

## SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL

### PROGRAMME OUTCOMES (UG)

On successful completion of Undergraduate Engineering Programmes, students will be able to-

**PO1. Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

**PO2. Problem Analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**PO3. Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**PO4. Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**PO5. Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

**PO6. The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

**PO7. Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

**PO8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**PO9. Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**PO10. Communication:** Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

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**PO11. Project Management and Finance:** Demonstrate knowledge understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**PO12. Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

### **PROGRAMME SPECIFIC OUTCOMES**

#### **B.Tech (Computer Science and Business System)**

**PSO1.** To create, select, and apply appropriate techniques, resources, modern engineering and business tools including prediction and data analytics to complex engineering activities and business solutions.

**PSO 2.** To evolve Computer Science domain specific methodologies for effective decision making in several domains like business processes and other domains.

**PSO 3.** To manage complex IT projects with consideration of the human, financial, ethical and environmental factors and an understanding of risk management processes, and operational and policy implications.

**SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL**

**B.TECH  
COMPUTER SCIENCE AND BUSINESS  
SYSTEM  
SEMESTER I SYLLABUS**

# SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL

## B.Tech(Computer Science and Business System) I Semester

### CB 101 (DISCRETE MATHEMATICS)

**Unit I- Boolean Algebra:** Introduction of Boolean algebra, truth table, basic logic gate, basic postulates of Boolean algebra, principle of duality, canonical form, Karnaugh map.

**Unit II- Abstract Algebra:** Set, relation, group, ring, field.

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

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

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

#### **Text Books-**

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

#### **Reference Books-**

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

#### **Course Outcomes-**

On successful completion of the course, the students will be able to:

CO1. Design and create logic circuits by applying the knowledge of Boolean algebra and logic gates

CO2. Apply the knowledge of Sets, Relations and groups to solve related problems

CO3. Identify or categorize counting problems and solve them

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- CO4. Identify the problems that can be solved by using graph theory and apply the knowledge of Graphs in developing algorithms and computer programs
- CO5. Understand logical arguments and validate them.

## **SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL**

### **CB 102 (INTRODUCTORY TOPICS IN STATISTICS, PROBABILITY AND CALCULUS)**

**Unit I- 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- 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.

**Unit III- Probability:** Concept of experiments, sample space, event, Definition of Combinatorial Probability, Conditional Probability, Bayes Theorem.

**Unit IV- Probability distributions:** Discrete & continuous distributions, Binomial, Poisson and Geometric distributions, Uniform, Exponential, Normal, Chi-square, t, F distributions. Expected values and moments: mathematical expectation and its properties, Moments (including variance) and their properties, interpretation, Moment generating function.

**Unit V- Calculus:** Basic concepts of Differential and integral calculus, application of double and triple integral.

#### **Text Books-**

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

#### **Reference Books-**

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

#### **Course Outcomes-**

On successful completion of the course, the students will be able to:

CO1: Apply the knowledge of differential calculus in optimizing functions of single variables.

CO2: Evaluate double, triple integrals and apply it in finding area and volume of solids.

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CO3: Understand the concepts of probability and random variables and apply it in solving real world problems.

CO4: Model and solve real life problems using various discrete and continuous distributions.

CO5: Analyze data using various statistical methods.

# **SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL**

## **CB 103(FUNDAMENTALS OF COMPUTER SCIENCE)**

**Unit I- General problem solving concepts:** 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)

**Unit II- 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 III- 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. 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, Initialisation, Recursion, Pre-processor, Standard Library Functions and return types.

**Unit IV- 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. Structures: Basic Structures, Structures and Functions, Array of structures, Pointer of structures, Self-referral structures, Table look up, typedef, unions, Bit-fields

**Unit V- 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. 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.

## **LABORATORY (FUNDAMENTALS OF COMPUTER SCIENCE LAB)**

1. Algorithm and flowcharts of small problems like GCD
2. Structured code writing with:
  - i. Small but tricky codes



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- 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. The C Programming Language, (Second Edition) B. W. Kernighan and D. M. Ritchi, PHI.
2. Programming in C, (Second Edition) B. Gottfried, Schaum Outline Series.

### **Reference Books-**

1. C: The Complete Reference, (Fourth Edition), Herbert Schildt, McGraw Hill.
2. Let Us C, Yashavant Kanetkar, BPB Publications

### **Course Outcomes-**

On successful completion of the course, the students will be able to:

- CO1: Formulate simple algorithms for arithmetic and logical problems.
- CO2: Implement conditional branching, iteration and recursion
- CO3: Use arrays, strings and functions to formulate algorithms and programs.
- CO4: Design and develop applications using Pointers
- CO5: Design and implement programs using structures and unix system interface.

## **SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL**

### **CB 104 (PRINCIPLES OF ELECTRICAL ENGINEERING)**

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

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

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

**Unit IV- Electrostatics and Electro-Mechanics:** Electrostatic field, electric field strength, concept of permittivity in dielectrics, capacitor composite, dielectric capacitors, capacitors in series and parallel, energy stored in capacitors, charging and discharging of capacitors, Electricity and Magnetism, magnetic field and Faraday's law, self and mutual inductance, Ampere's law, Magnetic circuit, Single phase transformer, principle of operation, EMF equation, voltage ratio, current ratio, KVA rating, efficiency and regulation, Electromechanical energy conversion.

**Unit V- Measurements and Sensors:** Introduction to measuring devices/sensors and transducers (Piezoelectric and thermo-couple) related to electrical signals, Elementary methods for the measurement of electrical quantities in DC and AC systems (Current & Single-phase power). Electrical Wiring and Illumination system: Basic layout of the distribution system, Types of Wiring System & Wiring Accessories, Necessity of earthing, Types of earthing, Safety devices & system.

For Further Reading - Principle of batteries, types, construction and application, Magnetic material and B-H Curve, Basic concept of indicating and integrating instruments.

### **LABORATORY (PRINCIPLES OF ELECTRICAL ENGINEERING LAB)**

1. Familiarization of electrical Elements, sources, measuring devices and transducers related to electrical circuits
2. Determination of resistance temperature coefficient

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3. Verification of Network Theorem (Superposition, Thevenin, Norton, Maximum Power
4. Transfer theorem)
5. Simulation of R-L-C series circuits for  $X_L > X_C$  ,  $X_L < X_C$
6. Simulation of Time response of RC circuit
7. Verification of relation in between voltage and current in three phase balanced star and delta connected loads.
8. Demonstration of measurement of electrical quantities in DC and AC systems.

### **Text Books-**

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

### **Reference Books-**

1. Basic of Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford University Press. T. K. Nagsarkar and M. S. Sukhija, Basic of Electrical Engineering, Oxford University Press, 2011.
2. Introduction to Electrodynamics, D. J. Griffiths, (Fourth Edition), Cambridge University Press.
3. Engineering Circuit Analysis, William H. Hayt & Jack E. Kemmerly, McGraw-Hill Book Company Inc.
4. Fundamentals of Electrical and Electronics Engineering, Smarjith Ghosh, Prentice Hall (India) Pvt. Ltd.

### **Course Outcomes-**

On successful completion of the course, the students will be able to:

CO1: Analyze electrical circuits and its elements.

CO2: Apply circuit theorems on DC circuits

CO3: Analyze and solve AC circuits

CO4: Acquire the knowledge in Electrostatics and Electro –mechanics.

CO5: Analyze Electrical Measuring, wiring and various sensors.

# **SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL**

## **CB 105 (FUNDAMENTALS OF PHYSICS)**

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

**Unit II-** Interference-principle of superposition-young's experiment:Theory of interference fringes-types of interference-Fresnel's prism-Newton's rings, Diffraction-Two kinds of diffraction-Difference between interference and diffraction-Fresnel's half period zone and zone plate-Fraunhofer diffraction at single slit-plane diffraction grating. Temporal and Spatial Coherence.

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

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

**Unit IV-** Quantum Mechanics: 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.

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

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

**Unit V-** Laser and Fiber 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, CO<sub>2</sub> 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.

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

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### **LABORATORY (FUNDAMENTALS OF PHYSICS LAB)**

- 1) Magnetic field along the axis of current carrying coil – Stewart and Gee
- 2) Determination of Hall coefficient of semi-conductor
- 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. Concepts of Modern Physics, (Fifth Edition) A Beiser, McGraw Hill International.
2. Fundamentals of Physics, David Halliday, Robert Resnick and Jearl Walker, Wileyplus.

#### **Reference Books-**

1. Optics, (Fifth Edition) Ajoy Ghatak, Tata McGraw Hill.
2. Sears & Zemansky University Physics, Addison-Wesley.
3. Fundamentals of Optics, (Third Edition) Jenkins and White, McGraw-Hill.

#### **Course Outcomes-**

On successful completion of the course, the students will be able to:

- CO1: Understand the principles of interference and polarization of light.
- CO2: Understand the principles lying behind crystallography and oscillations.
- CO3: Understand the basics of electromagnetism and thermodynamics.
- CO4: Learn the principles of semiconductor physics and quantum mechanics.
- CO5: Learn the fundamentals of lasers and Fiber Optics principles.

## **SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL**

### **CB 106 (BUSINESS COMMUNICATION & VALUE SCIENCE – I)**

**Unit I-** Overview of LOL (include activity on introducing self), Class activity – presentation on favorite cricket captain in IPL and the skills and values they demonstrate Self-work with immersion – interview a maid, watchman, sweeper, cab driver, beggar and narrate what you think are the values that drive them, Overview of business communication

Activity: Write a newspaper report on an IPL match

Activity: Record a conversation between a celebrity and an interviewer

Quiz, Self-awareness – identity, body awareness, stress management

**Unit II-** Essential Grammar – I: Refresher on Parts of Speech – Listen to an audio clip and note down the different parts of speech followed by discussion, Tenses: Applications of tenses in Functional Grammar – Take a quiz and then discuss, Sentence formation (general & Technical), Common errors, Voices. Show sequence from film where a character uses wrong sentence structure (e.g. Zindagi Na MilegiDobara where the characters use ‘the’ before every word)

**Unit III-** Communication Skills: Overview of Communication Skills, Barriers of communication, Effective communication, Types of communication- verbal and non – verbal – Role-play based learning, Importance of Questioning, Listening Skills: Law of nature- Importance of listening skills, Difference between listening and hearing, Types of listening, Expressing self, connecting with emotions, visualizing and experiencing purpose,

Activity: Skit based on communication skills, Evaluation on Listening skills – listen to recording and answer questions based on them.

**Unit IV-** Email writing: Formal and informal emails, activity, Verbal communication: Pronunciation, clarity of speech, 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 – Read Economic Times, Reader’s Digest, National Geographic and take part in a GD, using the words you learnt/liked from the articles.

Group discussion using words learnt, Practice: Toastmaster style Table Topics speech with evaluation, Written Communication: Summary writing, story writing,

Build your CV – start writing your comprehensive CV including every achievement in your life, no format, no page limit

Project: Create a podcast on a topic that will interest college students

Life skill: Stress management, working with rhythm and balance, colors, and teamwork

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Project: Create a musical using the learnings from unit

**Unit V**-Understanding Life Skills: Movie based learning – Pursuit of Happiness. What are the skills and values you can identify, what can you relate to Introduction to life skills, What are the critical life skills, Multiple Intelligences, Embracing diversity – Activity on appreciation of diversity, Life skill: Community service – work with an NGO and make a presentation, Life skill: Join a trek – Values to be learned: Leadership, teamwork, dealing with ambiguity, managing stress, motivating people, creativity, result orientation.

### **Reference Books-**

1. English vocabulary in use – Alan Mc’Carthy and O’dell
2. APAART: Speak Well 1 (English language and communication)
3. APAART: Speak Well 2 (Soft Skills)
4. Business Communication – Dr.Saroj Hiremath

### **Course Outcomes-**

On successful completion of the course, the students will be able to:

CO1:Comprehend conversations and talks presented in English.

CO2: Recognize the need for life skills and values.

CO3: Recognize own strengths and opportunities.

CO4: Apply the life skills to different situations.

CO5: Understand the basic tenets of communication.

**B.TECH  
COMPUTER SCIENCE AND BUSINESS  
SYSTEM  
SEMESTER II SYLLABUS**



# **SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL**

## **SYLLABUS**

### **B.Tech(Computer Science and Business System) II Semester**

#### **CB 201 (LINEAR ALGEBRA)**

**Unit I-** Introduction to Matrices and Determinants Introduction to Matrices and Determinants; Solution of Linear Equations; Cramer's rule; Inverse of a Matrix.

**Unit II-** Vectors and linear combinations Rank of a matrix; Gaussian elimination; LU Decomposition; Solving Systems of Linear Equations using the tools of Matrices.

**Unit III-** Vector Space Vector space; Dimension; Basis; Orthogonality; Projections; Gram-Schmidt orthogonalization and QR decomposition.

**Unit IV-** Eigen Values and Eigen Vectors Eigenvalues and Eigenvectors; Positive definite matrices; Linear transformations; Hermitian and unitary matrices;

**Unit V-** Singular Value Decomposition and Principal component analysis Introduction to their applications in Image Processing and Machine Learning.

#### **References-**

1. Higher Engineering Mathematics, B. S. Grewal.
2. Advanced Engineering Mathematics, 7th Edition, Peter V. O'Neil.
3. Advanced Engineering Mathematics, 2nd Edition, Michael. D. Greenberg.
4. Introduction to linear algebra, 5th Edition, Gilbert Strang.
5. Applied Mathematics (Vol. I & II) , by P. N. Wartikar& J. N. Wartikar.
6. Digital Image Processing, R C Gonzalez and R E Woods
7. [https://medium.com/@jonathan\\_hui/machine-learning-singular-value-decompositionsvd-principal-component-analysis-pca-1d45e885e491](https://medium.com/@jonathan_hui/machine-learning-singular-value-decompositionsvd-principal-component-analysis-pca-1d45e885e491)
8. <https://machinelearningmastery.com/introduction-matrices-machine-learning/>

#### **Course Outcomes-**

On successful completion of the course, the students will be able to:

- CO1: Solve system of linear equations using matrix methods and determinants.
- CO2: Apply decomposition methods to solve system of linear equations.
- CO3: Construct orthonormal basis and use it for QR decomposition of a matrix.
- CO4: Compute the eigen values and eigen vectors of a matrix and solve eigen value problems.
- CO5: Apply Singular Value Decomposition and Principal Component Analysis in analyzing data.

## **SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL**

### **CB 202 (STATISTICAL METHODS)**

**Unit I**-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**-Estimation and Sufficient Statistic: Estimation: Point estimation, criteria for good estimates (un-biasedness, consistency), Methods of estimation including maximum likelihood estimation. Sufficient Statistic: Concept & examples, complete sufficiency, their application in estimation

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

**Unit III**-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

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

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

#### **References-**

1. I.R. Miller, J.E. Freund and R. Johnson, "Probability and Statistics for Engineers" 9th Edition, Pearson.
2. A. Goon, M. Gupta and B. Dasgupta, —Fundamentals of Statistics, vol. I & II, World Press.
3. Chris Chatfield, "The Analysis of Time Series: An Introduction, 6th edition, Chapman and Hall/CRC.
4. D.C. Montgomery & E. Peck, "Introduction to Linear Regression Analysis", 5th edition, Wiley.
5. A.M. Mood, F.A. Graybill & D.C. Boes, —Introduction to the Theory of Statistics, 3rd edition, McGraw Hill.
6. N. Draper & H. Smith, "Applied Regression Analysis", 3rd edition, Wiley.
7. Garrett Grolmund, "Hands-on Programming with R", 1st edition, O'Reilly.
8. Jared P. Lander, "R for Everyone: Advanced Analytics and Graphics", 2nd edition, Addison-Wesley Professional.

#### **Course Outcomes-**

On successful completion of the course, the students will be able to:

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CO1: Understand various linear statistical models and acquire knowledge in hypothesis testing.

CO2: Apply methods of estimation in statistical analysis.

CO3: Understand Non-Parametric tests and its applications.

CO4: Design and forecast models using Time series data.

CO5: Understand and apply R language in data visualization.

# **SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL**

## **CB 203 (DATA STRUCTURES AND ALGORITHMS)**

**Unit I**-Basic Terminologies & Introduction to Algorithm and Data Organisation: 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**-Linear Data Structure: Dynamic memory allocation, Array, Stack, Queue, Linked-list and its types, Various Representations, Operations & Applications of Linear Data Structures

**Unit III**-Non-linear Data Structure: Trees (Binary Tree, Threaded Binary Tree, Binary Search Tree, B & B+ Tree, AVL Tree, Splay Tree) , Priority queue as heap, Graphs (Directed, Undirected), Various Representations, Operations (search and traversal algorithms and complexity analysis) & Applications of Non-Linear Data Structures

**Unit IV**-Searching and Sorting on Various Data Structures: 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 V**-File: Organisation (Sequential, Direct, Indexed Sequential, Hashed) and various types of accessing schemes.

### **References-**

1. E. Horowitz and S. Sahni, Fundamentals of Data Structures , Computer Science Press, 1977.
2. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, Data Structures and Algorithms, Pearson Education, 2002.
3. Donald E. Knuth, The Art of Computer Programming: Volume 1: Fundamental Algorithms, Donald E. Knuth, 3rd edition, Pearson Education.
4. Charles E. Leiserson, Thomas H. Cormen, Ronald L. Rivest, Clifford Stein, Introduction to Algorithms, Third edition, PHI, 2010.
5. Pat Morin, Open Data Structures: An Introduction (Open Paths to Enriched Learning), 31st ed. Edition , AU Press, 2013

### **Course Outcomes-**

On successful completion of the course, the students will be able to:

- CO1: Implement abstract data types for linear data structures.
- CO2: Implement abstract data types for non-linear data structure.
- CO3: Apply the different linear and non-linear data structures to problem solutions.
- CO4: Implement the various sorting and searching algorithms.
- CO5: Implement files and graph data structures for various applications

## **SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL**

### **CB 204 (PRINCIPLES OF ELECTRONICS)**

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

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

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

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 IV-** Feed Back Amplifier, Oscillators and Operational Amplifiers: Concept (Block diagram), properties, positive and negative feedback, loop gain, open loop gain, feedback factors; topologies of feedback amplifier; effect of feedback on gain, output impedance, input impedance, sensitivities (qualitative), bandwidth stability; effect of positive feedback: instability and oscillation, condition of oscillation, Barkhausen criteria. Introduction to integrated circuits, operational amplifier 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 V-** Digital Electronics: Introduction to binary number; Basic Boolean algebra; Logic gates and function realization with OPAMPs

#### **References-**

1. Adel S. Sedra and Kenneth C. Smith, —Microelectronic Circuits: Theory and Application, 7th Edition, Oxford University Press, 2017.
2. Jacob millman, christoshalkiaschetanparikh,"Millman's Integrated Electronics "McGraw Hill education (India) private limited, 2009
3. M. Morris Mano," Digital Logic & Computer Design" Pearson India Educational Services Pvt. Limited, 2016

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4. Robert L. Boylestad, Louis Nashelsky, "Electronic Devices and Circuit Theory", Pearson India Educational Services Pvt. Limited, 2015
5. Ben Streetman, Sanjay Banerjee, " Solid State Electronic Devices", 6th Edition, Prentice Hall of India, 2005
6. NPTEL online Course on —Fundamentals of Semiconductor devices, Course Link: [https://onlinecourses.nptel.ac.in/noc19\\_ee04/](https://onlinecourses.nptel.ac.in/noc19_ee04/)
7. <https://www.electronics-tutorials.ws/> 8. <https://circuitverse.org/>

### **Course Outcomes-**

On successful completion of the course, the students will be able to:

CO1: Understand the fundamentals of semiconductors.

