Bharati Vidyapeeth

(Deemed to be University)

Pune, India

College of Engineering, Pune

B.Tech. (Computer Science and Business Systems) Program Curriculum

(2021 Course)

VISION OF UNIVERSITY:

Social Transformation Through Dynamic Education.

MISSION OF UNIVERSITY:

- To make available quality education in different areas of knowledge to the students as per their choice and inclination.
- To offer education to the students in a conducive ambience created by enriched infrastructure and academic facilities in its campuses.
- To bring education within the reach of rural, tribal and girl students by providing them substantive fee concessions and subsidized hostel and mess facilities.
- To make available quality education to the students of rural, tribal, and other deprived sections of the population.

VISION OF THE INSTITUTE:

To be World Class Institute for Social Transformation Through Dynamic Education.

MISSION OF THE INSTITUTE:

- To provide quality technical education with advanced equipment, qualified faculty members, infrastructure to meet needs of profession and society.
- To provide an environment conducive to innovation, creativity, research, and entrepreneurial leadership.
- To practice and promote professional ethics, transparency and accountability for social community, economic and environmental conditions.

Vision of the Department

To syndicate industry and institute to impart high quality knowledge through scholarity, research and creative endeavour

Mission of the Department

- To impart contemporary technology conforming to a dynamic curriculum.
- To engage in professional development and scholarly endeavour through knowledge of common business principles.
- To promote the awareness of business discipline and ethical responsibility through industry alliance

Programme Educational Objectives (PEOs)

1. Prevail technical competency to concord the industry engrossment.
2. Assimilate business management skills.
3. Instigate business level innovation with societal consideration.

Program Specific Outcomes (PSOs)

Students of B. Tech (CSBS) will be

PSO1: Able to apply pragmatic, innovative and critical thinking approach for solving complex business problems.

PSO2: Able to choose effective business communication techniques in professional Institute/organization.

PSO3: Able to use financial domain understanding to formulate technological strategy.

PSO4: Skilled in contemporary courses from emerging domains such as artificial intelligence, Machine learning and data science.

Programme Outcomes (POs)

The students of B.Tech (Computer Science & Business Systems) will be able to

a. Demonstrate logical and programming skills through comprehensive programming foundation.
b. Apply knowledge of mathematics, computer engineering and basic science to comprehend and solve real world problems.
c. Develop software applications and processes for complex problems to provide efficient solutions by assessing its environmental, social and ethical constraints.
d. Investigate and solve complex computing problems with alternate solutions.
e. Use functional skills of modern IT tools and techniques for engineering activities.
f. Understand the social and cultural impact of computing on society.
g. Provide optimized computational solutions that apprehend the societal and environmental aspects.
h. Exhibit the professional, ethical and legal responsibilities related to industry.
i. Perform as an individual and efficient team player to accomplish a goal.
j. Present professional concepts through effective communication skills and documentation.
k. Demonstrate management skills for developing time-bound projects within the available budget and resources.
l. Develop the ability of lifelong learning for new IT practices.

CORELATION BETWEEN GRADUATE ATTRIBUTES AND PROGRAMME OUTCOMES

Graduate Attributes/ Programme Outcomes	a	b	c	d	e	f	g	h	i	j	k	l
Engineering Knowledge	✓											
Problem Analysis		✓										
Design/Development of Solutions			✓									
Conduct Investigations of Complex Problems				✓								
Modern Tool Usage					✓							
The Engineer and Society						✓						
Environment and Sustainability							✓					
Ethics								✓				
Individual and Teamwork									✓			
Communication										✓		
Project Management and Finance											✓	
Life-Long Learning												✓

DEFINITION OF CREDITS:

1 Hour Lecture (L) per week	1 credit
1 Hour Tutorial (T) per week	1 credit
2 Hour Practical (P) per week	1 credit
4 Hours Practical (P) per week	2 credit

STRUCTURE OF UNDERGRADUATE ENGINEERING PROGRAMME

Sr. No.	Category	Breakup of Credits
1	Basic Science Course (BSC)	61
2	Engineering Science Course (ESC)	08
3	Core Course (CC)	96
4	Elective Course (EC)	24
5	Project (PROJ)	18
6	Internship (INT)	03
7	Vocational Course (VC)	08
8	Massive Open Online Course (MOOC)	06
9	Research Paper Publication (Research)	02
10	Social Activities (SA)	04
11	Mandatory Courses (MC)	Non-Credit
TOTAL		230

DISTRIBUTION OF COURSE COMPONENTS

Sr. No.	Category	Number of Courses
1.	Basic Science Course (BSC)	18
2.	Engineering Science Course (ESC)	02
3.	Core Course (CC)	22
4.	Elective Course (EC)	06
5.	Project (PROJ)	04
6.	Internship (INT)	01
7.	Vocational Course (VC)	04
8.	Massive Open Online Course (MOOC)	03
9.	Research Paper Publication (Research)	01
10.	Social Activities	02
11.	Mandatory Courses	02
12.	Internal Assessment (IA)	--
13.	University Examination (UE)	--
TOTAL		65

Program: **B.TECH. (Computer Science & Business Systems)** **Semester – I** **2021 Course**

Sr. No.	Course Code	Name of Course	Teaching Scheme (Hrs./Week)			Examination Scheme (Marks)						Credits			
			L	P	T	UE	IA	TW	TW & OR	TW & PR	Total	L	P TW/OR/PR	T	Total
1		Discrete Mathematics	3	2	-	60	40	-	50	-	150	3	1	-	4
2		Statistics, Probability and Calculus	3	-	1	60	40	-	-	-	100	3	-	1	4
3		Principles of Electrical Engineering	3	2	-	60	40	25	-	-	125	3	1	-	4
4		Fundamentals of Computer Science	3	4	-	60	40	-	-	50	150	3	2	-	5
5		Physics for computing science	3	2	-	60	40	25	-	-	125	3	1	-	4
6		Business Communication & Value Science - I	3	2	-	50	-	-	50	-	100	3	1	-	4
	Total		**18**	**12**	**1**	**350**	**200**	**50**	**100**	**50**	**750**	**18**	**06**	**01**	**25**

Program: **B.TECH. (Computer Science & Business Systems)** **Semester – II** **2021 Course**

Sr. No.	Course Code	Name of Course	Teaching Scheme (Hrs./Week)			Examination Scheme (Marks)						Credits			
			L	P	T	UE	IA	TW	TW & OR	TW & PR	Total	L	P TW/OR/PR	T	Total
1		Linear Algebra	3	0	1	60	40	-	-	-	100	3	0	1	4
2		Statistical Methods	3	2	-	60	40	25	-	-	125	3	1	-	4
3		Data Structures and Algorithms	3	4	-	60	40	-	-	100	200	3	2	-	5
4		Fundamentals of Economics	3	0	-	60	40	-	-	-	100	3	0	-	3
5		Principles of Electronics Engineering	3	2	-	60	40	25	-	-	125	3	1	-	4
6		Business Communication & Value Science - II	3	4	-	50	-		50	-	100	3	2	-	5
	Total		**18**	**12**	**1**	**350**	**200**	**50**	**50**	**100**	**750**	**18**	**06**	**1**	**25**

Program: B.TECH. (Computer Science & Business Systems) Semester – III 2021 Course

Sr. No.	Course Code	Name of Course	Teaching Scheme (Hrs./Week)			Examination Scheme (Marks)						Credits			
			L	P	T	UE	IA	TW	TW & OR	TW & PR	Total	L	P TW/OR/PR	T	Total
1		Formal Language and Automata Theory	3	-	1	60	40	-	-	-	100	3	-	1	4
2		Computer Organization & Architecture	3	2	-	60	40	25	-	-	125	3	1	-	4
3		Object Oriented Programming	3	2	-	60	40	-	-	50	150	3	1	-	4
4		Computational Statistics	3	4	-	60	40	-	-	50	150	3	2	-	5
5		Software Engineering*	4	2	-	60	40	-	-	25	125	4	1	-	5
6		Business Communication & Value Science – III	2	4	-	50	-	-	50	-	100	2	2	-	4
7		Vocational Course- I	-	-	-	-	-	-	50	-	50	-	2	-	2
8		MOOC-I	-	-	-	-	-	-	-	-	-	-	-	-	2
9		Environmental Studies** (Mandatory Audit Course)	-	-	-	-	-	-	-	-	-	-	-	-	-
	Total		**18**	**14**	**1**	**350**	**200**	**25**	**100**	**125**	**800**	**18**	**9**	**1**	**30**

***Industry Taught Course-I** ** 100 Marks Theory Examination**

Vocational Course – I

S. No.	Course Name	Offered By	Offered By	Offered By
1.	Web Programming Fundamentals	HarvardX	IBM	Johns Hopkins University
2.	Excel Skills for Business	Macquarie University	IBM	PwC
3.	Software Design and Architecture	University of Alberta	University of Colorado System	IIT Madras
4.	Full Stack Development	IBM	IIT Madras	The Hong Kong University of Science and Technology
5.	Software Testing	Edureka	Udemy	ISTQB, LambdaTest

Program: **B.TECH. (Computer Science & Business Systems)** **Semester – IV** **2021 Course**

Sr. No.	Course Code	Name of Course	Teaching Scheme (Hrs./Week)			Examination Scheme (Marks)						Credits			
			L	P	T	UE	IA	TW	TW & OR	TW & PR	Total	L	P TW/OR/PR	T	Total
1		Operating Systems	4	2	-	60	40	25	-	-	125	4	1		5
2		Database Management Systems	4	4	-	60	40	-	-	50	150	4	2		6
3		Software Design with UML*	3	2	-	60	40	-	-	50	150	3	1		4
4		Introduction to Innovation, IP Management & Entrepreneurship	3	-	1	60	40	-	-	-	100	3	-	1	4
5		Business Communication & Value Science – IV	2	4	-	50	-	-	50	-	100	2	2		4
6		Operations Research	2	2	-	60	40	25	-	-	125	2	1		3
7		Vocational Course-II	-	-	-	-	-	-	50	-	50	-	2		2
8		Social Activities - I	-	-	-	-	-	-	-	-	-	-	-		2
9		Disaster Management** (Mandatory Audit Course)	-	-	-	-	-	-	-	-	-	-	-		-
	Total		**18**	**14**	**1**	**350**	**200**	**50**	**100**	**100**	**800**	**18**	**9**	**1**	**30**

*** Industry Taught Course-II** **** 100 Marks Theory Examination**

Vocational Course – II

S. No.	Course Name	Offered By	Offered By	Offered By
1.	NoSQL	IBM	MongoDBInc	AWS
2.	Linux and Git	Google,	Linux Foundation	IIT, Bombay
3.	Programming for Problem Solving	MITx	IIT Kanpur	edX/ Coursera
4.	Game Development	Harvard	Google for games	Coursera Michigan State University
5.	Python Certification	Google	Coursera	edX

Program: **B.TECH. (Computer Science & Business Systems)** **Semester – V** **2021 Course**

Sr. No.	Course Code	Name of Course	Teaching Scheme (Hrs./Week)			Examination Scheme (Marks)						Credits			
			L	P	T	UE	IA	TW	TW & OR	TW & PR	Total	L	P TW/OR/PR	T	Total
1		Design and Analysis of Algorithms	3	4	-	60	40	-	-	50	**150**	3	2		**5**
2		Compiler Design	3	2	-	60	40	-	25	-	**125**	3	1		**4**
3		Fundamentals of Management	2	-	-	60	40	-	-	-	**100**	2	0		**2**
4		Business Strategy	2	-	-	60	40	-	-	-	**100**	2	0		**2**
5		Design Thinking*	3	4	-	60	40	-	-	50	**150**	3	2		**5**
6		Elective-I	3	2	-	60	40	-	25	-	**125**	3	1		**4**
7		Project-I Stage- I	-	2	-	-	-	-	100	-	**100**	-	4		**4**
8		Vocational Course-III	-	-	-	-	-		50	-	**50**	-	2		**2**
9		MOOC-II	-	-	-	-	-	-	-	-	**-**	-	-		**2**
	Total		**16**	**14**	**-**	**360**	**240**	**-**	**200**	**100**	**900**	**16**	**12**		**30**

*** Industry Taught Course-III**

Elective - I	Machine Learning	Conversational Systems	Cloud, Microservices and Application

Vocational Course – III

S. No.	Course Name	Offered By	Offered By	Offered By
1.	Data Science	Databricks	IBM	IIT Madras
2.	UI / UX Design	University of Michigan	California Institute of the Arts	Google
3.	Agile Development & Management	University of Virginia	University of Minnesota	IBM
4.	Django	IBM	University of Michigan	HarvardX
5.	Machine Learning & AI with Python	Indian Institute of Technology, Bombay	Google, IBM	Stanford University, Harvard University

Program: **B.TECH. (Computer Science & Business Systems)** **Semester – VI** **2021 Course**

Sr. No.	Course Code	Name of Course	Teaching Scheme (Hrs./Week)			Examination Scheme (Marks)						Credits			
			L	P	T	UE	IA	TW	TW & OR	TW & PR	Total	L	P TW/OR/PR	T	Total
1		Computer Networks	3	2	-	60	40	-	-	25	125	3	1	-	**4**
2		Information Security	3	2	-	60	40	-	-	25	125	3	1	-	**4**
3		Artificial Intelligence*****	3	2	-	60	40	-	25	-	125	3	1	-	**4**
4		Financial & Cost Accounting	2	-	-	60	40	-	-	-	100	2	-	-	**2**
5		Quantitative Techniques Communication and Values	2	2	-	60	40	-	-	-	100	3	-	-	**3**
6		Elective- II	3	2	-	60	40	-	25	-	125	3	1	-	**4**
7		Project-I Stage-II	-	2	-	-	-	-	100	-	100	-	4	-	**4**
8		Internship	-	-	-	-	-	-	50	-	50	-	3	-	**3**
9		Vocational Course-IV	-	-	-	-	-	-	50	-	50	-	2	-	**2**
	Total		**16**	**12**	**-**	**360**	**240**	**-**	**250**	**50**	**900**	**17**	**13**		**30**

*** Industry Taught Course-IV**

Elective - II	Data Mining and Analytics	Robotics and Embedded Systems	Modern Web Applications

Vocational Course – IV

S. No.	Course Name	Offered By	Offered By	Offered By
1.	Artificial Intelligence and Deep Learning	Harvard University	IIT Roorkee	IBM
2.	Cyber Security	IBM	New York University	Uttarakhand Open University, Haldwani
3.	Angular JS	Harvard University	IICT Chennai	Sun Certified Enterprise
4.	Certification in Big Data Analytics	University of California	Electronics and ICT Academy, IIT Guwahati	SAP
5.	AI Foundations for Everyone	HarvardX	IIT Guwahati	IBM

Program: **B.TECH. (Computer Science & Business Systems)** **Semester – VII** **2021 Course**

Sr. No.	Course Code	Name of Course	Teaching Scheme (Hrs./Week)			Examination Scheme (Marks)						Credits			
			L	P	T	UE	IA	TW	TW & OR	TW & PR	Total	L	P TW/OR/PR	T	Total
1.		Usability Design of Software Applications	3	2	-	60	40	-	25	-	125	3	1	-	4
2.		IT Workshop*	3	4	-	60	40	-	-	25	125	3	2	-	5
3.		Financial Management	2	-	1	60	40	-	-	-	100	2	-	1	3
4.		Human Resource Management	2	-	-	60	40	-	-	-	100	2	-	-	2
5.		Elective- III	3	2	-	60	40	-	25	-	125	3	1	-	4
6.		Elective- IV	3	2	-	60	40	-	25	-	125	3	1	-	4
7.		Project-II Stage- I	-	4	-	-	-	-	200	-	200	-	4	-	4
8.		MOOC-III	-	-	-	-	-	-	-	-	-	-	-	-	2
9.		Research Paper Publication	-	-	-	-	-	-	-	-	-	-	-	-	2
	Total		**16**	**14**	**1**	**360**	**240**	**-**	**275**	**25**	**900**	**16**	**9**	**1**	**30**

*** Industry Taught Course-V**

Elective- III	DS	Cognitive Science & Analytics
	DTS	Introduction to IoT
	DS	Cryptology
Elective- IV	CS	Quantum Computation & Quantum Information
	DS	Advanced Social, Text and Media Analytics
	DTS	Mobile Computing

Program: **B.TECH. (Computer Science & Business Systems)** **Semester – VIII** **2021 Course**

Sr. No.	Course Code	Name of Course	Teaching Scheme (Hrs./Week)			Examination Scheme (Marks)						Credits			
			L	P	T	UE	IA	TW	TW & OR	TW & PR	Total	L	P TW/OR/PR	T	Total
1.		Services Science & Service Operational Management	4	2	-	60	40	-	50	-	150	4	1	-	5
2.		IT Project Management*****	3	2	-	60	40	-	50	-	150	3	1		4
3.		Marketing Research & Marketing Management	3	0	1	60	40	-	-	-	100	3	0	1	4
4.		Elective-V	3	2	-	60	40	-	25	-	125	3	1	-	4
5.		Elective-VI	3	2	-	60	40	-	25	-	125	3	1	-	4
6.		Seminar	-	2	-	-	-	-	50	-	50	-	1	-	1
7.		Project-II Stage-II	-	4	-	-	-	-	200	-	200	-	6	-	6
8.		Social Activities - II	-	-	-	-	-	-	-	-	-	-	-	-	2
	Total		**16**	**14**	**1**	**300**	**200**	**-**	**400**	**-**	**900**	**16**	**11**	**1**	**30**

*** Industry Taught Course -VI**

Elective-V	SH	Behavioral Economics
	MS	Computational Finance & Modeling
	SH	Psychology
Elective-VI	DTS	Enterprise Systems
	MS	Advance Finance
	DTS	Image Processing and Pattern Recognition

List of MOOCs

MOOC-I	MOOC-II	MOOC-III
Numerical Methods	Programming in Java	Data Analytics with Python
Probability and Statistics	Software Project Management	Big Data Computing
Communication Skills	Advanced Database Management System	Information security
Linear Algebra	Introduction to Artificial Intelligence	Introduction to Human Computer Interaction
Software Engineering	Machine Learning, ML	Data Mining
Data Structure and Algorithms Using Java	The Joy of Computing using Python	Management Information System
Introduction to Database Systems	Business and Sustainable Development	Decision Support System for Managers
Introduction to Automata, Languages and Computation	Applied Econometrics	Entrepreneurship
Software Engineering	Secure Computation: Part I	User-centric Computing for Human-Computer Interaction
An Introduction to Probability in Computing	Data Analytics with Python	Software Project Management

B.TECH (Computer Science & Business Systems)

SEMESTER – I

COURSE SYLLABUS

Discrete Mathematics

Teaching Scheme		Examination Scheme		Credit Scheme	
	Hours/Week		Marks		Credits
Theory:	03 Hours/Week	End Semester Examination	60 Marks	Theory	03 Credits
Practical:	02 Hours/Week	Internal Assessment	40 Marks	Practical	01 Credit
		Term work & Oral	50 Marks	Total	04 Credits

Course Prerequisite:
Basic knowledge of Elementary Linear Algebra, Numerical Mathematical Computation, Programming basics.

