BHARATI VIDYAPEETH

(DEEMED TO BE UNIVERSITY)

COLLEGE OF ENGINEERING, PUNE-43

B. Tech. (Computer Science & Business Systems)

2018 Course

B.Tech : Computer Science & Business Systems

Year 1

Sem 1		Teaching Scheme				Examination Scheme-Marks							Credit		
						End Semester Examination	Continuous Assessment			TW & Practical	TW & Oral	Total	Theory	Term Work	Total
ID	Course	Lecture	Tutorial	Practical	tact Hours per w		Unit Test	Attendance	Assignments						
1. 1	Mathematics I	3	1	0	4	60	20	10	10	-	-	100	4	0	4
1.2	Statistics I	3	1	0	4	60	20	10	10	-	-	100	4	0	4
1.3	Principles of Electrical Engineering	3	0	2	5	60	20	10	10	-	50	150	3	1	4
1.4	Fundamentals of Computer Science	3	1	2	6	60	20	10	10	50	-	150	4	1	5
1.5	Fundamentals of Physics	3	0	2	5	60	20	10	10	-	50	150	3	1	4
1.6	Business Communication & Value Science - I	2	1	2	5	50	-	-	-	-	50	100	3	1	4
	Total	17	4	8	29	350	100	50	50	50	150	750	21	4	25

Sem 2		Teaching Scheme				Examination Scheme-Marks							Credit		
						End Semester Examination	Continuous Assessment			TW & Practical	TW & Oral	Total	Theory	Term Work	Total
ID	Course	Lecture	Tutorial	Practical	tact Hours per w		Unit Test	Attendance	Assignments						
1. 7	Mathematics II	3	1	0	4	60	20	10	10	-	-	100	4	0	4
1.8	Statistics II	3	1	0	4	60	20	10	10	-	-	100	4	0	4
1. 9	Data Structures & Problem Solving	3	1	2	6	60	20	10	10	50	-	150	4	1	5
1.10	Fundamentals of Economics	3	0	0	3	60	20	10	10	-	-	100	3	0	3
1.11	Principles of Electronics	3	0	2	5	60	20	10	10		50	150	3	1	4
1.12	Business Communication & Value Science - II	2	1	2	5	50	-	-	-	-	50	100	3	1	4
1. 13	Self Learning Module	0	0	2	2	-	-	-	-	-	50	50	0	1	1
	Total	17	4	8	29	350	100	50		50	150	750	21	4	25

BHARATI VIDYAPEETH (Deemed to be University)

COLLEGE OF ENGINEERING, PUNE-43

B. Tech. (Computer Science & Business Systems)

Vision of the Department

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

Mission of the Department

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

Programme Educational Objectives

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

Programme Outcomes

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 life long learning for new IT practices.

Syllabus of Semester I

Mathematics I

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

Course Pre Requisites:

The students should have basic Knowledge of high school math, including trigonometry, geometry and calculus

Course Objective:

The course introduces fundamental concepts of Calculus and Discrete Mathematics.

Course Outcomes:

1) Evaluate double integral and triple integral to compute area, volume for two dimensional and three-dimensional solid structure.
2) Understand and apply basic concepts of Boolean algebra.
3) To recall the basic concepts of sets, functions and relations.
4) Develop fundamental understanding of Elementary Combinatory.
5) Understand various concepts of algebraic systems.
6) Student will be able to prove mathematical statements using induction method.

Topics to Be Covered:

UNIT – I **[6 Hours]**

Calculus: Differential calculus and integral calculus, double and triple integral.

UNIT – II **[6 Hours]**

Application of double and triple integral.

UNIT – III **[6 Hours]**

Boolean algebra: Introduction of Boolean algebra, truth table.

UNIT – IV **[6 Hours]**

Basic logic gate, basic postulates of Boolean algebra, principle of duality, canonical form, Karnaugh map.

UNIT – V **[6 Hours]**

Abstract algebra: Set, relation, group, ring, field.

UNIT – VI **[6 Hours]**

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

Home Assignments:

Assignments & tutorials covering the following: Successive differentiation, multiple integral, truth table, Karnaugh map, principle of mathematical induction, strong form of induction and pigeonhole principle.

Reference Books:

1. I. N. Herstein, "Topics in Algebra", John Wiley and Sons.
2. M. Morris Mano, "Digital Logic & Computer Design", Pearson
3. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publication, Delhi.

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

Statistics I

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 3Hrs/Week	Semester Examination: 60 marks	Theory: 4 Credits
Tutorials: 1Hr/Week	Continuous Assessment: 40 marks	
Lab: Nil	Term Work: Nil	

Course Pre-Requisites:

The students should have basic Knowledge of high school math and calculus

Course Objective:

The course introduces fundamental concepts of statistics and probability

Course Outcomes:

Course outcomes of Statistics-I

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 analyze relevant data
3) Students will be able to identify the types of sampling.
4) Students will be able to understand mathematical expectation and moments generating function.
5) Students will be able to apply concepts of various probability distributions to find probabilities.
6) Students will be able to apply concepts of Normal, Poisson, Binomial, uniform, exponential, t and F-distribution.

Topics to Be Covered:

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. Scatter diagram. Linear regression and correlation. Least squares method. Rank correlation.

UNIT III **[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 – IV **[6 Hours]**

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

UNIT – V **[6 Hours]**

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

UNIT – VI **[6 Hours]**

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

Home 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, Simulation

Text Books:

1. Introduction of Probability Models, S.M. Ross, Academic Press, N.Y.
2. Fundamentals of Statistics (vol. I and vol. II) - A. Goon, M. Gupta and B. Dasgupta.

Reference Books:

1. A first course in Probability, S.M. Ross.
2. Probability and Statistics for Engineers (4th Edition) - I.R. Miller, J.E. Freund and R. Johnson.
3. Statistical Concepts & Methods - G.K. Bhattacharyya and R.A. Johnson.
4. Introduction to the Theory of Statistics - A.M. Mood, F.A. Graybill & D.C. Boes.

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

Principles of Electrical Engineering

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hours / Week	End Semester Examination: 60 Marks	**Theory: 3 Credits**
Practical: 02 Hours / Week	Continuous Assessment: 40 Marks	
	Term Work and Oral: 50 Marks	**TW and Oral :1 Credit**

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.

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

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

Topics to Be Covered:

UNIT – I [4 Hours]

Basic Concepts: Concept of EMF, Potential Difference, current, resistance, Ohms law, resistance temperature coefficient, SI units of Work, power, energy. Conversion of energy from one form to another in electrical, mechanical and thermal systems

UNIT – II [8 Hours]

Network Theorems: Voltage source and current sources, ideal and practical, Kirchoff's laws and applications to network solutions using mesh analysis, Simplifications of networks using series-parallel, Star/Delta transformation. Superposition theorem, Thevenin's theorem, Max Power Transfer theorem.

UNIT III [4 Hours]

Electrostatics: Electrostatic field, electric field intensity, electric field strength, absolute permittivity, relative permittivity, capacitor composite, dielectric capacitors, capacitors in series& parallel, energy stored in capacitors, charging and discharging of capacitors, Batteries-Types, Construction& working.

UNIT – IV **[6 Hours]**

AC Fundamentals & 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 & rectangular form, concept of impedance, admittance, active, reactive, apparent and complex power, power factor, 3-ph balanced AC Circuits.

UNIT – V **[8 Hours]**

Magnetic Circuits & Transformer: Magnetic effect of electric current, cross and dot convention, right hand thumb rule, concept of flux, flux linkages, Flux Density, Magnetic field, magnetic field strength, magnetic field intensity, absolute permeability, relative permeability, Ampere's law, B-H curve, hysteresis loop, series-parallel magnetic circuit, composite magnetic circuit, Comparison of electrical and magnetic circuit

Faraday's law of electromagnetic induction, statically and dynamically induced emf, self-inductance, mutual inductance, coefficient of coupling,

Single phase transformer construction, principle of operation, EMF equation, voltage ratio, current ratio, kVA rating, losses in transformer, Determination of Efficiency & Regulation by direct load test.

UNIT – VI **[6 Hours]**

Electrical Wiring and Illumination system: Basic layout of distribution system, Types of Wiring System & Wiring Accessories, Necessity of earthing, Types of earthing, Different types of lamps (Incandescent, Fluorescent, Sodium Vapour, Mercury Vapour, Metal Halide, CFL, LED), Introduction to measuring devices/sensors and transducers related to electrical signals, Elementary methods for the measurement of electrical quantities in DC and AC systems and their practical application. :

Term Work: The term work shall consist of record of minimum eight exercises / experiments.

1. Determination of resistance temperature coefficient
2. Verification of Superposition Theorem
3. Verification of Thevenin's Theorem
4. Verification of Kirchoff's Laws
5. Verification of Maximum power transfer Theorem

6. Time response of RC circuit
7. Study of R-L-C series circuits for $X_L > X_C$, $X_L < X_C$ & $X_L = X_C$
8. Verification of current relations in three phase balanced star and delta connected loads.
9. Direct loading test on Single phase transformer
   a) Voltage and current ratios.
   b) Efficiency and regulations.
10. Study of a Residential (L.T.) Bill

Text Books:

1. B.L. Theraja- "A Textbook of Electrical Technology" Volume- I, S.Chand and Company Ltd.,New Delhi
2. V. K. Mehta, - "Basic Electrical Engineering", S. Chand and Company Ltd., New Delhi
3. I. J. Nagrath and Kothari – "Theory and problems of Basic Electrical Engineering", Prentice Hall of India Pvt. Ltd

Reference Books:

1. Edward Hughes – "Electrical Technology"- Seventh Edition, Pearson Education Publication
2. H. Cotton – "Elements of Electrical Technology", C.B.S. Publications
3. John Omalley Shawn – "Basic circuits analysis" Mc Graw Hill Publications
4. Vincent Del Toro – "Principles of Electrical Engineering", PHI Publications

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

Fundamentals of Computer Science

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 3Hrs./Week	Semester Examination: 60 marks	Theory: 4 Credits
Tutorials: 1Hr/Week	Continuous Assessment: 40 marks	
Lab: 2Hrs./Week	Term work & Practical: 50 Marks	TW and Practical :1 Credit

Course Pre-Requisites:

Knowledge of Class XII level computers will be helpful, but not mandatory.

