Elective Course	**OEC**
7	Project	**PROJ**
8	Internship	**INTR**
9	Audit Course	**AC**
10	Mandatory Course	**MC**
11	Life Skills	**LS**
12	Proficiency Course	**PFC**
13	MOOC	**MO**

Sr. No.	Type of course	No. of Courses	Total Credits	
			No	%
1	Basic Science Course	**8**	**23**	**14.3**
2	Engineering Core/Science Course	**14**	**22**	**13.7**
3	Humanities, Social Sciences and Management Course	**6**	**13**	**8.1**
4	Professional Core Course	**22**	**48**	**29.8**
5	Professional Elective Course	**6**	**18**	**11.2**
6	Open Elective Course	**6**	**18**	**11.2**
7	Project	**2**	**16**	**9.9**
8	Internship	**1**	**3**	**1.9**
9	Audit Course	**3**	**0**	**0.0**
10	Mandatory Course	**2**	**0**	**0.0**
11	Life Skills	**4**	**0**	**0.0**
12	Proficiency Course	**3**	**0**	**0.0**
13	MOOC	**1**	**0**	**0.0**
	Total	**78**	**161**	**100.0**

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	3	3	2						**8**
2	Engineering Core/Science Course	5	6	2	1					**14**
3	Humanities, Social Sciences and Management Course	1	1	1	1	1	1			**6**
4	Professional Core Course			5	6	3	4	4		**22**
5	Professional Elective Course					2	2	2		**6**
6	Open Elective Course				1	1	2	2		**6**
7	Project	1							1	**2**
8	Internship								1	**1**
9	Audit Course				1	1	1			**3**
10	Mandatory Course					1	1			**2**
11	Life Skills	1	1	1	1					**4**
12	Proficiency Course				1	1	1			**3**
13	MOOC								1	**1**
Total		**11**	**11**	**11**	**12**	**10**	**12**	**8**	**3**	**78**

CREDIT DISTRIBUTION: SEMESTER WISE

Sr. No.	Type of course	No. of Credits/Semester								Total
		1	2	3	4	5	6	7	8	
1	Basic Science Course	9	9	5						**23**
2	Engineering Core/Science Course	7	9	3	3					**22**
3	Humanities, Social Sciences and Management Course	2	2	3	2	2	2			**13**
4	Professional Core Course			12	12	8	8	8		**48**
5	Professional Elective Course					6	6	6		**18**
6	Open Elective Course				3	3	6	6		**18**
7	Project	2							14	**16**
8	Internship								3	**3**
9	Audit Course									**0**
10	Mandatory Course									**0**
11	Life Skills									**0**
12	Proficiency Course									**0**
13	MOOC									**0**
Total		**20**	**20**	**23**	**20**	**19**	**22**	**20**	**17**	**161**

B. Tech (Information Technology) Curriculum Structure Semester III

		Semester – III	Teaching Scheme					Evaluation Scheme						
Course Code	Category	Course Name	L	T	P	H	Cr	IE	MTE	ETE	TW	PR	OR	Total
BAS3205	BSC	Applied Mathematics	3	-	-	3	3	20	30	50	-	-	-	100
BAS3206	BSC	Data Analysis using R	-	-	4	4	2	-	-	-	50	-	-	50
BIT3301	ECC	Logic Design and Computer Organization	2	-	-	2	2	20	30	50	-	-	-	100
BIT3401	PCC	Discrete Mathematics	2	1	-	3	3	20	30	50	-	-	-	100
BIT3402	PCC	Fundamentals of Data Structures	3	-	-	3	3	20	30	50	-	-	-	100
BIT3403	PCC	Data Communication and Computer Networks	3	-	-	3	3	20	30	50	-	-	-	100
BIT3302	ECC	Logic Design and Computer Organization-Lab	-	-	2	2	1	-	-	-	25	-	-	25
BIT3404	PCC	Fundamentals of Data Structures – Lab	-	-	4	4	2	-	-	-	50	25	-	75
BIT3405	PCC	Data Communication and Computer Networks Lab	-	-	2	2	1	-	-	-	25	-	25	50
BHM3101	HSMC	Universal Human Values	3	-	-	3	3	30	-	20	-	-	-	50
BHM3939	LS	Life Skill-III	0	0	2	2	-	-	-	-	-	-	-	0
Total			**16**	**01**	**14**	**31**	**23**	**130**	**150**	**270**	**150**	**25**	**25**	**750**

B. Tech (Information Technology) Curriculum Structure Semester IV

		Semester – IV	Teaching Scheme					Evaluation Scheme						
Course Code	Category	Course Name	L	T	P	H	Cr	IE	MTE	ETE	TW	PR	OR	Total
BIT4301	ECC	Microprocessors and Microcontrollers	2	-	-	2	2	20	30	50	-	-	-	100
BIT4401	PCC	Data Structures & Algorithms	3	-	-	3	3	20	30	50	-	-	-	100
BIT4402	PCC	Object Oriented Programming with JAVA	2	-	-	2	2	20	30	50	-	-	-	100
BIT4403	PCC	Automata Theory	3	1	-	4	4	20	30	50	-	-	-	100
BIT4302	ECC	Microprocessors and Microcontrollers –Lab	-	-	2	2	1	-	-	-	25	25	-	50
BIT4404	PCC	Data Structures & Algorithms-Lab	-	-	2	2	1	-	-	-	25	25	-	50
BIT4405	PCC	Object Oriented Programming-Lab	-	-	4	4	2	-	-	-	50	25	-	75
BAS4601 to BAS4606	OEC	Open Elective-I	3	-	-	3	3	20	30	50	-	-	-	100
BHM4101	HSMC	Professional Skills for Engineers	2	-	-	2	2	30	-	20	-	-	-	50
BIT4911 To BIT4912	PFC	Proficiency Course-I	-	-	2	2	-	-	-	-	-	-	-	0
BHM4940	LS	Life Skill-IV	-	2	-	2	-	-	-	-	-	-	-	0
BHM9961	AC	Environmental Science	1	-	-	1	-	-	-	-	-	-	-	0
Total			**16**	**03**	**10**	**29**	**20**	**130**	**150**	**270**	**100**	**75**	**0**	**725**

Abbreviations: Course Abbreviation; **L**- Lecture; **P**- Practical; **H**- Hours; **CR**- Credits; **IE**– Internal Evaluation-1; **MTE** – Mid Term Examination **ETE** – End Term Examination; **TW** – Term Work; **OR** – Oral Exam.

List of Open Electives

Semester- IV

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

List of Proficiency Courses

Semester- IV

Course Code	Course Name	
BIT4911	Python Programming	Choose any one
BIT4912	Web Development	

List of Life Skill Courses

Semester- III

Course Code	Course Name: Life Skills-III	
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 performing arts

Semester- IV

Course Code	Course Name: Life Skills-IV	
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 caring & service

List of Audit Courses

Semester –IV

Course Code	Name of Course
BHM9961	Environmental Science

Course Syllabus

Semester-III

Program:	B. Tech. (Comp/IT)			Semester :	III		
Course :Applied Mathematics				Code :BAS3205			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**Internal Evaluation**	**MTE**	**ETE**	**Total**
3	-	-	3	20	30	50	100

Prior knowledge of

1. 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. 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. **Apply** the concepts of higher order linear differential equations to **analyze** Electrical Circuits.
2. **Analyze** numerical data using descriptive statistical techniques.
3. **Apply** probability theory and hypothesis tests to predict and **analyze** the data.
4. **Perform** vector differentiation to **analyze** the vector fields.
5. **Solve** problems related to Fourier transform using properties.
6. **Evaluate** Z-Transform and **apply** it to solve Difference equations.

Detailed Syllabus:

Unit	Description	Duration [Hrs]
1	**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.	6
2	**Statistics:** Measures of Variability: Standard deviation, Coefficient of variation, Moments, Skewness and Kurtosis, Curve fitting, Correlation and Regression	6
3	**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..	6
4	**Vector Differentiation:** Introduction, Vector differential operators, Gradient, Divergent, Curl, Physical Interpretation of Vector Differentiation, Directional Derivatives, Solenoidal, Irrotational and conservative fields, Scalar Potential.	6

5	**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.	6
6	**Z - Transform (ZT):** Introduction, Standard properties, Z Transform of discrete functions and their inverses. Solution of difference equations.	6
	Total	**36**

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

e-sources:

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. IT**			Semester :	**III**		
Course : **Data Analysis Using R**				Code :**BAS3206**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**Term Work**	**OR**	**PR**	**Total**
-	4	-	2	50	-	-	50

Prior Knowledge of

1. Descriptive Statistics
2. Inferential Statistics
3. Probability

is essential

Course Objectives:

This course aims at enabling the students to learn data collection, visualization, and preprocessing techniques for data science.

Course Outcomes:

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

1. **Implement** R packages related to data science and **Identify** the data properties.
2. **Apply** data preprocessing methods and generate quality data for analysis.
3. **Apply** different data visualization techniques to understand the data.
4. **Analyze** the data using analytical methods for regression in real life Problems using the R.
5. **Develop** a model for Prediction and Decision Making for a data set along with some of their characteristics, strengths, limitations, and applications.
6. **Frame** the hypothesis for the data and test it for data set in R.

Assignment No.	Suggested List of Assignments
1	.Introduction to data analytics and R Software fundamentals: a. Understanding the Data. b. R Packages for Data Science. c. Importing and Exporting Data in R Software. d. Getting Started: Analyzing Data in R Software. e. Accessing Databases with R Software
2	Data Wrangling: a. Pre-processing Data in R Software b. Dealing with Missing Values in R Software c. Data Formatting in R Software d. Data Normalization in R Software e. Binning in R Software f. Turning categorical variables into quantitative variables in R Software
3	Data Visualization in R Software: a. Histogram. b. Bar/ Line Chart. c. Box Plot (including group-by option) d. Scatter Plot (including 3D and other features) e. Mosaic Plot.

	f. Heat Map. g. 3D Graphs. h. Correlogram (GUIs)
4	Statistical Data Analysis: Descriptive Statistics: Central tendencies, Dispersion, Skewness, Kurtosis Probability, Normal Distribution Sampling & Sampling Distributions**.**
5	Exploratory Data Analysis: a. Correlation , Linear Regression and Multiple Linear Regression b. Hypothesis Testing. c. Analysis of Variance ANOVA.
6	Model Development using a dataset from Kaggle (Sample links are given below) and perform the following operation. a. Make visualization of data set for distribution of at least three attributes. b. Develop one descriptive model for the data set. c. Develop a model for Prediction and Decision Making for the data set. **sample links:** https://www.kaggle.com/code/cvaisnor/heart-2020/data https://www.kaggle.com/code/kailash068/crop-recommendation/data https://www.kaggle.com/datasets/debajyotipodder/co2-emission-by-vehicles https://www.kaggle.com/datasets/csafrit2/higher-education-students-performance-evaluation

Guidelines for Laboratory Conduction:

During every lab assignment the following activities will be carried out:

1. The instructor will explain the aims & objectives of the assignments.
2. The instructor will explain the topics required to carry out the assignment.
3. The students will do the hands on as per the Lab manual & Web resources provided.
4. The students will show the outcome to the instructor.
5. On each topic at least one assignment is expected to be submitted.