Course Objective:
The objective is to provide a mathematical foundation and skills those are required in further study of Computer Science. The course Discrete Mathematics deals with discrete objects, countable sets. It helps to develop logical thinking and a wide variety of real-world applications to computer science. It is a very good tool for improving reasoning and problem-solving capabilities.

Course Outcomes: On completion of the course, students will have the ability to:

1. Demonstrate the ability to write the sentences in the symbolic logic and evaluate a proof technique.
2. Apply the basic principles of set theory to analyse the data relationship and prove basic properties of set.
3. Analyse the properties of relations and functions to determine their properties.
4. Apply the knowledge of Boolean algebra for building basic electronic and digital circuits.
5. Solve problems of combinatorics and recurrence relations.
6. Model problems in Computer Science using graphs and trees.

Unit I **06 Hours**

Logic: Propositional calculus - propositions and connectives, syntax; Semantics – truth assignments and truth tables, validity and satisfiability, tautology; Adequate set of connectives; Equivalence and normal forms; Compactness and resolution; Formal reducibility - natural deduction system and axiom system; Soundness and completeness.

Unit II **06 Hours**

Set Theory: Types of sets, Sets operations and laws, Algebra of Sets, Multisets, Application of the principle of inclusion and exclusion.
Boolean algebra: Introduction of Boolean algebra, basic logic gate, basic postulates of Boolean algebra, principle of duality, canonical form, Karnaugh map.

Unit III **06 Hours**

Relations: Basic definition, properties and types of relations, relations and digraphs, paths in relations and digraphs, equivalence and partially ordered relations.
Functions: Types of functions, Identity functions, Composition of functions, Mathematical functions, Pigeonhole principle.

Unit IV **06 Hours**

Algebraic Structures: Isomorphism and Homomorphism. Algebraic Structures with Binary Operations, rings, Cyclic groups, codes.

Unit V **06 Hours**

Combinatorics: Basic counting, balls and bins problems, generating functions, recurrence relations. Proof techniques, principle of mathematical induction, pigeonhole principle.

Unit VI **06 Hours**

Graph Theory Graphs and digraphs, complement, isomorphism, connectedness and reachability, adjacency matrix, Eulerian paths and circuits in graphs and digraphs, Hamiltonian paths and circuits in graphs and tournaments, trees; Planar graphs, Euler's formula, dual of a planer graph, independence number and clique number, chromatic number, statement of Four-color theorem.

Textbooks:

1. Topics in Algebra, I. N. Herstein, John Wiley and Sons.
2. Digital Logic & Computer Design, M. Morris Mano, Pearson.
3. Elements of Discrete Mathematics, (Second Edition) C. L. LiuMcGraw Hill, New Delhi.
4. Graph Theory with Applications, J. A. Bondy and U. S. R. Murty, Macmillan Press, London.
5. Mathematical Logic for Computer Science,L.Zhongwan, World Scientific, Singapore.

Reference Books:

1. Introduction to linear algebra. Gilbert Strang.
2. Introductory Combinatorics, R. A. Brualdi, North-Holland, New York.
3. Graph Theory with Applications to Engineering and Computer Science, N. Deo, Prentice Hall, Englewood Cliffs.
4. Introduction to Mathematical Logic(Second Edition), E. Mendelsohn, Van-Nostrand, London.

List of Assignments:

The sample class assignments are given below.

1. Given a fact or a statement prove or disprove using suitable technique.
2. Write the given English language sentences represent in the Symbolic logic.
3. Given the statement forms Infer the validity of the statement form.
4. Draw a Hasse diagram and find chains and antichains.
5. Find the number of ways for any event or given sample space.
6. Given a problem represent in a graph and compute the optimal solution.
7. Given a communication network find the path between the given nodes.

List of Laboratory Exercises:

1. Perform set Operations.
2. Compute a power set of a given set.
3. List various properties of Relation and construct a program to evaluate it with a program.
4. Apply Warshall's algorithm to compute a Transitive Closure of a given relation entered by the user(Use any suitable programming language).
5. Solve a programming problem based on application of Eulerian and Hamiltonian Graph.
6. Develop a program using RSA algorithm.
7. Develop a program to apply different algorithms on graph and solve areal tie problem.

List of Project Based Learning Topics:

1. Discrete Mathematics in Railway Planning using graph theory and linear algebra.
2. Object transformations using linear algebra.
3. Discrete mathematics in cryptography.
4. In Google maps to determine fastest driving routes and times.
5. In image processing
6. In relation database using sets.
7. In cyber security using graph theory.
8. Shortest path between two cities using a transportation system.
9. Data compression system with the help of Huffman coding.

10. Find the shortest tour that visits each of a group of cities only once and then ends in the starting city using graphs.

Syllabus for Unit Tests:

Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

Statistics, Probability and Calculus

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 3 Hrs/Week	**Semester Examination: 60 Marks**	**Theory: 3 Credits**
Tutorials: 1 Hr/Week	**Internal Assessment: 40 Marks**	**Tutorial :1 Credit**
Practical: Nil	**Term Work: Nil**	**Total : 4 Credit**

Course Pre-Requisites:
The students should have basic knowledge of high school mathematics and calculus.

Course Objective:
The course introduces fundamental concepts of statistics and probability.

Course Outcomes:
1. Students will be able to use appropriate statistical terms to describe data.
2. Students will be able to use appropriate statistical methods to collect, organize, display and analyse relevant data.
3. Students will be able to apply concepts of various probability distributions to find probabilities and understand mathematical expectation and moments generating function.
4. Students will be able to apply concepts of Normal, Poisson, Binomial, uniform, exponential,t and F-distribution.
5. Students will be able to apply concepts of differentiation.
6. Students will be able to apply concepts of integration to find area and volume using double and triple integral.

UNIT – I **6 Hours**

Introduction to Statistics: Definition of Statistics. Basic objectives. Applications in various branches of science with examples

Collection of Data**:** Internal and external data, Primary and secondary data. Population and sample, Representative sample.

UNIT – II **6 Hours**

Descriptive Statistics: Classification and tabulation of univariate data, graphical representation, Frequency curves. Descriptive measures - central tendency and dispersion. Bivariate data. Summarization, marginal and conditional frequency distribution. Linear regression and correlation. Rank correlation.

UNIT III **6 Hours**

Probability Theory: concept of experiments, sample space, event. Definition of Combinatorial Probability. Conditional Probability, Bayes Theorem

Mathematical expectation: Expected values & moments: mathematical expectation & its properties, Moments (including variance) & their properties, interpretation, Moment generating function

UNIT – IV **6 Hours**

Probability distributions: Discrete & continuous distributions, Binomial, Poisson & Geometric distributions, Uniform, Exponential, Normal, Chi-square, t, F distributions

UNIT – V **6 Hours**

Differential Calculus: Differential equation and its application

UNIT – VI **6 Hours**

Integral Calculus: Multiple integral, application of double and triple integral.

List of Assignments:
Problem sets to be shared by faculty covering the following topics:
Graphical representation of data, Histograms, Descriptive measures - central tendency and dispersion
Estimating moments, Distribution parameters.

List of Project Based Learning Topics:

1. Prepare a questionnaire for survey
2. Do the population survey of a certain area
3. Prepare survey model of literate/illiterate
4. Prepare survey model of employed/ unemployed
5. Classify primary and secondary data
6. Collect the raw data, analyse it and plot it using graphs
7. Find the stability of the data using coefficient of variation
8. Use concept of correlation to find coefficient of correlation between different observations
9. Use Rank correlation to find correlation for qualitative data
10. Derive Spearman's Rank correlation
11. Data fitting using linear regression
12. Data fitting using nonlinear regression
13. Find the chance of happening particular event using Baye's theorem
14. Find the Moment generating function of given function.
15. Use probability theory to estimate the life of electric equipments
16. Find the height, weight of the population using the example of normal distribution
17. Evaluate the electric circuit problem using differential equations
18. Evaluate the heat conduction problem using differential equations
19. Find the area using double integrals
20. Find the volume using triple integrals

Textbooks:

1. Introduction of Probability Models, S.M. Ross, Academic Press, N.Y.
2. Fundamentals of Statistics, vol. I & II, A. Goon, M. Gupta and B. Dasgupta, World Press.
3. Higher Engineering Mathematics, B. S. Grewal, Khanna Publication, Delhi.

Reference Books:

1. A first course in Probability, S.M. Ross,Prentice Hall.
2. Probability and Statistics for Engineers (Fourth Edition), I.R. Miller, J.E. Freund and R. Johnson, PHI.
3. Introduction to the Theory of Statistics, A.M. Mood, F.A. Graybilland D.C. Boes,McGraw Hill Education.
4. Advanced Engineering Mathematics, (Seventh Edition), Peter V. O'Neil, Thomson Learning.
5. Advanced Engineering Mathematics, (Second Edition) M. D. Greenberg,, Pearson Education.
6. Applied Mathematics, Vol. I & II, P. N. WartikarandJ. N. Wartikar,VidyarthiPrakashan.

Syllabus for Unit Test:

Unit Test –I	UNIT – I, II and III
Unit Test -II	UNIT – IV, V and VI

Principles of Electrical Engineering

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 03 Hours / Week	**End Semester Examination: 60 Marks**	**Theory: 3 Credits**
Practical: 02 Hours / Week	**Internal Assessment: 40 Marks**	**Practical:1 Credit**
	Term Work: 25Marks	**Total : 4 Credits**

Course Pre-requisites:
The Students should have knowledge of Mathematics, physics.

Course Objectives:
The course introduces fundamental concepts of DC and AC circuits, Electrostatics electromagnetism, transformer, electrical wiring and illumination.

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

1. Apply knowledge of basic concepts of work, power, energy for energy conversion and calculate current in electrical network using Kirchoff's laws.
2. Calculate response of electrical circuit using network theorems.
3. Define basic terms of single phase and three phase ac circuits and supply systems.
4. Describe construction, principle of operation, specifications and applications of capacitors and batteries
5. Describe and apply fundamental concepts of magnetic and electro-mechanics for operation of single phase transformer.
6. Describe illumination, types of wiring and earthing system.

UNIT – I **6 Hours**

Introduction: Concept of EMF, Potential difference, voltage, current, resistance. Fundamental linear passive and active elements to their functional current-voltage relation, Terminology and symbols in order to describe electric networks, voltage source and current sources, ideal and practical sources, concept of dependent and independent sources, Kirchhoff-s laws and applications to network solutions using mesh and nodal analysis, Concept of work, power, energy, and conversion of energy.

UNIT – II **6 Hours**

DC Circuits: Current-voltage relations of the electric network by mathematical equations to analyze the network (Thevenin's theorem, Norton's Theorem, Maximum Power Transfer theorem) Simplifications of networks using series-parallel, Star/Delta transformation. Superposition theorem.

UNIT III **6 Hours**

AC Circuits: AC waveform definitions, form factor, peak factor, study of R-L, R-C,RLC series circuit, R-L-C parallel circuit, phasor representation in polar and rectangular form, concept of impedance, admittance, active, reactive, apparent and complex power, power factor, 3 phase Balanced AC Circuits (Y-Δ & Δ-Y).

UNIT – IV **6 Hours**

Electrostatics: Electrostatic field, electric field strength, concept of permittivity in dielectrics, capacitor composite, dielectric capacitors, capacitors in series and parallel, energy stored in capacitors, charging and discharging of capacitors, Principle of batteries, types, construction and working, application.

UNIT – V **6 Hours**

Electro-Mechanics: Electricity and Magnetism, magnetic field and Faraday's law, self and mutual inductance, Ampere's law, Magnetic circuit, Magnetic material and B-H Curve, Single phase transformer, principle of operation, EMF equation, voltage ratio, current ratio, KVA rating, losses in transformer, efficiency and regulation, Determination of Efficiency & Regulation by direct load test, Electromechanical energy conversion

UNIT – VI **6 Hours**

Measurements and Sensors: Introduction to measuring devices/sensors and transducers (Piezoelectric and thermo-couple) related to electrical signals, Elementary methods for the measurement of electrical quantities in DC and AC systems(Current & Single-phase power), Basic concept of indicating and integrating instruments, Electrical Wiring and Illumination system: Basic layout of the distribution system, Types of Wiring System & Wiring Accessories, Different types of lamps (Incandescent, Fluorescent, Sodium Vapour, Mercury Vapour, Metal Halide, CFL, LED),Necessity of earthing, Types of earthing, Safety devices & system.

List of Assignments:

Respective subject teacher shall design minimum six assignments on above units.

List of Laboratory Exercises:

1. Familiarization of electrical Elements, sources, measuring devices and transducers related to electrical circuits.
2. Determination of resistance temperature coefficient
3. Verification of Superposition Theorem
4. Verification of Thevenin's Theorem
5. Verification of Norton's Theorem
6. Verification of Kirchoff's Laws
7. Verification of Maximum power transfer Theorem
8. Simulation of Time response of RC circuit
9. Study of R-L-C series circuits for $X_L > X_C$, $X_L < X_C$ & $X_L = X_C$
10. Verification of relation in between voltage and current in three phase balanced star and delta connected loads.
11. Direct loading test on Single phase transformer
12. a) Voltage and current ratios.
    b) Efficiency and regulations.
13. Demonstration of measurement of electrical quantities in DC and AC systems.

List of Project Based Learning Topics:

Student shall demonstrate minimum one concept based on syllabus topic.

1. Demonstration of conversion of energy.
2. Study and understand practical specifications of transformer.
3. Demonstration of electrostatics and understand practical specifications of batteries.
4. Demonstration of phenomenon of electromagnetic induction.
5. Demonstration of electromagnetism, electro mechanics and their applications by using professional software tool.
6. Development of practical kits for understanding different theorems related to electrical circuits. (Thevenin's theorem, Norton's Theorem, Maximum Power Transfer theorem, Superposition theorem etc.)
7. Demonstration of illumination system.
8. Demonstration of distribution system.
9. Study and understand safety practices in electrical system.
10. Study and understand electrical earthing system.

Textbooks:

1. Electric Machinery,(Sixth Edition) A.E. Fitzgerald, KingselyJr Charles, D. Umans Stephen, Tata McGraw Hill.
2. A Textbook of Electrical Technology,(vol. I),B. L. Theraja, Chand and Company Ltd., New Delhi.
3. Basic Electrical Engineering, V. K. Mehta, S. Chand and Company Ltd., New Delhi.
4. Theory and problems of Basic Electrical Engineering, (SecondEdition), J. Nagrath and Kothari, Prentice Hall of India Pvt. Ltd.

