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 THE UNIVERSITY:

Social Transformation Through Dynamic Education.

MISSION OF THE 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

Program 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.

Program 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	2credit

STRUCTURE OF UNDERGRADUATE ENGINEERING PROGRAMME

Sr. No.	Category	Breakup of Credits
1	Basic Science Course (BSC)	63
2	Engineering Science Course (ESC)	08
3	Core Course (CC)	90
4	Elective Course (EC)	23
5	Project (PROJ)	09
6	Internship (INT)	03
7	Vocational Course (VC)	04
8	Massive Open Online Course (MOOC)	04 (Add-on course)
9	Research Paper Publication (Research)	02 (Add-on course)
10	Social Activities (SA)	04 (Add-on course)
11	Mandatory Courses (MC)	Non-Credit
TOTAL		200

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)	02
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	01
12.	Internal Assessment (IA)	--
13.	End Semester Examination (ESE)	--
TOTAL		62

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	ESE	IA	TW	OR	PR	Total	L	P	T	Total
1		Discrete Mathematics	3	2	-	60	40	25	25	-	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	4	2	-	60	40	25	-	25	150	4	1	-	5
5		Physics for computing science	3	2	-	60	40	25	-	-	125	3	1	-	4
6		Business Communication & Value Science - I	3	2	-	50	-	25	25	-	100	3	1	-	4
	Total		**19**	**10**	**1**	**350**	**200**	**125**	**50**	**25**	**750**	**19**	**5**	**1**	**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	ESE	IA	TW	OR	PR	Total	L	P	T	Total
1		Linear Algebra	3	0	1	60	40	-	-	-	100	3	-	1	4
2		Statistical Methods	3	2	-	60	40	25	-	-	125	3	1	-	4
3		Data Structures and Algorithms	4	2	-	60	40	50	-	50	200	4	1	-	5
4		Fundamentals of Economics	3	0	-	60	40	-	-	-	100	3	-	-	3
5		Principles of Electronics Engineering	3	2	-	60	40	25	-	-	125	3	1	-	4
6		Business Communication & Value Science - II	3	4	-	50	-	25	25	-	100	3	2	-	5
	Total		**19**	**10**	**1**	**350**	**200**	**125**	**25**	**50**	**750**	**19**	**5**	**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	ESE	IA	TW	OR	PR	Total	L	P	T	Total
1		Formal Language and Automata Theory	3	-	1	60	40	25	-	-	125	3	-	1	4
2		Computer Organization & Architecture	3	-	1	60	40	25	-	-	125	3	-	1	4
3		Object Oriented Programming	3	2	-	60	40	25	-	25	150	3	1	-	4
4		Computational Statistics	3	2	-	60	40	25	-	25	150	3	1	-	4
5		Software Engineering*	3	2	-	60	40	25	25	-	150	3	1	-	4
6		Business Communication & Value Science – III	2	2	1	50	-	25	25	-	100	2	1	1	4
7		Vocational Course- I	-	2	-	-	-	25	25	-	50	-	1	-	1
	Total		**17**	**10**	**3**	**350**	**200**	**175**	**75**	**50**	**850**	**17**	**5**	**3**	**25**
		Social Activity - I	-	-	-	-	-	-	-	-	-	-	-	-	2

***Industry Taught Course-I**

List of Vocational Courses will be published by the department before the commencement of respective semester.

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	ESE	IA	TW	OR	PR	Total	L	P	T	Total
1		Operating Systems	4	2	-	60	40	25	-	50	175	4	1	-	5
2		Database Management Systems	4	2	-	60	40	25	-	25	150	4	1	-	5
3		Software Design with UML*	3	2	-	60	40	25	-	25	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	2	-	50	-	25	25	-	100	2	1	-	3
6		Operations Research	2	2	-	60	40	25	-	-	125	2	1	-	3
7		Vocational Course-II	-	2	-	-	-	25	25	-	50	-	1	-	1
	Total		**18**	**12**	**1**	**350**	**200**	**150**	**50**	**100**	**850**	**18**	**6**	**1**	**25**
		MOOC - I#	-	-	-	-	-	-	-	-	-	-	-	-	2

*** Industry Taught Course – II**

 # Add-on Course - List of MOOC and Vocational Courses will be published by the department before the commencement of respective semester.

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	ESE	IA	TW	OR	PR	Total	L	P	T	Total
1		Design and Analysis of Algorithms	4	2	-	60	40	25	-	25	150	4	1	-	**5**
2		Compiler Design	3	2	-	60	40	25	25	-	150	3	1	-	**4**
3		Fundamentals of Management	3	-	-	60	40	-	-	-	100	3	-	-	**3**
4		Business Strategy	3	-	-	60	40	-	-	-	100	3	-	-	**3**
5		Design Thinking*	4	2	-	60	40	25	25	-	150	4	1	-	**5**
6		Elective-I	3	2	-	60	40	25	25	-	150	3	1	-	**4**
7		Vocational Course-III	-	2	-	-	-	25	25	-	50	-	1	-	1
	Total		**20**	**10**	**0**	**360**	**240**	**125**	**100**	**25**	**850**	**20**	**5**	**0**	**25**
	Social Activity-II		-	-	-	-	-	-	-	-	-	-	-	-	2
	Environmental Studies**		2	-	-	50	-	-	-	-	-	-	-	-	-

*** Industry Taught Course – III**

**** Mandatory Audit Course - 50 Marks Theory Examination**

 # Add-on Course - List of Vocational Courses will be published by the department before the commencement of respective semester.

Elective - I	Machine Learning	Conversational Systems	Cloud, Micro services and Application

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	ESE	IA	TW	OR	PR	Total	L	P	T	Total
1		Computer Networks	4	2	-	60	40	25	-	25	150	4	1	-	**5**
2		Information Security	3	2	-	60	40	25	-	25	150	3	1	-	**4**
3		Artificial Intelligence*****	3	2	-	60	40	25	25	-	150	3	1	-	**4**
4		Quantitative Techniques Communication and Values	4	-	-	60	40	-	-	-	100	4	-	-	**4**
5		Financial & Cost Accounting	3	-	-	60	40	-	-	-	100	3	-	-	**3**
6		Elective- II	3	2	-	60	40	25	25	-	150	3	1	-	**4**
7		Vocational Course-IV	-	2	-	-	-	25	25	-	50	-	1	-	1
	Total		**20**	**10**	**0**	**360**	**240**	**125**	**75**	**50**	**850**	**20**	**5**	**0**	**25**
	MOOC - II #		-	-	-	-	-	-	-	-	-	-	-	-	2

*** Industry Taught Course – IV**

 # Add-on Course - List of MOOC and Vocational Courses will be published by the department before the commencement of respective semester.

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

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	ESE	IA	TW	OR	PR	Total	L	P	T	Total
1.		Usability Design of Software Applications	3	2	-	60	40	25	25	-	150	3	1	-	4
2.		IT Workshop*	2	2	-	60	40	25	-	25	150	2	1	-	3
3.		Financial Management	2	-	-	60	40	-	-	-	100	2	-	-	2
4.		Human Resource Management	2	-	-	60	40	-	-	-	100	2	-	-	2
5.		Elective- III	4	-	-	60	40	-	-	-	100	4	-	-	4
6.		Elective- IV	4	-	-	60	40	-	-	-	100	4	-	-	4
7.		Project Stage- I	-	2	-	-	-	50	50	-	100	-	2	-	3
8.		Internship	-	-	-	-	-	25	25	-	50	-	-	-	3
	Total		**17**	**6**	**0**	**360**	**240**	**125**	**100**	**25**	**850**	**17**	**4**	**0**	**25**

*** 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	ESE	IA	TW	OR	PR	Total	L	P	T	Total
1.		Services Science & Service Operational Management	3	-	-	60	40	-	-	-	100	3	-	-	3
2.		IT Project Management*****	3	2	-	60	40	25	25	-	150	3	1	-	4
3.		Marketing Research & Marketing Management	3	-	1	60	40	-	-	-	100	3	-	1	4
4.		Elective-V	3	-	-	60	40	-	-	-	100	3	-	-	3
5.		Elective-VI	3	2	-	60	40	25	-	25	150	3	1	-	4
6.		Seminar	-	2	-	-	-	-	50	-	50	-	1	-	1
7.		Project Stage-II	-	4	-	-	-	100	100	-	200	-	4	-	6
	Total		**15**	**10**	**1**	**300**	**200**	**150**	**175**	**25**	**850**	**15**	**7**	**1**	**25**
		Research Paper Publication[#]	-	-	-	-	-	-	-	-	-	-	-	-	2

*** Industry Taught Course –VI**

[#] Add-on Course

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

B.TECH (Computer Science & Business Systems)

SEMESTER – I

COURSE SYLLABUS

Discrete Mathematics

TEACHING SCHEME		EXAMINATION SCHEME		CREDITS ALLOTTED	
Theory	**:3 Hours/Week**	**End Semester Examination**	**:60 Marks**	**Theory**	**:3 Credits**
Lab	**:2 Hours/Week**	**Internal Assessment**	**:40 Marks**	**Practical**	**:1Credit**
		Term work **Oral**	**:25 Marks** **:25 Marks**	**Total**	**:4 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 **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.	**06 Hours**
Unit II **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.	**06 Hours**
Unit III **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.	**06 Hours**
Unit IV **Algebraic Structures:** Isomorphism and Homomorphism. Algebraic Structures with Binary Operations, rings, Cyclic groups, codes.	**06 Hours**
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 **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.	**06 Hours**
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. Liu McGraw 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**
		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, analyze 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 Bayes' theorem
14. Find the Moment generating function of given function.
15. Use probability theory to estimate the life of electric equipment
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. Graybill and 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 :3 Hours / Week	**End Semester Examination**	**:60 Marks**	**Theory**	**:3 Credits**
Lab :2 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 Kirchhoff'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 Kirchhoff'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, (Second Edition), 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 :4Hrs/Week	**Semester Examination :60 marks**	**Theory :4 Credits**
Lab :2 Hrs/Week	**Internal Assessment :40 marks**	**Practical :1 Credit**
	Term work :25 Marks	**Total :5 Credits**
	Practical :25 Marks	

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.

.

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 Arrays 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**
Lab :2 Hrs/Week	**Internal Assessment :40 marks**	**Practical :1 Credit**
	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 auto switch/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 colors

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, 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 Hrs./Week	**Semester Examination :50 marks**	**Theory :3 Credits**
Lab :2 Hrs./Week	**Internal Assessment : Yes**	**Practical :1 Credit**
	Term work :25 Marks	**Total :4 Credits**
	Oral :25 Marks	

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 be 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, Pushp Lata, 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, Meera Banerji 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 decomposition
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 Vidyarthi Griha Prakashan, 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**
Lab :2 Hrs/week	**Internal Assessment :40 marks**	**Practical :1 Credit**
	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 :4 Hrs./ Week	**Semester Examination :60 Marks**	**Theory :4 Credits**
Lab :2 Hrs./ Week	**Internal Assessment :40 Marks**	**Practical :1 Credits**
	Term work :50Marks	**Total :5 Credits**
	Practical :50 Marks	

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**
	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**
Lab :2 Hrs/ Week	**Internal Assessment :40 marks**	**Practical :1 Credit**
	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 selfbias, 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 De Morgan,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 :3 Hrs/Week	**Semester Examination :50 Marks**	**Theory :3 Credits**
Lab :4 Hrs/ Week	**Internal Assessment :Yes**	**Practical :2 Credits**
	Term work :25 Marks	**Total :5 Credits**
	Oral :25 marks	

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 major 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**
	Term Work :25 Marks	**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 :3 Hours / Week	**End Semester Examination**	**:60 Marks**	**Theory :3 Credits**
Tutorial :1 Hours / Week	**Internal Assessment**	**:40 Marks**	**Tutorial :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 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**
Lab :2Hrs/Week	**Internal Assessment**	**:40 Marks**	**Practical :1 Credit**
	Term work	**:25 Marks**	
	Practical	**:25 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, BjarneStroustrup.
2. C++ and Object-Oriented Programming Paradigm, Debasish Jana

Reference Books:

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

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 :3 Hours / Week	**End Semester Examination**	**:60 Marks**	**Theory :3 Credits**
Lab :2 Hours / Week	**Internal Assessment**	**:40 Marks**	
	Term work	**:25 Marks**	**Practical :1 Credits**
	Practical	**:25 Marks**	**Total :4 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: GroupBy 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 principal 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 :3 Hrs./Week	**Semester Examination :60 Marks**	**Theory :3 Credits**
Lab :2Hrs./Week	**Internal Assessment :40 Marks**	**Practical :1 Credit**
	Term work :25 Marks	**Total :4 Credits**
	Oral :25 Marks	

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.

List of 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**
Tutorial :1 Hr./Week		**Tutorial :1 Credit**
	Term work :25 Marks	**Practical :1 Credit**
Lab :2 Hrs./Week	**Oral :25 Marks**	**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 ofIndia
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 DananjayaHettiarachchi: 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, Meera Banerji 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 :4Hrs./Week	**Semester Examination :60 Marks**	**Theory :4 Credits**
Lab :2Hrs./Week	**Internal Assessment :40 Marks**	**Practical :1 Credit**
	Term Work :25 Marks	**Total :5 Credits**
	Practical :50 Marks	

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**
Lab :2 Hrs./Week	**Internal Assessment :40 marks**	**Practical :1 credit**
	Term work :25 Marks	**Total :5 Credits**
	Practical :25 Marks	

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 relation 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 multiple ways.
5. Design and develop a library management system. The relations in the system should be normalized up to 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**
Lab :2Hrs./Week	**Internal Assessment :40 Marks**	**Practical :1 Credit**
	Term work :25 Marks	**Total :4 Credits**
	Practical :25 Marks	

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 Modelling Language (UML) for representation of an object-oriented system using different modelling 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 Modelling, 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 :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:
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 :2 Hr./Week	**Semester Examination :50 Marks**	**Theory :2 Credits**
Lab :2 Hrs./Week	**Term work :25 Marks** **Oral :25 Marks**	**Practical :1 Credits** **Total :3 Credits**

Course Prerequisite: -
Basic Knowledge of English (verbal and written).
.

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 :1 Credit**
	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 **4Hours**

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

B.TECH (Computer Science & Business Systems)

SEMESTER – V

COURSE SYLLABUS

DESIGN AND ANALYSIS OF ALGORITHMS

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

Course Pre Requisites: Students should be well versed with algorithms and operations on basic data structures stacks, queues, linked lists, trees, graphs. Students should have knowledge of searching sorting algorithms.

Course Objective: Understand and compare important algorithmic design paradigms and methods of analysis. To choose and extend efficient algorithms required for designs.

Course Outcomes:

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

1. Interpret the performance of algorithms using analysis techniques.
2. Examine the fundamental algorithmic strategies.
3. Compare the fundamental algorithmic strategies.
4. Implement Graphs and trees algorithms.
5. Interpret the tractable or intractable problem.
6. Summarize the advance types of algorithms.

UNIT – I **8 Hours**

Introduction: Characteristics of Algorithm. Analysis of Algorithm: Asymptotic analysis of Complexity Bounds – Best, Average and Worst-Case behaviour, Performance Measurements of Algorithm, Time and Space Trade-Offs, Analysis of Recursive Algorithms through Recurrence Relations: Substitution Method, Recursion Tree Method and Masters' Theorem.

UNIT – II **8 Hours**

Fundamental Algorithmic Strategies: Brute-Force technique, Heuristics, Greedy algorithms, , Illustrations of these techniques for Problem-Solving

UNIT – III **8 Hours**

Fundamental Algorithmic Strategies : Dynamic Programming, Branch and Bound algorithms, Backtracking methodologies; Illustrations of these techniques for Problem-Solving

UNIT – IV **8 Hours**

Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.

UNIT – V **8 Hours**

Tractable and Intractable Problems: Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques.

UNIT – VI **8 Hours**

Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE, Introduction to Quantum Algorithms.

Text Books:

1. Fundamental of Computer Algorithms, E. Horowitz and S. Sahni, Orient Black Swan
2. Introduction to Algorithms, T. H. Cormen, C. E. Leiserson and R. L. Rivest, PHI Learning Pvt. Ltd. (Originally MIT Press)

Reference Books:

1. The Design and Analysis of Computer Algorithms, A. Aho, J. Hopcroft and J. Ullman, Pearson Education India
2. Computer Algorithms: Introduction to Design and Analysis, S. Baase, Pearson Education India
3. The Art of Computer Programming, Vol. 1, Vol. 2 and Vol. 3, .D. E. Knuth, Addison Wesley
    1. ElitzHorowith and SartajSahani, S. Rajasekaran, "Fundamentals of Computer Algorithms", Galgotia Publications.

List of Laboratory Exercises:

1. Calculate the space complexity of various algorithms.
2. Implement Knapsack Algorithm.
3. Implement Prim's Algorithm
4. Implement Kruskal's Algorithms
5. Study and analysis of 8-Queens Problem.
6. Implement Optimal Binary Search Tree.

Project Based Learning

1. Design a Sudoku using Recursion
2. Design a Phonebook
3. Simulate 15 Puzzle Problem
4. Design Tic Tac Toe
5. Travelling Salesman Problem
6. Design a board for simulating N-Queen Problem
7. Implement Multistage Graphs
8. Prime Number Generator
9. Random Number Generator
10. Devise and algorithm for large sparse matrix multiplication

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

COMPILER DESIGN

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

Course Pre-Requisites:

1. The students should have learnt Theory of Computation.
2. Basic of the structure of any Programming Language and Grammars.
3. Know the basics of Computer organization and Assembly Language Programming.

Course Objective:

1. To study the Compiler Design Tools.
2. To understand the Compiler for various Programming Languages.

Course Outcomes:

1. Understands compiler and various phases in compilation.
2. Understand Parser and its various techniques.
3. Understands Syntax Directed Translation, Symbol Tables and their applications.
4. Learn the techniques of Code Optimization.
5. Learn the techniques of Code improvement.
6. Understands compilation of Object-Oriented features.

UNIT – I **6 Hours**

Introduction: Phases of compilation and overview. Lexical Analysis (scanner): Regular languages, finite automata, regular expressions, relating regular expressions and finite automata, scanner generator (lex, flex).

UNIT – II **6 Hours**

Syntax Analysis (Top-down Parser): Context-free languages and grammars, push-down automata, Elimination of Left recursion, Elimination of Left factoring, Top down parsing, FIRST and FOLLOW, Non-Recursive Predictive Parsing, LL (1) grammars.

UNIT – III **6 Hours**

Syntax Analysis (Bottom Up Parser): Operator grammars, Bottom-up parsing, Shift Reduce Parser, LR(O), SLR (1), LR(1), CLR,LALR(1) grammars, ambiguity and LR parsing, LALR(1) parser generator (yacc, bison)

UNIT – IV **6 Hours**

Semantic Analysis: Attribute grammars, syntax directed definition, evaluation, and flow of attribute in a syntax tree.

Symbol Table: Basic structure, symbol attributes and management. Run-time environment: Procedure activation, parameter passing, value return, memory allocation, scope.

UNIT – V **6 Hours**

Intermediate Code Generation: Translation of different language features, different types of intermediate forms

Code Improvement (optimization): Control-flow, data-flow dependence etc.; local optimization, global optimization, loop optimization, peep-hole optimization etc.

UNIT – VI **6 Hours**

Architecture dependent code improvement: Instruction scheduling (for pipeline), loop optimization (for cache memory) etc. Register allocation and target code generation.

Advanced topics: Type systems, data abstraction, compilation of Object-Oriented features and non-imperative programming languages.