Assignment suggested:

1. Access the in build datasets in R, import and change the data type as per the requirement [*The datasets for each assignment can be specified]
2. Access the open source dataset [Ex:“ Students Adaptability Level in Online Education “ from Kaggle] and apply all techniques of data cleaning , wrangling and summarize the properties of the dataset.
3. Use the same data of “ Students Adaptability Level in Online Education” [from Kaggle] and apply following operations
   a. Make a visualization showing gender based adaptability
   b. Make a visualization based on most used Internet type
   c. Make a visualization based on age group
   d. Make a visualization based on adaptability level of entire dataset
4. Case study for payroll dataset, exam marks dataset, etc. to view statistical measures and correlation
5. Case study on probabilistic approach and testing for data prediction
6. Demonstration of project on real time dataset for prediction and decision making

Reference Books:

1. Montgomery and Runger, “Applied Statistics and Probability for Engineers”, Wiley, India, 6 Edition, ISBN: 9788126562947.
2. R. Johnson, “Probability and Statistics for Engineers”, Prentice India Ltd, 8 Edition, ISBN 13:978-8120342132.
3. S.P.Gupta, “Statistical Methods”, Papperbook publication, 43 edition, ISBN: 9788180549892, 8180549895.

4. R for Data Science: Import, Tidy, Transform, Visualize, and Model Data 1st Edition,Hadley Wickham and Garrett Grolemund, ISBN-13: 978-1491910399

e-sources:

NPTEL Course lectures links:

https://nptel.ac.in/courses/111/105/111105090/ (Probability)
https://nptel.ac.in/noc/courses/noc20/SEM2/noc20-ma53 (Introduction to R software)
https://nptel.ac.in/noc/courses/noc21/SEM1/noc21-ma37 (Descriptive statistics using R software)

Program:	**B. Tech. I.T.**			Semester: **III**			
Course: **Logic Design and Computer Organization**				Code: **BIT3301**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Tutorial**	**Credit**	**Hours**	**IE**	**MTE**	**ETE**	**Total**
2	-	2	2	20	30	50	100

Prior Knowledge of :

1. Analog and Digital Electronics
2. Logic gates

is essential

Course Objectives:

1. To make undergraduates, aware of different levels of abstraction of computer systems from hardware perspective.
2. To learn and understand basic digital design techniques.
3. To develop design and implementation skills of combinational and sequential logic circuits.
4. To make undergraduates understand the functions, characteristics of various components of Computer: processor & memory.

Course Outcomes:

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

1. Recall the knowledge of number systems, Boolean algebra, logic gates and code conversions, use of logic function representation for simplification with K-Maps.
2. Demonstrate Combinational logic circuit design using SSI & MSI chips.
3. Develop Sequential circuits like Flip-Flops (Truth Table, Excitation table), their conversion & applications.
4. Summarize the functions & organization of various blocks of Computer Architecture, different types of Computer Architectures.

Detailed Syllabus		
Unit	**Description**	**Duration (H)**
1.	**Number System and Logic Minimization** Number Systems: Binary, Octal, Hexadecimal and their conversions. signed binary number representation, complement representation and arithmetic's. Codes: BCD, Excess-3, Gray code, Binary Code and their conversions. Logic minimization: Representation of truth-table, SOP form, POS form, reduction techniques: K-Maps up to 4 variables, don't care conditions.	6
2.	**Combinational Logic Design** Design using SSI chips: Code Converters, Adders, Subtractors, n bit Binary Adder. Introduction to MSI chips: Multiplexer (IC 74153), De-multiplexer (IC 74138), Decoder (74238) Encoder (IC 74147), Binary adder (IC 7483).	6
3.	**Sequential Logic Design** Introduction to sequential circuits: Difference between combinational and sequential circuits; Memory element-Latch & Flip-Flop. Flip- Flops: Logic diagram, truth table & excitation table of SR, JK, D, T flip flops; Conversion from one FF to another, Study of flip flops with regard to asynchronous and synchronous, Preset & Clear.	6

	Application of flip-flops**:** Counters- Asynchronous, Synchronous and Modulo N Counters, Registers- shift register types& applications.	
4.	**Computer Organization** Computer organization & computer architecture: organization, functions & types of computer units- CPU (typical organization, Functions, Types), Memory (Types & their uses in computer), IO (types & functions) & system bus. (Address, data & control bus), ALU (ALU signals, functions & types); Register (types & functions of user visible, control & status registers such as general purpose, address registers, data registers, flags, PC, MAR, MBR, IR) & control unit. Types of Computer Architectures: Von Neumann & Harvard architecture, RISC and CISC Architectures.	6
	Total	**24**

Text Books:

1. R.P. Jain, "Modern Digital Electronics", 3rd Edition, Tata McGraw-Hill, ISBN: 0–07–049492–4.
2. William Stallings, "Computer organization and architecture, designing for performance" Prentice Hall, Eighth edition.

Reference Books:

1. Floyd, "Digital Principles", Pearson EducationISBN:978-81- 7758-643-6.
2. M Morris Mano, "Digital Design", Prentice Hall, 3rd Edition, ISBN: 0130621218.
3. John Yarbrough, "Digital Logic applications and Design", Thomson Publication ISBN: 978-0314066756.
4. Malvino, D. Leach, "Digital Principles and Applications", 5th edition, Tata McGraw Hill.
5. Hamacher and Zaky, "Computer organization", Fifth Edition.
6. D. Patterson, J. Hennessy, "Computer Organization and Design: The Hardware Software Interface" Fourth Edition, Morgan Kaufmann.

Program:	B. Tech. I.T.				Semester: **III**		
Course: **Discrete Mathematics**					Code: **BIT3401**		
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Tutorial**	**Credit**	**Hours**	**IE**	**MTE**	**ETE**	**Total**
2	1	3	3	20	30	50	100

Prior Knowledge of:

1. Basic Mathematics concepts**.**

is essential

Course Objectives:

1. To gain sound knowledge to formulate and solve problems with sets and propositions.
2. To understand and solve counting problems by applying elementary counting techniques to solve problems of discrete probability.
3. To understand Graph and Tree terminologies and models to be applied in real life problems.
4. To recognize types of relation, formulate and solve problems with relations and functions.
5. To understand basics of number theory and its applications.
6. To understand the various types' algebraic structures and its applications.

Course Outcomes:

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

1. Formulate and apply formal proof techniques and solve the problems with logical reasoning.
2. Analyse and evaluate the combinatorial problems by using probability theory.
3. Apply the concepts of graph theory to devise mathematical models.
4. Analyse types of relations and functions to provide solution to computational problems.
5. Identify techniques of number theory and its application.
6. Identify fundamental algebraic structures.

Detailed Syllabus		
Unit	**Description**	**Duration (H)**
1.	**Sets And Propositions** Sets: Sets, Combinations of Sets, Venn Diagram, Finite and Infinite Sets, Countable Sets, Multisets, Principle of Inclusion and Exclusion. Proof Techniques: Direct and Indirect Methods, Mathematical Induction, Propositions: Propositions, Logical Connectives, Conditional and Bi-conditional.	8
2.	**Combinatorics And Discrete Probability** Combinatorics: Rules of Sum and Product, Permutations, Combinations. Discrete Probability: Discrete Probability, Conditional Probability, Bayes Theorem, Applications of Combinatorics and Discrete Probability.	6
3.	**Relations & Functions** Relations**:** Properties of Binary Relations, Closure of Relations, Warshall's Algorithm, Equivalence Relations, Partitions, Partial Ordering Relations, Lattices. Functions: Functions, Composition of Functions, Invertible Functions, Pigeonhole Principle, Discrete Numeric Functions.	6
4.	**Graph Theory** Graphs: Basic Terminologies, Multi-Graphs, Weighted Graphs, Sub Graphs, Isomorphic graphs, Complete Graphs, Regular Graphs, Bipartite Graphs, Operations on Graphs, Paths, Circuits, Hamiltonian and Eulerian graphs, Travelling Salesman Problem, Factors of Graphs, Planar Graphs, Graph Colouring.	5

5.	**Trees** Trees**:** Tree Terminologies, Rooted Trees, Path Length in Rooted Trees, Prefix Codes, Spanning Trees, Fundamental Cut Sets and Circuits, Max flow –Min Cut Theorem (Transport Network). Binary Trees and traversal, Applications of Graph Theory.	5
6.	**Elementary Number Theory** Divisibility of Integers: Properties of Divisibility, Division Algorithm, Greatest Common Divisor GCD and its Properties, Euclidean Algorithm, Prime Factorization Theorem, Congruence Relation, Modular Arithmetic, Euler Phi Function, Euler's Theorem, Fermat's Little Theorem, Additive and Multiplicative Inverses, Chinese Remainder Theorem. Algebraic Structures: Introduction Semigroup, Monoid, Group, Abelian Group, Permutation Groups, Ring, Integral Domain, Field. Applications of Algebraic Structures.	6
	Total	**36**

Text Books:

1. Kenneth H. Rosen. Discrete Mathematics and Its Applications, 7th Edition, McGraw Hill, 2012.
2. C. L. Liu and D. P. Mohapatra, "Elements of Discrete Mathematics", 4th Edition, McGraw-Hill.