Reference Books:

1. Basic of Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford University Press. T. K. Nagsarkar and M. S. Sukhija, Basic of Electrical Engineering, Oxford University Press, 2011.
2. Introduction to Electrodynamics, D. J. Griffiths, (Fourth Edition), Cambridge University Press.
3. Engineering Circuit Analysis, William H. Hayt& Jack E. Kemmerly, McGraw-Hill Book Company Inc.
4. Fundamentals of Electrical and Electronics Engineering,Smarjith Ghosh, Prentice Hall (India) Pvt. Ltd.
5. Edward Hughes – "Electrical Technology"- Seventh Edition, Pearson Education Publication
6. H. Cotton – "Elements of Electrical Technology", C.B.S. Publications
7. John Omalley Shawn – "Basic circuits analysis" McGraw Hill Publications
8. Vincent Del Toro – "Principles of Electrical Engineering", PHI Publications

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Fundamentals of Computer Science

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 3Hrs/Week	**Semester Examination: 60 marks**	**Theory: 3 Credits**
Tutorials: Nil	**Internal Assessment: 40 marks**	**Practical: 2 Credits**
Lab: 4 Hrs/Week	**Term work & Practical: 50 Marks**	**Total : 5 Credits**

Course Pre-Requisites:
Basic knowledge of computers.

Course Objective:
The course introduces fundamental concepts of computer science

Course Outcomes:

1. Understand the basics of computer science & the process of moving from a problem statement to a computational formulation of a method for solving the problem.
2. Apply the basic concepts of control structures.
3. Understand basic concepts of function.
4. Implement concept of arrays and pointers.
5. Develop an application using the concept of file handling.
6. Describe unix system interface and programming method.

UNIT – I **6 Hours**

General problem-Solving concepts and Imperative languages: Algorithm, and Flowchart for problem solving with Sequential Logic Structure, Decisions and Loops.

Imperative languages: Introduction to imperative language; syntax and constructs of a specific language (ANSI C) .Types Operator and Expressions with discussion of variable naming and Hungarian Notation: Variable Names, Data Type and Sizes (Little Endian Big Endian), Constants, Declarations, Arithmetic Operators, Relational Operators, Logical Operators, Type Conversion, Increment Decrement Operators, Bitwise Operators, Assignment Operators and Expressions, Precedence and Order of Evaluation, proper variable naming and Hungarian Notation

UNIT – II **6 Hours**

Control Flow with discussion on structured and unstructured programming: Statements and Blocks, If-Else-If, Switch, Loops – while, do, for, break and continue, Goto Labels, structured and un- structured programming

UNIT – III **6 Hours**

Functions and Program Structure with discussion on standard library: Basics of functions, parameter passing and returning type, C main return as integer, External, Auto, Local, Static, Register Variables, Scope Rules, Block structure, Initialization, Recursion, Pre-processor, Standard Library Functions and return types

UNIT – IV **6 Hours**

Pointers and Arrays: Pointers and address, Pointers and Function Arguments, Pointers and Arrays, Address Arithmetic, character Pointers and Functions, Pointer Arrays, Pointer to Pointer, Multi-dimensional array and Row/column major formats, Initialisation of Pointer Arrays, Command line arguments, Pointer to functions, complicated declarations and how they are evaluated.

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UNIT – V **6 Hours**

Structures: Basic Structures, Structures and Functions, Array of structures, Pointer of structures, Self-referral Structures, Table look up, Typedef, Unions, Bit-fields

Input and Output: Standard I/O, Formatted Output – printf, Formated Input – scanf, Variable length argument list, file access including FILE structure, fopen, stdin, sdtout and stderr, Error Handling including exit, perror and error.h, Line I/O, related miscellaneous functions

UNIT – VI **6 Hours**

Unix system Interface: File Descriptor, Low level I/O – read and write, Open, create, close and unlink, Random access – lseek, Discussions on Listing Directory, Storage allocator
Programming Method: Debugging, Macro, User Defined Header, User Defined Library Function, make file utility.

List of Assignments:

1.Define Algorithm. Explain Characteristics of Algorithm.
2.Explain all types of Operators in detail with example.
3.Explain control structures in detail with example.
4.Define function. Explain types of Functions with example.
5.Write a short note on:
i) Pointers ii) Types of Array iii) Pointer Array
6.Define Structure. Explain concept of Array of Structure with suitable example.
7.Explain File Descriptor and Storage Allocator in detail.

List of Laboratory Exercises:

1. Algorithm and flowcharts of small problems like GCD
2. Structured code writing with:
   i. Small but tricky codes
   ii. Proper parameter passing
   iii. Command line Arguments
   iv. Variable parameter
   v. Pointer to functions
   vi. User defined header
   vii. Make file utility
   viii. Multi file program and user defined libraries
   ix. Interesting substring matching / searching programs
   x. Parsing related assignments

List of Project Based Learning Topics:

1. Inventory Management System using File Handling
2. Online Jewellery Shopping System using File Handling
3. Library Management System using File Handling
4. Online Examination System using File Handling
5. Hospital Management System using File Handling
6. Railway Reservation System using File Handling
7. Payroll Management System using File Handling
8. Cooking Recipe Portal using File Handling
9. Art Gallery Management System using File Handling
10. Student Database Management System using File Handling
11. Restaurant Management Database System using File Handling
12. Electric Bill System using File Handling
13. Online Examination System using File Handling
14. Event Management System using File Handling
15. Attendance Management System using File Handling
16. Slam book using File Handling.

Textbooks:

1. B. W. Kernighan and D. M. Ritchi, “The C Programming Language”, Second Edition, PHI.
2. B. Gottfried, “Programming in C”, Second Edition, Schaum Outline Series.

Reference Books:

1. Herbert Schildt, “C: The Complete Reference”, Fourth Edition, McGraw Hill.
2. YashavantKanetkar, “Let Us C”, BPB Publications.

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Physics for Computing Science

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 3Hrs/Week	**Semester Examination: 60 marks**	**Theory: 3 Credits**
Tutorials: Nil	**Internal Assessment: 40 marks**	**Practical : 1 Credit**
Lab: 2 Hrs/Week	**Term work :25 Marks**	**Total : 4 Credits**

Course Prerequisites: -

Students are expected to have a basic understanding of physics and calculus.

Course Objectives:-

To impart knowledge of basic concepts in physics relevant to engineering applications in a broader sense with a view to lay foundation for the Computer Science and Business System.

Course Outcomes: -

1. Summarise the terms damping constant, characteristic frequency, kinetic and potential energy of a spring.
2. Appraise the wave nature of light and apply it to measure stress, pressure and dimension etc.
3. Solve quantum physics problems to micro level phenomena and solid-state physics.
4. Summarise the arrangement of atoms in solids and its influence the properties of matter.
5. Summarise the structure and properties of lasers to their performance and intended applications such as fibre optics.
6. Summarise the applications of thermodynamics.

Unit I. Oscillation **6 Hours**

Periodic motion-simple harmonic motion-characteristics of simple harmonic motion-vibration of simple spring-mass system. Resonance-definition damped harmonic oscillator – heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor, forced mechanical and electrical oscillators.

Unit II. Wave Optics **6 Hours**

Interference-Principle of superposition-Young's experiment: Theory of interference fringes-types of interference-Fresnel's prism-Newton's rings.

Diffraction-Two kinds of diffraction-Difference between interference and diffraction- Fraunhofer diffraction at single slit-plane diffraction grating. Temporal and Spatial Coherence.

Polarization of light- Polarization - Concept of production of polarized beam of light from two SHM acting at right angle; plane, elliptical and circularly polarized light, Brewster's law, double refraction.

Unit III. Quantum Mechanics **6 Hours**

Introduction- Planck's quantum theory- Matter waves, de-Broglie wavelength, Heisenberg's Uncertainty principle, time independent and time dependent Schrödinger's wave equation, Physical significance of wave function, Particle in a one-dimensional potential box.

Unit IV. Crystallography and Semiconductor Physics **6 Hours**

Crystallography: Basic terms-types of crystal systems, Bravais lattices, miller indices, d spacing, Atomic packing factor for SC, BCC, FCC and HCP structures, X-ray diffraction.

Semiconductor Physics: Conductor, Semiconductor and Insulator; Origin of Band Theory, Basic concept of Band theory.

Unit V. Laser and Fiber optics **6 Hours**

Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: Ruby Laser, CO_2 and Neodymium YAG (Neodymium-doped Yttrium Aluminum Garnet); Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in engineering. Fiber optics and Applications, Types of optical fibers.

Unit VI. Thermodynamics and Electromagnetism **6 Hours**

Thermodynamics: Zero-th law of thermodynamics, first law of thermodynamics, brief discussion on application of 1st law, second law of thermodynamics and concept of Engine, entropy, change in entropy in reversible and irreversible processes.

Basic Idea of Electromagnetisms: Continuity equation for current densities, Maxwell's equation in vacuum and non-conducting medium.

List of Assignments:

Six assignments to be given by the subject teacher (Theory)-one from each unit/one mini project with report-students can work in group of 4 Maximum

List of Laboratory Exercises:

1. Determination of radius of planoconvex lens/wavelength of light/Flatness testing by Newton's rings
2. Determination of wavelength of light using diffraction grating
3. Determination of resolving power of telescope
4. Determination of thickness of a thin wire by air wedge
5. Determination of refractive index for O-ray and E-ray
6. Determination of divergence of a laser beam
7. Particle size by semiconductor laser
8. Determination of wavelength of laser by diffraction grating
9. To study Hall effect and determine the Hall voltage
10. Calculation of conductivity by four probe method
11. Study of solar cell characteristics and calculation of fill factor
12. Determination of band gap of semiconductor
13. Determination of Planck's Constant by photoelectric effect
14. Magnetic field along the axis of current carrying coil – Stewart and Gee
15. Determination of Stefan's Constant

List of Project Based Learning Topics:

1. Design and simulation of automatic solar powered time regulated water pumping
2. Solar technology: an alternative source of energy for national development
3. Double pendulum and its application
4. The study on the effect of length on the resistance of a copper wire (verification of ohms law r directly proportional to l)
5. Possible effects of electromagnetic fields (emf) on human health
6. Design and construction of digital distance measuring instrument
7. Design and construction of automatic bell ringer
8. Design and construction of remote control fan
9. Design and construction of sound or clap activated alarm
10. Electronic eye (Laser Security) as autoswitch/security system
11. Study of vibration of bars
12. Determination of absorption coefficient of sound absorbing materials
13. Determination of velocity of O-ray and E-ray in different double refracting materials
14. Need of medium for propagation of sound wave
15. Thin film interference in soap film-formation of colours

Textbooks

1. A Textbook of Engineering Physics, M N Avadhanulu, P G Kshirsagar and TVS Arun Murthy, S. Chand Publishing (2018)
2. Engineering Physics, R K Gaur and S L Gupta, DhanpatRai Publishing Co Pvt Ltd (2015)
3. Concepts of Modern Physics, Arthur Beiser, Shobhit Mahajan and S. Rai Choudhury, McGraw Hill Education (2017)

Reference Books

1. Fundamentals of Physics, Jearl Walker, David Halliday and Robert Resnick, John Wiley and Sons (2013)
2. Optics, Francis Jenkins and Harvey White, Tata Mcgraw Hill (2017)
3. Principles of Physics, John W. Jewett,Cengage publishing (2013)

4. Introduction to Solid State Physics, C. Kittel, Wiley and Sons (2004)
5. Principles of Solid State Physics, H. V. Keer, New Age International (1993)
6. Laser and Non-Linear Optics, B. B. Laud, New Age International Private Limited (2011)
7. Nanotechnology: Principles and Practices, Dr. S. K. Kulkarni, Capital Publishing Company (2014)
8. Science of Engineering Materials- C.M. Srivastava and C. Srinivasan, New Age International Pvt. Ltd. (1997)
9. Introduction to Electrodynamics –David R. Griffiths, Pearson (2013)
10. Renewable Energy: Power for a Sustainable Future, Boyle, Oxford University Press (2012)

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Business Communication & Value Science-I

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 3 Hr./Week	**Semester Examination: 50 marks**	**Theory: 3 Credits**
Lab: 2 Hrs./Week	**Internal Assessment: Yes**	**Practical: 1 Credit**
	Term work & Oral -50 Marks	**Total : 4 Credits**

Course Prerequisites: -

1. Students should have knowledge of Basic English grammar
2. Students should have basic information of sound system of English language
3. Basics of written communication

Course Objective:-

The course objective of Business Communication & Value Science-I aims to augment student's overall communication and interpersonal skills by engaging them in group activities and thus aid in helping them to emerge as professionals. The English language topics for this semester focus on the development of basic fluency in English, usage of words and introduce them to the concept and importance of interpersonal skills so as to effectively present their personalities. Understand what life skills are and their importance in leading a happy and well-adjusted life. Motivate students to look within and create a better version of self.

Course Outcomes: -

Graduates will able to:

1. Recognize the need for life skills, values and own strengths and opportunities and apply the life skills to different situations
2. Understand and apply applications of sounds of English language for correct pronunciation
3. Construct the error free sentences of English language and do implementation of it in the spoken and written business communication
4. Understand communication process and principles to do applications in professional communication
5. Build up the ability to study employment professional communication skills and its proper implications
6. Recognize the core of professional skills and apply them for future venture through activities

Unit 1 Skills and Values and Basics of Grammar: 6 Hours

Recognize the need for life skills and values, **Overview of LOL** (include activity on introducing self), **Self-awareness** – identity, body awareness, forms of tense, articles, preposition, use of auxiliaries and modal auxiliaries, common errors.

Unit II Vocabulary/Phonetics/study of sounds in English: 6 Hours

Vocabulary development through GRAPS-PT, types of sentences voice, direct indirect speech, degree of comparison, Introduction to phonetics, study of speech organs, study of phonetic script, transcriptions of words, articulation of different sounds in English

Unit III Honing Spoken Communication: 6 Hours

Situational conversation, Law of nature- Importance of listening skills, Difference between listening and hearing, Types of listening, building team, team communication dynamics

Unit IV Communication Skills 6 Hours

Introduction, forms and function of communication process, non-verbal codes in communication, barriers to communication and overcoming them, digital communication

Unit V Mechanics of Written Communication 6 Hours

Principles of effective writing, Email writing, technical report writing, format, structure and its types, real time report writing, create a podcast on an interested topic, create a musical using the learnings from unit

Unit VI Skill allied to professionalism: 6 Hours

Introduction to professional skills, overview of leadership, dealing with ambiguity, Time management, Pareto Principle (80/20) Rule in time management, Time management matrix, creativity and result orientation, working under pressure, stress management.

List of Laboratory Exercises:

01. Presentation on favourite cricket captain in IPL and the skills and values they demonstrate
02. Learning Vocabulary through activity
03. Self-work with immersion – interviews a maid, watchman etc.
04. Write a newspaper report on an IPL match
05. Expressing self, connecting with emotions, visualizing and experiencing purpose
06. Evaluation on Listening skills – listen to recording and answer questions based on them
07. Written Communication: Summary writing, story writing
08. Understanding Life Skills: Movie based learning-**Pursuit of Happiness**.
09. Multiple Intelligences, Embracing diversity – Activity on appreciation of diversity
10. Life skill: Leadership, teamwork, dealing with ambiguity, managing stress, motivating people, creativity, result orientation etc.

Project:	01	Create a podcast on a topic that will interest college students
	02	Create a musical using the learnings from the whole course

List of Project Based Learning Topics:

01. Communication Origami
02. Preparing a model for the LOL activity
03. Investigating values around you and imbibing
04. Vocabulary: play-way method by using cards
05. Investigating into linguistic by creating models
06. Interviewing your role model for situational conversation
07. Honing LSRW: Preparing a model on each skill
08. Knowing body language: Making a video of professional presentation
09. Preparing a model of report writing (preferably real time report)
10. Analysis of Pareto Principle for Time Management
11. Creating a model of Leadership styles and their functions
12. Analysis of Time Management Matrix for effective time Management

Reference Books:

1. Business Communication by Meenakshi Raman, Prakash Singh published by Oxford University press, second edition,
2. Spoken English- A manual of Speech and Phoonetics by R. K. Bansal, J. B. Harrison published by Orient Blackswan
3. Communication Skills by Sanjay Kumar, PushpLata, published by Oxford University press, second edition
4. Technical Communication by Meenakshi Raman, Sangeeta Sharma published by Oxford University press
5. Developing Communication Skills by Krishna Mohan, MeeraBanerji published by Macmillan India Pvt Ltd

Recommended web-links for enhancing English language and business communication

1. http://www.bbc.co.uk/worldservice/learningenglish
2. http://www.englishlearner.com/tests/test.html

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

B. TECH (Computer Science & Business Systems)

SEMESTER – II

COURSE SYLLABUS

Linear Algebra

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 3Hrs./Week	**Semester Examination: 60 marks**	**Theory: 3 Credits**
Tutorials: 1Hr./Week	**Internal Assessment: 40 marks**	**Tutorial: 1 credit**
		Total : 4 Credits

Course Pre-Requisites:
The students should have basic Knowledge of high school math, Boolean algebra and calculus.