Textbooks:

1. Compilers: Principles, Techniques and Tools, V. Aho, R. Sethi and J. Ullman.
2. Lex & Yacc, Levine R. John, Tony Mason and Doug Brown

Reference Books:

The Design and Evolution of C++, Bjarne Stroustrup.

List of Laboratory Exercises:

Subject teacher would give suitable list of experiments.

Topics for Project Based Learning

1. Design a lexical analyzer for given language and the lexical analyzer should ignore redundant spaces, tabs and new lines. It should also ignore comments. Although the syntax specification states

that identifiers can be arbitrarily long, you may restrict the length to some reasonable value. Simulate the same in C language.

2. Design an application to recognize strings under 'a*', 'a*b+', 'abb'.
3. Develop an application to test whether a given identifier is valid or not.
4. Develop an application to simulate lexical analyzer for validating operators.
5. Implement the lexical analyzer using JLex, flex or other lexical analyzer generating tools.
6. Translation of different language features
7. Implement operator precedence parsing.

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

FUNDAMENTALS OF MANAGEMENT

TEACHING SCHEME	EXAMINATION SCHEME	CREDITS ALLOTTED
Lectures :3 Hrs./Week	**Semester Examination :60 marks**	**Theory :3 Credits**
Lab :0 Hrs./Week	**Internal Assessment :40 marks**	**Practical/Oral :0 Credit**
	Term Work :00 Marks	**Total :3 Credits**

Course Pre Requisites: Preliminary awareness about the functioning of any organization

Course Objective:

1. To impart knowledge about various management and organization principles which governs the functioning of a firm/organization
2. To explain about concepts of leadership, organizational design, organization behavior and managerial ethics.

Course Outcomes: After completion of course, students should be able to

1. Understand the evolution of management
2. Explain intricacies of different functions of management.
3. Categorize behaviour of individuals in an organization
4. Distinguish between approaches to organizational design.
5. Analyze importance and types of work ethics
6. Identify importance and traits of leadership

UNIT – I **6 Hours**

Management Theories: Concept and Foundations of Management, Evolution of Management Thoughts [Pre-Scientific Management Era (before 1880), Classical management Era (1880- 1930), Neo-classical Management Era (1930-1950), Modern Management era (1950-on word). Contribution of Management Thinkers: Taylor, Fayol, Elton Mayo etc.

UNIT – II **6 Hours**

Functions of Management- Planning, Organizing, Staffing, Directing, Controlling

UNIT – III **6 Hours**

Organization Behavior: Introduction, Personality, Perception, Learning and Reinforcement, Motivation, Group Dynamics, Power & Influence, Work Stress and Stress Management, Decision Making, Problems in Decision Making, Decision Making, Organizational Culture, Managing Cultural Diversity.

UNIT – IV **6 Hours**

Organizational Design: Classical, Neoclassical and Contingency approaches to organizational design; Organizational theory and design, Organizational structure (Simple Structure, Functional Structure, Divisional Structure, Matrix Structure)

UNIT – V **6 Hours**

Managerial Ethics: Ethics and Business, Ethics of Marketing & advertising, Ethics of Finance & Accounting, Decision – making frameworks, Business and Social Responsibility, InternationalStandards, Corporate Governance, Corporate Citizenship, Corporate Social Responsibility

UNIT – VI **6 Hours**

Leadership: Concept, Nature, Importance, Attributes of a leader, developing leaders across the organization, Leadership Grid.

List of Project Based Learning:

1. Do a case study with referring any company or enterprise and discuss how the evaluation of management has been occurred from the establishment period of that firm and what outcomes that enterprise has been received after applying and changing management strategies effectively?
2. Make a short model based on the functions of the management.
3. Choose any MNCs and find out what are the organizational behavior factors applied in that firm which make an influence and enhance the productivity of the workforce do the short research on it.
4. Make a model on the types of Organizational Theories and Organizational Cultures? Find a company or an organization and analyze which theory or culture has been followed in it, discuss in detail
5. Define the concept of managerial ethics with studying any company' ethics model and how do that ethics play significant role in the work productivity of the company?
6. Prepare the short model on the different leadership styles.

Text Books: Richard L. Daft, *Understanding the Theory and Design of Organizations*

Reference Books:

1. Stephen P. Robbins, Timothy A. Judge, Neharika Vohra, *Organizational Behavior*
2. Other relevant articles or books could be sent later to the students.

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

BUSINESS STRATEGY

TEACHING SCHEME	EXAMINATION SCHEME	CREDITS ALLOTTED
Lectures :3 Hrs./Week	Semester Examination :60 marks	Theory :3 Credits
Lab :0 Hrs./Week	Internal Assessment :40 marks	Practical/Oral :0 Credit
	Term Work :00 Marks	Total :3 Credits

Course Pre Requisites: Introductory awareness of Business terminologies and functions

Course Objective: Familiarize the fundamental principles and practices of business development

Course Outcomes:

This course will help students,

1. To summarize the important concepts of strategic management
2. To identify the process and capabilities for internal environment of a firm.
3. To understand the strategies applicable for external environments of firm
4. To examine corporate strategies
5. To compare the various business growth strategies
6. To understand the process of strategy implementation

UNIT – I **6 Hours**

Introduction to Strategic Management: Importance of Strategic Management**,** Vision and Objectives**,** Schools of thought in Strategic Management**,** Strategy Content, Process, and Practice**,** Fit Concept and Configuration Perspective in Strategic Management

UNIT – II **6 Hours**

Internal Environment of Firm- Recognizing a Firm's Intellectual Assets: Core Competence as the Root of Competitive Advantage**,** Sources of Sustained Competitive Advantage**,** Business Processes and Capabilities-based Approach to Strategy

UNIT – III **6 Hours**

External Environments of Firm- Competitive Strategy: Five Forces of Industry Attractiveness that Shape Strategy**,** The concept of Strategic Groups, and Industry Life Cycle**,** Generic Strategies**,** Generic Strategies and the Value Chain

UNIT – IV **6 Hours**

Corporate Strategy: The Motive for Diversification**,** Related and Unrelated Diversification**,** Business Portfolio Analysis

UNIT – V **6 Hours**

Growth Strategies: Expansion, Integration and Diversification**,** Strategic Alliances, Joint Ventures, and Mergers & Acquisitions

UNIT – VI **6 Hours**

Strategy Implementation: Structure and Systems: The 7S Framework**,** Strategic Control and Corporate Governance

Project Based Learning:

1. Choose an organization and do analysis of Vision Mission and Objectives
2. Case study of an organization through the lens of ten school of thoughts
3. Select an organization and do analysis of it from the perspective of fit concepts and configuration
4. Study a research paper related to core competencies and build your opinion related to taking advantage of core competencies
5. Analyse the process of Business Processes and Capabilities-based Approach to Strategy
6. Case study on Porter's Five forces
7. Do generic study of different strategies and prepare a research paper on them
8. Do a case study on motives of diversifications
9. Choose an organization and prepare a business portfolio
10. Make an analysis of different expansion strategy and prepare a research paper on it.

Text Books:

1. Robert M. Grant (2012). Contemporary Strategic Management, Blackwell, 7th Edition.

Reference Books:

1. M.E. Porter, Competitive Strategy, 1980. M.E. Porter,
2. Competitive Advantage, 1985 Richard Rumelt (2011).
3. Good Strategy Bad Strategy: The Difference and Why It Matters.

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

DESIGN THINKING

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

Course Pre Requisites: Students should be well versed Completion of all units fromSemesters 1, 2, 3 and 4

Course Objective:

1. Recognize the importance of DT
2. Explain the phases in the DT process
3. List the steps required to complete each phase in DT process
4. Apply each phase in the DT process
5. Use doodling and storytelling in presenting ideas and prototypes
6. Create value proposition statements as part of their presentations
7. Recognize how DT can help in functional work
8. Recognize how Agile and DT complement each other to deliver customer satisfaction

Course Outcomes:

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

1. Implement the Phases in the DT process
2. Identify the steps required to conduct an immersion activity
3. Design personas to create problem statements in the define phase of DT
4. Apply the steps in the ideate phase of DT
5. Design a prototype to create a value proposition statement
6. Test a prototype created through a DT process

UNIT – I **8 Hours**

Introduction: Recognize the importance of Design Thinking why is Design Thinkingimportant for business?, Why is Design Thinking important for you? , Identify the steps in the DT process What is DT? Empathize (search for rich stories and find some love), Define (user need and insights – their POV), Ideate (ideas, ideas, ideas), Prototype (build to learn), Test (show, don't tell)

UNIT – II **8 Hours**

Empathy Phase: Recognize the steps in the empathize phase of DT, What is empathy? Ask What? How? Why?, Different types to developing Empathy towards People Identify the steps

required to conduct an immersion activity, How to empathize?, Intro to Immersion Activity, Conduct an immersion activity and fill up the DT question template, Immersion activity

UNIT – III **8 Hours**

Define Phase: Creating personas: Recognize the steps to create personas in the definephase of DT, What is a persona and how do I create one? Four Different Perspectives on Personas 1)Goal-directed Personas 2)Role-Based Personas 3) Engaging Personas
4) Fictional Personas, 10 steps to Creating Your Engaging Personas and Scenarios Recognize the steps to create problem statements in the define phase of DT, Problem statements, Defining problem statements, Define the problem statements in the define phase of DT

UNIT – IV **8 Hours**

Ideate Phase: How to Ideate?, Recognize the steps in the ideate phase of DT, Apply the steps in the ideate phase of DT, Ideation games: Game 1: Six Thinking Hats, Game 2: Million-dollar idea, Ideate to find solutions, Characteristics Required for Successful Ideation, Recognize how doodling can help to express ideas, Recognize the importance storytelling in presenting ideas and prototypes, What is Storytelling in DT?

UNIT – V **8 Hours**

Prototype phase: Recognize the importance of the prototype phase in DT, Prototype your idea, Create a prototype: Types of Prototyping 1)Low-Fidelity Prototyping 2) High-Fidelity Prototyping , Guidelines for Prototyping, Recognize the importance of service value proposition, Create a value proposition statement

UNIT – VI **8 Hours**

Testing Phase: Testing in Design Thinking, Test the Prototype, Role of DT in your work, discuss How DT can help me to become a better coder?, Agile and DT complement each other to deliver customer satisfaction, Share your Satori.

Text Books:

There are no prescribed texts for Semester 5 – there will be handouts and referencelinks shared.

Reference Books:

Hooked by Nir Eyal

The Art of Creative Thinking by Rod JudkinsStart

Up nation by Dan Senor and Saul singerStart with

Why by Simon Sinek

List of Laboratory Exercises

1. Foundations of DT, Course outline, Group roles
2. Intro and Problem Definition of project (phase 1 – Hear)
3. Idea Generation of project (phase 2 - Create)
4. Concept Development and Design project (phase 3 - Create)
5. Project Teams meet to discuss and continue to prepare their work
6. Testing and Project Documentation on project (phase 4 - Deliver)
7. Final group project presentation

List of Project Based Learning

1. Case study on Airbnb
2. Case study on Pill pack
3. Case study on Clean Team
4. Case study on IBM
5. Case study on Stanford hospital
6. Case study on Uber eats
7. Case study on Bank of America

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

ELECTIVE -I A . MACHINE LEARNING

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

Course Pre-Requisites: Basic concepts of statistics, Knowledge of fundamentals of AI.

Course Objective:

1. To simulate decision making and thinking in machine.
2. To understand standard Machine Learning practices.
3. To apply algorithms for precise result.

Course Outcomes: Students will be able to

1. Learn relationship between human and machine.
2. Implement basic classification algorithms
3. Implement enhanced classification algorithms
4. Implement HMM in detail
5. Apply concepts of regression for various application
6. Apply expectation maximization techniques for optimization.

UNIT – I **6 Hours**

Introduction to Machine Learning (ML): Relationship between ML and human learning; A quicksurvey of major models of how machines learn; Example applications of ML

UNIT – II **6 Hours**

Classification: Supervised Learning; The problem of classification; Feature engineering; Training and testing classifier models; Cross-validation; Model evaluation (precision, recall, F1- measure, accuracy, area under curve); Statistical decision theory including discriminant functions and decision surfaces.

UNIT – III **6 Hours**

Naive Bayes classification; Bayesian networks; Decision Tree and Random Forests; k-Nearest neighbor classification; Support Vector Machines; Artificial neural networks including backpropagation; Applications of classifications; Ensembles of classifiers including bagging and boosting.

UNIT – IV **6 Hours**

Hidden Markov Models (HMM) with forward-backward and Vierbi algorithms; Sequence classification using HMM; Conditional random fields; Applications of sequence classification such as part-of-speech tagging.

UNIT – V **6 Hours**

Regression: Multi-variable regression; Model evaluation; Least squares regression; Regularization; LASSO; Applications of regression Association rule mining algorithms including apriori.

UNIT – VI **6 Hours**

Expectation-Maximization (EM) algorithm for unsupervised learning Clustering: average linkage; Ward's algorithm; Minimum spanning tree clustering; K-nearest neighbors clustering; BIRCH; CURE; DBSCAN Anomaly and outlier detection methods.

Text Books:

1. [1] R.O. Duda, P.E. Hart, D.G. Stork, **Pattern Classification**, 2/e, Wiley, 2001.

Reference Books:

1. C. Bishop, Pattern Recognition and Machine Learning, Springer, 2007.
2. E. Alpaydin, Introduction to Machine Learning, 3/e, Prentice-Hall, 2014.
3. A. Rostamizadeh, A. Talwalkar, M. Mohri, Foundations of Machine Learning, MIT Press.
4. A. Webb, Statistical Pattern Recognition, 3/e, Wiley, 2011.

List of Laboratory Exercises:

1. Predict the price of the Uber ride from a given pickup point to the agreed drop-off location. Perform tasks such as: Pre-process the dataset, identify outliers, check the correlation, implement linear regression and random forest regression models, evaluate the models and compare their respective scores like R2, RMSE, etc. Dataset link: https://www.kaggle.com/datasets/yasserh/uber-fares-dataset
2. Classify the email using the binary classification method. Email Spam detection has two states: a) Normal State – Not Spam, b) Abnormal State – Spam. Use K-Nearest Neighbors and Support Vector Machine for classification. Analyze their performance. Dataset link: The emails.csv dataset on the Kaggle https://www.kaggle.com/datasets/balaka18/email-spam-classification-dataset-csv
3. Given a bank customer, build a neural network-based classifier that can determine whether they will leave or not in the next 6 months. Dataset Description: The case study is from an open-source dataset from Kaggle. The dataset contains 10,000 sample points with 14 distinct features such as CustomerId, CreditScore, Geography, Gender, Age, Tenure, Balance, etc.
   Link to the Kaggle project: https://www.kaggle.com/barelydedicated/bank-customer-churn-modeling Perform following steps: Read the dataset, Distinguish the feature and target set and divide the data set into training and test sets. Normalize the train and test data. Initialize and build the model. Identify the points of improvement and implement the same. Print the accuracy score and confusion matrix (5 points).
4. Implement Gradient Descent Algorithm to find the local minima of a function. For example, find the local minima of the function $y=(x+3)^2$ starting from the point $x=2$.
5. Implement K-Nearest Neighbors algorithm on diabetes.csv dataset. Compute confusion matrix, accuracy, error rate, precision and recall on the given dataset.
   Dataset link : https://www.kaggle.com/datasets/abdallamahgoub/diabetes
6. Implement K-Means clustering/ hierarchical clustering on sales_data_sample.csv dataset. Determine the number of clusters using the elbow method.
   Dataset link : https://www.kaggle.com/datasets/kyanyoga/sample-sales-data

List of Project Based Learning

1. Zillow Home Value Prediction ML Project ...
2. BigMart Sales Prediction ML Project – Learn about Unsupervised Machine Learning Algorithms
3. Music Recommendation System ML Project
4. Iris Flowers Classification ML Project
5. Stock Prices Predictor using TimeSeries

6. Predicting Wine Quality using Wine Quality Dataset
7. MNIST Handwritten Digit Classification
8. Build a Movie Recommender System Movielens Dataset

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

ELECTIVE -I B . CONVERSATIONAL SYSTEMS

TEACHING SCHEME		EXAMINATION SCHEME		CREDIT SCHEME	
Lecture:	**03 Hours/Week**	**University Examination:**	**60 Marks**		
Practical:	**02 Hours/Week**	**Internal Assessment:**	**40 Marks**	**Lecture**	**03**
		Term Work	**25 Marks**	**Practical/Oral**	**01**
		Oral	**25 Marks**		

Course Objective:

1. Enable attendees to acquire knowledge on chatbots and its terminologies
2. Work with ML Concepts and different algorithms to build custom ML Model
3. Better understand on Conversational experiences and provide better customer experiences

Prerequisite: Students should be well versed with concepts of programming language

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

1. To understand the basic technologies required for building a conversational system
2. To be familiar with the NLTK tool kit and the pre-processing techniques of natural language processing
3. To implement various python programs
4. Build a chatbot for any application and deploy it.
5. Involve AI in building conversational system and build advanced systems that can be cognitively inclined towards human behaviour
6. Will be able build a real time working conversational system for social domain that can intelligently process inputs and generate relevant replies.

Unit I **06 Hours**

Introduction: Overview, Case studies, Explanation about different modes of engagement for a human being, History and impact of AI, Underlying technologies: Natural Language Processing, Artificial Intelligence and Machine Learning, NLG, Speech-To-Text, Text-To-Speech, Computer Vision etc., Introduction to Top players in Market: Google, MS, Amazon &Market trends, Messaging Platforms (Facebook, WhatsApp) and Smart speakers: Alexa, Google Home and other new channels, Ethical and Legal Considerations in AI Overview

Unit II **06 Hours**

Foundational Blocks for Programming: Basic Python programming concepts, Node Basics, Coding Best Practices

Unit III **06 Hours**

Natural Language Processing: Brief history, Basic Concepts, Phases of NLP, Application of chatbots etc., General chatbot architecture, Basic concepts in chatbots: Intents, Entities, Utterances, Variables and Slots, Fulfilment, Lexical Knowledge Networks (WordNet, Verbnet, PropBank, etc), Lexical Analysis, Part-of-Speech Tagging, Parsing/Syntactic analysis, Semantic Analysis, Word Sense Disambiguation, Information Extraction, Sentiment Analysis, NLP using Python - Make use of any of the NLP libraries like NLTK, spaCy, StanfordNLP etc. (Practice session to use an NLP Tool -Hands on), Affective NLG

Unit IV **06 Hours**

Building a chatbot/Conversational AI Systems: Fundamentals of Conversational Systems (NLU, DM and NLG), Chatbot framework & Architecture, Conversational Flow & Design,

Intent Classification (ML and DL based techniques), Dialogue Management Strategies, Natural Language Generation, UX design, APIs and SDKs, Usage of Conversational Design Tools, Introduction to popular chatbot frameworks: Google Dialog flow, Microsoft Bot Framework, Amazon Lex, RASA, Channels: Facebook Messenger, Google Home, Alexa, WhatsApp, Custom Apps, Overview of CE Testing techniques, A/B Testing, Introduction to Testing Frameworks - Botium /Mocha ,Chai, Security & Compliance – Data Management, Storage, GDPR, PCI, Building a Voice/Chat Bot - Hands on

Unit V **06 Hours**

Role of ML/AI in Conversational Technologies: Brief Understanding on how Conversational Systems uses ML technologies in ASR, NLP, Advanced Dialog management, Language Translation, Emotion/Sentiment Analysis, Information extraction, etc. to effectively converse

Unit VI **06 Hours**

Contact Centres: Introduction to Contact centres – Impact & Terminologies, Case studies & Trends, How does a Virtual Agent/Assistant fit in here? Overview on Conversational Analytics: The need of it, Introduction to Conversational Metrics

Where are we headed: Summary, Robots and Sensory Applications overview, XR Technologies in Conversational Systems , XR-Commerce, What to expect next? – Future technologies and market innovations overview

Textbooks

1. Michael McTear, "Conversational AI: Dialogue Systems, Conversational Agents, and Chatbots", Second Edition, Moran and Claypool Publishers, 2020.
2. Cathy Pearl, "Designing Voice User Interfaces: Principles of Conversational Experiences", O'REILLY, 2016.