Reference Books:

1. Bernard Kolman, Robert C. Busby, Sharon Cutler Ross, "Discrete mathematical structures", 6th edition, Prentice Hall of India.
2. Edgar G. Goodaire, Michael M. Parmenter, "Discrete Mathematics with Graph Theory", 3rd Edition, Pearson Education.
3. Tremblay J. S., "Discrete mathematical structures with application", 3rdEdition, Tata McGraw Hill.
4. Lipschutz Seymour, "Discrete mathematics", 4th Edition, Tata McGraw-Hill.
5. Johnsonbaugh Richard, "Discrete Mathematics", 7th edition, Pearson.
6. Narsingh Deo, "Graph Theory with Applications to Engineering and Computer Science", Dover publication.
7. Introduction to Discrete Mathematics for Computer Science Specialization by Coursera, https://www.coursera.org/specializations/discrete-mathematics.
8. "Discrete Mathematics", Master Discrete Math for Computer Science and Mathematics Students by Udemy.

Program:	**B. Tech. I.T.**			Semester**: III**			
Course: **Fundamentals of Data Structures**				**Code: BIT3402**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Tutorial**	**Credit**	**Hours**	**IE**	**MTE**	**ETE**	**Total**
3	0	3	3	20	30	50	100

Prior knowledge of:

1. Programming and problem-solving skills

is essential

Course Objectives:

1. To apply C language constructs and pointers in depth
2. To learn and apply linear data structures and their applications
3. To apply various advanced data structures such as trees and graphs to the applications

Outcomes:

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

1. Apply pointers, dynamic memory allocation concepts and file handling in application development.
2. Construct Linear data structures using arrays and linked list
3. Make use of abstract properties of stack data structures
4. Construct abstract properties of various queue data structures
5. Apply algorithms to create and traverse non-linear data structure trees.
6. Apply graphs to various computing problems

Detailed Syllabus		
Unit	**Description**	**Duration (H)**
1.	**Pointers in C and File Handling:** Introduction to Pointers, pointer to pointer, pointer to single and multidimensional arrays, array of pointers, pointer to functions, dynamic memory allocation, Pointer to file structure and basic operations on file, single and multiple file handling in C. Time complexity & Space complexity of an algorithm, and its representation.	6 Hours
2.	**Linear Data Structures Using Sequential and Linked Organization:** Concept of data structures, Concept of sequential organization, Multidimensional arrays and their storage representation: row-major and column-major form and address calculation. Representation of sparse matrix using arrays, algorithms for sparse matrix simple and fast transpose. Concept of linked organization, singly linked list, doubly linked list, circular linked list.	6 Hours
3.	**Stacks:** Concept of the stack, stack as an ADT, Implementation of stack using linked organization. Concept of the implicit and explicit stack, Applications of the stack: reversing the list, expression conversion, and evaluation	6 Hours

4.	**Queues:** Concept of queues as ADT, Implementation of queue using linked organization. Concept of the circular queue, double-ended queue, and priority queue. Applications of queues.	6 Hours
5.	**Trees** The difference in the linear and non-linear data structure, Trees, and binary trees-concept and terminology. Conversion of the general tree to binary tree. Binary tree as an ADT. Recursive and non-recursive algorithms for binary tree traversals, Binary search trees, Binary search tree as ADT, Expression tree.	6 Hours
6.	**Graphs** Graph as an ADT, Representation of graphs using adjacency matrix and adjacency list, Depth First Search and Breadth-First Search traversal. Prim's and Kruskal's algorithms for minimum spanning tree.	6 Hours
	Total	**36**

Text Books:

1. E. Horowitz, S. Sahani, S. Anderson-Freed "Fundamentals of Data Structures in C", Universities Press, (2008).
2. Richard F. Gilberg, Behrouz A. Forouzan, "Data Structures: A Pseudocode Approach with C", Second Edition, Cengage Learning, ISBN 9780534390808 (2004).

Reference Books:

1. Yashwant Kanetkar, "Understanding Pointers in C", 4th Publication, BPB Publication, ISBN: 9788176563581 (2003).
2. G. A.V. PAI, "Data Structures and Algorithms ", McGraw Hill, ISBN -13: 978-0-07-066726-6.
3. Y. Langsam, M. Augenstin, A. Tannenbaum, "Data Structures using C and C++", 2nd Edition, Prentice Hall of India, 2002, ISBN-81-203-1177-9.
4. A. Tharp," File Organization and Processing", Willey India edition, 9788126518685, (2008).
5. J. Tremblay, P. Soresan, "An Introduction to Data Structures with Applications", 2nd edition, Tata McGraw Hill International Editions, 1984, ISBN-0-07-462471-7.

Program:	**B. Tech. I.T.**				Semester: **III**		
Course: **Data Communication and Computer Networks**					Code: **BIT3403**		
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. Fundamentals of communication

is essential

Course Objectives:

1. To gain the knowledge of communication systems.
2. To Learn and understand the History of Computer Network and its evolution with the help of service models
3. To learn the various issues of Network layer, its management and Routing algorithms at Network layer
4. To learn the services offered by Transport Layer
5. To learn the session layer and Applications Layer protocols; and its services.
6. To Learn and understand the Internet and Web functionality with its protocols

Course Outcomes:

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

1. Identify various Data Communication Techniques and its trade off.
2. Specify and identify existing topological structures and protocols.
3. Analyse routing strategies for an IP based networking infrastructure
4. Evaluate the challenges in building networks and solutions to those.
5. Gain the knowledge of datagram and Internet.
6. Use and apply the standards and protocols learned, for application development

Detailed Syllabus		
Unit	**Description**	**Duration (H)**
1.	**Introduction to Data Transmission and Modulations** Data Transmission methods – Synchronous & Asynchronous, Flow Control, Error Control, Error Detection and correction, Overview of Data & Signal Bits. Baud & Bit Rate. Analog Modulations Techniques, Digital Modulation Techniques. Types of Noise: External Noise, Internal Noise. Communication Channel - Discrete and Continuous Channel, Shannon-Hartley Theorem, Channel Capacity, Nyquist and Shanon Theorem, Bandwidth S/N Trade Off.	8
2.	**Introduction to Computer Networks** Introduction to OSI and TCP/IP Protocol Suite, Classification of Addressing Mechanisms, Types of Networks-LAN, WAN And MAN, Network Topologies. Guided Media: Twisted-Pair Cable, Coaxial Cable and Fiber-Optic Cable, Unguided Media: Wireless, Radio Waves, Microwaves and Infrared, Wireless frequency spectrum (EU and American Standard).	5
3.	**Network Layer and Routing Principles** Design issues, virtual circuit and datagram subnet, Study of Router, Routing algorithms like adaptive and non-adaptive, Congestion control algorithms and prevention policies, Load shading, Traffic Management, jitter control, quality of service, internetworking, Routing Algorithms.	5

4.	**Transport Layer and its Services** Overview of Transport layer, Transport layer service primitives, Multiplexing and De-multiplexing, Connection oriented (TCP) and Connection less transport (UDP) protocol, Flow control-Retransmission, TCP Congestion control, Congestion avoidance, Connection management, QoS and Application requirements.	6
5.	**Session and Application Layer** Overview of Session Layer and Services Offered, Role of Session Layer in OSI Model, Session Control Protocols, Session Management in TCP. Introduction to Application Layer, OSI vs TCP/IP, WWW & HTTP, FTP, TFTP, SMTP, POP3, IMAP, MIME, P2P.	6
6.	**Internet and Web** Internet Addressing Scheme, IPv4 vs IPv6, Network Byte Order, Domain name system (DNS) and DNS servers, Resource records, Introduction to Internet security and Firewall, Website Planning and Hosting.	6
	Total	**36**

Text Books:

1. Behrouz A Forouzan , “Data Communications and Networking”, 4th Ed, Tata McGraw – Hill, 2011.
2. S. Tanenbaum : "Computer, Networks", PHI Publication, 4th edition, ISBN: 8178087855

Reference Books:

1. H. Taub And K.L. Shiling, “Principles of Communication System”, 3rd Edition, Tata Mcgraw Hill Education Private Limited.
2. James F. Kurose, Keith W. Ross, “Computer Networking – A Top-Down Approach Featuring the Internet”, Fifth Edition, Pearson Education, 2009.
3. Behrouz A. Forouzan,”TCP-IP protocol suite “, Tata McGraw Hill Edition, 2nd edition,2003, ISBN: 978007060004.

Program:	B. Tech. I.T.				Semester: **III**		
Course: **Logic Design and Computer Organization Laboratory**					Code: **BIT3302**		
Teaching Scheme				**Evaluation Scheme**			
Practical	**Tutorial**	**Credit**	**Hours**	**TW**	**OR**	**PR**	**Total**
2	-	1	2	25	-	-	25

Course Objectives:

1. To design & implement combinational and sequential circuits.
2. To learn simulation of digital systems.
3. To Study Basic Computer Architecture.

Course Outcomes:

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

1. Illustrate the concepts of logic function representation for simplification with K-Maps.
2. Construct Combinational & Sequential logic circuits.
3. Develop circuits of Modulus and Ripple counters using synchronous counters.
4. Demonstrate simulation of basic Computer blocks such as ALU & memory.

Assignment No.	Suggested List of Assignments
	GROUP A **Combinational Logic Design (Any 4)**
1.	Realize Full Adder and Subtractor using a) Basic Gates and b) Universal Gates.
2.	Design and implement 4-bit BCD to Excess-3 code.
3.	Design and implement 1 digit BCD adder using IC7483.
4.	Design and implement following using multiplexer IC 74153 1) full adder 2) Any three-variable function (cascade method).
5.	Design and implement full subtractor using decoder IC 74138.
	GROUP B **Sequential Logic Design**
6.	Design and implement 3 bits Up and 3 bit Down Asynchronous Counters using master slave JK flip-flop IC 7476.
7.	Design and implement 3 bits Up and 3 bit Down Synchronous Counters using master slave JK flip-flop IC 7476.
8.	Design and implement Modulo ‘N’ counter using IC7490. (N= 100 max).
9.	Design of Ripple Counter using suitable Flip Flops.
	GROUP C **Computer organization (Any 1 using virtual lab simulator)**

10.	Design & simulate single bit ALU with four functions (AND, OR, XOR, ADD).
11.	Design & simulate single bit RAM cell.
GROUP D **Study Practical (Any 1)**	
12.	Study of Shift Registers (SISO,SIPO, PISO,PIPO).
13.	Study of Basic Computer Architecture in detail.
Remark: Implementation of all assignments is encouraged.	

