

# 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:

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

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.

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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.