Course Objective:
To develop ability to use the mathematical techniques, skills, and tools necessary for computer science.

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

1. Apply knowledge of basics of Matrices,Determinants.
2. Solve the consistency of any type of systems.
3. Describe Vector space, Orthogonality and Projection.
4. Apply methods Gram-Schmidt orthogonalization and QR decomposition.
5. Calculate Eigenvalues and Eigenvectors.
6. Describe Singular value decomposition and Principal component analysis.

UNIT – I **6 Hours**
Introduction to Matrices and Determinants, Solution of Linear Equations, Cramer's rule, Inverse of a Matrix.

UNIT – II **6 Hours**
Vectors and linear combinations, Rank of a matrix, Gaussian elimination, LU Decomposition, Solving Systems of Linear Equations using the tools of Matrices.

UNIT – III **6 Hours**
Vector space, Dimension, Basis, Orthogonality, Projection.

UNIT – IV **6 Hours**
Gram-Schmidt orthogonalization and QR decomposition.

UNIT – V **6 Hours**
Eigenvalues and Eigenvectors, Positive definite matrices, Linear transformations, Hermitian and Unitary matrices.

UNIT – VI **6 Hours**
Singular value decomposition and Principal component analysis, Introduction to their applications in Image Processing and Machine Learning.

List of Assignments:

Assignments & tutorials covering the following: Vectors and linear combinations, Matrices, Determinants, Linear transformations, Complete solution to AX=b, Eigenvalues and Eigenvectors.

List of Project Based Learning Topics:

Students are expected prepare report on any one topic, write its definition, applications and illustrate with few examples. Also, write pseudo code for it, wherever applicable.

1. Cramer's rule
2. System of linear equations solution
3. Rank of matrix
4. Gauss elimination

5. LU-decomposition method
6. Dimension and basis
7. Gram Schmidt Orthogonalization
8. QR decomposition
9. Single value ecomposition
10. Principal component analysis
11. Eigen values and eigen vectors
12. Hermitian and unitary matrices
13. Positive definite matrices
14. Image processing
15. Machine learning

Textbook:

1. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publication, Delhi.

Reference Books:

1. Advanced Engineering Mathematics, 7e, by Peter V. O'Neil.
2. Advanced Engineering Mathematics, 2e, by M. D. Greenberg, Pearson Education.
3. Introduction to linear algebra, 5^{th} Edition, Gilbert Strang.
4. Applied Mathematics (Volumes I and II) by P. N. Wartikar& J. N. Wartikar, Pune VidyarthiGrihaPrakashan, Pune.
5. Digital Image Processing,R C Gonzalez and R E Woods.
6. https://machinelearningmastery.com/introduction-matrices-machine-learning/

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Statistical Methods

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 3 Hrs/Week	**Semester Examination: 60 marks**	**Theory: 3 Credits**
Tutorials: Nil	**Internal Assessment: 40 marks**	**Practical: 1 Credit**
Laboratory: 02 Hrs/week	**Term Work: 25**	**Total : 4 Credits**

Course Pre-requisites:
Basic of statistics and probability, Basic programming experience (in any language).

Course Objective:
The course introduces fundamental concepts of linear statistical models, estimation methods, hypothesis testing and fundamental concepts of programming in R.

Course Outcomes:
The students completing this course will be able to

1. Understand the basic concepts of Statistical Inference,
2. Understand the basic concepts of Estimation methods,
3. Understand the basic concepts of Hypothesis Testing
4. Understand the basic concepts of linear statistical models.
5. Understand Introductory R language fundamentals, basic syntax and how to use R; what R is and how it's used to perform data analysis.
6. Understand major R data structures and create visualizations using R.

UNIT – I **6 Hours**

Sampling Techniques: Random sampling. Sampling from finite and infinite populations. Estimates and standard error (sampling with replacement and sampling without replacement), Sampling distribution of sample mean, stratified random sampling

UNIT – II **6 Hours**

Linear Statistical Models: Scatter diagram. Linear regression and correlation. Least squares method. Rank correlation. Standard multiple regression models with emphasis on detection of collinearity, outliers, non-normality and autocorrelation, Validation of model assumptions. Multiple correlation, Analysis of variance (one way, two way with as well as without interaction)

UNIT – III **6 Hours**

Estimation: Point estimation, criteria for good estimates (un-biasedness, consistency), Methods of estimation including maximum likelihood estimation.

UNIT – IV **6 Hours**

Test of hypothesis: Concept & formulation, Type I and Type II errors, Neyman Pearson lemma, Procedures of testing

UNIT – V **6 Hours**

Non-parametric Inference: Comparison with parametric inference, Use of order statistics. Sign test, Wilcoxon signed rank test, Mann-Whitney test, Run test, Kolmogorov-Smirnov test. Spearman's and Kendall's test**.**

UNIT – VI **6 Hours**

Basics of Time Series Analysis & Forecasting: Stationary, ARIMA Models: Identification, Estimation and Forecasting.

List of Assignments:
Problem sets to be shared by faculty covering the following topics: Estimation Methods: Parametric & Non – Parametric, Hypothesis Testing

List of Laboratory Exercises:

R statistical programming language: Introduction to R, Functions, Control flow and Loops, Working with Vectors and Matrices, Reading in Data, Writing Data, Working with Data, Manipulating Data, Simulation, Linear model, Data Frame, Graphics in R

List of Project Based Learning Topics:

Project Based learning topics:

Students are expected prepare report on any one topic, write its definition, applications and analyze the hypothetical data. Also, write pseudo code for it, wherever applicable.

1. Random Sampling
2. Stratified random sampling
3. Linear regression
4. Rank correlation
5. Method of least squares
6. Multiple correlation
7. One way analysis of variance
8. Two way analysis of variance
9. Estimation
10. Maximum likelihood estimation
11. Testing of hypothesis
12. Types of errors
13. Nonparametric tests
14. Time series
15. Forecasting

Textbooks:

1. Probability and Statistics for Engineers (4th Edition) - I.R. Miller, J.E. Freund and R. Johnson.
2. Fundamentals of Statistics (vol. I and vol. II) - A. Goon, M. Gupta and B. Dasgupta.
3. Hands-on Programming with R - Garrett Grolemund
4. R for Everyone: Advanced Analytics and Graphics - Jared P. Lander

Reference Books:

1. Statistical Theory with Engineering Application - A. Hald.
2. Statistical Methods - G.W. Snedicor and W.G. Cochran.
3. Statistical Concepts & Methods - G.K. Bhattacharyya and R.A. Johnson.
4. Introduction to Linear Regression Analysis - D.C. Montgomery &E.Peck
5. Introduction to the Theory of Statistics - A.M. Mood, F.A. Graybill& D.C. Boes.
6. Practical Non-Parametric Statistics - W.J. Conover
7. Applied Regression Analysis - N. Draper & H. Smith

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Data Structures and Algorithms

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 3 Hrs./ Week	**Semester Examination: 60 marks**	**Theory: 3 Credits**
Tutorials: Nil	**Internal Assessment: 40 marks**	**Practical: 2 Credits**
Lab: 4 Hrs./ Week	**Term work & Practical: 100Marks**	**Total : 5 Credits**

Course Pre-Requisites:
Students should have knowledge of Fundamentals of data types and programming concepts

Course Objective:
The course is aimed to provide an understanding of key concepts underlying the choice and implementation of data structures, algorithms and step by step approach in solving problems with the help of these fundamental data structures.

Course Outcomes:
Students will be able to:
1. Understand the fundamentals and analysis of algorithms
2. Implement Linear data structures
3. Implement Non-Linear data structure of Trees.
4. Implement Non-Linear data structure of Graphs.
5. Implement the sorting algorithms
6. Understand the concepts of different file system organisation.

UNIT – I **6 Hours**
Basic Terminologies & Introduction to Algorithm and Data Organization: Algorithm specification, Recursion, Performance analysis, Asymptotic Notation - The Big-O, Omega and Theta notation, Programming Style, Refinement of Coding - Time-Space Trade Off, Testing, Data Abstraction

UNIT – II **6 Hours**
Linear Data Structure: Array, Stack, Queue, Linked list and its types, Various Representations, Operations & Applications of Linear Data Structures

UNIT – III **6 Hours**
Non-linear Data Structure Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, B & B+ Tree, AVL Tree, Splay Tree), Various Representations, Operations: search and traversal algorithms and complexity analysis Applications of Trees.

UNIT – IV **6 Hours**
Non-linear Data Structure Graphs: Graphs: Directed and Undirected, Various Representations
Operations: Search and traversal algorithms and complexity analysis
Applications of Graphs.

UNIT – V **6 Hours**
Searching and Sorting: Sequential Search, Binary Search, Breadth First Search, Depth First Search, Insertion Sort, Selection Sort, Shell Sort, Divide and Conquer Sort, Merge Sort, Quick Sort, Heap Sort, Introduction to Hashing

UNIT – VI **6 Hours**
File: Organisation (Sequential, Direct, Indexed Sequential, Hashed) and various types of accessing schemes

List of Assignments:

Respective subject teacher shall design any six assignments on above units.

List of Laboratory Exercises:

1. Towers of Hanoi using user defined stacks.
2. Reading, writing, and addition of polynomials.
3. Trees with all operations.
4. All graph algorithms.
5. Saving / retrieving non-linear data structure in/from a file

List of Project Based Learning Topics:

1. Create an appropriate data structure for student data and result representation. Provide operations on these structures.
2. Develop a string reverser using stack. The stack operations called herein should be defined in file other than the reverser.
3. Develop a polynomial multiplier. The polynomials should be stored using linked lists.
4. Develop a phonebook using double linked list.
5. Demonstrate the bubble sort technique on doubly linked list.
6. Develop a two way threaded binary tree with its traversals.
7. Develop a customer database using direct access file which provides functions to read, write, modify, add and search records.
8. Write students information to a sequential file. Extract these records and construct a binary search tree out of these records. Use any parameter of the information for search/arranging criteria.
9. Develop a file merge application. It should have provision to create new files or add records to existing files. Any selected two or more files should be merged into a single new one.
10. Convert a graph representation using adjacency matrix to represent the same using adjacency list.

Textbooks:

1. Fundamentals of Data Structures, E. Horowitz and S. Sahni, 1977.
2. Data Structures and Algorithms, Alfred V. Aho, John E. Hopperoft, Jeffrey D. UIlman

Reference Books:

1. The Art of Computer Programming: Volume 1: Fundamental Algorithms, Donald E. Knuth
2. Introduction to Algorithms, Thomas, H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein.
3. Open Data Structures: An Introduction (Open Paths to Enriched Learning)), 31st ed. Edition , Pat Morin

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Fundamentals of Economics

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 3 Hrs/Week	**Semester Examination: 60 marks**	**Theory: 3 Credits**
Tutorials: Nil	**Internal Assessment: 40 marks**	**Total : 3 Credits**

Course Pre-Requisites:

Knowledge of Class XII level Mathematics

Course Objective:

1. To impart knowledge, with respect to concepts, principles of Economics, which govern the functioning of a firm/organization.
2. To explain the students about concept of production, cost, national income, an aggregate supply and aggregate demand consumption.

Course Outcomes:

After completing this course, students should be able to:
1. Demonstrate an understanding of the methods and principles of microeconomic and macroeconomic theory, including tradeoffs, opportunity costs, and marginal decision making.
2. Explain how markets work and how market prices are determined using principles of supply and demand.
3. Assess the impact of market failure such as externalities, and public goods and evaluate possible public policy remedies.
4. Analyze financial markets and investments, including the stock market, and their relation to the economy.
5. Evaluate key economic indicators (including GDP, unemployment, inflation) and their use in evaluating macroeconomic conditions.
6. Understand major macroeconomic tools, including fiscal and monetary policies, and their use in managing the economy. Also apply ethical principles in a variety of economic contexts.

UNIT – I **6 Hours**

Microeconomics

Principles of Demand and Supply – Supply Curves of Firms – Elasticity of Supply Demand Curves of Households – Elasticity of Demand Equilibrium and Comparative Statics (Shift of a Curve and Movement along the Curve) Welfare Analysis – Consumers' and Producers' Surplus – Price Ceilings and Price Floors

UNIT –II **6 Hours**

Consumer Behaviour – Axioms of Choice – Budget Constraints and Indifference Curves Consumer's Equilibrium – Effects of a Price Change, Income and Substitution Effects – Derivation of a Demand Curve ,Applications – Tax and Subsidies – Intertemporal Consumption – Suppliers' Income Effect

UNIT – III **6 Hours**

Theory of Production – Production Function and Iso-quants – Cost Minimization Cost Curves – Total, Average and Marginal Costs – Long Run and Short Run Costs ,Equilibrium of a Firm Under Perfect Competition Monopoly and Monopolistic Competition

UNIT – IV **6 Hours**

Macroeconomics

National Income and its Components – GNP, NNP, GDP, NDP Consumption Function Investment Simple Keynesian Model of Income Determination and the Keynesian Multiplier
Government Sector – Taxes and Subsidies External Sector – Exports and Imports

UNIT – V **6 Hours**

Money – Definitions ,Demand for Money – Transitionary and Speculative Demand
Supply of Money – Bank's Credit Creation Multiplier ,Integrating Money and Commodity Markets – IS, LM Model ,Business Cycles and Stabilization – Monetary and Fiscal Policy – Central Bank and the Government .

UNIT – VI **6 Hours**

The Classical Paradigm – Price and Wage Rigidities – Voluntary and Involuntary Unemployment.

List of Assignments: -

In the discussion topics mentioned above, students should be asked to prepare in advance in groups and present in class .

List of Project Based Learning Topics:

1. Types of markets (Monopoly, Monopolistic, Perfect Competition) and their real time examples in the economy.
2. Fiscal and Monetary Policy of India.
3. Concept of Price Ceilings and Price Floors and it's practical working in the economy.
4. Elasticity of Demand and it's types.
5. Elasticity of Supply and it's types.
6. Types of Costs in a Firm.
7. Money and it's demand
8. Understanding Credit Creation by banks using real time data from various banks.
9. Studying Unemployment and its types and the type of unemployment prevailing in India.

Textbooks:

1. Microeconomics- Pindyck, Robert S., and Daniel L. Rubinfeld Microeconomics
2. Macroeconomics- Dornbusch, Fischer and Startz

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Principles of Electronics Engineering

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 3 Hrs/Week	**Semester Examination: 60 marks**	**Theory: 3 Credits**
Tutorials: Nil	**Internal Assessment: 40 marks**	**Practical :1 Credit**
Lab: 2 Hrs/ Week	**Term Work: 25 marks**	**Total : 4 Credits**

Course Pre-Requisites:

The students should have knowledge of Class XII level Electronics, Physics & Mathematics

Course Objective:

The course introduces fundamental concepts of electronics

Course Outcomes:

Students will be able to,

1. Identify semiconductor materials, draw band-diagrams and distinguish between intrinsic and extrinsic semiconductors.
2. Explain the phenomenon of rectification, draw the I-V characteristics and calculate ripple factor.
3. Explain the I-V characteristics of BJTs: Input and output, learn to bias transistors as an amplifier.
4. Describe FET and MOSFET and differentiate between BJT, FET and MOSFET.
5. Explain the fundamentals of feedback amplifiers, Oscillators and Operational Amplifier.
6. Demonstrate the knowledge of Boolean algebra including simplification techniques and operation of basic types of flip-flops.

UNIT – I **6 Hours**

Semiconductors: Crystalline material: Mechanical properties, Energy band theory, Fermi levels; Conductors, Semiconductors & Insulators: electrical properties, band diagrams. Semiconductors: intrinsic & extrinsic, energy band diagram, P&N-type semiconductors, drift & diffusion carriers.

UNIT –II **6 Hours**

Diodes and Diode Circuits: Formation of P-N junction, energy band diagram, built-in-potential, forward and reverse biased P-N junction, formation of depletion zone, V-I characteristics, Zener breakdown, Avalanche breakdown and its reverse characteristics; Junction capacitance and Varactor diode. Simple diode circuits, load line, linear piecewise model; Rectifier circuits: half wave, full wave, PIV, DC voltage and current, ripple factor, efficiency, idea of regulation.

UNIT – III **6 Hours**

Bipolar Junction Transistors: Formation of PNP / NPN junctions, energy band diagram; transistor mechanism and principle of transistors, CE, CB, CC configuration, transistor characteristics: cut-off active and saturation mode, transistor action, injection efficiency, base transport factor and current amplification factors for CB and CE modes. Biasing and Bias stability: calculation of stability factor.

UNIT – IV **6 Hours**

Field Effect Transistors: Concept of Field Effect Transistors (channel width modulation), Gate isolation types, JFET Structure and characteristics, MOSFET Structure and characteristics, depletion and enhancement type; CS, CG, CD configurations; CMOS: Basic Principles

UNIT – V **6 Hours**

Feed Back Amplifier, Oscillators and Operational Amplifiers: Concept (Block diagram), properties, positive and negative feedback, loop gain, open loop gain, feedback factors; topologies of feedback amplifier; effect of feedback on gain, output impedance, input impedance, sensitivities (qualitative), bandwidth stability;

effect of positive feedback: instability and oscillation, condition of oscillation, Barkhausen criteria. Introduction to integrated circuits, operational amplified and its terminal properties; Application of operational amplifier; inverting and non-inverting mode of operation, Adders, Subtractors, Constant-gain multiplier, Voltage follower, Comparator, Integrator, Differentiator.