Reference Books:

1. R.P. Jain, "Modern Digital Electronics", 3rd Edition, Tata McGraw-Hill, ISBN:0-07-049492-4
2. William Stallings, “Computer organization and architecture, designing for performance” ,Prentice Hall, Eighth edition
3. Virtual Lab simulator Link http://vlabs.iitkgp.ac.in/coa/

Program:	**B. Tech. I.T.**						Semester: **III**
Course: **Fundamentals of Data Structures Laboratory**							Code: **BIT3404**
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**TW**	**OR**	**PR**	**Total**
-	4	-	2	50	-	25	75

Course Objectives:

1. To write a neat code by following coding standards by selecting appropriate data structures.
2. To implement abstract properties of various data structures such as stacks, queues.
3. To apply various advanced data structures such as trees and graphs to the applications.

Course Outcomes:

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

1. Make use of coding standard for application development.
2. Construct linear data structures using arrays and linkedlists.
3. Make use of abstract properties of stacks.
4. Apply queue data structure to various applications.
5. Apply algorithms to create and traverse non-linear data structure trees.
6. Apply graphs to various computing problems.

Assignment No.	**Suggested List of Assignments** (Write a program in C)
	GROUP A
1.	**Assignments for the practice of language syntax, data types, and programming constructs** a) To simulate a simple calculator that performs basic tasks such as addition, subtraction, multiplication, and division. b) Pass two parameters to function as(start and end), and display all prime numbers between two Intervals c) Create class STORE to keep track of Products (Product Code, Name, and price). Display menu of all products to the user. Generate bill as per order. d) Accept a string and change the case of each character of the string. Example “THIs Is a C Program” changes to “thiSiS A c pROGRAM”. e) Accept a string from the user and perform the following string operations- i. Calculate the length of string ii. String reversal iii. Equality check of two strings iii. Check palindrome ii. Check substring (Pointer to strings) f) Represent matrix using two-dimensional arrays and perform the following operations without using pointers: i. Addition ii. multiplication

GROUP B (Any 8)	
2.	Represent sets using one-dimensional arrays and implement functions to perform i. Union ii. Intersection iii. Difference iv. Symmetric difference of two sets
3.	Represent matrix using two-dimensional arrays and perform the following operations with pointers: i. Addition ii. multiplication iii. transpose iv. Saddle point
4.	Write a Menu driven program in C for a cricket player's display board. The information of the cricketer can be (not limited to) Name, Age, Country, Category (Batsman, Bowler, Wicket keeper, All-rounder), Number of ODI's played, Number of International 20-20's played. Display following. a) Number of batsman of a particular country b) Sort the Batsman as per the average batting score(Bubble/insertion sort) c) Batsman with highest average score (Binary search) d) Number of bowlers of a particular country e) The bowler that has taken a maximum no of wickets f) Show particular players the entire "Display board information" g) Delete/Modify the record
5.	Implement a sparse matrix with operations like initialize empty sparse matrix, insert an element, add two matrices, transpose a matrix.
6.	Implement a Polynomial with operations like create an empty polynomial, insert an entry into a polynomial, add two polynomials and evaluate a polynomial.
7.	Department of Information Technology has a student's club named 'Pinnacle Club'. Students of the Second, third and final year of the department can be granted membership on request. Similarly, one may cancel the membership of the club. The first node is reserved for the president of the club and the last node is reserved for the secretary of the club. Write C program to maintain club member's information using a singly linked list. Store student PRN and Name. Write functions to a) Add and delete the members as well as the president or even secretary. b) Compute the total number of members of the club c) Display members of the club d) Display list in reverse order using recursion
8.	Implement any database using a doubly-linked list with the following options a) Insert a record b) delete a record c) modify a record d) Display list forward e) Display list backward
9.	To convert decimal numbers to binary numbers using the stack as sequential or linked representation.
10.	Implement stack as an abstract data type using linked list and use this ADT for conversion of infix expression to postfix, prefix, and evaluation of postfix and prefix expression.
11.	Implement Circular Queue using Array. Perform following operations on it. a) Insertion (Enqueue) b) Deletion (Dequeue) c) Display
12.	Implement priority queue as ADT using a single linked list for servicing patients in a hospital with priorities as a) Serious (top priority)

	b) medium illness (medium priority) c) General (Least priority)
13.	Department maintains student information. The file contains roll number, name, division, and address. Write a program to create a sequential file to store and maintain student data. It should allow the user to add, delete information of the student. Display information of the particular employee. If the record of the student does not exist an appropriate message is displayed. If a student record is found it should display the student details.
14.	Construct and expression tree from postfix/prefix expression and perform recursive and non-recursive In-order, pre-order and post-order traversals.
15.	Implement binary search tree and perform following operations: a. Insert b. Delete c. Search d. Mirror image e. Display f. Display level wise (algorithmic analysis)
16.	Implement DFS and BFS on a graph.
17.	Represent any real-world graph using adjacency list /adjacency matrix find minimum spanning tree using Prim's algorithm.
GROUP C (Mini-project)	
18.	Mini-project: Write an application demonstrating your skills in defining a problem, writing down the requirements carefully, designing a modular solution with clear separation of abstract data types and their use, design of proper function prototypes, and division of work among functions. The application can be defined after discussion with the course instructor.

Remark: Assignment 1 (week 1) is for practice of all prerequisites. Hence, this assignment is not included in the Practical Exam.

Reference Books:

1. Richard Reese - Understanding and Using C Pointers-O'Reilly Media (2013).
2. G. A.V. PAI, "Data Structures and Algorithms ", McGraw Hill, ISBN -13: 978-0-07-066726-6.
3. Y. Langsam, M. Augenstin, A. Tannenbaum, "Data Structures using C and C++", 2nd Edition, Prentice Hall of India, 2002, ISBN-81-203-1177-9.
4. A. Tharp," File Organization and Processing", Willey India edition, 9788126518685, (2008).
5. J. Tremblay, P. Soresan, "An Introduction to Data Structures with Applications", 2nd edition, Tata McGraw Hill International Editions, 1984, ISBN-0-07-462471-7.
6. Amiya Kumar Rath, Alok Kumar Jagdev, "Data Structures using C", Scitech Publication, 2nd Edition, ISBN: 978-81-8371-2323.
7. ds1-iiith.vlabs.ac.in/exp/stacks-queues/index.html
8. ds1-iiith.vlabs.ac.in/exp/poly-arithmetic/index.html

Program:	**B. Tech. I.T.**					Semester: **III**	
Course: **Data Communication and Computer Networks Laboratory**						Code: **BIT3405**	
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Credit**	**Hours**	**TW**	**OR**	**PR**	**Total**
-	2	1	2	25	25	-	50

Course Objectives:

1. To study installation, maintenance of network Laboratory based on Computer Networks Technology
2. To design network by using various topologies
3. To Learn and apply the TCP/IP commands
4. To learn and use Network Simulators
5. To learn various Server application

Course Outcomes:

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

1. Design and install various Network topologies
2. Apply various Commands to gain the information of the installed Network and Internet
3. Design the networks using the simulators
4. Install and configure various server services.
5. Explore use of protocols in various web applications.
6. Develop applications on emerging trends.

Detailed Syllabus	
Unit	**Description**
1.	Network Design by using various Topologies in CISCO Packet tracer
2.	Basic TCP/IP utilities and commands. (eg: ping, ifconfig, tracert, arp, tcpdump, whois, host, netsat, nslookup, ftp, telnet etc…)
3.	Design of • Small Network • Large Network using CISCO Packet Tracer / NS3.0 Simulators
4.	Installation and Configuration of the Following • Remote Login Service – TELNET/SSH • Configuration of FTP server and accessing it via FTP Client. • Installation and configuration of APACHE WEB SERVER / IIS • PWS along with HTTP server. • Installation and configuration of DHCP Server in Wireless Environment using an Access Point. • Installation and configuration of DNS Server. Installation and configuration of Mail Server.

Instruments Required:

1. LAN Trainer Kit

2. Unmanaged Switch
3. Router
4. Access Point

Reference Books:

1. James F. Kurose, Keith W. Ross, “Computer Networking – A Top-Down Approach Featuring the Internet”, Fifth Edition, Pearson Education, 2009.
2. Behrouz A. Forouzan, “Data communication and Networking”, Fourth Edition, Tata McGraw – Hill, 2011.
3. S. Tanenbaum : "Computer, Networks", PHI Publication, 4th edition, ISBN: 8178087855.
4. Behrouz A. Forouzan,”TCP-IP protocol suite “, Tata McGraw Hill Edition, 2nd edition,2003, ISBN: 978007060004.

List of Open Source Software/learning website:

Wireshark packet analyzer,

1. NS3.0/CISCO network simulator
2. Netsim

Program:	**B. Tech. (All branches)**			Semester :**III**					
Course : **Universal Human Values**				Code: **BHM3101**					
Teaching Scheme				**Evaluation Scheme**					
Lecture	**Practical**	**Tutorial**	**Credit**	**IE**	**MTE**	**ETE**	**TW**	**PR**	**Total**
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. Develop more awareness of their surroundings, society, social problems and their sustainable solutions, while keeping human relationships and human nature in mind.
2. Develop better critical ability by developing the right understanding of reality
3. Understand and become sensitive to their commitment towards what they believe in (humane values. humane relationships and humane society).
4. Apply what they have learnt to their own self in differ

Detailed Syllabus:		
Unit	**Description**	**Duration**
1	**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 fulfil the Basic Human Aspirations	06
	Practice Session: Sharing about Oneself, Exploring Human Consciousness, Exploring Natural Acceptance	02
2	**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	02
3	**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, Reverence, Glory, Gratitude, Love	04
	Practice Session: Exploring the Feeling of Trust, Exploring the Feeling of Respect	02
4	**Harmony in Society:**Understanding Harmony in the Society, Vision for the Universal Human Order**,** Human Order Five Dimensions	03

	Practice Session: Exploring Systems to fulfil Human Goal	01
5	**Harmony in the Nature/Existence:** Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence	03
	Practice Session: Exploring the Four Orders of Nature, Exploring Co-existence in Existence	01
6	**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	02
	Total	**36**

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, JeevanVidyaPrakashan, 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

Links for additional learning

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

Program:	B. Tech. (All branches)									
Course :**Life Skills-III**							Code :**BHM3939**			
Teaching Scheme				**Evaluation Scheme**						
Lecture	**Practical**	**Tutorial**	**Credit**	**IE**	**MTE**	**ETE**	**TW**	**PR**	**OR**	**Total**
0	2	0	0	-	-	-	-	-	-	-

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 (Hrs)**
1.	**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**
2.	**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”, 3July 2016.
9. Dina Serto and Mary Kom, “Unbreakable”, 19November 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

Semester-IV

Program:	B. Tech. (I.T.)			Semester : IV			
Course : Microprocessors and Microcontrollers				Code :**BIT4301**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Tutorial**	**Credit**	**Hours**	**IE**	**MTE**	**ETE**	**Total**
2	-	2	2	20	30	50	100

Prior Knowledge of :

1. Number system and logic minimization
2. Computer organization & computer architecture

is essential

Course Objectives:

1. To study architecture and features of 8086 microprocessors.
2. To know the programming with 8086 concepts.
3. To study architectural details of PIC18 microcontroller.
4. To introduce the concept of PIC I/O Ports and Timer.