Reference Books

1. Diana Perez-marin and Ismael Pascual-Nieto, "Conversational Agents and Natural Language Interaction" ,Premier Reference Source,2011.

List of Laboratory Exercises:

Subject teacher can decide suitable list of practical

List of Project based Learning

1. Build a learning chatbot
2. Build a ML Model using LSTM/any RNN and integrate with chatbot

Syllabus for Unit Tests:

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

ELECTIVE -I C . CLOUD, MICRO SERVICES AND APPLICATION

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

Course Objective: The course intends to introduce students to the fundamentals of developing application on Cloud, specifically public clouds such as AWS, AZURE and Google. Students would be able to appreciate

1. To design applications for Cloud
2. Develop applications using various services
3. Deploy applications on Cloud by using cloud native services

Prerequisite:
Good knowledge of Basics of Programming concepts(OOP) covered through a course prior to this semester

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

1. Understand the fundamental concepts of cloud
2. Learn the principles of cloud computing
3. Apply the concepts of cloud computing
4. Learn the concepts of microservices
5. Implement the application of API and microservices
6. Analyse different cloud security and monitoring tools

Unit I **6 Hours**

Cloud Fundamentals: Cloud Service Components, Cloud service/Deployment Models. Application of Cloud Computing, Cloud components Guiding Principle with respect to utilization/Security/Pricing, Public Cloud Platforms overview and their usage.

Unit II **6 Hours**

Principles of Cloud Computing: Cloud Computing Fundamentals, Cloud Computing terminologies and comparison of service Types, Cloud Computing terminologies and comparison of service Types, Cloud Security Challenges and Solutions, zscaler cloud Security

Unit III **6 Hours**

Public cloud platform overview and usage: Tools and Applications, Azure Virtual Machines, Azure App Service, Azure Kubernetes Service, Azure SQL, Google Compute Engine, Google Kubernetes Engine, AWS Virtual Machines

Unit IV **6 Hours**

Fundamentals of Microservices: Characteristics of Microservice Architecture, Cloud Native design Patterns, Architecting .Net applications for Azure, Cloud Native Applications- Fundamental, Insights, Cloud Native Landscape, Spring Boot Features. Spring Cloud and Advantages

Unit V **6 Hours**

API Fundamentals and Application of API and Microservice
API lifecycle, Spring Boot Rest API example using Swagger2, Postman, Introduction to Swagger (OpenAPI) complete tools, Cloud Native DevOps With Kubernetes, Introduction to Docker

Unit VI **6 Hours**

Cloud Security and Monitoring Tool: Application Security Fundamentals, Azure Security, AWS Security , Google Cloud Infrastructure security

Textbooks

1. Cloud Computing Architecture (IBM ICE)
2. Cloud Native Microservices with Spring and Kubernetes
3. George Reese Cloud Application Architectures, First Edition, O'Reilly Media 2009

Reference Books

1. Cloud computing for Dummies (November 2009) Judith Hurwitz, Robin Bloor, Marcia Kaufman, Fern Halper
2. Mastering Cloud Computing by Rajkumar Buyya, Christian Vecchiola, S.Thamarai Selvi from TMH 2013.
3. Cloud Computing 2 nd Edition by Dr. Kumar Saurabh from Wiley India 2012
4. Cloud Computing and SOA Convergence in Your Enterprise A Step-by-Step Guide by David S. Linthicum from Pearson 2010.

List of Laboratory Exercises

The subject teacher will decide the list of practical.

Project Based Learning:

1. Cloud-enabled Attendance System
2. Online Blood Bank System
3. Online, cloud-enabled book store system
4. Data Redundancy Removal System
5. Detecting Data Leaks using SQL injection
6. Cloud based Bus Pass System
7. Making a Chatbot
8. Secure Text Transfer using Cloud Computing

Syllabus for Unit Tests:

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 – VI

COURSE SYLLABUS

COMPUTER NETWORK

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

Course Pre Requisites: The prerequisite for this class is successful completion of Object Oriented Design, Data Structures, Data Communications.

Course Objective:

1. Become familiar with layered communication architectures (OSI and TCP/IP).
2. Understand the client/server model and key application layer protocols.
3. Learn sockets programming and how to implement client/server programs.
4. Understand the concepts of reliable data transfer and how TCP implements these concepts.
5. Know the principles of congestion control and trade-offs in fairness and efficiency.
6. Learn the principles of routing and the semantics and syntax of IP.

Course Outcomes:

1. Have a good understanding of the OSI Reference
2. Analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technologies;
3. Specify and identify deficiencies in existing protocols, and then go onto formulate new and better protocols;
4. Have an understanding of the issues surrounding Mobile and Wireless Networks.
5. Have a working knowledge of datagram and internet socket programming
6. Have a basic knowledge of the use of cryptography and network security

UNIT – I **8 Hours**

Introduction: Computer networks and distributed systems, Classifications of computer networks, Preliminaries of layered network structures. **Data communication Components:** Representation of data and its flow, Various Connection Topology, Protocols and Standards, OSImodel, Transmission Media. **LAN:** Wired LAN, Wireless LAN, Virtual LAN

UNIT – II **8 Hours**

Data Link Layer and Medium Access Sub Layer: Fundamentals of Error Detection and Error Correction, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go-back–N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols - Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA\

UNIT – III **8 Hours**

Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP,BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

UNIT – IV **8 Hours**

Application Layer: DNS, DDNS, TELNET, EMAIL, FTP, WWW, HTTP, SNMP, Bluetooth, Firewalls.

UNIT – V **8 Hours**

Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division andWave division, Concepts on spread spectrum.

UNIT – VI **8 Hours**

Network Security: Electronic mail, directory services and network management, Basic conceptsof Cryptography.

Text Books:

1. *Computer Networks*, A. Tannenbaum.
2. *Data and Computer Communication*, William Stallings

Reference Books:

1 Network Security, Kaufman, R. Perlman and M. Speciner.
2 UNIX Network Programming, Vol. 1,2 & 3, W. Richard Stevens

List of Laboratory Exercises

1. Setup a wired LAN using Switch, Router and then IP switch of minimum four computers, configuration machine using IP addresses, testing using PING utility using Network Simulation tool Cisco Packet Tracer.
2. Write a program for error detection and correction for 7/8 bits ASCII codes using Hamming Codes and CRC.
3. Write a program to simulate Go back N and Selective Repeat Modes of Sliding Window Protocol in peer to peer mode.
4. Write a program to demonstrate subnetting and find the subnet masks
5. Configure RIP/OSPF/BGP using packet Tracer
6. Write a program for DNS lookup. Given an IP address input, it should return URL and vice-versa
7. Write a program using TCP socket for wired network.

8. Write a program using UDP Sockets to enable file transfer (Script, Text, Audio and Video one file each) between two machines
9. Use network simulator NS2 to implement: Monitoring traffic for the given topology
10. Study of Installation and configuration of DHCP server

List of Project Based Learning

1. IP based patient monitoring system:
2. Secondary Authorization Server.
3. Security issues with Mobile IP.
4. Chat Application.
5. Network monitoring System.
6. Intruder Detection System.
7. Computing shortest path between nodes.
8. Dynamic search algorithm for intelligent message routing.
9. Controlling Network usage.
10. Enterprise network using cisco packet tracer

Syllabus for Unit Test:

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

INFORMATION SECURITY

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

Course Prerequisites:

Fundamentals of Digital Communication and Computer Networks, Operating Systems

Course Objectives:

1. Discuss various administrative, technical, governance, regularity and policy aspects of Information Security Management.
2. Discuss and provide hands on approaches to better understand and to devise strategies related to security policy.
3. Understand different security issues related to computer network, operating systems and database systems.

Course Outcome:

Students will be able to:

1. Understand security parameters and cryptosystems.
2. Understand security and access control models.
3. Understand aspect of information security management including planning, process, policy, procedureand monitoring.
4. Understand various issues related to threats like Threat Analysis, Threat Modeling, threat awareness and threat modeling
5. Understand security issues related to networks, operating systems and database.
6. Learn information audit and business continuity planning concepts.

UNIT-I **6 Hours**

Overview of Security Parameters and Cryptosystems: Confidentiality, integrity and availability; Security violation and threats; Security policy and procedure; Assumptions and Trust; Security Assurance, Implementation and Operational Issues; Security Life Cycle. Simple Cryptosystems: Enciphering Matrices, Encryption Schemes, Symmetric and, Asymmetric Cryptosystems, Cryptanalysis, Different Ciphers used for Information Security, Secure Cryptosystem.

UNIT-II **6 Hours**

Access Control Models: Discretionary, mandatory, roll-based and task-based models, unified models, access control algebra, temporal and spatio-temporalmodels, Authorization and Authentication - types, policies and techniques, Trusted Computing and multilevel security - Securitymodels, Trusted Systems.

UNIT-III **6 Hours**

Security Policies: Confidentiality policies, integrity policies, hybrid policies, non- interference and policy composition, international standards, Security certification - Security monitoring and Auditing - Security Requirements Specifications - Security Policies and Procedures, Role of Information Security Department

UNIT-IV **6 Hours**

Security Threats: Sources of security threats- Motives - Target Assets and Vulnerabilities – Consequences of threats- E-mail threats - Web- threats - Intruders and Hackers, Insider threats, Cyber crime Security Threat Management: Risk Assessment - Forensic Analysis - Security threat correlation – Threat awareness - Vulnerability sources and assessment- Vulnerability assessment tools -Threat identification - Threat Analysis - Threat Modeling - Model for Information Security Planning**,**

UNIT-V **6 Hours**

Logic-based System: Malicious logic, vulnerability analysis, auditing, intrusion detection. Applications: Network security, user security, program security. Database Security Architecture, Operating Systems Security**,** Enterprise Security, Data privacy, introduction to digital forensics, Incidence Response and Forensics, enterprise security specification, Software security issues, Email and Internet use policies, Third PartyDevelopment - Intellectual Property Issues.

UNIT-VI **6 Hours**

Auditing and Business Continuity Planning: Introduction to information security audit and principles of audit. Business continuity planning and disaster recovery. Case study: 9/11 tragedy. Backup and recovery techniques for applications and storage. Computer forensics: techniques and tools. Forensic tools VMware, Security testing tool Backtrack, Audit Tools: NESSUS and NMAP. Information Security Standards and Compliance: Overviewof ISO 17799 Standard. Legal and Ethical issues, Database auditing

List of Laboratory Exercises:

1. Write a program to Implement Asymmetric encryption using any RSA /DSA
2. Implementation of various cryptographic algorithms using HashCalc
3. Case study on secure configuration of Email Server
4. Case study on Incidence Response and Forensics analysis
5. Study of Computer Forensic Tools
6. Study of how antivirus works according to online and offline mode
7. Case study on cyber security

Project Based Learning:

1. ISO 17799 Standard
2. NESSUS and NMAP Audit Tools
3. Asymmetric Cryptosystems
4. Build your own encryption software
5. Key-logger projects

Text Books:

1. Neal Koblitz, "A Course in Number Theory and Cryptography", 2nd Edition, Springer,2002.
2. Johannes A. Buchman, "Introduction to Cryptography", 2nd Edition, Springer, 2004.
3. Serge Vaudenay, "Classical Introduction to Cryptography – Applications forCommunication Security", Springer, 2006.
4. Victor Shoup, "A Computational Introduction to Number Theory and Algebra",Cambridge University Press, 2005.
5. William Stallings and Lawrie Brown, "Computer Security: Principles and Practice",Prentice Hall, 2008.
6. Thomas Calabres and Tom Calabrese, "Information Security Intelligence: CryptographicPrinciples & Application", Thomson Delmar Learning, 2004.

References Books:

1. .Nina Godbole, Information Systems Security-Security Management, Metrics, Frameworksand Best Practices, Wiley, 2009
2. Information Security Policies, Procedures, and Standards:Guidelines for EffectiveInformation Security Management (Paperback) Auerbach,1st edition, 2001
3. Neal Koblitz, "A Course in Number Theory and Cryptography", 2ndEdition, Springer, 2002.
4. Swiderski, Frank and Syndex, "Threat Modeling", Microsoft Press, 2004.

Syllabus for Unit Test:

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

ARTIFICIAL INTELLIGENCE

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

Course Pre Requisites: Discrete mathematics, Data structures,

Course Objective:

To provide the insight to the students the about basic knowledge representation, problem solving, and learning methods of artificial intelligence.

Course Outcomes:

After completion of the course the students will able to,

1 Describe the concept of Artificial Intelligence, Intelligent agents and Learning agents
2 Identify issues in problem solving and apply the appropriate search methods.
3 Use the appropriate search method and identify the constraints
4 Describe and select the different knowledge representation methods
5 Identify the components of planning for a particular System
6 Use appropriate domain knowledge and develop an Expert system

UNIT – I **6 Hours**

Introduction, Overview of Artificial intelligence: Problems of AI, AI technique, Tic - Tac - Toe problem. Intelligent Agents, Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents.

UNIT – II **6 Hours**

Problem Solving, Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs.

Search techniques: Problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies. Heuristic search strategies Greedy best-first search, A* search, AO* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search

UNIT – III **6 Hours**

Constraint satisfaction problems: Local search for constraints Satisfaction problems. Adversarial search, Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.

UNIT – IV **6 Hours**

Knowledge & reasoning: Knowledge representation issues, representation & mapping, approaches to knowledge representation. Using predicate logic, representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction. Representing knowledge using rules, Procedural verses declarative knowledge, logic programming, forward verses backward reasoning, matching, control knowledge.

UNIT – V **6 Hours**

Probabilistic reasoning: Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Planning Overview, components of a planning system, Goal stack planning, Hierarchical planning, other planning techniques.

UNIT – VI **6 Hours**

Expert Systems: Representing and using domain knowledge, expert system shells, and knowledge acquisition.

Home Assignments:

Assignments should include problems related to the topics covered in lectures, like heuristics, optimal search, and graph heuristics. Constraint satisfaction problems, k-nearest neighbors, decision trees, etc. can be included in home assignments.

Text Books:

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach
2. Artificial Intelligence, Russel, Pearson

Reference Books:

1. Artificial Intelligence, Ritch & Knight, TMH
2. Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI
3. Logic & Prolog Programming, Saroj Kaushik, New Age International
4. Expert Systems, Giarranto, VIKAS

List of Laboratory Exercises

1. Implement Water jug problem.
2. Implement Tic-Tac-Toe game for 3×3 grid.
3. Implement concept of Breadth First Search Technique
4. Implement concept of Depth First Search Technique
5. Implement Best first search for given Problem
6. Implementation of A* algorithm (Always gives optimal solution) for solving Puzzle problems
7. To solve Travelling Salesman Problem (TSP) using Hill climbing Algorithm
8. To implement graph colouring algorithm using Constraint Satisfaction problem.
   OR
   Implementation of Constraint Satisfaction Problem for solving Crypt-arithmetic Problem
9. Implementation of MinMax Search Procedure with alpha beta pruning for finding the solutions of games.
10. To design a simple expert system using decision trees.

Project Based Learning

1. Expert system
2. Game development
3. NLP
4. Solving problem with AI
5. Voice-based Virtual Assistant for Windows
6. Heart Disease Prediction Project
7. Stock Price Prediction
8. Predict Housing Price
9. Facial Emotion Recognition and Detection
10. Banking Bot

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

QUANTITATIVE TECHNIQUES, COMMUNICATION AND VALUES

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 4Hours / Week	Semester End Examination: 60 Marks	Credits:4
Tutorial: Nil	Internal Assessment: 40 Marks	

Course Pre-requisites: The students should have knowledge of

1 Basic math's and reasoning, and comprehensive ability
2 Basic knowledge of communication process, soft skills
3 Basic knowledge and idea about leaders and leadership qualities, ethics, etiquettes and values

Course Objective:

The **Quantitative Techniques, Communication and Values**aims to augment students to face the campus recruitment test and train them on applying short techniques/ tricks to solve questions of Maths, reasoning and English in very less amount of time. The communication and values section focuses on the aspects of communication and soft skills such as grooming personality for leading team, presentation, business communication which would enable graduates to project themselves as a professionals in the corporate sector and/or otherwise.

Course Outcomes: The student will be able to

1 Solve the aptitude test in the recruitment and competitive exam by applying short techniques and solve the question in less amount of time
2 Apply the short mnemonics and techniques to solve the questions of logical reasoning in the placement and competitive exam in lesser time.
3 Develop the verbal ability to communicate effectively using suitable vocabulary and proper sentence pattern
4 Understand the concept of soft skills and its implication at workplace
5 Build up the ability to study employment business correspondences and its proper implications
6 Understand business ethics, etiquettes and values and apply them in the professional ventures.

Unit-I **8 hours**

Quantitative Aptitude :Number system, Percentage, profit and loss, Simple Interest and Compound Interest, Ratio, Proportion and Average, Mixture and Allegation, Time, Speed & Distance, Time & Work , Permutation & Combination, Probability, Pipes and Cisterns

Unit-II **8 hours**

Non-Verbal Reasoning: Coding, Decoding, Number series, Blood relation Directions, cubes & dices, Data Interpretation, Data Sufficiency, Set Theory & Syllogisms, Matching, Selection & Arrangement, Clocks & Calendars, Visual Reasoning, Input, Output & Flow Chart.

Unit-III **8 hours**

Verbal Reasoning: Sentence Patterns, Sentence correction and spotting errors, Vocabulary, antonyms and synonyms and analogy, Phrasal Verbs, idiomatic expressions, reading comprehension, closest, sentence rearrangement and theme detection.

Unit-IV **8 hours**

Self Awareness and Soft Skills Development: Concept of SWOT, Importance of SWOT, Individual & Organizational SWOT Analysis, Soft skills, meaning, need and importance, difference between soft skills and hard skills, life skills and personal skills, Leadership skills,-Importance ,Types, Attributes of good leader Motivational theories and leadership ,Emotional intelligence in personal and professional lives its importance need and application, Team Building and conflict resolution Skills ,Problem solving skills, Time Management and Stress Management Skills Pareto Principle(80/20) Rule in time management, Time management matrix, creativity and result orientation, working under pressure, stress management

Unit-V

Communication And Honing Employment Skills: Communication process, Non-verbal codes in communication, importance of LSRW in communication, Barriers to communication, Principles of effective Technical writing, Email writing and Netiquettes, **Letter writing** – formal letters, job application letter, cover letter, structure of technical report writing, Building Resume and CV, Tips to build an effective Resume Group discussion, Skills required for Group Discussion Interview skills, Ways of handling telephonic interviews, Importance of body language, grooming &etiquettes for getting right impression in PI&GD , Extempore, Introduction to PowerPoint presentation, ,Structure & flow of presentation,

Unit-VI

Business Ethics , Etiquettes And Values: The Importance of Ethics and Values in Business World, Respect for Individuality and diversity at workplace values of a good manager Key features of corporate etiquette, Corporate grooming & dressing, etiquettes in social & office Setting-Understand the importance of professional behaviour at the work place, Corporate social responsibility (CSR) its importance and need.