UNIT – VI **6 Hours**

Digital Electronics Fundamentals: Difference between analog and digital signals, Logic ICs, half and full adder/subtractor, multiplexers, demultiplexers, flip-flops, shift registers, counters.

List of Assignments: -

1. Describe applications of diodes as Clippers and Clampers.
2. Describe application of Zener diode as Voltage regulator.
3. Study of characteristic curves for CB configuration of BJT using Virtual Lab.
4. Simulation of BJT amplifier using Virtual Lab.
5. Design and Implementation of Various Arithmetic Circuits using Virtual Lab.
6. To design, built and test any electronic circuit (Group activity)/ Presentation on any Electronic circuit application.

List of Laboratory Exercises:

1. To plot V-I characteristics of PN junction diode.
2. To plot regulation characteristics of half wave rectifier
3. To plot regulation characteristics of Full wave rectifier
4. To plot input-output characteristics of CE configuration of BJT.
5. To study Biasing techniques of BJT- to find stability factor of self bias, collector to base bias, fixed bias circuits.
6. To plot frequency response of single stage FET amplifier (CS/CD configuration) and find its bandwidth.
7. To study Colpitts Oscillator.
8. Study of OP-AMP circuits: Inverting and Non-inverting Amplifier.
9. Implementation and verification of DeMorgan,s theorem .
10. Implementation and verification of half adder and full adder.

List of Project Based Learning Topics:

1. Water Level Indicator.
2. LED Emergency Light.
3. Security control System
4. AC to DC converter.
5. Automatic Street Light controller
6. Rain Alarm system.
7. Flashing LED
8. Dancing Light
9. Voltage regulator using Zener diode.
10. Amplifier using Op-Amp.
11. JFET as an analog switch.
12. BJTs as a digital switch.
13. Sine wave generator
14. Adder/ Subtractor circuit

15. Up/Down counter

Textbooks:

1. Microelectronics Circuits, Adel S. Sedra and Kenneth Carless Smith, Oxford University Press.
2. Millman's Integrated Electronics, Jacob Millman, Christos Halkias, Chetan Parikh, McGraw Hill Education.
3. Digital Logic & Computer Design, M. Morris Mano, Pearson

Reference Books:

1. Electronic Devices and Circuit Theory, Robert L. Boylestad, Louis Nashelsky.
2. Solid State Electronic Devices, 6th Edition, Ben Streetman, Sanjay Banerjee
3. Electronic Principle, Albert Paul Malvino.
4. Electronics Circuits:Discrete& Integrated, D Schilling C Belove T Apelewicz R Saccardi.
5. Microelectronics, Jacob Millman, Arvin Grabel.
6. Electronics Devices & Circuits, S. Salivahanan, N. Suresh Kumar, A. Vallavaraj
7. Electronic Devices & Circuit Theory, 11th Edition, Robert L. Boylestad, Louis Nashelsky

Business Communication & Value Science – II

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 03 Hrs/Week	**Semester Examination: 50 marks**	**Theory: 3 Credits**
Lab: 04 Hrs/ Week	**Internal Assessment: Yes**	**Practical:2 Credits**
	Term work & Oral:50 marks	**Total : 5 Credits**

Course Prerequisites: -

Basic knowledge of the parts of speech in English.
Vocabulary covered in the previous semester along with basic knowledge of verbs & adverbs.
Basic awareness of the need of speaking skills within social circle.
The elements of team dynamics done during the previous semester with proper application and basic awareness of the concepts of feedback, criticism.
The various common conflicts that may arise at varied situations

Course Objective:-

The course objective of Business Communication & Value Science-I aims to augment student's overall communication and interpersonal skills by engaging them in group activities and thus aid in helping them to emerge as professionals. The soft skills topics for this semester are intended to develop student's expertise on public speaking skills and to deal positively with criticism and to effectively present their personalities

Course Outcomes: -

Graduates will able to:

1. To understand the concept of soft skills, Business Values and its implication at workplace
2. To construct the error free sentences of English language and develop proper reading Skills for Oral and written business communication
3. To develop team building and leadership skills by applying motivational factors
4. To construct effective business presentation and do effective implementation of it through activities
5. To inculcate appropriate business ethics and etiquettes for effective professionalism
6. To understand the concept of Diversity and Inclusion and its application at workplace

Unit I Importance of Soft skills and Values Sciences: 6 Hours

Soft skills, meaning, need and importance, difference between soft skills and hard skills, life skills and personal skills, applying soft skills across culture values of a good manager, Respect for Individual and Integrity. Importance of Ethics and Values in Business World.

Unit II Enhancing Writing and Reading Skills: 6 Hours

Good and Bad Writing. Common errors, punctuation rules, use of words Formation of an E-magazine, Blog writing, writing notice, agenda and Minutes of meeting, Introduction to skimming and scanning Techniques of Good Reading, Bad reading Habits **[**

Unit III Developing interpersonal skills: **6 Hours**

Team Building Skills, Team dynamics, Types of teams Classification of teams, Bruce Tuckman's Team Building Model, Challenges and Remedies of Team Development Belbin's 8 Team Roles and Lindgren's Big 5 personality traits. Belbin's 8 team player styles Leadership Skills: Good Leadership Skills, Difference between Leadership and Management Defining Qualities and Strengths of leadership

Unit IV Public Speaking and Presentation Skills: **6 Hours**

Public Speaking: fundamentals of effective public speaking, types- Extempore speech, manuscript speech, and ways to enhance public speaking skills, storytelling, oral review Power Point presentations, Effective ways to structure the presentation, importance of body language Group discussion, interview skills

Unit V Corporate / Business Etiquettes: **6 Hours**

Corporate grooming & dressing, etiquettes in social & office Setting-Understand the importance of professional behaviour at the workplace, Understand and Implement etiquettes in workplace, presenting oneself with finesse and making others comfortable in a business setting. Importance of first impression, Grooming

Unit VI Diversity and Inclusion: **6 Hours**

Concepts**,** Advantages and Disadvantages, Different forms of Diversity in our society. Socio-Cultural and Cross-Cultural Sensitivities at the Workplace: PWD and LGBT at the workplace, Learning disabilities at the workplace; Caste, class, regionalism, religion and poverty: the different identities of Indian employees and employers and how to include everyone; Global diversity identities of race, religion, nationhood; Appropriate Social Media Use

List of Laboratory Exercises:

1) Join Hands Movement'. Individual identification of social Issues
2) SATORI – Participants share the personal take away acquired from GD, writing and reading skills activities captured in their handbook
3) Form an NGO. Create Vision, Mission, Value statement, tagline and Design a logo.
4) Plan and design an E Magazine.
5) Lucid Writing, Catherine Morris and Joanie McMahon's writing techniques.
6) Speed Reading session: Introduction to skimming and scanning; practice the same.
7) Design a skit- a) write the script articulating the message of their respective NGOs.Read out the script. (Skit time-5 minutes).
8) Promote the play through a social media and gather your audience. Enact the play. Capture the numbers of likes and reviews
9) Team Falcon Practical to identify individual personality traits with Belbin's 8 team player styles
10) Ten minutes of your time – a short film on diversity. Play the video, Discuss the concept of empathy
11) Touch the target (Blind man) - Debriefing of the Practical. Film: "The fish and I'' by Babak Habibifar"
12) To create a story – 10 minutes of a person's life affected by the social issue groups
13) Research on a book, incident or film based on the topic of your respective NGO and Discuss
14) Interviews of people from diverse groups (Ask 5 questions). Share the recordings in FB
15) Prepared speech- Every student will narrate the challenges faced by a member of a diverse group in 4 minutes (speech in first person)
16) Discussion on TCS values, Respect for Individual and Integrity.

Project:	01	Form an NGO with a social cause in a group and make an awareness among people by doing different activities

List of Project Based Learning Topics:

1. Analysing difference between Soft Skills and Hard skills
2. Preparing a model for evaluating Values and Ethics of Good Managers
3. Developing Reading and writing Skills: Preparing a model on each skill
4. Form a model for communicative writing which avoid grammar mistakes and common errors
5. Develop Bruce Tuchman's Team Building Models with classmates/Teammates
6. Analysing difference between Leadership and Management skills
7. Watch and Listen the best videos of Good Public Speaker s and List out their Qualities and Attributes
8. Knowing body language and Paralinguistic Features for the Presentation: Making a video of professional presentation

9. Visit one nearest origination/Firm and find out what etiquettes and mannerism are being used there that enhance the capacity of their work place
10. Preparing a model of dress codes and attire for different professional situations
11. Analysing the majors aspects of diversity and inclusion in the workplace
12. Creating a good model for increasing diversity and enhancing the proper inclusion that will help in achieve the goal of the origination effectively
13. Analysing markers of global identities for inclusive work culture

Reference Books:

1. Business Communication Today by Bovee, Thill, Raina
2. Business Communication by Meenakshi Raman, Prakash Singh published by Oxford University press, second edition,
3. Spoken English- A manual of Speech and Phoonetics by R. K. Bansal, J. B. Harrison published by Orient Blackswan
4. Communication Skills by Sanjay Kumar, PushpLata, published by Oxford University press, second edition
5. Technical Communication by Meenakshi Raman, Sangeeta Sharma published by Oxford University press
6. Developing Communication Skills by Krishna Mohan, MeeraBanerji published by Macmillan India Pvt Ltd
7. Strategic Communication by Charles Marsh
8. English vocabulary in use – Alan Mc'carthy and O'dell
9. Business Communication – Dr.SarojHiremath

Web References:

01. Ethics fundamentals and approaches to ethics
https://www.eolss.net/Sample-Chapters/C14/E1-37-01-00.pdf
02. A Framework for Making Ethical Decisions
https://www.brown.edu/academics/science-and-technology-studies/framework-making-ethical-decisions
03. Five Basic Approaches to Ethical Decision-
http://faculty.winthrop.edu/meelerd/docs/rolos/5_Ethical_Approaches.pdf

B. TECH (Computer Science & Business Systems)

SEMESTER – III

COURSE SYLLABUS

Formal Language & Automata Theory

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 3Hrs./Week	**Semester Examination: 60 marks**	**Theory: 3 Credits**
Tutorials: 1Hr./Week	**Internal Assessment: 40 marks**	**Tutorial:1 Credit**
Lab: Nil	**Term Work: Nil**	**Total : 4 Credits**

Course Pre-Requisites:
The students should have basic Knowledge Set algebra, elementary formal logic, constructing proofs, recurrence relations, Discrete Structures and Data structures and problem solving.

Course Objective:
1. To understand problem classification and problem solving by machines.
2. To understand the basics of automata theory and its operations.
3. To study computing machines by describing, classifying and comparing different types of computational models.
4. Encourage students to study theory of computability and complexity.
5. To understand the P and NP class problems and its classification.
6. To understand the fundamentals of problem decidability and reducibility.

Course Outcomes:
1) To construct finite state machines to solve problems in computing.
2) To write mathematical expressions for the formal languages.
3) To understand context free and context sensitive languages.
4) To construct Turing Machine for formal languages.
5) To express the understanding of the decidability and undecidability problems.
6) To identify NP Hard and complete problems.

UNIT – I **6 Hours**
Introduction: Alphabet, Strings and languages, Graphs, Directed Graphs, Trees, FSM.

UNIT – II **6 Hours**
Regular languages and finite automata: Regular expressions and languages, deterministic finite automata (DFA) and equivalence with regular expressions, nondeterministic finite automata (NFA) and equivalence with DFA, regular grammars and equivalence with finite automata, properties of regular languages, *Keene's theorem*, pumping lemma for regular languages, Myhill-Nerode theorem and its uses, minimization of finite automata.

UNIT – III **6 Hours**
Context-free languages and pushdown automata: Productions and Derivation, Context-free grammars (CFG) and languages (CFL), Chomsky hierarchy of languages, Chomsky Normal Forms and Greibach normal forms, nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic pushdown automata, closure properties of CFLs.
Context-sensitive languages: Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG.

UNIT – IV **6 Hours**
Turing machines: The basic model for Turing machines (TM), Turing recognizable (recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs, unrestricted grammars and equivalence with Turing machines, TMs as enumerators.

UNIT – V **6 Hours**

Undecidability: Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice s theorem, undecidable problems about languages.

UNIT – VI **6 Hours**

Basic Introduction to Complexity: Introductory ideas on Time complexity of deterministic and nondeterministic Turing machines, P and NP, NP- completeness, Cook's Theorem, other NP -Complete problems.

List of Assignments:

YACC, the parser-generating tool (Chapter 5 of Introduction to Automata Theory, Languages, and Computation (John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman.)

List of Project Based Learning Topics:

1. Design a FA for Vending Machine
2. Explain Pigeon hole Principle
3. Implement Push Down Automata
4. Implement Regular Expression
5. Implement lexical Analyzer
6. Implement Turing Machine for Mathematical Expression
7. Design an application to search a string from given text using FA
8. Implement a FSM for residing mod 3.
9. Provide solutions for Missionaries and Cannibals problems.

Textbooks:

1. Introduction to Automata Theory, Languages, and Computation John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman. Pearson Publication.

Reference Books:

1. Elements of the Theory of Computation, Harry R. Lewis and Christos H. Papadimitriou.
2. Automata and Computability, Dexter C. Kozen.
3. Introduction to the Theory of Computation, Michael Sipser.
4. Introduction to Languages and the Theory of Computation, John Martin.
5. Computers and Intractability: A Guide to the Theory of NP Completeness, M. R. Garey and D. S. Johnson.

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Computer Organization & Architecture

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 03 Hours / Week	**End Semester Examination: 60 Marks**	**Theory: 3 Credits**
Practical: 02 Hours / Week	**Internal Assessment: 40 Marks**	**Practical :1 Credit**
	Term Work: 25 Marks	**Total : 4 Credits**

Course Pre-Requisites:
The students should have basic Knowledge Digital electronics and computer system

Course Objective:
To understand the design of the various functional units of computer system.

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

1. Explain the architecture and functions of Central Processing Unit.
2. Solve fixed point and floating-point arithmetic problems using algorithms
3. List the design approaches and functional requirements for implementing control unit.
4. Analyze the characteristics of memory system.
5. Describe the I/O organization and interconnections.
6. Infer parallel processing and multiprocessor configuration.

UNIT – I **6 Hours**
Revision of basics in Boolean logic and Combinational/Sequential Circuits.
Functional blocks of a computer: CPU, memory, input-output subsystems, control unit.
Introduction to x86 architecture
Instruction set architecture of a CPU: Registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Outlining instruction sets of some common CPUs.

UNIT – II **6 Hours**
Data representation: Signed number representation, fixed and floating-point representations, character representation.
Computer arithmetic: Integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication – shift-and-add, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, floating point arithmetic, IEEE 754 format.

UNIT – III **6 Hours**
CPU control unit design: Hardwired and micro-programmed design approaches, design of a simple hypothetical CPU.

UNIT – IV **6 Hours**
Memory system design: Semiconductor memory technologies, memory organization.
Memory organization: Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policies.

UNIT – V **6 Hours**
Peripheral devices and their characteristics: Input-output subsystems, I/O device interface, I/O transfers – program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes – role of interrupts in process state transitions, I/O device interfaces – SCSI, USB

UNIT – VI **6 Hours**
Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards.
Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache coherency.

List of Assignments:

Assignments covering the following topics should be given

1. Booth's algorithm for multiplication
2. Restoring and non-restoring division
3. Fixed point and floating-point representation
4. Programmer's model of 80386
5. Hardwired and micro-programmed design approaches.
6. Characteristics of Memory system
7. Cache organization and address mapping
8. Virtual memory and replacement algorithms
9. Calculating throughput and speed in pipelining
10. Multiprocessor architecture

List of Laboratory Exercises:

1. Circuits on breadboard or simulators

(a) Implementation of Combinational Digital/Boolean Circuits: Adder, Subtractor, Multiplication Module, Division Module, Multiplexer, Demultiplexer, Encoder, Decoder.

(b) Implementation of Sequential Circuits: Counters, Linear Feedback Shift Registers (LFSR)

2. C/C++ programming to understand the formats of char, int, float, double, long etc.

3. Machine language programming on x86 or higher version kits or simulators

List of Project Based Learning Topics:

1. Automatic night lamp with morning alarm
2. Traffic light with sensor + 7segment
3. Multi pattern running lights.
4. .Washing machine
5. Simple Lock Using Keypad and 7 segment
6. Electronic quiz table
7. Electronic Digital Clock
8. .temperature controller
9. Plant Irrigation System
10. Car Parking Management
11. Customer counter for supermarket
12. Electronic queue management system in food stall
13. Safety box
14. Shop lot automatic door with 7segment display
15. Bank queue management system
16. Water level controller
17. Automatic home system
18. Commuter system
19. Automatic room light control
20. Elevator control system

Textbooks:

1. Computer System Architecture M. M. Mano: 3rd ed., Prentice Hall of India, New Delhi, 1993.
2. Computer Organization and Design: The Hardware/Software Interface, David A. Patterson and John L. Hennessy.
3. Computer Organization and Embedded Systems, Carl Hamacher.