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.

Topics to Be Covered:

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, Preprocessor, Standard Library Functions and return types

UNIT – IV **[6 Hours]**

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

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UNIT – V **[6 Hours]**

Structures: Basic Structures, Structures and Functions, Array of structures, Pointer of structures, Self-referral Structures, Table look up, Typedef, Unions, Bit-fields
Input and Output: Standard I/O, Formatted Output – printf, Formated Input – scanf, Variable length argument list, file access including FILE structure, fopen, stdin, sdtout and stderr, Error Handling including exit, perror and error.h, Line I/O, related miscellaneous functions

UNIT – VI **[6 Hours]**

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

Home Assignments:

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

Text Books:

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. Yashavant Kanetkar, "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

Fundamentals of Physics

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 3Hrs. /Week	Semester Examination: 60 marks	Theory: 3 Credits
Tutorials: Nil	Continuous Assessment: 40 marks	
Lab: 2 Hrs. / Week	Term Work and Oral : 50 marks	TW and Oral :1 Credit

Course Pre-Requisites:

Knowledge of Class XII level Physics and Mathematics

Course Objective:

The course introduces fundamental concepts of physics

Course Outcomes:

1. To understand the Importance of applications of Applied Physics in daily life
2. To provide students with a basic understanding of the Physics that may be required by engineers in the course of their careers
3. To impart knowledge related to the importance of EM waves and magnetic materials
4. To enhance knowledge related to lasers and its different components to make it suitable for various purposes
5. To introduce most important concepts of superconductivity, crystallography and fiber optics to the students
6. To introduce the learners to the basics of Special theory of relativity, X- rays, Quantum Mechanics

Topics to Be Covered:

UNIT – I [6 Hours]

Oscillations: Periodic motion-simple harmonic motion-characteristics of simple harmonic motion-vibration of simple springs 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 [6 Hours]

Classical Optics: Theory of interference fringes-types of interference-Fresnel's prism-Newton's rings, Diffraction-Two kinds of diffraction-Difference between interference and diffraction-Fresnel's half period zone and zone plate-Fraunhofer diffraction at single slit-plane diffraction grating. Temporal and Spatial Coherence, 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 **[6 Hours]**

Quantum Physics: 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, Heisenberg Picture.

UNIT – IV **[6 Hours]**

X-ray & Crystallography: Crystallography - Basic terms-types of crystal systems, Bravais lattices, miller indices, d spacing, Debye Scherrer powder method, laue method- Atomic packing factor for SC, BCC, FCC and HCP structures. Semiconductor Physics - conductor, semiconductor and Insulator; Basic concept of Band theory

UNIT – V **[6 Hours]**

Modern Optics: Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: Ruby Laser, CO2 and Neodymium lasers; 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 **[6 Hours]**

Thermodynamics: Zeroth law of thermodynamics, first law of thermodynamics, determination of j by Joule's method, Applications of first law, heat engines, Carnot's cycle and Carnot's engine, second law of thermodynamics, entropy, change in entropy in reversible and irreversible processes, third law of thermodynamics.

Home Assignments:

Problems based on Newton rings, Michelson interference, young double slit

Laboratory

1) Magnetic field along the axis of current carrying coil – Stewart and Gee
2) Determination of Hall coefficient of semiconductor
3) Determination of Plank constant
4) Determination of wave length of light by Laser diffraction method
5) Determination of wave length of light by Newton's Ring method
6) Determination of laser and optical fiber parameters
7) Determination of Stefan's Constant.

Text Books:

1. Halliday, Resnic and Walker, Fundamentals of Physics, 9th Ed.,John Wiley, 2011.
2. Beiser A, Concepts of Modern Physics, 5th Ed., McGraw Hill International, 2003.

3. Ajoy Ghatak, Optics, 5th Ed., Tata McGraw Hill, 2012
4. University Physics-Sears & Zemansky (Addison-Wesley)

Reference Books:

1. Basic Engineering Physics-Amal Chakraborty (Chaya Prakashani Pvt. Ltd.)
2. Basic Engineering Physics-I -Sujoy Bhattacharya, Saumen Paul (TMH)

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: 2Hr./Week	Semester Examination: 50 marks	Theory: 3 Credits
Tutorials: 1 Hr. / Week	Continuous Assessment: No	
Lab: 2 Hrs. / Week	Term Work and Oral: 50 marks	TW and Oral :1 Credit

Course Pre-Requisites:

1. Basic communication in tenses (past, present, future).
2. Awareness of common words (adjectives used in daily verbal communication).
3. Basic idea of sentence formation and thereby paragraph building and writing.
4. Communication according to daily and varied contextual scenarios.
5. Basic communication model/channel (sender, receiver and feedback), Active and passive listening skills.
6. Basic social etiquettes and knowledge of group work and communication that will enhance their professional growth.

Course Objective:

The course 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 also introduce them to the concept and importance of interpersonal skills so as to effectively present their personalities.

Course Outcomes:

1. Speak fluently in English without errors in tenses and hence present themselves as effective English communicators. They will be able to learn the 12 tenses and use them appropriately.
2. Differentiate between active and passive vocabulary and be able to use the 60 words discussed in class for their daily conversation and 40 words also given as assignments.
3. The ability to process their ideas and thoughts (verbal communication) into written communication in an effective, coherent and logical manner within a stipulated time and specific word limit of 100-150 words for paragraph writing.
4. Present them in a certain manner by using the 50-55 phrases discussed in class appropriately for group discussions, personal interviews during the campus recruitment process/competitive exams.
5. Enhance their communication skills by acquainting with the 2 important aspects of communication and helping them to overcome the 10 most common barriers of communication. Learn the 7 different types of listening skills; differentiate effective listening skills and understand the importance of it through 5 activities held in class and implement them in professional life.

6. Understand the importance of team work, team motivation and effective team communication for further implementation in the corporate life. They should also be able to identify concretely between team and group dynamics.

Topics to Be Covered:

UNIT – I **[6 Hours]**

Essential Grammar – I: Tenses: Basic forms and use, sentence formation (general & Technical), Common errors, Parts of speech through context, Direct and reported speech structures and voices.

UNIT – II **[6 Hours]**

Vocabulary Enrichment: Exposure to words from General Service List (GSL) by West, Academic word list (AWL) technical specific terms related to the field of technology, phrases, idioms, significant abbreviations formal business vocabulary

Phonetic: Pronunciation, Reduction of MTI in spoken English, Question formation with emphasis on common errors made during conversation

UNIT – III **[6 Hours]**

Written Communication – I: Letter Writing –Formal and Informal letter writing, Application letters, Report writing academic and business report, Job application letter

UNIT – IV **[6 Hours]**

Communication Skills: Importance of effective communication, types of communication- verbal and non - verbal, barriers of communication, effective communication, Listening Skills: Law of nature- Importance of listening skills, Difference between listening and hearing, Types of listening.

UNIT – V **[6 Hours]**

Self - Awareness & Self Development: Self - Assessment, Self - Appraisal, SWOT, Goal setting - Personal & career- Self-Assessment, Self-Awareness, Perceptions and Attitudes, Positive Attitude, Values and Belief Systems, Self-Esteem, Self - appraisal, Personal Goal setting, Career Planning, Personal success factors, Handling failure, Depression and Habit, relating SWOT analysis & goal setting, and prioritization

Socio-Cultural and Cross-Cultural Sensitivities at the Workplace: What is Inclusion? Women's contributions in Industry, work issues faced by women, what is sexual harassment, what is appropriate behavior for everyone at work

UNIT – VI **[6 Hours]**

Interpersonal Skills – I: Team work, Team effectiveness, Group discussion, Decision making - Team Communication. Team, Conflict Resolution, Team Goal Setting, Team Motivation Understanding Team Development, Team Problem Solving, Building the team dynamics. Multicultural team activity

Time Management: The Time management matrix, apply the Pareto Principle (80/20 Rule) to time management issues, to prioritize using decision matrices, to beat the most common time wasters, how to plan, how to handle interruptions, to maximize your personal effectiveness, how to say "no" to Time wasters

Values of a good manager: Understanding Corporate Values and behavior; Personal / Human Values; Pride and grace in Nationalist

Text Books:

1. Business Communication – Dr. Saroj Hire math
2. English vocabulary in use – Alan McCarthy and O'Dell

There will be handouts and reference links shared.

Reference Books

1. Strategic Writing by Charles Marsh
2. The Seven Basic Plots by Christopher Booker

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COLLEGE OF ENGINEERING, PUNE-43

B. Tech. (Computer Science & Business Systems)

Syllabus of Semester II

Mathematics II

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

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.

Topics to Be Covered:

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.

Home Assignments:

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

Text Book:

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

Statistics II

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 3 Hrs/Week	Semester Examination: 60 marks	Theory: 4 Credits
Tutorials: 1Hr/Week	Continuous Assessment: 40 marks	
Lab: Nil	Term Work: Nil	

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]**

Linear Statistical Models: Simple linear regression & correlation, multiple regression & multiple correlation, Analysis of variance (one way, two way with as well as without interaction)

UNIT – II **[6 Hours]**

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

UNIT – III **[6 Hours]**

Sufficient Statistic: concept & examples, complete sufficiency, their application in 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. Tolerance region

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

UNIT – VI **[6 Hours]**

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, Graphics in R

Home Assignments:

Problem sets to be shared by faculty covering the following topics:

Estimation Methods: Parametric & Non – Parametric, Hypothesis Testing

Text Books:

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 & Problem Solving

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 3 Hrs. / Week	Semester Examination: 60 marks	Theory: 4 Credits
Tutorials: 1 Hr. / Week	Continuous Assessment: 40 marks	
Lab: 2 Hrs./ Week	Term Work and Practical: 50 Marks	TW and Practical :1 Credit

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) Understand and implement Linear data structures
3) Understand and implement Non Linear data structure of Trees.
4) Understand and implement Non Linear data structure of Graphs.
5) Understand and implement the .
6) Understand the concepts of distributed system security.