Reference Books:

1 Quantitative Aptitude by R. S. Agarwal published by S. Chand
2 The Book of Numbers by Shakuntala Devi
3 A Modern Approach To Logical Reasoning by R. S. Agarwal published by S. Chand
4 A New Approach to Reasoning Verbal & Non-Verbal by Indu Sijwali
5 Business Communication by Meenakshi Raman, Prakash Singh published by Oxford University press, second edition
6 Communication Skills by Sanjay Kumar, Pushp Lata, published by Oxford University press, second edition
7 Technical Communication by Meenakshi Raman, Sangeeta Sharma published by Oxford University press
8 Developing Communication Skills by Krishna Mohan, Meera Banerji published by Macmillan India Pvt Ltd
9 Soft Skills by Meenkashi Raman, published by Cengage publishers
10 Soft Skills by Dr. K Alex published by Oxford University press
11 Soft skills for Managers by Dr. T. Kalyana Chakravarthi and Dr. T. Latha Chakravarthi published by biztantra

Project Based Learning Topics:

1 Prepare mock Tests on Unit –I and solve it in given time(use of PSD lab manual)
2 Prepare mock Tests on Unit –I and solve it in given time(use of PSD lab manual)

3 Prepare online model test based on Unit-II and solve it in specific time(use of PSD lab manual)
4 Prepare online model test based on Unit-II and solve it in specific time(use of PSD lab manual)
5 Form a model for spoken and written communication skills which avoid grammar mistakes and common errors
6 Develop various activity models for enriching and developing vocabulary
7 Preparing strategies by using SWOT and TWOS analysis
8 Analysing differences between Soft Skills, Hard skills, and Personal skills
9 Develop Bruce Tuchman's Team Building Models with classmates/Teammates
10 To study different personalities of Leaders from various sectors and find out their attributes and success stories
11 Preparing a model for Time Management Skills and Stress Management and conduct activities for effective implementation of it.
12 Form a model to develop LSRW and communication Skills
13 Conduct mock interview and practice GD activities to build competencies for actual selection process
14 Preparing a model for evaluating Values and Ethics of Good Managers
15 Preparing a model of dress codes and attire for different professional situations Corporate etiquettes and its implications
16 Develop some good activities to understand the importance and need of Corporate social responsibility (CSR)

Syllabus for Unit Test:

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

FINANCIAL AND COST ACCOUNTING

TEACHING SCHEME	EXAMINATION SCHEME	CREDITS ALLOTTED
Lectures :3 Hrs./Week	**Semester Examination :60 marks**	**Theory :3 Credits**
Lab :0 Hrs./Week	**Internal Assessment :40 marks**	**Practical/Oral :0 Credit**
	Term Work :00 Marks	**Total :3 Credits**
	Oral :00 Marks	

Course Pre Requisites: familiarity with common concepts and terminologies in economics and accounts.

Course Objective*:*

1. To impart knowledge about different ways of accounting process
2. Understanding and interpreting financial statements.

Course Outcomes:

After successful completion of this course students will be able to

1. Understand the important concepts of accounting and their importance in management
2. Interpret the accounting process
3. Analyze financial statements
4. Review the cash flow and fund flow techniques
5. Interpret the costing systems
6. Infer the accounts and reports

UNIT – I **6 Hours**

Accounting Concept: Introduction, Techniques and Conventions, Financial Statements- Understanding & Interpreting Financial Statements

UNIT – II **6 Hours**

Accounting Process: Book Keeping and Record Maintenance**,** Fundamental Principles and Double Entry**,** Journal, Ledger, Trial Balance, Balance Sheet, Final Accounts**,** Cash Book and Subsidiary Books, Rectification of Errors

UNIT – III **6 Hours**

Financial Statements: Form and Contents of Financial Statements, Analyzing and Interpreting Financial Statements, Accounting Standards.

Class Discussion: Corporate Accounting Fraud- A Case Study of Satyam

UNIT – IV **6 Hours**

Cash Flow and Fund Flow Techniques: Introduction, How to prepare, Difference between them

UNIT – V **6 Hours**

Costing Systems: Elements of Cost**,** Cost Behavior, Cost Allocation, OH Allocation**,** Unit Costing, Process Costing, Job Costing**,** Absorption Costing, Marginal Costing, Cost Volume Profit Analysis**,** Budgets**,** ABC Analysis

Class Discussion: Application of costing concepts in the Service Sector

UNIT – VI **6 Hours**

Company Accounts and Annual Reports: Audit Reports and Statutory Requirements**,** Directors Report**,** Notes to Accounts**,** Pitfalls

Text Books:

1. Robert N Anthony, David Hawkins, Kenneth Marchant, *Accounting: Texts and Cases*, McGraw-Hill
2. Case Study Materials: To be distributed for class discussion

Reference Books:

Cost Accounting: Texts and Problems Reference Book By M. C. Shukla

Project Based Learning:

1. Effectiveness of human relations in the banking industry.
2. An evaluation of the impact of wages and salaries policies on the performance of workers.
3. An appraisal of the relevance of financial incentives to workers MOTIVATION.

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

ELECTIVE II A. DATA MINING AND ANALYTICS

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

Course Pre Requisites: Student should possess a strong mathematical background in Probability and Statistics. Also should have programming proficiency with algorithmic approach.

Course Objective: is to make statistical foundation, followed by various machine learning and data mining algorithms. This course will also give coverage to practical systems and software used in data analytics.

Course Outcomes:

1. Understand basic concepts and techniques of Data Mining
2. Evaluate different models used for OLAP and data preprocessing.
3. Classify and differentiate between situations for applying data-mining techniques such as frequent pattern mining, association, correlation, classification, prediction, cluster, and outlier analysis.
4. Apply knowledge for understanding data and select suitable linear, nonlinear data modeland time series analysis model.
5. Develop skills of using data mining software for solving practical problems.
6. Understand and apply several statistical analysis techniques: regression, ANOVA, data reduction

UNIT – I **6 Hours**

Introduction to Data Mining: What is data mining? Related technologies - Machine Learning, DBMS, OLAP, Statistics, Stages of the Data Mining Process, Data Mining Techniques, Knowledge Representation Methods, Applications

UNIT – II **6 Hours**

Data pre-processing: Data cleaning, Data transformation, Data reduction, Discretization and generating concept hierarchies, Installing Weka 3 Data Mining System, Experiments with Weka - filters, discretization
Data mining knowledge representation: Task relevant data, Background knowledge, Representing input data and output knowledge, Visualization techniques
Attribute-oriented analysis: Attribute generalization, Attribute relevance, Class comparison, Statistical measures

UNIT – III **6 Hours**

Data mining algorithms - Association rules: Motivation and terminology, Example: mining weather data, Basic idea: item sets, Generating item sets and rules efficiently, Correlation analysis
Data mining algorithms - Classification: Basic learning/mining tasks, Inferring rudimentary rules: 1R, algorithm, Decision trees, covering rules
Data mining algorithms – Prediction: The prediction task, Statistical (Bayesian) classification, Bayesian networks, Instance-based methods (nearest neighbor), linear models

.

UNIT – IV **6 Hours**

Descriptive analytics: Data Modeling, Trend Analysis, Simple Linear Regression Analysis
Forecasting models: Heuristic methods, predictive modeling and pattern discovery, Logistic Regression: Logit transform, ML estimation, Tests of hypotheses, Wald test, LR test, score test, test for overall regression, multiple logistic regression, forward, backward method, interpretation of parameters, relation with categorical data analysis. Interpreting Regression Models, Implementing Predictive Models

UNIT – V **6 Hours**

Generalized Linear model: link functions such as Poisson, binomial, inverse binomial, inverse Gaussian, Gamma.
Non Linear Regression (NLS): Linearization transforms, their uses & limitations, examination of non-linearity, initial estimates, iterative procedures for NLS, grid search, Newton-Raphson, steepest descent, Marquardt's methods. Introduction to semiparametric regression models, additive regression models. Introduction to nonparametric regression methods

UNIT – VI **6 Hours**

Time Series Analysis: Auto - Covariance, Auto-correlation and their properties. Exploratory time series analysis, Test for trend and seasonality, Exponential and moving average smoothing, Holt – Winter smoothing, forecasting based on smoothing
Linear time series models: Autoregressive, Moving Average, Autoregressive Moving Average and Autoregressive Integrated Moving Average models; Estimation of ARMA models such as Yule-Walker estimation for AR Processes, Maximum likelihood and least squares estimation for ARMA Processes, Forecasting using ARIMA models

Prescriptive Analytics: Mathematical optimization, Networks modeling-Multi-objective optimization-Stochastic modelling, Decision and Risk analysis, Decision trees.

Text Books:

1. Jiawei Han and Micheline Kamber, "Data Mining: Concepts and Techniques", Morgan Kaufmann Publishers, 3rd ed, 2010.
2. Lior Rokach and Oded Maimon, "Data Mining and Knowledge Discovery Handbook", Springer, 2nd edition, 2010
3. Box, G.E.P and Jenkins G.M. (1970) Time Series Analysis, Forecasting and Control, Holden-Day.

Reference Books:

1. Draper, N. R. and Smith, H. (1998). Applied Regression Analysis (John Wiley) Third Edition.

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

ELECTIVE II B. ROBOTICS AND EMBEDDED SYSTEMS

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

Course Prerequisites:

Students should have primary knowledge of

1 Good programming skills in C/C++. Basic knowledge of linear algebra. (for Robotics)

2. Basic knowledge of operating system

3. Basic knowledge of microprocessors and microcontrollers

Course Objectives:

During the course the students will: -

1) Learn the concepts of embedded system, its components and its application areas.
2) Learn the concepts of robotics and robot design components.

Course Outcome:

Students will be able to:

1 Acquire knowledge about microcontrollers embedded processors and their applications.
2 Understand the internal architecture and interfacing of different peripheral devices with Microcontrollers.
3 Understand the role of embedded systems in industry.
4 Understand the concepts of real time operating system.
5 Understand various applications of embedded system and various electronics parts usedin embedded system design.
6 Understand different concepts in robotics, various parts used in robotics.

UNIT-I **6 Hours**

Introduction to Embedded System Embedded system Vs General computing systems, History of Embedded systems, Purpose of Embedded systems, Microprocessor and Microcontroller, Hardware architecture of the real time systems.

UNIT-II **6 Hours**

Devices and Communication Buses: I/O types, serial and parallel communication devices, wireless communication devices, timer and counting devices, watchdog timer, real time clock, serial bus communication protocols, parallelcommunication network using ISA, PCI, PCT-X, Intrnet embedded system network protocols, USB, Bluetooth.

UNIT-III **6 Hours**

Program Modeling: Program Modeling Concepts; Fundamental issues in Hardware software co-design, Unified Modeling Language(UML), Hardware Software trade-offs DFG model, state machine programming model, model for multiprocessor system.

UNIT-IV **6 Hours**

Real Time Operating Systems: Operating system basics, Tasks, Process and Threads, Multiprocessing and multitasking, task communication, task synchronization, qualities of good RTOS. Real time scheduling: Clock Driven, Weighted Round Robin, Priority Driven Approach,RM,EDF algorithms

UNIT-V **6 Hours**

Examples of Embedded System: Mobile phones, RFID, WISENET, Robotics, BiomedicalApplications, Brain machine interface etc. Popular microcontrollers used in embedded systems, sensors, actuators, Design of microcontroller systems using ADC/DAC, LED/LCD, PWM, Keyboard, Stepper motor etc.

UNIT-VI **6 Hours**

Robotics: Introduction, Elements of robots -- joints, links, actuators,and sensors

Kinematics: Kinematics of serial robots, Kinematics of parallelrobots, Motion planning and control

Advanced Topics on Robotics: Sensing distance and direction, Line Following Algorithms, Feedback Systems, Other topics on advancerobotic techniques

List of Practical Assignments

1. Arithmetic Operations using 8051
2 Interfacing ADC and DAC
3 Interfacing LED and PWM
4 Interfacing real time clock and serial port
5 Interfacing keyboard and LCD
6 Flashing of LEDS
7 Interfacing stepper motor and temperature sensor.
8 Study of robotic arm and its configuration
9 Study the robotic end effectors

List of Assignments/Tutorials

1. Assignment on State machine programming model of Fibonacci sequence generator.
2. Assignment on actuator behavior.
3. Assignment on Real time scheduling algorithms.
4. Assignment on CAN protocol.
5. Assignment on microcontrollers used in embedded systems.
6. Assignment on Program Modeling concepts.

Project Based Learning

1. Line Follower Robot Using PID Algorithm
2. Cloud-Enhanced Robotic System for Smart City Crowd Control
3. Smartphone-based Robot Control for Localization
4. Hector Slam Mapping and Indoor Positioning ROBOT
5. Metal Detector Robotic Vehicle
6. Pick and Place Robotic Vehicle

Text Books:

1. Introduction to Embedded Systems : Shibu K. V. (TMH)
2. Embedded System Design – A unified hardware and software introduction: F. Vahid (John Wiley)

3.Embedded Systems : Rajkamal (TMH)
4.Embedded Systems : L. B. Das (Pearson)
5. The 8051 Microcontroller and embedded systems by Muhammad Ali Mazidi, PHI.
6.Robotics: Fundamental Concepts and Analysis, Oxford University Press

Reference Books:

1) Embedded System design : S. Heath (Elsevier)
2) Embedded microcontroller and processor design: G. Osborn (Pearson)
3) Embedded systems design by Steve Heath, Newnes

Syllabus for Unit Test:

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

ELECTIVE II C. MODERN WEB APPLICATION

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

Course Objective:

1. To introduce students to modern web technologies.
2. To learn and understand the concepts of HTML and CSS
3. Ta apply the concepts of JavaScript , PHP and XML

Prerequisite:

Basic knowledge of Java Script, Basics of web application development, Knowledge of what is Client and Server side programming.

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

1. Understand the concepts and techniques that enable web applications
2. Learn the concepts of HTML and CSS
3. Apply the concepts of JavaScript
4. Learn the concepts of XML and XSL
5. Implement the program using basics of PHP
6. Create Data in MySQL Using PHP

Unit I **06 Hours**

Introduction to Internet & World Wide Web: History of the Internet & World- Wide Web, Web Browsers, − Web Servers, Uniform Resource Locator, Tools and Web Programming Languages. Web Standards, Categoriesof Web Applications, Characteristics of Web Applications, Tiered Architecture

Unit II **06 Hours**

Hypertext Mark Up Language: (HTML) Revision: Basic HTML page, Text Formatting, Table, Headers, Linking,Images,List, Meta Elements

Cascading Style Sheets (CSS) Revision: Inline, Internal and External Style Sheet,Bootstrap-CSS Text, CSS forms , CSS components drop down .

Unit III **06 Hours**

Java Script: Introduction to Java Scripts, Objects in Java Script, Dynamic HTML with Java Script, Bootstrap- JS, Alert, JS Button, JS popover

Unit IV **06 Hours**

Extensible Markup Language(XML): Introduction, Structuring Data, Document Type Definition, XML Vocabularies, Document Object Model (DOM) with JavaScript, Extensible Stylesheet LanguageTransforms (XSL)

Unit V **06 Hours**

PHP: Writing Basic PHP Programs: Creating PHP Programs, Numbers and Strings, Literalsand Variables, Operators and Functions**,** Form & PHP: Creating Form Controls, Using Values Returned From, Forms Using PHP

Unit VI **06 Hours**

PHP Database Connectivity and Manipulating Data in MySQL: PHP Database Connectivity: Connecting to MySQL Server, Selecting Databases,Checking for Errors, Closing the MySQL Server Connection

Manipulating Data in MySQL Using PHP: Inserting, Viewing, Updating and DeletingRecords, Manipulating joined tables. `

User Authentication: Creating Session, Authorization Level

Textbooks

1. 1. Deitel P. J., Deitel H. M. and Deitel A. (2012) Internet and World Wide Web: How to Program, Fifth Edition, Pearson Prentice Hall.
2. HTML & CSS: Design and Build Websites, Jon Duckett, John Wiley & Sons
3. Naramore E., Gerner J., Scouarnec Y.L., et al., (2005) Beginning PHP5, Apache, MySQL Web Development: Programmer to Programmer, John Wiley & Sons Inc., ISBN: 9780764579660.

Reference Books

1. Sebesta R. W. (2014) Programming the World Wide Web, 8th edition, Pearson.

2. Pressman R. and Lowe D. (2008) Web Engineering: a practitioner's approach, First Edition, Mc GrawHill

3. Kappel G., et al. (2006) Web Engineering: The Discipline of systematic Development of Web Applications, First Edition, John Wiley & Sons.

4. Suh W. (2005) Web Engineering: Principles and Techniques , Idea Group Inc.

5. Ullman L (2016) PHP for the Web: Visual Quick Start Guide, Fifth Edition, Peachpit Press.

List of Laboratory Exercises

1.Design the static web pages required for an online book store web site.

2. Create a "registration form "with the following fields

1) Name (Text field)
2) Password (password field)
3) E-mail id (text field)
4) Phone number (text field)
5) Sex (radio button)
6) Date of birth (3 select boxes)
7) Languages known (check boxes – English, Telugu, Hindi, Tamil)
8) Address (text area)

3. a) Write JavaScript to validate the following fields of the above registration page.

- Name (Name should contains only alphabets and the length should not be less than 6 characters).
- Password (Password should not be less than 6 characters length).
- E-mail id (should not contain any invalid and must follow the standard pattern name@domain.com)
- Phone number (Phone number should contain 10 digits only).

b) Write JavaScript to validate the above login page with the above parameters.

4. Design a web page using CSS (Cascading Style Sheets) which includes the following:

1) Use different font, styles:
2) Set a background image for both the page and single elements on the page.
3) Control the repetition of the image with the background-repeat property.
4) Define styles for links
5) Add a customized cursor:

5. Write an XML file that will display the Book information which includes the following:

1) Title of the book
2) Author Name
3) ISBN number
4) Publisher name
5) Edition
6) Price

6. Write a Document Type Definition (DTD) to validate the XML file.
7. Write Program in PHP to demonstrate basics of PHP
8. Write a PHP Code to make database connection, Create Data Base, Create Table In Mysql
9. Write a program in PHP to perform CRUD(Create, InseRt, Update, Delete operations)
10. Study of Image Uploading in PHP Design A from which upload And Display Image in PHP
11. Install a database (Mysql).
    - Create a table that should contain at least the following fields: name, password, email-id,
    - phone number (these should hold the data from the registration form).
    - Write a PHP code to connect to that database and extract data from the
    - tables and display them. Experiment with various SQL queries.
    - Insert the details of the users who register with the web site, whenever a new user click
    - the submit button in the registration page
    - Update user data, delete specific users

Project Based Learning

1. CRM for Businesses.
2. CEO Dashboard.
3. Online Classroom App.
4. Online Dating Web App.
5. Payment Gateway.
6. Virtual Event Hosting Web App.
7. Telemedicine.
8. Crime Alert Web Apps
9. Workflow Management
10. Chatbot Hosting App
11. Employee Training Web App
12. Language Learning App
13. Food Delivery Web App

Syllabus for Unit Tests:

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 – VII

COURSE SYLLABUS

USABILITY DESIGN OF SOFTWARE APPLICATIONS

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

Prerequisite:

Basic understanding of web and mobile app development

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

1. To sensitise the students to the fundamentals of User Centred Design and User Experience their relevance and contribution to businesses
2. Familiarise them to the facets of User Experience (UX) Design, particularly as appliedto the digital artefacts
3. Appreciation of user research, solution conceptualisation and validation as interwovenactivities in the design and development lifecycle
4. Acquire the ability to constructively engage with the Design professionals they wouldwork with in the future
5. To understand user-centered design and usability engineering principles as they design a variety of software user interfaces.
6. Use prototyping methods to discover requirements and to evaluate design alternatives.