Course Outcomes:

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

1. Explain basics of assembly language programming & 8086 architecture.
2. Illustrate programming concepts of 8086 like register set, instruction set & interrupt handling.
3. Interpret architecture and memory organization of PIC18 microcontroller.
4. Utilize concepts of I/O ports and timers of PIC18.

Detailed Syllabus		
Unit	**Description**	**Duration (H)**
1.	**Introduction To Assembly Language Programming & 8086 Processor** Introduction to assembly language programming, ALP tools- Assembler, Linker, Loader, Debugger, Emulator, Assembler directives, Far and near procedure, Macros, DOS Internals, DOS Calls. Introduction to microprocessor concept, 8086 - Features and Architecture.	**6**
2.	**Programming With 8086** Pin out Diagram, Register Set, 8086 Real mode segmentation and Address translation, Addressing modes, Instruction set.8086 Interrupt structure, ISR.	**6**
3.	**PIC Microcontroller Architecture** Introduction: Microcontroller, Difference between microprocessor and microcontroller, Criteria for selection of microcontroller, PIC18F: Features and architecture, Pin out Diagram, Registers set. Program and data memory organization: The Program Counter and Programmable ROM space in the PIC, File register and Access bank, Bank switching; Addressing modes: Addressing modes with instruction example, Reset operations, Brownout reset, Watchdog timer & Configuration registers.	**6**
4.	**PIC I/O Ports and Timer** I/O Port: I/O Port structure with programming: I/O Port structure, I/O Port programming, I/O Bit manipulation Programming. Timer/Counter: Registers used for Timer/Counter operation, Delay calculations, Programming of Timers using Embedded C. Case Study Traffic light signal controller using Timer/Counter.	**6**
	Total	**24**

Text Books:

1. James Turley, "Advanced 80386 Programming Techniques", McGraw Hill Education.
2. Muhammad Ali Mazidi , Danny Causey, RolinMcKinlay, “PIC Microcontroller and Embedded Systems: Using Assembly and C for PIC18”, 4th Edition by,Pearson international edition.

Reference Books:

1. Walter A. Tribel, Avtar Singh, "The 8088 and 8086 Microprocessors", 4th edition, Prentice Hall of India.
2. Ray Duncan, "Advanced MS DOS Programming", 2nd edition, BPB Publications.
3. Peatman, John B, “Design with PIC Microcontroller”, Pearson Education PTE.
4. Ramesh Gaonkar, “Fundamentals of Microcontrollers and Applications In Embedded Systems(with the PIC18 Microcontroller Family)”Thomson/Delmar Learning; 1 edition (January 8, 2007)ISBN:978-1401879143.

Program:	**B. Tech. I.T.**			Semester: **IV**			
Course: **Data Structures and Algorithms**				Code: **BIT4401**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Tutorial**	**Credit**	**Hours**	**IE**	**MTE**	**ETE**	**Total**
3	-	3	3	20	30	50	100

Prior knowledge of:

1. Basics of trees and graphs
2. Proof Techniques

is essential

Course Objectives:

1. To know the basics of computational complexity analysis of various algorithms.
2. To select appropriate algorithm design strategies to solve real-world problems.
3. To understand the concept of nondeterministic polynomial algorithms.

Course Outcomes:

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

1. Calculate computational complexity using asymptotic notations for various algorithms.
2. Apply Divide & Conquer as well as Greedy approach to design algorithms.
3. Understand and analyze optimization problems using dynamic programming.
4. Illustrate different problems using Backtracking.
5. Compare different methods of Branch and Bound strategy.
6. Classify P, NP, NP-complete, NP-Hard problems.

Detailed Syllabus

Unit	Description	Duration (H)
1.	**Analysis of Algorithm**: Efficiency- Analysis framework, asymptotic notations – big O, theta and omega. Analysis of sorting techniques. Analysis of Non-recursive and recursive algorithms: Solving Recurrence Equations using Masters theorem and Substitution method. Brute Force method: Introduction to Brute Force method & Exhaustive search, Brute Force solution to 8 queens' problem.	5
2.	**Divide And Conquer** Divide & Conquer: General method, Binary Search, Merge sort and Quick sort **Greedy Method** Greedy Method: General method and characteristics, Optimal storage on tapes, Fractional Knapsack problem. Sigle Source shortest Path.	7
3.	**Dynamic Programming:** Dynamic Programming: General strategy, Principle of optimality, Multistage Graph problem, 0/1 knapsack Problem, , Bellman Ford Algorithm Travelling Salesman Problem.	6
4.	**Backtracking** Backtracking:General method, Recursive backtracking algorithm, Iterative backtracking method. 8-Queen problem, Sum of subsets, Graph coloring	6

5.	**Branch-and-bound** The method, Control abstractions for Least Cost Search, Bounding, FIFO branch and bound, LC branch and bound, 0/1 Knapsack problem – LC branch and bound and FIFO branch and bound solution, Traveling salesperson problem- LC branch and bound	6
6.	**Complexity Theory:** The classes P, NP, NP complete, NP hard satisfiability problem, proofs for NP complete problem, Clique, Vertex cover problem.	6
	Total	**36**

Text Books:

1. E. Horowitz, S. Sahani, S. Anderson-Freed "Fundamentals of Data Structures in C", Universities Press, 2008.
2. Ellis Horwitz, Sartaj Sahni,Raj Sekaran. Fundamentals of computer algorithms University Press.

Reference Books:

1. Thomas H Cormen and Charles E.L Leiserson, Introduction to Algorithm, PHI, ISBN:81-203-2141-3.
2. G. A.V, PAI, “Data Structures and Algorithms “, McGraw Hill, ISBN -13: 978-0-07-066726-6.
3. Gilles Brassard, Paul Bratle, Fundamentals of Algorithms, Pearson, ISBN 978-81-317-1244.
4. Y. Langsam, M. Augenstin, A. Tannenbaum, "Data Structures using C and C++", 2nd Edition, Prentice Hall of India, 2002, ISBN-81-203-1177-9.

Program:	**B. Tech. I.T.**						Semester: **IV**
Course: **Object Oriented Programming with JAVA**							Code: **BIT4402**
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Tutorial**	**Credit**	**Hours**	**IE**	**MTE**	**ETE**	**Total**
2	-	2	2	20	30	50	100

Prior knowledge of:

1. Problem solving skills
2. Procedure Oriented Programming

is essential

Course Objectives:

1. To teach fundamentals of object-oriented concepts and programming
2. To apply the concepts of object-oriented paradigm.
3. To develop object oriented programming skills
4. To design and implement applications for real life problems by using object oriented programming.

Course Outcomes:

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

1. Explain features of JAVA and object oriented programming
2. Construct classes for given real life data and operations.
3. Design hierarchy of classes using inheritance.
4. Develop application which handles different types of exceptions.

Detailed Syllabus		
Unit	**Description**	**Duration (H)**
1	**Foundations of Object Oriented Programming** Object Oriented Paradigm, Features of Object-Oriented Programming: Objects and Classes, Data Abstraction and Encapsulation, Inheritance, Polymorphism, Dynamic Binding, Message Communication. Features of Java, Overview of Java.	6
2	**Classes, Methods and Constructors** Class Fundamentals, Methods, Constructors, Instance variable hiding, Garbage Collection, Finalize Method, Method Overloading, Object as a Parameter, Returning Object, Visibility/Access Control, Static Variable and Methods.	6
3	**Inheritance and Polymorphism** Inheritance Basics, Use of Super, Constructors in derived Classes, Method Overriding, Dynamic Method Dispatch, Abstract Classes, and Using Final with inheritance, Interfaces and Packages.	6
4	**Exception Handling** Fundamentals, Exception Types, Using try and catch, throw, throws and finally, multiple catch clauses, Nested try statements, built in exceptions.	6
	Total	**24**

Text Books:

1. E. Balagurusamy, “Programming with Java – A Primer”, Tata – McGraw-Hill Publication, 4thEdition, 2019.
2. Steven Holzner et al. “Java 2 Programming”, Black Book, Dreamtech Press, 2009.

Reference Books:

1. Java The complete reference, Herbert Schildt, McGraw Hill Education (India) Pvt. Ltd. 9th edition, 2014, ISBN: 978-0-07-180856-9 (E-book).
2. MitsunoriOgihara, “Fundamentals of Java Programming”, Springer; 2018, ISBN 978-3-319-89490-4.
3. Brahma DathanSarnath Ramnath, “Object-Oriented Analysis, Design and Implementation An Integrated Approach”, Springer; 2nd ed. 2015, ISSN 1863-7310 ISSN 2197-1781 (electronic) Undergraduate Topics in Computer Science ISBN 978-3-319-24278-1, ISBN 978-3-319-24280-4.
4. Object-Oriented Design Using Java, Dale Skrien, McGraw-Hill Publishing, 2008, ISBN - 0077423097, 9780077423094.

Program:	B. Tech. I.T.					Semester: **IV**	
Course: **Automata Theory**						Code: **BIT4403**	
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Tutorial**	**Credit**	**Hours**	**IE**	**MTE**	**ETE**	**Total**
3	1	4	4	20	30	50	100

Prior knowledge of:

1. Logic and Set Theory.
2. Computer Programming and Problem Solving

is essential

Course Objectives:

1. To understand the basics of automata theory and its operations.
2. To study various automata for different types of language classes.
3. To understand the fundamentals of decidability.