Topics to Be Covered:

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

Home Assignments:

1. Towers of Hanoi using user defined stacks.
2. Reading, writing, and addition of polynomials.
3. Line editors with line count, word count showing on the screen.
4. Trees with all operations.
5. All graph algorithms.
6. Saving / retrieving non-linear data structure in/from a file

Text Books:

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

Reference Books:

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

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

Fundamentals of Economics

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 3 Hrs/Week	Semester Examination: 60 marks	Theory: 3 Credits
Tutorials: Nil	Continuous Assessment: 40 marks	
Lab: Nil	Term Work: Nil	

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.

Topics to Be Covered:

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.

Home Assignments:

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

Text Books:

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

Reference Books:

Other articles could be sent through email as and when a relevant topic is discussed.

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

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Lectures: 3Hrs/Week	**Semester Examination: 60 marks**	**Theory: 3 Credits**
Tutorials: Nil	**Continuous Assessment: 40 marks**	
Lab: 2 Hrs/ Week	**Term Work and Oral: 50 marks**	**TW and Oral :1 Credit**

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, 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 – both 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 and Operational Amplifier .
6. Demonstrate the knowledge of Boolean algebra including simplification techniques and operation of basic types of flip-flops.

Topics to Be Covered:

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. 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; 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, 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. 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, Boolean algebra, Basic and Universal Gates, Symbols, Truth tables, logic expressions, Logic simplification using K- map, Logic ICs, half and full adder/subtractor, multiplexers, demultiplexers, flip-flops, shift registers, counters.

List of Experiments:

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

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)

Text Books:

1. Sedra & Smith: Microelectronics Engineering
2. Millman &Halkias: Integrated Electronics

Reference Books:

1. Electronic Devices and Circuit Theory by Robert Boylestad
2. Solid State Electronic Devices by Streetman, Banerjee
3. Malvino: Electronic Principle

4. Schilling & Belove: Electronics Circuits
5. Millman & Grabal: Microelectronics
6. Salivahanan: Electronics Devices & Circuits
7. Boylestad & Nashelsky: Electronic Devices & Circuit Theory

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 - II

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Lectures: 2 Hrs/Week	**Semester Examination: 50 marks**	**Theory: 3 Credits**
Tutorials: 1 Hr/ Week	**Continuous Assessment: Nil**	
Lab: 2 Hrs/ Week	**Term Work and Oral: 50 marks**	**TW and Oral :1 Credit**

Course Pre-requisites:

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

Course Objective:

The course aims to augment students 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 so as to effectively present their personalities

Course Outcomes:

By the end of the course, students should be able to

1. Speak fluently in English without errors in the sentence construction and hence present themselves as effective English communicators. They will be able to learn 20-25 common errors made in parts of speech and also use 10 modal verbs efficiently during professional communication.
2. Differentiate between vocabulary used as adjectives, verbs and adverbs and be able to use the 60-70 words for their daily conversation.

3. Overcome the fear of speaking and will be aware of the 3 types of public speaking necessary according to the contemporary requirements. They would be able to deliver a public speech according to the need of the audience and also be aware of positive body language to be manifested during a speech.
4. Deal with the deeper parameters of working in teams like team motivation, multicultural team activity and team conflict resolution.
5. Analyze them relating to their hobbies and strengths and hence set realistic goals in terms of personal and professional growth. They will be able to identify at least 5-7 strengths and a couple of goals to be achieved that will enable their lives to be directed appropriately.
6. Apply 5-6 positive strategies to diversity and inclusion during team work.

Topics to Be Covered:

UNIT – I **[6 Hours]**

Essential Grammar – II: Application of tenses, Auxiliaries- correct usage and importance in formal communication, Business Vocabulary - Vocabulary exercises through web-based applications

UNIT – II **[6 Hours]**

Written Communication II: Email writing- Formal and Informal email writing structure, Inquiry letters, Instruction letters, complaint letters, Routine business letters, Sales Letters etc. Technical writing, Essay writing, Paragraph writing.

UNIT – III **[6 Hours]**

Vocabulary- II: Vocabulary exercises through web-based applications, Usage and application through mock meetings

Situational Conversation: Application of grammar and correct spoken English according to context/ situation and application in business scenario.

UNIT – IV **[6 Hours]**

Fundamentals of Effective Communication: Public Speaking: fundamentals of effective public speaking, types- Extempore speech, manuscript speech, and ways to enhance public speaking skills, storytelling, oral review

Presentation Skills: PowerPoint presentations, Effective ways to structure the presentation, importance of body language

Leadership Skills, Leader's Role, Responsibilities And Skill Required: Understanding good Leadership behaviors, Learning the difference between Leadership and Management, Gaining insight into your Patterns, Beliefs and Rules, Defining Qualities and Strengths of leadership, Determining how well you perceive what's going on around you, interpersonal Skills and Communication Skills, Learning about Commitment and How to Move Things Forward, Making Key Decisions, Handling Your and Other People's Stress, Empowering, Motivating and Inspiring Others, Leading by example, effective feedback.

Problem Solving Skill: Problem solving skill, Confidence building

UNIT – V **[6 Hours]**

Corporate / Business Etiquettes: Corporate grooming & dressing, etiquettes in social & office Setting-Understand the importance of professional behavior at the work place, Understand and Implement etiquettes in workplace, presenting oneself with finesse and making others comfortable in a business setting. Importance of first impression, Grooming, Wardrobe, Introduction to Ethics in engineering and ethical reasoning, rights and responsibilities

UNIT – VI **[6 Hours]**

Diversity and Inclusion Part II: 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

Values Sciences Part II: Values of a good manager: Ethics in Business; Embodying organizational pride with grace

Text Books:

1. Business Communication Today by Bovee, Thill, Raina
2. APAART: Speak Well 1 (English Language and Communication)
3. APAART: Speak Well 2 (Soft Skills)

Reference Books:

1. Strategic Communication by Charles Marsh
2. English vocabulary in use – Alan Mc'carthy and O'dell
3. Business Communication – Dr. Saroj Hiremath

Self Learning Module

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Lectures: 0 Hrs/Week	**Semester Examination: Nil**	
Tutorials: 0 Hr. / Week	**Continuous Assessment: Nil**	
Lab: 2 Hrs/ Week	**Term Work and Oral: 50 marks**	**TW and Oral :1 Credit**

Students will be undertaking self-learning courses in consultation with the faculty member as per their choices.

Bharati Vidyapeeth (Deemed to be University) College of Engineering, Pune
B.Tech- Computer Science & Business Systems (Semester- III and IV)
Revised New Syllabus Structure

Semester- III		Teaching Scheme				Examination Scheme-Marks							Credit		
						End Semester Examination	Continuous Assessment			TW & Practical	TW & Oral	Total	Theory	Term Work	Total
ID	Course	Lecture	Tutorial	Practical	Contact Hours per week		Unit Test	Attendance	Assignments						
2.1	Formal Language and Automata Theory	4	1	0	7	60	20	10	10	-	0	100	5	0	5
2.2	Computer Organization & Architecture	4	0	2	10	60	20	10	10	-	50	150	4	1	5
2.3	Object Oriented Programming	3	0	2	9	60	20	10	10	50	-	150	3	1	4
2.4	Computational Statistics	3	0	4	15	60	20	10	10	50	-	150	3	2	5
2.5	Software Engineering	4	1	2	13	60	20	10	10	50	-	150	5	1	6
2.6	Indian Constitution (Non Credit)	2	-	-	-	50	-	-	-	-	-	50	0	0	0
	Total	20	2	10	54	400	100	50	50	150	50	750	20	5	25

Semester- IV		Teaching Scheme				Examination Scheme-Marks							Credit		
						End Semester Examination	Continuous Assessment			TW & Practical	TW & Oral	Total	Theory	Term Work	Total
ID	Course	Lecture	Tutorial	Practical	Contact Hours per week		Unit Test	Attendance	Assignments						
2.7	Operating Systems	4	0	2	10	60	20	10	10	50	-	150	4	1	5
2.8	Database Management Systems	4	0	2	10	60	20	10	10	50	-	150	4	1	5
2.9	Software Design with UML	4	0	2	10	60	20	10	10	50	-	150	4	1	5
2.10	Introduction to Innovation, IP Management & Entrepreneurship	3	0	0	3	60	20	10	10	-	-	100	3	0	3
2.11	Business Communication & Value Science – III	2	0	4	14	50	0	0	0	-	50	100	2	2	4
2.12	Operations Research	2	0	2	8	60	20	10	10	-	50	150	2	1	3
2.13	Essence of Indian Traditional Knowledge(Non Credit)	2	-	-	-	50	-	-	-	-	-	50	0	0	0
	Total	21	0	12	55	400	100	50	50	150	100	850	19	6	25

FORMAL LANGUAGE & AUTOMATA THEORY

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 4Hrs./Week	Semester Examination: 60 marks	Theory: 5 Credits
Tutorials: 1Hr./Week	Continuous Assessment: 40 marks	
Lab: Nil	Term Work: Nil	

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 understand NP Hard and complete problems.

Topics to Be Covered:

UNIT – I **[6 Hours]**

Introduction: Alphabet, Strings and languages, Graphs, Directed Graphs, Trees.

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, *Kleene'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.

Reference Books:

Text Books:

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

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: 04 Hours / Week	End Semester Examination: 60 Marks	**Theory: 4 Credits**
Practical: 02 Hours / Week	Continuous Assessment: 40 Marks	
	Term Work and Oral: 50 Marks	**TW and Oral :1 Credit**

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.

Topics to Be Covered:

UNIT – I **[8 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 **[8 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 **[8 Hours]**

CPU control unit design: Hardwired and micro-programmed design approaches, design of a simple hypothetical CPU.

UNIT – IV **[8 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 **[4 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 **[4 Hours]**

Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards.

Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache coherency.

Home 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

Text Books:

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

B.Tech (Computer Science & Business Systems)

Semester – III

OBJECT ORIENTED PROGRAMMING

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 3Hrs./Week	Semester Examination: 60 marks	Theory: 3 Credits
Practical: 2 Hrs/Week	Continuous Assessment: 40 marks	
	Term Work and Practical: 50 marks	Term Work and Practical: 1 Credit

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.