Unit I **06 Hours**

Introduction to User Centered Design.

Unit II **06 Hours**

Aspects of User Centered Design Product Appreciation Assignment – Evaluating the product from user centered design aspects such as functionality, ease of use, ergonomics, and aesthetics.

Unit III **06 Hours**

Heuristic Evaluation: Heuristic Principles, Examples Heuristic Evaluation: Group Assignment initiation (Website and App) Evaluation for key tasks of the app or website for heuristic principles, severity, recommendations.

Unit IV **06 Hours**

Group Project identification, UX Research Understanding users, their goals, context of use, and environment of use. Research Techniques: Contextual Enquiry, User Interviews, Competitive Analysis forUX

Unit V **06 Hours**

Scenarios and Persona Technique , Presentation of Personas for the group project, Design Thinking Technique, Discovery and brainstorming, Concept Development, Task flow detailing for the Project

Unit VI **06 Hours**

Prototyping Techniques Paper, Electronic, Prototyping Tools, Project Prototyping Iteration 1, Project Prototyping Iteration 2

Textbooks

1. Interaction Design: Beyond Human-Computer Interaction, 4th Edition, Jenny Preece, Helen Sharp and Yvonne Rogers
2. About Face, 4th Edition, Alan Cooper and Robert Reimann
3. Understanding Design Thinking, Lean, and Agile - Jonny Schneider.

Reference Books

1. Observing the User Experience, Second Edition: A Practitioner's Guide to User Research. Elizabeth Goodman, Mike Kuniavsky, Andrea Moed
2. The Elements of User Experience: User-Centered Design for the Web and Beyond 2nd Edition, Jesse James Garrett

Project Based Learning

1. Design a user interface for registration of a student for admissions
2. How to open the Visual Studio software and the steps and tutorial about the software
3. Design a User Interface for
4. a) Welcome screen
   b) Multiplication and Addition of any two numbers
5. Design a user interface for assigning a grade to students based on the subjects marks
6. Design a User interface for printing the numbers in
   a) Ascending order
   b) Descending order
   c) Subtraction
7. Design a user interface for calculator

Syllabus for Unit Tests:

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

IT WORKSHOP

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/oral :1 Credit
	Term Work :25 Marks	Total :3 Credits
	Practical : 25 Marks	

Prerequisite:
Need to know basics of image representation.

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

1. Understand Matlab
2. Learn Matlab Workspace
3. Learn Mathematical functions of Matlab
4. Learn Plotting
5. Understand Matlab Programming
6. Learn Debugging

Unit I **06 Hours**

Introduction to MATLAB
History, basic features, strengths and weaknesses, good programming practices and plan your code.

Unit II **06 Hours**

Working with variables, workspace and miscellaneous commands Creating MATLAB variables, overwriting variable, error messages, making corrections, controlling the hierarchy of operations or precedence, controlling the appearance of floating-point number, managing the workspace, keeping track of your work session, entering multiple statements per line, miscellaneous commands.

Unit III **06 Hours**

Matrix, array and basic mathematical functions
Matrix generation, entering a vector, entering a matrix, matrix indexing, colon operator, linear spacing, creating a sub-matrix, dimension, matrix operations and functions matrix generators, special matrices, array and array operations, solving linear equations, other mathematical functions.

Unit IV **06 Hours**

Basic plotting
Overview, creating simple plots, adding titles, axis labels, and annotations, multiple data sets in one plot, specifying line styles and colours

Unit V **06 Hours**

Introduction to programming
Introduction, M-File Scripts, script side-effects, M-File functions, anatomy of a M-File function, input and output arguments, input to a script file, output commands

Control flow and operators
``if ... end" structure, relational and logical operators, ``for...end" loop, ``while... end" loop, other flow structures, operator precedence, saving output to a file

Unit VI **06 Hours**

Debugging M-files

Debugging process, preparing for debugging, setting breakpoints, running with breakpoints, examining values, correcting and ending debugging, correcting an M-file

Textbooks

1. Digital Image Processing using MATLAB. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, Pearson Education, Inc., 2004.

2 MATLAB: A Practical Introduction to Programming and Problem Solving. Stormy Attaway, Butterworth-Heinemann.

Reference Books

1. https://www.mathworks.com/content/dam/mathworks/mathworks-dot-com/moler/exm/book.pdf
2. https://www.mathworks.com/help/releases/R2014b/pdf_doc/matlab/getstart.pdf

Project Based Learning:

1. Image Recognition for Security System using MATLAB
2. Automatic Invitation Generator using MATLAB
3. Diabetic Detection using MATLAB
4. Car Number Plate Detection using MATLAB
5. Piano Note Recognition using MATLAB
6. Real time Face Recognition using MATLAB
7. Adaptive traffic filtering and smoothing using MATLAB
8. Handwriting Recognition using MATLAB
9. Study of traffic related accidents using MATLAB
10. Fruits Detections using MATLAB

Similarly, other Real Times Problem using MATLAB

Syllabus for Unit Tests:

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

FINANCIAL MANAGEMENT

TEACHING SCHEME	EXAMINATION SCHEME	CREDITS ALLOTTED
Lectures :2 Hrs./Week	Semester Examination :60 Marks	Theory :2 Credits
Lab :0 Hrs./Week	Internal Assessment :40 Marks	Practical/Oral :0 Credit
	Term Work :NIL	Total :2 Credits
	Practical : NIL	

Course Overview

This course intends to introduce students to understand the financial aspects of IT projects. They shall understand the management of funds for a project and risks and returns involved therein.

Prerequisite:

Students should be familiar with the basic concepts of economics and project life cycle.

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

1. Interpret the fundamental concepts of financial management time value of money
2. Categorise valuation of securities, risks and returns
3. Summarise leverage for deciding financial angle of IT projects
4. Understand capital cost and budgeting
5. Understand working Capital and cash management
6. Analyse accounts receivable management

Unit I **06 Hours**

Introduction : Introduction to Financial Management - Goals of the firm - Financial Environments.

Time Value of Money : Simple and Compound Interest Rates, Amortization,Computing more than once a year, Annuity Factor.

Unit II **06 Hours**

Valuation of Securities : Bond Valuation, Preferred Stock Valuation ,Common Stock Valuation, Concept of Yield and YTM.

Risk & Return: Defining Risk and Return, Using Probability Distributions to Measure Risk, Attitudes Toward Risk, Risk and Return in a Portfolio Context, Diversification, The Capital Asset Pricing Model (CAPM)

Unit III **06 Hours**

Operating & Financial Leverage: Operating Leverage, Financial Leverage, Total Leverage, Indifference Analysis in leverage study

Unit IV **06 Hours**

Cost of Capital : Concept , Computation of Specific Cost of Capital for Equity - Preference – Debt, Weighted Average Cost of Capital – Factors affecting Cost of Capital 4L

Capital Budgeting : The Capital Budgeting Concept & Process - An Overview, Generating Investment Project Proposals, Estimating Project, After Tax Incremental Operating Cash Flows, Capital Budgeting Techniques, ProjectEvaluation and Selection - Alternative Methods

Unit V **06 Hours**

Working Capital Management: Overview, Working Capital Issues, Financing Current Assets (Short Term and Long Term- Mix), Combining Liability Structures and Current Asset Decisions, Estimation of Working Capital.

Cash Management: Motives for Holding cash, Speeding Up Cash Receipts, Slowing Down Cash Payouts, Electronic Commerce, Outsourcing, Cash Balances to maintain, Factoring

Unit VI **06 Hours**

Accounts Receivable Management: Credit & Collection Policies, Analyzing the Credit Applicant, Credit References, Selecting optimum Credit period. 4L

Textbooks

1. Chandra, Prasanna - Financial Management - Theory & Practice, Tata McGraw Hill.

Reference Books

1. Srivastava, Misra: Financial Management, OUP
2. Van Horne and Wachowicz : Fundamentals of Financial Management, Prentice Hall/ Pearson Education

Topics for Project Based Learning

1. Case studies based on Time Value of Money
2. Case study of Valuation of Securities, Risk & Return
3. Case study of Costof Capital, Capital Budgeting
4. Working Capital Management, Cash Management
5. Case study of Accounts Receivable Management
6. Choose an origination of your choice and do an analysis of it from the perspectives of capital budgeting
7. Analysis of an organization for capital budgeting
8. Analysis of CAPM model for analyzing risk
9. Case study of Credit and collection policies
10. Prepare a portfolio for an individual investment

Syllabus for Unit Tests:

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

HUMAN RESOURCE MANAGEMENT

TEACHING SCHEME	EXAMINATION SCHEME	CREDITS ALLOTTED
Lectures :2 Hrs./Week	Semester Examination :60 Marks	Theory :2 Credits
Lab :0 Hrs./Week	Internal Assessment :40 Marks	Practical/Oral :0 Credit
	Term Work :NIL	Total :2 Credits
	Practical : NIL	

Course Overview

Students must be aware of the basic principles of Human Resource Management because success intoday's complex business environment depends on effective management of its human resources. This introductory course on Human Resource Management will familiarize the students with the basic concepts, roles, functional areas and activities of HR and help students understand organization's employees, their interest, motivation and satisfaction, and their belief of fair treatment- all of which actually impact the firm's current performance and sustainability in the longrun.

Prerequisite: NIL

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

1. Effectively manage and plan key **human resource** functions within organizations.
2. Examine current issues, trends, practices, and processes in **HRM**.
3. Contribute to employee performance **management** and organizational effectiveness.
4. Problem-solve **human resource** challenges.
5. Develop employability skills for the Canadian workplace.

Unit I **06 Hours**

Human Resource Management: Concept and Challenges, HR Philosophy, Policies,Procedures and Practices.

Unit II **06 Hours**

Human Resource System Design: HR Profession, and HR Department, Line Management Responsibility in HRM, Measuring HR, Human resources accounting and audit; Human resource information system

Unit III **06 Hours**

Functional Areas of HRM: recruitment and staffing, benefits, compensation, employee relations, HR compliance, organizational design, training and development,human resource information systems (H.R.I.S.) and payroll.

Unit IV **06 Hours**

Human Resource Planning: Demand Forecasting, Action Plans– Retention, Training, Redeployment & Staffing, Succession Planning

Unit V **06 Hours**

Strategic Management of Human Resources: SHRM, relationship between HR strategy and overall corporate strategy, HR as a Factor of Competitive Advantage, Managing Diversity in the Workplace

Unit VI **06 Hours**

Human Resource Management in Service Sector- Special considerations for Service Sector including: Managing the Customer – Employee Interaction, Employee Empowerment and Customer Satisfaction, Service Failure and Customer Recovery – the Role of Communication andTraining, Similarities and Differences in Nature of Work for the Frontline Workers andthe Backend, Support Services - Impact on HR Practices Stressing Mainly on Performance, Flexible Working Practices – Implications for HR

Textbooks

1 Gary Dessler, Human Resource Management

Reference Books

1. Dave Ulrich, Human Resource Management, Mc Graw Hill Publication

List of Activities

Further, the topic for class discussion will be mentioned beforehand. Students are required to meet in groups before coming to class and prepare for the topic to be discussed. Instructor may ask the student groups to present their analysis and findings to the class. Few topics are mentioned belowas examples. Instructor can add or change any topic as per requirement.

1. Topic: Understanding the issues and challenges involved in managing a diverse workforce
2. Topic: Is The Only Purpose of a Corporation to Maximize Profit?
3. Topic: Similarities and Differences in Manufacturing and Service Sector - Impact on HRPractices

Project Based Learning:

1) Visit the any organization /Company and make a study model of its HR Department with analyzing their philosophy, Policies, and Procedure

2) Prepared the list of the application of HRIS which are used nowadays in various HR Departments and highlight its advantages and benefits

3) Make a model on Fictional areas of any company and discuss its recruitment process and Payroll Method

4) Do a case study on Demand forecasting and strategies used for Retention, Training, Redeployment & Staffing, Succession Planning

5) Analyze the concept SHRM and what are the major HR factors are used in it for the effectiveness of the firm , make a case study

6) Choose any service sector and study in detail the role of HR in that

Syllabus for Unit Tests:

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

ELECTIVE III A) COGNITIVE SCIENCE & ANALYTICS

TEACHING SCHEME	EXAMINATION SCHEME		CREDITS ALLOTTED	
Lectures :4 Hrs./Week	**Semester Examination**	**:60 Marks**	**Theory**	**:4 Credits**
Lab :0 Hrs./Week	**Internal Assessment**	**:40 Marks**	**Practical/Oral**	**:0 Credit**
	Term Work	**:NIL**	**Total**	**:4 Credits**
	Practical	**: NIL**		

Course Overview

The course teaches cognitive Sciences.

Prerequisite:

Knowledge of Neural Networks and Artificial Intelligence.

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

1. Know Introduction to Cognitive Science, Psychology, Nervous system and brain
2. Understand Brain and sensory motor information, Representation of sensory information
3. Analyse From Sensation to Cognition; Roots of Cognitive Science
4. Develop Language and Embodiment
5. Implement Affordances in biological and artificial systems, Cognitive Development
6. Make Attention, Learning, Memory, Reasoning, Social Cognition.

Unit I **06 Hours**

Introduction to the study of cognitive sciences. What is language? Affordances, Categories and concepts; Concept learning, Introduction to the study of cognitive sciences. Neural Network Models ,Linguistic knowledge: Syntax, semantics, (and pragmatics), Direct perception, Machine learning. History of cognitive science, Processing of sensory information in the brain, Ecological Psychology, Constructing memories, Methodological concerns in philosophy, Discretization and generating concept hierarchies, Installing Weka 3 Data Mining System, Generative linguistic, Affordance learning in robotics, Explicit vs. implicit memory

Unit II **06 Hours**

Cognitive Science and its methodology concerns in philosophy, Written materials needed to get a CogNeuro research study with human subjects off the ground: Runsheets, SOPs, questionnaires, informed consent forms, Perform stemming operation in python using NLTK, Writing and running Robot programs – Activity of PICK and Place of an object, Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.

Unit III **06 Hours**

Artificial intelligence and psychology, Brain Imaging, Brain and language, Affordance learning in robotics, Information processing (three-boxes) model of memory, Structure and constituents of the brain, fMRI, MEG, Language disorders,

Development, Brief history of neuroscience, PET, EEG, Lateralization, Child and robotic development, Sensory memory; Short term memory, Mathematical models, Multisensory integration in cortex, Lateralization, Attention and related concepts, Long term memory, Rationality.

Unit IV **06 Hours**

Experimental approach to studying the working human brain and body. How to use Brain Voyager Brain Tutor. How to use the BESA dipole simulator? Introduction to EEG recordings. Theory, physiology, practical aspects of recording and analyzing scalp recorded brain potentials. Perform lemmatization in python using NLTK. Make simulation model using Rockwell ARENA 11.0 to show the functions / predictions for a manufacturing work cell. Evaluating ML algorithm with balanced and unbalanced datasets Comparison of Machine Learning algorithms.

Unit V **06 Hours**

Mathematical models, Information fusion, The great past tense debate, Human visual attention, Bounded rationality; Prospect theory ; Heuristics and biases, Looking at brain signals, From sensation to cognition, The great past tense debate, Computational models of attention, Reasoning in computers. Looking at brain signals, Cybernetics, Cognitivist and emergent stand points, Computational models of attention, Key points in social cognition.

Unit VI **06 Hours**

Processing of sensory information in the brain. From physics to meaning, Analog vs. Digital: Code duality. A robotic perspective, Applications of computational models of attentional, Context and social judgment; Schemas; Social signals, Experimental approach to processing sensory information in the brain using python. EEG analysis: How to get from the raw recording to specific brain waves. An example analysis. Perform parts of speech tagging in python using NLTK, Simulation modeling of four machine system using Rockwell ARENA 11.0., Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.

Textbooks

1. Jiawei Han and Micheline Kamber, "Data Mining: Concepts and Techniques", Morgan KaufmannPublishers, 3rd ed, 2010.

Reference Books

1. LiorRokach and Oded Maimon, "Data Mining and Knowledge Discovery Handbook", Springer, 2nd edition, 2010
2. Box, G.E.P and Jenkins G.M. (1970) Time Series Analysis, Forecasting and Control, Holden-Day.
3. Draper, N. R. and Smith, H. (1998). Applied Regression Analysis (John Wiley) Third Edition. Hosmer, D. W. and Lemeshow, S. (1989). Applied Logistic Regression (Wiley).

Project Based Learning:

1. Implement an application using Backpropagation algorithm.

2. Make simulation model using Rockwell ARENA 11.0 0 to show the functions/ predictions for a manufacturing work cell.
3. Develop an application to process sensory information in the brain by using python.
4. Apply EM algorithm to cluster a set of data stored in a .CSV file and for the same data for clustering by using K-means algorithm.
5. Perform lemmatization in python using NLTK. (Natural Language ToolKit)
6. Case study on child and robotic development.
7. Case study on the great past tense debate.

Syllabus for Unit Tests:

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

ELECTIVE-III B INTRODUCTION TO IOT

TEACHING SCHEME	EXAMINATION SCHEME	CREDITS ALLOTTED
Lectures :4 Hrs./Week	**Semester Examination :60 Marks**	**Theory :4 Credits**
Lab :0 Hrs./Week	**Internal Assessment :40 Marks**	**Practical/Oral :0 Credit**
	Term Work :NIL	**Total :4 Credits**
	Practical : NIL	

Course Overview

This course covers the development of Internet of Things (IoT) products and services—including devices for sensing, actuation, processing, and communication—to help the learners to develop skills and experiences which they can employ in designing novel systems.

Prerequisite:

1. Basic principles of Electronics
2. Basic Programming Skills

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

1. Understand basic principles and concepts of Internet-of-Things use cases, applications, architecture and technologies
2. Get an overview of an end-to-end IoT system encompassing the edge, cloud and application tier
3. Architect a complete IoT application on their own
4. Build upon the foundations created in the pre-requisite courses
5. Think innovatively to come up with a hardware solution to a given problem
6. Understand various industrial IoT applications as well as IIoT

Unit I **8 Hours**

Introduction to IoT and Use cases: Understanding basic concepts of IoT, Consumer IoT vs Industrial Internet, Fundamental building blocks, Use Cases of IoT in various industry domains,

Unit II **8 Hours**

Architecture: IoT reference architectures, Industrial Internet Reference Architecture, Edge Computing, IoT Gateways, Data Ingestion and Data Processing Pipelines, Data Stream Processing

Unit III **8 Hours**

Sensors and Industrial Systems: Introduction to sensors and transducers, integrating sensors to sensor processing boards, introduction to industrial data acquisition systems, industrial control systems and their functions.