CO2: Learn the principles of diodes and diode circuits.

CO3: Understand the principles of bipolar junction transistors and field effect transistors.

CO4: Learn the working principles of feedback amplifiers and oscillators.

CO5: Understand the working of operational amplifiers and digital electronic fundamentals.

# **SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL**

## **CB 205 (FUNDAMENTALS OF ECONOMICS)**

**Unit I**-Introduction to Microeconomics: The themes of microeconomics, Elasticity of Supply, Elasticity of Demand, Microeconomics versus Macroeconomics, Behavior of firm and House hold.

Principles of Demand and Supply: Supply Curves of Firms — Demand Curves of Households; 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**-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**-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**-Introduction to 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.

**Unit V**-Monetary Policy: External Sector — Exports and Imports; Money — Definitions; Demand for Money — Transactionary 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; The Classical Paradigm — Price and Wage Rigidities — Voluntary and Involuntary Unemployment.

### **References-**

1. Pindyck, Robert S., and Daniel L. Rubinfeld, —Microeconomics, 8th Edition, The Pearson Education, Inc., 2013.
2. Dornbusch, Fischer and Startz, —Macroeconomics, 13th Edition, McGraw Hill, 2018.
3. Paul Anthony Samuelson, William D. Nordhaus, —Economics, 19th Edition, McGraw Hill International Edition, 2009.
4. <https://data.oecd.org/economy.htm>
5. <https://www.focus-economics.com>
6. <https://www.rbi.org.in>

### **Course Outcomes-**

On successful completion of the course, the students will be able to:

CO1: Understand basic principles and concepts of Microeconomics and use them to solve real world business problems.

## **SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL**

CO2: Develop an understanding of the basic macroeconomic principles; and appreciate the relationship between key macroeconomic variables such as the investment, savings, inflation, employment, money supply, trade and forex, etc.

CO3: Explain the fundamentals of national income and Aggregate supply and aggregate demand consumption.

CO4: Comprehend the concepts of money and banking.



## **SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL**

### **CB 206 (BUSINESS COMMUNICATION AND VALUE SCIENCE – II)**

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

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-II** 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.

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

**Unit-III** 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 behaviours, 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.

**Unit-IV** Problem Solving Skill: Problem solving skill, Confidence building

Corporate / Business Etiquettes: Corporate grooming & dressing, etiquettes in social & office Setting-Understand the importance of professional behaviour 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-V** Diversity and Inclusion Part 2: 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

## **SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL**

Values Sciences Part 2: Values of a good manager: Ethics in Business; Embodying organizational pride with grace

### **References-**

1. Business Communication Today by Bovee, Thill, Raina
2. APAART: Speak Well 1 (English Language and Communication)
3. APAART: Speak Well 2 (Soft Skills)
4. Strategic Communication by Charles Marsh
5. English vocabulary in use – Alan Mc'Carthy and O'dell
6. Business Communication – Dr.Saroj Hiremath

### **Course Outcomes-**

On successful completion of the course, the students will be able to:

CO1: Understand and use the tools of structured written communication.

CO2: Develop materials to create an identity for an organization dedicated to a social cause.

CO3: Apply the basic concept of speed reading, skimming and scanning.

CO4: Recognize the concepts of behavior and identify individual role in a team.

CO5: Understand the basic concepts of Morality and Diversity and to create communication material.

**B.TECH  
COMPUTER SCIENCE AND BUSINESS  
SYSTEM  
SEMESTER III SYLLABUS**

# **SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL**

## **SYLLABUS**

### **B.Tech(Computer Science and Business System) III Semester**

#### **CB 301 (FORMAL LANGUAGES AND AUTOMATA THEORY)**

**UNIT I:** Fundamentals: Strings, Alphabet, Language, Operations, Finite state machine, definitions, finite automaton model, acceptance of strings, and languages, deterministic finite automaton and nondeterministic finite automaton, transition diagrams and Language recognizers.

Finite Automata: NFA with  $\hat{I}$  transitions - Significance, acceptance of languages. Conversions & Equivalence: Equivalence between NFA with and without  $\hat{I}$  transitions, NFA to DFA conversion, minimization of FSM, equivalence between two FSM's, Finite Automata with output- Moore and Melay machines.

**UNIT II:** Regular Languages: Regular sets, regular expressions, identity rules, Constructing finite Automata for a given regular expressions, Conversion of Finite Automata to Regular expressions. Pumping lemma of regular sets, closure properties of regular sets.

Grammar Formalism: Regular grammars-right linear and left linear grammars, equivalence between regular linear grammar and FA, inter conversion, Context free grammar, derivation trees, and sentential forms. Right most and left most derivation of strings.

**UNIT III:** Context Free Grammars: Ambiguity in context free grammars. Minimization of Context Free Grammars. Chomsky normal form, Greiback normal form, Pumping Lemma for Context Free Languages. Enumeration of properties of CFL.

Push Down Automata: Push down automata, definition, model, acceptance of CFL, Acceptance by final state and acceptance by empty state and its equivalence. Equivalence of CFL and PDA, interconversion. (Proofs not required). Introduction to DCFL and DPDA.

**UNIT IV:** Turing Machine: Turing Machine, definition, model, design of TM, Computable functions, recursively enumerable languages. Church's hypothesis, counter machine, types of Turing machines (proofs not required). , linear bounded automata and context sensitive language

**UNIT V:** Computability Theory: Chomsky hierarchy of languages, decidability of, problems, Universal Turing Machine, undecidability of posts. Correspondence problem, Turing reducibility, Definition of P and NP problems, NP complete and NP hard problems.

#### **Textbooks-**

1. "Introduction to Automata Theory Languages and Computation". Hopcroft H.E. and Ullman J. D. Pearson Education.
2. Introduction to Theory of Computation –Sipser 2nd edition Thomson.

## **SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL**

### **References-**

1. Introduction to Formal Languages, Automata Theory and Computation Kamala Krithivasan, Rama
2. Introduction to Computer Theory, Daniel I.A. Cohen, John Wiley.
3. Theory of Computation : A Problem – Solving Approach- Kavi Mahesh, Wiley India Pvt. Ltd.
4. “Elements of Theory of Computation”, Lewis H.P. & Papadimitriou C.H. Pearson / PHI.
5. Theory of Computer Science – Automata languages and computation -Mishra and Chandrashekar, 2nd edition, PHI.
6. Introduction to languages and the Theory of Computation, John C Martin, TMH.

### **Course Outcomes-**

On successful completion of the course, the students will be able to:

CO1: Explain basic concepts in formal language theory, grammars, automata theory, computability theory, and complexity theory.

CO2: Demonstrate abstract models of computing, including deterministic (DFA), non-deterministic (NFA), Push Down Automata(PDA) and Turing (TM) machine models and their power to recognize the languages.

CO3: Explain the application of machine models and descriptors to compiler theory and parsing. Students will be able to relate practical problems to languages, automata, computability, and complexity.

CO4: Demonstrate an increased level of mathematical sophistication.

CO5: Apply mathematical and formal techniques for solving problems in computer science. Students will be able to explain the relationship among language classes and grammars with the help of Chomsky Hierarchy

# **SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL**

## **CB 302 (COMPUTER ORGANIZATION AND ARCHITECTURE)**

**UNIT I-** Digital Computers: Introduction, Block diagram of Digital Computer, Definition of Computer Organization, Computer Design and Computer Architecture.

Register Transfer Language and Micro operations: Register Transfer language, Register Transfer, Bus and memory transfers, Arithmetic Micro operations, logic micro operations, shift micro operations, Arithmetic logic shift unit.

Basic Computer Organization and Design: Instruction codes, Computer Registers Computer instructions, Timing and Control, Instruction cycle, Memory Reference Instructions, Input – Output and Interrupt.

**UNIT II-** Microprogrammed Control: Control memory, Address sequencing, micro program example, design of control unit.

Central Processing Unit: General Register Organization, Instruction Formats, Addressing modes, Data Transfer and Manipulation, Program Control.

**UNIT III-** Data Representation: Data types, Complements, Fixed Point Representation, Floating Point Representation.

Computer Arithmetic: Addition and subtraction, multiplication Algorithms, Division Algorithms, Floating – point Arithmetic operations. Decimal Arithmetic unit, Decimal Arithmetic operations.

**UNIT IV-** Input-Output Organization: Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt Direct memory Access.

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary memory, Associate Memory, Cache Memory.

**UNIT V-** Reduced Instruction Set Computer: CISC Characteristics, RISC Characteristics.

Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processor.

Multi Processors: Characteristics of Multiprocessors, Interconnection Structures, Interprocessor arbitration, Interprocessor communication and synchronization, Cache Coherence.

### **Textbooks-**

1. Computer System Architecture – M. Moris Mano, Third Edition, Pearson/PHI.

### **References-**

## **SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL**

1. Computer Organization – Car Hamacher, ZvonksVranesic, SafeaZaky, Vth Edition, McGraw Hill.
2. Computer Organization and Architecture – William Stallings Sixth Edition, Pearson/PHI.
3. Structured Computer Organization – Andrew S. Tanenbaum, 4th Edition, PHI/Pearson

### **Course Outcomes-**

On successful completion of the course, the students will be able to:

- CO1: Understand the basics of instructions sets and their impact on processor design.
- CO2: Demonstrate an understanding of the design of the functional units of a digital computer system.
- CO3: Evaluate cost performance and design trade-offs in designing and constructing a computer processor including memory.
- CO4: Design a pipeline for consistent execution of instructions with minimum hazards.
- CO5: Recognize and manipulate representations of numbers stored in digital computers

# **SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL**

## **CB 303 (OBJECT ORIENTED PROGRAMMING)**

**UNIT – I** Object-Oriented Thinking: Different paradigms for problem solving, need for OOP paradigm, differences between OOP and Procedure oriented programming, Overview of OOP concepts Abstraction, Encapsulation, Inheritance and Polymorphism.

C++ Basics: Structure of a C++ program, Data types, Declaration of variables, Expressions, Operators, Operator Precedence, Evaluation of expressions, Type conversions, Pointers, Arrays, Pointers and Arrays, Strings, Structures, References. Flow control statement- if, switch, while, for, do, break, continue, goto statements. Functions - Scope of variables, Parameter passing, Default arguments, inline functions, Recursive functions, Pointers to functions. Dynamic memory allocation and de-allocation operators-new and delete, Preprocessor directives.

**UNIT – II** C++ Classes and Data Abstraction: Class definition, Class structure, Class objects, Class scope, this pointer, Friends to a class, Static class members, Constant member functions, Constructors and Destructors, Dynamic creation and destruction of objects, Data abstraction, ADT and information hiding.

**UNIT – III** Inheritance: Defining a class hierarchy, Different forms of inheritance, Defining the Base and Derived classes, Access to the base class members, Base and Derived class construction, Destructors, Virtual base class.

Virtual Functions and Polymorphism: Static and Dynamic binding, virtual functions, Dynamic binding through virtual functions, Virtual function call mechanism, Pure virtual functions, Abstract classes, Implications of polymorphic use of classes, Virtual destructors.

**UNIT – IV** C++ I/O: I/O using C functions, Stream classes hierarchy, Stream I/O, File streams and String streams, Overloading operators, Error handling during file operations, Formatted I/O.

**UNIT – V** Exception Handling: Benefits of exception handling, Throwing an exception, The try block, Catching an exception, Exception objects, Exception specifications, Stack unwinding, Rethrowing an exception, Catching all exceptions.

### **Textbooks-**

1. The Complete Reference C++, 4th Edition, Herbert Schildt, Tata McGraw Hill.
2. Problem solving with C++: The Object of Programming, 4th Edition, Walter Savitch, Pearson Education.

### **References-**

1. The C++ Programming Language, 3rd Edition, B. Stroutstrup, Pearson Education.
2. OOP in C++, 3rd Edition, T. Gaddis, J. Walters and G. Muganda, Wiley Dream Tech Press.



## **SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL**

3. Object Oriented Programming in C++, 3rd Edition, R. Lafore, Galigotia Publications Pvt Ltd.

### **Course Outcomes-**

On successful completion of the course, the students will be able to:

CO1: Define Object Oriented Programming concepts.

CO2: Demonstrate C++ classes and data abstraction.

CO3: Develop C++ programs with reusability concept.

CO4: Explain File handling in C++

CO5: Handle exceptions in programming

## **SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL**

### **CB 304 (COMPUTATIONAL STATISTICS + LAB)**

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

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

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

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

**UNIT – V** Clustering: Introduction, Types of clustering, Correlations and distances, clustering by partitioning methods, hierarchical clustering, overlapping clustering, K-Means Clustering- Profiling and Interpreting Clusters

### **LABORATORY (COMPUTATIONAL STATISTICS LAB)**

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

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

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

#### **Textbooks-**

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

#### **Course Outcomes-**

On successful completion of the course, the students will be able to:



# **SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL**

## **CB 305 (DATABASE MANAGEMENT SYSTEM + LAB)**

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

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

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

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

**UNIT V:** 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.

### **Textbooks-**

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

### **Reference books-**

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

### **Course Outcomes-**

On successful completion of the course, the students will be able to:

CO1: Acquire a good understanding of the architecture and functioning of database management systems

CO2: Construct an ER model and derive the relational schemas from the model

CO3: Analyse and apply the principles and practices of good database design.

CO4: Use the concepts of data normalization to analyse, measure and evaluate the performance of a database application

CO5: Grant and revoke privileges and comprehend database recovery techniques. Construct efficient SQL queries to retrieve and manipulate data as required.

**SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL**

**B.TECH  
COMPUTER SCIENCE AND BUSINESS  
SYSTEM  
SEMESTER IV SYLLABUS**

# **SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL**

## **SYLLABUS**

### **B.Tech(Computer Science and Business System) IV Semester**

#### **CB 401 (OPERATING SYSTEMS)**

**UNIT I**-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**-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.

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 III** -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.

**UNIT IV**-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, Dining 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)

**UNIT V**-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).

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

# **SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL**

## **LABORATORY (OPERATING SYSTEMSLAB)**

1. Unix/Linux commands (files directory, data manipulation, network communication etc), shell programming and vi editor
2. C programs for implementation of the following:
  - a. Scheduling Algorithms
  - b. Shared memory
  - c. Thread and Multi Thread
  - d. Inter Process Communication
  - e. Deadlock Avoidance and Deadlock Detection
  - f. Semaphore
  - g. Memory Management
  - h. Indexing and Hashing
3. C Programs for implementing certain commands and a shell like Unix/Linux system shell, using the Unix/Linux System calls.

### **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, .itaseC ocraM

### **Course Outcomes-**

On successful completion of the course, the students will be able to:

CO1: Understand the various OS functionalities and acquire the knowledge of various types of OS

CO2: Design and Implement CPU scheduling algorithms to meet and validate the scheduling criteria

CO3: Implement directories and perform various operations on files/directories in the file system

CO4: Apply the acquired knowledge of deadlocks to Design and implement deadlock free computer programs as well as understand the issues in inter process communication

CO5: Understand how memory is allocated to processes by OS and Implement algorithms related to main and Virtual memory techniques.

## **SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL**

### **CB-402 (DESIGN AND ANALYSIS OF ALGORITHMS)**

**UNIT I**-Introduction:Characteristics of Algorithm. Analysis of Algorithm: Asymptotic analysis ofComplexity Bounds – Best, Average and Worst-Case behavior; Performance Measurements ofAlgorithm, Time and Space Trade-Offs, Analysis of Recursive Algorithms through Recurrence Relations: Substitution Method, Recursion Tree Method and Masters’ Theorem.

**UNIT II**-Fundamental Algorithmic Strategies:Brute-Force, Heuristics, Greedy, Dynamic Programming, Branch andBound and Backtracking methodologies; Illustrationsof these techniques for Problem-Solving, Bin Packing, Knapsack, Travelling Salesman Problem.

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

**UNIT IV**-Tractable and Intractable Problems:Computability of Algorithms, Computability classes – P,NP, NP-complete and NP-hard. Cook’s theorem, Standard NP-complete problems andReduction techniques.

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

### **LABORATORY (DESIGN AND ANALYSIS OF ALGORITHMS LAB)**

Implementation of Different Algorithms based on various algorithmic strategies using C/C++

#### **Text Books:**

1. Fundamental of Computer Algorithms, E. Horowitz and S. Sahni.
2. The Design and Analysis of Computer Algorithms, A. Aho, J. Hopcroft and J. Ullman.

#### **Reference Books:**

1. Introduction to Algorithms, T. H. Cormen, C. E. Leiserson and R. L. Rivest.
2. Computer Algorithms: Introduction to Design and Analysis, S. Baase.
3. The Art of Computer Programming, Vol. 1, Vol. 2 and Vol. 3, .D. E. Knuth.

#### **Course Outcomes-**

On successful completion of the course, the students will be able to:



# **SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL**

## **CB-403 (SOFTWARE ENGINEERING)**

**UNIT I-Introduction:**Programming in the small vs. programming in the large; software project failures and importance of software quality and timely availability; of software engineering towards successful execution of large software projects; emergence of software engineering as a discipline, Software Engineering Historical Development from Jackson Structured Programming to Agile Development.

**UNIT II-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-Software Quality Management and Reliability:**Software quality; Garvin's quality dimensions, McCall's quality factor, ISO 9126 quality factor; Software Quality Dilemma; Introduction to Capability Maturity Models (CMM and CMMI); Introduction to software reliability, reliability models and estimation.

**UNIT IV-Software Requirements Analysis, Design and Construction:**Introduction to Software Requirements Specifications (SRS) and requirement elicitation techniques; techniques for requirement modelling – 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.

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 V-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; Unit Testing, Integration Testing, System Testing and Acceptance Testing.

Agile Software Engineering:Concepts of Agile Methods, Extreme Programming; Agile Process Model - Scrum, Feature; Scenarios and Stories

## **LABORATORY (SOFTWARE ENGINEERING LAB)**

Development of requirements specification, function-oriented design using SA/SD, object-oriented design using UML, test case design, implementation using C++ and testing. Use of appropriate CASE tools and other tools such as configuration management tools, program analysis tools in the software life cycle.

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### **Text Books:**

1. Software Engineering, Ian Sommerville
2. Software Engineering A Practitioner's Approach, Rogers S. Pressman and Bruce R. Maxim.