Topics to Be Covered:

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 vs const, 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

Text Books:

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

Reference Books:

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

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

B.Tech in Computer Science & Business Systems

Final Syllabus, Semester – III

Computational Statistics

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 03 Hours / Week	End Semester Examination: 60 Marks	**Theory: 3 Credits**
Practical: 04 Hours / Week	Continuous Assessment: 40 Marks	**TW and Practical :2 Credit**
	Term Work and Practical: 50 Marks	

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

Course Objectives:

The aim of this course is to give graduate students a solid foundation of computational statistics, basics of analysis and Python programming. The course objective is to exercise students for data set handling, data wrangling, data visualization etc. using Python.

Course Outcomes:

- Understand basics of normal distribution and linear regression model.
- Apply knowledge of multivariate regression and discriminant analysis.
- Outline component analysis and factor analysis.
- Design various clusters
- Understand and demonstrate fundaments of Python programming.
- Demonstrate visualization in Python

Topics to Be Covered:

UNIT – I [8 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 – II [5 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 III [7 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 – IV **[5 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.

UNIT – V **[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 – VI **[6 Hours]**

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

Visualization in Python: Matplotlib package, Plotting Graphs, Controlling Graph, Adding Text, More Graph Types, Getting and setting values, Patches.

Term Work

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 Multivariate Normal Distribution.
8. Implementation Multiple Linear Regression Model
9. Implementation Multivariate Regression
10. Implementation Discriminant Analysis
11. Implementation clustering and segmentation
12. Implementation of data wrangling, data aggregation, group operations and time series operations.
13. Data Visualization in Python.

Text Books:

1. *An Introduction to Multivariate Statistical Analysis,* T.W. Anderson.
2. *Applied Multivariate Data Analysis, Vol I & II,* J.D. Jobson.
3. *Beginning Python: From Novice to Professional,* Magnus Lie Hetland. *Edition, 2005.*

Reference Books:

1. *The Foundations of Factor Analysis*, A.S. Mulaik.
2. *Introduction to Linear Regression Analysis*, D.C. Montgomery and E.A. Peck.
3. *Python for Data Analysis,* Wes Mc Kinney.
4. *Programming Python,* Mark Lutz.
5. *Python 3 for Absolute Beginners,* Tim Hall and J-P Stacey.

SOFTWARE ENGINEERING

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 4Hrs./Week	Semester Examination: 60 marks	Theory: 5 Credits
Tutorials: 1Hr./Week	Continuous Assessment: 40 marks	Term Work and Practical credit: 1
Lab: 2Hrs./Week	Term Work and Practical: 50	

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

Topics to Be Covered:

UNIT – I [6 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 [6 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 [6 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 [6 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 [6 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 [6 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.

Home Assignments:

1. UML diagrams
2. Data Flow Diagrams
3. Testing
4. Software project covering various software development methodology techniques will be implemented.

Text Books:

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

Reference Books:

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

4. *Software Requirements and Specification: A Lexicon of Practice, Principles and Prejudices*, MichaelJackson
5. *The Unified Development Process*, Ivar Jacobson, Grady Booch, James Rumbaugh
6. *Design Patterns: Elements of Object-Oriented Reusable Software*, Erich Gamma, Richard Helm,Ralph Johnson, John Vlissides
7. *Software Metrics: A Rigorous and Practical Approach*, Norman E Fenton, Shari Lawrence Pfleeger

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

Indian Constitution

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 2Hrs./Week	**Semester Examination: 50 marks**	**Theory: Non Credits**

Course Pre-Requisites:

Basic knowledge of Panchayat Raj and human rights studied at schooling level.

Course Objective:

Developing constitutional awareness, democracy at grass root level, human rights and duties among students and responsibilities towards nation building through technology.

Course Outcomes:

Upon completion of the course, Students will be able to

1. Aware with constitutional creation and Process.
2. Understand the process of Panchayat Raj and its working.
3. Understand human rights and responsibilities.
4. Recognize the responsibilities for societal well-being.
5. Recognize the roles of constitution for corporate culture building.
6. Get familiar with the science of Nation building through constitutional process of India.

Topics to Be Covered:

UNIT – I [6 Hours]

Union Government and its Administration: 'Constitution' meaning of the term, Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy, Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha.

UNIT – II [6 Hours]

State Government and its Administration: Governor: Role and Position, CM and Council of ministers, State Secretariat: Organization, Structure and Functions. Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Pachayati raj: Introduction, PRI: Zila Pachayat, Elected officials and their roles, CEO Zila Pachayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

UNIT – III [6 Hours]

Duties and Fundamental Rights: Features of fundamental rights, laws inconsistent with fundamental rights, right to equality, right to freedom, right against exploitation, right to freedom of religion, cultural and educational rights, right to constitutional remedies, criticism of fundamental rights, significance of fundamental rights Swaran Singh's Committees recommendation, list of fundamental duties, features of fundamental duties, Protection of Human Rights Act, 1993.

Reference Books:

1. Indian Polity' by Laxmikanth Pub Macgrow Hill
2. Indian Constitution by M.V. Pylee,
3. Human Rights in Constitutional Law by Durgadas Basu
4. Indian Constitution Upkar Publication

OPERATING SYSTEM

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 4Hrs./Week	Semester Examination: 60 marks	Theory: 4 Credits
Tutorials: 0Hr./Week	Continuous Assessment: 40 marks	Term Work and Practical credit: 1
Lab: 2Hrs./Week	Term Work and Practical: 50	

Course Pre Requisites:

Prerequisites for this course include thorough knowledge in some high-level programming language of C or C++ and UNIX and Linux 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 Objective:

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 algorithms, deadlock detection algorithms and agreement protocols

5. To know the management aspects of memory management and virtual memory

6. To learn programmatically file management techniques

Course Outcomes:

1. To learn the evolution of operating system.
2. To Understand the concept of process and process state transition and thread and concept of multithreading.
3. Understand the importance of scheduling and types of scheduling algorithms.
4. To understand the inter process communication strategies, concept of deadlock and criteria of deadlock occurrence along with its avoidance
5. To understand the memory management techniques, paging and segmentation.
6. To understand the file management and disk management techniques

Topics to Be Covered:

UNIT – I [6 Hours]

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 [6 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 [6 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 [6 Hours]

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 [6 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 [6 Hours]

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.

Home Assignments:

1. To implement scheduling algorithms
2. To implement resource allocation graph
3. To implement Banker's Algorithm
4. To implement the shell programming in UNIX OS

Text Books:

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

Reference Books:

1. *Operating Systems: Internals and Design Principles*. William Stallings.
2. *Operating System: A Design-oriented Approach*. Charles Patrick Crowley.
3. *Operating Systems: A Modern Perspective*. Gary J. Nutt.
4. *Design of the Unix Operating Systems*. Maurice J. Bach.
5. *Understanding the Linux Kernel*, Daniel Pierre Bovet, Marco Cesati.

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

Database Management Systems

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 4 Hrs./Week	Semester Examination: 60 marks	Theory: 4 Credits
Tutorials: NIL	Continuous Assessment: 40 marks	Term Work and Practical : 1 credit
Lab: 2 Hrs./Week	Term Work and Practical: 50	

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

Course Outcomes:

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

Topics to Be Covered:

UNIT – I [6 Hours]

Introduction: Introduction to Database. Hierarchical, Network and Relational Models.

Database system architecture: Data Abstraction, Data Independence, Data DefinitionLanguage (DDL), Data Manipulation Language (DML).

Data models: Entity-relationship model, network model, relational and object orienteddata models, integrity constraints, data manipulation operations.

UNIT – II[6 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 [6 Hours]

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

UNIT – IV [6 Hours]

Query processing and optimization: Evaluation of relational algebra expressions, Queryequivalence, Join strategies, Query optimization algorithms.

Storage strategies: Indices, B-trees, Hashing.

UNIT – V [6 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 [6 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, Webdatabases, Distributed databases, Data warehousing and data mining.

Assignments:

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

Text Books:

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: 4Hrs./Week	Semester Examination: 60 marks	Theory: 4 Credits
Lab: 2Hrs./Week	Continuous Assessment: 40 marks	Term Work and Practical credit: 1
	Term Work and Practical: 50	

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 behavior and business processes using .

Course Outcomes:

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

Topics to Be Covered:

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.

Home Assignments:

5. Study of UML notations
6. Class diagram
7. Interaction diagrams
8. Activity diagram
9. State diagram
10. Software project covering various software development methodology techniques will be implemented.

Text Books:

1. Object-Oriented Software Engineering: using UML, Patterns, and Java. Bernd Bruegge and Allen H. Dutoit.

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: 5 Credits
Tutorials: 0Hr./Week	Continuous Assessment: 40 marks	Term Work and Practical credit: 1
Lab: 0Hrs./Week	Term Work and Practical: 00	

Course Pre Requisites:

Good knowledge of Fundamentals of Management (Covered in Year 2, Semester 1)

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:

As a part of this course, students will:

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

Topics to Be Covered:

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.

Home Assignments:

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.

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.

Topic 1- Is innovation manageable or just a random gambling activity?

Topic 2- Innovation: Co-operating across networks vs. 'go-it-alone' approach.

Topic 3- Major Court battles regarding violation of patents between corporate companies.

Text Books:

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 and Value Science-III

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 2Hrs./Week	Semester Examination: 50 marks	Theory: Credits 02
Tutorials: 0 Hr./Week	Continuous Assessment: No	Term Work Credit: 02
Lab: 4 Hrs./Week	Term Work and Oral: 50	

Course Pre Requisites:

Good knowledge of Business Communication and Value Science (Covered Semester 1 and 2) Basic Knowledge of English (verbal and written) Completion of all units from Semesters 1 and 2

Course Objective:

Develop technical writing skills; introduce students to Self-analysis techniques like SWOT & TOWS and develop the sense of Pluralism & cultural spaces, Cross-cultural communication, Science of Nation building**.**

Course Outcomes:

Upon completion of the course, students shall have ability to

Apply & analyze the basic principles of SWOT & life positions.

Understand, analyze & leverage the power of motivation in real life.

Identify & respect pluralism in cultural spaces.

Understand and apply the concepts of Global, glocal and translocational

Analyze cross cultural communication

Apply the science of Nation building, the diverse culture of India

Identify the common mistakes made in cross-cultural communication, tools of technical writing, recognize the roles and relations of different genders.