Unit IV **8 Hours**

Networking for IoT: Recap of OSI 7 layer architecture and mapping to IoT architecture, Introduction to proximity networking technologies (ZigBee, Bluetooth, Serial Communication), Industrial network protocols (Modbus, CANbus),

Unit V **8 Hours**

Communication for IoT: Communicating with cloud applications (web services, REST, TCP/IP and UDP/IP sockets, MQTT, WebSockets, protocols. Message encoding (JSON, Protocol Buffers)

Unit VI IoT **8 Hours**

Data Processing and Storage: Time Series Data and their characteristics, time series databases, basic time series analytics, data summarization and sketching, dealing with noisy and missing data, anomaly and outlier detection,

Textbooks

1. The Internet of Things, Samuel Greengard, MIT Press Essential

Knowledge Series2 Getting started with Internet of Things,Cuno Pfister

3 Precision: Principles, Practices and Solutions for the Internet of Things, Timothy Chou

4 Learning Internet of Things, Peter Waher

5 Analytics for the Internet of Things (IoT)**,** Andrew Minteer

Reference Books

1. Industrial Internet Reference Architecture - http://www.iiconsortium.org/IIRA.htm
2. World Economic Forum Report on Industrial Internet of Things -https://www.weforum.org/reports/industrial-internet-things
3. 50 Sensor Applications for a Smarter World - http://www.libelium.com/resources/top_50_iot_sensor_applications_ranking/
4. Visualizing Data-Exploring and Explaining Data with the Processing Environment, By Ben Fry,Publisher: O'Reilly Media
5. Raspberry Pi Computer Architecture Essentials, by Andrew K Dennis
6. Getting Started with Arduino, M. Banzi, O Reilly Media
7. GSMA IoT Security Guidelines & Assessment - https://www.gsma.com/iot/future-iot-networks/iot-security-guidelines/

List of Assignments

1. Setting up the Arduino Development Environment, connecting analog sensors to an Arduino Boarding and reading analog sensor data.

2. Digital Input and Output reading using and Arduino board and Arduino Development Environment.

3. Integrate an Arduino Board to a Raspberry Pi computer and send sensor data from Arduino to the R Pi

4. Setup Python on the R Pi and run sample R Pi programs on the R Pi. Read the data from Arduino using Python language

5. Connect a R Pi Camera module to the Raspberry Pi and using Python programming capture still images and video

6. Set up TCP/IP socket server on a PC. Send a message from the R Pi to the PC using socket communication

7. Set up a MQTT broker on the PC. Send data from R Pi to PC using MQTT protocol. Receive data from PC to R Pi using MQTT protocol

Project Based Learning:

1.Connect LED lights to an Arduino. Connect the Arduino to the R Pi. Send Message from PC to R Pi via MQTT protocol. On receipt of the message , toggle the LED lights on the Arduino

2.Connect LED lights to an Arduino. Connect the Arduino to the R Pi. Send Message from PC to R Pi via MQTT protocol. On receipt of the message toggle the LED lights on the Arduino

3.Set up an account in a cloud service (such as Google / AWS or Azure). Set up a simple Http server using a language of your choice. Push the image captured from the R Pi camera to this web service. On receiving the image, store the image in a database or file

4.Develop a mobile application to view the images captured by the R Pi camera.

Syllabus for Unit Tests:

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

ELECTIVE- III C. CRYPTOLOGY

TEACHING SCHEME	EXAMINATION SCHEME	CREDITS ALLOTTED
Lectures :4 Hrs./Week	**Semester Examination :60 Marks**	**Theory :4 Credits**
Lab :0 Hrs./Week	**Internal Assessment :40 Marks**	**Practical/Oral :0 Credit**
	Term Work :NIL	**Total :4 Credits**
	Practical : NIL	

Course Overview

To highlight the features of different technologies involved in Cryptology.

Prerequisite: Basic knowledge in Discrete Mathematics, logarithms and set theory, Basic knowledge in networking concepts of presentation layer and application layer.

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

1. An overview of basic cryptographic concepts and methods
2. A good knowledge of some commonly used cryptographic primitives and protocols
3. A sound understanding of theory and implementation, as well as limitations and vulnerabilities
4. An appreciation of the engineering difficulties involved in employing cryptographic tools to build secure systems

Unit I **06 Hours**

Introduction to Cryptography: Elementary number theory, Pseudo-randombit generation, Elementary Cryptosystems.

Unit II **06 Hours**

Basic security services: confidentiality, integrity, availability, non-repudiation, privacy

Unit III **06 Hours**

Symmetric key cryptosystems: Stream Cipher: Basic Ideas, Hardware and Software Implementations, Examples with some prominent ciphers: A5/1, Grain family, RC4, Salsa and ChaCha, HC128, SNOW family, ZUC; Block Ciphers: DES, AES, Modes of Operation; Hash Functions; Authentication

Unit IV **06 Hours**

Public Key Cryptosystems: RSA, ECC; Digital signatures

Unit V **06 Hours**

Security Applications (Selected Topics): Electronic commerce (anonymous cash, micro-payments), Key management, Zero-knowledge protocols, Cryptology in Contact Tracing Applications, Issues related to Quantum Cryptanalysis

Unit VI **06 Hours**

Introductory topics in Post-Quantum Cryptography: Refer to https://csrc.nist.gov/projects/post-quantum-cryptography. May discuss anytwo ciphers from this list.

List of Project Based Learning:

1. Enhanced Security Threat Analysis
2. Cybersecurity based on Applied Cryptography
3. Intrusion Detection and Prevention Systems
4. Hardware Trojans Identification and Stoppage
5. Resilience Challenges in Cyber-Physical Systems
6. Web-based Malware Detection, Analysis, and Prevention
7. Privacy, Trust and Security in Cloud Computing Hardware
8. Possible Computer Fault Attacks and Preventive Measures
9. Security Attack Detection and Mitigation in Side-channel
10. Cybersecurity against Cyber-attacks in the Internet of Things
11. Advanced Detection of Denial-of-Service (DoS) Attacks
12. Advance Security Mechanism for Artificial Intelligence

Textbooks

1. Cryptography, Theory and Practice. D. R. Stinson, CRC Press.
2. Handbook of Applied Cryptography. A. J. Menezes, P. C. van Oorschot, and S. A. Vanstone, CRC Press

Reference Books

1. A course in number theory and cryptography. N. Koblitz:, GTM, Springer.
2. Cryptography and Network Security. W. Stallings, Prentice Hall.
3. Security Engineering, R. Anderson, Wiley
4. RC4 Stream Cipher and Its Variants. G. Paul and S. Maitra: CRC Press, Taylor
5. & Francis Group, A Chapman & Hall Book, 2012
6. Design & Cryptanalysis of ZUC - A Stream Cipher in Mobile Telephony. C. S. Mukherjee, D. Roy, S. Maitra, Springer 2020
7. Contact Tracing in Post-Covid World - A Cryptologic Approach. P. Chakraborty, S. Maitra, M. Nandi, S. Talnikar, Springer 2020
8. Presskil Lecture notes: Available online: http://www.theory.caltech.edu/~preskill/ph229/

Syllabus for Unit Tests:

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

ELECTIVE IV A. QUANTUM COMPUTATION & QUANTUM INFORMATION

TEACHING SCHEME	EXAMINATION SCHEME	CREDITS ALLOTTED
Lectures :4 Hrs./Week	**Semester Examination :60 Marks**	**Theory :4 Credits**
Lab :0 Hrs./Week	**Internal Assessment :40 Marks**	**Practical/Oral :0 Credit**
	Term Work :NIL	**Total :4 Credits**
	Practical : NIL	

Course Overview:
This is an introductory course on quantum computing from perspective of computer science. This course will introduce the students to the postulates of quantum computing, formalisms like density matrices, effects of measurement. It will cover the quantum Turing machine and quantum circuit models of computation, and discuss Shor's factoring and Grover's search algorithms in this model

Prerequisite:
Basic Linear Algebra, Probability, Analysis and Design of Algorithms

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

1. To understand principles of quantum computing
2. To understand principles of quantum computing
3. To understand different quantum models of computation
4. To implement important quantum algorithms
5. To understand random number generation exploiting quantum physics
6. To learn quantum key distribution protocols

Unit I **08 Hours**

Quantum Mechanics: Hilbert space, Unitary and stochastic dynamics, Probabilities and measurements, Entanglement, Density operators and correlations.

Unit II **08 Hours**

Introduction to Quantum Information: States, Operators, Measurements, Quantum Entanglement: Quantum Teleportation, Super-dense coding, CHSHGame, Quantum gates and circuits

Unit III **08 Hours**

Quantum Algorithms: Deutsch-Jozsa, Simon, Grover, Shor, Implication of Grover's and Simon's algorithms towards classical symmetric key cryptosystems, Implication of Shor's algorithm towards factorization and Discrete Logarithm based classical public key cryptosystems

Unit IV **08 Hours**

Quantum True Random Number Generators (QTRNG): Detailed design and issues of quantumness, Commercial products and applications

Unit V **08 Hours**

Quantum key distribution (QKD):BB84, Ekert, Semi-Quantum QKD protocols and their variations, Issues of Device Independence, Commercial products

Unit VI **08 Hours**

Refer to https://csrc.nist.gov/projects/post-quantum-cryptography. May discuss any two ciphers from this list. Quantum key distribution, entropic uncertainty relations

Note: If any student also opts for Cryptology course, in that case the ciphers discussed in this course must differ from the ciphers that will be discussed in Cryptology course.

Textbooks

1. Quantum Computation and Quantum Information. M. A. Nielsen and I. L. Chuang, Cambridge University Press
2. Presskil Lecture notes: Available online: http://www.theory.caltech.edu/~preskill/ph229/

Reference Books

1. Introduction to Quantum Computing. P. Kaye, R. Laflamme, and M. Mosca, Oxford University Press, New York
2. Quantum Computer Science. N. David Mermin, Cambridge University Press
3. Quantum Cryptography. D. Unruh: Available online: https://courses.cs.ut.ee/all/MTAT.07.024/2017_fall/uploads/
4. NIST Post Quantum Cryptography, Available online: https://csrc.nist.gov/projects/post-quantum- An cryptography/round-2-submissions
5. Quantum Algorithms for Cryptographically Significant Boolean Functions - An IBMQ Experience. SAPV Tharrmashastha, D. Bera, A. Maitra and S. Maitra, Springer 2020.
6. Quantum Algorithm Zoo. https://quantumalgorithmzoo.org/
7. Handbook of Applied Cryptography. A. J. Menezes, P. C. van Oorschot, and S. A. Vanstone. CRC Press

Project Based Learning

1. Library with implementation of quantum gates and hardware, a part of Arline Benchmarks project.
2. Software for analysing fermionic quantum simulation algorithms with ProjectQ.
3. Compiling and analysing quantum algorithms for quantum chemistry simulations.
4. Algorithms for adaptive refinement of measurements.
5. Adaptive quantum computation in changing environments using projective simulation

Syllabus for Unit Tests:

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

ELECTIVE IV B. ADVANCED SOCIAL, TEXT AND MEDIA

TEACHING SCHEME	EXAMINATION SCHEME	CREDITS ALLOTTED
Lectures :4 Hrs./Week	**Semester Examination :60 Marks**	**Theory :4 Credits**
Lab :0 Hrs./Week	**Internal Assessment :40 Marks**	**Practical/Oral :0 Credit**
	Term Work :NIL	**Total :4 Credits**
	Practical : NIL	

Course Overview

Students will be able to hone their skills even further by embracing thenewer techniques in our data-driven world. Understanding how Web & Data Analytics, Artificial Intelligence & Machine Learning can be applied to Social Media and Digital Marketing will be the prime objective of this content rich program**.**

Prerequisite: Machine Learning, Database and Data mining

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

1.To be able to use various tools for Text Mining and carry out Pattern Discovery, Predictive Modelling.

2. Explore the use of social network analysis to understand the growing connectivity andcomplexity in the world around us on different scales ranging from small groups to the World Wide Web.

3.Perform social network analysis to identify important social actors, subgroups (i.e., clusters), and network properties in social media sites such as Twitter, Facebook, andYouTube.

4. Summarize knowledge on extraction and analyzing of social web
5. Describe Association rule mining algorithms
6. Recognize the evolution of social networks

Unit I **06 Hours**

Text Mining: Introduction, Core text mining operations, Preprocessing techniques, Categorization, Clustering, Information extraction, Probabilistic models for information extraction, Text mining applications

Unit II **06 Hours**

Methods & Approaches: Content Analysis; Natural Language Processing; Clustering & Topic Detection; Simple Predictive Modeling; Sentiment Analysis; Sentiment Prediction

Unit III **06 Hours**

Text Extraction: Introduction, Rapid automatic keyword extraction: candidate keywords, keyword scores, adjoining keywords, extracted keywords, Benchmark evaluation: precision and recall, efficiency, stop list, generation, Evaluation on new articles.

Unit IV **06 Hours**

Web Analytics: Web analytics tools, Clickstream analysis, A/B testing, onlinesurveys; Web search and retrieval, Search engine optimization, Web crawling and Indexing, Ranking algorithms, Web traffic models

Unit V **06 Hours**

Social Media Analytics: Social network and web data and methods. Graphs and Matrices. Basic measures for individuals and networks. Information visualization; Making connections: Link analysis. Random graphs and network evolution. Social contexts: Affiliation and identity; Social network analysis

Unit VI **06 Hours**

Extracting And Analyzing Web Social Networks: Extracting Evolution of Web Community from a Series of Web Archive, Temporal Analysis on Semantic Graphusing Three-Way Tensor, Decomposition, Analysis of Communities and Their Evolutions in DynamicNetworks.

Textbooks

1 Peter Mika, "Social networks and the Semantic Web", Springer, 2007. 2.
2. GuandongXu,Yanchun Zhang, and Lin Li, "Web Mining and Social Networking Techniques andApplications", Springer

Reference Books

1. Borko Furht, "Handbook of Social Network Technologies and Applications", 1st Edition, Springer,2010.
2. Guandong Xu ,Yanchun Zhang and Lin Li, "Web Mining and Social Networking – Techniques andapplications", First Edition Springer, 2011.
3. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, "Collaborative and Social InformationRetrieval and Access: Techniques for Improved user Modelling", IGI Global Snippet, 2009.
4. Charu C. Aggarwal, "Social Network Data Analytics", Springer; 2011.

Project Based Learning:

1. Analyze Amazon Product Reviews
2. Rotten Tomatoes and Their Review
3. Comparative Review of Facebook, Instagram, and TikTok as Primary Marketing Platforms for Small Businesses
4. Analyze IMDb Reviews
5. Track Customer Sentiment Over Time

Syllabus for Unit Tests:

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

ELECTIVE IV C. MOBILE COMPUTING

TEACHING SCHEME	EXAMINATION SCHEME		CREDIT ALLOTED	
Lecture: 04 Hours/Week	**University Examination:**	**60 Marks**		
	Internal Assessment:	**40 Marks**	**Lecture**	**4 credits**
	Term Work	**NIL**	**Total**	**4 credits**

Course Objective:
1.Course covers Mobile structure, communication technologies.

Prerequisite:
Basic understanding of networking is required

Course Outcomes: On completion of the course, students will have the ability to:
1.Study Mobile Infrastructure
2.Understand Location Management of Mobile.
3.Understand the Multiple Access Control
4.Use a wireless Network
5.Understand Cognitive radio network
6.Use 5G technology.

Unit I **08 Hours**

Introduction: Overview of wireless and mobile infrastructure; Preliminary concepts on cellular architecture; Design objectives and performance issues; Radio resource management and interface; Propagation and path loss models; Channel interference and frequency reuse; Cell splitting; Channel assignment strategies; Overview of generations:- 1G to 5G.

Unit II **08 Hours**

Location and handoff management: Introduction to location management (HLR and VLR); Mobility models characterizing individual node movement (Random walk, Fluid flow, Markovian, Activity based); Mobility models characterizing the movement of groups of nodes (Reference point based group mobility model, Community based group mobility model); Static (Always vs. Never update, Reporting Cells, Location Areas) and Dynamic location management schemes (Time, Movement, Distance, Profile Based); Terminal Paging (Simultaneous paging, Sequential paging); Location management and Mobile IP; Overview of handoff process; Factors affecting handoffs and performance evaluation metrics; Handoff strategies; Different types of handoffs (soft, hard, horizontal, vertical).

Unit III **08 Hours**

Wireless transmission fundamentals: Introduction to narrow and wideband systems; Spread spectrum; Frequency hopping; Introduction to MIMO; MIMO Channel Capacity and diversity gain; Introduction to OFDM; MIMO- OFDM system; Multiple access control (FDMA, TDMA, CDMA, SDMA); Wireless local area network; Wireless personal area network (Bluetooth and zigbee).

Unit IV **08 Hours**

Mobile Ad-hoc networks: Characteristics and applications; Coverage and connectivity problems; Routing in MANETs.
Wireless sensor networks: Concepts, basic architecture, design objectives and applications; Sensing and communication range; Coverage and connectivity; Sensor placement; Data relaying and aggregation; Energy consumption; Clustering of sensors; Energy efficient Routing (LEACH).

Unit V **08 Hours**

Cognitive radio networks: Fixed and dynamic spectrum access; Direct and indirect spectrum sensing; Spectrum sharing; Interoperability and co-existence issues; Applications of cognitive radio networks.

Unit VI **08 Hours**

D2D communications in 5G cellular networks: Introduction to D2D communications; High level requirements for 5G architecture; Introduction to the radio resource management, power control and mode selection problems; Millimetre wave communication in 5G

Textbooks

1. Mobile Communications. Jochen Schiller, Pearson Education.
2. Wireless Communications. Andrea Goldsmith, Cambridge University Press.
3 Wireless Communications: Principles and Practice. Theodore Rappaport, Pearson Education.
4. Wireless Communications. Ezio Biglieri, MIMO, Cambridge University Press.
5. Handbook of Wireless Networking and Mobile Computing. Ivan Stojmenovic, Wiley.

Reference Books

1. Dynamic Location Management in Heterogeneous Cellular Networks. James Cowling,
2. Wireless Device-to- Device Communications and Networks. Lingyang Song, Dusit Niyato, Zhu Han, and Ekram Hossain, Cambridge University Press.

List of Project Based Learning

1.Cluster Formation by Importance Rate & Butterfly form-based Partitioning
2.Device to Device Communication by Matching Theories
3.Inter-Cluster Multimedia Routing
4.Cloudlets Multimedia Routing
5.Task Offloading using Load Criterion Measures
6.PMSE: A Personalized Mobile Search Engine
7.Analyzing Wi-fi P2P in the Context of a Hangman Game
8.Facial Rigging and Animation in 3D: From a videogame perspective
9.Dynamically Personalizing Search Results for Mobile Users
10.Mobile Web Search Personalization using Ontological User Profile

Syllabus for Unit Tests:

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

PROJECT STAGE -I

TEACHING SCHEME		EXAMINATION SCHEME		CREDIT SCHEME	
					Credits
Lecture:	Hrs/Week	**End Semester Examination:** Marks		**Theory**	NIL
Practical:	2 Hrs/Week	**Continuous Assessment:** Marks			
Tutorials:	Hrs/Week	**Practical:**	NIL	**Practical**	NIL
		Term Work :	50 Marks	**Term Work:**	NIL
		Oral:	50 Marks	**Oral:**	03
		Total	100 marks	**Total**	**03**

Course Pre-requisites:
Basics of Software engineering, Software testing and knowledge of core computer engineering subjects.

Course Objectives:

- To develop problem solving abilities using mathematics.
- To apply algorithmic strategies while solving problems.
- To develop time and space efficient algorithms.
- To develop software engineering documents and testing plans.
- To use algorithmic solutions using distributed, Embedded, concurrent and parallel environments.

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

- Review and understand how previous experiences had an impact on affective states and intellectual performance
- Identify and define the problem.
- Decide critically to solve the problem.
- Demonstrate the ability to synthesize complex information from a variety of sources in decision-making.
- Predict and develop a group process and desired outcomes.
- Plan and perform collaboratively towards a common purpose.