### **Reference Books:**

1. The Essentials of Modern Software Engineering: Free the Practices from the Method Prisons!, Ivar Jacobson, Harold "Bud" Lawson, Pan-Wei Ng, Paul E. McMahon and Michael Goedicke.
2. Fundamentals of Software Engineering, Carlo Ghezzi, Jazayeri Mehdi and Mandrioli Dino.
3. Software Requirements and Specification: A Lexicon of Practice, Principles and Prejudices, Michael Jackson.
4. The Unified Development Process, Ivar Jacobson, Grady Booch and James Rumbaugh.
5. Design Patterns: Elements of Object-Oriented Reusable Software, Erich Gamma, Richard Helm, Ralph Johnson and John Vlissides.
6. Software Metrics: A Rigorous and Practical Approach, Norman E Fenton and Shari Lawrence Pfleeger.
7. Software Engineering: Theory and Practice, Shari Lawrence Pfleeger and Joanne M. Atlee.
8. Object-Oriented Software Construction, Bertrand Meyer.
9. Object Oriented Software Engineering: A Use Case Driven Approach --Ivar Jacobson.
10. Touch of Class: Learning to Program Well with Objects and Contracts --Bertrand Meyer.
11. UML Distilled: A Brief Guide to the Standard Object Modeling Language --Martin Fowler.
12. Introduction to Business Domains for Software Engineers, Manoj Kumar Lal
13. Knowledge Driven Development – Bridging Waterfall and Agile Methodologies -- Manoj Kumar Lal

### **Course Outcomes-**

On successful completion of the course, the students will be able to:

- CO1: Define software engineering process and practices, and demonstrate various process models
- CO2: Identify different types of risks in software development
- CO3: Distinguish different testing strategies and its working
- CO4: Estimate the quality of software process
- CO5: Develop the SRS document for project.

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## **CB-404 (INTRODUCTION TO INNOVATION, IP MANAGEMENT AND ENTREPRENEURSHIP)**

### **UNIT – I**

#### **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**

#### **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**

#### **Entrepreneurship:**

- Opportunity recognition and entry strategies
- Entrepreneurship as a Style of Management
- Maintaining Competitive Advantage- Use of IPR to protect Innovation

### **UNIT – IV**

#### **Entrepreneurship- Financial Planning:**

- Financial Projections and Valuation
- Stages of financing
- Debt, Venture Capital and other forms of Financing

### **UNIT – V**

#### **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**

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## **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

## **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

## **Course Outcomes-**

On successful completion of the course, the students will be able to:

CO1: Be familiar with creative and innovative thinking styles

CO2: Learn to investigate, understand and internalize the process of founding a startup

CO3: Learn to manage various types of IPR to protect competitive advantage

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## CB-405 (DESIGN THINKING)

	Leadership Oriented Learning (LOL)		
Nature of Course		Behavioral	
Pre requisites		Completion of all units from Semesters 1, 2, 3 and 4	
Course Terminal Objectives:			
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 Enabling Objectives:			
Upon completion of the course, students shall have ability to			
1	Recognize the importance of Design Thinking		[U]
2	Identify the steps in the DT process		[C]
3	Recognize the steps in the empathize phase of DT		[C]
4	Identify the steps required to conduct an immersion activity		[C]

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5	Conduct an immersion activity and fill up the DT question template	[AP]
6	Recognize the steps to create personas in the define phase of DT	[C]
7	Create personas in the define phase of DT	[AP]
8	Recognize the steps to create problem statements in the define phase of DT	[AP]
9	Define the problem statements in the define phase of DT	[E]
10	Recognize the steps in the ideate phase of DT	[C]
11	Apply the steps in the ideate phase of DT	[AP]
12	Recognize how doodling can help to express ideas	[U]
13	Recognize the importance storytelling in presenting ideas and prototypes	[U]
14	Recognize the importance of the prototype phase in DT	[C]
15	Create a prototype	[AP]
16	Recognize the importance of service value proposition	[C]
17	Create a value proposition statement	[AP]
18	Recognize the best practices of the testing phase in DT	[U]
19	Test a prototype created through a DT process	[AP]
20	Recognize how DT can help in functional work	[E]
21	Recognize how Agile and DT complement each other to deliver customer satisfaction	[C]
Course Contents:		
Total Hours:		45 hours
Textbooks:		
	There are no prescribed texts for Semester 5 – there will be handouts and reference links shared.	
Reference Books:		
1	Hooked by NirEyal	

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2	The Art of Creative Thinking by Rod Judkins		
3	Start Up nation by Dan Senor and Saul singer		
4	Start with Why by Simon Sinek		
<b>Web References:</b>			
1	What is Design Thinking? Interaction Design Foundation		
2	What are some of the good examples of design thinking? - Quora		
3	Design thinking 101: Principles, Tools & Examples to transform your creative process		
<b>Online Resources:</b>			
1	Understanding Design thinking WF NEN		
2	Design Thinking and Innovation at Apple Wei Li		
3	Stanford Webinar- Design Thinking = Method, Not Magic		
4	Stanford Design Thinking Virtual Crash Course		
5	So Many Uses- activity to spark creativity and design		
<b>Assessment Methods &amp; Levels (based on Bloom’s Taxonomy)</b>			
<b>Formative assessment (Max. Marks:20)</b>			
<b>Course Outcome</b>	<b>Bloom’s Level</b>	<b>Assessment Component</b>	<b>Mark s</b>
	Apply	Defining problem statement	5
	Apply	Ideating solutions	5
	Apply	Creating a prototype	10
<b>Summative Assessment based on End Semester Project</b>			

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Bloom's Level		
Understand	Understand, Analyze, Apply  Conduct and apply DT in the project.	50
Apply		
Analyze		

### Lesson Plan

Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
1	Recognize the importance of Design Thinking	2	<p><b>Why is Design Thinking important for business?</b></p> <p>Stories and examples will be used to introduce Design Thinking to the participants. We will use relevant stories and the following videos.</p> <ol style="list-style-type: none"> <li>1. YouTube video: The Design Thinking Process – Sprouts(3.57 mins)</li> <li>2. Leverage TCS-provided DT content to show the evolution of DT and why is important in present business environment. Can be a video. (2 mins)</li> </ol> <p>Lecturer to encourage the students to maintain their Satori slam book and capture their learning points in it.</p>	Introduction and discussion	60 mins
1	Recognize the importance of Design Thinking	2	<p><b>Why is Design Thinking important for you?</b></p> <p>Experiential activity</p> <p><b>Products that you loved and</b></p>	Activity	90 mins



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Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
			<p><b>hated:</b> In this activity, learners will have to share about a product they like or dislike based on their experience.</p> <p>What would they need in a bad product to make it good?</p>		
1	Identify the steps in the DT process	2	<p><b>What is DT?</b></p> <p>Introduce the 5-Step Stanford Model using YouTube videos:</p> <p>The video will give a brief idea about the five steps:</p> <ul style="list-style-type: none"> <li>• Empathize (search for rich stories and find some love)</li> <li>• Define (user need and insights – their POV)</li> <li>• Ideate (ideas, ideas, ideas)</li> <li>• Prototype (build to learn)</li> <li>• Test (show, don't tell)</li> </ul> <p>Start all over and iterate the flow as much as possible</p>	Lecture and demo	60 mins
1	Recognize the steps in the empathize phase of DT	2	<p><b>What is empathy?</b></p> <p>Touch the target activity (Recap from Sem 2 Unit 4)</p> <p>Discussions in class</p> <p>Reference: FHIL   Stages of Design Thinking   EMPATHY (2:29 mins)</p>	Activity	60 mins

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1	Identify the steps required to conduct an immersion activity	1 and 2	<b>How to empathize?</b>  Moccasin Walk activity for 1 hour to allow learners experience stepping into the shoes of another person. <i>This is an individual activity.</i>  Sharing observations with the group.  Suggest that students try this even in their free time away from studies.	Activity and lecture	90 mins
1	Identify the steps required to conduct an immersion activity	1 and 2	<b>Intro to Immersion Activity</b>  Introduction to immersion activity through flowcharts and handouts and examples (to be provided by	Lecture	45 mins
Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
			TCS DT Team) (steps and thequestion template:  <ol style="list-style-type: none"> <li>1. We met;</li> <li>2. We were amazed to realize that;</li> <li>3. We wonder if this means</li> <li>4. It would change the world if)</li> </ol>		
1	Conduct an immersion activity and fill up the DT question template	3	<b>Immersion activity</b>  Participants will be divided into four groups. Each group will need to visit any one of the following places to conduct an immersion activity. They need to interview people and fill up the DT question template (explained in the last class)  <ol style="list-style-type: none"> <li>1. College cafeteria</li> <li>2. College library</li> <li>3. College sports facility</li> <li>4. Transport facility near college</li> </ol>	Practical	180 mins

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2	<p>Recognize the steps to create personas in the define phase of DT</p> <p>Create personas in the define phase of DT</p>	<p>2</p> <p>3</p>	<p><b>Creating personas</b></p> <p>Start with YouTube videos explaining the process of persona creation:</p> <p>1. Personas – What is a persona and how do I create one? (2019)</p> <p><a href="https://www.youtube.com/watch?v=GNvLpfXCge8">https://www.youtube.com/watch?v=GNvLpfXCge8</a></p> <p>Each group will create at least one persona based on the immersion study they conducted in the empathize stage (refer to the four question templates). The group can use A4 pages, colours and other props to create and display their respective persona.</p> <p><b>Reference:</b>  <a href="https://www.interaction-design.org/literature/article/personas-why-and-how-you-should-use-them">https://www.interaction-design.org/literature/article/personas-why-and-how-you-should-use-them</a></p>	Lecture and practical	120 mins
Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
			Lecturer to guide participants on getting the personas right (based on guidelines provided by TCS DTTeam).		
2	<p>Recognize the steps to create problem statements in the define phase of DT</p>	2	<p><b>Problem statements</b></p> <p>Session will begin with YouTube videos on how to define problem statements in the Define phase.</p> <p>1. FHIL   Stages of Design Thinking   REFRAME (1:55mins)</p> <p>Lecturer will provide examples of problem statements in class (based on handouts provided by TCS DT</p>	Lecture and demo	60 mins

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			Team)		
<b>2</b>	Define the problem statements in the define phase of DT	3	<b>Defining problem statements</b>  Group activity, in which each group will define the key problem statements (max three) for their lead personas.  Each group will present while the remaining groups will do a peer review.  Finally, lecturer will moderate/validate the problem statements (based on handouts provided by TCS DT Team)	Formative assessment	90 mins
<b>3</b>	Recognize the steps in the ideate phase of DT	1 and 2	<b>How to Ideate?</b>  The session will start with YouTubevideos:	Lecture and demo	60 mins
Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
			1. FHIL   Stages of DesignThinking   IDEATE (1:54secs) 2. What Is Six Thinking Hats?(Litmos Heroes) (1:58 secs)  Lecturer to briefly tell them about the guidelines of ideating (to be provided by TCS DT Team)		
<b>3</b>	Apply the steps in the ideate phase of DT	3	<b>Ideation games</b>  Game 1: Six Thinking Hats Game 2: Million-dollar idea	Activity	90 mins

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3	Apply the steps in the ideate phase of DT	3	<b>Ideate to find solutions</b>  Participants will work in their assigned groups to ideate solutions for the problem statements they identified (as continuation of immersion activity) applying ideation methods discussed in the previous session. They will get scores based on how well they can apply the ideation methods.  Lecturers will observe the groups separately and assign them scores based on specific rubric (provided by the TCS DT Team).	Formative assessment	90 mins
3	Recognize how doodling can help to express ideas	1	<b>Let's doodle!</b>  Participants will first watch a video on doodling:  Doodling – how it can help in presenting ideas during ideate and prototype phases  After that, participants will complete an activity on doodling.	Demo and activity	60 mins
3	Recognize the importance of storytelling in presenting ideas and prototypes	1	<b>What is Storytelling in DT?</b>  Activity- Research to find out about people who have used DT in providing solutions. Present their findings in forms of stories. (Recap from Unit- Sem-)  Suggested topics to be provided by the TCS DT team.	Activity	120 mins
<b>Unit No</b>	<b>Objective</b>	<b>Bloom's Level</b>	<b>Content</b>	<b>Type of Class</b>	<b>Duration</b>
4	Recognize the importance of the prototype phase in DT	2	<b>Why is a Prototype important in Design Thinking?</b>  The session will start with an activity to drive home the importance of creating a prototype in the design thinking process.  As part of debrief of the activity,	Activity and demo	60 mins

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			<p>lecturer will share relevant examples and prototyping guidelines (provided by the TCS DTTeam).</p> <p>Finally, the participants will watch two YouTube videos:</p> <p>1. FHIL   Stages of Design Thinking   PROTOTYPE</p> <p>2. Prototyping Phase - Design Thinking   Coursera  <a href="https://www.coursera.org/lecture/patient-safety-project-planning/prototyping-phase-jVuQn">https://www.coursera.org/lecture/patient-safety-project-planning/prototyping-phase-jVuQn</a></p>		
4	Create a prototype	3	<p><b>Prototype your idea</b></p> <p>This is a group activity in which the participants will work in groups (created at the beginning of the course, in which they did immersion, persona creation, defining problem statement and ideating) to create prototypes based on the solutions they had identified.</p> <p>Lecturer to share feedback based on guidelines provided by the TCsDT team.</p>	Formative assessment	180 mins
4	<p>Recognize the importance of service value proposition</p> <p>Create a value proposition statement</p>	<p>2</p> <p>3</p>	<p><b>Value Proposition Statement</b></p> <p>You Tube: What is Value Proposition (by Venture Well)(3:51 mins)?</p> <p>Lecturer to discuss the guidelines for creating a value proposition</p>	Lecture	<p>120 mins</p> <p>1635 mins</p>
<b>Unit No</b>	<b>Objective</b>	<b>Bloom's Level</b>	<b>Content</b>	<b>Type of Class</b>	<b>Duration</b>

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			<p>statement (to be provided by the TCS DT Team)</p> <p>Each group now needs to create value proposition statement for the solution they have suggested.</p>		
4	Recognize the best practices of the testing phase in DT	1	<p><b>Testing in Design Thinking</b></p> <p>Participants will first watch a YouTube video:</p> <p>FHIL   Stages of Design Thinking   TESTING</p> <p>After that lecturers will explain them the importance of Testing the prototype through stories (provided by the TCS DT Team).</p> <p>They will also explain how the loop works in DT between the Empathize and Testing phases.</p>	Lecture	60 mins
	Test a prototype created through a DT process	3	<p><b>Test the Prototype</b></p> <p>Each group needs to test their prototype created earlier and:</p> <ol style="list-style-type: none"> <li>1. Document user feedback</li> <li>2. Write down their inference from the feedback</li> <li>3. Suggest next steps (the loop that happens in DT)</li> </ol>	Activity	120 mins
4	Recognize how DT can help in functional work	1	<p><b>Role of DT in your work</b></p> <p>Lecturer conducts a group/open house discussion on:</p> <p>“How DT can help me to become a better coder?”</p> <p>Lecturer needs to capture the key learning points in these discussions.</p>	Discussion	60 mins

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4	Recognize how Agile and DT complement each other to deliver customer satisfaction	1	<p>Suggested session on:</p> <p><b>How Agile and DT complement each other to deliver customersatisfaction</b></p>	Lecture	45 mins
4			<p><b>Share your Satori</b></p> <p>Participants will be asked to share their Satori moments from the DT sessions</p>	Reflection activity	60 mins
Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
					33 hours
			<p><b>Project</b></p> <p><b>Option 1:</b> 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.</p> <p>Option 2: Each group will apply DT to create a prototype to improve any existing product or service.</p> <p>For both options, groups need to complete all phases of the Stanford DT model and include the outputs of each phase in their presentation.</p> <p>Lecturers will evaluate the project based on the rubric provided by the TCS DT Team.</p>		12 hours
				<b>Total</b>	<b>45 hours</b>



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## CB-406 (OPERATIONS RESEARCH)

### **Unit-I: 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 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 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**

**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.

**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-V**

**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 behaviour, 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.

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**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.

### **LABORATORY (OPERATIONS RESEARCH)**

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

#### **Text Books:**

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

#### **Reference Books:**

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

#### **Course Outcomes-**

On successful completion of the course, the students will be able to:

**B.TECH  
COMPUTER SCIENCE AND BUSINESS  
SYSTEM  
SEMESTER V SYLLABUS**

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## **SYLLABUS**

### **B.Tech(Computer Science and Business System) V Semester**

#### **CB-501 SOFTWARE DESIGN WITH UML**

##### **UNIT – I**

##### **INTRODUCTION TO SOFTWARE ENGINEERING AND UML:** Introduction- Software

Engineering Concepts- Development activities- Managing software development- UML introduction- modeling concepts- Project organization and communication.

##### **UNIT – II**

**REQUIREMENTS ELICITATION AND ANALYSIS:** Introduction-Requirement Elicitation Concepts- Requirements Elicitation Activities- Managing Requirements Elicitation- Case Study: ARENA-Analysis concepts- Analysis activities: From Use cases to Objects- Managing Analysis.

##### **UNIT – III**

**STATIC UML DIAGRAMS:** Class Diagram- Elaboration - Domain Model- Finding conceptual classes and description classes- Associations- Attributes- Domain model refinement- Finding conceptual class Hierarchies- Aggregation and Composition- Relationship between sequence diagrams and use cases - When to use Class Diagrams

##### **UNIT – IV**

**DYNAMIC UML DIAGRAMS:** Dynamic Diagrams- UML interaction diagrams - System sequence diagram - Collaboration diagram- When to use Communication Diagrams- State machine diagram and Modelling - When to use State Diagrams-Activity diagram- When to use activity diagrams Implementation Diagrams- UML package diagram-When to use package diagrams- Component and Deployment Diagrams- When to use Component and Deployment diagrams

##### **UNIT – V**

**DESIGN PATTERNS:** Design Pattern- Describing Design Patterns- How design patterns solve design problems- Selecting a design Pattern- Using a design pattern- Case Study: Designing a Document Editor

##### **List of Experiments**

Students should design a mini project and should apply the following experiments.

1. Requirement Engineering
  1. Writing Problem Statement
  2. Writing Requirement Specification
    - SRS
    - Use Case
  3. Planning Project with PERT Diagram
2. **Designing Project.**
  1. Use Case Diagrams
  2. Interaction Diagrams
  3. State chart Diagrams
  4. Activity Diagrams

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5. Class Diagrams
6. Package Diagrams
7. Component Diagrams
8. Deployment Diagrams.
9. Mapping Design to code.

### **Text Book**

1. Bernd Bruegge and Allen H. Dutoit, “Object-Oriented Software Engineering: using UML, Patterns, and Java”, Third Edition, Prentice Hall, 2010.

### **Reference Books:**

1. Erich Gamma, Richard Helm, Ralph Johnson, and John M. Vlissides, “Design Patterns: Elements of Reusable Object-Oriented Software” Addison-Wesley Professional, 1994.
2. Ali Bahrami, “Object Oriented Systems Development”, McGraw Hill Edition, 2017.

### **Online Resources**

3. [https://www.umsl.edu/~sauterv/analysis/488\\_f01\\_papers/quillin.htm](https://www.umsl.edu/~sauterv/analysis/488_f01_papers/quillin.htm)
4. <https://medium.com/omarelgabrys-blog/object-oriented-analysisand-design-introduction-part-1-a93b0ca69d36>

# SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL

## CB-502 COMPILER DESIGN

### UNIT – I

**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

**Syntax Analysis (Parser):** Context-free languages and grammars, push-down automata, LL(1) grammars and top-down parsing, operator grammars, LR(0), SLR(1), LR(1), LALR(1) grammars and bottom-up parsing, ambiguity and LR parsing, LALR(1) parser generator, yacc, bison

### UNIT – III

**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 – IV

**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 – V

**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.

### List of Experiments

1. Implement a lexical analyzer to recognize tokens in C. (identifiers, constants, operators, keywords etc.).
2. Design a Calculator using LEX.
3. Identify an arithmetic expression using LEX and YACC.
4. Evaluate expression that takes digits, \*, + using YACC.
5. Generate Three address codes for a given expression (arithmetic expression, flow of control).
6. Implement Code Optimization Techniques like copy propagation, dead code elimination, common sub expression elimination.
7. Generate Target Code (Assembly language) for the given set of Three Address Code.