Understand Artificial intelligence &recognize its impact in daily life

Topics to Be Covered:

UNIT – I [6 Hours]

SWOT and Life Positions:

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 [6 Hours]

SWOT and TOWS:

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 [6 Hours]

Pluralism in cultural spaces:

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

UNIT – IV [6 Hours]

Cross cultural communication

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 [6 Hours]

Nation Building:

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

UNIT – VI [6 Hours]

Roles of technical writing in science and technology:

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

Text Books:

1. **Swot Analysis: A Guide to Swot for Business Studies Students by Alan Sarsby**
2. **The SWOT Analysis: Using Your Strength to Overcome Weaknesses, Using Opportunities to Overcome Threats by Lawrence G. Fine**
3. **Cross-Cultural and Intercultural Communication by William B. Gudykunst**

Operations Research

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 2Hrs./Week	Semester Examination: 60 marks	Theory: 2 Credits
Tutorials: 0Hr./Week	Continuous Assessment: 40 marks	Term Work and Practical credit: 1
Lab: 2Hrs./Week	Term Work and Practical: 50	

Course Pre Requisites:

Good knowledge of mathematics (Covered in Year 1,2)

Course Objective:

Course Outcomes:

As a part of this course, students will:

- Understand OR problem and associated models.
- Understand Linear Algebra.
- Use transportation and assignment problems.
- Use PERT for modeling.
- Use Inventory Control System.
- Apply queuing theory and modulation techniques.

Topics to Be Covered:

UNIT – I [6 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 [6 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 [6 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 [6 Hours]

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

UNIT – V [6 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 [6 Hours]

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.

Text Books:

3. *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

Essence of Indian Traditional Knowledge

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 2Hrs./Week	Semester Examination: 50 marks	Theory: Non-Credits

Course Objective: Give exposure to the repositories of our indigenous knowledge and wisdom which have evolved over centuries, and they still continue to serve social and cultural functions.

Course Outcomes: Student will be able to

1. Understand basic principles, thought process, reasoning and inference of Indian Traditional Knowledge Systems.
2. Recognize wisdom of Sanskrit literature and its importance in modern society with rapid technological advancements.
3. Be familiar with scientific worldview and basic principles of Yoga and holistic health care system
4. Understand that sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature.

Topics to Be Covered:

UNIT – I [6 Hours]

Basic Structure of Indian Knowledge System: The historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), Traditional Knowledge (TK) Vs western knowledge traditional knowledge vis-à-vis formal knowledge. Significance of TK Protection, value of TK in global economy, Role of Government to harness TK. The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act).

.

UNIT – II [6 Hours]

Modern Science and Indian Knowledge System; Mathematics in India, Early Historical Period, The Classical Period, The Classical Period, post-Āryabhaṭa, Features of Indian Mathematics. Early Chemical Techniques, Atomism in Vaiśeṣika, Chemistry in Early Literature, Indian Philosophy Sāṁkhya, Yoga, Vaiśeṣika, Nyāya, Mīmāṁsā, Vedānta, Sāṁkhya.

UNIT – III [6 Hours]

Yoga and Holistic Health care: Ayurveda for Life, Health and Well-being ,Definition of Ayurveda, The Principles of Ayurvedic Healing, Treating diseases to restore health, Astanga Ayurveda.

Reference Books:

1. V. Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, Bharatiya Vidya Bhavan, Mumbai. 5th Edition, 2014.

2. Swami Jitatmanand, Holistic Science and Vedant, Bharatiya Vidya Bhavan.
3. "Knowledge Traditions and Practices of India" Kapil Kapoor, Michel Danino
4. RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, Vidyanidhi Prakasham, Delhi, 2016

E-Resources:

1. https://www.youtube.com/watch?v=LZP1StpYEPM
2. http://nptel.ac.in/courses/121106003/

Bharati Vidyapeeth (Deemed to be University) College of Engineering, Pune
B.Tech- Computer Science & Business Systems (Semester- V and VI)
Revised New Syllabus Structure

Semester- V		Teaching Scheme				Examination Scheme-Marks							Credit		
						End Semester Examination	Continuous Assessment			TW & Practical	TW & Oral	Total	Theory	Term Work	Total
ID	Course	Lecture	Tutorial	Practical	Contact Hours per week		Unit Test	Attendance	Assignments						
3.1	Design And Analysis of Algorithms	3	0	2	5	60	20	10	10	50	--	150	3	1	4
3.2	Compiler Design	3	0	2	5	60	20	10	10	50	--	150	3	1	4
3.3	Fundamentals of Management	4	0	0	4	60	20	10	10	--	--	100	4	0	4
3.4	Business Strategy	3	0	0	3	60	20	10	10	--	--	100	3	0	3
3.5	Design Thinking	3	0	2	5	60	20	10	10	--	50	150	3	1	4
3.6	Elective I	3	1	2	6	60	20	10	10	--	50	150	4	1	5
3.7	Mini Project	0	0	2	2	50	--	--	--	--	50	50	0	1	1
	Total	19	1	10	30	410	120	60	60	100	150	850	20	5	25

Elective I	Coversational Systems
	Cloud, Microservices & Application
	Machine Learning

Semester- VI		Teaching Scheme				Examination Scheme-Marks							Credit		
						End Semester Examination	Continuous Assessment			TW & Practical	TW & Oral	Total	Theory	Term Work	Total
ID	Course	Lecture	Tutorial	Practical	Contact Hours per week		Unit Test	Attendance	Assignments						
3.8	Computer Networks	3	0	2	5	60	20	10	10	50	--	150	3	1	4
3.9	Information Security	3	0	2	5	60	20	10	10	--	50	150	3	1	4
3.10	Artificial Intelligence	3	0	2	5	60	20	10	10	50	--	150	3	1	4
3.11	Financial & Cost Accounting	4	0	0	4	60	20	10	10	--	--	100	4	0	4
3.12	Business Communication & Value Science – IV	3	0	2	5	50	0	0	0	-	50	100	3	1	4
3.13	Elective II	3	1	2	6	60	20	10	10	--	50	150	4	1	5
	Total	19	1	10	30	350	100	50	50	100	150	800	20	5	25

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

DESIGN AND ANALYSIS OF ALGORITHMS

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 3 Hrs./Week	Semester Examination: 60 marks	Theory: 3 Credits
Tutorials: NA	Continuous Assessment: 40 marks	Term Work and Practical Credit: 1
Lab: 2 Hrs./Week	Term Work and Practical: 50	

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.

Topics to Be Covered:

UNIT – I [6 Hours]

Introduction: Characteristics of Algorithm. Analysis of Algorithm: Asymptotic analysis of Complexity Bounds – Best, Average and Worst-Case behavior; 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 [6 Hours]

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

UNIT – III [6 Hours]

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

UNIT – IV [6 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 [6 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 [6 Hours]

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

Home Assignments:

Implementation of Different Algorithms based on various algorithmic strategies studied abpve using C

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

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: 3Hrs./Week	Semester Examination: 60 marks	Theory: 4 Credits
Tutorials: 1Hr./Week	Continuous Assessment: 40 marks	Term Work and Oral credit: 1
Lab: 2Hrs./Week	Term Work and Oral: 50	

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.

Topics to Be Covered:

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.

Home Assignments:

Assignments using Lex and Yaac

Text Books:

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.

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: 4 Hrs/Week	Semester Examination: 60 marks	Theory: 4 Credits
Tutorials: NIL	Continuous Assessment: 40 marks	Term Work and Practical Credit: NIL
Lab: NIL	Term Work and Practical: Nil	

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 behavior 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

Topics to Be Covered:

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, International Standards, 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.

Home Assignments: 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.

1. Topic: Corporate social responsibility (CSR) and HRM implications: What does it mean to be socially responsible within an increasingly financially driven market economy?
2. Topic: Leaders are Born, Not Made! The debate

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
Tutorials: NIL	Continuous Assessment: 40 marks	Term Work and Practical credit: NIL
Lab: NIL	Term Work and Practical: NIL	

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 startegies 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

Topics to Be Covered:

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

Home Assignments:

- Latest business events would be discussed in class and students should be ready to discuss these events (in groups). The topic will be mentioned beforehand. Students are required to meet in groups before coming to class and prepare on the topic.
- There will be periodic homework assignments relating to the course concepts or mini-cases. Specific instructions will be given separately.

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).

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: 3Hrs./Week	**Semester Examination: 60 marks**	**Theory: 3 Credits**
Tutorials: NA	**Continuous Assessment: 40 marks**	**Term Work credit: 1**
Lab: 2 Hrs./Week	**Term Work and Oral: 50**	

Course Pre Requisites: Students should be well versed Completion of all units from Semesters 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

Topics to Be Covered:

UNIT – I [6 Hours]

Introduction: Recognize the importance of Design Thinking why is Design Thinking important 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 [6 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 [6 Hours]

Define Phase: Creating personas: Recognize the steps to create personas in the define phase 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 [6 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 [6 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 [6 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.

Home Assignments:

Implementation of Different Design Thinking Phase based on various activities.

Text Books:

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

Reference Books:

Hooked by Nir Eyal

The Art of Creative Thinking by Rod Judkins

Start Up nation by Dan Senor and Saul singer

Start with Why by Simon Sinek

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

Practical

Summative Assessment based on End Semester Project

Bloom's Level	**Topics**	**Contents**		**Marks**
Understand	Understand, Analyze, Apply	**Option 1:** Each group needs to present a Prototype of how they can apply DT in their functional work or coding. Examples will be provided to explain what exactly they need to do.		50
Apply	Conduct and apply DT in the project.		**12 Hours**	
Analyze		**Option 2:** Each group will apply DT to create a prototype to improve any existing product or service. For both options, groups need to complete all phases of the Stanford DT model and include the outputs of each phase in their presentation.		

Elective -I Machine Learning

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 3Hrs./Week	Semester Examination: 60 marks	Theory: 4 Credits
Tutorials: 1Hr./Week	Continuous Assessment: 40 marks	Term Work and Oral Credit: 1
Lab: 2 Hrs./Week	Term Work and Oral: 50	

Course Pre-Requisites:

1) Basic concepts of statistics.
2) 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.