Course Outcomes:

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

1. Construct finite state machines to solve problems in computing.
2. Write regular expressions for the formal languages.
3. Construct grammar for the formal languages.
4. Design push down automata for formal languages.
5. Construct Turing machine for formal languages.
6. Explain the decidability and decidability problems.

Detailed Syllabus		
Unit	**Description**	**Duration (H)**
1.	**Finite State Machines (FSM)** Basic Concepts: Symbols, strings, formal and natural languages. FSM without output: definition and construction-Deterministic Finite Automata (DFA), Nondeterministic Finite Automata (NFA) with and without epsilon. FSM with output: Definition and construction of Moore and Mealy machines, applications of automata.	10
2.	**Regular Expressions** Definition of Regular Expressions (RE), Construction of regular expression of the given language, construction of language from the RE, construction of FA from the given RE using direct method, conversion of NFA to DFA, minimization of DFA, conversion of FA to RE using Arden's theorem.	9
3.	**Context Free Grammar and Languages** Introduction, formal definition of grammar, derivation process, Context Free Grammar (CFG), ambiguous CFG, removal of ambiguity, simplification of CFG, normal forms, Chomsky hierarchy, regular grammar.	9
4.	**Pushdown Automata** Introduction and definition of Push Down Automata (PDA), Construction of deterministic and non-deterministic PDA.	7
5.	**Turing Machines** Formal definition of a Turing machine (TM), Design of Turing machines, Variants of Turing machines. Comparisons of all automata.	7

6.	**Decidability** Decidability problems, recursive languages and recursively enumerable languages, decidability problems related to regular languages and context free grammar, universal Turing machine, halting problem of TM, un-decidable problems, post correspondence problem, mapping reducibility.	6
	Total	**48**

Text Books:

1. Introduction to the Theory of Computation by Michael Sipser (CENGAGE Learning, 3e).
2. Theory of Computation by Vivek Kulkarni (Oxford University Press).

Reference Books:

1. Introduction to Automata Theory, Languages and Computations by Hopcroft Ullman (Pearson Education, 3e).
2. Theory of Computation: A Problem-Solving Approach by Kavi Mahesh (Wiley-India).
3. Theory of Computation video lectures by Portland State University: Prof. Harry Porter; www.cs.pdx/~harry
4. Introduction to Computer Theory by Daniel I. A. Cohen (Wiley-India).
5. Theory of Computer Science (Automata, Languages and Computation) by K.L.P Mishra, N. Chandrasekaran (Prentice Hall India, 2e).

Program:	**B. Tech. (IT)**					Semester :**IV**	
Course :**Microprocessor & Microcontroller Laboratory**						Code :**BIT4302**	
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**TW**	**OR**	**PR**	**Total**
-	2	-	1	25	-	25	50

Course Objectives:

1. To learn assembly language programming of 8086 microprocessors.
2. To learn embedded C programming and PIC18FXXXmicrocontrollers.
3. To learn interfacing of real-world input and output devices to PIC18 microcontroller.

Course Outcomes:

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

1. Execute assembly language program to perform array addition.
2. Develop assembly language program for code conversion.
3. Execute assembly language program to perform string operations
4. Apply concepts related to embedded C programming.
5. Develop embedded C program to perform array addition, block transfer, sorting operations
6. Execute interfacing of real-world input and output devices to PIC18microcontroller.

Assignment No.	**Suggested List of Assignments**
GROUP A (Any 3)	
1.	Write Assembly Language Program (ALP) to add array of N numbers stored in the memory.
2.	Write menu driven ALP to convert 4-digit Hex number into its equivalent BCD number and 5-digit BCD number into its equivalent HEX number. Make your program user friendly to accept the choice from user for i. HEX to BCD ii. BCD to HEX iii. EXIT. Display proper strings to prompt the user while accepting the input and displaying the result. Write near procedures to complete the task.
3.	Write ALP to perform following operation on string: i. Find and display length ii. Display reverse iii. Check whether string is palindrome or not. Display proper strings to prompt the user while accepting the input and displaying the result. Write near procedures to complete the task.
4.	Write menu driven ALP to perform string manipulations. The strings to be accepted from the user is to be stored in code segment Module_1 and write FAR PROCEDURES in code segment Module_2 to perform any two of the following string operations: i. Concatenation of two strings. ii. Comparison of two strings. iii. Finding Number of occurrences of a sub-string in the given string iv. Finding number of alphabets, digits, special characters, lower & upper case alphabets, words and number of lines from the text.
GROUP B(Any 3)	

5.	Study of Embedded C programming language (Overview, syntax, One simple program like addition of two numbers).
6.	Write an Embedded C program to add array of n numbers.
7.	Write an Embedded C program to transfer elements from one location to another for following: i) Internal to internal memory transfer ii) Internal to internal memory exchange.
8.	Write an Embedded C menu driven program for : i) Multiply 8 bit number by 8 bit number ii) Divide 8 bit number by 8 bit number .
9.	Write an Embedded C program for sorting the numbers in ascending and descending order.
GROUPC (Any 1)	
10.	Write an Embedded C program to interface PIC 18FXXX with LED & blinking it using specified delay.
11.	Write an Embedded C program for Timer programming ISR based buzzer on/off.
12.	Write an Embedded C program for LCD interfacing with PIC 18FXXX.
GROUP D	
13.	Study of ARM processor.
Remark: Implementation of all assignments is encouraged.	

Reference Books:

1. Peter Abel, NiyazNizamuddin, "IBM PC Assembly Language and Programming", Pearson Education.
2. Ray Duncan, "Advanced MS DOS Programming", 2nd edition, BPB Publications.
3. Mazidi, RolinMcKinlay and Danny Causey, ‘PIC Microcontroller and Embedded Systems using Assembly and C for PIC18”, Pearson Education.

Program:	**B. Tech. I.T.**					Semester: **IV**	
Course: **Data Structures and Algorithms Laboratory**						Code: **BIT4404**	
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**TW**	**OR**	**PR**	**Total**
-	2	-	1	25	-	25	50

Course Objectives:

1. To apply various advanced data structures such as trees and graphs to the applications.
2. To know the basics of computational complexity analysis and various algorithm design strategies.
3. To provide a thorough knowledge of the most common algorithms and data structures.
4. Design algorithms using appropriate design techniques.

Course Outcomes:

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

1. Apply and implement algorithms to create/represent and traverse non-linear data structures such as trees, graphs.
2. Experiment with Symbol tables.
3. Explain and apply the concept of hashing in database creation and manipulation.
4. Build the various algorithmic design paradigms.
5. Apply appropriate algorithmic strategy in problem-solving.
6. Analyze space and running times of the algorithms.

Assignment No.	**Suggested List of Assignments** (Write a program in C, any 8)
1.	Construct and expression tree from postfix/prefix expression and perform recursive and non-recursive In-order, pre-order and post-order traversals.
2.	Implement binary search tree and perform following operations: a. Insert b. Delete c. Search d. Mirror image e. Display f. Display level wise (algorithmic analysis)
3.	Implement DFS and BFS on a graph.
4.	Implement Merge Sort to sort the given list of numbers using divide-and-conquer strategy and verify the time complexity.
5.	Represent any real-world graph using adjacency list /adjacency matrix find minimum spanning tree using Prim's algorithm.
6.	Store data of students with telephone no and name in the structure using hashing function for telephone number and implement chaining with and without replacement.
7.	Develop functions to insert and delete into/from a max heap.
8	Implement Knapsack problem using Greedy approach.
9.	Write a program to implement Bellman-Ford Algorithm using Dynamic Programming and verify the time complexity.

10.	Write a recursive program to find the solution of placing n-queens on chessboard so that no two queens attack each other using Backtracking.

Reference Books:

1. Thomas H Cormen and Charles E.L Leiserson, “Introduction to Algorithm”, PHI, ISBN:81-203-2141-3.2. G. A.V, PAI, “Data Structures and Algorithms “, McGraw Hill, ISBN -13: 978-0-07-066726-6.
2. Gilles Brassard, Paul Bratle, “Fundamentals of Algorithms”, Pearson, ISBN 978-81-317-1244.
3. Y. Langsam, M. Augenstin, A. Tannenbaum, "Data Structures using C and C++", 2nd Edition, Prentice Hall of India, 2002, ISBN-81-203-1177-9.
4. https://ds1-iiith.vlabs.ac.in/exp/depth-first-search/index.html
5. https://ds1-iiith.vlabs.ac.in/exp/breadth-first-search/index.html

Program:	**B. Tech. I.T.**					Semester: **IV**	
Course: **Object Oriented Programming Laboratory**						Code: **BIT4405**	
Teaching Scheme				**Evaluation Scheme**			
Practical	**Tutorial**	**Credit**	**Hours**	**TW**	**OR**	**PR**	**Total**
4	-	2	4	50	-	25	75

Course Objectives:

1. To apply the concepts of object oriented paradigm.
2. To design and implement models for real life problems by using object oriented programming.
3. To develop object oriented programming skills.

Course Outcomes:

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

1. Construct classes for given real life data and operations.
2. Make use of static data members and methods for given real life problem
3. Design hierarchy of classes using inheritance.
4. Apply the concept of interface to solve a real-life problem.
5. Develop an application which handles different types of exceptions
6. Build an object-oriented solution to solve a real-life problem.

Assignment No.	Suggested List of Assignments
1.	Design a class 'Complex' with data members for real and imaginary part. Provide default and Parameterized constructors. Write a program to perform arithmetic operations of two complex numbers.
2.	Design a class named weather report that holds a daily weather report with data members day_of_month, hightemp, lowtemp, amount_rain and amount_snow. Use different types of constructors to initialize the objects. Write a program to generate monthly report that displays average of each attribute.
3.	Identify commonalities and differences between Publication, Book and Magazine classes. Title, Price, Copies are common instance variables and saleCopy is common method. The differences are, Bookclass has author and order_Copies(). Magazine Class has orderQty, Current_issue() andreceive_issue().Write a program to find how many copies of the given books are ordered and display the total sale of publication.
4.	Design and develop inheritance for a given case study and identify objects and relationships in it. Employee class with Emp_name, Emp_id, Address, Mail_id, and Mobile_no as data members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP, DA 10 % of BP, HRA is12% of BP, and PF is 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.
5.	Design a base class shape with two double type values and member functions to input the data and compute_area() for calculating area of figure. Derive two classes' triangle and rectangle. Make compute_area() as abstract function and redefine this function in the derived class to suit their requirements. Write a program that accepts dimensions of triangle/rectangle and display calculated area. Implement dynamic binding for given case study.
6.	Design and develop a context for given case study and implement an interface for Vehicles Consider the example of vehicles like bicycle, car, and bike. All Vehicles have common functionalities such as Gear Change, Speed up and apply breaks. Make an interface and put all these common functionalities. Bicycle, Bike, Car classes should be implemented for all these functionalities in their own class in their own way.