### Books:

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

### Reference Books:

1. The Design and Evolution of C++, Bjarne Stroustrup.
2. Compiler Design, Raghavan, TMH Pub.
3. Compiler Construction: Principles and Practice, Loudon, Cengage Learning
4. Compiler Design in C, A. C. Holub. Prentice-Hall Inc., 1993.
5. Writing compiler & Interpreters, Mak, Willey Pub.

# SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL

## CB-503 FUNDAMENTALS OF MANAGEMENT

### UNIT – I

**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

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

### UNIT – III

**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

**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

**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

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

#### Home Assignment:

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:

1. Understanding the Theory and Design of Organizations by Richard L. Daft, 11e, Cengage, 2020
2. Management by James Arthur, Finch Stoner, R. Edward Freeman, and Daniel R Gilbert 6th Ed; Publisher: Pearson Education/Prentice Hall
3. Organizational Behaviour by Stephen P. Robbins, Prentice Hall, 2013

#### Reference Books:

1. Organizational Behaviour by Fred Luthans, Mc Graw-Hill, 2013
2. Organizational Behavior by Stephen P. Robbins, Timothy A. Judge, Neharika Vohra, 16e, Pearson Education, 2016
3. Business Ethics: Ethical Decision Making & Cases, by O. C. Ferrell, John Fraedrich, Linda Ferrell, 12th edition, Cengage, 2017

# **SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL**

## **CB-504 Business Strategy**

### **UNIT – I**

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**

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**

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**

Corporate Strategy, and Growth Strategies, The Motive for Diversification, Related and Unrelated Diversification, Business Portfolio Analysis, Expansion, Integration and Diversification, Strategic Alliances, Joint Ventures, and Mergers & Acquisitions

### **UNIT – V**

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

### **Home Assignment:**

- 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.

### **Final Project:**

Students (in groups) are required to work on a project and submit the project report and deliver presentation. The topic of the project will be given later.

### **Text Books:**

1. Contemporary Strategic Management by Robert M. Grant, 7th Edition, Blackwell, 2012
2. Competitive Strategy by Michael E. Porter, The Free Press, 1980
3. Competitive Advantage by Michael E. Porter, The Free Press, 1985

### **Reference Books:**

1. Competitive Strategy, 1980.M.E. Porter,
2. Competitive Advantage, 1985 Richard Rumelt (2011).
3. Good Strategy Bad Strategy: The Difference and Why It Matters by Richard Rumelt, Profile Books Ltd, 2013
4. Strategic Management by Francis Cherunilam, 4th Edition, HPH, 2016
5. Strategic Management and Business Policy by Azhar Kazmi, McGraw Hill Education, 2018



# **SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL**

## **CB-505 Business Communication & Value Science-III**

### **Unit I**

SWOT and Motivation in Real Life Scenarios, SWOT and Life Positions; Create your SWOT; SWOT Vs. TOWS – The Balancing Act; Presentation on the strengths identified to survive in the VUCA World; Motivation; Scenario based activity on identifying and leveraging motivation; Present findings and approaches as groups.

### **Unit II**

Pluralism in Cultural Spaces Rivers of India; Awareness and respect for pluralism in cultural spaces; Rhythms of India (Cultures in India; Global, Glocal, Translocational, Debate on Global, Glocal, translocational impacts; Cross-cultural communication; Culture shock; Gender awareness - Gender awareness campaign

### **Unit III**

Role of science in nation building, Role of science post- independence, Introduction to technical writing, Basic rules of technical writing through examples. Practice activity on technical writing. Application of technical writing in real-life scenarios. Maslow's theory - Recognize how motivation helps real life - Leverage motivation in real-life scenarios.

### **Unit IV**

Introduction to Artificial Intelligence, Importance of AI, AI in Everyday Life

### **Text Book(s)**

1. Kumar, Sanjay and Pushp Lata. English Language and Communication Skills for Engineers, Oxford University Press.

### **Reference Books**

2. Pringle, A. S., & O'Keefe, S. S. (2009). Technical Writing 101: A Real-World Guide to Planning and Writing Technical Content (3rd ed.). Scriptorium Publishing Services, Inc.
4. Alfred, G. J., Brusaw, C. T., & Oliu, W. E. (2011). Handbook of Technical Writing, Tenth Edition (10th ed.). St. Martin's Press.
5. Reynolds, S., Valentine, D., & Munter, M. M. (2019). Guide to Cross-Cultural Communications (2<sup>nd</sup> Edition) (Guide to Series in Business Communication) (2nd ed.). Pearson
6. Hurn, B., & Tomalin, B. (2016). Cross-Cultural Communication: Theory and Practice (1st ed. 2013 ed.). Palgrave Macmillan.

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## CB-506 (A) Conversational Systems

### Unit I

#### **Fundamentals of Conversational Systems:**

**Introduction:** Overview, Case studies, Explanation about different modes of engagement for a human being, History and impact of AI.

**Underlying Technologies:** Natural Language Processing, Artificial Intelligence and Machine Learning, NLG, Speech-To-Text, Text-To-Speech, Computer Vision etc.

**Introduction to Top players in Market** – Google, MS, Amazon & Market trends.

**Messaging Platforms** (Facebook, WhatsApp) and Smart speakers – Alexa, Google Home and other new channels. Ethical and Legal Considerations in AI Overview

### Unit II

**Foundational Blocks for Programming:** Basic Python programming concepts, Node Basics.

**Natural Language Processing:** Introduction: Brief history, Basic Concepts, Phases of NLP, Application of chatbots etc. General chatbot architecture,

**Basic concepts in chatbots:** Intents, Entities, Utterances, Variables and Slots, Fulfillment. Lexical Knowledge Networks (WordNet, Verbnet, PropBank, etc). Lexical Analysis, Part-of-Speech Tagging, Parsing/Syntactic analysis, Semantic Analysis, Word Sense Disambiguation. Information Extraction, Sentiment Analysis), Affective NLG

### Unit III

**Building a chatbot/Conversational AI system:** Fundamentals of Conversational Systems (NLU, DM and NLG), Chatbot framework & Architecture, Conversational Flow & Design, Intent Classification (ML and DL based techniques), Dialogue Management Strategies, Natural Language Generation, UX design, APIs and SDKs, Usage of Conversational Design Tools.

**Introduction to popular chatbot frameworks** – Google Dialog flow, Microsoft Bot Framework, Amazon Lex, RASA Channels: Facebook Messenger, Google Home, Alexa, WhatsApp, Custom Apps. Overview of CE Testing techniques, A/B Testing, Introduction to Testing Frameworks - Botium /Mocha ,Chai. Security & Compliance – Data Management, Storage, GDPR, PCI.

### Unit IV

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

### Unit V

**Contact Centers: Introduction to Contact centers** – Impact & Terminologies. Case studies & Trends, How does a Virtual Agent/Assistant fit in here?

**Overview on Conversational Analytics:** Conversation Analytics: The need of it, Introduction to Conversational Metrics.

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

### List of Experiments

1. A python program to identify morphological features of a word by analysing it.
2. A python program to generate word forms from root and suffix information.
3. A python program to perform morphological analysis of a word by the use of Add-Delete table.
4. A python program to calculate the bigrams from a given corpus and calculate probability of a

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sentence.

5. A python program to do sentiment analysis for the given dataset and to classify sentences based on their categories.
6. A python program to find Parts – Of - Speech tags of words in a sentence.
7. A python program to know the importance of context and size of training corpus in learning Parts of Speech and understand the concept of chunking and get familiar with the basic chunk tagset.
8. A python program to detect the entities from the dataset and tag them based on their categories.
9. A python program to build a Neural Network to recognize handwritten digits using MNIST dataset.
10. A python program to build a Recurrent Neural Model with Keras.
11. Formulate a problem statement for mini-project to build a chatbot for an application that proves its importance from a social perspective.

### **Text Books:**

1. Designing Voice User Interfaces: Principles of Conversational Experiences 1st Edition by Cathy Pearl, O'Reilly
2. Conversational Interfaces: Principles of Successful Bots, Chatbots & Messaging Apps By Mariya Yao

### **References:**

1. Bot Business 101: How to start, run & grow your Bot / AI business By Ekim Kaya
2. Designing Bots: Creating Conversational Experiences By Amir Shevat O'Reilly
3. Designing Conversational Interfaces By Alper Çuğun

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## **CB-506 (B) Cloud, Microservices & Application**

### **Unit I**

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

### **Unit II**

Application architectures-Monolithic & Distributed, Microservice fundamental and design approach, Cloud Native applications-12 Factors App.

### **Unit III**

Application integration process/Apification Process, API Fundamental. Microservice /API management, Spring boot Fundamental and design of microservice, API tools. Developer Portal. Applications of Microservice and APIFICATION.

### **Unit IV**

Devops fundamentals: Tools and Applications Containerization Process and application. Python-Refresher, Use cases for cloud application development.

### **Unit V**

Design and developing solution steps using containers & containerization of application and deployment using Kubernetes, Cloud Security and Monitoring Tools

### **List of Experiments**

1. Find procedure to run the virtual machine of different configuration using virtual-manager.
2. Virtualize a machine and check how many virtual machines can be utilized at a particular time.
3. Create a VM Clone and attach virtual block to the cloned virtual machine and check whether it holds the data even after the release of the virtual machine.
4. Create a Snapshot of a VM at a given point in time and test the snapshot by restoring the VM to that time. (Note: Testing can be done by installing an application and then restore it.)
5. Develop a simple application to understand the concept of PAAS using GAE/Amazon Elastic Beanstalk/IBM Blue Mix and launch it.
6. Test how a SaaS applications scales in response to demand.
7. Find the procedure to launch a Cloud instance using a Public IaaS cloud like AWS/GCP.
8. Setup a Private Cloud by performing the procedure using a Single node OPENSTACK implementation.
9. Find the procedure to develop a DevSecOps – Cloud (AWS, GCP, Azure).
10. Find the procedure to develop a DevSecOps – Cluster (Kubernetes).
11. Find the procedure to develop a Container (Docker).

To Build and Test Your Docker Images in the Cloud with Docker commands.

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### **Text Books:**

1. Cloud Computing: Principles and Paradigms by Rajkumar Buyya, James Broberg and Andrzej M. Goscinski, Wiley, 2011
2. Cloud Computing Virtualization Specialist Complete Certification Kit - Study Guide Book, Ivanka Menken Gerard Blokdijs, 2009
3. Cloud Security: A Comprehensive Guide to Secure Cloud Computing By Ronald L. Krutz, Russell Dean Vines

### **Reference Books:**

1. Cloud Computing: A Practical Approach, Anthony T. Velte, Tobe J. Velte, Robert Elsenpeter, Publication Person Education, 2009
2. Storage Virtualization: Technologies for Simplifying Data Storage and Management, Tom Clark, Addison-Wesley, 2005
3. Cloud Computing Technologies and Strategies of the Ubiquitous Data Center, Curtis Franklin Jr. Brian J.S. Chee, 2010
4. Introduction to Cloud Computing: Business & Technology, Timothy Chou, 2009

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## CB-506 (C) Machine Learning

### UNIT – I

**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

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

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

### UNIT – IV

**Regression:** Multi-variable regression; Model evaluation; Least squares regression; Regularization; LASSO; Applications of regression

### UNIT – V

Association rule mining algorithms including apriori, Expectation-Maximization (EM) algorithm for unsupervised learning. Clustering: Average linkage; Ward's algorithm; Minimum spanning tree clustering; K- nearest neighbours clustering; BIRCH; CURE; DBSCAN, Anomaly and outlier detection methods.

### List of Experiments

1. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate- Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
2. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file. A python program to implement decision tree
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Python ML libraries.
5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the support vector Classifier model to perform this task. Python can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Python ML libraries can be used for this problem.
8. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
9. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points.

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Select appropriate data set for your experiment and draw graphs.

10. 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 Python ML API in the program.
11. Implementation of a mini project – Stock prices predictor/ Sports predictor/ Sentiment analyzer/ Healthcare predictor.

### **Text Books:**

1. Machine Learning, Tom M. Mitchell, vMcGraw-Hill
2. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012
3. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007

### **References:**

1. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis
2. Machine Learning: The art and science of algorithms that make sense of data, Peter Flash, Cambridge. University press
3. The Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani, Jerome Friedman, Springer 2009
4. Pattern Classification, 2/e, R.O. Duda, P.E. Hart, D.G. Stork, Wiley, 2001
5. Pattern Recognition and Machine Learning, C. Bishop, Springer, 2007
6. Introduction to Machine Learning, 3/e, E. Alpaydin, Prentice-Hall, 2014
7. Foundations of Machine Learning, A.Rostamizadeh, A. Talwalkar, M. Mohri, MIT Press
8. Statistical Pattern Recognition, 3/e, A. Webb, Wiley, 2011

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**B.TECH  
COMPUTER SCIENCE AND BUSINESS  
SYSTEM  
SEMESTER VI SYLLABUS**



# **SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL**

## **SYLLABUS**

### **B.Tech(Computer Science and Business System) VI Semester**

#### **CB-601 COMPUTER NETWORK**

##### **Objectives:**

- Understand the concepts of computer networks and learn techniques for bandwidth utilization.
- Be exposed to various addressing schemes and error detection-correction of data.
- Learn the routing protocols, transport layer, flow control and congestion control algorithms.
- Be familiar with real time applications of networking devices and tools.
- To write different applications using different types of sockets.

##### **UNIT – I**

**FUNDAMENTALS AND PHYSICAL LAYER:** 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. Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.

##### **UNIT – II**

**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**

**NETWORK LAYER:** Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP-Delivery, Forwarding and Unicast Routing protocols.

##### **UNIT – IV**

**TRANSPORT LAYER:** Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service (QoS), QoS improving techniques - Leaky Bucket and Token Bucket algorithms.

##### **UNIT – V**

##### **APPLICATION LAYER AND SECURITY:**

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

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

##### **List of Experiments**

1. Learn to use basic commands.
2. Configuration of Network in Linux Environment.
3. Assignment of IP Address to computers.
4. Implementation of Subnet mask in IP addressing.

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5. Implementation of setup of a Local Area Network (using Switches) – Minimum 3 nodes and Internet.
6. To capture, save, and analyse network traffic on TCP / UDP / IP / HTTP / ARP /DHCP /ICMP /DNS using Wireshark Tool.
7. Write a socket PING program to test the server connectivity.
8. Study of system administration and network administration.
9. Study of socket programming and client server model using TCP and UDP.
10. Programs using TCP Sockets (like date and time server & client, echo server & client, chat etc.)
11. Programs using UDP Sockets (like echo server, chat, simple DNS).
12. Simulation of sliding window.
13. Implementation of ARP.

### **Course Outcomes:**

1. On completion of the course, the students will be able to:
2. Choose the required functionality at each layer for given application.
3. Trace the flow of information from one node to another node in the network.
4. Apply the knowledge of addressing scheme and various routing protocols in data communication to select optimal path.
5. Monitor the traffic within the network and analyze the transfer of packets.
6. Develop real time applications of networks using socket programming.

### **Text Book**

1. Andrew S. Tanenbaum and David J. Wetherall, “Computer Networks”, 5th edition, Pearson education, 2016.
2. William Stallings, “Data and Computer Communication”, 10th edition, Pearson education, 2017.

### **Reference Books:**

3. Kaufman, R. Perlman and M. Speciner, “Network Security”, Pearson education, 2017.
4. W. Richard Stevens, “UNIX Network Programming, Vol. 1,2 & 3”, Prentice-Hall of India, 2004.

### **Online Resources**

5. [https://www.umsl.edu/~sauterv/analysis/488\\_f01\\_papers/quillin.htm](https://www.umsl.edu/~sauterv/analysis/488_f01_papers/quillin.htm)
6. <https://medium.com/omarelgabrys-blog/object-oriented-analysisand-design-introduction-part-1-a93b0ca69d36>

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## **CB-602 INFORMATION SECURITY**

### **Objectives:**

- To understand the overview of computer security.
- To understand the information security policy and system design.
- To understand techniques of system security.
- To learn about various applications of system security.
- To learn about operating system and database security.

### **UNIT-I**

**OVERVIEW OF COMPUTER SECURITY:** The Basic Components- Confidentiality, integrity and availability; Security policy and procedure; Assumptions and Trust; Security Assurance, Implementation and operational issues; Security Life Cycle -Access Control Models: Role based Model.

### **UNIT-II**

**SECURITY POLICIES AND SYSTEM DESIGN:** Types of Security Policies-Confidentiality policies: Goals of Confidentiality Policies, The Bell-LaPadula Model- Integrity policies: Biba Integrity Model, Clark-Wilson Integrity Model -Hybrid policies: Chinese Wall Model, Clinical Information Systems Security Policy. Access Control Mechanisms: Access Control Lists-Information Flow:

Compiler-Based Mechanisms, Execution-Based Mechanisms- Confinement Problem: Isolation, Covert Channels- Assurance: Building Secure and Trusted Systems- Evaluating Systems: Goals of Formal Evaluation.

### **UNIT-III**

**SYSTEM SECURITY:** Malicious Logic: Trojan Horses, Computer Viruses, Computer Worms- Vulnerability Analysis: Penetration Studies, Vulnerability Classification-Auditing: Anatomy of an Auditing System, Auditing Mechanisms, Audit Browsing- Intrusion Detection: Architecture, Organization of Intrusion Detection Systems- Design Principles- Representing Identity: Files and Objects, Users, Groups and Roles, Naming and Certificates.

### **UNIT-IV**

**APPLICATIONS:** Network Security: Policy Development, Network Organization- System Security: Policy- User Security: Policy, Access, Files and Devices- Program Security: Requirements and Policy, Design, Case Study: Common Security-Related Programming Problems.

### **UNIT-V**

**OPERATING SYSTEM AND DATABASE SECURITY:** Operating System Security: Security Architecture, Analysis of Security in Linux/Windows-Database Security: Security Architecture, Database Auditing-Case Study: Discretionary Access Control.

### **LIST OF EXPERIMENTS**

1. Analysis of security in Unix/Linux.
2. Administration of users, password policies, privileges and roles.
3. Implementation of discretionary access control and mandatory access control.
4. Demonstrate intrusion detection system (ids) using any tool Eg. Snort or any other software.
5. Implementation of IT audit, malware analysis and vulnerability assessment and generate the report.
6. Implementation of mobile audit and generate the report of the existing artifacts.
7. Implementation of OS hardening and RAM dump analysis to collect the artifacts and other

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information.

8. Implementation of digital forensics tools for disk imaging, data acquisition, data extraction and data analysis and recovery.
9. Perform mobile analysis in the form of retrieving call logs, SMS log, all contacts list using the forensics tool like SAFT.
10. Implementation to identify web vulnerabilities, using OWASP project.

### **Course Outcomes:**

1. On completion of the course, the students will be able to
2. Discuss the basics of information security and international standards.
3. Analyse information security policy and system design.
4. Comprehend system level security.
5. Apply system level security in various environments.
6. Analyze the operating system and database security methods.

### **Text Book(s):**

1. Ross Anderson, "Security Engineering: A Guide to Building Dependable Distributed Systems", Third Edition, Wiley, 2021.
2. M. Bishop, "Computer Security: Art and Science", 2nd Edition, Pearson Education, 2019.
3. M. Stamp, "Information Security: Principles and Practice", 2nd Edition, Wiley, 2011.