Reference Books:

1. Computer Architecture and Organization, John P. Hayes.
2. Computer Organization and Architecture: Designing for Performance, William Stallings

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Object Oriented Programming

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 3Hrs./Week	**Semester Examination: 60 Marks**	**Theory: 3 Credits**
Practical: 2Hrs/Week	**Internal Assessment: 40 Marks**	**Practical :1 Credit**
	Term work & Practical: 50 Marks	**Total : 4 Credits**

Course Pre-Requisites:
The students should have basic Knowledge of "C" programming language.

Course Objective:
The course introduces fundamental concepts of Object-oriented programming.

Course Outcomes:
At the end of this course students will able to:

1. Understand basic concepts of Procedural programming and, the overview of C programming language
2. Understand some basic difference between C and C++.
3. Understand basic concepts of Object Oriented Programming, classes and objects in OOP.
4. Apply the concept of Access Specifier, friend function, constructor, destructor and Error Handling using C++ programs
5. Implement the concept of polymorphism, virtual functions and inheritance using C++
6. Develop OOP applications using Templates and file Handling.

UNIT – I **6 Hours**

Procedural programming, An Overview of C: Types Operator and Expressions, Scope and Lifetime, Constants, Pointers, Arrays, and References, Control Flow, Functions and Program Structure, Namespaces, error handling, Input and Output (C-way), Library Functions (string, math, stdlib), Command line arguments, Pre-processor directive

UNIT – II **6 Hours**

Some difference between C and C++: Single line comments, Local variable declaration within function scope, function declaration, function overloading, stronger type checking, Reference variable, parameter passing – value vs reference, passing pointer by value or reference, #define constant vsconst, Operator new and delete, the typecasting operator, Inline Functions in contrast to macro, default arguments

UNIT – III **6 Hours**

The Fundamentals of Object Oriented Programming: Necessity for OOP, Data Hiding, Data Abstraction, Encapsulation, Procedural Abstraction, Class and Object.

UNIT – IV **6 Hours**

More extensions to C in C++ to provide OOP Facilities: Scope of Class and Scope Resolution Operator, Member Function of a Class, private, protected and public Access Specifier, this Keyword, Constructors and Destructors, friend class, error handling (exception)

UNIT – V **6 Hours**

Essentials of Object Oriented Programming: overloading, Inheritance – Single and Multiple, Class Hierarchy, Pointers to Objects, Assignment of an Object to another Object, Polymorphism through dynamic binding, Virtual Functions, Overloading, overriding and hiding, Error Handling.

UNIT – VI **6 Hours**

Generic Programming: Template concept, class template, function template, template specialization
Input and Output: Streams, Files, Library functions, formatted output
Object Oriented Design and Modelling: UML concept, Use case for requirement capturing, Class diagram, Activity diagram and Sequence Diagram for design, Corresponding C++ code from design

List of Assignments:

1. Define Procedural Oriented Programming. Explain basic concepts of procedural oriented programming.
2. Differentiate between C and C++ in detail with suitable example.
3. Explain basic concepts of Object-Oriented Programming in detail with suitable example.
4. Write short note on:
   i)Scope Resolution Operator
   ii)Access Specifiers
5. Explain Virtual Function and Function Overloading in detail with Example.
6. Explain Concepts of Object-Oriented Design and Modelling.

List of Laboratory Exercises:

1. Parameter passing: passing parameter by value vs by reference, passing array as constant pointer
2. Function overloading: writing string operations like strcat and strncat, strcpy and strncpy as overloaded functions.
3. Dynamically allocating space for a pointer depending on input and doing this repeatedly, depending on different inputs and finally de-allocating the pointer.
4. Define class complex with all possible operations: constructor, destructor, copy constructor, assignment operator with the data members stored as pointer to integers.
5. Define class vector of integers with all possible operations like constructor, destructor, copy constructor and assignment operators
6. Define class matrix of integers with all possible operations like constructor, destructor, copy constructor and assignment operators
7. Define class matrix of integers using vector, with all possible operations like constructor, destructor, copy constructor and assignment operators
8. Define class stack, queue, linked-list, array, set using some data-type (int) with data members kept as private and functions kept in both protected and public sections.
9. Define class complex with all possible operators: constructor, destructor, copy constructor, assignment operator and operators >, <, >=, <=, ==, ++ (pre and post), +, +=, ( ), with the data members stored as pointer to integers.
10. Define class vector of integers with all possible operations like constructor, destructor, copy constructor and assignment operators>, <, >=, <=, ==, ++ (pre and post), +, +=, ( )
11. Define class matrix of integers with all possible operations like constructor, destructor, copy constructor and assignment operators>, <, >=, <=, ==, ++ (pre and post), +, +=, ( ).
12. Define class matrix of integers using vector, with all possible operations like constructor, destructor, copy constructor and assignment operators>, <, >=, <=, ==, ++ (pre and post), +, +=, ( ).
13. Define stack and queue inherited from array class, with standard functions and operators
14. Define a class called ‘array’ with data type passed as template type with constructor, destructor, copy constructor and assignment operators and index operator.
15. Define template functions for compare and use it in the algorithms like bubble sort, insertion sort, merge sort.
16. Formatted input-output examples
17. Input manipulators
18. Overriding operators <<, >>
19. Define class model for complex number, student class, book class and show it using UML diagram as well as concrete class.
20. Show behavioural modelling through sequence diagram and activity diagram for workflow in a typical log-in, log-out situation.

List of Project Based Learning Topics:

1. Employee Management System.
2. Trading Software.
3. Billing System.
4. Intuitive Gadgets.
5. Traffic Management System
6. Security Systems.
7. Car Rental System.
8. Login and Registration System.
9. Bookshop inventory system.
10. Student Report Management System.
11. Calendar application.

Text Books:

1. The C++ Programming Language, Bjarne Stroustrup.
2. C++ and Object-Oriented Programming Paradigm, Debasish Jana

Reference Books:

1. Programming – Principles and Practice Using C++, Bjarne Stroustrup.
2. The Design and Evolution of C++, Bjarne Stroustrup.

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Computational Statistics

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 03 Hours / Week	**End Semester Examination: 60 Marks**	**Theory: 3 Credits**
Practical: 04 Hours / Week	**Internal Assessment: 40 Marks**	**Practical :2 Credits**
	Term work & Practical -50 Marks	**Total : 5 Credits**

Course Pre-requisites: The Students should have knowledge of basics of statistics.

Course Objectives:
The aim of this course is to give graduate students knowledge of statistical concepts like factor analysis, regression analysis and Python programming. The course objective is to exercise students for data set handling, data wrangling, data visualization etc. using Python.

Course Outcomes:
1. Understand basics of normal distribution and linear regression model.
2. Apply knowledge of multivariate regression and discriminant analysis.
3. Outline component analysis and factor analysis.
4. Design various clusters.
5. Understand and demonstrate fundaments of Python programming.
6. Demonstrate visualization in Python.

UNIT – I **6 Hours**

Python Concepts, Data Structures, Classes: Interpreter, Program Execution, Statements, Expressions, Flow Controls, Functions, Numeric Types, Sequences and Class Definition, Constructors, Text & Binary Files - Reading and Writing.

Data Wrangling: Combining and Merging Datasets, Reshaping and Pivoting, Data Transformation, String Manipulation, Regular Expressions

UNIT – II **6 Hours**

Data Aggregation, Group Operations, Time series: GoupBy Mechanics, Data Aggregation, Groupwise Operations and Transformations, Pivot Tables and Cross Tabulations, Time Series Basics, Data Ranges, Frequencies and Shifting.

UNIT – III **6 Hours**

Multivariate Normal Distribution: Multivariate Normal Distribution Functions, Conditional Distribution and its relation to regression model, Estimation of parameters.

Multiple Linear Regression Model: Standard multiple regression models with emphasis on detection of collinearity, outliers, non-normality and autocorrelation, Validation of model assumptions.

UNIT – IV **6 Hours**

Multivariate Regression: Assumptions of Multivariate Regression Models, Parameter estimation, Multivariate Analysis of variance and covariance.

Discriminant Analysis: Statistical background, linear discriminant function analysis, Estimating linear discriminant functions and their properties.

UNIT - V **6 Hours**

Principal Component Analysis: Principal components, Algorithm for conducting principal component analysis, deciding on how many principal components to retain, H-plot.

Factor Analysis: Factor analysis model, Extracting common factors, determining number of factors, Transformation of factor analysis solutions, Factor scores.

UNIT – VI **6 Hours**

Clustering and Segmentation Analysis: Introduction, Types of clustering, Correlations and distances, clustering by partitioning methods, hierarchical clustering, overlapping clustering, K-Means Clustering-Profiling and Interpreting Clusters.

List of Assignments:

Respective subject teacher shall design any six assignments on above units.

List of Laboratory Exercises:

1. Introduction to python programming (String operation, Mathematical operation, loops, branching).
2. Implementation of classes and constructor in Python.
3. Implementation of basic data structures in Python.
4. File Handling in the Python.
5. Introduction to data set handling in Python.
6. Implement various pre-defined libraries in Python like Panda, NumPy, Cbor (Drawing of statistical graph).
7. Implementation of Multivariate Normal Distribution.
8. Implementation of Multiple Linear Regression Model
9. Implementation of Multivariate Regression
10. Implementation of Discriminant Analysis
11. Implementation of clustering and segmentation
12. Implementation of data wrangling, data aggregation, group operations and time series operations.
13. Data Visualization in Python.

Textbooks:

1. An Introduction to Multivariate Statistical Analysis, T.W. Anderson.
2. Applied Multivariate Data Analysis, Vol I & II, J.D. Jobson.
3. Statistical Tests for Multivariate Analysis, H. Kris.
4. Programming Python, Mark Lutz.
5. Python 3 for Absolute Beginners, Tim Hall and J-P Stacey.
6. Beginning Python: From Novice to Professional, Magnus Lie Hetland. Edition, 2005.

List of Project Based Learning Topics:

1. Design and development of Student management system using object oriented approach and file structure.
2. Development of student performance analysis system (Use of file, OO Python and regression model, Graphical dash board).
3. Development of multivariate predictive model for rain forecasting (use rainfall data for last 50 years).
4. Development of multivariate predictive model for gold rate. (Use daily gold rate data for last 10 years).
5. Development of multivariate predictive model for patrol rate. (Use daily patrol rate data for last 10 years).
6. Comparative analysis of predictions of single multivariate predictive model against multiple linear predictive models.
7. Comparative analysis of dimensionality reduction performance using principle component analysis (PCA) and linear discriminant analysis (LDA).
8. Comparative analysis of classification performance of principle component analysis (PCA) and linear discriminant analysis (LDA) techniques.
9. Study of effectiveness of analysis of variance (ANOVA) and analysis of covariance (ANCOVA) for predictive analysis.
10. Comparing operating differences of various clustering Techniques.
11. Comparative analysis of performance for parameter (variable/factors) selection using principle component analysis (PCA) and factor analysis (FA) for multivariate analysis.

Reference Books:

1. Regression Diagnostics , Identifying Influential Data and Sources of Collinearety, D.A. Belsey, E. Kuh and R.E. Welsch
2. Applied Linear Regression Models, J. Neter, W. Wasserman and M.H. Kutner.
3. The Foundations of Factor Analysis, A.S. Mulaik.
4. Introduction to Linear Regression Analysis, D.C. Montgomery and E.A. Peck.
5. Cluster Analysis for Applications, M.R. Anderberg.
6. Multivariate Statistical Analysis, D.F. Morrison.
7. Python for Data Analysis, Wes Mc Kinney.

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Software Engineering

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 4Hrs./Week	Semester Examination: 60 Marks	Theory: 4 Credits
Lab: 2Hrs./Week	Internal Assessment: 40 Marks	Practical: 1 Credit
	Term work & Practical: 25 Marks	Total : 5 Credits

Course Pre-Requisites:
The students should have sound knowledge of data structures, programming experience and an extensive hands-on experience of using software.

Course Objective:
The course introduces key aspects of software engineering processes for the development of a complex software system.

Course Outcomes:

1. Learn importance of software engineering process and its principles
2. Understand the software development life cycle with appropriate models
3. Understand software quality concepts
4. Document user requirements using suitable techniques
5. Analyze the software design from and Object-Oriented perspective.
6. Apply appropriate testing techniques on a software

UNIT – I **8 Hours**

Introduction: Programming in the small vs. programming in the large; software project failures and importance of software quality and timely availability; engineering approach to software development; role of software engineering towards successful execution of large software projects; emergence of software engineering as a discipline.

UNIT – II **8 Hours**

Software Project Management: Basic concepts of life cycle models – different models and milestones; software project planning –identification of activities and resources; concepts of feasibility study; techniques for estimation of schedule and effort; software cost estimation models and concepts of software engineering economics; techniques of software project control and reporting; introduction to measurement of software size; introduction to the concepts of risk and its mitigation; configuration management.

UNIT – III **8 Hours**

Software Quality and Reliability: Internal and external qualities; process and product quality; principles to achieve software quality; introduction to different software quality models like McCall, Boehm, FURPS / FURPS+, Dromey, ISO – 9126; introduction to Capability Maturity Models (CMM and CMMI); introduction to software reliability, reliability models and estimation.

UNIT – IV **8 Hours**

Software Requirements Analysis, Design and Construction: Introduction to Software Requirements Specifications (SRS) and requirement elicitation techniques; techniques for requirement modeling – decision tables, event tables, state transition tables, Petri nets; requirements documentation through use cases; introduction to UML, introduction to software metrics and metrics-based control methods; measures of code and design quality.

UNIT – V **8 Hours**

Object Oriented Analysis, Design and Construction: Concepts -- the principles of abstraction, modularity, specification, encapsulation and information hiding; concepts of abstract data type; Class Responsibility Collaborator (CRC) model; quality of design; design measurements; concepts of design patterns; Refactoring; object oriented construction principles; object oriented metrics.

UNIT – VI **8 Hours**

Software Testing: Introduction to faults and failures; basic testing concepts; concepts of verification and validation; black box and white box tests; white box test coverage – code coverage, condition coverage, branch coverage; basic concepts of black-box tests – equivalence classes, boundary value tests, usage of state tables; testing use cases; transaction-based testing; testing for non-functional requirements – volume, performance and efficiency; concepts of inspection.

Listof Assignments:

Teaching faculty will design home assignment on following topics

1. Software development Models
2. Software Requirement Specification
3. Data Flow Diagrams
4. Testing
5. Object Oriented Analysis, Design and Construction
6. Software project covering various software development methodology techniques will be implemented.