1. The project will be undertaken preferably by a group of at least3- 4 students who will jointly work and implement the project over the academic year. The work will involve the design of a system or subsystem in the area of Computer Science.
2. If the project is chosen a hardware project it will involve the designing a system or subsystem or upgrading an existing system. The design must be implemented into a working model with necessary software interfacing and a user manual.
3. If the project is chosen in the pure Software Application it must involve the detail Software Design Specifications, Data Structure Layout, File Design, Testing with complete documentation and user interface, with life cycle testing and as an executable package.
4. The group will select a project with the approval of the guide (Staff members assigned) and submit the name of the project with a synopsis of 2 or 3 pages in the month of August in the academic year. A preliminary study report by the group must be submitted and certified at the end of seventh Semester.
5. It is expected that at least one research paper is published by each group with guide.

The project report stage-I will contain the details.

Problem definition and requirement specification, acceptance test procedure (ATP).

a) System definition, requirement analysis.

b) System design with UML.

c) Documentation and references.

Documentation will use UML approach with Presentation, Category, Use Case, Class Diagrams, etc

INTERNSHIP

TEACHING SCHEME		EXAMINATION SCHEME		CREDIT SCHEME	
					Credits
Lecture:	Hrs/Week	**End Semester Examination:**	Marks	**Theory**	
Practical:	Hrs/Week	**Continuous Assessment:**	Marks		
Tutorials:	Hrs/Week	**Practical:**	NIL	**Practical:**	NIL
		Term Work:	25 Marks	**Oral:**	03
		Oral:	25 Marks	**Term Work:**	NIL
		Total	50 marks	**Total**	**03**

Course Pre-requisites:
Professional Skills, Knowledge of core computer engineering subjects.

Course Objectives:

- To provide exposure for the students on practical engineering fields
- To have better understanding of engineering practice in general and a sense of frequent possible problems.
- To develop problem Identification abilities in real world
- To experience use of technology /tools for software development.
- To Identify their skills, values, beliefs, interests and personal abilities to develop the skills.
- To prepare and present a report.

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

- Propose a solution to solve real world problems with the help of technology.
- Apply software engineering principles.
- Evaluate and compare the various methodologies to solve a real-world problem.
- Report hands on experience of using modern software development tools.
- Assess their skills, values, beliefs, interests and personal abilities and act in congruence with them.
- Identify social and ethical responsibilities and develop skills to compete for lifelong learning.

As a part of the B. Tech Computer Science and Business System curriculum, Industrial Training is a Practical course, which the students B. Tech Computer Science and Business System should undergo in reputed Private / Public Sector / Government organization / companies as industrial training of 60 days weeks to be undergone by the student in the summer vacation after the semester VI. Examination and Oral examination will be conducted at the end of the semester VI

The Industrial Training Report:

An Industrial Training report should be prepared by each student. The report is expected to demonstrate development of practical and professional skills in Engineering through technical experience and application of theoretical knowledge. Development of skills in dealing with people,

and communication skills form part of the training experience. Students should seek advice from their employers to ensure that no confidential material is included into the report. The student should be able to present the report to prospective employers,

The following should be observed:

- Length of training
- Preliminary information
- Technical report/diary References should be made in the text to books, technical papers, standards etc., used during the training period and should be listed.
- Finally, a conclusion should include comprehensive comments on the type and value of experience gained, and how this relates to your professional career.
- A copy of the report should be submitted to his/her employer, another copy to the Department (through the respective Adviser).
- Students should also retain a personal copy of the report

B. TECH (Computer Science & Business Systems)

SEMESTER – VIII

COURSE SYLLABUS

SERVICES SCIENCE & SERVICE OPERATIONAL MANAGEMENT

TEACHING SCHEME	EXAMINATION SCHEME		CREDITS ALLOTTED	
Lectures :3 Hrs./Week	**Semester Examination**	**:60 Marks**	**Theory**	**:3 Credits**
Lab :0 Hrs./Week	**Internal Assessment**	**:40 Marks**	**Practical/Oral**	**:0 Credit**
	Term Work	**:NIL**	**Total**	**:3 Credits**
	Practical	**: NIL**		

Course Overview

Introduction to service, its nature, operations, development, design, quality relationships and Innovation.

Prerequisite:

Fundamentals of Management, Operations Research

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

1 Understand concepts about Services and distinguish it from Goods.
2 Able to identify characteristics and nature of Services.
3 Comprehend ways to design Services and evaluate those using Service qualities.
4 Understand how various methods can be used to operate and manage Servicebusinesses.
5 Understand how innovation can be approached from Services point of view.
6 Understand the need of Services Innovation.

Unit I **06 Hours**

Introduction: Introduction to the course, Introduction to service operations, Role of service in economy and society, Introduction to Indian service sector.

Nature of Services and Service Encounters: Differences between services and operations, Service package, characteristics, various frameworks to design service operation system, Kind of service encounter, importance of encounters.

Unit II **06 Hours**

Service-Dominant Logic: From Goods-Dominant logic to Service-Dominant logic, Value Co-creation. **Service Strategy and Competitiveness:** Development of Strategic Service Vision (SSV), Data Envelopment Analysis.

New Service Development: NSD cycle, Service Blueprinting, Elements of service delivery system.

Service Design: Customer Journey and Service Design, Design Thinking methods to aid Service Design.

Unit III **06 Hours**

Locating facilities and designing their layout: models of facility locations(Huff's retail model), Role of service-scape in layout design.

Service Quality: SERVQUAL, Walk through Audit, Dimensions of Servicequality & other quality tools.

Service Guarantee & Service Recovery: How to provide Service guarantee? How to recover from Service failure?

Unit IV **06 Hours**

Forecasting Demand for Services: A review of different types of forecasting methods for demand forecasting.

Managing Capacity and Demand: Strategies for matching capacity and demand, Psychology of waiting, Application of various tools used in managing waiting line in services.

Managing Facilitating Goods: Review of inventory models, Role of inventoryin services.

Unit V **06 Hours**

Managing service supply relationship: Understanding the supply chain/hub of service, Strategies for managing suppliers of service.

Unit VI **06 Hours**

Vehicle Routing Problem: Managing after sales service, Understanding services that involve transportation of people and vehicle, Techniques for optimizing vehicle routes.

Service Innovation: Services Productivity, Need for Services Innovation.

Textbooks

1. Fitzsimmons & Fitzsimmons, Service Management: Operations, Strategy, Information Technology, McGraw Hill publications (7th edition).

Reference Books

1. Wilson, A., Zeithaml, V. A., Bitner, M. J., & Gremler, D. D. (2012). Services marketing: Integrating customer focus across the firm. McGraw Hill.
2. Lovelock, C. (2011). Services Marketing, 7/e. Pearson Education India
3. Reason, Ben, and Lovlie, Lavrans, (2016) Service Design for Business: A Practical Guide to Optimizing the Customer Experience, Pan Macmillan India.
4. Chesbrough, H. (2010). Open services innovation: Rethinking your business to grow and compete in a new era. John Wiley & Sons.

Topics for Project Based Learning :

1. Choose any service organization around and present it from the perspective of: nature of service, classification of service, blueprint or service design analysis, service quality, and any additional perspective you would like to add.
2. Choose any latest research paper in services and explain your understanding and feedback on the same.
3. Case study of Huff's Retail model with reference to the service organization for locating different facilities.
4. Do a case study and prepare strategies for matching capacity and demand
5. Analyze the Psychology of waiting with reference to the service organization
6. Do a review of different types of forecasting methods for demand forecasting
7. Case study of inventory models, Role of inventoryin services.
8. Do a case study of supply chain/hub of service and prepare strategies for managing suppliers of service.
9. Prepare a case study Vehicle Routing Problem
10. Service industry requires innovation continuously. Do case study of its requirement

Syllabus for Unit Tests:

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

IT PROJECT MANAGEMENT

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

Course Overview

Course provides an in depth understanding of project management principles and industry perspective software project management practices

Prerequisite:
Knowledge of Software Engineering Principles.

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

1. Learn the techniques to effectively plan
2. Perform the Project Scheduling, tracking, Quality management and Project Cost estimation using different techniques
3. Develop strategies to calculate risk factors involved in IT projects.
4. decide an effective project management strategy by assessing the project's business background and scope
5. understand responsibility as a professional practitioner of project management
6. Use project management and monitoring tools.

Unit I **06 Hours**

Project Overview and Feasibility Studies: Identification, Market and Demand Analysis, Project Cost Estimate, Financial Appraisal.

Unit II **06 Hours**

Project Scheduling: Project Scheduling, Introduction to PERT and CPM, Critical Path Calculation, Precedence Relationship, Difference between PERT and CPM, Float Calculation and its importance, Cost reduction by Crashing of activity.

Unit III **06 Hours**

Cost Control and Scheduling: Project Cost Control (PERT/Cost), Resource Scheduling & Resource Levelling

Unit IV **06 Hours**

Project Management Features: Risk Analysis, Project Control, Project Audit and Project Termination.
Agile Project Management: Introduction, Agile Principles, Agile methodologies:
Agile Methodologies: XP, FDD, DSDM, Crystal.

Unit V **06 Hours**

Scrum: Various terminologies used in Scrum (Sprint, product backlog, sprint backlog, sprint review, retro perspective), various roles (Roles in Scrum), Best practices of Scrum. Relationship between Agile Scrum and Lean.

Unit VI **06 Hours**

DevOps: Overview and its Components, Containerization Using Docker, Managing Source Code and Automating Builds, Automated Testing and Test Driven Development, Continuous Integration, Configuration Management, Continuous Deployment, Automated Monitoring.

Textbooks

1. Mike Cohn, Succeeding with Agile: Software Development Using Scrum
2. Notes to be distributed by the course instructor on various topics

Reference Books

1. Roman Pichler, Agile Product Management with Scrum
2.Ken Schwaber, Agile Project Management with Scrum (Microsoft Professional)

Note: Workshops will be conducted as a part of this course which is mandatory for students to attend. The primary objective of the workshops is to teach the students the agile project management including Scrum and DevOps through group activities.

Project Based Learning:

1. Case study of Inventory IT Project Management
2. Case study of Communications IT Project management
3. Case study of IT Project Cost Management.
4. Case study of IT Project Integration Management.
5. Case study of IT Project Procurement Management.
6. Case study of IT Project Quality Management
7. Case study of IT Project Resource Management.
8. Case study of IT Project Scope Management.
9. Case study of IT Project Stakeholder Management.
10. Others related in this Domain

Syllabus for Unit Tests:

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

MARKETING RESEARCH & MARKETING MANAGEMENT

TEACHING SCHEME	EXAMINATION SCHEME	CREDITS ALLOTTED
Lectures :3 Hrs./Week	**Semester Examination :60 Marks**	**Theory :3 Credits**
Lab :0 Hrs./Week	**Internal Assessment :40 Marks**	**Practical/Oral :0 Credit**
Tutorial :1 Hrs./Week	**Term Work :NIL**	**Tutorial : 1 Credit**
	Practical : NIL	**Total :4 Credits**

Course Overview:

Course includes concepts of Marketing, Product Management, Business Marketing and marketing management.

Prerequisite:

Students should have basic knowledge about marketing skills.

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

1. Understand the basic marketing concepts.
2. Comprehend the concept of Product Life cycle and Product development.
3. Understand the basics of Pricing, Promotion and Distribution Strategy.
4. Comprehend the dynamics of marketing and analyze how its various components interact with each other in the real world.
5. Leverage marketing concepts for effective Internet Marketing.
6. Understand basic concepts and application of statistical tools in Marketing research.

Unit I **06 Hours**

Marketing Concepts and Applications: Introduction to Marketing & Core Concepts, Marketing of Services, Importance of marketing in service sector.

Marketing Planning & Environment: Elements of Marketing Mix, Analyzing needs & trends in Environment - Macro, Economic, Political, Technical & Social.

Understanding the consumer: Determinants of consumer behaviour, Factors influencing consumer behaviour.

Market Segmentation: Meaning & Concept, Basis of segmentation, selection of segments, Market Segmentation strategies, Target Marketing, Product Positioning.

Unit II **06 Hours**

Product Management: Product Life cycle concept, New Product development & strategy, Stages in New Product development, Product decision and strategies, Branding & packaging

Unit III **06 Hours**

Pricing, Promotion and Distribution Strategy: Policies & Practices –Pricing Methods & Price determination Policies. Marketing Communication– The promotion mix, Advertising & Publicity, 5 M's of Advertising Management. Marketing Channels, Retailing, Marketing Communication, Advertising.

Unit IV **06 Hours**

Marketing Research: Introduction, Type of Market Research, Scope, Objectives & Limitations, Marketing Research Techniques, Survey Questionnaire design & drafting, Pricing Research, Media Research, Qualitative Research

Data Analysis: Use of various statistical tools – Descriptive & Inference Statistics, Statistical Hypothesis Testing, Multivariate Analysis - Discriminant Analysis, Cluster Analysis, Segmenting and Positioning, Factor Analysis.

Unit V **06 Hours**

Internet Marketing: Introduction to Internet Marketing. Mapping fundamental concepts of Marketing (7Ps, STP); Strategy and Planning for Internet Marketing.

Unit VI **06 Hours**

Business to Business Marketing: Fundamental of business markets. Organizational buying process. Business buyer needs. Market and sales potential. Product in business markets. Price in business markets. Place in business markets. Promotion in business markets. Relationship, networks and customer relationship management. Business to Business marketing strategy.

Textbooks

1. Marketing Management (Analysis, Planning, Implementation & Control) – Philip Kotler
2. Fundamentals of Marketing – William J. Stanton & Others
3. Marketing Research – Rajendra Nargundkar
4. Marketing Management – V.S. Ramaswamy and S. Namakumari
5. Market Research – G.C. Beri
6. Market Research, Concepts, & Cases – Cooper Schindler

Reference Books

1. Marketing Management – Rajan Saxena
2. Marketing Management – S.A. Sherlekar
3. Service Marketing – S.M. Zha
4. Journals – The IUP Journal of Marketing Management, Harvard Business Review
5. Research for Marketing Decisions by Paul Green, Donald, Tull
6. Business Statistics, A First Course, David M Levine at al, Pearson Publication

Project Based Learning:

1) Make a case study on consumer behavior, and market segmentation with referring any product or service

2) Find a company and make a model of its Product Life Cycle and highlight their strategies of launching a new product

3) Make a short model on promotion mix, pricing and 5 M's of Advertising Management for considering your product or services

4 Make a tools (questionnaire,) for market research and discuss its outcomes and usages

5) Make a case study of the company which is using internet marketing effectively and productively highlight their strategies

6) Do the study of the firm which is good at B2B marketing discus its policies and tools are used by it

Syllabus for Unit Tests:

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

ELECTIVE V A. BEHAVIOURAL ECONOMICS

TEACHING SCHEME		EXAMINATION SCHEME		CREDITS ALLOTTED	
Lectures	**:3 Hrs./Week**	**Semester Examination**	**:60 Marks**	**Theory**	**:3 Credits**
Lab	**:0 Hrs./Week**	**Internal Assessment**	**:40 Marks**	**Practical/Oral**	**:0 Credit**
Tutorial	**:0 Hrs./Week**	**Term Work**	**:NIL**	**Tutorial**	**: 0 Credit**
		Practical	**: NIL**	**Total**	**:3 Credits**

Course Overview: : To impart knowledge on current ideas and concepts regarding decision making in Economics, particularly from a behavioral science perspective, which can affect choices and behavior of firms, households and other economics entities

Prerequisite: Knowledge of Mathematics

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

1. Various concepts in understand and apply traditional and modern Microeconomics, focusing on decision making, and
2. develop a holistic understanding of these concepts and their interconnections

Unit I **06 Hours**

Introduction The neoclassical/standard model and behavioral economics in contrast; historical background; behavioral economics and other social sciences; theory and evidence in the social sciences and in behavioral economics; losses, money illusion, charitable donation.

Unit II **06 Hours**

Basics of choice theory Revisiting the neoclassical model; utility in economics and psychology; models of rationality; connections with evolutionary biology and cognitive neuroscience; policy analysis – consumption and addiction, environmental protection, retail therapy; applications – pricing, valuation, public goods, choice anomalies

Unit III **06 Hours**

Beliefs, heuristics and biases Revisiting rationality; causal aspects of irrationality; different kinds of biases and beliefs; self-evaluation and self- projection; inconsistent and biased beliefs; probability estimation; trading applications – trade in counterfeit goods, financial trading behaviour, trade in memorabilia.

Unit IV **06 Hours**

Choice under uncertainty Background and expected utility theory; prospect theory and other theories; weighting; applications – reference points; loss aversion; marginal utility; decision and performance and probability ownership and trade consumption, income, in sports.

Unit V **06 Hours**

Intertemporal choice Geometric Discounting; preferences over time, of inter-temporal decisions; hyperbolic; discounting instantaneous; utility alternative concepts –future projection, mental accounts , heterogeneous selves, procedural choice; policy analysis – mobile calls, credit cards, organization of government; applications – consumption and savings clubs and membership, consumption planning

Unit VI **06 Hours**

Strategic Choice: Review of game theory and Nash equilibrium – strategies, information, equilibrium in pure and mixed strategies, iterated games, bargaining, signaling, learning; applications – competitive sports, bargaining and negotiation, monopoly and market entry Individual preferences; choice anomalies and inconsistencies; social preferences; altruism; fairness; reciprocity; trust; learning; communication; intention; demographic and cultural aspects; social norms; compliance and punishment; inequity aversion; policy analysis – norms and markets, labor markets, market clearing, public goods; applications – logic and knowledge, voluntary contribution, compensation design

Textbooks

1 An Introduction to Behavioral Economics, by N. Wilkinson and M. Klaes

Reference Books

1 Colin Cramer, George Loewenstien, Mathew Rabin Advances in Behavioral Economics, Princeton University Press

Project Based Learning:

Case studies based on following topics-

1. The effect of labor force participation on the economy and budget – A comparison
2. The effect of income changes on consumer choices
3. The impact of marital status on the labor force composition.
4. The difference in the consumption attitude in over the last decade – Critical analysis of consumer behavior trends
5. The relationship between salary levels and 'economic convergence'
6. Analyzing salary inequalities in and the forces behind such inequalities.
7. The evolution of consumption in over the last 10 years: Trends and consumer behavior.
8. Dynamics of the Gini index as a reflection of the problem of inequality in income
9. Cashless economy: The impact of demonetization on small and medium businesses
10. Privatization of Public Enterprises and its implications on economic policy and development

Syllabus for Unit Tests:

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

ELECTIVE V B. COMPUTATIONAL FINANCE & MODELING

TEACHING SCHEME	EXAMINATION SCHEME		CREDITS ALLOTTED	
Lectures :3 Hrs./Week	**Semester Examination**	**:60 Marks**	**Theory**	**:3 Credits**
Lab :0 Hrs./Week	**Internal Assessment**	**:40 Marks**	**Practical/Oral**	**:0 Credit**
Tutorial :0 Hrs./Week	**Term Work**	**:NIL**	**Tutorial**	**: 0 Credit**
	Practical	**: NIL**	**Total**	**:3 Credits**

Course Overview: Computational finance emphasizes practical numerical methods rather than mathematical proofs and focuses on techniques that apply directly to economic analyses

Prerequisite: Numerical Methods, Probability, Statistics, ordinary and partial differential equations, linearalgebra and analysis.

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

1. Understand existing financial models in a quantitative and mathematical way.
2. Apply these quantitative tools to solve complex problems in the areas of portfolio management, risk management and financial engineering.
3. Explain the approaches required to calculate the price of options.
4. Identify the methods required to analyse information from financial data and tradingsystems.
5. Understanding Statistical Analysis
6. Understanding Incomplete Markets and Electronic Trading

Unit I **06 Hours**

Numerical methods relevant to integration, differentiation and solving the partial differential equations of mathematical finance: examples of exact solutions including Black Scholes and its relatives, finite difference methods including algorithms and question of stability and convergence, treatment of near and far boundary conditions, the connection with binomial models, interest rate models, early exercise, and the corresponding free boundary problems, and a brief introduction to numerical methods for solving multi-factor models.

Unit II **06 Hours**

Black-Scholes framework: Black-Scholes PDE: simple European calls and puts; put- call parity. The PDE for pricing commodity and currency options. Discontinuous payoffs - Binary and Digital options. The Greeks: theta, delta, gamma, vega & rho and their role in hedging. The mathematics of early exercise - American options: perpetual calls and puts; optimal exercise strategy and the smooth pasting condition. Volatility considerations - actual, historical, and implied volatility; local vol and volatility surfaces.

Simulation including random variable generation, variance reduction methods and statistical analysis of simulation output. Pseudo random numbers, Linear congruential generator, Mersenne twister RNG. The use of Monte Carlo simulation in solving applied problems on derivative pricing discussed in the current finance literature. The technical topics addressed include importance sampling, Monte Carlo integration, Simulation of Random walk and approximations to diffusion processes, martingale control variables, stratification, and the estimation of the "Greeks. "

Unit III **06 Hours**

Financial Products and Markets: Introduction to the financial markets and the products which are traded in them: Equities, indices, foreign exchange, and commodities. Options contracts and strategies for speculation and hedging.

Unit IV **06 Hours**

Application areas include the pricing of American options, pricing interest rate dependent claims, and credit risk. The use of importance sampling for Monte Carlo simulation of VaR for portfolios of options

Unit V **06 Hours**

Statistical Analysis of Financial Returns: Fat-tailed and skewed distributions, outliers, stylized facts of volatility, implied volatility surface, and volatility estimation using high frequency data.

Unit VI **06 Hours**

Copulas, Hedging in incomplete markets, American Options, Exotic options, Electronic trading, Jump Diffusion Processes, High-dimensional covariance matrices, Extreme value theory, Statistical Arbitrage.

Textbooks

1. R. Seydel: Tools for Computational Finance, 2nd edition, Springer-Verlag, New York,2004.
2. P. Glasserman: Monte Carlo Methods in Financial Engineering, Springer-Verlag, NewYork, 2004.

Reference Books

1. W. Press, S. Teukolsky, W. Vetterling and B. Flannery, Numerical Recipes in C: The Artof Scientific Computing, 1997. Cambridge University Press, Cambridge, UK. Available on-line at: http://www.nr.com/
2. A. Lewis: Option Valuation under Stochastic Volatility, Finance Press, Newport Beach, California, 2000.
3. A. Pelsser: Efficient Methods for Valuing Interest Rate Derivatives, Springer-Verlag, NewYork, 2000.
4. D. Ruppert, Statistics and Data Analysis for Financial Engineering
5. R. Carmona: Statistical Analysis of Financial Data in S-Plus
6. N. H. Chan, Time Series: Applications to Finance
7. R. S. Tsay, Analysis of Financial Time Series
8. J. Franke, W. K. Härdle and C. M. Hafner, Statistics of Financial Markets: An Introduction

Project Based Learning

1. Monte Carlo methods for American options
2. Black–Scholes Analysis
3. Stochastic Return Models (VAR)
4. Stochastic Volatility Models (Heston, AR, GARCH)
5. Variance Reduction Methods

Syllabus for Unit Tests:

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

ELECTIVE V C. PSCYCHOLOGY

TEACHING SCHEME		EXAMINATION SCHEME		CREDITS ALLOTTED	
Lectures	**:3 Hrs./Week**	**Semester Examination**	**:60 Marks**	**Theory**	**:3 Credits**
Lab	**:0 Hrs./Week**	**Internal Assessment**	**:40 Marks**	**Practical/Oral**	**:0 Credit**
Tutorial	**:0 Hrs./Week**	**Term Work**	**:NIL**	**Tutorial**	**: 0 Credit**
		Practical	**: NIL**	**Total**	**:3 Credits**

Course Overview

Introduces students to the content areas of industrial psychology and the application of psychological theory to organizational issues. Topics include employment law, job analysis, recruitment and selection, training, performance appraisal and discipline, employee motivation, and workplace safety. Using an applied approach, this course will help prepare students for their roles as employees and managers.

Prerequisite:

Statistics courses are a must for any psychology major. Statistics offers a core background for understanding how psychologists investigate human behaviour.

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

1. Become conversant about the major content areas of Industrial Psychology (i.e., job analysis, recruitment, selection, employment law, training, performance management, and health/well-being issues in the workplace).
2. Gain further comfort with statistical concepts in the context of making personnel decisions to reinforce content learned in PSY203 or an equivalent introductory statistics course.
3. Gain practical experience by completing a series of hands-on projects involving job analysis, selection decisions, training programs, and employee well-being.
4. Deepen your understanding of tests and measurements so that you can collect accurate information and make sound data-based decisions.
5. Prepare for other focused seminar courses in Industrial/Organizational Psychology or Human Resource Management.
6. To allow the students to observe and interpret individual differences in behaviour in the light of sound theoretical systems of personality.

Unit I **06 Hours**

What is I/O Psychology? Research Methods, Statistics, and Evidence-based Practice, Introduction & Legal Context of Industrial Psychology, Job Analysis & Competency Modeling, Job Evaluation & Compensation, Job Design & Employee Well-Being, Recruitment.

Unit II **06 Hours**

Identifying Criteria & Validating Tests and Measures, Screening Methods, Intensive Methods.

Unit III **06 Hours**

Performance Goals and Feedback, Performance Coaching and Evaluation, Evaluating Employee Performance

Unit IV **06 Hours**

Employee Motivation, Satisfaction and Commitment, Fairness and Diversity

Unit V **06 Hours**

Leadership, Organizational Climate, Culture, and Development, Teams in Organizations, The Organization of Work Behavior

Unit VI **06 Hours**

Stress Management: Demands of Life and Work

Textbooks

1 Landy, F. J. and Conte, J. M. (2013). Work in the 21st Century (4th Edition). Oxford: Blackwell Publishing

2 Introduction to Psychology, University of Minnesota Libraries Publishing, ISBN 13: 9781946135131

3 Introduction to Psychology, Manoj Kr Singh, Anmol Publications Pvt. Ltd.

Reference Books

1 Encyclopedia of Psychology (English, Hardcover, unknown), Oxford University Press Inc ISBN: 9781557981875, 9781557981875,Edition: 2000

List of Assignments

1 Case study on Legal Context of Industrial Psychology

2 How to get Employee Motivation, Satisfaction and Commitment in working environment?

3 How to reducing the stress for compromising demands of life?

4 Case Study on Evaluating Employee Performance

Project Based Learning:

1. Causes and effects of communication breakdown in an organization (A case study of champions' breweries Uyo Akwa Ibom State)
2. Effect of parental care on the academic performance of primary school pupils
3. Organizational Behavior
4. Role of Emotional Words in Learning

Syllabus for Unit Tests:

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

ELECTIVE VI A) ENTERPRISE SYSTEMS

TEACHING SCHEME	EXAMINATION SCHEME		CREDITS ALLOTTED
Lectures :3 Hrs./Week	**Semester Examination**	**:60 Marks**	**Theory :3 Credits**
Lab :2 Hrs./Week	**Internal Assessment**	**:40 Marks**	**Practical :1 Credit**
Tutorial :0 Hrs./Week	**Term Work**	**:25 Marks**	**Tutorial : 0 Credit**
	Practical	**: 25 Marks**	**Total :4 Credits**

Course Overview

The course deals with Enterprise Systems, Service Oriented Architecture.

Prerequisite:

Have the knowledge of Databases and Networks.

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

1. Design and deploy Simple Web Applications using MVC
2. Design SOA and ERP models
3. Design of CRM models
4. Design interactive network and application
5. Manage, Maintain and configuration of Networking
6. Learn how to use the user interface using ERP Tools and Technologies.

Unit I **06 Hours**

Overview of: Database Management Systems. Overview of Model - View - Control (MVC),Control (MVC) method of software development in a 3 tier environment

Tools and Technologies: overview of the following : Java server pages , Related Java Technologies, Microsoft .NET framework, PHP, Ruby on Rails, Javascript, Ajax.

Unit II **06 Hours**

Service Oriented Architecture (SOA): Principles of loose coupling, encapsulation Inter-operatibility ,Web Services as the implementation vehicle protocols, usage **Enterprise Resource Planning (ERP):** systems and their architecture, Overview ofSAP and Oracle Applications, Generic ERP Modules: Finance, HR, Materials Management, Investment, etc , Examples of Domain Specific Modules .

Unit III **06 Hours**

Electronic Data Exchange, Customer Relationship Management (CRM), Supplier Relationship Management (SRM)

Security Issues - Authentication, Authorisation, Access control, Roles; single-sign-on, Directory servers, Audit trails; Digital signatures; Encryption: review of IPSec, SSL and other technologies; Simple Applications Demo .

Unit IV **06 Hours**

Network management in ERP: Overview of : MPLS, Virtual Private Networks (VPN),

Firewalls, Network monitoring and enforcement of policies.

Unit V **06 Hours**

ERP Software Acquisition Process: Tendering; conditions of contract, Commercial off the shelf software (COTS) versus Bespoke Implementations; Total cost of ownership, Issues on using Open source software or free software, Licensed software.

Unit VI **06 Hours**

Hardware Architectures for Enterprise Systems : Servers ,Clustering, Storage area networks, Storage units, Back-up strategies, Local Area Network (LAN) technologies and products, Data Centres.
Disaster recovery site design and implementation issues, Hardware Acquisition Issues.

Textbooks

1. Enterprise Resource Planning - Alexis Leon, Tata McGraw Hill.
2. Enterprise Resource Planning – Diversified by Alexis Leon, TMH.
3. Enterprise Resource Planning - Ravi Shankar & S. Jaiswal , Galgotia

Reference Books

1. E-Business Network Resource planning using SAP R/3 Baan and Peoplesoft : APractical Roadmap For Success By Dr. Ravi Kalakota

Project Based Learning

1. Shared Office Finder System Using Flutter
2. Memory Card Game Flutter App
3. Flutter Based Bill Reminder App
4. Three-Level Password System Using Python
5. Skin Disease Detection System Using CNN
6. Signature Verification System Using CNN
7. Online Election System Using Python
8. Library Management System Using Python
9. Heart Failure Prediction System

Syllabus for Unit Tests:

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

ELECTIVE VI B. ADVANCE FINANCE

TEACHING SCHEME	EXAMINATION SCHEME		CREDITS ALLOTTED	
Lectures :3 Hrs./Week	**Semester Examination**	**:60 Marks**	**Theory**	**:3 Credits**
Lab :2 Hrs./Week	**Internal Assessment**	**:40 Marks**	**Practical/Oral**	**:1 Credit**
Tutorial :0 Hrs./Week	**Term Work**	**:25 Marks**	**Tutorial**	**:0 Credit**
	Practical	**:25 Marks**	**Total**	**:4 Credits**

Course Overview

This course focuses on advanced financial decisions of corporate managers. The course uses case studies to illustrate the application of theoretical concepts to real- life.

Prerequisite:

Basics of Financial accounting

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

1. Imbibe knowledge about the decisions and decision variables involved with financial activities of the firm.
2. Develop skills for interpretation business information and application of financial theory in corporate investment decisions, with special emphasis on working capital management.
3. Familiarizing the students with the corporate and financial restructuring.
4. Explain optionality and its application to financial management and financial decisions
5. Present ideas and advocate for decisions using effective finance arguments,models and frameworks
6. Analyse how organisations can effectively manage risk in today's uncertain economy

Unit I: Sources of Funds (including regulatory framework) 06 Hours

Types of securities, Issuing the capital in market, Pricing of issue, Valuation of Stocks and bonds

Unit II: Dividend Decisions 06 Hours

Traditional Approach, Dividend Relevance Model, Miller and Modigliani Model, Stability of Dividends, Forms of Dividends, Issue of bonus shares, Stock Split.

Unit III: Evaluation of Lease Contracts, Corporate Restructuring 06 Hours

Mergers and Acquisitions- Types of Mergers, Evaluation of Merger Proposal, Take-over, Amalgamation, Leverage buy-out, Management buy-out, Corporate, Failure and Liquidation

Unit IV: Financial Restructuring 06 Hours

Share Split, Consolidation, Cancellation of Paid-up Capital, Other Mechanisms

Unit V: Working Capital Management: 06 Hours

Working Capital Planning, Monitoring and Control of Working Capital, Working Capital Financing, Managing the Components of Working Capital, Cash Management, Receivable Management, Inventory Management

Unit VI: Introduction to derivatives **06 Hours**

Basics of Futures, Forwards, Options, Swaps, Interest rate Payoff Diagrams, Pricing of Futures, Put Call Parity,Option Pricing using Binomial Model and Black Scholes Model, Use of Derivatives for Risk-Return Management- Credit DefaultSwaps

Textbooks

1. Brealey, Myers and Allen, Principles of Corporate Finance
2. Case Study Materials: To be distributed for class discussion

Project Based Learning :

1. Historical perspectives of markets like major boom and busts, bull and bear cycles, major market crashes, bubbles
2. Topic: Major scams in the market, e.g. Satyam case

Syllabus for Unit Tests:

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

ELECTIVE VI C. IMAGE PROCESSING AND PATTERN_RECOGNITION

TEACHING SCHEME	EXAMINATION SCHEME	CREDITS ALLOTTED
Lectures :3 Hrs./Week	**Semester Examination :60 Marks**	**Theory :3 Credits**
Lab :2 Hrs./Week	**Internal Assessment :40 Marks**	**Practical/Oral :1 Credit**
Tutorial :0 Hrs./Week	**Term Work :25 Marks**	**Tutorial :0 Credit**
	Practical :25 Marks	**Total :4 Credits**

Course Overview

It emphasizes general principles of image processing, rather than specific applications. This course includes foundations of pattern recognition algorithms and machines, including statistical and structural methods.

Prerequisite:

Fundamental knowledge of computer graphics algorithms, probability theory and transform operations in mathematics.

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

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.

1. Understand Basics of Image formation and transformation using sampling and quantization
2. Understand different types of signal processing techniques used for image sharpening and smoothing
3. Perform and apply compression and coding techniques used for image data
4. Understand the nature and inherent difficulties of the pattern recognition problems
5. Understand concepts, trade-offs, and appropriateness of the different feature types and classification techniques.
6. Understand and select a suitable classification process, features, and proper classifier to address a desired pattern recognition problem.

Unit I: Introduction to Image Processing **06 Hours**

Image formation, image geometry perspective and other transformation, stereo imaging elements of visual perception. Digital Image-sampling and quantization serial & parallel Image processing.

Unit II: Image Restoration **06 Hours**

Image Restoration-Constrained and unconstrained restoration Wiener filter, motion blur remover, geometric and radiometric correction Image data compression-Huffman and other codes transform compression, predictive compression two tone Image compression, block coding, run length coding, and contour coding.

Unit III: Segmentation Techniques **06 Hours**

Segmentation Techniques-thresh holding approaches, region growing, relaxation, line and edge detection approaches, edge linking, supervised and unsupervised classification techniques, remotely sensed image analysis and applications, Shape Analysis – Gestalt principles, shape number, moment Fourier and other shape descriptors, Skelton detection, Hough trans-form, topological and textureanalysis, shape matching.

Unit IV: Pattern Recognition **06 Hours**

Basics of pattern recognition, Design principles of pattern recognition system, Learning and adaptation, Pattern recognition approaches, Mathematical foundations – Linear algebra, Probability Theory, Expectation, mean and covariance, Normal distribution, multivariate normal densities, Chi squared test.

Unit V: Statistical Patten Recognition **06 Hours**

Bayesian Decision Theory, Classifiers, Normal density and discriminant functions, Parameter estimation methods: Maximum-Likelihood estimation,Bayesian Parameter estimation.

Unit VI Dimension reduction methods **06 Hours**

Principal Component Analysis (PCA), Hough Transform, Fisher Linear discriminant analysis, Expectation-maximization (EM), Hidden Markov Models (HMM),Gaussian mixture models.

Textbooks

1. Digital Image Processing – Ganzalez and Wood, Addison Wesley.
2. Fundamental of Image Processing – Anil K.Jain, Prentice Hall of India.
3. Pattern Classification – R.O. Duda, P.E. Hart and D.G. Stork, John Wiley.

Reference Books

1. Digital Picture Processing – Rosenfeld and Kak, vol.I & vol.II, Academic.
2. Computer Vision – Ballard and Brown, Prentice Hall.
3. Pattern Recognition and Machine Learning – C. M. Bishop, Springer.
4. Pattern Recognition – S. Theodoridis and K. Koutroumbas, 4th Edition, Academic Press.

List of Project Based Learning Topics:

1. Color Extraction of Images
2. RGB to HSI
3. Pseudo coloring
4. Addition Of Two Images
5. Subtraction Of Two Images
6. Multiplication Of Two Images

Syllabus for Unit Tests:

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

PROJECT STAGE -II

TEACHING SCHEME		EXAMINATION SCHEME		CREDIT SCHEME	
					Credits
Lecture:	Hrs/Week	**End Semester Examination:**	Marks	**Theory**	NIL
Practical:	4 Hrs/Week	**Continuous Assessment:**	Marks		
Tutorials:	Hrs/Week	**Practical:**	NIL	**Practical:**	NIL
		Term Work:	100 Marks	**Oral:**	06
		Oral:	100 Marks	**Term Work:**	NIL
		Total	200 marks	**Total**	**06**

Course Pre-requisites:
Fundamentals of Python, Data Visualization tools, Basics of Software engineering, Software testing and knowledge of core computer engineering subjects.

Course Objectives:

- To develop problem solving abilities using mathematics.
- To apply algorithmic strategies while solving problems.
- To prepare software engineering documents and design test cases.
- To demonstrate use of algorithmic solutions in real time problem.
- To encourage and expose students for participation in National/ International paper.
- presentation activities.
- Exposure to Learning and knowledge access techniques using Conferences, Journal
- papers and participation in research activities.

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

- Understand how to solve the problem.
- Demonstrate the ability to synthesize complex information from a variety of sources in decision-making
- Plan and perform collaboratively towards a common purpose.
- Demonstrate self-advocacy skills and self-reliant behaviour.
- Demonstrate the ability to develop and maintain satisfying interpersonal relationships.
- Evaluate and conclude the results with documentation.

1. The project will be undertaken preferably by a group of at least 3- 4 students who will jointly work and implement the project over the academic year. The work will involve the design of a system or subsystem in the area of Computer Engineering.

2. If the project is chosen a hardware project it will involve the designing a system – subsystem or upgrading an existing system. The design must be implemented into a working model with necessary software interfacing and a user manual.

3. If the project is chosen in the pure Software Application it must involve the detail Software Design Specifications, Data Structure Layout, File Design, Testing with complete documentation and user interface. With life cycle testing and as an executable package.

The group will submit at the end of Semester-VIII,

i) The workable project.

ii) The details of Research paper published in National/International paper conferences/journals for the project work carried out.

iii) Project Report in the form of bound journal complete in all aspects, 3 copies for the institute and 1 copy of each student in the group for certification.

The examiner in consultation with the guide will assess the term work.

Oral examination will be based on the project work completed by the candidate.

The project report will contain the following details:

1. Problem definition and requirement specification, acceptance tests procedure (ATP).
2. System definition, requirement analysis.
3. System design.
4. System implementation-code documentation –dataflow diagram / algorithm.
5. Test results and procedure, test report as per ATP.
6. Platform choice, use.
7. Appendix tools used, references.
8. Documentation will use UML approach with Presentation, Category, Use Case, Class Diagrams, etc.