7.	Design a Base class STACK and Handle runtime anomalies like Overflow when the stack is full and underflow when the stack is empty. Display error codes and messages by using appropriate try and catch block to handle the exceptions thrown
	****** Implement a Mini Project using all the concepts of Object Oriented Programming implemented using JAVA ****** The project should be built using a version control system like GitHub. Sample Mini Project Implement a Mini Project for online ticket booking system in which the customer able to book a ticket based on the availability of seats. Make the payment based on the type and number of tickets booked for the particular show. Type of tickets is Gold, Platinum, Silver. Discount will be given for booking maximum of 5 or greater number of tickets only for Gold category.

Reference Books:

1. Java The complete reference, Herbert Schildt, McGraw Hill Education (India) Pvt. Ltd.9th edition, 2014. ISBN: 978-0-07-180856-9(E-book available athttp://www.sietk.org/downloads/javabook.pdf).
2. Mitsunori Ogihara, "Fundamentals of Java Programming", Springer; 2018, ISBN 978-3-319-89490-4.
3. Coursera Course on "Java Programming and Software Engineering Fundamentals Specialization" by Duke University. Available at https://www.coursera.org/specializations/java-programming).
4. Coursera Course on Java for Android by Vanderbilt University. Available at (https://www.coursera.org/learn/java-for-android?specialization=android-app-development).

Program:**B. Tech. I.T. (Open Elective – I)**				Semester :**IV**			
Course: **Numerical methods**				Code :**BAS4601**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**Internal Evaluation**	**MTE**	**ETE**	**Total**
3	-	-	3	20	30	50	100

Prior Knowledge of:

1. Univariate Calculus
2. Multivariate Calculus is essential

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 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. **Apply** numerical methods to **solve** the systems of linear equations.
2. **Perform** different numerical methods to **solve** differentiation and integration.
3. **Understand** basic operators, packages, syntax of software to **develop** programs for systems of linear equations, differentiation and Integration.
4. **Apply** single & multistep numerical methods to ordinary differential equations of first order for analyzing engineering problems.
5. **Apply** Explicit and Implicit methods to partial differential equations for **analyzing** heat, wave and Laplace equations.
6. **Develop** programs for Numerical Methods 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	**6**
II	**Numerical Integration**: Difference formulae for numerical differentiation, Boole's rule, Romberg integration and Gauss quadrature for multiple integration.	**6**
III	**Problem Solving-I:** Solutions of systems of linear equations, Differentiation and Integration using open source software.	**6**
IV	**Ordinary differential equations:** Euler's method, Modified Euler's method, Runge-Kutta 4^{th} order methods, predictor corrector method.	**4**
V	**Partial Differential Equations:** Difference formulae for numerical partial differentiation. Explicit and Implicit method, Stability of finite difference method, Applications of finite difference analysis in boundary value problems: Laplace equation, one dimensional diffusion equation, Wave equation.	**8**

VI	**Problem Solving-II:** Solutions of ordinary and partial differential equations using open source software.	**6**
	Total	**36**

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,4 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

e-sources:

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. (All branches)**			Semester :	**IV**		
Course :	**Mathematical Optimization**			Code **: BAS4602**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**Internal Evaluation**	**MTE**	**ETE**	**Total**
3	-	-	3	20	30	50	100

Prior Knowledge: Linear Algebra & Univariate Calculus, Multivariate Calculus, Applied Mathematics

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. **Apply** basic theoretical principles for formulation and solution of linear programming models.
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 for Linear Programming Problems.
4. **Apply** optimization techniques to solve transportation and assignment problems.
5. **Analyze** the project network and nonlinear problems using different methods to optimize models.
1. **Develop** programs for transportation and assignment problems and Nonlinear Programming problems

Detailed Syllabus:		
Unit	**Description**	**Duration [Hrs]**
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,	**6**
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.	**6**
III	**Duality:** Duality in linear programming, Formulation of Dual Linear programming problems. **Problem Solving-I:** Solutions of LPP using software**..**	**6**
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, solutions to Assignment problems using Hungarian method, variations in Assignment problems	**6**
V	**Network Analysis:** Network diagram, Project management: PERT and CPM, Critical path analysis, Project scheduling with uncertain activity time, Project time-cost, trade-off.	**6**
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	**6**

	nonlinear optimization problems using software.	
	Total	**36**

Text Books:

1. Rao S S, Engineering Optimization theory and Practice, Willy Easter Ltd. 4th Edition, ISBN: 978-0-470-18352-6
2. TahaHamdy, Operation Research: An Introduction, Pearson Education, 9th Edition, ISBN: 0134444019

Reference Books:

1. Sharma S. D. Operation Research, Kadar Nath Ram Nath& Co. Edition, ISBN: 9380803389
2. MatteoFischetti, "Introduction to mathematical optimization", First Edition, ISBN: 9781692792022
3. Judith L. Gersting, "Mathematical Structures for Computer Science", Freeman Co, 4 Edition, ISBN: 9780716783060
4. Peter V. O'Neil, "Advanced Engineering Mathematics", Thomson Learning ,7 Edition, ISBN 13: 9781337274524
5. Hira and Gupta, "Operation research", S. Chand publication, ISBN (13): 9788121909686.
6. Sharma J. K. "Operations Research- Theory and Applications", Trinity Press, 6 Edition, ISBN: 9789385935145

e-sources:

1. **NPTEL Course lectures links:**
   https://nptel.ac.in/courses/111/102/111102012/ (LPP)
   https://nptel.ac.in/courses/110/106/110106059/ (Transportation & Assignments Problems)

Program:	**B. Tech. (All branches)**			Semester :	**IV**		
Course : **Calculus of Variation**				Code:**BAS4603**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**Internal Evaluation**	**MTE**	**ETE**	**Total**
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. **Construct** 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 for optimization of functional.
4. **Apply** theory & techniques of calculus of variation to solve boundary value problems.
5. **Analyze** given problem to construct finite element structure and **apply** theory of calculus of variation to solve it
6. **Develop** programs for approximate and FEM models using open source software.

Detailed Syllabus:		
Unit	**Description**	**Duration (Hrs)**
I	**The foundations of calculus of variations** Introduction, The Euler-Lagrange differential equation, Minimal path problems, open boundary variational problems. **Constrained variational problems.** Algebraic boundary conditions, Lagrange's solution, Isoperimetric problems, Closed-loop integrals,	6
II	**Multivariate functional** Variational problems in parametric form, Functional with two independent variables, Minimal surfaces, Functionals with three independent variables (only conversion). **Higher order derivatives** The Euler-Poisson equation, The Euler-Poisson system of equations, Algebraic constraints on the derivative.	6
III	**Problem Solving-I:** Solutions of constrained and unconstrained variational problems using open source software.	6
IV	**Approximate methods** Euler's method, Rayleigh-Ritz method, Galerkin's method	6
V	**Finite Element Methods**	6

	Boundary integral method, Finite element method, Case Studies.	
VI	**Problem Solving-II:** Solutions of Approximate and FEM models using open source software.	6
	Total	**36**

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

e-sources:

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. (All branches)**			Semester :	**IV**		
Course : **Mathematical Modeling and Simulation**				Code : **BAS4604**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**Internal Evaluation**	**MTE**	**ETE**	**Total**
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 (Hrs)
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.	6
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.	6
III	**Problem Solving-I:** Analytical Solutions of ordinary and partial differential equations using open source software.	6
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.	6
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.	6
VI	**Problem Solving-II:** Numerical Solutions of ordinary and partial differential equations using open source software.	6
	Total	**36**

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

e-sources:

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. (All branches)**			Semester :	**IV**		
Course : **Financial Mathematics**				Code : **BAS4605**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**Internal Evaluation**	**MTE**	**ETE**	**Total**
3	-	-	3	20	30	50	100

Prior Knowledge: Nil

Course Objectives:

This course aims at enabling students to get acquainted with,

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 [Hrs]**
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, simpleinterest, compound interest.	6
II	**Fundamentals of Financial Mathematics II:** The time value of money, annuities and cash flows, loans, general cashflows and portfolios, derivatives, swaps, and hedging.	6
III	**Basics of Options :**Options; (call option and put options), payoffs call and put options, speculation(call or put) and its application (option).	6
IV	**Stocks and bonds:**Stocks and bonds, Valuation of stocks and bonds, Mutual funds, Cost of capital andratio analysis.	6
V	**Basics of Investment:** Investment return. Uneven cash flows Compounding frequency of interest, Economicequivalence. Portfolio diversification	6
VI	**Risk & uncertainty:** Decision under risk & uncertainty, Risk premium, Portfolio diversification, Life Insurance,Endowment	6
	Total	**36**

Text Books:

1. MarekCapinski and Tomasz Zastawniak, “Mathematics for Finance”, Springer 2nd Edition, ISBN 13:978-0857290816.
2. AmbadNazriWahidudin, “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

e-sources:

1. NPTEL Course lectures links:

https://nptel.ac.in/courses/112/107/112107260/

Program:	**B. Tech. (All branches)**			Semester :	**IV**		
Course : **Neural Network and Fuzzy Logic Control**				Code : **BAS4606**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**Internal Evaluation**	**MTE**	**ETE**	**Total**
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. Model a Neural Network using feedforward network.
2. Apply backpropagation and feedback networks to study on real time data.
3. Understand basic operators, packages, syntax of software and implementation of an artificial neural network using the NN simulation toolbox.
4. Apply concepts of fuzzy logics in Fuzzification and Defuzzification.
5. Appl fuzzy logic control in Pattern recognition and Home Heating system.
6. Implement Fuzzy Logic Toolbox in fuzzy logic control..