Topics to Be Covered:

UNIT – I [6 Hours]

Introduction to Machine Learning (ML); Relationship between ML and human learning; A quick survey 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-mesure, 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.

Home Assignments:

(1) Introduction to WEKA and R
(2) Classification of some public domain datasets in UCI ML repository

Mini projects in the Lab:

(1) Implementation of one clustering algorithm
(3) Implementation of one association rule mining algorithm
(4) Implementation of one anomaly detection algorithms
(5) Implementation of EM algorithm for some specific problem

Text Books:

[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.

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

Computer Network

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 3 Hrs/Week	Semester Examination: 60 marks	Theory: 3 Credits
Tutorials: NIL	Continuous Assessment: 40 marks	Term Work and Practical credit: 1
Lab: 2 Hrs./Week	Term Work and Practical: 50	

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

Topics to Be Covered:

UNIT – I [6 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, OSI model, Transmission Media.**LAN:** Wired LAN, Wireless LAN, Virtual LAN

UNIT – II[6 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 [6 Hours]

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

UNIT – IV [6 Hours]

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

UNIT – V [6 Hours]

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

UNIT – VI [6 Hours]

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

Home Assignments:

1. Socket Programming using C/C++
2. Network System Administration: Understanding switches and routers

Text Books:

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

Reference Books:

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

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

Subject Name : Information Security

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 4Hrs./Week	Semester Examination: 60 marks	Theory: 5 Credits
Tutorials: 1Hr./Week	Continuous Assessment: 40 marks	Term Work and Practical credit: 1
Lab: 2Hrs./Week	Term Work and Practical: 50	

Course Prerequisites:		
Students should have primary knowledge of		
1 Fundamentals of Digital Communication and Computer Networks. **2**. Operating Systems		
Course Objectives:		
• Discuss various administrative, technical, governance, regularity and policy aspects of Information Security Management. • Discuss and provide hands on approaches to better understand and to devise strategies related to security policy. • Understand different security issues related to computer network, operating systems and database systems.		
Course Outcome:		
Students will be able to:		
1Understand security parameters and cryptosystems.		
2) Understand security and access control models.		
3) Understand aspect of information security management including planning, process, policy, procedure and 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	**Overview of Security Parameters and Cryptosystems**	**(6 Hours)**
	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	**Access Control Models**	**(6 Hours)**
	Discretionary, mandatory, roll-based and task-based models, unified models, access control algebra, temporal and spatio-temporal models, Authorization and Authentication - types, policies and techniques, Trusted Computing and multilevel security - Security models, Trusted Systems.	
UNIT-III	**Security Policies**	**(6 Hours)**
	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	**Security Threats**	**(6 Hours)**
	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	**Logic-based System**	**(6 Hours)**
	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 Party Development - Intellectual Property Issues.	
UNIT-VI	**Auditing and Business Continuity Planning**	**(6 Hours)**
	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: Overview of ISO 17799 Standard. Legal and Ethical issues, Database auditing	

Assignment List:	
1.	Assignments on different ciphers.
2.	Assignments on RSA, DSA, DES, AES, Blowfish, TripleDES.
3.	Assignment based on the presentation on following topics: ISO 17799 Standard NESSUS and NMAP Audit Tools Asymmetric Cryptosystems
4.	Case study on secure configuration of Email Server
5.	Case study on Incidence Response and Forensics analysis
6.	Assignment on Computer Forensic Tools

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 for Communication 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: Cryptographic Principles & Application", Thomson Delmar Learning, 2004.

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

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

Artificial Intelligence

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 4Hrs./Week	Semester Examination: 60 marks	Theory: 5 Credits
Tutorials: 1Hr./Week	Continuous Assessment: 40 marks	Term Work and Practical credit: 1
Lab: 2Hrs./Week	Term Work and Practical: 50	

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

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

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

FINANCIAL AND COST ACCOUNTING

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 4 Hrs/Week	Semester Examination: 60 marks	Theory: 4 Credits
Tutorials: NIL	Continuous Assessment: 40 marks	Term Work and Practical credit: -- NIL
Lab: NIL	Term Work and Practical: -- NIL	

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

Topics to Be Covered:

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

Home Assignments: 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.

Further, the topic for class discussion will be mentioned beforehand and students should be prepared to discuss these topics in class. Few topics are mentioned below as examples. Instructor can add or change any topic as per requirement.

1. Topic: Corporate Accounting Fraud: A Case Study of Satyam
2. Topic: Application of costing concepts in the Service Sector

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:

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 and Business Systems) Sem-VI

BUSINESS COMMUNICATION & VALUE SCIENCE – IV

Designation of Course	**BUSINESS COMMUNICATION & VALUE SCIENCE – IV**		
Teaching Scheme:	**Examination Scheme:**		**Credits Allotted**
Theory:- 03 Hours/ Week	End Semester Examination	50 Marks	Theory: 03 Tutorial: 00 Practical: 01
Practical : 02 Hours/ Week	Term Work & Oral	50 Marks	
	Total	100 Marks	
	Continuous Assessment	Yes	04

Course Prerequisites:-	Basic Knowledge of English (verbal and written) Completion of all units from Semesters 1, 2, 3, 4 and 5
Course Objective	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** 01. Understand the importance of diversity in workplace 02. Recognize the best practices of communicative writing 03. Apply knowledge of multiple intelligences and learning styles in interpersonal interactions 04. Recognize the attributes needed to function and grow in a corporate environment 05. Identify the best practices to manage stress 06. Understand the importance of corporate social responsibility (CSR)

Course Contents

Unit 1	Diversity and Inclusion at workplace	**(6 Hrs.)**
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 2	**Communicative Writing**:	**(6 Hrs.)**
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 3	**Emotional Intelligence**	**(6 Hrs.)**
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 4	**Corporate Social Responsibility (CSR)**	**(6 Hrs.)**
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 5	**Intelligences and learning styles in interpersonal interactions:**	**(6 Hrs.)**
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 6	**Corporate etiquette, Stress & Time Management:**	**(6 Hrs.)**
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		
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.	

Reference Books:

01	Emotional Intelligence: Why it Can Matter More Than IQ by Daniel Goleman
02	Putting Emotional Intelligence To Work by Ryback David
03	How to Develop Self Confidence and Improve Public Speaking - Time - Tested Methods of Persuasion by Dale Carnegie
04	TED Talks: The official TED guide to public speaking: Tips and tricks for giving unforgettable speeches and presentations
05	Diversity, Inclusion and Engagement 3rd Edition by Mervyn Hyde Lorelei Carpenter , Shelley Dole
Web References:	
https://www.tata.com/about-us/tata-group-our-heritage	
https://economictimes.indiatimes.com/tata-success-story-is-based-on-humanity-philanthropy-and-ethics/articleshow/41766592.cms	
Online Resources:	
https://youtu.be/reu8rzD6ZAE	
https://youtu.be/Wx9v_J34Fyo	
https://youtu.be/F2hc2FLOdhI	
https://youtu.be/wHGqp8lz36c	
https://youtu.be/hxS5He3KVEM	
https://youtu.be/nMPqsjuXDmE	

ELECTIVE II : Robotics and Embedded Systems

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 3 Hrs./Week	Semester Examination: 60 marks	Theory: 4 Credits
Tutorials: 1Hr./Week	Continuous Assessment: 40 marks	Term Work and Oral Credit: 1
Lab: 2Hrs./Week	Term Work and Oral: 50	

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:

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

UNIT-I	Introduction to Embedded System	(6 Hours)

	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	**Devices and Communication Buses**	**(6 Hours)**
	I/O types, serial and parallel communication devices, wireless communication devices, timer and counting devices, watchdog timer, real time clock, serial bus communication protocols, parallel communication network using ISA, PCI, PCT-X, Intrnet embedded system network protocols, USB, Bluetooth.	
UNIT-III	**Program Modeling**	**(6 Hours)**
	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	**Real Time Operating Systems**	**(6 Hours)**
	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	**Examples of Embedded System**	**(6 Hours)**
	Mobile phones, RFID, WISENET, Robotics, Biomedical Applications, 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	**Robotics**	**(6 Hours)**
	Robotics: Introduction, Elements of robots -- joints, links, actuators, and sensors **Kinematics:** Kinematics of serial robots, Kinematics of parallel robots, Motion planning and control **Advanced Topics on Robotics**: Sensing distance and direction, Line Following Algorithms, Feedback Systems, Other topics on advance robotic 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.	
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 : DATA MINING AND ANALYTICS

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 3 Hrs/Week	Semester Examination: 60 marks	Theory: 4 Credits
Tutorials: 1 Hr./Week	Continuous Assessment: 40 marks	Term Work and Oral Credit: 1
Lab: 2 Hrs/Week	Term Work and Oral: 50	

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 model and 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

Topics to Be Covered:

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 preprocessing: 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 modeling, Decision and Risk analysis, Decision trees.

Home Assignments:

Course faculty must design one home assignment on every unit.

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.

Hosmer, D. W. and Lemeshow, S. (1989). Applied Logistic Regression (Wiley).