### **Reference Books:**

1. C.P. Pfleeger, S.L. Pfleeger, J. Margulies, "Security in Computing", 5th Edition, Prentice Hall, 2015.
2. David Wheeler, "Secure Programming HOW TO", v3.010 Edition, 2003.
3. Michael Zalewski, "Browser Security Handbook", Google Inc., 2009.
4. M. Gertz, S. Jajodia, "Handbook of Database Security", Springer, 2008.

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## CB-603 ARTIFICIAL INTELLIGENCE

### Objectives:

- To understand the intelligent agents and formulate a problem in search space.
- To analyze the problem and learn the different search techniques.
- To learn the constraint satisfaction problem and game theory.
- Study the system of knowledge representation using rules and reasoning.
- To gain knowledge on probabilistic reasoning and expert systems.

### UNIT-I

#### INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND PROBLEM-SOLVING

**AGENT:** Intelligent agents, agents & environment, nature of environment, structure of agents, goal-based agents, utility-based agents, learning agents. Problems of AI, AI technique, Tic - Tac - Toe problem. Defining the problem as state space search, production system, problem characteristics, and issues in the design of search programs.

### UNIT-II

**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

**CONSTRAINT SATISFACTION PROBLEMS AND GAME THEORY:** Local search for constraint 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

**PROBABILISTIC REASONING AND EXPERT SYSTEMS:** 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.

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

#### List of Experiments

1. Programs on Problem Solving
  - a. Write a program to solve 8 Queens problem
  - b. Solve any problem using depth first search
  - c. Implement MINIMAX algorithm
  - d. Implement A\* algorithm
2. Programs on Decision Making and Knowledge Representation
  - a. Introduction to PROLOG

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- b. Implementation of Unification and Resolution Algorithm.
- c. Implementation of Backward Chaining
- 3. Programs on Planning and Learning
  - a. Implementation of Blocks World program.
  - b. Implementation of SVM for an application using python.
  - c. Implementing Artificial Neural Networks for an application using python.
  - d. Implementation of Decision Tree
  - e. Implementation of K-mean algorithm

### **Text Books:**

- 4. Stuart J. Russell, Peter Norvig , “Artificial Intelligence –A Modern approach”, 3rd Pearson Education, 2016.
- 5. Artificial Intelligence, Russel, Pearson

### **Reference Books:**

- 1. Ritch & Knight, ”Artificial Intelligence”, Third Edition, Tata McGraw Hill, 2009.
- 2. Patterson, “Introduction to Artificial Intelligence & Expert Systems”, First Edition, Pearson, 2015.
- 3. Saroj Kaushik, “Logic & Prolog Programming”, First Edition, New Age International, 2008.
- 4. Joseph C. Giarratano, Gary D. Riley,”Expert Systems: Principles and Programming”, Fourth Edition, Cengage, 2007.

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## **CB-604 FINANCIAL & COST ACCOUNTING**

### **Objectives:**

- To create an awareness about the importance and usefulness of the accounting concepts and their managerial implications.
- To develop an understanding of the financial statements and the underlying principles and learn to interpret financial statements.
- To create awareness about cost accounting, different types of costing and cost management.
- Understand how financial statement information can help solve business problems and increase the ability to read and understand financial statements and related information.

### **UNIT-I**

**ACCOUNTING CONCEPT:** Introduction, Techniques and Conventions, Financial Statements- Understanding & Interpreting Financial Statements. Company Accounts and Annual Reports- Audit Reports and Statutory Requirements, Directors Report, Notes to Accounts, Pitfalls.

### **UNIT-II**

**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**

**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**

**CASH FLOW AND FUND FLOW TECHNIQUES:** Introduction, How to prepare – Cash flow and Fund flow, Difference between them.

### **UNIT-V**

**COSTING SYSTEMS:** Elements of Cost, Cost Behavior, Cost Allocation, Overhead 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.

### **Course Outcomes:**

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

1. Understand the theories, concept, and evolution of management.
2. Demonstrate the ability to employ the management way of thinking.
3. Understand how organizations work and find it easier to grasp the intricacies of other management areas such as finance, marketing, strategy etc.
4. Understand the qualities of a leader in the managerial aspect in future terms.
5. Understand the managerial ethics and CSR and its importance.

### **Text Books:**

1. Robert N Anthony, David Hawkins, Kenneth Marchant, “Accounting: Texts and Cases”, Thirteenth

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Edition, McGraw-Hill, 2017.

2. M.Y.Khan & P.K.Jain, “Management Accounting”, Tata McGraw Hill, 2011.
3. R.Narayanaswamy, Financial Accounting – A managerial perspective, Fifth Edition, PHI Learning, New Delhi, 2011.

### **Reference Books:**

1. Jan Williams, “Financial and Managerial Accounting – The basis for business Decisions”, Fifteenth Edition, Tata McGraw Hill Publishers, 2010.
2. Horngren, Surdem, Stratton, Burgstahler, Schatzberg, “Introduction to Management Accounting”, Sixteenth Edition, PHI Learning, 2014.



# **SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL**

## **CB-605 Business Communication & Value Science-IV**

### **Objectives:**

- To recognize the best practices of communicative writing.
- To understand the importance of emotional intelligence in personal and professional lives.
- To understand how stress impacts life and work.
- To use the best practices to manage stress.
- To understand how to make start-ups and public speaking.

### **UNIT-I**

**COMMUNICATIVE WRITING:** Concepts: Principles of Communicative writing – Formal Business letters – Writing Proposals – Use of charts in communicative writing – use of business idioms – corporate terms. Activity: Group business proposals – presentation of proposal – Story telling using charts and graphs (demonstrative speech).

### **UNIT-II**

**EMOTIONAL INTELLIGENCE:** Concepts: Concepts of emotional intelligence – Its importance in human life and professional life – difference between Emotional quotient and Intelligent quotient – Corporate etiquette Activity: Any two Anubhaav activities – 10 ways to build Emotional Intelligence by Daniel Goleman – Mock interview.

### **UNIT-III**

**CONFLICT MANAGEMENT:** Concepts: Conflicts – Corporate and workplace conflicts – reason and impacts of conflicts – guidelines to manage conflicts. Teams - role of team player – stress – stress management – importance of feedbacks – Time Management. Activity: Creating posters with stress management tips – open house discussion on challenges of time management –Tracking time activity.

### **UNIT-IV**

**CORPORATE SOCIAL RESPONSIBILITY:** Concepts: Corporate Social Responsibility - Social responsibilities of companies - Diversity in workplace – Individual social responsibility – Social connect – life skills – empathy. Activity: Discussion & Role play in diversity – Ubuntu story of social responsibility – creating audio embedded PPT on the concept of social responsibility.

### **UNIT-V**

**DESIGN THINKING & PUBLIC SPEAKING:** Concepts: Design thinking – importance of start-ups – Proof of concept for start-ups – Best practices – Art of Public speaking Activity: Pitch in start-up idea – watching videos of public speaking – Finding similarities among world famous speeches – watching videos of Sw. Vivekananda's speech – Martin Luther King's My Dream speech.

### **List of Experiments**

1. Write formal business letter for proposal of goods item.
2. Create a presentation based on business proposal.
3. Perform activities to test IQ.
4. Perform activities to build emotional intelligence.
5. Create posters based on social issues.
6. Create a presentation based on social issues and our responsibility.
7. Create a presentation based on new startup idea.
8. Perform an activity based on public speaking.
9. Perform group discussion on current social issues.

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### **Course Outcomes:**

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

1. Recognize the best practice of Communicative writing.
2. Apply emotional intelligence in real life scenarios.
3. Identify the best practices of stress management.
4. Recognize the attributes needed to function and grow in a corporate environment.
5. Apply the best practices of public speaking.

### **Reference Books:**

1. Daniel Goleman,” Emotional Intelligence: Why it Can Matter More Than IQ”, Bloomsbury, 2004.
2. Ryback David, “Putting Emotional Intelligence To Work”, CRC Press, 1998.
3. Dale Carnegie, “How to Develop Self Confidence and Improve Public Speaking - Time - Tested Methods of Persuasion”, Ebury Publishing, 1998.
4. Chris Anderson, “TED Talks: The official TED guide to public speaking: Tips and tricks for giving unforgettable speeches and presentations”, Hachette, 2016.

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## CB-606 (A) Robotics and Embedded Systems

### Objectives:

- To understand the concept of Industry 4.0 and technologies for cognitive robotics
- To understand the fundamentals of robotics operating systems
- To understand the role of AI in cognitive robotics
- To understand and demonstrate the role of Data Science and their working principles in robotics
- To demonstrate the concepts of cloud computing with robot on various real time applications

### UNIT-I

#### INTRODUCTION TO MODERN DAY ROBOTICS AND THEIR INDUSTRIAL APPLICATIONS:

**Industry 4.0 Concept:** Background and Overview-Industry 4.0 technologies: implementation patterns in manufacturing companies-Evolution of Industrial Robots and their Applications-Advancements in Robotics and Its Future Uses-Types of robotics in various fields for applications.

**Technologies essential for Cognitive Robotics:** Computer systems and Technologies relevant to modern day robotics- Robotic Process Automation: Overview of RPA and its applications-RPA, AI, and Cognitive Technologies for Leaders- Introduction to Robotics: Analysis, Control, Applications.

### UNIT-II

**BASICS OF ROBOTIC OPERATING SYSTEM:** Basics of Robotic operating System: ROS for beginners an overview- Introduction to the Robot Operating System (ROS) Middleware - Secure communication for the Robot Operating System - An Introduction to Robot Operating System: The Ultimate Robot Application Framework by Adnan.

Quality of Service and Cybersecurity Communication Protocols -Analysis for the Robot Operating System Robotics systems communication- Threat modelling using ROS.

Towards cloud robotic system: A case study of online co-localization for fair resource competence- A Case Study on Model-Based Development of Robotic Systems using Monti Arc with Embedded Automata.

### UNIT-III

**AI IN THE CONTEXT OF COGNITIVE ROBOTICS AND ROLE OF AI IN ROBOTICS:** Foundation for Advanced Robotics and AI- A Concept for a Practical Robot Design Process- Demo to train A Robot Using AI - Deep learning core applications-Deep learning business applications.

Introduction to computer vision and application of Vision Systems in Robotics: Concepts of computer vision and the how vision systems are becoming essential part of Robotics-Computer Vision: Models, Learning, and Inference - Mastering Computer Vision with TensorFlow 2.x: Build advanced computer vision applications using machine learning and deep learning techniques- Machine Vision Applications- Application areas for vision systems-Robot inspection case study- Autonomous driving using 3D imaging case study.

### UNIT-IV

**DATA SCIENCE AND BIG DATA IN THE CONTEXT OF COGNITIVE ROBOTICS:** Cognitive Technologies: The Next Step Up for Data and Analytics in robotics-Cognitive Deep Learning Technology for Big Data Cognitive Assistant Robots for Reducing Variability in Industrial Human-Robot Activities.

Introduction to Python and R Programming in the context of Robotics: Introduction to Python - Python Functions for Data Science-Basic ROS Learning Python for robotics- An introduction to R - The R in Robotics rosR: A New Language Extension for the Robot Operating System.

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Artificial Intelligence and Robotics - The Review of Reliability Factors Related to Industrial Robots  
-Failure analysis of mature robots in automated production- Data Analytics for Predictive Maintenance of Industrial Robots - Failure Is an Option: How the Severity of Robot Errors Affects Human-Robot Interaction.

### **UNIT-V**

**CONCEPTS OF CLOUD COMPUTING, CLOUD PLATFORMS AND IT APPLICATIONS IN ROBOTICS:** Learning Cloud Computing: Core Concepts - Cloud Computing: Private Cloud Platforms -Robot as a Service in Cloud Computing -Cloud Computing Technology and Its Application in Robot Control - A Comprehensive Survey of Recent Trends in Cloud

Robotics Architectures and Applications - Google's cloud robotics and high computing needs of industrial automation and systems-The role of cloud and opensource software in the future of robotics-The Power of Cloud Robotics by Robotics Industry Association.

#### **List of Experiments**

1. Build a Self-Driving Robot that can automatically follow a line
2. Build a basic obstacle-avoiding robot and improve the design to help it avoid getting stuck
3. Build a Humanoid Robot
4. Autonomous Robot Navigation using Computer Vision for exhaustive path-finding
5. A Mobile Autonomous Chemical Detecting Robot
6. Build a voice controlled robot
7. Web-Controlled Mobile Video-Enabled Robotic Litter Collection Device
8. Utilizing Artificial Neural Networks to Create a Learning Robot
9. Hospital Sanitizing Robot
10. Autonomous Robotic Vehicle: Saving lives, preventing accidents one at a time
11. Build a robot with Python and 3D Printed Robotic Arm
12. Build an Intelligent Irrigation Control System
13. AI-powered Hearing Aid
14. Fire Extinguishing Robot
15. Remote Operated Spy Robot Circuit

#### **Course Outcomes:**

1. Develop skills of using advanced software for solving practical problems in robotics pertaining to various industries
2. Understand the basics of Robotic operating systems and communication system
3. Understand basic concepts and technological advancements in AI and robotics
4. Understand and apply several statistical analysis techniques, business analytics for cognitive robotics and programming of robots using python and R languages
5. Understand and apply the cloud computing concepts in robotics

#### **Text Books:**

3. Saeed Benjamin Niku, "Introduction to Robotics: Analysis, Control, Applications", Wiley Publishers, 2nd edition, 2011.
4. Simon J. D. Prince, "Computer Vision: Models, Learning, and Inference", Cambridge University Press, 2012.
5. Francis X. Govers, "Artificial Intelligence for Robotics: Build Intelligent Robots that Perform Human Tasks Using AI Techniques", Packt publishing, 2018.

## **SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL**

### **Reference Books:**

1. Krishnendu Kar, "Mastering Computer Vision with TensorFlow 2.x: Build Advanced Computer Vision Applications Using Machine Learning and Deep Learning Techniques", Packt publishing, 2020.
2. Armando Vieira, Bernardete Ribeiro," Introduction to Deep Learning Business Applications for Developers from Conversational Bots in Customer Service to Medical Image processing",Apress, 2018.
3. Steve Heath, "Embedded System Design 2nd Edition", EDN Series for Design Engineers, 2003

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## CB-606 (B) MODERN WEB APPLICATIONS

### Objectives:

- To understand different internet technologies.
- Know the importance of object oriented aspects of scripting.
- Understand creating database connectivity using PHP and MySQL.

### UNIT-I

**INTRODUCTION TO INTERNET & WORLD WIDE WEB:** History of the Internet & World-Wide Web, Web Browsers, Web Servers, Uniform Resource Locator, Tools and Web Programming Languages. Web Standards, Categories of Web Applications, Characteristics of Web Applications, Tiered Architecture.

### UNIT-II

**HYPERTEXT MARKUP LANGUAGE (HTML) AND CASCADING STYLE SHEETS (CSS):**

HTML: Basic HTML page, Text Formatting, Table, Headers, Linking, Images, List, Meta Elements.

CSS: Inline, Internal and External Style Sheet, Bootstrap-CSS Text, CSS forms, CSS components drop down.

### UNIT-III

**JAVASCRIPT AND EXTENSIBLE MARKUP LANGUAGE(XML):**

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

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

### UNIT-IV

**PHP BASICS:** Writing Basic PHP Programs: Creating PHP Programs, Numbers and Strings, Literals and Variables, Operators and Functions.

Form & PHP: Creating Form Controls, Using Values Returned From, Forms Using PHP.

### UNIT-V

**PHP DATABASE CONNECTIVITY:** PHP Database Connectivity: Connecting to MySQL Server, Selecting Databases, Checking for Errors, Closing the MySQL Server Connection.

Manipulating Data in MySQL Using PHP: Inserting, Viewing, Updating and Deleting Records, Manipulating joined tables.

User Authentication: Creating Session, Authorization Level.

### List of Experiments

1. Create a HTML page with frames, links, tables and other tags for highlighting the facilities in the Department in your College. State the assumptions you make (business logic you are taking into consideration).
2. Create a web page with the following using HTML:
  - a. To embed a map in a web page.
  - b. To fix the hot spots in that map.
  - c. Show all the related information when the hot spots are clicked.
  - d. Embed an image map picture (India map) on a Web page that provides different links to other

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- Web pages (different states) and show the all the related information depending on where a user clicks on the image.
- e. Create a webpage to embed a human body image, identify and display all the related information about the human body parts (head, eye, nose, finger etc.) based on the user clicks on the human body image map.
3. Create a web page with the following:
    - a. Cascading style sheets.
    - b. Embedded style sheets.
    - c. Inline style sheets.
    - d. Use your college information for the web pages.
  4. Create a User Registration form with First Name, Last name, Address, City, State, Country, Pincode, Username and Password fields for a General login webpage and satisfy the following criteria:
    - a. Create a validate() function that does the following:
    - b. Checks that the First Name, Last Name, City, Country, Username, and Password fields are filled out.
    - c. Checks that the Pincode is exactly 6 numeric.
    - d. Checks that the state is exactly two characters.
    - e. Checks that the email is a valid email address.
      - i. false if email has fewer than 6 characters
      - ii. false if email does not contain an @ symbol
      - iii. false if email does not contain a period (.)
      - iv. true otherwise
  5. Write a DTD for a XML document that declares an address book containing contacts. Each contact has a name and address. An address should contain attributes for street name, state and phone number. Write a XML document and validate it against this DTD.
  6. Create and save a XML document at the server, which contains 10 users information. Write a Program, which takes user Id as an input and returns the user details by taking the user information from the XML document.
  7. Create a XML to represent the BOOKS catalog that has the following elements (TITLE, ISBN NO, AUTHOR, PUBLISHER, and PRICE). Display the book details styled with XSLT.
  8. Create an Extensible markup language to represent the students mark information of a class. Create a webpage to display all the students consolidated mark statement with pass (green color) or fail (red color) using XSLT.
  9. Write programs in PHP to create three-tier applications:
    - a. for conducting on-line examination.
    - b. for displaying student mark list. Assume that student information is available in a database which has been stored in a database server.
  10. Session tracking using hidden form fields and Session tracking for a hit count.
  11. Convert the static webpages of programs 1 to 4 into dynamic web pages using PHP and cookies. Hint: Users information (user id, password, credit card number) would be stored in web.xml.
  12. Write a PHP program for Employee Details which includes EmpID, Name, Designation, Salary, DOJ, etc., to connect with the database and execute queries to retrieve and update data. Prepare the report for single and group of employees based on the end user needs.
  13. Consider a Library Management System. Develop a JavaScript program that will validate the controls in the forms you have created for the application. State the assumptions you make (business logic you are taking into consideration). Note: Your application must access a database using PHP.

### Course Outcomes:

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

1. Construct a basic website using HTML and Cascading Style Sheets.
2. Build dynamic web page with validation using Java Script objects and by applying different event handling mechanisms.
3. Construct simple web pages in PHP and to represent data in XML format.
4. Design and implement server side programs using PHP.

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5. Do database manipulation using MySQL and authenticate data.

### **Text Books:**

1. Deitel P. J., Deitel H. M. and Deitel A., "Internet and World Wide Web: How to Program", Fifth Edition, Pearson Prentice Hall, 2012.
2. Jon Duckett, "HTML & CSS: Design and Build Websites", First Edition, John Wiley & Sons, 2011.
3. Naramore E., Gerner J., Scouarnec Y.L., et al., "Beginning PHP5, Apache, MySQL Web Development: Programmer to Programmer", John Wiley & Sons Inc., 2005.