Detailed Syllabus:		
Unit	**Description**	**Duration [Hrs]**
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.	**6**
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.	**6**
III	**Problem Solving-I: :** Neural Network (NN) Toolbox, NN Simulink Demos, Neural Network (ANN) implementation, NN Tool Artificial Neural Network (ANN) implementation, Case studies-	**6**
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	**6**
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.	**6**
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.	**6**
	Total	**36**

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

E-source:

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. (All Branches)**				Semester :**IV**			
Course :**Professional skills for Engineers**				Code :**BHM4101**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**IE**	**MTE**	**ETE**	**Total**
1	2	-	2	30	-	20	50

Prior knowledge of

1. Basic Language Skills

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. **Apply** effective communication skills at the workplace.
2. **Demonstrate** presentation skills and group discussions skills to excel in the professional environment.
3. **Demonstrate** interview skills and corporate etiquettes effectively to hone the opportunities of employability
4. **Apply** career management skills that can lead to improved employment

Detailed Syllabus		
Unit	**Description**	**Duration (H)**
1	**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	**6**
2	**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	6
3	**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 **CorporateEtiquettes:** Dressing Etiquettes, Dining Etiquettes, Telephonicetiquette, Business card Etiquettes, Email etiquettes	**6**

4	**Professional Ethics:** Integrity, Objectivity, Professional competence and due care, Confidentiality Professional behavior. **Organizational Skills:** Physical Organization, Digital Organization, Planning, Time management & Communication	**6**
	Total	**24**

Text Books:

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, New Delhi 2010
2. Indrajit Bhattacharya, "An Approach to Communication Skills", DhanpatRai, Delhi, 2008
3. Simon Sweeney, "English for Business Communication", Cambridge University Press.
4. Sanjay Kumar and PushpaLata, "Communication Skills", Oxford University Press.
5. BarunK.Mitra, Personality Development & Soft Skills, Oxford University Press, 2012 New Delhi

E-sources:

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. I.T.**				Semester :**IV**		
Course :**Python Programming**				Code :**BIT4911**		
Teaching Scheme				**Evaluation Scheme**		
Lecture	**Practical**	**Tutorial**	**Credit**	**Continuous Evaluation**	**MTE**	**ETE**
1	2	-	-	-	-	-

Course Objectives:

1. To acquaint with problem solving, problem solving aspects, programming and various program design tools.
2. To develop problem solving skills with computers.
3. To develop competency for the design, coding and debugging.
4. To build the programming skills using 'Python Language'.

Course Outcomes:

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

1. Apply skills in problem solving for finding solutions to real life problems.
2. Analyze the methods and apply the most appropriate one for solving problems.
3. Apply Programming logic/logical constructs of Python language for problem solving.
4. Demonstrate significant experience with the 'Python' program development environment.

Detailed Syllabus		
Unit	**Description**	**Duration (H)**
1.	**Problem Solving Using Computers** Basics of Python Programming: Features of Python, literal constants, variables and identifiers, input operation, Reserved words, Indentation, Operators and expressions.	3
2.	**Decision Control Statements** Decision control statements, selection/conditional branching statements, loop Structures/Iterative statement, selecting appropriate loop. Nested loops, the break, continue, pass, else statement used with loops. Other data types- Tuples, Lists and Dictionary.	6
3.	**Functions and Modules** Need for functions, Function: definition, call, variable scope and lifetime, the return statement. Defining functions, Lambda or anonymous function, documentation string, good programming practices. Introduction to modules and packages, Introduction to standard library modules and packages.	6
4.	**Strings and Operations** Concatenation, appending, multiplication and slicing. Strings are immutable, strings formatting operator, built in string methods and functions. Slice operation, ord() and chr() functions, in and not in operators, comparing strings, iterating strings, the string module.	5
	Total	**20**

Text Books:

1. How to Solve it by Computer, R. G. Dromey, First edition, Pearson Education.
2. "Python Programming Using Problem Solving Approach", Reema Thareja, Second edition Oxford University. Press

Reference Books:

1. R. Nageswara Rao, "Core Python Programming" Second edition, Dreamtech Press.
2. Maureen Spankle, "Problem Solving and Programming Concepts", 9th edition, Pearson.
3. Paul Barry, "Head First Python- A Brain Friendly Guide", 2nd Edition.
4. Martin C, "Python: The Complete Reference", fourth edition Brown, McGraw Hill Education.
5. Ashok Namdev Kamthane, "Programming and Problem Solving with Python" , McGraw Hill Education.

Program:	B. Tech. IT			Semester: **IV**			
Course: **Web Development**				Code: **BIT4912**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Tutorial**	**Credit**	**Hours**	**IE**	**MTE**	**ETE**	**Total**
-	2	-	-	-	-	-	-

Prior Knowledge of: Nil

Course Objectives:

1. To apply principles of designing for effective user interfaces.
2. To quickly develop high quality and interactive website.

Course Outcomes:

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

1. Understand different web technologies.
2. Develop static web pages using HTML.
3. Build user-friendly website using different web technologies.
4. Learn to deploy the website and access through URL

Assignment No.	Suggested List of Assignments
1.	Using HTML5 layout tags develop informative page with sections which include various images, links to other pages for navigation, make use of all possible formatting (for example font, color etc.).
2.	Create a registration form in HTML using HTML form input elements viz. textbox, text area, radio button and drop down menu, check box, submit, file and reset button. Field should contain name, address, birth- date, qualification, email, phone number, gender, comments, attach photo etc. Use HTML Form elements wherever required. Align all elements using table.
3.	Create a HTML programs using frames. Three frames displaying three different HTML files. i. Frame 01–contain examples of ordered as well as unordered list ii. Frame 02–contain examples of text formatting tags i.e. <b>, <i>, <u>, <h1>--<h6>, <p>,<sup>,<sub>iii.Frame 03 – contain example of 3 by 4 tables with data. iii.Create a hyperlink in Frame 01 that opens in Frame 03 Frame 1 | Frame 2 Frame 3
4.	Apply CSS properties Border, margins, Padding, Navigation, dropdown list to page created in first assignment.
5.	Create form in HTML with all form elements apply form validations (e.g. Email, mobile, Pin code, Password) and Write program using Java script that checks the empty values from that form and alert backusing alert function

6.	Create feedback form in PHP which contains first name, last name, address, email, comment and mobile

Reference Books:

1. Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML and PHP, 4th Edition by Ivan Bayross, BPB Publications. ISBN: 9788183330084.
2. Professional Word Press: Design and Development by Brad Williams, David Damstra, Hal Stern, Wrox publications Web Technologies Black Book: HTML, JavaScript, PHP, Java, JSP, XML and AJAX by Kogent Learning Solutions Inc. ISBN: 9788126554560, 8126554568.

Program:	B. Tech. (All Branches)			Semester: **IV**			
Course: **Life Skill IV**				Code: **BHM4940**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Tutorial**	**Credit**	**Hours**	**IE**	**MTE**	**ETE**	**Total**
-	2	-	-	-	-	-	-

Prior Knowledge of: Nil

Course Objectives:

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

Course Outcomes:

After learning the course, the students will 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)**
1	**Social Welfare** Environment awareness such as Tree Plantation, Natural resources awarenessetc, 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, Strucuraland Functional, Ego States Diagnosis, Egogram,Structural Pathology, Contamination, Theory of Communication, Types of Transactions, Strokes, Stroke Economy, Theory of Life Positions, Injunctions	**12**

2	**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. AroupChatterjee , "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. BenjaminColodzin, "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. (All Branches)**			Semester: **IV**			
Course: **Environmental Science**				Code: **BHM9961**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Tutorial**	**Credit**	**Hours**	**IE**	**MTE**	**ETE**	**Total**
1	-	-	-	-	-	-	-

Prior Knowledge of:

1. Basic Mathematics concepts**.**

is essential

Course Objectives:

1. To gain an understanding on the concepts and strategies related to sustainable development and identify and analyse various conservation methods for renewable and non-renewable resources.
2. To examine biotic and abiotic factors within an ecosystem and to identify energy flow in ecosystem.
3. To understand the value of biodiversity and identify current efforts for it's conservation at national and local level
4. To provide comprehensive overview of environmental pollution and technology associated with monitoring and control.

Course Outcomes:

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

1. Demonstrate an integrative approach to environmental issues with a focus on sustainability and identify the role of organism in energy transfer in different ecosystem.
2. Distinguish between renewable and non-renewable resources and analyse consumption of resources
3. Identify key threats to biodiversity and develop appropriate policy options for it's conservation.
4. Analyse the impact of environmental pollution and the science behind those problems and potential solutions.

Detailed Syllabus		
Unit	**Description**	**Duration (H)**
1	Multidisciplinary nature of environmental studies: Definition, scope and importance, Need for Public awareness, Natural Resources: Renewable and non-renewable resources: Natural resources and associated problems a) Forest b)Water c)Mineral d)Food e) Land f) Energy, Role of an individual in conservation of natural resources, Use of resources for sustainable lifestyle.	3
2	Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposer, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids, Characteristic features, Case study on Forest ecosystem, Aquatic ecosystem.	3
3	Biodiversity and its conservation: Introduction – Definition: genetic, species and ecosystem diversity, Bio geographical classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic values, Biodiversity at global, national and local levels, India as a mega-diversity nation, Hotspots of biodiversity, Threats to biodiversity, Conservation of biodiversity, Case study on any one Hotspot of biodiversity.	3

4	Environmental Pollution: Definition, Cause, effects and control measures of different pollution: a. Air b. Water c. Soil d. Noise e. Thermal f. Nuclear hazards, Solid waste management, Relevance of environmental ethics for environmental protection, Social Issues and the Environment :From Unsustainable to Sustainable development ,Urban problems related to energy ,Water conservation, Impact of Climate change, Innovative ideas for creating public environmental awareness.	3
	Total	**12**

Text Books:

1. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T., "Environmental Encyclopedia", Jaico Publications House, 1st edition, 2000, ISBN-13: 978-8172247867
2. Agarwal, K.C, "Environmental Biology", Nidhi Publishers, 2nd edition ,2008, ISBN-13978-8189153021

Reference Books:

11. BharuchaErach, "The Biodiversity of India", Mapin Publishing Pvt. Ltd., 1st edition, 20021, ISBN-108188204064