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

Bharati Vidyapeeth (Deemed to be University) College of Engineering, Pune

B.Tech- Computer Science & Business Systems (Semester- VII and VIII)

Revised New Syllabus Structure

Semester- VII		Teaching Scheme				Examination Scheme-Marks							Credit		
						End Semester Examination	Continuous Assessment			TW & Practical	TW & Oral	Total	Theory	Term Work	Total
ID	Course	Lecture	Tutorial	Practical	Contact Hours per week		Unit Test	Attendance	Assignments						
4.1	Usability Design of Software Applications	3	0	2	5	**60**	**20**	**10**	**10**	**50**	_	**150**	3	1	4
4.2	IT Workshop	3	0	2	5	**60**	**20**	**10**	**10**	**50**	_	**150**	3	1	4
4.3	Financial Management	3	0	0	3	**60**	**20**	**10**	**10**	_	_	**100**	3	0	3
4.4	Human Resource Management	3	0	0	3	**60**	**20**	**10**	**10**	_	_	**100**	3	0	3
4.5	Elective III	3	0	2	5	**60**	**20**	**10**	**10**	_	50	**150**	3	1	4
4.6	Elective IV	3	0	2	5	**60**	**20**	**10**	**10**	_	50	**150**	3	1	4
4.7	Project Evaluation I	**0**	**0**	**2**	2	_	_	_	_	_	**50**	**50**	0	1	1
4.8	Internship	**0**	**0**	**0**	0	_	_	_	_	_	**50**	**50**	0	2	2
	Total	**18**	**0**	**10**	**28**	**360**	**120**	**60**	**60**	**100**	**200**	**900**	**18**	**7**	**25**

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

Semester-VIII		Teaching Scheme				Examination Scheme-Marks							Credit		
							Continuous Assessment								
ID	Course	Lecture	Tutorial	Practical	Contact Hours per week	End Semester Examination	Unit Test	Attendance	Assignments	TW & Practical	TW & Oral	Total	Theory	Term Work	Total
4.9	Services Science & Service Operational Management	4	0	2	6	**60**	**20**	**10**	**10**	**50**	_	**150**	4	1	5
4.1O	IT Project Management	3	0	2	5	**60**	**20**	**10**	**10**	_	**50**	**150**	3	1	4
4.11	Marketing Research & Marketing Management	3	0	0	3	**60**	**20**	**10**	**10**	_	_	**100**	3	0	3
4.12	Elective V	3	0	2	5	**60**	**20**	**10**	**10**	_	**50**	**150**	3	1	4
4.13	Elective VI	3	0	2	5	**60**	**20**	**10**	**10**	_	**50**	**150**	3	1	4
4.14	Project Evaluation II	0	0	6	6	_	_	_	_	_	**150**	**150**	0	3	3
4.15	Seminar	0	0	2	2	_	_	_	_	_	**50**	**50**	0	2	2
	Total	**16**	**0**	**16**	**30**	**300**	**100**	**50**	**50**	**50**	**350**	**900**	**16**	**9**	**25**

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

Usability Design of Software Applications

TEACHING SCHEME		EXAMINATION SCHEME		CREDIT SCHEME	
					Credits
Lecture:	3Hours/Week	**End Semester Examination:**	60Marks	**Theory**	3
Practical:	2 Hours/Week	**Continuous Assessment:**	40 Marks		
Tutorials:	NIL	**TW & Practical:**	50 Marks	**TW & Practical:**	1
		TW &Oral:	NA	**TW & Oral:**	NA
		Term Work:	NA	**Term Work**	NA
Total	150Marks	**Total**	**4**	**4**	

Course Overview

This course teaches concepts of User Centered Design.

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 andUser Experience their relevance and contribution to businesses
2. Familiarise them to the facets of User Experience (UX) Design, particularly as applied to the digital artefacts
3. Appreciation of user research, solution conceptualisation and validation as interwoven activities in the design and development lifecycle
4. Acquire the ability to constructively engage with the Design professionals they would work with in the future

Unit I **06 Hours**

Introduction to User Centred Design.

Unit II **06 Hours**

Aspects of User Centred Design
Product Appreciation Assignment – Evaluating the product from user centred 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 for UX

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 detailingfor 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

List of Assignments

2 -3 Assignment to be framed on each Unit.

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		CREDIT SCHEME	
					Credits
Lecture:	3 Hours/Week	**End Semester Examination:**	60Marks	**Theory**	3
Practical:	2Hours/Week	**Continuous Assessment:**	40 Marks		
Tutorials:	NIL	**TW & Practical:**	50 Marks	**TW & Practical:**	1
		TW & Oral:	NA	**TW & Oral:**	NA
		Term Work	NA	**Term Work**	NA
Total	150	**Total**	4		

Course Overview

Prerequisite:
Need to know basics of image reprentation.

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

List of Assignments

2-3 Assignment for each unit to be framed by the Course Instructor and Implementation of various Image Processing Algorithms

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		CREDIT SCHEME	
					Credits
Lecture:	3 Hours/Week	**End Semester Examination:**	60Marks	**Theory**	3
Practical:	-	**Continuous Assessment:**	40 Marks		
Tutorials:	-	**TW &Practical:**	NA	**TW & Practical:**	NA
		TW &Oral:	NA	**TW & Oral:**	NA
		Term Work	NA	**Term Work**	NA
Total	**100 MarksTotal3**				

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. Interpretthe fundamental concepts of financial management time value of money
2. Categorise valuation of securities, risks and returns
3. Summariseleverage 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 that once ayear, 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, IndifferenceAnalysis 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 ProjectProposals, Estimating Project, After Tax Incremental Operating Cash Flows, Capital Budgeting Techniques,Project Evaluation and Selection - Alternative Methods

Unit V **06 Hours**

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

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, CreditReferences, 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

List of Assignments

Case studies based on Time Value of Money, Valuation of Securities, Risk & Return, Cost of Capital, Capital Budgeting, Working Capital Management, Cash Management, Accounts Receivable Management

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		CREDIT SCHEME	
					Credits
Lecture:	03Hours/Week	**End Semester Examination:**	60Marks	**Theory**	03
Practical:	NA	**Continuous Assessment:**	40 Marks		
Tutorials:	NA	**TW & Practical:**	Marks	**TW & Practical:**	NA
		TW & Oral:	NA	**TW & Oral:**	NA
		Term Work	**NA**	**Term Work**	
Total :	100 Marks	**Total**	**3**		

Course Overview

Students must be aware of the basic principles of Human Resource Management because success in today'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 long run.

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 and Training
- Similarities and Differences in Nature of Work for the Frontline Workers and the 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 below as 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 HR Practices

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	CREDIT SCHEME	
				Credits
Lecture:	Hours/Week	**End Semester Examination:**60Marks	**Theory**	3
Practical:	3 Hours/Week	**Continuous Assessment:** 40 Marks		
Tutorials:	Hours/Week	**TW &Practical:**NA	**TW & Practical:**	
		TW &Oral:50 Marks	**TW & Oral:**	1
		Term Work NA	**Term Work**	
Total : 100 MarksTotal		**4**		

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 Kaufmann Publishers, 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).

List of Assignments

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	CREDIT SCHEME	
				Credits
Lecture:	03 Hours/Week	**End Semester Examination:** 60Marks	**Theory**	03
Practical:	02 Hours/Week	**Continuous Assessment:** 40 Marks		
Tutorials:	NIL	**TW & Practical:** -- Marks	**TW & Practical:**	NA
		TW & Oral: 50 Marks	**TW & Oral:**	01
		Term Work -- Marks	**Term Work**	
		TotalMarks: 150	**TotalCredits**: 04	

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 IIntroduction 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, **06 Hours**

Unit II Architecture

IoT reference architectures, Industrial Internet Reference Architecture, Edge Computing, IoT Gateways, Data Ingestion and Data Processing Pipelines, Data Stream Processing **06 Hours**

Unit III 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 **06 Hours**

Unit IV 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), **06 Hours**

Unit V Communication for IoT

Communicating with cloud applications (web services, REST, TCP/IP and UDP/IP sockets, MQTT, WebSockets, protocols. Message encoding (JSON, Protocol Buffers) **06 Hours**

Unit VI IoT 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, **06 Hours**

Textbooks

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

2 Getting started with Internet of Things,Cuno Pfister

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

4Learning 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

8. 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

9. 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

10. 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

11. 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	CREDIT SCHEME	
				Credits
Lecture:	3Hours/Week	**End Semester Examination:**60Marks	**Theory**	3
Practical:	2 Hours/Week	**Continuous Assessment:** 40 Marks		
Tutorials:	Hours/Week	**TW & Practical:** Marks	**TW & Practical:**	NA
		TW & Oral:50 Marks	**TW & Oral:**	1
		Term Work **NA**	**Term Work**	
		TotalMarks: 150	**TotalCredits**: 04	

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-random bit 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, Exampleswith 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 any two ciphers from this list.

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		CREDIT SCHEME	
					Credits
Lecture:	3 Hours/Week	**End Semester Examination:**	60Marks	**Theory**	3
Practical:	3 Hours/Week	**Continuous Assessment:**	40 Marks		
Tutorials:	--Hours/Week	**TW & Practical:** --	Marks	**TW & Practical:**	--
		TW & Oral:	50 Marks	**TW & Oral:**	--
		Term Work	**NA**	**Term Work**	1
Total	150	**Total**		**4**	

Course Overview

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

Prerequisite: 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 different quantum models of computation
3. To implement important quantum algorithms
4. To understand random number generation exploiting quantum physics
5. To learn quantum key distribution protocols
6. To apply quantum computing to different computational areas like cryptography

Unit I **06 hours**

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

Unit II **06 Hours**

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

Unit III **06 Hours**

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

Unit IV **06 Hours**

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

Unit V **06 Hours**

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

Unit VI **06 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. An 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-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

List of Assignments-

Will be provided by Course Coordinator. 1 or 2 assignments on each unit.

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 Analytics

TEACHING SCHEME		EXAMINATION SCHEME	CREDIT SCHEME	
				Credits
Lecture:	3Hours/Week	**End Semester Examination:**60Marks	**Theory**	3
Practical:	2Hours/Week	**Continuous Assessment:** 40 Marks		
Tutorials:	0Hours/Week	**TW &Practical: NA**	**TW & Practical:**	
		TW &Oral:50 Marks	**TW & Oral:**	
		Term Work NA	**Term Work**	1
		TotalMarks: 150	**TotalCredits**: 04	

Course Overview Students will be able to hone their skills even further by embracing the newer 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 Modeling.

2. Explore the use of social network analysis to understand the growing connectivity and complexity 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, and YouTube.

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: Text Extraction: Introduction, Rapid automatic keyword extraction: candidate keywords, keyword scores,adjoining keywords, extracted keywords, Benchmark evaluation: precision and recall, efficiency, stoplist

generation, Evaluation on new articles.

Unit IV **06 Hours**

Web Analytics: Web analytics tools, Clickstream analysis, A/B testing, online surveys; 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 and Applications", Springer

Reference Books

1Borko 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 and applications", 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.

List of Assignments

1.Review two case studies of applying social media analytics using both textand network analysis available**.**

2.Students will select two companies/organizations/groups to conduct acomparative analysis of social networks by examining social mediaactivity.