### **Reference Books:**

1. Sebesta R. W., "Programming the World Wide Web", Eight Edition, Pearson, 2014.
2. Pressman R. and Lowe D., "Web Engineering: a practitioner's approach", First Edition, McGrawHill, 2008.
3. Kappel G., et al., "Web Engineering: The Discipline of systematic Development of Web Applications", First Edition, John Wiley & Sons, 2006.
4. Suh W., "Web Engineering: Principles and Techniques", Idea Group Inc., 2005.
5. Ullman L., "PHP for the Web: Visual Quick Start Guide", Fifth Edition, Peach pit Press, 2016.



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## CB-606 (C) DATA MINING AND ANALYTICS

### Objectives:

- To introduce the fundamental concepts of data mining and data representation.
- To learn the data preprocessing task and attribute oriented analysis
- To understand the association rules, classification and prediction algorithms
- To learn and apply the linear and non-linear models of data analysis
- To understand the time series analysis and aspects of prescriptive analysis

### UNIT-I

**INTRODUCTION AND KNOWLEDGE REPRESENTATION:** Introduction - Related technologies - Machine Learning, DBMS, OLAP, Statistics, Stages of the Data Mining Process, Data Mining Techniques, Knowledge Representation Methods, Task relevant data, Background knowledge, Representing input data and output knowledge, Visualization techniques, Applications.

### UNIT-II

**DATA PREPROCESSING:** Data preprocessing: Data cleaning, Data transformation, Data reduction, Discretization and generating concept hierarchies. Attribute-oriented analysis: Attribute generalization, Attribute relevance, Class comparison, Statistical measures.

### UNIT-III

**ASSOCIATION AND MINING METHODS:** Association rules: Motivation and terminology, Basic idea: item sets, Generating item sets and rules efficiently, Correlation analysis. Classification: Basic learning/mining tasks, Inferring rudimentary rules: 1R, algorithm, Decision trees, covering rules. Prediction: The prediction task, Statistical (Bayesian) classification, Bayesian networks, Instance- based methods (nearest neighbor), linear models.

### UNIT-IV

#### LINEAR AND NON-LINEAR MODELS:

**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.

**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-V

#### TIME SERIES ANALYSIS:

**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.

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**Linear time series models:** Autoregressive, Moving Average, Autoregressive Moving Average and Autoregressive Integrated Moving Average models; Estimation of ARIMA models such as Yule-Walker estimation for AR Processes, Maximum likelihood and least squares estimation for ARIMA Processes, Forecasting using ARIMA models.

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

## List of Experiments:

1. Installing Weka and exploring a dataset.
2. Loading a dataset and visualizing the Data
3. Preprocessing a dataset from a real domain (Medical/Retail/Banking)
4. Building a classifier- Run Decision Tree, Naïve Bayesian Classifier, NN classifier and SVM.
5. Mining Association Rules- Run Apriori Algorithm.
6. Building a statistical model using a sample dataset – preprocessing, hypothesis building, model fitting, model validation and interpretation of results.
7. Implementation of linear regression technique for statistical model building.
8. Implementation of Non-linear regression technique for statistical model building.

## Course Outcomes:

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

1. Understand the fundamentals of data mining and data representation.
2. Perform preprocessing tasks for the data set.
3. Apply association rules and predictive methods for data mining.
4. Build data models using linear and non-linear regression techniques.
5. Gain knowledge on time series analysis and prescriptive analysis.

## Text Books:

4. Jiawei Han and Micheline Kamber, “Data Mining Concepts and Techniques”, Third Edition, Elsevier, 2012.
5. Lior Rokach and Oded Maimon, “Data Mining and Knowledge Discovery Handbook”, Springer, 2nd edition, 2010.
6. Ian H. Witten, Eibe Frank and Mark A. Hall “Data Mining: Practical Machine Learning Tools and Techniques”, Fourth Edition, Elsevier, 2017.

## Reference Books:

9. Draper, N. R. and Smith, H., “Applied Regression Analysis”, Third Edition, John Wiley, 1998.
10. Hosmer, D. W. and Lemeshow, S., “Applied Logistic Regression”, Third Edition, Wiley, 2003.
11. Daniel T.Larose, “Data Mining Methods and Models”, Wiley-Interscience, 2006.
12. Jason Brownlee “Machine Learning Mastery with Weka” ,2020.
13. <http://garfield.library.upenn.edu/classics1989/A1989AV48500001.pdf>

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**B.TECH  
COMPUTER SCIENCE AND BUSINESS SYSTEM  
SEMESTER VII SYLLABUS**

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## **SYLLABUS**

### **B.Tech(Computer Science and Business System) VII Semester**

#### **CB-701 USABILITY DESIGN OF SOFTWARE APPLICATIONS**

##### **Objectives:**

- ☐ To learn the fundamentals of User Centred Design, their relevance and contribution to businesses.
- ☐ To study the principles of heuristic evaluation for interactive design.
- ☐ To understand the appreciation of user research, solution conceptualization and validation as interwoven activities in the design and development lifecycle.
- ☐ To familiarize the facets of User Experience (UX) Design, particularly as applied to the digital artefacts.
- ☐ To implement complex mobile/web applications.

##### **UNIT-I INTRODUCTION TO USER CENTRED DESIGN**

Basics of User Centred Design-Elements-Models and approaches-User Centred Design Principles-Usability-UCD Process-Analysis tools: personas, scenarios, and essential use cases with examples-User-Centred Design and Agile aspects of User Centred Design.

##### **UNIT-II INTERACTIVE DESIGN EVALUATION**

Introduction to Interactive Design process – Interactive design in practice – Introducing evaluation – Evaluation: Inspection, Analysis and Models – Inspection: Heuristic Evaluation: 10 Heuristic Principles, Examples – Case study: A Heuristic Evaluation of Iraq E-Portal.

##### **UNIT-III DEVELOPMENT OF APPLICATION**

Case Study: Development of any application like mobile or web based on User Centred Design – Design lifecycle: Establishing Requirements, Design, Prototyping and Construction.

##### **UNIT-IV 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 ITERATIVE PRODUCT DEVELOPMENT**

The Problem with Complexity - Iterative Product Development - Scenarios and Persona Technique, Design Thinking Technique: Discovery and brainstorming - Concept Development - Prototyping Techniques : Paper, Electronic, Prototyping Tools – Review and feedback

##### **List of Experiments**

- 1 Product Appreciation Assignment – Evaluating the product from User Centred Design aspects such as functionality, ease of use, ergonomics, and aesthetics.
- 2 Heuristic Evaluation: Group Assignment initiation (Website and App) Evaluation for key tasks of the app or website for heuristic principles, severity, recommendations.
- 3 Students will identify a project in the given domain (Healthcare, E-Commerce, Online Learning Platforms, Gaming, Point-of-Sale, Smart Things) and its related website or mobile app to redesign. They will take this redesign project through the design lifecycle:  
Discovery  
Define Design  
Implement (Design Prototype) Usability  
Testing  
The below design methods and techniques will be imparted w.r.t. the group project selected by the students.
- 4 Presentation of Persona for the group project
- 5 Task flow detailing for the project
- 6 Project Prototyping Iteration 1
- 7 Project Prototyping Iteration 2
- 8 Final Product Demo( Mobile or Web Application)

##### **Course Outcomes:**

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

- ☐ Understand the fundamentals and importance of User-Centred design.
- ☐ Perform design evaluation by applying the heuristic principles.

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- ☐ Develop an application focusing on the design aspects.
- ☐ Do research on understanding user requirement.
- ☐ Perform iterative product development using prototyping technique.

### **Text Book (s):**

- 1 Jenny Preece, Helen Sharp and Yvonne Rogers, "Interaction Design: Beyond Human-Computer Interaction", 3<sup>rd</sup> Edition, 2004.
- 2 Jonny Schneider , "Understanding Design Thinking, Lean, and Agile", 1<sup>st</sup> Edition, 2020.

### **Reference Books:**

- 1 Alan Cooper and Robert Reimann, "About Face", John Wiley, 4<sup>th</sup> Edition.
- 2 Elizabeth Goodman, Mike Kuniavsky, Andrea Moed, "Observing the User Experience: A Practitioner's Guide to User Research", 2<sup>nd</sup> Edition, 2012.
- 3 Jesse James Garrett, The Elements of User Experience: User-Centered Design for the Web and Beyond, 2<sup>nd</sup> Edition, 2010.

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## CB-702 IT Workshop (Matlab)

### Objectives:

- ☐ To introduce the students with the basic features of MATLAB for problem solving.
- ☐ To introduce the students about the Mathematical functions like matrix generation and Plotting with multiple data sets, line styles and colors.
- ☐ To introduce the students about the Array operations and solving Linear equations in MATLAB.
- ☐ To introduce the students about the control flow and operators using if-end structures and loops.

### UNIT-I INTRODUCTION TO MATLAB

Introduction to MATLAB: History, basic features, strengths and weaknesses, good programming practices and plan your code. 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-II 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-III BASIC PLOTTING

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

### UNIT-IV INTRODUCTION TO PROGRAMMING

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-V DEBUGGING M-FILES

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

#### List of Experiments

- 1 Programs using mathematical, relational expressions and the operators.
- 2 Vectors and Matrices: Programs using array operations and matrix operations (such as matrix multiplication).
- 3 Programs on input and output of values.
- 4 Selection Statements: Experiments on if statements, with else and elseif clauses and switch statements.
- 5 Loop Statements and Vectorizing Code: Programs based on the concepts of counted (for) and conditional (while) loops.
- 6 Programs based on scripts and user-defined functions.
- 7 Programs on Built-in text manipulation functions and conversion between string and number types.
- 8 Programs based on two main data structures: cell arrays and structures.
- 9 Programs based on Data Transfer
- 10 Programs based on Advanced Functions.
- 11 Introduction to Object-Oriented Programming and Graphics.
- 12 Programs based on Advanced Plotting Techniques.
- 13 Programs based on sound files and image processing.
- 14 Programs based on Advanced Mathematics.

### Course Outcomes:

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

- ☐ Write fundamental programs in MATLAB, creating variables and mathematical functions.
- ☐ Understand how to program matrix operations, array operations and how to solve the system of linear equations.
- ☐ Program the fundamentals concepts of basic Plotting consisting of simple and multiple data sets in one plot.
- ☐ Understand how to program M-file scripts, M- file functions, Input –output Arguments and program control flow operators, loops, flow structures.
- ☐ Use the debugging process and debugging M-files.

## **SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL**

### **Text Books:**

- 1 Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, “Digital Image Processing using MATLAB”, Pearson Education, Inc., 2004.
- 2 Stormy Attaway, Butterworth-Heinemann, “MATLAB: A Practical Introduction to Programming and Problem Solving”, 5<sup>th</sup> Edition, 2018.

### **References:**

- 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](https://www.mathworks.com/help/releases/R2014b/pdf_doc/matlab/getstart.pdf)

# **SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL**

## **CB-703 FINANCIAL MANAGEMENT**

### **Objectives:**

- ☐ Understand the functional distinctions of a Finance Manager.
- ☐ Comprehend the technique of making decisions related to finance function.
- ☐ Understand the techniques involved in deciding upon purchase or sale of securities.
- ☐ An overview and generating investment project proposals.
- ☐ Motives for holding cash and receivables.

### **UNIT-I INTRODUCTION**

Introduction to Financial Management - Goals of the firm - Financial Environments. Time Value of Money: Simple and Compound Interest Rates, Amortization, Computing more than once a year, Annuity Factor.

### **UNIT-II 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 CAPITAL BUDGETING**

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

### **UNIT-IV COST OF CAPITAL, OPERATING & FINANCIAL LEVERAGE**

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.

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

### **UNIT-V WORKING CAPITAL MANAGEMENT**

Working Capital Management: Overview, Working Capital Issues, Financing Current Assets (Short Term and Long Term- Mix), Combining Liability Structures and Current Asset Decisions, Estimation of Working Capital. Accounts Receivable Management: Credit & Collection Policies, Analyzing the Credit Applicant, Credit References, Selecting optimum Credit period. 4L. Cash Management: Motives for Holding cash, Speeding Up Cash Receipts, Slowing Down Cash Payouts, Electronic Commerce, Outsourcing, Cash Balances to maintain, Factoring.

### **Course Outcomes:**

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

- ☐ Identify the basic concepts of financial management and time value of money.
- ☐ Understand the various processes involved in securities market.
- ☐ Evaluate and choose the best project from alternatives based on cost-benefit analysis.
- ☐ Compute the fundamental concepts of financial management.
- ☐ Influence the concept for deciding financial angle of IT projects.

### **Text Books:**

- 1 Chandra Prasanna, “Financial Management - Theory & Practice”, Tata McGraw Hill, 10<sup>th</sup> Edition, 2019.
- 2 M.Y.Khanand and P.K.Jain, “Financial management, Text, Problems and Cases”, Tata Mc Graw Hill, 5<sup>th</sup> Edition, 2000.
- 3 I.M.Pandey, “Financial Management”, Vikas Publishing House Pvt.Ltd., 8<sup>th</sup> Edition, 2007.
- 4 Aswat Damodaran, “Corporate Finance Theory and Practice”, John Wiley & Sons, 2<sup>nd</sup> Edition, 2008.
- 5 James C.Vanhorne, “Fundamentals of Financial Management”, PHI Learning, 11<sup>th</sup> Edition, 2008.

### **Reference Books:**

- 1 Van Horne and Wachowicz, “Fundamentals of Financial Management”, Prentice Hall, 13<sup>th</sup> Edition, 2009.
- 2 Brigham and Ehrhardt, “Financial Management Theory and Practice”, 11<sup>th</sup> edition, Cengage Learning, 2011.



# **SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL**

## **CB-704 HUMAN RESOURCES MANAGEMENT**

### **Objectives:**

- ☐ Facilitate student to imbibe knowledge about understanding the basic concepts and importance of Human Resources Management, Recruitment, Training, Communications, Employee Empowerment, Employee Interaction, Various Human Resources Applications and Practices, Managerial functions etc.

### **UNIT-I HUMAN RESOURCES MANAGEMENT**

Concept and Challenges, HR Philosophy, Policies, Procedures and Practices.

### **UNIT-II 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 FUNCTIONAL AREAS OF HRM**

Recruitment and Staffing, benefits, compensation, Employee Relations, HR Compliance, Organizational Design, Training and Development, Human Resources Information systems (HRIS) and Payroll.

### **UNIT-IV HUMAN RESOURCES PLANNING**

Demand Forecasting, Action Plans – Retention, Training, Redeployment and staffing, succession Planning.

### **UNIT-V 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.

### **Course Outcomes:**

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

- ☐ Be aware of the basic principles of Human Resource Management.
- ☐ Be familiarizing with the system design of Human Resource Management.
- ☐ Know the concepts, roles, functional areas and activities of HR.
- ☐ Understand organization's employee, their interest, motivation, satisfaction belief of fair treatment.
- ☐ Get awareness on actual impact on the firm's current performance and sustainability in the long run.

### **Text Books:**

- 1 Prof. Gary Dessler , Human Resources Management, Pearson, 16<sup>th</sup> Edition, 2020.
- 2 Prof. John M. Ivancevich, "Human Resource Management", Tata McGraw Hill Publication, 12<sup>th</sup> Edition, 2003.
- 3 Prof. Aswathappa, "Human Resource Management and Personnel Management", 3<sup>rd</sup> Edition, Tata McGraw Hill, 2002.

### **Reference Books:**

- 1 Dr. C.B. Gupta, "Human Resource Management", Sultan Chand & Sons, New Delhi, 1<sup>st</sup> Edition, 2018.
- 2 Prof. S.S. Khanka, "Human Resource Management", Chand & Company, New Delhi, 2019.
- 3 Dr. S. Seetharaman et al., "Human Resource Management", SciTech Publications Pvt Ltd. Chennai, 2012.

# SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL

## CB-705 (A) COGNITIVE SCIENCE AND ANALYTICS

### Objectives:

- ☐ Introduction to cognitive science, psychology, nervous system and brain.
- ☐ Understand brain and sensory motor information, representation of sensory information.
- ☐ Analyze from sensation to cognition; Roots of cognitive science.
- ☐ Develop language and embodiment.
- ☐ Implement affordances in biological and artificial systems, cognitive development.

### UNIT-I INTRODUCTION TO THE STUDY OF COGNITIVE SCIENCES

Introduction to the study of cognitive sciences - A brief history of cognitive science - Methodological concerns in philosophy - Artificial intelligence and psychology - Structure and constituents of the brain - Brief history of neuroscience - Mathematical models - Looking at brain signals - Processing of sensory information in the brain.

### UNIT-II COGNITIVE MODELS

Brain Imaging - FMRI, MEG - PET, EEG - Multisensory integration in cortex - Information fusion - From sensation to cognition - Cybernetics - From physics to meaning, Analog vs. Digital: Code duality.

### UNIT-III LINGUISTIC KNOWLEDGE

Linguistic knowledge: Syntax, semantics, (and pragmatics) - Generative linguistic - Brain and language - Language disorders - Lateralization - The great past tense debate - Cognitivist and emergent stand points - A robotic perspective.

### UNIT-IV AFFORDANCES

Direct perception - Ecological Psychology - Affordance learning in robotics - Child and robotic development - Attention and related concepts - Human visual attention - Computational models of attention - Applications of computational models of attention.

### UNIT-V CATEGORIES AND CONCEPTS

Logic; Machine learning - Constructing memories - Explicit vs. implicit memory - Information processing (three-boxes) model of memory - Sensory memory; Short term memory - Long term memory; Rationality - Bounded rationality; Prospect theory; Heuristics and biases - Reasoning in computers - Key points in social cognition - Context and social judgment; Schemas; Social signals.

### List of Experiments

- 1 Overview and practice: Cognitive Science and its methodology concerns in philosophy.
- 2 Experimental approach to processing sensory information in the brain using python.
- 3 Perform stemming operation in python using NLTK
- 4 Perform lemmatization in python using NLTK
- 5 Perform parts of speech tagging in python using NLTK
- 6 Writing and running Robot programs - Activity of PICK and Place of an object.
- 7 Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.  
RNN NLU: Build a Recurrent Neural Network model using Microsoft Cognitive Tool Kit for spoken language understanding, mainly for intent detection and slot filling.
- 8 LSTM Human Activity Recognition: Build a Recurrent Neural Network model using Python for Human Activity Recognition (HAR) using TensorFlow on smartphone sensors dataset and a LSTM RNN.
- 9
- 10 NER-LSTM Build a Recurrent Neural Network model using Python for Named Entity Recognition.

### Course Outcomes:

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

- ☐ Know introduction to cognitive science, psychology, nervous system and brain.
- ☐ Understand brain and sensory motor information, representation of sensory information.
- ☐ Analyze from sensation to cognition; Roots of Cognitive Science.
- ☐ Implement affordances in biological and artificial systems, cognitive development.
- ☐ Make attention, learning, memory, reasoning, social cognition.

### Text Books:

- 1 Pradeep Kumar Mallick, Samarjeet Borah, "Emerging Trends and Applications in Cognitive Computing", IGI Global Publishers, 2019.

### Reference Books:

- 1 Jose Luis Bermudez, "Cognitive Science: An Introduction to the Science of the Mind", Cambridge University Press, New York, 2020.

# SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL

## CB-705 (B) INTRODUCTION TO IOT

### Objectives:

- ☐ To understand about the fundamentals of Internet of Things and its building blocks along with their characteristics.
- ☐ To gain knowledge about IoT Architecture.
- ☐ To understand and learn about Sensors and industrial systems.
- ☐ To understand the other associated technologies like networking and communication in the domain of IoT.
- ☐ To understand the data processing and standards designed for IoT and the current research on it.

### UNIT-I INTRODUCTION TO IOT AND USE CASES

Understanding basic concepts of IoT, Consumer IoT vs Industrial Internet, Fundamental building blocks, Use Cases of IoT in various industry domains.

### UNIT-II ARCHITECTURE

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

### 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.

### UNIT-IV NETWORKING AND COMMUNICATION 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), Communicating with cloud applications - web services, REST, TCP/IP and UDP/IP sockets, MQTT, WebSockets, protocols. Message encoding (JSON, Protocol Buffers).

### UNIT-V 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.

#### List of Experiments

- 1 Setting up the Arduino development environment, connecting analog sensors to an Arduino board and reading analog sensor data.
- 2 Digital input and output reading using an 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 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.
- 10 Develop a mobile application to view the images captured by the R Pi camera.

### Course Outcomes:

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

- ☐ Understand basic principles and concepts of Internet-of-Things use cases, applications, architecture and technologies.
- ☐ Gets an overview of an end to end IoT system encompassing the edge, cloud and application tiers.
- ☐ Build upon the foundations created in the pre-requisite courses and will equip the students to architect a complete IoT application on their own.
- ☐ Lead to building an IoT end-to-end application.
- ☐ Apply the concept to do research.

## **SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL**

### **Text Books:**

- 1 Samuel Greengard, "The Internet of Things-Essential Knowledge Series", MIT Press, 1<sup>st</sup> Edition, 2015.

### **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/](http://www.libelium.com/resources/top_50_iot_sensor_applications_ranking/)
- 4 Ben Fry, "Visualizing Data-Exploring and Explaining Data with the Processing Environment", O'Reilly Media, 2007.
- 5 Andrew K Dennis, "Raspberry Pi Computer Architecture Essentials", 2016.
- 6 M. Banzl, "Getting Started with Arduino", O'Reilly Media.
- 7 GSMA IoT Security Guidelines & Assessment - <https://www.gsma.com/iot/future-iot-networks/iot-security-guidelines/>

# SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL

## CB-705 (C) CRYPTOLOGY

### Objectives:

- ☐ To understand the Basics of Number Theory.
- ☐ To be able to secure a message over an insecure channel by various means.
- ☐ To use a variety of public key cryptosystems and authentication methods.
- ☐ To gain a better understanding of the different security applications.
- ☐ To acquire a deeper insight of quantum computing on cryptography and security.

### UNIT-I INTRODUCTION

Introduction to Cryptography: Elementary number theory, Pseudo-random bit generation, Elementary cryptosystems. Basic security services: confidentiality, integrity, availability, non-repudiation, privacy.

### UNIT-II SYMMETRIC KEY CRYPTOSYSTEMS

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

### UNIT-III PUBLIC KEY CRYPTOSYSTEM & AUTHENTICATION

Public Key Cryptosystems: RSA, ECC; Digital signatures; Hash Functions; Authentication.

### UNIT-IV SECURITY APPLICATIONS

Electronic commerce (anonymous cash, micro-payments), Key management, Zero-knowledge protocols, Cryptology in Contact Tracing Applications.

### UNIT-V QUANTUM CRYPTANALYSIS & POST-QUANTUM CRYPTOGRAPHY

Quantum cryptography, quantum encryption, Issues related to Quantum Cryptanalysis. Post-Quantum Cryptography: Lattice-based cryptography : NTRU, Hash-based cryptography :SPHINCS, Multivariate cryptography: Rainbow.

### List of Experiments

- 1 Implement the following Substitution and Transposition Techniques:
  - a) Caesar Cipher
  - b) Playfair Cipher
  - c) Hill Cipher
  - d) Vigenere Cipher
  - e) Rail fence – row & Column Transformation
  - f) Affine Cipher
- 2 Implement the following algorithms
  - a) DES
  - b) RSA Algorithm
  - c) MD5
  - d) SHA-1
- 3 Implement the Digital Signature Algorithm (DSA).
- 4 Implement Linux Privilege Escalation Checker.
- 5 Implement a Keylogger to record the keystrokes.
- 6 Set Up a honey pot and monitor the honeypot on network (Pentbox or Honeyd or any other equivalent s/w).
- 7 Demonstrate Intrusion Detection System using any tool (snort or any other equivalent s/w).
- 8 Demonstrate various exploits of Windows OS using Metasploit framework.
- 9 Install and Configure Firewalls for a variety of options (iptables or pfsense).
- 10 Demonstrate simple MITM attack (ettercap).

### Course Outcomes:

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

- ☐ Understand and apply the various concepts of basics of Number Theory.
- ☐ Secure a message over an insecure channel by numerous symmetric key cryptosystem.
- ☐ Apply diverse Public Key Cryptosystem & Authentication.
- ☐ Implement varied security applications.
- ☐ Understand the implications of quantum computing on cryptography and security.

### Text Books:

- 1 Douglas R. Stinson, “Cryptography, Theory and Practice”, CRC Press, 3rd Edition, 2018.

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- 2 A. Menezes, P. Van Oorschot and S. Vanstone, "Handbook of Applied Cryptography", CRC Press, 5th printing, 2001.
- 3 Stallings William, "Cryptography and Network Security - Principles and Practice", Pearson, Seventh Edition, 2017.

### **Reference Books:**

- 1 Neal Koblitz, "A course in number theory and cryptography", GTM, Springer.
- 2 Ross Anderson, "Security Engineering", Wiley, 3<sup>rd</sup> Edition, 2020.
- 3 <http://theory.caltech.edu/~preskill/ph229/>

# SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL

## CB-706(A) QUANTUM COMPUTATION AND QUANTUM INFORMATION

### Objectives:

- ☐ To learn about Quantum information.
- ☐ To gain knowledge about Quantum algorithms.
- ☐ To understand and learn about Quantum random number generators.
- ☐ To study the basis of Post-Quantum cryptography.

### UNIT-I INTRODUCTION TO QUANTUM INFORMATION

States, Operators, Measurements, Quantum Entanglement: Quantum Teleportation, Super-dense coding, CHSH Game, Quantum gates and circuits.

### UNIT-II QUANTUM ALGORITHMS

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

### UNIT-III QUANTUM TRUE RANDOM NUMBER GENERATORS

Detailed design and issues of quantumness, Commercial products and applications.

### UNIT-IV QUANTUM KEY DISTRIBUTION

BB84, Ekert, Semi-Quantum QKD protocols and their variations, Issues of Device Independence, Commercial products.

### UNIT-V INTRODUCTORY TOPICS IN POST-QUANTUM CRYPTOGRAPHY

API-Public-key Signatures, Key Encapsulation Mechanism (KEM), Digital Signature standard, Pair-Wise Key Establishment-Discrete Logarithm Cryptography, Integer Factorization Cryptography.

### Course Outcomes:

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

- ☐ Apply quantum gates and circuits using quantum information.
- ☐ Apply quantum algorithms in cryptosystems.
- ☐ Understand the importance of Quantum random number generator.
- ☐ Understand the importance of Quantum key distribution.
- ☐ Apply the concept of post-quantum cryptography.

### List of Experiments

1. Encoding logical qubits as grid states.
2. Sneaky error mitigation by IBM.
3. 2D cluster states of photons.
4. Quantum supremacy and its enemies.
5. Boson sampling and its enemies.
6. Diamond qubits shine bright.
7. Error correction with superconducting qubits.

### Text Books:

- 1 M. A. Nielsen and I. L. Chuang, "Quantum Computation and Quantum Information", Cambridge University Press, 10th Edition, 2010.
- 2 Presskil Lecture notes: Available online: <http://www.theory.caltech.edu/~preskill/ph229/>

### Reference Books:

- 1 P. Kaye, R. Laflamme, and M. Mosca, "An Introduction to Quantum Computing". Oxford University Press, New York.
- 2 N. David Mermin, "Quantum Computer Science", Cambridge University Press.
- 3 Quantum Cryptography. D. Unruh:, Available online: [https://courses.cs.ut.ee/all/MTAT.07.024/2017\\_fall/uploads/](https://courses.cs.ut.ee/all/MTAT.07.024/2017_fall/uploads/)
- 4 SAPV Tharmashastha, D. Bera, A. Maitra and S. Maitra, "Quantum Algorithms for Cryptographically Significant Boolean Functions - An IBMQ Experience", Springer, 2020.
- 5 Quantum Algorithm Zoo. <https://quantumalgorithmzoo.org/>
- 6 A. J. Menezes, P. C. van Oorschot, and S. A. Vanstone, "Handbook of Applied Cryptography", CRC Press.

# **SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL**

## **CB-706(B) ADVANCED SOCIAL, TEXT AND MEDIA ANALYTICS**

### **Objectives:**

- ☐ To learn the fundamentals of text mining analysis.
- ☐ To be able to use various tools for text mining and carry out pattern discovery, predictive modeling.
- ☐ Explore the use of social network analysis to understand the growing connectivity and complexity.
- ☐ Perform social network analysis to identify important network properties in social media sites.
- ☐ Analysing interactions between people, and determine structural patterns in such interactions in real time application.

### **UNIT-I INTRODUCTION TO TEXT MINING**

Introduction- Defining text mining, general architecture of text mining systems. Core text mining operations- Using background knowledge for text mining, Text mining query languages. Pre-processing techniques-Task oriented approaches. Categorization-Applications of text categorizations, Definition of the problem, Document representations, Knowledge engineering approach to TC, Machine learning approach to TC, Using unlabeled evaluation of text classifiers.

### **UNIT-II CLUSTERING AND INFORMATION EXTRACTION**

Information extraction –Introduction, Historical evolution, Examples, Architecture of IE systems, Anaphora Resolution, Inductive algorithms, Structural IE.

Probabilistic models for information extraction- Hidden Markov Models, Stochastic Context Free Grammars, Maximal entropy modeling, Maximal entropy Markov Models, Conditional Random Fields. Text mining applications.

### **UNIT-III TEXT MINING METHODS & APPROACHES**

Content Analysis; Natural Language Processing; Clustering & Topic Detection; Simple Predictive Modelling; Sentiment Analysis; Sentiment Prediction.

### **UNIT-IV 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 SOCIAL MEDIA ANALYTICS**

Social network and web data and methods. Graphs and Matrices-Why Graphs? Graphs, Directed Graphs, Signed Graphs, Valued Graphs, Multigraphs, Hypergraphs, Relations, Matrices. Basic measures for individuals and networks. Information visualization: Architectural considerations, common visualization approaches for text mining, visualization technique in link analysis; Making connections: Link analysis. Random graphs and network evolution. Social contexts: Affiliation and identity; Social network analysis.

#### **List of Experiments**

- 1 Installation of NLTK and perform simple tokenize on any web page.
- 2 Find the frequency distribution of words for the given web page.
- 3 Perform word stemming using NLTK.
- 4 Perform an experiment for text summarization applying Deep Learning.
- 4 Collect the Tweets of a particular Movie and interpret the influence of the Movie providing the Positive/Negative Comments.
- 5 Analyse emoticons feedbacks of consumable product and conclude whether to buy a product or not from e-newspaper.
- 6 Based upon the counts of share, like, comments for a post in Facebook, analyse and comment the Post.
- 7 Consider the role of a marketing manager for an apparel software company and develop a campaign for LinkedIn target audience.
- 8 Use Tableau to derive decision for knowledge worker from available previous data sets.
- 9 In a video frame sequence use snapchat to raise trigger to skip horror frames by analysing the video.
- 10 Create an ontology for news article in English contents that are good/bad to the country.

### **Course Outcomes:**

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

- ☐ Perceive the trends in recent years on online social networks.
- ☐ Draw the graphical relation between the community.
- ☐ Know various social network algorithms related to predictive modelling and pattern discovery.
- ☐ Determine the relation between the participants of various social media.
- ☐ Understand Social Network Mining Tools and apply in real time problems.

### **Text Books:**



## **SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL**

- 1 Ronen Feldman and James Sanger, "The Text Mining Handbook: Advanced Approaches in Analyzing Unstructured Data", Cambridge University Press, 2006.
- 2 Hansen, Derek, Ben Shneiderman, Marc Smith, "Analyzing Social Media Networks with NodeXL: Insights from a Connected World", Morgan Kaufmann, 2011.
- 3 Avinash Kaushik, "Web Analytics 2.0: The Art of Online Accountability", 2009.
- 4 Hanneman, Robert and Mark Riddle, "Introduction to Social Network Method", 2005.
- 5 Ronen Feldman and James Sanger, "The Text Mining Handbook: Advanced Approaches in Analyzing Unstructured Data", Cambridge University Press, 2006.

### **Reference Books:**

- 1 Wasserman, S. & Faust, K.. "Social Network Analysis: Methods and Applications", New York: Cambridge University Press, 1994.
- 2 Monge, P. R. & Contractor, N. S., "Theories of Communication Networks", New York: Oxford University Press, 2003.

# SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL

## CB-706(C) MOBILE COMPUTING

### Objectives:

- ☐ To learn about the mobile infrastructure, radio resource management, overview of generation 1G to 5G.
- ☐ To illustrate the location management involved in GSM, Mobile IP.
- ☐ To illustrate the transmission, transaction technology involved in mobile.
- ☐ To explore the wireless network in mobile.
- ☐ To discover the cognitive radio networks in mobile.

### UNIT-I 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 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 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 WIRELESS NETWORK

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 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, Introduction to D2D communications-High level requirements for 5G architecture, Introduction to the radio resource management, power control and mode selection problems, Millimeter wave communication in 5G.

### List of Experiments

Design and Development of different wireless network protocols using network simulators such as NS-3/ OMNET++

1. MAC Protocol
2. Routing Protocol
3. Transport Protocol
4. Congestion Control Protocol
5. Application Protocol
6. Security Protocol

### Course Outcomes:

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

- ☐ Understand and apply the various concepts of Basics of Number Theory
- ☐ Secure a message over an insecure channel by numerous symmetric key cryptosystem
- ☐ Apply diverse Public Key Cryptosystem & Authentication
- ☐ Implement varied Security Applications
- ☐ Understand the implications of quantum computing on cryptography and security

### Text Books:

- 1 Jochen Schiller, "Mobile Communications", Second Edition, Pearson, 2004.
- 2 Andrea Goldsmith, "Wireless Communications", Cambridge University Press, 2005.

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### Reference Books:

- 1 Theodore Rappaport, "Wireless Communications: Principles and Practice", Pearson Education, 2014.
- 2 Ezio Biglieri, MIMO, "Wireless Communications", Cambridge University Press, 2009.
- 3 Ivan Stojmenovic, "Handbook of Wireless Networking and Mobile Computing", Wiley, 2002.
- 4 James Cowling, "Dynamic Location Management in Heterogeneous Cellular Networks", 2004.
- 5 MIT Thesis. <http://people.csail.mit.edu/cowling/hons/jcowling-dynamic-Nov 2004.pdf>
- 6 Travis Keshav, Location Management in Wireless Cellular Networks. 2006.  
[https://www.cse.wustl.edu/~jain/cse574-06/ftp/cellular\\_location.pdf](https://www.cse.wustl.edu/~jain/cse574-06/ftp/cellular_location.pdf).
- 7 Fahd A. Batayneh, Location Management in Wireless Data Networks. 2006  
[https://www.cse.wustl.edu/~jain/cse574-06/ftp/wireless\\_location.pdf](https://www.cse.wustl.edu/~jain/cse574-06/ftp/wireless_location.pdf).
- 8 Lingyang Song, Dusit Niyato, Zhu Han, and Ekram Hossain, "Principles of Mobile Communication", Springer, 2017.
- 9 Ezio Biglieri, Andrea J. Goldsmith, Larry J. Greenstein, Narayan Mandayam and H. Vincent Poor, "Principles of Cognitive Radio", Cambridge University Press, 2012.
- 10 Edgar H. Callaway, Jr. and Edgar H. Callaway, "Wireless Sensor Networks: Architectures and Protocols", CRC Press, 2003.

**B.TECH  
COMPUTER SCIENCE AND BUSINESS  
SYSTEM SEMESTER VIII SYLLABUS**

# SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL

## SYLLABUS

### B.Tech(Computer Science and Business System) VIII Semester

#### CB-801 SERVICES SCIENCE & SERVICE OPERATIONAL MANAGEMENT

##### Objectives:

- ☐ Understand the services and service operations management concepts.
- ☐ Comprehend the techniques of service operations.
- ☐ Understand the service quality and service design aspects.
- ☐ Understand the service innovation aspects.
- ☐ To analyse how services are different from products by its characteristics.

#### UNIT-I 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. Service-Dominant Logic: From Goods-Dominant logic to Service-Dominant logic, Value co-creation.

#### UNIT-II 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 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.

#### UNIT-III SERVICE GUARANTEE & SERVICE RECOVERY

Service quality GAP analysis, Service guarantee-Service encounter-service profit chain.

#### UNIT-IV FORECASTING DEMAND FOR SERVICES

Types of demand forecasting methods for Managing Capacity and Demand: Strategies for matching capacity and demand, managing waiting line in services. Managing Facilitating Goods: inventory models, Role of inventory in services - Managing service supply relationship: Understanding the supply chain, Strategies for managing suppliers of service - Vehicle Routing Problem: understanding services that involve transportation of people and vehicle.

#### UNIT-V SERVICE INNOVATION

Services Productivity, Need for Services Innovation, service innovation in different service sector – educational, health and hospitality sectors.

#### LABORATORY

Perform lab on the basis of following primary activities of operations management:

Job design, scheduling, materials management, capacity management, facilities management, and quality management.

##### Course Outcomes:

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

- ☐ Understand concepts about services and distinguish it from goods.
- ☐ Able to identify characteristics and nature of services.
- ☐ Comprehend ways to design services and evaluate them using service qualities.
- ☐ Understand how various methods can be used to operate and manage service businesses.
- ☐ Understand how innovation can be approached from services point of view.

##### Text Book:

- 1 Fitzsimmons & Fitzsimmons, "Service Management: Operations, Strategy, Information Technology", McGraw Hill publications, 7th Edition, 2017.
- 2 Christopher H.Lovelock and JochenWirtz, "Services Marketing", Pearson Education, New Delhi, 7th Edition, 2011.
- 3 Richard Metters, Karthryn King-Metters, Madeleine pullman, Steve Walton, "Successful Service Operations Management", South-Western, Cengage Learning, 2nd Edition, 2008.
- 4 Cengiz Haksever, Barry Render, Roberta S Russell, Pober G Mirdick, "Service Management and Operations", Pearson Education, 2<sup>nd</sup> Edition, 2000.

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### **Reference Books:**

- 1 Wilson, A., Zeithaml, V. A., Bitner, M. J., & Gremler, D. D., “ Services marketing: Integrating customer focus across the firm”, McGraw Hill, 2012
- 2 Lovelock, C, Services, “ Marketing”, Pearson Education India, 7<sup>th</sup> Edition ,2011.
- 3 Robert Johnson, Graham clark, “Service Operations Management”, Pearson Education, 2nd Edition, 2005.
- 4 Reason, Ben, and Lovlie, Lavrans, “Service Design for Business: A Practical Guide to Optimizing the Customer Experience”, Pan Macmillan India, 2016.
- 5 Chesbrough, H, “Open Services Innovation: Rethinking Your Business To Grow and Compete in a New Era”. John Wiley & Sons, 2010.

# SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL

## CB-802 IT PROJECT MANAGEMENT

### Objectives:

- ☐ Gain knowledge on fundamental concepts of project and project scheduling.
- ☐ Understand Project Cost Control, Scheduling and Management Features.
- ☐ Obtain knowledge on Agile Project Management.
- ☐ Know about the Scrum framework in detail.
- ☐ Obtain knowledge on DevOps and its related concepts.

### UNIT-I PROJECT OVERVIEW AND PROJECT SCHEDULING

Project Overview and Feasibility Studies: Identification, Market and Demand Analysis, Project Cost Estimate, Financial Appraisal- 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-II COST CONTROL, SCHEDULING AND MANAGEMENT FEATURES

Cost Control and Scheduling: Project Cost Control (PERT/Cost), Resource Scheduling & Resource Leveling - Project Management Features: Risk Analysis, Project Control, Project Audit and Project Termination.

### UNIT-III AGILE PROJECT MANAGEMENT

Agile Project Management: Introduction, Agile Principles, Agile methodologies, Relationship between Agile Scrum, Lean, DevOps and IT Service Management (ITIL). Other Agile Methodologies: Introduction to XP, FDD, DSDM, Crystal.

### UNIT-IV SCRUM

Scrum: Various terminologies used in Scrum (Sprint, product backlog, sprint backlog, sprint review, retro perspective), various roles (Roles in Scrum), Best practices of Scrum, Case Study.

### UNIT-V DEVOPS

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, Case Study.

### List of Experiments

A mini-project to be identified in the given domain (Crowd Source System, Day Book, Smart Transport System, Resume Builder, E-Commerce, Expert System, Puzzle Corner) to apply the IT Project Management Principles.

- 1 Estimation of project cost and control activity using open-source tools.
- 2 Scheduling of project with PERT and CPM techniques to estimate the completion time.
- 3 Assessment of IT Project Risk Analysis using open-source tools.
- 4 Perform IT Project Audit and generate a report using open-source tools.
- 5 Study of Agile project management tools.
- 6 Application of Scrum practices in the project.
- 7 Design and perform automated testing.

### Course Outcomes:

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

- ☐ Learn to effectively plan, and schedule projects within time and cost targets.
- ☐ Have Knowledge in Cost Control, Scheduling and Management Features.
- ☐ Be aware of different Agile Project Methodologies.
- ☐ Know in detail about Scrum.
- ☐ Obtain good knowledge in DevOps.

### Text Book:

- 1 Mike Cohn, "Succeeding with Agile: Software Development Using Scrum", Addison-Wesley Professional Publisher, 1st Edition, 2009.

### Reference Bookss:

- 1 Roman Pichler, "Agile Product Management with Scrum", Addison-Wesley publisher, 1st Edition, 2010.
- 2 Ken Schwaber, "Agile Project Management with Scrum (Microsoft Professional)", Microsoft Press US publisher, 1st Edition, 2004.

# SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL

## CB-803 MARKETING RESEARCH & MARKETING MANAGEMENT

### Objectives:

- The course will enable in understanding the concepts of marketing with respect to the changing business environment. It will also provide a balance of the theoretical and practical aspects of marketing research and encourage the students to take up a critical and analytical thinking through research.

### UNIT-I MARKETING CONCEPTS

Introduction to marketing —Core concepts — Marketing of Services ; importance of marketing in service sector — Marketing planning and Environment ; Elements of marketing mix; analyzing the needs and trends in Environment-Macro, Economical, Political, Technical and Social — Understanding the Consumers – Determinants and factors - Market Segmentation – Meaning and concept; Basis of segmentation, selection of segments, Segmentation strategies, Target marketing, target Positioning.

### UNIT-II PRODUCT MANAGEMENT

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

### UNIT-III 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 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 INTERNET MARKETING

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

### Course Outcomes:

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

- Understand the basic marketing concepts.
- Comprehend the dynamics of marketing and analyze how various components interact with each other in the real world.
- Leverage marketing concepts for effective decision making.
- Understand the basic concepts and the application of statistical tools in marketing research.
- Understand internet marketing, Business to Business marketing, Promotion in business markets, CRM and Strategies adopted in B2B markets.

### Text Books:

- 1 Philip Kotler and Kevin Lane Keller, "Marketing Management", PHI 14<sup>th</sup> Edition, 2012.
- 2 Donald R. Cooper, Pamela S. Schindler and J K Sharma, "Business Research Methods", 11<sup>th</sup> Edition, Tata McGraw Hill, New Delhi, 2012.
- 3 Uma Sekaran and Roger Bougie, "Research methods for Business", 5<sup>th</sup> Edition, Wiley India, New Delhi, 2012.
- 4 KS Chandrasekar, "Marketing management-Text and Cases", Tata McGraw Hill First edition, 2010.

### Reference Books:

- 1 Paul Baines, Chris Fill and Kelly Page, "Marketing", Oxford University Press, 2<sup>nd</sup> Edition, 2011.
- 2 William G Zikmund, Barry J Babin, Jon C.Carr, Atanu Adhikari, Mitch Griffin, "Business Research methods, A South Asian Perspective", 8<sup>th</sup> Edition, Cengage Learning, New Delhi, 2012.



# SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL

## CB-804(A) BEHAVIORAL ECONOMICS

### Objectives:

- ☐ To understand the concept and theory of economics.
- ☐ To acquire knowledge on the choices and behavior of firms, households and other economics entities.
- ☐ To learn the behavioral science perspective in economics.
- ☐ To know the current ideas and concepts regarding decision making in economics.
- ☐ To study the intertemporal choice in economics.

### UNIT-I INTRODUCTION

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

### UNIT-II 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 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, policy analysis – norms and markets, labor markets, market clearing, public goods; applications – logic and knowledge, voluntary contribution, compensation design.

### UNIT-IV CHOICE UNDER UNCERTAINTY

Background and expected utility theory; prospect theory and other theories; reference points; loss aversion; marginal utility; decision and probability weighting; applications – ownership and trade, income and consumption, performance in sports. Strategic choice-Review of game theory and Nash equilibrium – strategies, information, equilibrium in pure and mixed strategies, iterated games, bargaining, signaling, learning; applications – competitive sports, bargaining and negotiation, monopoly and market entry.

### UNIT-V INTERTEMPORAL CHOICE

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

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.

### Course Outcomes:

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

- ☐ Understand and apply various concepts in traditional and modern Microeconomics.
- ☐ Focus on decision making, and develop a holistic understanding of these concepts and their interconnections.
- ☐ Explore the knowledge on behavioral science perspective in Economics.
- ☐ Understand current ideas and concepts regarding decision making in Economics.
- ☐ Students will be able to understand the intertemporal choice in Economics.

### Text Books:

- 1 N. Wilkinson and M. Klaes , “An Introduction to Behavioral Economics”, 2017.
- 2 Paul A. Samuelson, William D. Nordhaus, Sudip Chaudhuri and AnindyaSen, “Economics”, 19th edition, Tata McGraw Hill, 2010.
- 3 M.L.Trivedi, “Managerial Economics:Theory & Applications”, Tata McGraw-Hill Education, 4<sup>th</sup> Edition, 2002.
- 4 Robert H. Frank, 2014, “Microeconomics and Behaviour”, McGraw-Hill, 9<sup>th</sup> Edition, 2014.
- 5 Philip Corr, Anke Plagnol, “Behavioral Economics: The Basic”, Routledge; 1st edition, 2018.

### Reference Books:

- 1 William Boyes and Michael Melvin, “Textbook of Economics”, DTECH, 6th Edition, 2004.
- 2 N. Gregory Mankiw, “Principles of Economics”, Thomson learning, 3rd Edition, 2003.
- 3 Richard Lipsey and Alec Charystal, “Economics”, Oxford, University Press, 12th Edition, 2011.

# SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL

## CB-804(B) COMPUTATIONAL FINANCE & MODELING

### Objectives:

- ☐ To make the students to understand how the techniques in computational finance applied in risk hedging and pricing of options.

### UNIT-I NUMERICAL METHODS AND MODELS

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 model- early exercise- the corresponding free boundary problems. Introduction to numerical methods for solving multi-factor models.

### UNIT-II 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. Option Greeks 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 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 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 APPLICATION AREAS

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

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

### Course Outcomes:

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

- ☐ Understand existing financial models in a quantitative and mathematical way.
- ☐ Apply these quantitative tools to solve complex problems in the areas of portfolio management, risk management and financial engineering.
- ☐ Explain the approaches required to calculate the price of options.
- ☐ Identify the methods required to analyze information from financial data and trading systems.
- ☐ Understand the various statistical methods to analyze the financial data.

### Text Books

- 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.
- 3 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/>
- 4 A. Lewis, "Option Valuation under Stochastic Volatility", Finance Press, Newport Beach, California, 2000
- 5 A. Pelsser, "Efficient Methods for Valuing Interest Rate Derivatives", Springer-Verlag, New York, 2000.

# **SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL**

## **CB-804(C) PSYCHOLOGY**

### **Objectives:**

- 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.

### **UNIT-I**

Industrial/Organizational 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**

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

### **UNIT-III**

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

### **UNIT-IV**

Employee Motivation, Satisfaction and Commitment, Fairness and Diversity.

### **UNIT-V**

Leadership, Organizational Climate, Culture, and Development, Teams in Organizations, The Organization of Work Behavior, Stress Management: Demands of Life and Work.

### **Course Outcomes:**

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

- Become conversant about the major content areas of Industrial Psychology.
- Gain further comfort with statistical concepts in the context of making personnel decisions.
- Gain practical experience by completing a series of hands-on projects involving job analysis, selection decisions, training programs, and employee well-being.
- Deepen your understanding of tests and measurements so that you can collect accurate information and make sound data-based decisions.
- Prepare for other focused seminar courses in Industrial/Organizational Psychology or Human Resource Management.

### **Text Books**

- 1 Elmes, D., Kantowitz, B., & Roediger, H, "Research methods in psychology", Cengage Learning, 9<sup>th</sup> Edition, 2011.
- 2 Landy, F. J. and Conte, J. M, "Work in the 21st Century", Oxford: Blackwell Publishing, 4<sup>th</sup> Edition, 2013.
- 3 TV.Rao, "Performance Management towards Organizational Excellence", Sage, 2<sup>nd</sup> Edition, 2016.
- 4 Stephen Robbins, Tim Judge, Neharika Vohra, "Organizational Behaviour", Pearson, 18<sup>th</sup> Edition, 2019.
- 5 Pratibha Goyal , Alok Chakrawal , "Stress Management", Studera Press, 1<sup>st</sup> Edition, 2016.

### **Reference Books**

- 1 Breakwell, G.M., Smith, J.A., &Wright, D.B, "Research methods in psychology", Sage, 4<sup>th</sup> Edition, 2012.

# SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL

## CB-805(A) ENTERPRISE SYSTEMS

### Objectives:

- ☐ Understand the concept of Simple Web Applications using MVC.
- ☐ Be exposed to different models in SOA and ERP.
- ☐ Be exposed to CRM models.
- ☐ Be exposed to interactive networks and applications.
- ☐ Be familiar with configuration of networking.

### UNIT-I WEB APPLICATIONS USING MVC

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; Brief overview of the following : Java server pages; Related Java Technologies; Microsoft .NET framework; PHP; Ruby on Rails; JavaScript; Ajax; Angular/React JS.

### UNIT-II SOA AND ERP MODELS

Service Oriented Architecture (SOA); Principles of loose coupling, encapsulation; Inter-operability; 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 CRM MODELS

Electronic Data Exchange; Customer Relationship Management (CRM); 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; Case study.

### UNIT-IV INTERACTIVE NETWORK AND APPLICATION

Overview of : MPLS ; Virtual Private Networks (VPN) ; Firewalls ; Network monitoring and enforcement of policies ; 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; Case study.

### UNIT-V CONFIGURATION OF NETWORKING

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; Case study.

### List of Experiments

- 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 customer, material master data. Execute the sales process in SAP.
- 5 Create vendor, material master data for purchasing. Execute the Purchasing process in SAP.
- 6 A model of customer relationship management and business intelligence systems for catalogue and online retailers.
- 7 A model of customer relationship management and business intelligence systems for catalogue and online retailers with access control.
- 8 Configure firewall settings for an interactive network.
- 9 Configure and Implement a COTS.
- 10 Mini project.

### Course Outcomes:

On completion of the course, the students will be able 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.

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## **Text Books:**

- 1 Alexis Leon, “Enterprise Resource Planning”, Tata McGraw Hill, 3<sup>rd</sup> Edition, 2017.
- 2 Alexis Leon, “Enterprise Resource Planning – Diversified”, TMH, 2<sup>nd</sup> Edition.

## **Reference Books:**

- 1 Ravi Shankar & S. Jaiswal, Galgotia, “Enterprise Resource Planning”, 1<sup>st</sup> Edition, 1999.
- 2 Dr. Ravi Kalakota, “E-Business Network Resource planning using SAP R/3 Baan and Peoples soft: A Practical Roadmap For Success”, Pearson, 2<sup>nd</sup> Edition, 2001.

# SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL

## CB-805(B) ADVANCE FINANCE

### Objectives:

- ☐ Imbibe knowledge about the decisions and decision variables in Finance.
- ☐ Comprehend the technique of making decisions related to finance function.

### UNIT-I SOURCES OF FUNDS

Sources of Funds (including regulatory framework) Types of securities- Issuing the capital in market- Pricing of issue - Valuation of Stocks and bonds

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

### UNIT-II EVALUATION OF LEASE CONTRACTS

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

### UNIT-III FINANCIAL RESTRUCTURING

Share Split – Consolidation -Cancellation of Paid-up Capital -Other Mechanisms.

### UNIT-IV WORKING CAPITAL MANAGEMENT

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-V INTRODUCTION TO DERIVATIVES

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

### LABORATORY

Perform lab based on the case study of various financial schemes.

### Course Outcomes:

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

- ☐ Understand the sources of funds including regulatory framework.
- ☐ Understand the Corporate Restructuring.
- ☐ Develop skills for the interpretation of business information and application of financial theory in corporate investment decisions.
- ☐ Predict the working capital requirements of a concern.
- ☐ Understand Basics of Derivatives.

### Text Books

- 1 John.C.Hull, Options, “Futures and other Derivative Securities”, PHI Learning, 9<sup>th</sup> Edition, 2012.
- 2 Fred Weston, Kwang S Chung, Susan E Hoag Mergers, “Restructuring And Corporate Control”, Pearson Education, 4<sup>th</sup> Edition.
- 3 I.M.Pandey, “Financial Management”, Vikas Publishing House Pvt. Ltd., 9<sup>th</sup> Edition, 2014.

### Reference Books

- 1 Stulz, “Risk Management and Derivatives”, Cengage Learning, 2<sup>nd</sup> Edition, 2011.
- 2 Rajinder S. Aurora, Kavita Shetty and Sharad R. Kale, “Mergers and Acquisitions”, Oxford University Press, 2011.
- 3 M.Y.Khan and P.K.Jain, “Financial Management, Text, Problems and Cases”, Tata McGrawHill, 5<sup>th</sup> edition, 2008.

# SCHOOL OF INFORMATION TECHNOLOGY, RGPV, BHOPAL

## CB-805(C) IMAGE PROCESSING AND PATTERN RECOGNITION

### Objectives:

- ☐ To learn the fundamentals of image formation and formats.
- ☐ To understand the intensity transformations and filtering techniques.
- ☐ To acquire knowledge on image segmentation operations.
- ☐ To learn the feature extraction and image registration process.
- ☐ To understand the components of colour image processing.

### UNIT-I INTRODUCTION AND IMAGE FORMATION

**Introduction** - Image processing systems and its applications - Basic image file formats.

**Image formation:** Geometric and photometric models; Digitization - sampling, quantization; Image definition and its representation, neighborhood metrics.

### UNIT-II INTENSITY TRANSFORMATIONS AND SPATIAL FILTERING

Enhancement, contrast stretching, histogram specification, local contrast enhancement; Smoothing, linear and order statistic filtering, sharpening, spatial convolution, Gaussian smoothing, DoG, LoG- Morphological Filtering Basics - Dilation and Erosion Operators, Top Hat Filters.

### UNIT-III IMAGE SEGMENTATION

Pixel classification; Grey level thresholding, global/local thresholding; Optimum thresholding - Bayes analysis, Otsu method; Derivative based edge detection operators, edge detection/linking, Canny edge detector; Region growing, split/merge techniques, line detection, Hough transform.

### UNIT-IV FEATURE EXTRACTION AND IMAGE REGISTRATION

Textural features - gray level co-occurrence matrix; Moments; Connected component analysis; Convex hull; Distance transform, medial axis transform, skeletonization/thinning, shape properties. Mono-modal/multimodal image registration; Global/local registration; Transform and similarity measures for registration; Intensity/pixel interpolation.

### UNIT-V COLOUR IMAGE PROCESSING

Fundamentals of different Colour models - RGB, CMY, HSI, YCbCr, Lab; False Colour; Pseudo Colour; Enhancement.

#### List of Experiments

- 1 Write a program for Histogram Mapping and Equalization.
- 2 Write a program for Image Smoothing and Sharpening.
- 3 Write a program for Morphological Operations on Binary Images.
- 4 Write a program for Edge Detection using Sobel, Prewitt and Roberts Operators.
- 5 Write a program for Canny Edge Detector.
- 6 Write a program to calculate the GLCM of the given image.
- 7 Write a program to perform image registration of the given images.
- 8 Write a program to implement colour model conversion.
- 9 Write a program for pseudo-colour operation on the given image.
- 10 Write a program for Image Intensity slicing technique for image enhancement.
- 11 Write a program to analyze the given set of camera captured images and identify the nature of the image.
- 12 Write a program to detect the face from the given set of images and determine the type of animal.

### Course Outcomes:

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

- Be familiar with the fundamentals of image formation and formats.
- Perform image transformation functions and filtering operations.
- Apply the segmentation techniques on the images.
- Extract the features of an image and perform image registration.
- Able to do colour image processing and conversion operations.





## **SCHOOL OF INFORMATION TECHNOLOGY, RGPV, BHOPAL**

### **Text Books:**

- 1 R. C. Gonzalez and R. E. Woods, “Digital Image Processing”, Pearson, 4<sup>th</sup> Edition, 2018.
- 2 Maria Petrou and Panagiota Bosdogianni, “Image Processing: The Fundamentals”, John Wiley & Sons, Ltd, 2<sup>nd</sup> Edition, 2010.
- 3 K. R. Castleman, “Digital Image Processing”, Prentice Hall, Englewood Cliffs, 1<sup>st</sup> Edition, 1995.

### **Reference Books:**

- 1 A. Blake and A. Zisserman, “Visual Reconstruction”, MIT Press, Cambridge.  
<https://doi.org/10.7551/mitpress/7132.001.0001>
- 2 A. N. Netravali and B. G. Haskell, “Digital Pictures”, Plenum Press, 2<sup>nd</sup> Edition, 1995
- 3 A. B. Watson, “Digital Images and Human Vision”, MIT Press, Cambridge, 1993.