List of Laboratory Exercises:

1. Develop Flow-Charts for (any open-ended problem statement) to understand basic problem solving technique using suitable tool.
2. Perform domain analysis for given problem.
3. Develop requirements specification document as per IEEE format for a given problem
4. Develop DFD model (level-0, level-1 DFD and Data dictionary) of the project under consideration.
5. Perform Structured design for the developed DFD model.
6. Calculate Cyclomatic complexity for given code snippet.
7. Identify the usage of regression testing.
8. Identify the different types of performance testing

List of Project Based Learning Topics:

1. Fingerprint voting system
2. Weather forecasting system
3. Android local train ticketing system
4. Railway tracking and arrival time prediction system
5. Android Patient Tracker
6. Opinion mining for social networking platforms
7. Automated payroll system with GPS tracking and image capture
8. Data leakage detection system
9. Credit card fraud detection
10. AI shopping system
11. Camera motion sensor system
12. Bug tracker
13. e-Learning platform
14. Smart health prediction system
15. Software piracy protection system

Text Books:

1. Software Engineering, Ian Sommerville
2. Object Oriented Software Engineering: A Use Case Driven Approach --Ivar Jacobson

Reference Books:

1. Fundamentals of Software Engineering, Carlo Ghezzi, Jazayeri Mehdi, Mandrioli Dino

2. Software Requirements and Specification: A Lexicon of Practice, Principles and Prejudices, MichaelJackson
3. The Unified Development Process, Ivar Jacobson, Grady Booch, James Rumbaugh
4. Design Patterns: Elements of Object-Oriented Reusable Software, Erich Gamma, Richard Helm,Ralph Johnson, John Vlissides
5. Software Metrics: A Rigorous and Practical Approach, Norman E Fenton, Shari Lawrence Pfleeger
6. Software Engineering: Theory and Practice, Shari Lawrence Pfleeger and Joanne M. Atlee
7. Object-Oriented Software Construction, Bertrand Meyer
8. Object Oriented Software Engineering: A Use Case Driven Approach --Ivar Jacobson
9. Touch of Class: Learning to Program Well with Objects and Contracts --Bertrand Meyer
10. UML Distilled: A Brief Guide to the Standard Object Modeling Language --Martin Fowler

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Business Communication & Value Science-III

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 2 Hr./Week	**Semester Examination: 50 Marks**	**Theory: 2 Credits**
Lab: 4 Hrs./Week	**Internal Assessment: Yes** **Term work & Oral: 50Marks**	**Practical:2 Credits** **Total : 4 Credits**

Course Prerequisites: -

Good knowledge of Business Communication and Value Science (Covered Semester I and II) Basic Knowledge of English (verbal and written) Completion of all units from Semesters I and II

Course Objective

The course objective of **Business Communication & Value Science-III** aims to develop technical writing skills; introduce students to Self-analysis techniques like SWOT & TOWS and develop the sense of Pluralism in cultural spaces, Cross-cultural communication, Science of Nation building

Course Outcomes: -

Graduates will able to:

1. Apply &analyze the basic principles of SWOT & life positions.
2. Understand, analyse & leverage the power of motivation in real life Identify & respect pluralism in cultural spaces.
3. Understand and apply the concepts of Global, glocal and trans-locational &analyse cross cultural communication
4. Apply the science of Nation building, the diverse culture of India
5. Identify &analyze the common mistakes made in cross-cultural communication, tools of technical writing,
6. Recognize the roles and relations of different genders. Understand Artificial intelligence &recognize its impact in daily life

Unit I SWOT and Life Positions: 4 Hours

Summarize the basic principles of SWOT and Life Positions; apply SWOT in real life scenarios. TOWS analysis, research on TOWS and find out how you can turn your threat into opportunity

Unit II VUCA World & Motivation: 4 Hours

Research through SWOT and TOWS on what are the strengths they have identified to survive in the VUCA World, Motivation: its role and application in real life.

Unit III Pluralism in cultural spaces: 4 Hours

Identify pluralism in cultural spaces, Respect pluralism in cultural spaces, Differentiate between the different cultures of India.

Unit IV Cross cultural communication 4 Hours

Define the terms global, glocal and translocational, differentiate between global, glocal and translocational culture, implications of cross-cultural communication, common mistakes made in cross-cultural communication, roles and relations of different genders.

Unit V Technical Communication 4 Hours

Role of science in nation building, tools and best practices of technical writing, technical writing in real-life scenarios.

Unit VI Role of technical writing in science and technology 4 Hours

AI (artificial intelligence), the importance of AI, Designing College in the year 2090 with help of technical writing and technology, role of technical writing in science and technology, IOT

List of Laboratory Exercises:

01 SWOT and Life Positions Meet Dananjaya Hettiarachchi: https://www.youtube.com/watch?v=bbz2boNSeL0&t=24s
02 SWOT Vs. TOWS: The Balancing Act https://www.youtube.com/watch?v=RHrO4t86phA
03 Presentation on what are the strengths they have identified to survive in the VUCA World.
04 Maslow's Theory: Present their findings and approaches as groups. They need to explain the idea of motivation with the help of examples
05 Cultural diversity: Awareness and respect for pluralism in cultural spaces
06 Pluralism through the representation of Indian rivers
07 Global, glocal, translocational
08 Group discussion on the implications of cross-cultural communication.
09 Gender awareness: An activity to sensitize gender awareness
10 Role of science in nation building
11 Role of science post- independence
12 Practice activity on technical writing.
13 How will a voice assistant evolve in 25 years from now?
14 Design your college in the year 2090
15 Applying technical writing in profession
16 Scenario-based Assessment on technical writing
17 Explain IOT to your helping hand at home
18 Will machines control us in future?
Debate in the presence of an external moderator.

Project:	01	Visit rural area/ underprivileged parts of city to address some of the local issues; if relevant suggest a practical technology solution to the issues.

List of Project Based Learning Topics:

01. Preparing strategies by using SWOT and TWOS analysis
02. Analysis of SWOT and TWOS for VUCA world
03. Application of motivation for surviving in VUCA world
04. Identify pluralism in cultural spaces and presentation on its application for organization
05. Preparing a model of local, global and translocational
06. Preparing a model by using translocational strategies for marketing purpose
07. Preparing a model on benefits and limitation of cross-cultural communication
08. Real time application of Technical Writing for scientific topics
09. Investigation into contribution of science in nation building and preparing a model of technical writing
10. Identifying the role of technical writing in science and preparing five blogs on current scientific inventions
11. Using learning of earlier semester; prepare a technical document
12. Investigation into a research paper of your area of interest and preparing a review paper on them.

Reference Books:

01 Swot Analysis: A Guide to Swot for Business Studies Students by Alan Sarsby
02 The SWOT Analysis: Using Your Strength to Overcome Weaknesses, Using Opportunities to Overcome Threats by Lawrence G. Fine
03 Cross-Cultural and Intercultural Communication by William B. Gudykunst
04 Technical Communication by Meenakshi Raman, Sangeeta Sharma published by Oxford University press
05 Developing Communication Skills by Krishna Mohan, MeeraBanerji published by Macmillan India Pvt Ltd

Recommended web-links for enhancing English language and business communication

01 https://youtube/CsaTslhSDI

02 https://m.youtube.com/watch?feature=youtu.be&v=IIKvV8_T95M
03 https://m.youtube.com/watch?feature=youtu.be&v=e80BbX05D7Y
04 https://m.youtube.com/watch?v=dT_D68RJ5T8&feature=youtu.be
05 https://m.youtube.com/watch?v=7sLLEdBgYYY&feature=youtu.be

B.TECH (Computer Science & Business Systems)

SEMESTER – IV

COURSE SYLLABUS

Operating System

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 4 Hrs./Week	**Semester Examination: 60 Marks**	**Theory: 4 Credits**
Tutorials: nil	**Internal Assessment: 40 Marks**	**Practical: 1 Credit**
Lab: 2 Hrs./Week	**Term Work: 25 Marks**	**Total : 5 Credits**

Course Pre Requisites:
Prerequisites for this course include thorough knowledge in some high-level programming language as C or C++ and UNIX / Linux operating system environment. As programs are to be implemented by writing C code during the course and will cover the details of C and its close relationship to UNIX and Linux in the case study in 6^{th}unit.

Course Objectives:
1. To learn the basic concepts of Operating Systems.
2. To learn the mechanisms of OS to handle processes and threads and their communication.
3. To learn the methods of process scheduling.
4. To gain knowledge on Mutual exclusion, deadlock detection algorithms.
5. To know the concept of memory management and virtual memory.
6. To learn programmatically file management techniques.

Course Outcomes:
1. To learn and apply the basic concept of operating system.
2. To infer the concept of process and process state transition and concept of thread and multithreading.
3. Understand the importance of scheduling and types of scheduling algorithms.
4. To gain the knowledge of interprocess communication strategies, concept of deadlock along with its avoidance.
5. To analyse the memory management techniques, paging and segmentation.
6. To understand the file management and disk management techniques.

UNIT – I **8Hours**

Introduction: Concept of Operating Systems (OS), Generations of OS, Types of OS, OS Services, Interrupt handling and System Calls, Basic architectural concepts of an OS, Concept of Virtual Machine, Resource Manager view, process view and hierarchical view of an OS.

UNIT – II **8 Hours**

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching.
Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads.

UNIT – III **8 Hours**

Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time.
Scheduling algorithms: Pre-emptive and non-pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.

UNIT – IV **8Hours**

Inter-process Communication: Concurrent processes, precedence graphs, Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Semaphores, Strict Alternation, Peterson's Solution, The Producer / Consumer Problem, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem, Barber's shop problem.
Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.
Concurrent Programming: Critical region, conditional critical region, monitors, concurrent languages, communicating sequential process (CSP); Deadlocks - prevention, avoidance, detection and recovery.

UNIT – V **8 Hours**

Memory Management: Basic concept, Logical and Physical address maps, Memory allocation: Contiguous Memory allocation – Fixed and variable partition–Internal and External fragmentation and Compaction.

Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page allocation, Partitioning, Paging, Page fault, Working Set, Segmentation, Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).

UNIT – VI **8Hours**

I/O Hardware: I/O devices, Device controllers, Direct Memory Access, Principles of I/O.

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed),Free-space management (bit vector, linked list, grouping), directory implementation(linear list, hash table), efficiency and performance.

Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks.

Case study: UNIX OS file system, shell, filters, shell programming, programming with the standard I/O, UNIX system calls.

List of Assignments:

1. To learn evolution and structure of operating system.
2. To understand the concept of Real Time scheduling.
3. To analyse the problem of process synchronization.
4. To implement the shell programming in UNIX OS.

List of Laboratory Exercises:

1. Unix commands (files directory, data manipulation, network communication etc), shell programming and vi editor
2. C program implementation of the following:
    a. Scheduling Algorithms
    b. Shared memory
    c. Thread and Multi Thread
    d. Inter Process Communication
    e. Deadlock Avoidance and Deadlock Detection
    f. Semaphore
    g. Memory Management
    h. Indexing and Hashing

List of Project Based Learning Topics:

1. Virtual traffic management system using threads with semaphore to control traffic.
2. Virtual memory management system.
3. File system handling.
4. A Client -Server application, use of IPC.
5. A simple web browser.
6. Device driver for some device.
7. Design of mail system project.
8. Design of RTOS for embedded system.
9. Mini project on Linux Shell.
10. Railway reservation system using scheduling.

Textbooks:

3. Operating System Concepts Essentials. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne.

Reference Books:

1. Operating Systems: Internals and Design Principles. William Stallings.
2. Operating System: A Design-oriented Approach. Charles Patrick Crowley.
3. Operating Systems: A Modern Perspective. Gary J. Nutt.
4. Design of the Unix Operating Systems. Maurice J. Bach.

5. Understanding the Linux Kernel, Daniel Pierre Bovet, .*Marco Cesati*

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Database Management Systems

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 4 Hrs./Week	Semester Examination: 60 marks	Theory: 4 Credits
Tutorials: NIL	Internal Assessment: 40 marks	Practical: 2 credits
Practical: 4 Hrs./Week	Term work & Practical: 50 marks	Total : 6 Credits

Course Prerequisites:
Students should have knowledge of
1) Basic understanding of data and data structure
2) Basic understanding of programming language

Course Objectives:
1. Identify various techniques to communicate with database.
2. Relate relevant data for effective processing of data.
3. Construct a database to maintain data adroitly.
4. Study various queries and tools to deal with the data.
5. Understand the relation between data set and respective means to access it.
6. Understand influence of data in the effective development of software.

Course Outcomes:
After successful completion of this course students will be able to:

1. Model an application's data requirements using conceptual modeling tools
2. Demonstrate concepts of relational algebra and queries
3. Demonstrate concepts of relational database design
4. Interpret the query processing and optimization activities in database
5. Interpret the transaction activities in database
6. Recognize the emerging database applications and security concerns

UNIT – I **8 Hours**

Introduction: Introduction to Database. Hierarchical, Network and Relational Models. Database system architecture: Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML).Data models: Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.

UNIT – II **8 Hours**

Relational query languages: Relational algebra, Tuple and domain relational calculus,SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL,ORACLE, DB2, SQL server.

UNIT – III **8 Hours**

Relational database design: Domain and data dependency, Armstrong's axioms, Functional Dependencies, Normal forms, Dependency preservation, Lossless design.

UNIT – IV **8 Hours**

Query processing and optimization: Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.
Storage strategies: Indices, B-trees, Hashing.

UNIT – V **8 Hours**

Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp-based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.

UNIT – VI **8 Hours**

Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.

Advanced topics: Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.

List of Assignments:

Respective subject teacher shall design any six assignments on above units.

List of Laboratory Exercises:

Assignments & tutorials covering the relational database design and operations in SQL and PL/SQL

List of Project Based Learning Topics:

1. Make a project to maintain employee data using files and dynamic object/structure. The project should be able to read, write, modify, add and search records. Also demonstrate the effect of performing change in employer data definition after few records have been added.
2. Make an extended ER diagram for insurance management system. Transform this into ralation design and implement these relations with appropriate domain and integrity constraints.
3. Employ various data control restrictions on databases, relations and attributes of relations.
4. Create a phonebook which enables user to save contacts with additional information and provides various retrieval mechanisms. Provisions should be made to view data in mutliple ways.
5. Design and develop a library management system. The relations in the system should be normalized upto BCNF
6. Design and develop a inventory management system and create multiple views on the relations so that users not authorised to edit the relations should be able to views the data.
7. Implement of audit trails and backup on relations.
8. Create a student result calculation system. However when updating final results after calculation should be only of students who paid complete fees, such that transaction of each row is executed separately. Hint- use explicit cursor
9. Develop a student data management system using hash files.
10. Installation of a NoSQL database and implementing a simple student database to compare with SQL database.

Textbooks:

1. Database System Concepts. Abraham Silberschatz, Henry F. Korth and S. Sudarshan.

Reference Books:

1. Principles of Database and Knowledge – Base Systems, Vol 1 by J. D. Ullman.
2. Fundamentals of Database Systems. R. Elmasri and S. Navathe.
3. Foundations of Databases. Serge Abiteboul, Richard Hull, VictorVianu.

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Software Design with UML

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 3Hrs./Week	**Semester Examination: 60 Marks**	**Theory: 3 Credits**
Practical: 2Hrs./Week	**Internal Assessment: 40 Marks**	**Practical: 01 Credit**
	Term work & Practical: 50Marks	**Total : 4 Credits**

Course Pre Requisites:
The students should have sound knowledge software engineering and programming experience using data structures.

Course Objective:
To model software solutions, application structures, system behaviour and business processes using UML.

Course Outcomes:

1. Apply Unified Modeling Language (UML) for representation of an object-oriented system using different modeling views
2. Analyze requirements to represent logical design that is recognized by various object relationships.
3. Identify interaction among structural elements to translate analysis model into design model.
4. Model dependencies among packages and package able element ownership
5. Model dynamic behavior of the system and message flow from one object to other.
6. Envision the topology of the physical components of a system where the software components are utilized

UNIT – I **6 Hours**

Introduction to on Object Oriented Technologies and the UML Method: Software development process: The Waterfall Model vs. The Spiral Model; The Software Crisis, description of the real world using the Objects Model; Classes, inheritance and multiple configurations; Quality software characteristics; Description of the Object Oriented Analysis process vs. the Structure Analysis Model. UML Language: Standards; Elements of the language; General description of various models; The process of Object Oriented software development; Description of Design Patterns; Technological Description of Distributed Systems.

UNIT – II **6 Hours**

Requirements Analysis Using Case Modeling AND The Logical View Design: Analysis of system requirements; Actor definitions; Writing a case goal; Use Case Diagrams; Use Case Relationships. **The Static** Structure Diagrams:The Class Diagram Model; Attributes descriptions; Operations descriptions; Connections descriptions in the Static Model; Association, Generalization, Aggregation, Dependency, Interfacing, Multiplicity.

UNIT – III **6 Hours**

Transfer from Analysis to Design in the Characterization Stage: Interaction Diagrams: Description of goal; Defining UML Method, Operation, Object Interface, Class; Sequence Diagram; Finding objects from Flow of Events; Describing the process of finding objects using a Sequence Diagram; Describing the process of finding objects using a Collaboration Diagram.

UNIT – IV **6 Hours**

Package Diagram Model: Description of the model; White box, black box; Connections between packagers; Interfaces. ; Create Package Diagram; Drill Down.

UNIT – V **6 Hours**

Dynamic Model: State Diagram / Activity Diagram: Description of the State Diagram; Events Handling; Description of the Activity Diagram; Exercise in State Machines.

UNIT – VI **6 Hours**

Component Diagram Model: Physical Aspect; Logical Aspect; Connections and Dependencies; User face; Initial DB design in a UML environment. Deployment Model: Processors; Connections; Components; Tasks; Threads; Signals and Events.

List of Assignments:

Teaching faculty will take assignment on following topic for internal assessment.

1. Study of UML notations
2. Class diagram
3. Interaction diagrams
4. Activity diagram
5. State diagram
6. Software project covering various software development methodology techniques will be implemented.

List of Laboratory Exercises:

1. For Object Oriented Modeling, choose a hypothetical system of significant complexity (on your project topic) and write an SRS.
2. Draw one or more Use Case diagrams for capturing and representing requirements of the system. Use case diagrams must include various scenarios as per template.
3. Draw basic class diagrams to identify and describe key concepts like classes, types in your system and their relationships.
4. Draw sequence diagrams with advanced notation for your system to show objects and their message exchanges.
5. Draw activity diagrams to display either business flows or activity flow.
6. Draw component diagrams assuming that you will build your system reusing existing components along with a few new ones.
7. Draw deployment diagrams to model the runtime architecture of your system.
8. Implement Singleton Pattern, Abstract Factory Pattern and Singleton Pattern using Java.