3.Identify 2 relevant social media platforms used by both entities and use Netlytic to collect publicly available social media data (e.g., Twitter messages, Facebook page posts, etc.).

4.Conduct text and network analysis of each platforms used by theorganizations. Students will end up with a set of interactive visualizationsto investigate the similarities and differences between the contentdiscussed and social networks developed among each organization.

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 SCHEME	
					Credits
Lecture:	03 Hours/Week	**End Semester Examination:**	60Marks	**Theory**	03
Practical:	02 Hours/Week	**Continuous Assessment:**	40 Marks		
Tutorials:	00 Hours/Week	**TW & Practical:**	00 Marks	**TW & Practical:**	00
Total	05 Hours/Week	**TW & Oral:**	50 Marks	**TW & Oral:**	01
		Term Work	**00** Marks	**Term Work**	00
Total	150	**Total**	**04**		

Course Overview

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 wireless Network
5. Understand Cognitive radio network
6. Use 5G technology.

Unit I **06 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 **06 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 **06 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 **06 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 **06 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 **06 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- DeviceCommunications and Networks*.Lingyang Song, Dusit Niyato, Zhu Han, and Ekram Hossain, Cambridge University Press.

List of Assignments

1 Understand the cell splitting in crowded region.
2 Study the evolution from 1G to 5G
3 Use handoff approach for switching of network
4 Explain various mobility models in detail.
5 Use frequency hopping approaches in detail.
6 Exemplify the compatibility issues.
7 Explain energy efficient routing.
8 Explain dynamic spectrum access in detail
9 List out issues in D2D communication.
10 Analyse the changes required in architecture for 5G

Syllabus for Unit Tests:

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

Semester VIII

Services Science & Service Operational Management

TEACHING SCHEME		EXAMINATION SCHEME	CREDIT SCHEME	
				Credits
Lecture:	04 Hours/Week	**End Semester Examination:**60Marks	**Theory**	4
Practical:	02 Hours/Week	**Continuous Assessment:**40 Marks		
Tutorials:	NA	**TW &Practical:**50Marks	**TW & Practical:**	01
		TW &Oral:NA	**TW & Oral:**	NA
Total	**06 Hours/Week**	**Total :** 150 Marks	**Total**	5

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:

5. Understand concepts about Services and distinguish it from Goods.
6. Able to identify characteristics and nature of Services.
7. Comprehend ways to design Services and evaluate those using Service qualities.
8. Understand how various methods can be used to operate and manage Service businesses.
9. Understand how innovation can be approached from Services point of view.
10. 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 Service quality & 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 inventory in services.

Unit V **06 Hours**

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

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

Unit VI **06 Hours**

Service Innovation: Services Productivity, Need for Services Innovation.

Student Project:

Option 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.

Option 2: Choose any latest research paper in services and explain your understanding and feedback on the same.

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.

List of Assignments

1. Manufacturing game (in-class activity)
2. Online activities (industrial service spotting blog, commenting)
3. Article reviews (in-class activity, in groups of 4 students)
4. Learning cases (visiting lectures, case examples)
5. Course essay (group activity in groups of 2 students)

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		CREDIT SCHEME	
					Credits
Lecture:	3 Hours/Week	**End Semester Examination:** 60Marks		**Theory**	3
		Continuous Assessment: 40 Marks			
Practical:	2 Hours/Week	**TW & Oral:**	50 Marks	**TW& Oral**	1
Total	5 Hours/Week	**Total:150** Marks		**Total4**	

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

3. Roman Pichler, *Agile Product Management with Scrum*
4. Ken Schwaber, *Agile Project Management with Scrum (Microsoft Professional)*

List of Assignments

Case studies will be distributed to students beforehand and students should prepare and try to solve these cases before coming to class. Students will be asked submit and present their understanding of the cases and solutions before the class.

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.

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		CREDIT SCHEME	
					Credits
Lecture:	3 Hours/Week	**End Semester Examination:**60Marks		**Theory**	3
Practical:	NA	**Continuous Assessment:** 40 Marks			
Tutorials:	NA	**TW &Practical:** NA		**TW & Practical:**	NA
		TW &Oral: NA		**TW & Oral:**	NA
		Term Work:NA		**Term Work**	NA
Total	**3** Hours/Week	**Total:**	**100 Marks**	**Total**	**3**

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

List of Assignments

1.Case study on various marketing management, Product Management, Data Analysis, Internet Marketing

2.Field visit & live project covering steps involved in formulating Market Research Project

3.Measuring Internet Marketing Effectiveness: Metrics and Website Analytics

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) Behavioral Economics

TEACHING SCHEME		EXAMINATION SCHEME	CREDIT SCHEME	
				Credits
Lecture:	**3 Hours/Week**	**End Semester Examination:60 Marks**	**Theory**	**3**
Practical:	**2 Hours/Week**	**Continuous Assessment: 40 Marks**		
Tutorials:	**NA**	**TW & Practical:50 Marks**	**TW & Practical:**	**1**
		TW & Oral:NA	**TW & Oral:**	**NA**
		Term Work :NA	**Term Work**	**NA**
Total	**5** Hours/Week	**Total:150 Marks**	**Total**	**4**

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, focusingon 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; historicalbackground; behavioral economics and other social sciences; theory and evidencein the social sciences and in behavioraleconomics; 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 behavior, 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-temporaldecisions; hyperbolic; discounting instantaneous; utility alternative concepts –future projection, mental accounts , heterogeneous selves, procedural choice; policyanalysis – mobile calls, credit cards, organization of government; applications – consumption and savings clubs and membership, consumption planning

Unit VI **06 Hours**

Strategic Choice

1. 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

2. 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 RabinAdvances in Behavioral Economics, Princeton University Press

List of Assignments

2 -3 Assignment on Each Unit

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 and Modelling

TEACHING SCHEME		EXAMINATION SCHEME	CREDIT SCHEME	
				Credits
Lecture:	**3 Hours/Week**	**End Semester Examination:60 Marks**	**Theory**	**3**
Practical:	**2Hours/Week**	**Continuous Assessment: 40 Marks**		
Tutorials	**NIL**	**TW & Practical: NIL**	**TW & Practical:**	**1**
		TW & Oral: 50 Marks	**TW & Oral:**	
		Term Work:	**Term Work**	
Total	**5 Hours/Week**	**Total: 150 Marks**	**Total**	**4**

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, linear algebra 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 trading systems.
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, New York, 2004.

Reference Books

1. W. Press, S. Teukolsky, W. Vetterling and B. Flannery, Numerical Recipes in C: The Art of 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, New York, 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

List of Assignments

1 Implement different Numerical methods
2 Implement variance reduction methods
3 Study Financial Markets
4 Implement Monte Carlo Method

5 Analyze frequency data.
6 Study High Dimensional Covariance Matrix

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) PSYCHOLOGY

TEACHING SCHEME		EXAMINATION SCHEME	CREDIT SCHEME	
				Credits
Lecture:	03 Hours/Week	**End Semester Examination:**60Marks	**Theory**	03
Practical:	02 Hours/Week	**Continuous Assessment:**40 Marks		
Tutorials:	00 Hours/Week	**TW &Practical:00** Marks	**TW & Practical:**	
		TW &Oral: 50 Marks	**TW & Oral:**	01
		Term Work: 00 Marks	**Term Work**	
Total	**05** Hours/Week	**Total: 150 Marks**	**Total**	**04**

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 Behaviour

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 onLegal 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

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		CREDIT SCHEME	
					Credits
Lecture:	3 Hours/Week	**End Semester Examination:**	60Marks	**Theory**	03
Practical:	2 Hours/Week	**Continuous Assessment:**	40 Marks		
Tutorials:	NA	**TW & Practical:**	NA	**TW & Practical:**	
		TW & Oral:	50 Marks	**TW & Oral:**	01
		Term Work	NA	**Term Work**	
		Total	150 Marks	**Total**	04

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:

- Design and deploy Simple Web Applications using MVC
- Design SOA and ERP models
- Design of CRM models
- Design interactive network and application
- Manage, Maintain and configuration of Networking
- 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 of SAP 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 : A Practical Roadmap For Success By Dr. Ravi Kalakota

List of Assignments

1. Create a Movie Database Application using MVC
2. Creating an ASP.NET MVC Web Application Project.
3. Explore the client/server architecture of SAP. Learn how to use the user interface
4. Create vendor, material master data for purchasing. Execute the Purchasing process in SAP
5. A model of customer relationship management and business intelligence systems for catalogue and online retailers.
6. Firewalls configuration
7. COTS configuration and Implementation
8. A model of customer relationship management and business intelligence systems for catalogue and online retailers

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		CREDIT SCHEME	
					Credits
Lecture:	3Hours/Week	**End Semester Examination:**	60Marks	**Theory**	3
Practical:	2Hours/Week	**Continuous Assessment:**	40 Marks		
Tutorials:	NA	**TW & Practical:**	NA	**TW & Practical:**	NIL
		TW & Oral:	25 Marks	**TW & Oral:**	1
		Term Work	**25** Marks	**Term Work**	
Total	150 Marks	**Total**	**4**		

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: Traditional Approach, Dividend Relevance Model, Miller and Modigliani Model, Stability of Dividends, Forms of Dividends, Issue of bonus shares, Stock Split. **06 Hours**

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 ofDerivatives for Risk-Return Management- Credit Default Swaps

Textbooks

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

List of Assignments

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.

Further, the topic for class discussion will be mentioned beforehand and students should be prepared to discuss these topics in class. Few topics are mentioned below as examples. Instructor can add or change any topic as per requirement.

1. Topic: 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		CREDIT SCHEME	
					Credits
Lecture:	3 Hours/Week	End Semester Examination:	60 Marks	Theory	3
Practical:	2 Hours/Week	Continuous Assessment:	40 Marks		
		TW & Oral:	50 Marks	TW & Oral:	1
Total	150 Marks	Total	4		

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 texture analysis, 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 VIDimension 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 Assignments

1. Implement the noise reduction for the noisy image.
2. Implement various transformation methods
3. Implement the histogram equalization for two images
4. Implemented Hough Transform for circles from scratch.

Syllabus for Unit Tests:

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