List of Project Based Learning Topics:

1. Implementation level UML class diagram to illustrate usage of Android Camera API Deployment diagram for Android application deployment.
2. Online shopping UML diagrams
3. Ticket vending machine UML diagrams
4. Bank ATM UML diagrams
5. Hospital management UML diagrams
6. Airport check-in and security screening Use case modeling and Requirement analysis
7. e-Library online public access UML
8. Coffee vending machine UML diagrams.
9. Online order Processing UML diagrams.

Textbooks:

1. Object-Oriented Software Engineering: using UML, Patterns, and Java. Bernd Bruegge and Allen H. Dutoit.
2. The Unified Modelling Language User Guide. Grady Booch, James Rumbaugh, Ivar Jacobson, Pearson Education.

Reference Books:

1. Design Patterns: Elements of Reusable Object-Oriented Software. Erich Gamma, Richard Helm, Ralph Johnson, and John M. Vlissides.

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Introduction to Innovation, IP Management & Entrepreneurship

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 3 Hrs./Week	**Semester Examination: 60 marks**	**Theory: 3 Credits**
Tutorials: 1Hr./Week	**Internal Assessment: 40 marks**	**Tutorial:1 Credit**
		Total : 4 Credits

Course Pre-Requisites:
Good knowledge of Fundamentals of Management.

Course Objective:
The major emphasis of the course will be on creating a learning system through which management students can enhance their innovation and creative thinking skills, acquaint themselves with the special challenges of starting new ventures and use IPR as an effective tool to protect their innovations and intangible assets from exploitation.

Course Outcomes:

1. Learn to be familiar with creative and innovative thinking styles.
2. Learn opportunity reorganization and entrepreneurship skills.
3. Learn to investigate, understand and internalize the process of founding a startup.
4. Understand financial aspects of Entrepreneurship.
5. Learn to manage various types of IPR to protect competitive advantage.
6. Understand the types of IP.

UNIT – I **6 Hours**
Innovation: What and Why?
Innovation as a core business process, Sources of innovation, Knowledge push vs. need pull innovations.
Class Discussion- Is innovation manageable or just a random gambling activity?

UNIT – II **6 Hours**
Building an Innovative Organization
Creating new products and services, exploiting open innovation and collaboration, use of innovation for starting a new venture
Class Discussion- Innovation: Co-operating across networks vs. 'go-it-alone' approach

UNIT – III **6 Hours**
Entrepreneurship:
Opportunity recognition and entry strategies, Entrepreneurship as a Style of Management, Maintaining Competitive Advantage- Use of IPR to protect Innovation

UNIT – IV **6 Hours**
Entrepreneurship- Financial Planning: Financial Projections and Valuation. Stages of financing, Debt, Venture Capital and other forms of Financing

UNIT – V **6 Hours**
Intellectual Property Rights (IPR): Introduction and the economics behind development of IPR: Business Perspective, IPR in India – Genesis and Development, International Context, Concept of IP Management, Use in marketing.

UNIT – VI **6 Hours**
Types of Intellectual Property: Patent- Procedure, Licensing and Assignment, Infringement and Penalty, Trademark- Use in marketing, example of trademarks- Domain name, Geographical Indications- What is GI, Why protect them?, Copyright- What is copyright, Industrial Designs- What is design? How to protect?

Class Discussion- Major Court battles regarding violation of patents between corporate companies.

List of Assignments:

1. Case study materials book will be given to students. Students are required to meet in groups before coming to class and prepare on the case for the day. Instructor may ask the student groups to present their analysis and findings to the class.
2. Further, the topic for class discussion will be mentioned beforehand and students should be ready to discuss these topics (in groups) in class. Students are required to meet in groups before coming to class and prepare on the topic. Few topics are mentioned below as examples. Instructor can add or change any topic as per requirement.
3. Topic 1- Is innovation manageable or just a random gambling activity?
4. Topic 2- Innovation: Co-operating across networks vs. 'go-it-alone' approach.
5. Topic 3- Major Court battles regarding violation of patents between corporate companies.

List of Project Based Learning Topics:

Design case studies for based on any of the following technologies

1. Artificial intelligence
2. Machine Learning
3. Cloud Computing
4. IOT
5. HCI
6. Brain Computer Interface
7. Web Designing
8. Blockchain

Textbooks:

1. Joe Tidd, John Bessant. Managing Innovation: Integrating Technological, Market and Organizational Change
2. Case Study Materials: To be distributed for class discussion

Syllabus for Unit Test:	**Unit**
Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Business Communication & Value Science – IV

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 02 Hr./Week	**Semester Examination: 50 Marks**	**Theory: 02 Credits**
Practical: 04 Hrs./Week	**Internal Assessment: Yes**	**Practical:02 Credit**
	Term work & Oral: 50 Marks	**Total : 4 Credits**

Course Prerequisite: -
Basic Knowledge of English (verbal and written).
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Course Objectives:
Recognize the importance of diversity in workplace, Recognize the best practices of communicative writing, Understand the importance of emotional intelligence in personal and professional lives, Apply emotional intelligence in real life scenarios, Use the best practices of public speaking in real life scenarios, Understand the importance of corporate social responsibility (CSR), Understand the importance of corporate etiquettes, Practice corporate etiquettes in real life scenarios

Course Outcomes: -
Upon completion of the course, students shall have ability to
1. Understand the importance of diversity in workplace
2. Recognize the best practices of communicative writing
3. Apply knowledge of multiple intelligences and learning styles in interpersonal interactions
4. Recognize the attributes needed to function and grow in a corporate environment
5. Identify the best practices to manage stress
6. Understand the importance of corporate social responsibility (CSR)

Unit I Diversity and Inclusion at workplace 4 Hours
Recapitulation activity of Satori. Introduce the concept of Diversity in corporate environments through an activity. Understand the importance of diversity and inclusion at workplace, Diversity and inclusion matter at workplace.

Unit II Communicative Writing: **4 Hours**
Aspects of communicative writing, Application of communicative writing in real life scenarios, Use of charts and graphs in communicative writing, The best practices of communicative writing

Unit III Emotional Intelligence 4 Hours
what is emotional intelligence? Emotional intelligence in personal and professional lives its importance need and application**,** public speaking at workplace, Importance, need and ways, The best practices of public speaking, Apply public speaking in real life scenarios

Unit IV Corporate Social Responsibility (CSR) 4 Hours
Corporate social responsibility (CSR) its importance and need, Stalwarts in CSR, the attributes needed to function and grow in a corporate environment, the best practices to share and receive feedback for CSR

Unit V Intelligences and learning styles in interpersonal interactions: 4 Hours
Application of emotional intelligence in real life scenarios, intelligences and learning styles in interpersonal interactions, the impact of conflicts, Basic guidelines required to manage conflicts.

Unit VI Corporate etiquette, Stress & Time Management: 4 Hours
The key features of corporate etiquette, Application of the business idioms and corporate terms, the impact of stress in life and work, the best practices to manage stress, the importance of time management, the best time management practices

List of Laboratory Exercises:

1) Introduce the concept of Diversity in corporate environments through Role play activity
2) Students will be asked to create a business writing proposal to get funding to begin a start-up of their choice.
3) How to tell a story with charts and graphs: how to visually represent information to tell complete story. Students will be required to use the proposal for the start-up that they created in the previous class for this.
4) Introduce the concept of EI and give them the experience through a game/activity. Discuss the findings that students with higher EQ Ask students to note down the names of at least two movies in their Satori slam book, in which the characters display EI. Ref reading: 10 Ways to Build EI by Daniel Goleman
5) Public speaking – best practices Ask each group (formed earlier) to research and come up with a list of best practices along with examples (in the class)
6) Get, Set, Go – sell your start-up ideas
7) Tell a CSR story Activity - Groups will research in class, prepare and present CSR activity of Tata Steel, Microsoft, Google, TCS, Starbucks, Titan, Tata Chemicals and TOMS Shoes
8) Who am I? (Image Management. Building a perfect image) connect to importance of personal branding to stay relevant
9) Examination Result Activity - Locus of control
10) Applying emotional intelligence
11) Understanding conflicts
12) Corporate etiquette Mock interview rounds for each group with a prospective employer followed by discussions on corporate etiquette (leverage Interview Ready app)
13) Each group will present their posters and the class will come up with a list of stress management tips to be put up on the Fb/Insta page.
14) Managing your time better through activities
15) Business idioms and Corporate Terms Identify the business idioms and corporate terms from given excerpts Download the TCS BizVocab on their Smartphone
16) Create memories and Satori Discussion

Project: (Summative Assessment based on End Semester Project)	Each group to create a POC (Proof of Concept) for their start-up applying their learning's from the CSBS course (core subjects + BCVS). The evaluation for this POC will be done as part of the Sem end assessment by the TCS team. During the assessment, students need to share the journey of creating their start-up: from inception to POC.

List of Project Based Learning Topics:

1. Diversity and inclusion at workplace.
2. Challenges in workplace due to diversity.
3. Importance and Benefits of Inclusion in Workplace.
4. Use of charts and graphs in communicative writing,
5. Best practices of communicative writing
6. Emotional intelligence in personal and professional lives
7. The best practices of public speaking.
8. Public speaking at workplace.
9. Importance and need of Corporate social responsibility (CSR)
10. Best CSR Practices in India.
11. Learning styles in interpersonal interactions.
12. Best Practices of Conflict Management.
13. Effective ways of Stress Management.
14. Time Management Practices

15. Corporate etiquettes and its implications

Reference Books:

1. Emotional Intelligence: Why it Can Matter More Than IQ by Daniel Goleman
2. Putting Emotional Intelligence to Work by Ryback David.
3. How to Develop Self Confidence and Improve Public Speaking - Time - Tested Methods of Persuasion by Dale Carnegie.
4. TED Talks: The official TED guide to public speaking: Tips and tricks for giving unforgettable speeches and presentations
5. Diversity, Inclusion and Engagement 3rd Edition by Mervyn Hyde Lorelei Carpenter, Shelley Dole

Web References:

01. https://www.tata.com/about-us/tata-group-our-heritage
02. https://economictimes.indiatimes.com/tata-success-story-is-based-on-humanity-philanthropy-and-ethics/articleshow/41766592.cms
03. https://youtu.be/reu8rzD6ZAE
04. https://youtu.be/Wx9v_J34Fyo
05. https://youtu.be/F2hc2FLOdhI
06. https://youtu.be/wHGqp8lz36c
07. https://youtu.be/hxS5He3KVEM
08. https://youtu.be/nMPqsjuXDmE

Operations Research

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 2 Hrs./Week	**Semester Examination: 60 marks**	**Theory: 2 Credits**
Lab: 2 Hrs./Week	**Internal Assessment: 40 marks**	**Practical: 1Credit**
	Term Work :25 marks	**Total : 3 Credits**

Course Pre-Requisites:
Good knowledge of mathematics.

Course Objective: The students will be able to understand various models in operations research used in industries to solve problems

Course Outcomes:
As a part of this course, students will:

1. Understand OR problem and associated models.
2. Understand Linear Algebra.
3. Use transportation and assignment problems.
4. Use PERT for modelling.
5. Use Inventory Control System.
6. Apply queuing theory and modulation techniques.

UNIT – I **4 Hours**

Introduction to OR:
Origin of OR and its definition. Concept of optimizing performance measure, Types of OR problems, Deterministic vs. Stochastic optimization, Phases of OR problem approach – problem formulation, building mathematical model, deriving solutions, validating model, controlling and implementing solution.

UNIT – II **4 Hours**

Linear Programming:
Linear programming – Examples from industrial cases, formulation & definitions, Matrix form. Implicit assumptions of LPP.
Some basic concepts and results of linear algebra – Vectors, Matrices, Linear Independence/Dependence of vectors, Rank, Basis, System of linear eqns., Hyperplane, Convex set, Convex polyhedron, Extreme points, Basic feasible solutions.
Geometric method: 2-variable case, Special cases – infeasibility, unboundedness, redundancy &degeneracy, Sensitivity analysis.
Simplex Algorithm – slack, surplus & artificial variables, computational details, big-M method, identification and resolution of special cases through simplex iterations.
Duality – formulation, results, fundamental theorem of duality, dual-simplex and primal-dual algorithms.

UNIT – III **4 Hours**

Transportation and Assignment problems:
TP - Examples, Definitions – decision variables, supply & demand constraints, formulation, Balanced & unbalanced situations, Solution methods – NWCR, minimum cost and VAM, test for optimality (MODI method), degeneracy and its resolution.
AP - Examples, Definitions – decision variables, constraints, formulation, Balanced &unbalanced situations, Solution method – Hungarian, test for optimality (MODI method), degeneracy & its resolution.

UNIT – IV **4 Hours**

PERT – CPM:
Project definition, Project scheduling techniques – Gantt chart, PERT & CPM, Determination of critical paths, Estimation of Project time and its variance in PERT using statistical principles, Concept of project crashing/time-cost trade-off.

UNIT – V **4 Hours**

Inventory Control:

Functions of inventory and its disadvantages, ABC analysis, Concept of inventory costs, Basics of inventory policy (order, lead time, types), Fixed order-quantity models – EOQ, POQ & Quantity discount models. EOQ models for discrete units, sensitivity analysis and Robustness, Special cases of EOQ models for safety stock with known/unknown stock out situations, models under prescribed policy, Probabilistic situations.

UNIT – VI **4Hours**

Queuing Theory:

Definitions – queue (waiting line), waiting costs, characteristics (arrival, queue, service discipline) of queuing system, queue types (channel vs. phase).

Kendall's notation, Little's law, steady state behavior, Poisson's Process & queue, Models with examples - M/M/1 and its performance measures; M/M/m and its performance measures; brief description about some special models.

Simulation Methodology:

Definition and steps of simulation, random number, random number generator, Discrete Event System Simulation – clock, event list, Application in Scheduling, Queuing systems and Inventory systems.

List of Assignments:

Respective subject teacher shall design any six assignments on above units.

List of Laboratory Exercises:

1. Formulation of linear programming problems.
2. Solution of linear programming problem using graphical method with:
   i. Multiple constraints
   ii. Unbounded solution
   iii. Infeasible solution
   iv. Alternative or multiple solution
3. Enumeration of all basic solutions for linear programming problem.
4. Solution of linear programming problem with simplex method.
5. Problem solving using Big M method.
6. Problem solving using two phase method.
7. Solution on primal problem as well as dual problem.
8. Solution based on dual simplex method.
9. Verification of weak duality, strong duality and complementary slackness property.
10. Solution of transportation problem.
11. Solution of assignment problem.
12. Solution of integer programming problem using Branch and Bound method.
13. Solution of integer programming problem using Gomory's cutting plane method.
14. Simulation: Random number generation.
15. Monte Carlo method.
16. Performance measures for M/M/1 queuing model.
17. ABC analysis.
18. Inventory model.

List of Project Based Learning Topics:

1. Students must work on one of the projects listed below (but not limited to) during the semester
2. Find the companies that used OR as a tool to sort a problem successfully and unsuccessfully. Compare them and analyze as to why certain strategies worked and others failed.
3. Visit any industry and choose one of their products. Develop a LPP for maximizing profits on the sale of that product considering the various constraints on it. Solve the LPP and make suggestions of the same for the company.
4. Develop a software that helps in making timetable for the department by making and solving an LPP.
5. Visit a small departmental store/hotel, collect data, and make an LPP for optimum use of space. Solve the LPP and make relevant suggestions

6. Write a research paper on how LPP helps companies to solve problems referencing latest papers.
7. Write a research paper on how assignment tools help companies to solve problems referencing latest papers.
8. Write a research paper on how transportation tools help companies to solve problems referencing latest papers.
9. Visit a small-scale industry. Collect data and make WBS and a network diagram. Solve it by CPS and PERT methods ad make relevant suggestions
10. Write a research paper on how network analysis tools help companies to solve problems referencing latest papers.
11. Write a research paper on how queuing models help companies to solve problems referencing latest papers.
12. Go to a nearby petrol pump, bank, departmental store, hotel. Record the arrival and service rates for multiple day. Analyze the data and make relevant suggestions
13. Write a research paper on how inventory models help companies to solve problems referencing latest papers.
14. Go to a nearby petrol pump, departmental store, hotel. Record inventory levels and inventory practices for multiple day. Analyze the data and make relevant suggestions

Textbooks:

1. Operations Research: An Introduction. H.A. Taha.

Reference Books:

1. Linear Programming. K.G. Murthy.
2. Linear Programming. G. Hadley.
3. Principles of OR with Application to Managerial Decisions. H.M. Wagner.
4. Introduction to Operations Research. F.S. Hiller and G.J. Lieberman.
5. Elements of Queuing Theory. Thomas L. Saaty.
6. Operations Research and Management Science, Handbook: Edited By A. Ravi Ravindran.
7. Management Guide to PERT/CPM. Wiest& Levy.
8. Modern Inventory Management. J.W. Prichard and R.H. Eagle.

Syllabus for Unit Test:	**Unit**
Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI