DEPARTMENT OF COMPUTER SCIENCE

AWADHESH PARATAP SINGH UNIVERSITY, REWA (M.P.)

Programmes Structure (4 Years) Semester System
B.Sc. (Hons) Computer Science
UGC-CBCS System as per Ordinance 14(A)
2021-22

SEMESTER-I					
Course Code and Name	**Course Type**	**Theory Paper**	**Internal Assessment**	**Maximum Marks**	**Credit**
101: Programming Methodology	Major Core	60	40	100	6
102: Calculus	Minor Core	60	40	100	6
103: Internet Technology*	GE	60	40	100	4
104: English	AE	60	40	100	4
SEMESTER TOTAL				**400**	**20**
CUMULATIVE TOTAL				**400**	**20**

SEMESTER-II					
Course Code and Name	**Course Type**	**Theory Paper**	**Internal Assessment**	**Maximum Marks**	**Credit**
201: Computer System Architecture	Major Core	60	40	100	6
202: Algebra and Geometry	Minor Core	60	40	100	6
203: Mobile Application Development*	GE	60	40	100	4
204: Environment Science	AE	60	40	100	4
SEMESTER TOTAL				**400**	**20**
CUMULATIVE TOTAL				**400**	**20**

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SEMESTER-III					
Course Code and Name	**Course Type**	**Theory Paper**	**Internal Assessment**	**Maximum Marks**	**Credit**
301: Data Structure And Algorithms	Major Core	60	40	100	6
302: Mechanics	Minor Core	60	40	100	6
303: Data Mining*	GE	60	40	100	4
304: Programming in Java	SE	60	40	100	4
SEMESTER TOTAL				**400**	**20**
CUMULATIVE TOTAL				**400**	**20**

SEMESTER-IV					
Course Code and Name	**Course Type**	**Theory Paper**	**Internal Assessment**	**Maximum Marks**	**Credit**
401: Discrete Structure	Major Core	60	40	100	6
402: Mathematical Physics	Minor Core	60	40	100	6
403: Python Programming*	GE	60	40	100	4
404: MATLAB Programming	SE	60	40	100	4
SEMESTER TOTAL				**400**	**20**
CUMULATIVE TOTAL				**400**	**20**

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2021-22

SEMESTER-V					
Course Code and Name	**Course Type**	**Theory Paper**	**Internal Assessment**	**Maximum Marks**	**Credit**
501: Database Management System	Major Core	60	40	100	6
502 (A): Object Oriented Programming** 502(B): Image Processing** 502(C): Data Analytics**	DSE	60	40	100	4
503: Web Programming	SE	60	40	100	4
504: Field Project / Internship / Apprenticeship	Core	60	40	100	6
SEMESTER TOTAL				**400**	**20**
CUMULATIVE TOTAL				**400**	**20**

SEMESTER-VI					
Course Code and Name	**Course Type**	**Theory Paper**	**Internal Assessment**	**Maximum Marks**	**Credit**
601: Computer Network	Major Core	60	40	100	6
602(A): System Security** 602(B): Computer Ethics** 602(C): Human Computer Interface**	DSE	60	40	100	4
603 (A): Software Engineering** 603 (B): Modelling and Simulation** 603(C): GIMP (GNU Image Manipulation Program**	DSE	60	40	100	4
604: Field Project / Internship / Apprenticeship	Core	60	40	100	6
SEMESTER TOTAL				**400**	**20**
CUMULATIVE TOTAL				**400**	**20**

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UGC-CBCS System as per Ordinance 14(A)
2021-22

SEMESTER-VII					
Course Code and Name	**Course Type**	**Theory Paper**	**Internal Assessment**	**Maximum Marks**	**Credit**
701: Operating System	Major Core	60	40	100	6
702 (A): Cloud Computing ** 702 (B): System Programming** 702 (C): Artificial Intelligence** 702 (D): Internet of Things**	DSE	60	40	100	4
703: Research Methodology	Minor Core	60	40	100	4
704: Field Project / Internship / Apprenticeship	Core	60	40	100	6
SEMESTER TOTAL				**400**	**20**
CUMULATIVE TOTAL				**400**	**20**

SEMESTER-VIII					
Course Code and Name	**Course Type**	**Theory Paper**	**Internal Assessment**	**Maximum Marks**	**Credit**
801: Theory of Computation (TOC)	Major Core	60	40	100	6
802: Quantum Mechanics	Minor Core	60	40	100	4
803: Field Project / Internship / Apprenticeship or Research Project	Core			200	10
SEMESTER TOTAL				**400**	**20**
CUMULATIVE TOTAL				**400**	**20**

DEPARTMENT OF COMPUTER SCIENCE

AWADHESH PARATAP SINGH UNIVERSITY, REWA (M.P.)

Programme – B.Sc. (Hon) Computer Science

Programme Outcomes

POs.1	To understand both the theoretical and practical concepts of Computer Science.
POs.2	To gain programming skill to provide solutions for real world problems.
POs.3	To gather a better understanding to analyze, design and development of software systems.

Programme Specific Outcomes

PSOs.1	Demonstrate understanding of the principles and concepts of the computer systems to develop efficient computing system.
PSOs.2	Analyze, design, develop, implement and test computer programme for providing solutions for computing problems.
PSOs.3	Enhancing skills and learning new computing technologies for attaining professional excellence and research.
PSOs.4	Design and develop computer programs/computer-based systems in the areas related to algorithms, networking, web design and data analytics of varying complexity.
PSOs.5	Acquaint with the contemporary trends in industrial/research and thereby bring forth novel solutions to existing problems.

DEPARTMENT OF COMPUTER SCIENCE

AWADHESH PARATAP SINGH UNIVERSITY, REWA (M.P.)

B.Sc. (HONS) COMPUTER SCIENCE I SEM

101: PROGRAMMING METHODOLOGY

Course Learning Outcomes

1. Learn to develop simple algorithms and flow charts to solve a problem.
2. Develop problem solving skills coupled with top down design principles.
3. Learn about the strategies of writing efficient and well-structured computer algorithms/programs.
4. Develop the skills for formulating iterative solutions to a problem.
5. Learn array processing algorithms coupled with iterative methods.
6. Learn text and string processing efficient algorithms.
7. Learn searching techniques and use of pointers.
8. Understand recursive techniques in programming

SYLLABUS

A. Theory **Credit 6**

UNIT-I

Introduction to Programming, Program Concept, Characteristics of Programming, Stages in Program Development, Algorithms, Notations, Design, Flowcharts, Types of Programming Methodologies, Introduction to C++ Programming- Basic Program Structure In C++, Variables and Assignments, Input and Output, Selection and Repetition Statements.

UNIT-II

Top-Down Design, Predefined Functions, Programmer -defined Function, Local Variable, Function Overloading, Functions with Default Arguments, Call -By-Value and Call-By-Reference Parameters, Recursion.

UNIT-III

Introduction to Arrays, Declaration and Referring Arrays, Arrays in Memory, Initializing Arrays, Arrays in Functions, Multi-Dimensional Arrays.

UNIT-IV

Structures- Member Accessing, Pointers to Structures, Structures and Functions, Arrays of Structures, Unions.

UNIT-V

Declaration and Initialization, Reading and Writing Strings, Arrays of Strings, String and Function, Strings and Structure, Standard String Library Functions, Searching Algorithms - Linear Search, Binary Search, Use of files for data input and output, merging and copy files.

TEXT AND REFERENCE BOOKS

1. Problem Solving and Program Design in C, J. R. Hanly and E. B. Koffman, Pearson, 2015.
2. Programming and problem solving with C++: brief edition, N. Dale and C. Weems, Jones & Bartlett Learning, 2010.

B. Practical

1. Given the problem statement, students are required to formulate problem, develop flowchart/algorithm, write code, execute and test it. Students should be given assignments on following:

a. To learn elementary techniques involving arithmetic operators and mathematical expressions, appropriate use of selection (if, switch, conditional operators) and control structures
b. Learn how to use functions and parameter passing in functions, writing recursive programs.

2. Write Programs to learn the use of strings and string handling operations.
a. Problems which can effectively demonstrate use of Arrays, Structures and Union.
b. Write programs using pointers.
c. Write programs to use files for data input and output.
d. Write programs to implement search algorithms.

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AWADHESH PARATAP SINGH UNIVERSITY, REWA (M.P.)

B.Sc. (HONS) COMPUTER SCIENCE I SEM

102: CALCULUS

Course Learning Outcomes: This course will enable the students to-

1. Assimilate the notions of limit of a sequence and convergence of a series of real numbers.
2. Calculate the limit and examine the continuity of a function at a point.
3. Understand the consequences of various mean value theorems for differentiable functions.
4. Sketch curves in Cartesian and polar coordinate systems.
5. Apply derivative tests in optimization problems appearing in social sciences, physical sciences, life sciences and a host of other disciplines.

SYLLABUS **Credit 6**

Unit-I

Sequences and Integration

Real numbers, Sequences of real numbers, Convergence of sequences and series, Bounded and monotonic sequences; Definite integral as a limit of sum, Integration of irrational algebraic functions and transcendental functions, Reduction formulae, Definite integrals.

Unit-II

Limit and Continuity

Definition of limit of a real valued function, Limit at infinity and infinite limits; Continuity of a real valued function, Properties of continuous functions, Intermediate value theorem, Geometrical interpretation of continuity, Types of discontinuity; Uniform continuity.

Unit-III

Differentiability

Differentiability of a real valued function, Geometrical interpretation of differentiability, Relation between differentiability and continuity, Differentiability and monotonicity, Chain rule of differentiation; Darboux's theorem, Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Geometrical interpretation of mean value theorems, Successive differentiation, Leibnitz's theorem.

Unit-IV

Expansions of Functions

Maclaurin's and Taylor's theorems for expansion of a function in an infinite series, Taylor's theorem in finite form with Lagrange, Cauchy and Roche–Schlomilch forms of remainder, Maxima and minima.

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Unit-V

Curvature, Asymptotes and Curve Tracing

Curvature; Asymptotes of general algebraic curves, Parallel asymptotes, Asymptotes parallel to axes; Symmetry, Concavity and convexity, Points of inflection, Tangents at origin, Multiple points, Position and nature of double points; Tracing of Cartesian, polar and parametric curves.

REFERENCES BOOKS

1. Howard Anton, I. Bivens & Stephan Davis (2016). Calculus (10th edition). Wiley India.
2. Gabriel Klambauer (1986). Aspects of Calculus. Springer-Verlag.
3. Wieslaw Krawcewicz & Bindhyachal Rai (2003). Calculus with Maple Labs. Narosa.
4. Gorakh Prasad (2016). Differential Calculus (19th edition). Pothishala Pvt. Ltd.
5. George B. Thomas Jr., Joel Hass, Christopher Heil & Maurice D. Weir (2018).
6. Thomas' Calculus (14th edition). Pearson Education

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AWADHESH PARATAP SINGH UNIVERSITY, REWA (M.P.)

B.Sc. (HONS) COMPUTER SCIENCE I SEM

103: INTERNET TECHNOLOGIES

Course Learning Outcomes

1. To understand the terms related to the Internet and how the Internet is changing the world.
2. To understand how computers are connected to the Internet and demonstrate the ability to use the World Wide Web.
3. Demonstrate an understanding of and the ability to use electronic mail and other internet based services.
4. Understand the design principles of Web pages and how they are created
5. To develop skills and an ability to create basic Web pages with HTML.

SYLLABUS **Credits 4**

UNIT-I

Introduction: Overview, Network of Networks, Intranet, Extranet and Internet. World Wide Web, Domain and Sub domain, Address Resolution, DNS, Telnet, FTP, HTTP. Review of TCP/IP: Features, Segment, Three-Way Handshaking, Flow Control, Error Control, Congestion control

UNIT-II

IP Datagram, IPv4 and IPv6, IP Subnetting and addressing: Classful and Classless Addressing, Subnetting, NAT, IP masquerading, IP tables. Internet Routing Protocol: Routing -Intra and Inter Domain Routing, Unicast and Multicast Routing, Broadcast. Electronic Mail: POP3, SMTP

UNIT-III

HTML:Introduction, Editors, Elements, Attributes, Heading, Paragraph. Formatting, Link, Head, Table, List, Block, Layout, CSS. Form, Iframe, Colors, Colorname, Colorvalue, Image Maps: map, area, attributes of image area. Extensible Markup Language (XML): Introduction, Tree, Syntax, Elements, Attributes, Validation, Viewing. XHTML in brief, CGI Scripts: Introduction, Environment Variable, GET and POST Methods.

UNIT-IV

PERL: Introduction, Variable, Condition, Loop, Array, Implementing data structure, Hash, String, Regular Expression, File handling, I/O handling. JavaScript: Basics, Statements, comments, variable, comparison, condition, switch, loop, break, Object-string, array, Boolean, reg-ex, Function, Errors, Validation, Cookies: Definit ion of cookies, Create and Store a cookie with example. Java Applets: Container Class, Components, Applet Life Cycle, Update method; Parameter passing applet, Applications.

UNIT-V

Client-Server programming In Java: Java Socket, Java RMI. Threats: Malicious code-viruses, Trojan horses, worms; eavesdropping, spoofing, modification, denial of service attacks. Network security techniques: Password and Authentication; VPN, IP Security, security in electronic transaction, Secure Socket Layer (SSL), Secure Shell (SSH). Firewall: Introduction, Packet filtering, Stateful, Application layer, Proxy.

Internet Telephony: Introduction, VoIP. Multimedia Applications: Multimedia over IP: RSVP, RTP, RTCP and RTSP. Streaming media, Codec and Plug-ins, IPTV, mywbut.com Search Engine and Web Crawler: Definition, Meta data, Web Crawler, Indexing, Page rank, overview of SEO.

REFERENCE BOOKS

1. Web Technology: A Developer's Perspective, N.P. Gopalan and J. Akilandeswari, PHI, Learning, Delhi, 2013.
2. Internetworking Technologies, An Engineering Perspective, Rahul Banerjee, PHI, Learning, Delhi, 2011

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AWADHESH PARATAP SINGH UNIVERSITY, REWA (M.P.)

B.Sc. (HONS) COMPUTER SCIENCE I SEM

104: ENGLISH

Course Level Learning Outcomes

Some of the course learning outcomes that students of this course are required to demonstrate run thus:

1. Appreciate the diversity of modern Indian literatures and the similarities between them understand and creatively engage with the notion of nation and nationalism
2. Appreciate the impact of literary movements on various Indian literatures
3. Critically engage with significant social issues like caste and gender
4. Understand the historical trajectories of Indian literatures

Course Content

The texts suggested here are in addition to those in the CBCS syllabus. Some texts/portions have been changed keeping in view the Course Level Learning Outcomes (CLLO) as well as global guidelines in the LOCF documents. Stakeholders, as already suggested, may make amendments in the finalization of the corpus as well as the points raised in the CLLO.

SYLLABUS **Credit 4**

UNIT-I

Grammar: The simple sentence, Statements, questions, imperatives and exclamations, Questions and answers, Leaving out and replacing words, Information and emphasis, Verb Forms: The verb phrase, Verb tenses and aspects, The future, Be, have and do, Modal verbs, The passive, Infinitive, gerund and participles: The infinitive, The gerund, The noun phrase: Nouns and noun phrases, Agreement, The articles: a/an and the, Possessives and demonstratives, Quantifiers, Pronouns, Numbers and measurements, Adjectives, adverbs and prepositions: Adjectives, Adverbials, Comparison, Prepositions, Phrasal verbs and patterns with prepositions.

UNIT-II

The Aesthetics and Politics of Translation, Linguistic Regions and Languages, Modernity in Indian Literature, Caste, Gender and Resistance, Questions of Form in 20th Century Indian Literature

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UNIT-III

SHORT FICTION: Definition, History, Importance

- Premchand, 'The Shroud', in Penguin Book of Classic Urdu Stories, ed. M. Asaduddin (New Delhi: Penguin/Viking, 2006).
- Ismat Chugtai, 'The Quilt', in Lifting the Veil: Selected Writings of Ismat Chugtai, tr. M. Asaduddin (New Delhi: Penguin Books, 2009).
- Gurdial Singh, 'A Season of No Return', in Earthy Tones, tr. Rana Nayar (Delhi: Fiction House, 2002).
- Fakir Mohan Senapati, 'Rebati', in Oriya Stories, ed. Vidya Das, tr. Kishori Charan Das (Delhi: Srishti Publishers, 2000).
- G. Kalyan Rao, Untouchable Spring, tr. Alladi Uma and M. Sridhar (Delhi: Orient Black Swan, 2010)/ Bama, Karukku, tr. Lakshmi Holmstrom (Delhi: OUP, 2000)

UNIT-IV

POETRY: Definition, History, Importance

- Rabindra Nath Tagore, 'Light, Oh Where is the Light?' and 'When My Play was with thee', in Gitanjali: A New Translation with an Introduction by William Radice (New Delhi: Penguin India, 2011)
- G.M. Muktibodh, 'The Void', (tr. Vinay Dharwadker) and 'So Very Far', (tr. Tr. Vishnu Khare and Adil Jussawala), in The Oxford Anthology of Modern Indian Poetry, ed.Vinay Dharwadker and A.K. Ramanujam (New Delhi: OUP, 2000).
- Amrita Pritam, 'I Say Unto Waris Shah', (tr. N.S. Tasneem) in Modern Indian Literature: An Anthology, Plays and Prose, Surveys and Poems, ed. K.M. George, vol. 3 (Delhi: Sahitya Akademi, 1992).
- Thangjam Ibopishak Singh, 'Dali, Hussain, or Odour of Dream, Colour of Wind' and 'The Land of the Half-Humans', tr. Robin S. Ngangom, in The Anthology of Contemporary Poetry from the Northeast (NEHU: Shillong, 2003).

UNIT-V

DRAMA: Definition, History, Indian Drama , Indian Drama and Importance

- Dharamveer Bharati Andha Yug, tr. Alok Bhalla (New Delhi: OUP, 2009).
- Hanif Kureshi My Beautiful Launderette

REFERENCE BOOK

1. Oxford Guide to English Grammar e-book, by John Eastwood.

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B.Sc. (HONS) COMPUTER SCIENCE II SEM

201: COMPUTER SYSTEM ARCHITECTURE

Course Learning Outcomes

1. To make students understand the basic structure, operation and characteristics of digital computer.
2. To familiarize the students with arithmetic and logic unit as well as the concept of the concept of pipelining.
3. To familiarize the students with hierarchical memory system including cache memories and virtual memory.
4. To make students know the different ways of communicating with I/O devices and standard I/O interfaces.

SYLLABUS

A. Theory **6 credits**

UNIT-I

Fundamentals of Digital Electronics: Data Types, Complements, Fixed-Point Representation, Floating-Point Representation, Other Binary Codes, Error Detection Codes, Logic Gates, Boolean Algebra, Map Simplification, Combinational Circuits, Flip Flops, Sequential Circuits, Registers, Counters, Multiplexer, Demultiplexer, Decoder, Encoder.

UNIT-II

Register Transfer and Micro operations: Register Transfer Language, Register Transfer, Bus & Memory Transfer, Arithmetic Micro operations, Logic Micro operations, Shift Micro operation

Basic Computer Organization: Instruction codes, Computer Registers, Computer Instructions, Timing & Control, Instruction Cycles, Memory Reference Instruction, Input - Output & Interrupts, Complete Computer Description & Design of Basic Computer.

UNIT-III

Processor and Control Unit: Hardwired vs. Micro programmed Control Unit, General Register Organization, Stack Organization, Instruction Format, Data Transfer & Manipulation, Program Control, RISC, CISC, Pipelining – Pipelined data path and control – Handling Data hazards & Control hazards.

UNIT-V

Memory and I/O Systems: Peripheral Devices, I/O Interface, Data Transfer Schemes, Program Control, Interrupt, DMA Transfer, I/O Processor. Memory Hierarchy, Processor vs. Memory Speed, High-Speed Memories, Cache Memory, Associative Memory, Interleave, Virtual Memory, Memory Management.

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UNIT-VI

Parallelism: Instruction-level-parallelism – Parallel processing challenges – Flynn's classification – Hardware multithreading – Multicore processors.

TEXT BOOKS

1. Computer System Architecture, M. Morris Mano, 3rd Edition, Prentice Hall.
2. Computer Organization and Design, David A. Patterson and John L. Hennessey, Fifth edition, Morgan Kauffman / Elsevier, 2014.

REFERENCE BOOKS

1. Computer Architecture: A Quantitative Approach, John L. Hennessy, David A. Patterson, 4th Edition.
2. Computer Organization and Architecture, William Stallings, Prentice Hall.

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AWADHESH PARATAP SINGH UNIVERSITY, REWA (M.P.)

B.Sc. (HONS) COMPUTER SCIENCE II SEM

202: ALGEBRA AND GEOMETRY

Course Learning Outcomes: This course will enable the students to:

1. Understand the importance of roots of real and complex polynomials and learn various methods of obtaining roots.
2. Familiarize with relations, equivalence relations and partitions.
3. Employ De Moivre's theorem in a number of applications to solve numerical problems.
4. Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix, using rank.
5. Find eigenvalues and corresponding eigenvectors for a square matrix.
6. Explain the properties of three dimensional shapes

SYLLABUS **6 credits**

Unit-I

Theory of Equations and Complex Numbers

Elementary theorems on the roots of an equations including Cardan's method, The remainder and factor theorems, Synthetic division, Factored form of a polynomial, The Fundamental theorem of algebra, Relations between the roots and the coefficients of polynomial equations, Imaginary roots, Integral and rational roots; Polar representation of complex numbers, The nth roots of unity, De Moivre's theorem for integer and rational indices and its applications.

Unit-II

Relations and Basic Number Theory

Relations, Equivalence relations, Equivalence classes; Functions, Composition of functions, Inverse of a function; Finite, countable and uncountable sets; The division algorithm, Divisibility and the Euclidean algorithm, The fundamental theorem of arithmetic, Modular arithmetic and basic properties of congruences, Principles of mathematical induction and well ordering.

Unit-III

Row Echelon Form of Matrices and Applications

Systems of linear equations, Row reduction and echelon forms, Linear independence, The rank of a matrix and applications; Introduction to linear transformations, The matrix of a linear transformation, Matrix operations, Determinants, The inverse of a matrix, Characterizations of invertible matrices; Applications to Computer Graphics, Eigenvalues and eigenvectors, The characteristic equation and the Cayley–Hamilton theorem

Unit-IV

Planes, Straight Lines and Spheres

Planes: Distance of a point from a plane, Angle between two planes, pair of planes, Bisectors of angles between two planes; Straight lines: Equations of straight lines, Distance of a point from a straight line, Distance between two straight lines, Distance between a straight line and a plane; Spheres: Different forms, Intersection of two spheres, Orthogonal intersection,

Tangents and normal, Radical plane, Radical line, Coaxial system of spheres, Pole, Polar and Conjugacy.

Unit-V

Locus, Surfaces, Curves and Conicoids

Space curves, Algebraic curves, Ruled surfaces, Some standard surfaces, Classification of quadric surfaces, Cone, Cylinder, Central conicoids, Tangent plane, Normal, Polar planes, and Polar lines.

REFERENCES BOOKS

1. Titu Andreescu, & Dorin Andrica (2014). Complex Numbers from A to...Z. (2nd edition).
3. Robert J. T. Bell (1994). An Elementary Treatise on Coordinate Geometry of Three Dimensions. Macmillan India Ltd.
4. D. Chatterjee (2009). Analytical Geometry: Two and Three Dimensions. Narosa Publishing House.
5. Leonard Eugene Dickson (2009). First Course in the Theory of Equations. The Project Gutenberg EBook (http://www.gutenberg.org/ebooks/29785)
6. Edgar G. Goodaire & Michael M. Parmenter (2015). Discrete Mathematics with Graph Theory (3rd edition). Pearson Education Pvt. Ltd. India.
7. Bernard Kolman & David R. Hill (2003). Introductory Linear Algebra with Applications (7th edition). Pearson Education Pvt. Ltd. India.
8. David C. Lay, Steven R. Lay & Judi J. McDonald (2016). Linear Algebra and its Applications (5th edition) Pearson Education Pvt. Ltd. India.

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AWADHESH PARATAP SINGH UNIVERSITY, REWA (M.P.)

B.Sc. (HONS) COMPUTER SCIENCE II SEM

203: MOBILE APPLICATION DEVELOPMENT

Course Learning Outcomes

1. To understand Android platform and its architecture.
2. To learn about mobile devices types and different modern mobile operating systems.
3. To learn activity creation and Android User Interface designing.
4. To learn basics of Intent, Broadcast and Internet services.
5. To learn about different wireless mobile data transmission standards.
6. To understand and learn how to integrate basic phone features, multimedia, camera and Location based services in Android Application.
7. To learn about different systems for mobile application development, deployment and distribution in Mobile market place (Android, IoS).
8. To understand and carry out functional test strategies for mobile applications

SYLLABUS **Credits 4**

UNIT I

(Introduction) What is Android, Android Versions and its Feature Set, Various Android Devices on the Market, Android Market Application Store, Android Development Environment System Requirements, Android SDK, Installing Java, and ADT bundle - Eclipse Integrated Development Environment (IDE), Creating Android Virtual Devices (AVDs)

UNIT II

(Android Architecture Overview and Application) Android Software Stack, The Linux Kernel, Android Runtime - Dalvik Virtual Machine, Android Runtime – Core Libraries, Dalvik VM Specific Libraries, Java Interoperability Libraries, Android Libraries, Application Framework, Creating a New Android Project ,Defining the Project Name and SDK Settings, Project Configuration Settings, Configuring the Launcher Icon, Creating an Activity, Running the Application in the AVD, Stopping a Running Application, Modifying the Example Application, Reviewing the Layout and Resource Files

UNIT III

(Android Software Development Platform and Framework) Understanding Java SE and the Dalvik Virtual Machine, The Directory Structure of an Android Project, Common Default Resources Folders, The Values Folder, Leveraging Android XML, Screen Sizes , Launching Mobile Application: The AndroidManifest.xml File, Android Application Components, Android Activities: Defining the UI, Android Service s: Processing in the Background, Broadcast Receivers: Announcements and Notifications Content Providers: Data Management, Android Intent Objects: Messaging for Components, Android Manifest XML: Declaring Your Components

UNIT IV

(Understanding Android User Interfaces, Views and Layouts) Designing for Different Android Devices, Views and View Groups, Android Layout Managers, The View Hierarchy, Designing an Android User Interface using the Graphical Layout Tool Displaying Text with TextView, Retrieving Data from Users, Using Buttons, Check Boxes and Radio Groups, Getting Dates and Times from Users, Using Indicators to Display Data to Users, Adjusting Progress with Seek Bar, Working with Menus using views, Gallery, Image Switcher, Grid View, and Image View views to display images, Creating Animation.

UNIT V

(Databases, Intents, Location-based Services) Saving and Loading Files, SQLite Databases, Android Database Design, Exposing Access to a Data Source through a Content Provider, Content Provider Registration, Native Content Providers Intents and Intent Filters: Intent Overview, Implicit Intents, Creating the Implicit Intent Example Project, Explicit Intents, Creating the Explicit Intent Example Application, Intents with Activities, Intents with Broadcast Receivers.

Sending SMS Messages Programmatically, Getting Feedback after Sending the Message Sending SMS Messages Using Intent Receiving, sending email, Introduction to location-based service, configuring the Android Emulator for Location -Based Services, Geocoding and Map-Based Activities Multimedia: Audio, Video, Camera: Playing Audio and Video, Recording Audio and Video, Using the Camera to Take and Process Pictures.

REFERENCE BOOKS

1. Android Programming Unleashed (1st Edition) by Harwani.
2. Beginning Mobile Application Development in the Cloud (2011), Richard Rodger.

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B.Sc. (HONS) COMPUTER SCIENCE II SEM

204: ENVIRONMENT SCIENCE

Course Learning Outcomes

1. Knowledge of the environment and the role of human beings in shaping the environment
2. Understand various components of the environment and interfaces
3. Critically appreciate the environmental concerns of today

SYLLABUS **Credit 4**

UNIT-I

Multidisciplinary nature of Environmental Science

Environment– Definition and the components– the physical components, socioeconomic and cultural component, Natural resources – definition and types, renewable and non-renewable resources, resource use and depletion

UNIT-II

The atmosphere – structure and composition, physicochemical role of the atmosphere, radiative balance and earth's temperature regime

UNIT-III

Rocks and minerals, the rock cycle, biogeochemical cycles, soil- structure and types, land resources, and landforms, Water resources, water bodies and water use, issues with water and conservation, Ecosystems – concepts and structure, diversity and stability, concepts of biomes, biodiversity

UNIT-IV

The Urban environment and issues – internal migration, waste generation and management, vehicular traffic, air and water pollution, urban heat island, future of cities, urban green space and aesthetics, Concept of smart cities, sustainable cities

UNIT-V

Environmental issues- local, regional and global, Concepts of pollution of air, water, and land, urbanization and solid wastes, biodiversity loss, land degradation and desertification, biodiversity loss, ozone layer depletion, climate change Environmental concerns – historical development of environmentalism and conservation with Indian perspective

TEXTBOOKS

1. William P. Cunningham, Mary Ann Cunningham, Barbara Woodworth Saigo, Environmental Science: A global concern, McGrawHill 2003
2. William Cunningham, Mary Cunningham, Principles of Environmental Science: Seventh Edition, McGrawHill 2014

REFERENCE BOOKS

1. Roosa SA, Sustainable Development Handbook, CRC Press 2008
2. Atkinson G., Dietz S., Neumayer E., Agarwala M, Handbook of Sustainable Development, Edward Elger, 2014

DEPARTMENT OF COMPUTER SCIENCE

AWADHESH PARATAP SINGH UNIVERSITY, REWA (M.P.)

B.Sc. (HONS) COMPUTER SCIENCE III SEM

301: DATA STRUCTURE AND ALGORITHMS

Course Learning Outcomes

1. To learn good principles of algorithm design;
2. To learn how to analyse algorithms and estimate their worst-case and average case behaviour (in easy cases);
3. To become familiar with fundamental data structures and with the manner in which these data structures can best be implemented; become accustomed to the description of algorithms in both functional and procedural styles;
4. To learn how to apply their theoretical knowledge in practice (via the practical component of the course)

SYLLABUS **Credit 6**

UNIT-I

Introduction: Basic Design and Analysis Techniques of Algorithms, Correctness of Algorithm. Algorithm Design Techniques: Iterative Techniques, Divide and Conquer, Dynamic Programming, Greedy Algorithms.

UNIT-II

Sorting and Searching Techniques: Elementary Sorting techniques– Bubble Sort, Insertion Sort, Merge Sort, Advanced Sorting techniques- Heap Sort, Quick Sort, Sorting in Linear Time - Bucket Sort, Radix Sort and Count Sort, Searching Techniques- Medians & Order Statistics, complexity analysis

UNIT-III

Graphs, Graph ADT, Graph Representations, Graph Traversals, Graphs Algorithms: Graph Algorithms– Breadth First Search, Depth First Search and its Applications, Minimum Spanning Trees. String Processing, Hashing- Introduction, Hash tables, Hash functions, Overflow Handling.

UNIT-IV

Tree Data structure, Search Trees- Binary Search Trees, AVL Trees- Definition and Examples. Lower Bounding Techniques: Decision Trees, Balanced Trees, Red-Black Trees and Splay Trees, Comparison of Search Trees, Pattern Matching Algorithm- The Knuth-Morris-Pratt Algorithm

UNIT-V

Advanced Analysis Technique: Randomized Algorithm, Distributed Algorithm, Heuristics Algorithms, Parallel Algorithms

REFERENCE BOOKS

1. T.H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein Introduction to Algorithms, PHI, 3rd Edition 2009
2. Sara basse & A.V. Gelder Computer Algorithm – Introduction to Design and Analysis, Publisher – Pearson 3rd Edition 1999

B. Practical

The student shall develop programs in a chosen language to solve problems using algorithm design techniques such as Divide and Conquer, Greedy, Dynamic programming and Backtracking. Some of the problems to be solved are indicated below-

1. Write a test program to implement Divide and Conquer Strategy. Eg: Quick sort algorithm for sorting list of integers in ascending order
2. Write a program to implement Merge sort algorithm for sorting a list of integers in ascending order.
3. Write program to implement the DFS and BFS algorithm for a graph.
4. Write program to implement backtracking algorithm for solving problems like Nqueens.
5. Write a program to implement the backtracking algorithm for the sum of subsets problem
6. Write program to implement greedy algorithm for job sequencing with deadlines.
7. Write a program to implement Dijkstra's algorithm for the Single source shortest path problem.
8. Write a program that implements Prim's algorithm to generate minimum cost spanning tree.
9. Write a program that implements Kruskal's algorithm to generate minimum cost spanning tree
10. Write program to implement Dynamic Programming algorithm for the 0/1 Knapsack problem.
11. Write program to implement Dynamic Programming algorithm for the Optimal Binary Search Tree Problem.

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AWADHESH PARATAP SINGH UNIVERSITY, REWA (M.P.)

B.Sc. (HONS) COMPUTER SCIENCE III SEM

302: MECHANICS

Course learning outcome

After going through the course, the student should be able to

1. Understand the role of vectors and coordinate systems in Physics.
2. Write the expression for the moment of inertia about the given axis of symmetry for different uniform mass distributions.
3. Explain the conservation of energy, momentum, angular momentum and apply them to basic problems.
4. Understand the analogy between translational and rotational dynamics, and application of both motions simultaneously in analyzing rolling with slipping.
5. Apply Kepler's law to describe the motion of planets and satellite in circular orbit.
6. Explain the phenomena of simple harmonic motion and the properties of systems executing such motions.
7. Describe how fictitious forces arise in a non-inertial frame, e.g., why a person sitting in a merry-go-round experiences an outward pull.
8. Describe special relativistic effects and their effects on the mass and energy of a moving object

SYLLABUS **Credit 6**

UNIT-I

Fundamentals of Dynamics: Reference frames, Inertial frames, Galilean transformations, Galilean invariance, Review of Newton's Laws of Motion. Momentum of variable mass system: motion of rocket, Dynamics of a system of particles, Principle of conservation of momentum. Impulse, Determination of Centre of Mass of discrete and continuous objects having cylindrical and spherical symmetry (1-D, 2-D & 3-D)

UNIT-II

Work and Energy: Work and Kinetic Energy Theorem, Conservative and non-conservative forces, Potential Energy, Energy diagram, Stable, unstable and neutral equilibrium. Force as gradient of potential energy, Work & Potential energy, Work done by non-conservative forces, Law of conservation of Energy.

Collisions: Elastic (1-D and 2-D) and inelastic collisions. Centre of Mass and Laboratory frames.

UNIT-III

Rotational Dynamics: Angular momentum of a particle and system of particles, Torque, Principle of conservation of angular momentum, Rotation about a fixed axis, Moment of inertia, theorem of parallel and perpendicular axes, Determination of moment of inertia of

discrete and continuous objects [1-D, 2-D & 3-D (rectangular, cylindrical and spherical)], Kinetic energy of rotation, Motion involving both translation and rotation.

Gravitation and Central Force Motion: Law of gravitation, Gravitational potential energy, Inertial and gravitational mass, Potential and field due to spherical shell and solid sphere.

UNIT-IV

Motion of a particle under a central force field: Two-body problem, its reduction to one body problem and its solution. Reduction of angular momentum, kinetic energy and total energy, the energy equation and energy diagram, Kepler's Laws, Satellite in circular orbit, Geosynchronous orbits.

Oscillations: Idea of SHM, Differential equation of SHM and its solution, Kinetic energy, potential energy, total energy and their time-average values, Compound pendulum, Damped oscillation

Forced oscillations: Transient and steady states, sharpness of resonance and Quality Factor, Non-Inertial Systems: Non-inertial frames and fictitious forces, Uniformly rotating frame, Centrifugal force, Coriolis force and its applications.

UNIT-V

Special Theory of Relativity: Outcomes of Michelson-Morley Experiment, Postulates of Special Theory of Relativity, Lorentz Transformations, Simultaneity, Length contraction, Time dilation, Relativistic transformation of velocity, acceleration, frequency and wave number, Mass of relativistic particle, Mass-less Particles, Mass-energy Equivalence, Relativistic Doppler effect (transverse and longitudinal), Relativistic Kinematics (decay problems, inelastic collisions and Compton effect), Transformation of Energy and Momentum.

REFERENCES BOOKS

1. An Introduction to Mechanics (2/e), Daniel Kleppner & Robert Kolenkow, 2014, Cambridge University Press.
2. Mechanics Berkeley Physics Course, Vol. 1, 2/e: Charles Kittel, et. al., 2017, McGraw Hill Education.
3. Theory and Problems of Theoretical Mechanics, Murray R. Spiegel, 1977, McGraw Hill Education.
4. Intermediate Dynamics, Patrick Hamill, 2010, Jones and Bartlett Publishers.
5. Analytical Mechanics, G. R. Fowles and G. L. Cassiday, 2005, Cengage Learning.

DEPARTMENT OF COMPUTER SCIENCE

AWADHESH PARATAP SINGH UNIVERSITY, REWA (M.P.)

B.Sc. (HONS) COMPUTER SCIENCE III SEM

303: DATA MINING

Course Learning Outcomes

1. Demonstrate advanced knowledge of data mining concepts and techniques.
2. Apply the techniques of clustering, classification, association finding, feature selection and visualisation on real world data
3. Determine whether a real world problem has a data mining solution
4. Apply data mining software and toolkits in a range of applications
5. Set up a data mining process for an application, including data preparation, modelling and evaluation
6. Demonstrate knowledge of the ethical considerations involved in data mining.

SYLLABUS **Credit 4**

UNIT I

Introduction to Data Mining, Understanding Data, Data Mining Functionalities, Data mining Architecture, Major Issues in Data Mining, Relations to Database, Statistics, Machine Learning

UNIT II

Association Rule Mining, Level-wise Method, FP-Tree Method, Other Variants, Association Mining to Correlation Analysis, Constraint Based Association Mining

UNIT III

Classification, Classification and prediction, Decision Tree Algorithm, CART, PUBLIC, Pruning Classification Tree, Issue regarding classification

UNIT IV

Clustering Techniques, Clustering of Numeric Data, of Ordinal Data, Efficiency of Clustering, Consensus Clustering, Spectral Clustering, cluster Analysis

UNIT V

Rough Set Theory and its Application to Data Mining, ROC Analysis, Data Mining Trends, Big Data, Data Analytics

TEXT BOOKS

Data Mining Techniques (4e) Universities Press Arun K Pujari

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B.Sc. (HONS) COMPUTER SCIENCE III SEM

304: PROGRAMMING IN JAVA

Course Learning Outcomes

1. Knowledge of the structure and model of the Java programming language,
2. Use the Java programming language for various programming technologies
3. Develop software in the Java programming language,
4. Evaluate user requirements for software functionality required to decide whether the Java programming language can meet user requirements

SYLLABUS **4 credits**

A. Theory

UNIT-I

Introduction: Java Essentials, Its characteristics, Execution and Compilation, Keyword, Data types, Variables, Operators, Control Statements, Standard Input/ Output

UNIT-II

Object Oriented Concepts: Classes, Object, Encapsulation, Abstraction, Inheritance, Polymorphisms, Constructors, Array, JAVA Packages

UNIT-III

String Handling, String Operations, Java Memory Management, Exception Handling, Wrapper Classes, Auto-boxing, Multi-thread Programming, Java Thread Model, Creating a Thread

UNIT-IV

Applets: Applet Class, Applet Architecture, Applet Skeleton, Event Handling, AWT, Database Handling using JDBC

UNIT-V

Java Collections Framework overview, Collection interfaces, Collection Classes, java utility classes, String Tokenizer, Working with java graphics

B. Practical

Students are required to implement object-oriented paradigm using JAVA. Below are the list of some of the experiments.

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Part A

1. Program on strings: Check the equality of two strings, Reverse a string.
2. Program using loops: to find the sum of digits of a given number, display a multiplication table, display all prime numbers between 1 to 1000.
3. Program to demonstrate all math class functions.

Part B

4. Program on files: to copy a file to another file using Java to package classes.
5. Program to demonstrate method over-riding and overloading
6. Programs on inheritances.
7. Multi-threaded programming.

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B.Sc. (HONS) COMPUTER SCIENCE III SEM

401: DISCRETE STRUCTURE

Course Learning Outcomes

1. Understand the notion of mathematical thinking, mathematical proofs, and algorithmic thinking, and be able to apply them in problem solving.
2. Understand the basics of combinatory, and be able to apply the methods from these subjects in problem solving.
3. Be able to use effectively algebraic techniques to analyze basic discrete structures and algorithms.
4. Understand asymptotic notation, its significance, and be able to use it to analyze asymptotic performance for some basic algorithmic examples.
5. Understand some basic properties of graphs and related discrete structures, and be able to relate these to practical examples

SYLLABUS **Credits 6**

UNIT-I

Sets: Finite and Infinite Sets, Uncountable Infinite Sets; Functions, Relations, Properties of Binary Relations, Closure, Partial Ordering Relations; Counting - Pigeonhole Principle, Permutation and Combination; Mathematical Induction, Principle of Inclusion and Exclusion.

UNIT-II

Growth of Functions: Asymptotic Notations, Summation Formulas and Properties, Bounding Summations, Approximation by Integrals

UNIT-III

Recurrences: Recurrence Relations, Generating Functions, Linear Recurrence Relations with Constant Coefficients and their Solution, Substitution Method, Recurrence Trees, Master Theorem

UNIT-IV

Graph Theory: Basic Terminology, Models and Types, Multigraphs and Weighted Graphs, Graph Representation, Graph Isomorphism, Connectivity, Euler and Hamiltonian Paths and Circuits, Planar Graphs, Graph Coloring, Trees, Basic Terminology and Properties of Trees, Introduction to Spanning Trees

UNIT-V

Propositional Logic: Logical Connectives, Well-formed Formulas, Tautologies, Equivalences, Inference Theory

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REFERENCE BOOKS

1. C.L. Liu & Mahopatra, Elements of Discrete mathematics, 2nd Sub Edition 1985, Tata McGraw Hill
2. Rosen, Discrete Mathematics and Its Applications, Sixth Edition 2006
3. T.H. Coremen, C.E. Leiserson, R. L. Rivest, Introduction to algorithms, Prentice Hall on India (3rd edition 2009)
4. M. O. Albertson and J. P. Hutchinson, Discrete Mathematics with Algorithms 1988 John wiley Publication

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AWADHESH PARATAP SINGH UNIVERSITY, REWA (M.P.)

B.Sc. (HONS) COMPUTER SCIENCE IV SEM

402: MATHEMATICAL PHYSICS

Course Learning Outcomes

On successfully completing this course, the students will be able to

1. Represent a periodic function by a sum of harmonics using Fourier series and their applications in physical problems such as vibrating strings etc.
2. Obtain power series solution of differential equation of second order with variable coefficient using Frobenius method.
3. Understand properties and applications of special functions like Legendre polynomials, Bessel functions and their differential equations and apply these to various physical problems such as in quantum mechanics.
4. Learn about gamma and beta functions and their applications.
5. Solve linear partial differential equations of second order with separation of variable method

SYLLABUS **Credit 6**

UNIT-I

Fourier Series: Periodic functions, Orthogonality of sine and cosine functions, Dirichlet Conditions (Statement only), Expansion of periodic functions in a series of sine and cosine functions and determination of Fourier coefficients, Even and odd functions and their Fourier expansions (Fourier Cosine Series and Fourier Sine Series), Application, Summing of Infinite Series, Parseval's Identity and its application to summation of infinite series

UNIT-II

Frobenius Method and Special Functions: Singular Points of Second Order Linear Differential Equations and their importance, Frobenius method and its applications to differential equations: Legendre, Bessel, Hermite and Laguerre Differential Equations, Properties of Legendre Polynomials: Rodrigues Formula, Generating Function, Orthogonality, Simple recurrence relations, Expansion of function in a series of Legendre Polynomials, Bessel Functions of the First Kind: Generating Function, simple recurrence relations, Zeros of Bessel Functions (Jo(x) and J1(x)) and Orthogonality.

UNIT-III

Some Special Integrals: Beta and Gamma Functions and Relation between them, Expression of Integrals in terms of Gamma Functions.

UNIT-IV

Partial Differential Equations: Solutions to partial differential equations (2 or 3 independent variables) using separation of variables: Laplace's Equation in problems of

rectangular geometry, Solution of wave equation for vibrational modes of a stretched string, rectangular and circular membranes, Solution of 1D heat flow equation, (Wave/Heat equation not to be derived)

UNIT-V

Complex Analysis: Brief Revision of Complex Numbers and their Graphical Representation, Euler's formula, De-Moivre's theorem, Roots of Complex Numbers, Functions of Complex Variables, Analyticity and Cauchy-Riemann Equations, Examples of analytic functions, Singularities: poles, removable singularity, essential singularity, branch points, branch cut, Integration of a function of a complex variable, Cauchy-Goursat Theorem, Cauchy's Inequality, Cauchy's Integral formula, Simply and multiply connected region, Laurent and Taylor's expansion, Residues and Residue Theorem, Application of Contour Integration in solving Definite Integrals.

REFERENCES BOOKS

1. Advanced Engineering Mathematics, Erwin Kreyszig, 2008, Wiley India .
2. Advanced Mathematics for Engineers and Scientists: Schaum Outline Series, M. R Spiegel, McGraw Hill Education (2009).
3. Differential Equations, George F. Simmons, 2006, Tata McGraw-Hill.
4. Mathematical Methods for Physicists, Arfken, Weber and Harris, Elsevier
5. Applied Mathematics for Engineers and Physicists, L.A. Pipes and L.R. Harvill, Dover Publications (2014).
6. Complex Variables and Applications, J.W.Brown& R.V.Churchill, 7th Ed. 2003, Tata McGraw-Hill.

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AWADHESH PARATAP SINGH UNIVERSITY, REWA (M.P.)

B.Sc. (HONS) COMPUTER SCIENCE IV SEM

403: PYTHON PROGRAMMING

Course Learning Outcomes

1. Develop and execute simple Python programs.
2. Structure a Python program into functions.
3. Using Python lists, tuples to represent compound data
4. Develop Python Programs for file processing

SYLLABUS **Credit 4**

A. Theory

UNIT I

Introduction to Python, Python, Features of Python, Execution of a Python, Program, Writing Our First Python Program, Data types in Python, Python Interpreter and Interactive Mode, Values and Types: int, float, boolean, string, and list, Variables, Expressions, Statements, Tuple Assignment, Precedence of Operators, Comments, Modules and Functions, Function Definition and use, Flow of Execution, Parameters and Arguments

UNIT II

Operators in Python, Input and Output, Control Statements, Boolean Values and operators, Conditional (if), Alternative (if-else), Chained Conditional (if-elif-else), Iteration: state, while, for, break, continue, pass, Fruitful Functions: Return Values, Parameters, Local and Global Scope, Function Composition, Recursion

UNIT III

Arrays in Python, Strings and Characters, Strings: String Slices, Immutability, String Functions and Methods, String Module, Lists as Arrays, Illustrative Programs: Square Root, gcd, Exponentiation, Sum an Array of Numbers, Linear Search, Binary Search

UNIT IV

Functions, Lists and Tuples, List Operations, List Slices, List Methods, List Loop, Mutability, Aliasing, Cloning Lists, List Parameters; Tuples: Tuple Assignment, Tuple as Return Value, Dictionaries: Operations and Methods, Advanced List Processing - List Comprehension, Illustrative Programs: Selection Sort, Insertion Sort, Merge sort, Histogram

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UNIT V

Files and Exception: Text Files, Reading and Writing Files, Format Operator; Command Line Arguments, Errors and Exceptions, Handling Exceptions, Modules, Packages, Illustrative Programs: Word Count, Copy File.

TEXT BOOKS

1. Mark Lutz, Learning Python
2. Tony Gaddis, Starting Out With Python
3. Kenneth A. Lambert, Fundamentals of Python
4. James Payne, Beginning Python using Python 2.6 and Python 3

B. Practical

The students are required to verify their ability to use core programming basics and program design with functions using Python programming language. The teacher shall programs to strengthen the practical expertise of the students. The following is an indicative list of programs that can be practised

1. Write a program to demonstrate different number data types in Python.
2. Write a program to perform different Arithmetic Operations on numbers in Python.
3. Write a program to create, concatenate and print a string and accessing sub-string from a given string.
4. Write a python script to print the current date in the following format “Fri Oct 11 02:26:23 IST 2019”
5. Write a program to create, append, and remove lists in python.
6. Write a program to demonstrate working with tuples in python.
7. Write a program to demonstrate working with dictionaries in python.
8. Write a python program to find largest of three numbers.
9. Write a Python program to construct the following pattern, using a nested for loop

```
  *
* *
*
* * *
* * * *
* * * * *
* * * *
* * *
* *
*
```

10. Write a Python script that prints prime numbers less than 20.
11. Write a python program to define a module to find Fibonacci Numbers and import the module to another program.

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AWADHESH PARATAP SINGH UNIVERSITY, REWA (M.P.)

B.Sc. (HONS) COMPUTER SCIENCE IV SEM

404: MATLAB PROGRAMMING

Course Learning Outcomes

1. Understand the fundaments of procedural and functional programming
2. Understand Matlab data types and structures
3. Be able to set up simple real-life numerical problems such that they can be solved and visualized using basic codes in Matlab
4. Be ready to use advanced coding in Matlab in their subsequent studies

SYLLABUS **Credit 4**

UNIT-I

Introduction to MATLAB Programming- Basics of MATLAB programming, Array operations in MATLAB, Loops and execution control, Working with files: Scripts and Functions, Plotting and program output

UNIT-II

Approximations and Errors- Defining errors and precision in numerical methods, Truncation and round-off errors, Error propagation, Global and local truncation errors

UNIT-III

Linear Equations- Linear algebra in MATLAB, Gauss Elimination, LU decomposition and partial pivoting, Iterative methods: Gauss Siedel Method

UNIT-IV

Regression and Interpolation- Introduction, Linear least squares regression (including lsqcurvefit function), Functional and nonlinear regression (including lsqnonlin function), Interpolation in MATLAB using spline and pchip

UNIT-V

Nonlinear Equations- Nonlinear equations in single variable, MATLAB function fzero in single variable, Fixed-point iteration in single variable, Newton-Raphson in single variable, MATLAB function fsolve in single and multiple variables, Newton-Raphson in multiple variables

TEXT BOOKS

1. Fausett L.V.(2007) Applied Numerical Analysis Using MATLAB, 2nd Ed., Pearson Education
2. Essential MATLAB for Engineers and Scientists, 6th Edition, Brian Hahn, Daniel T. Valentine, Academic Press, Web ISBN-13: 978-0-12-805271-6

DEPARTMENT OF COMPUTER SCIENCE

AWADHESH PARATAP SINGH UNIVERSITY, REWA (M.P.)

B.Sc. (HONS) COMPUTER SCIENCE V SEM

501: DATABASE MANAGEMENT SYSTEM

Course Learning Outcomes

1. Gain knowledge of database systems and database management systems software.
2. Ability to model data in applications using conceptual modelling tools such as ER Diagrams and design data base schemas based on the model.
3. Formulate, using SQL, solutions to a broad range of query and data update problems.
4. Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database.
5. Be acquainted with the basics of transaction processing and concurrency control.
6. Familiarity with database storage structures and access techniques.
7. Compare, contrast and analyse the various emerging technologies for database systems such as NoSQL.
8. Analyse strengths and weaknesses of the applications of database technologies to various subject areas.

SYLLABUS **Credit 6**

A. Theory

UNIT-I

Basic Database Concepts, Terminology, and Architecture; Types of Database Management Systems, Differences between Relational and other Database Models, Data Modelling: Relations, Schemas, Constraints, Queries, and Updates, Conceptual vs Physical Modelling, Entity Types, attributes, ER Diagrams

UNIT-II

SQL Data Definition: Specifying Tables, Data Types, Constraints; Simple SELECT, INSERT, UPDATE, DELETE Statements; Complex SELECT Queries, including Joins and Nested Queries; Actions and Triggers; Views; Altering Schemas

UNIT-III

Relational Algebra: Definition of Algebra; Relations as Sets; Operations: SELECT, PROJECT, JOIN, etc. Normalization Theory and Functional Dependencies, 2NF, 3NF, BCNF, 4NF, 5NF;

UNIT-IV

Indexing: Files, Blocks, and Records, Hashing, RAID, Replication; Single-Level and Multi-Level Indexes, B-Trees and B+-Trees, Query Processing Translation of SQL into Query Plans; Basics of Transactions, Concurrency and Recovery.

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UNIT-V

DATABASE PROGRAMMING: Embedded SQL, Dynamic SQL, JDBC, Avoiding Injection Attacks, Stored Procedures; Lightweight Data Access Layers for Python and JavaScript Applications, PHP and MySQL, Object Relational Modeling: Hibernate for Java, Active Record for Rails.

BIG DATA: Motivations; OLAP vs. OLTP, Batch Processing, MapReduce and Hadoop, Spark, Other Systems: HBase, Working with POSTGRES, REDIS, MONGO, and NEO: Setting up the same Database on Four Platforms, Basic Queries and Reporting

TEXTBOOKS

1. Elmasri's and Navathe's Fundamentals of Database Systems, Addison-Wesley

REFERENCE BOOKS

2. Data base Management Systems, Raghu Ramakrishnan, Johannes Gehrke, McGraw Hill Education
3. Data base System Concepts, A. Silberschatz, Henry. F. Korth, S. Sudarshan, McGraw Hill Education

B. Practical

Students are required to practice the concepts learnt in the theory by designing and querying a database for a chosen organization (Like Library, Transport etc). The teacher may devise appropriate weekly lab assignments to help students practice the designing, querying a database in the context of example database. Some indicative list of experiments is given below.

Experiment 1: E-R Model

Analyze the organization and identify the entities, attributes and relationships in it. Identify the primary keys for all the entities. Identify the other keys like candidate keys, partial keys, if any.

Experiment 2: Concept design with E-R Model

Relate the entities appropriately. Apply cardinalities for each relationship. Identify strong entities and weak entities (if any).

Experiment 3: Relational Model

Represent all the entities (Strong, Weak) in tabular fashion. Represent relationships in a tabular fashion.

Experiment 4: Normalization

Apply the First, Second and Third Normalization levels on the database designed for the organization

Experiment 5: Installation of Mysql and practicing DDL commands

Installation of MySql, Creating databases, How to create tables, altering the database, dropping tables and databases if not required. Try truncate, rename commands etc.

Experiment 6: Practicing DML commands on the Database created for the example organization

DML commands are used to for managing data within schema objects. Some examples:

- SELECT - retrieve data from the a database
- INSERT - insert data into a table
- UPDATE - updates existing data within a table
- DELETE - deletes all records from a table, the space for the records remain

Experiment 7: Querying

Practice queries (along with sub queries) involving ANY, ALL, IN, Exists, NOT EXISTS, UNION, INTERSECT, Constraints etc.

Experiment 8 and Experiment 9: Querying (continued…)

Practice queries using Aggregate functions (COUNT, SUM, AVG, and MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.

Experiment 10: Triggers

Work on Triggers. Creation of, insert trigger, delete trigger, update trigger. Practice triggers using the above database.

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AWADHESH PARATAP SINGH UNIVERSITY, REWA (M.P.)

B.Sc. (HONS) COMPUTER SCIENCE V SEM

502(A): OBJECT ORIENTED PROGRAMMING

Course Learning Outcomes

1. Learn the concepts of data, abstraction and encapsulation
2. Be able to write programs using classes and objects, packages.
3. Understand conceptually principles of Inheritance and Polymorphism and their use and program level implementation.
4. Learn exception and basic event handling mechanisms in a program
5. To learn typical object-oriented constructs of specific object oriented programming language

SYLLABUS **Credit 4**

A. Theory

UNIT-I

Basics: Introduction to Object Oriented Programming and its Basic Features, Basic Components of C++, Characteristics of Object-Oriented Language, Structure of a C++ Program, Flow Control Statements in C++, Functions - Scope of Variables, Inline Functions, Recursive Functions, Pointers to Functions, C++ Pointers, Arrays, Dynamic Memory Allocation and De-Allocation

UNIT-II

Differences Between Object Oriented and Procedure Oriented Programming, Abstraction, Overview of Object-Oriented Programming Principles, Encapsulation, C++ Classes, Objects, User Defined Types, Constructors and Destructors, this Pointer, Friend Functions, Data Abstraction, Operator Overloading, Type Conversion

UNIT-III

Class Inheritance, Base and Derived Classes, Virtual Base Class, Virtual Functions, Polymorphism, Static and Dynamic Bindings, Base and Derived Class Virtual Functions, Dynamic Binding through Virtual Functions, Pure Virtual Functions, Abstract Classes, Virtual Destructors

UNIT-IV

Stream Classes Hierarchy, Stream I/O, File Streams, Overloading the Extraction and Insertion 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, Rethrowing an Exception, Uncaught Exceptions

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TEXT BOOKS

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

B. Practical

Students are required to understand the object-oriented concepts using C++. They are required to practice the concepts learnt in the theory . Some of the programs to be implemented are listed as follows:

Part A

1. Number of vowels and number of characters in a string.
2. Write a function called zeros maller () that is passed with two introduce arguments by reference and set the smaller of the number to zero. Write a man() program to access this function.
3. Demonstration of array of object.
4. Using this pointer to return a value (return by reference).
5. Demonstration of virtual function.
6. Demonstration of static function.
7. Accessing a particular record in a student's file.
8. Demonstration of operator overloading.

Part B

1. Write a program to create a database for students that contains Name, Enrolment no, Department, Programme using Constructors, destructors, input and output functions ; input and output for 10 people using different methods.
2. Create a class holding information of the salaries of all the family members (husband, wife, son, and daughter). Using friend functions give the total salary of the family.

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B.Sc. (HONS) COMPUTER SCIENCE V SEM

502(B): IMAGE PROCESSING

Course Learning Outcomes

1. To familiarize the students with the image fundamentals and mathematical transforms necessary for image processing.
2. To make the students understand the image enhancement techniques
3. To make the students understand the image restoration and reconstruction procedures.
4. To familiarize the students with the image segmentation procedures.

SYLLABUS **Credits 4**

UNIT I

Digital Image Fundamentals: Elements of Visual Perception, Light, Brightness Adaption and Discrimination, Image Sensing and Acquisition, Image Sampling and Quantization, Pixels, Some Basic Relationships between Pixels, Coordinate Conventions, Imaging Geometry, Perspective Projection, Linear and Nonlinear Operations

UNIT II

Image Enhancement in the Spatial Domain: Intensity transformations, Contrast Stretching, Histogram Equalization, Correlation and Convolution, Basics of Spatial Filtering, Smoothing Filters, Sharpening Filters, Gradient and Laplacian.

UNIT III

Filtering in the Frequency domain: Hotelling Transform, Fourier Transforms and properties, FFT (Decimation in Frequency and Decimation in Time Techniques), Convolution, Correlation, 2-D sampling, Discrete Cosine Transform, Frequency domain filtering.

UNIT IV

Image Restoration and Reconstruction: Basic Framework, Interactive Restoration, Image deformation and geometric transformations, image morphing, Restoration techniques, Noise characterization, Noise restoration filters, Adaptive filters, Linear, Position invariant degradations, Estimation of Degradation functions, Restoration from projections.

UNIT V

Color Image Processing, Color Fundamentals, Color Models, Pseudocolor Image Processing, Basics of Full-Color Image Processing, Color Transformations, Smoothing and Sharpening, Color Segmentation. Morphological Image Processing, Dilation and Erosion, Opening and Closing, Extensions to Gray -Scale Images.

Image Segmentation: Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation, Segmentation by Morphological Watersheds

DEPARTMENT OF COMPUTER SCIENCE

AWADHESH PARATAP SINGH UNIVERSITY, REWA (M.P.)

TEXT BOOKS

1. Digital Image Processing, Rafael C. Gonzalez and Richard E. Woods, 4th Edition, Prentice Hall

REFERENCE BOOKS

1. Anil K. Jain, Fundamentals of Digital Image Processing, Prentice Hall.
2. Stan Birchfield, Image Processing and Analysis, Cengage Learning

DEPARTMENT OF COMPUTER SCIENCE

AWADHESH PARATAP SINGH UNIVERSITY, REWA (M.P.)

B.Sc. (HONS) COMPUTER SCIENCE V SEM

502(C): DATA ANALYTICS

Course Learning Outcomes

1. This course prepares students to gather, describe, and analyze data, and use advanced statistical tools to support decision making.
2. To gather sufficient relevant data, conduct data analytics using scientific methods, and understand appropriate connections between quantitative analysis and realworld problems.
3. Understand the exact scopes and possible limitations of each method to provide constructive guidance in decision making.
4. To Use advanced techniques to conduct thorough and insightful analysis, and interpret the results correctly with detailed and useful information.
5. To make better decisions by using advanced techniques in data analytics.

SYLLABUS **Credit 4**

UNIT-I

Data Definitions and Analysis Techniques: Elements, Variables, and Data Categorization, Levels of Measurement, Data Management and Indexing

UNIT-II

Descriptive Statistics: Measures of Central Tendency, Measures of Location of Dispersions, Error Estimation and Presentation (Standard Deviation, Variance), Introduction to Probability

UNIT-III

Basic Analysis Techniques: Statistical Hypothesis Generation and Testing, Chi-Square Test, T-Test, Analysis of Variance, Correlation Analysis, Maximum Likelihood Test

UNIT-IV

Data Analysis Techniques-I: Regression Analysis, Classification Techniques, Clustering Techniques (K-Means, K-Nearest Neighborhood)

UNIT-V

Data Analysis Techniques-II: Association Rules Analysis, Decision Tree, Introduction to R Programming: Introduction to R Software Tool, Statistical Computations using R (Mean, Standard Deviation, Variance, Regression, Correlation etc.) Practice and Analysis with R and Python Programming, Sensitivity Analysis

REFERENCE BOOKS

1. Probability and statistics for Engineers and Scientists (9 Edn.), Ronald E Walppole, Raymond H Myres, Sharon L. Myres and Leying Ye, Prentice Hall Inc
2. The Elements of Statistical Learning, Data Mining, Inference, and Prediction (2nd Edn.) Travor Hastie Robert Tibshirani Jerome Friedman, Springer, 2014
3. Software for Data Analysis: Programming with R (Statistics and Computing), John M. Chambers, Springer

DEPARTMENT OF COMPUTER SCIENCE

AWADHESH PARATAP SINGH UNIVERSITY, REWA (M.P.)

B.Sc. (HONS) COMPUTER SCIENCE V SEM

503: WEB PROGRAMMING

Course Learning Outcomes

1. To understand basics of the Internet and World Wide Web
2. To acquire knowledge and skills for creation of web site considering both client and server-side programming
3. To learn basic skill to develop responsive web applications
4. To understand different web extensions and web services standards
5. To understand basic concepts of Search Engine Basics.
6. To learn Web Service Essentials.
7. To learn Rich Internet Application Technologies.
8. To understand and get acquainted with Web Analytics 2.0

UNIT-I

(Introduction to World Wide Web) -Internet Standards, Introduction to WWW and WWW Architecture, Internet Protocols, Overview of HTTP, HTTP request – response, Generations of dynamic web pages

UNIT-II

(User Interface Design) Introduction to HTML and HTML5, TML Tags, Formatting and Fonts, Commenting Code, Anchors, Backgrounds, Images, Hyperlinks, Lists, Tables, Frames, HTML Forms. The need for CSS, Introduction to CSS, Basic syntax and structure, Inline Styles, Embedding Style Sheets, Linking External Style, Backgrounds, Manipulating Text, Margins and Padding, Positioning using CSS.

UNIT-III

(Java Programming) Java Script, Introduction, Core features, Data types and Variables, Operators, Expressions, Functions, Objects, Array, Date and Math related Objects. JAVA Networking classes, TCP/IP Protocol Suite, File Transfer Protocol (FTP), Java Environment Setup for Web Applications, JavaBean, Application Builder Tool, Bean Developer Kit (BDK), The Java Beans API, Introduction to EJB

UNIT-IV

(Database) Database basics, SQL, MySQL, PostgreSQL, JDBC API, Driver Types, Two-tier and Three-tier Models, Connection Overview, Transactions, Driver Manager Overview, Statement Overview, Result Set Overview, Types of Result Sets, Concurrency Types, Prepared Statement Overview

UNIT-V

(Java Applet and JSP) Java Web Programs and Applets, Web Application, Servlet, Servlet Life Cycle, Servlet Programming, Introduction to JSP, Life Cycle of a JSP Page, Translation and Compilation, Creating Static Content, Response and Page Encoding, Creating Dynamic Content, Using Objects within JSP Pages, JSP Programming

(Dot Net Framework) Introduction to Dot Net, Dot Net framework and its architecture, CLR, Assembly, Components of Assembly, DLL hell and Assembly Versioning, Overview to C#, Introduction to ASP.net, Asp.net Programming

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REFERENCE BOOKS

1. J2EE: The complete Reference by James Keogh.
2. Java EE and HTML5 Enterprise Application Development (Oracle Press) by John Brock, Arun Gupta, Geertjan Wielenga
3. Struts: The Complete Reference, 2nd Edition by James Holmes
4. ASP.NET Unleashed by Stephen Walther, Kevin Scott Hoffman, Nate Dudek
5. Microsoft Visual C# 2013 Step by Step by John Sharp

DEPARTMENT OF COMPUTER SCIENCE

AWADHESH PARATAP SINGH UNIVERSITY, REWA (M.P.)

B.Sc. (HONS) COMPUTER SCIENCE VI SEM

601: COMPUTER NETWORK

Course Learning Outcomes

1. Understand the structure of Data Communications System and its components. Be familiarizing with different network terminologies.
2. Familiarize with contemporary issues in network technologies.
3. Know the layered model approach explained in OSI and TCP/IP network models
4. Identify different types of network devices and their functions within a network.
5. Learn basic routing mechanisms, IP addressing scheme and internetworking concepts.
6. Familiarize with IP and TCP Internet protocols.
7. To understand major concepts involved in design of WAN, LAN and wireless networks.
8. Learn basics of network configuration and maintenance.
9. Know the fundamentals of network security issues

SYLLABUS **Credits 6**

UNIT I

Introduction to Computer Networks and Networking Elements: Network Definition, Network Topologies, Network Classifications, Network Protocol, Layered Network Architecture, Overview of OSI Reference Model, Overview of TCP/IP Protocol Suite, Hub, Switch (Managed and Unmanaged), Routers

UNIT II

Data Communication Fundamentals and Techniques: Analog and Digital Signal, Data-Rate Limits, Digital to Digital Line Encoding Schemes, Pulse Code Modulation, Parallel and Serial Transmission, Digital to Analog Modulation-Multiplexing Techniques- FDM, TDM, Transmission Media

UNIT III

Networks Switching Techniques and Access Mechanisms: Circuit Switching, Packet Switching- Connectionless Datagram Switching, Connection Oriented Virtual Circuit Switching; Dial-Up Modems, Digital Subscriber Line, Cable TV for Data Transfer

UNIT IV

Data Link Layer Functions and Protocol: Error Detection and Error Correction Techniques, Data-Link Control- Framing and Flow Control, Error Recovery Protocols-Stop and Wait ARQ, Go-Back-N ARQ, Point to Point Protocol on Internet

UNIT V

Multiple Access Protocol and Network Layer: CSMA/CD Protocols, Ethernet LANS; Connecting LAN and Back-Bone Networks- Repeaters, Hubs, Switches, Bridges, Router and Gateways, Networks Layer Functions and Protocols , Routing, Routing Algorithms, Network Layer Protocol of Internet - IP Protocol, Internet Control Protocols

Transport Layer and Application Layer Functions and Protocols: Transport Services- Error and Flow Control, Connection Establishment and Release- Three Way Handshake, Overview of Application Layer Protocol, Overview of DNS Protocol, Overview of WWW & HTTP Protocol

REFERENCE BOOKS

1. B. A. Forouzan: Data Communications and Networking, Fourth edition, THM Publishing Company Ltd 2007.
2. S. Tanenbaum: Computer Networks, Fourth edition, PHI Pvt. Ltd 2002

DEPARTMENT OF COMPUTER SCIENCE

AWADHESH PARATAP SINGH UNIVERSITY, REWA (M.P.)

B.Sc. (HONS) COMPUTER SCIENCE VI SEM

602(A): SYSTEM SECURITY

Course Learning Outcomes

1. Develop an understanding of information assurance as practiced in computer operating systems, distributed systems, networks and representative applications.
2. Gain familiarity with prevalent network and distributed system attacks, defences against them, and forensics to investigate the aftermath.
3. Develop a basic understanding of cryptography, how it has evolved, and some key encryption techniques used today.
4. Develop an understanding of security policies (such as authentication, integrity and confidentiality), as well as protocols to implement such policies in the form of message exchanges.

SYLLABUS **Credit 4**

UNIT-I

Cryptographic Tools- Confidentiality with Symmetric Encryption, Message Authentication and Hash Functions, Public-Key Encryption, Digital Signatures and Key Management, Random and Pseudorandom Numbers, Practical Application: Encryption of Stored Data

UNIT-II

User Authentication- Means of Authentication, Password-Based Authentication, Token-Based Authentication, Biometric Authentication, Remote User Authentication, Security Issues for User Authentication, Practical Application: An Iris Biometric System, Case Study: Security Problems for ATM Systems

Access Control- Access Control Principles, Subjects, Objects, and Access Rights, Discretionary Access Control, Example: UNIX File Access Control, Role Based Access Control, Case Study: RBAC System for a Bank

UNIT-III

Database Security-The Need for Database Security, Database Management Systems, Relational Databases, Database Access Control, Inference, Statistical Databases, Database Encryption, Cloud Security

UNIT-IV

Malicious Software-Types of Malicious Software (Malware), Propagation– Infected Content– Viruses, Propagation–Vulnerability Exploit–Worms, Propagation–Social Engineering–SPAM E-mail, Trojans, Payload–System Corruption, Payload–Attack Agent–Zombie, Bots, Payload–Information Theft– Keyloggers, Phishing, Spyware, Payload–Stealthing–Backdoors, Rootkits, Countermeasures

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UNIT-V

Denial-of-Service Attacks- Denial-of-Service Attacks, Flooding Attacks, Distributed Denial-of-Service Attacks, Application-Based Bandwidth Attacks, Reflector and Amplifier Attacks, Defences Against Denial-of-Service Attacks, Responding to a Denial-of-Service Attack.

TEXT BOOKS

1. M. Stamp, "Information Security: Principles and Practice," 2 st Edition, Wiley, ISBN: 0470626399, 2011.
2. M. E. Whitman and H. J. Mattord, "Principles of Information Security," 4 st Edition, Course Technology, ISBN: 1111138214, 2011.
3. M. Bishop, "Computer Security: Art and Science," Addison Wesley, ISBN: 0-201-44099-7, 2002.
4. G. McGraw, "Software Security: Building Security In," Addison Wesley, ISBN: 0321356705, 2006.

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AWADHESH PARATAP SINGH UNIVERSITY, REWA (M.P.)

B.Sc. (HONS) COMPUTER SCIENCE V SEM

602(B): COMPUTER ETHICS

Course Learning Outcomes

1. The student will be able to describe and distinguish between the various ethical theories which can be used to form the basis of solutions to moral dilemmas in computing.
2. Identify traditional and current Issues related to Computers, Information Systems, Ethics, Society and Human Values;
3. The student will be able to identify and define the components of a structured plan for solving ethical problems and, in the process, will be able to understand the basis for her/his own ethical system.
4. Given several examples of professional codes of ethics related to computing, the student will be able to compare and contrast these examples, discussing their commonalties, differences, and implications.
5. Develop skills of critical analysis and applying ethical principles to situations and dialectical thinking

SYLLABUS **Credit 4**

UNIT-I

The Need for Computer Ethics Training and Historical Milestones, Defining the Field of Computer Ethics

UNIT-II

Computer ethics codes, Sample Topics in Computer Ethics: Computer crime and computer security, Software theft and intellectual property rights, Computer hacking and the creation of viruses, Computer and information system failure, Invasion of privacy. Privacy in the Workplace and on the Internet, Social implications of artificial intelligence and expert systems, The information technology salesman issues

UNIT-III

Transparency and Virtual Ethics, Free Speech, Democracy, Information Access

UNIT-IV

Developing the Ethical Analysis Skills and Professional Values, Privacy, Accountability, Government Surveillance

UNIT-V

Boundaries of Trust, Trust Management, Wikipedia, Virtual Trust, Plagiarism in Online Environment, Intellectual Property, Net neutrality

REFERENCE BOOKS

1. Deborah, J, Nissenbaun, H, Computing, Ethics & Social Values, Englewwod Cliffs, New Jersey, Prentice Hall, 1995.
2. Spinello, R, Tavani, H, T, Readings in Cyberethics, Sudbury, MA, Jones and Bartlett Publishers, 2001.
3. Bynum, T, W; Rogerson, S, Computer Ethics and Professional Responsibility, Blackwell, 2004

DEPARTMENT OF COMPUTER SCIENCE

AWADHESH PARATAP SINGH UNIVERSITY, REWA (M.P.)

B.Sc. (HONS) COMPUTER SCIENCE VI SEM

602(C): HUMAN COMPUTER INTERFACE

Course Learning Outcomes

1. Provide an overview of the concepts relating to the design of human -computer interfaces in ways making computer-based systems comprehensive, friendly and usable.
2. Understand the theoretical dimensions of human factors involved in the acceptance of computer interfaces.
3. Understand the important aspects of implementation of human-computer interfaces.
4. Identify the various tools and techniques for interface analysis, design, and evaluation.
5. Identify the impact of usable interfaces in the acceptance and performance utilization of information systems.

SYLLABUS **Credit 4**

UNIT I

Introduction: Historical Evolution of HCI, Interactive System Design: Concept of Usability-Definition and Elaboration, HCI and Software Engineering, GUI Design and Aesthetics, Prototyping Techniques

UNIT II

Model-Based Design and Evaluation: Basic Idea, Introduction to Different Types of Models, GOMS Family of Models (KLM And CMN -GOMS), Fitts' Law and Hickhyman's Law,

UNIT III

General Development Guidelines and Principles: Shneiderman's Eight Golden Rules, Norman's Seven Principles, Norman's Model of Interaction, Nielsen's Ten Heuristics with Example of its use, Contextual Inquiry

UNIT IV

Dialog Design: Introduction to Formalism in Dialog Design, Design using FSM (Finite State Machines), State Charts and (Classical) Petri Nets in Dialog Design

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UNIT V

Task Modelling and Analysis: Hierarchical Task Analysis (HTA), Engineering Task Models and Concur Task Tree (CTT), Object Oriented Modelling: Object Oriented Principles, Definition of Class and Object and their Interactions, Object Oriented Modelling for User Interface Design, Case Study Related to Mobile Application Development

REFERENCE BOOKS

1. Dix A., Finlay J.,Abowd G. D. and Beale R. Human Computer Interaction, 3 rd edition, Pearson Education, 2005.
2. Preece J., Rogers Y.,Sharp H.,Baniyon D., Holland S. and Carey T. Human Computer Interaction,Addison-Wesley, 1994.
3. B.Shneiderman, Designing the User Interface, Addison Wesley 2000 (Indian Reprint).

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AWADHESH PARATAP SINGH UNIVERSITY, REWA (M.P.)

B.Sc. (HONS) COMPUTER SCIENCE VI SEM

603(A): SOFTWARE ENGINEERING

Course Learning Outcomes

1. Basic knowledge and understanding of the analysis and design of complex systems.
2. Ability to apply software engineering principles and techniques.
3. To produce efficient, reliable, robust and cost-effective software solutions.
4. Ability to work as an effective member or leader of software engineering teams.
5. To manage time, processes and resources effectively by prioritising competing demands to achieve personal and team goals Identify and analyzes the common threats in each domain.

SYLLABUS **Credit 4**

UNIT I

Software Development Approaches: Introduction; Evolving Role of Software; Software Characteristics; Software Applications, Software Design Processes: Introduction, What is Meant by Software Engineering? Definitions of Software Engineering; The Serial or Linear Sequential Development Model, Iterative Development Model; The incremental Development Model

UNIT II

Software Design Principles: Introduction, System Models: Data-flow Models, Semantic Data Models, Object Models, Inheritance Models, Object Aggregation, Service Usage Models, Data Dictionaries; Software Design: The Design Process, Design Methods, Design description, Design Strategies, Design Quality, Architectural Design: System Structuring, The Repository Model, The Client–Server Model, The Abstract Machine Model, Control Models, Modular Decomposition, Domain-Specific Architectures.

UNIT III

Object Oriented Design: Introduction; Object Oriented Design: Objects, Object Classes & Inheritance, Inheritance, Object Identification, An Object -Oriented Design Example, Object Aggregation; Service Usage; Object Interface Design: Design Evolution, Function Oriented Design, Data–Flow Design; Structural Decomposition: Detailed Design.

UNIT IV

An Assessment of Process Life-Cycle Models: Introduction; Overview of the Assessment of Process; The Dimension of Time; The Need for a Business Model in Software Engineering; Classic Invalid Assumptions: First Assumption: Internal or External Drivers, Second Assumption: Software or Business Processes, Third Assumption: Processes or Projects, Fourth Assumption: Process Centered or Architecture Centered; Implications of the New Business Model; Role of the Problem -Solving Process in this Approach: Data, Problem

Definition, Tools and Capabilities, Redefining the Software Engineering Process: Round-Trip Problem-Solving Approach, Activities, Goals, Interdisciplinary Resources, Time.

UNIT V

Software Reliability: Introduction; Software Reliability Metrics, Programming for Reliability: Fault Avoidance, Fault Tolerance, Software Reuse, Software Testing Techniques: Introduction; Software Testing Fundamental; Testing Principles; White Box Testing; Control Structure Testing; Black Box Testing; Boundary Value Analysis; Testing GUIs; Testing Documentation and Help Facilities; Software Testing Strategies: Introduction; Organizing for Software Testing; Software Testing Strategy, Unit Testing: Unit Test Considerations, Top-Down Integration, Bottom-Up Integration.

REFERENCE BOOKS

1. R. G. Pressman – Software Engineering, TMH
2. Sommerville, Ian, Software Engineering, Pearson Education
3. Pankaj Jalote – An Integrated Approach to Software Engineering, Narosa Publications.
4. Pfleeger, Shari Lawrence, Software Engineering Theory and Practice, second edition. Prentice- Hall 2001.
5. Object Oriented & Classical Software Engineering (Fifth Edition), SCHACH,TMH

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B.Sc. (HONS) COMPUTER SCIENCE VI SEM

603(B): MODELLING AND SIMULATION

Course Learning Outcomes

1. Characterise systems in terms of their essential elements, purpose, parameters, constraints, performance requirements, sub-systems, interconnections and environmental context.
2. Understand the technical underpinning of modern computer simulation software.
3. System problem modelling and solving through the relationship between theoretical, mathematical, and computational modelling for predicting and optimizing performance and objective.
4. Mathematical modelling real world situations related to information systems development, prediction and evaluation of outcomes against design criteria.
5. Develop solutions and extract results from the information generated in the context of the information systems
6. Interpret the model and apply the results to resolve critical issues in a real world environment.
7. Develop different models to suit special characteristics of the system being modelled

SYLLABUS **Credit 4**

UNIT-I

Systems and environment: Concept of model and model building, model classification and representation, Use of simulation as a tool, steps in simulation study.

UNIT-II

Continuous-time and Discrete-time systems: Laplace transform, transfer functions, statespace models, order of systems, z-transform, feedback systems, stability, observability, controllability. Statistical Models in Simulation: Common discrete and continuous distributions, Poisson process, empirical distributions

UNIT-III

Random Numbers: Properties of random numbers, generation of pseudo random numbers, techniques of random number generation, tests for randomness, random variate generation using inverse transformation, direct transformation, convolution method, acceptance-rejection

UNIT-IV

Design and Analysis of simulation experiments: Data collection, identifying distributions with data, parameter estimation, goodness of fit tests, selecting input models without data, multivariate an time series input models, verification and validation of models, static and dynamic simulation output analysis, steady -state simulation, terminating simulation,

confidence interval estimation, Output analysis for steady state simulation, variance reduction techniques

UNIT-V

Queuing Models: Characteristics of queuing systems, notation, transient and steady state behaviour, performance, network of queues, Large Scale systems: Model reduction, hierarchical control, decentralized control, structural properties of large-scale systems.

REFERENCE BOOKS

1. Shailendra Jain, Modeling and Simulation using MATLAB - Simulink, 2ed, Kindle edition

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B.Sc. (HONS) COMPUTER SCIENCE VI SEM

603(C): GNU IMAGE MANIPULATION PROGRAM (GIMP)

Course Learning Outcomes

1. To familiarize the students with the underlying concepts of digital images.
2. To make the students know how to enhance images and prepare them for printing and publishing.

SYLLABUS **Credit 4**

A. Theory

UNIT-I

Imaging Concepts and Graphic Formats: Pixel, Resolution, File Size, Image Compression, Raster & Vector Images, Color Model.

UNIT-II

Capturing and Creating Images: Saving Images, Scanning Images, Familiarization with GIMP Interface.

UNIT-III

Settings: Foreground and Background Colors, Grid Properties.

UNIT-IV

Image Manipulations: Resizing images, Cropping images, Moving and Copying images, Rotating and flipping images.

UNIT-V

Working with Text: Creating and editing text, Formatting Text, Applying text wraps, Tools: Drawing tools, Painting tools.

REFERENCE BOOKS

1. Kay Richter, GIMP 2.8- Buch (e-book)
2. Olivier Lecarme and Karine Delvare, The Book of GIMP, A complete Guide to Nearly Everything, Kindle Edition

B. Practical

Students are required to implement a project based on learned concepts.

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B.Sc. (HONS) COMPUTER SCIENCE VII SEM

701: OPERATING SYSTEM

Course Learning Outcomes

1. Describe the important computer system resources and the role of operating system in their management policies and algorithms.
2. To understand various functions, structures and history of operating systems and should be able to specify objectives of modern operating systems and describe how operating systems have evolved over time.
3. Understanding of design issues associated with operating systems.
4. Understand various process management concepts including scheduling, synchronization, and deadlocks.
5. To have a basic knowledge about multithreading.
6. To understand concepts of memory management including virtual memory.
7. To understand issues related to file system interface and implementation, disk management.
8. To understand and identify potential threats to operating systems and the security features design to guard against them.
9. To have sound knowledge of various types of operating systems including Unix and Android.
10. Describe the functions of a contemporary operating system with respect to convenience, efficiency, and the ability to evolve.

SYLLABUS **Credit 6**

UNIT-I

(Introduction to Operating System) What is Operating System? History and Evolution of OS, Basic OS functions, Resource Abstraction, Types of Operating Systems– Multiprogramming Systems, Batch Systems, Time Sharing Systems, Operating Systems for Personal Computers, Workstations and Hand-held Devices, Process Control & Real time Systems.

(Introduction to Android Operating System) Introduction to Android Operating System, Android Development Framework, Android Application Architecture, Android Process Management and File System, Small Application Development using Android Development Framework.

UNIT-II

(Operating System Organization and Process Characterization) Processor and User Modes, Kernels, System Calls and System Programs, System View of the Process and Resources, Process Abstraction, Process Hierarchy, Threads, Threading Issues, Thread Libraries; Process Scheduling, Non-Pre-emptive and Preemptive Scheduling Algorithms.

UNIT-III

Process Management (Deadlock) Deadlock, Deadlock Characterization, Necessary and Sufficient Conditions for Deadlock, Deadlock Handling Approaches: Deadlock Prevention, Deadlock Avoidance and Deadlock Detection and Recovery.

UNIT-IV

(Inter Process Communication and Synchronization) Concurrent and Dependent Processes, Critical Section, Semaphores, Methods for Inter-process Communication; Process Synchronization, Classical Process Synchronization Problems: Producer-Consumer, Reader-Writer.

UNIT-V

(Memory Management) Physical and Virtual Address Space; Memory Allocation Strategies– Fixed and -Variable Partitions, Paging, Segmentation, Virtual Memory (File and I/O Management, OS security) Directory Structure, File Operations, File Allocation Methods, Device Management, Pipes, Buffer, Shared Memory, Security Policy Mechanism, Protection, Authentication and Internal Access Authorization

REFERENCE BOOKS

1. A Silberschatz, P.B. Galvin, G. Gagne, Operating Systems Concepts, 8th Edition, John Wiley Publications 2008.
2. A.S. Tanenbaum, Modern Operating Systems, 3rd Edition, Pearson Education 2007.
3. G. Nutt, Operating Systems: A Modern Perspective, 2nd Edition Pearson Education 1997.
4. W. Stallings, Operating Systems, Internals & Design Principles 2008 5th Edition, Prentice Hall of India.
5. M. Milenkovic, Operating Systems- Concepts and design, Tata McGraw Hill 1992.

DEPARTMENT OF COMPUTER SCIENCE

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B.Sc. (HONS) COMPUTER SCIENCE VII SEM

702(A): CLOUD COMPUTING

Course Learning Outcomes

1. Analyze the trade-offs between deploying applications in the cloud and over the local infrastructure.
2. Compare the advantages and disadvantages of various cloud computing platforms.
3. Deploy applications over commercial cloud computing infrastructures such as Amazon Web Services, Windows Azure, and Google AppEngine.
4. Program data intensive parallel applications in the cloud.
5. Analyze the performance, scalability, and availability of the underlying cloud technologies and software.
6. Identify security and privacy issues in cloud computing.
7. Explain recent research results in cloud computing and identify their pros and cons.
8. Solve a real-world problem using cloud computing through group collaboration.

SYLLABUS **Credit 4**

A. Theory

Unit-I

Introduction to cloud computing

Definition, characteristics, components, Cloud service provider, the role of networks in Cloud computing, Cloud deployment models- private, public & hybrid, Cloud service models, multitenancy, Cloud economics and benefits, Cloud computing platforms - IaaS: Amazon EC2, PaaS: Google App Engine, Microsoft Azure, SaaS.

Unit-II

Virtualization

Virtualization concepts , Server virtualization, Storage virtualization, Storage services, Network virtualization, Service virtualization, Virtualization management, Virtualization technologies and architectures, virtual machine, Measurement and profiling of virtualized applications. Hypervisors: KVM, Xen, VMware hypervisors and their features.

Unit-III

Data in cloud computing

Relational databases, Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo, MapReduce and extensions: Parallel computing, the map-Reduce model, Parallel efficiency of MapReduce, Relational operations using Map-Reduce, Enterprise batch processing using MapReduce.

Unit-IV

Cloud security

Cloud security fundamentals, Vulnerability assessment tool for cloud, Privacy and Security in cloud, Cloud computing security architecture: General Issues, Trusted Cloud computing, Secure Execution Environments and Communications, Micro - architectures; Identity Management and Access control, Autonomic security, Security challenges : Virtualization

security management - virtual threats, VM Security Recommendations, VM - Specific Security techniques, Secure Execution Environments and Communications in cloud.

Unit-V

Issues in cloud computing

Implementing real time application over cloud platform, Issues in Inter-cloud environments, QOS Issues in Cloud, Dependability, data migration, streaming in Cloud, Quality of Service (QoS) monitoring in a Cloud computing environment, Cloud Middleware, Mobile Cloud Computing. Inter Cloud issues. A grid of clouds, Sky computing, load balancing, resource optimization, resource dynamic reconfiguration, Monitoring in Cloud

TEXT BOOK:

1. Enterprise Cloud Computing by Gautam Shroff, Cambridge publication

REFERENCE BOOK:

1. Cloud Security by Ronald Krutz and Russell Dean Vines, Wiley-India
2. Dr. Kumar Saurabh,"Cloud Computing", Wiley Publication

B. Practical

The students shall explore development of web applications in cloud. Practically Design and develop processes involved in creating a cloud based application and programming using Hadoop

Indicative List of Experiments

1. Install Virtual box/VMware Workstation with different flavours of linux or windows OS with virtualization support
2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
3. Install Google App Engine. Create hello world app and other simple web applications using python/java.
4. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
5. Experiment a procedure to transfer the files from one virtual machine to another virtual machine.
6. Experiment a procedure to launch virtual machine using trystack (Online Openstack Demo Version)
7. Install Hadoop single node cluster and run simple applications like word count.

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B.Sc. (HONS) COMPUTER SCIENCE VII SEM

702(B) SYSTEM PROGRAMMING

Course Learning Outcomes

The general objective of this course is to introduce students' basic concepts, techniques and skills for systems programming. Specific objectives include:

1. Understand basic concepts in systems programming.
2. Understand basic concepts of microprocessors.
3. Understand the concept of virtual machine.
4. Develop skills to write programs using system services.

SYLLABUS **Credit 4**

UNIT I ASSEMBLER

Introduction: Introduction to Systems Software and machine architecture, Review of Computer Architecture, Machine Instructions and Programs, Assemblers –Basic Assembler Functions – Assembler Features – Assembler Design Options.

UNIT II LOADERS AND LINKERS

Loaders and Linkers: Basic Loader Functions, Machine-Dependent Loader Features, Machine-Independent Loader Features, Loader Design Options,Dynamic Linking and Loading, Object files, Contents of an object file, designing an object format, Null object formats, Code sections, Relocation ,Symbols and Relocation, Relocatable -a.out- ELF.

UNIT III MACROPROCESSORS AND EMULATORS

Macro processors: Basic Macro Processor Functions, Machine-Independent, Macro Processor Features, Macro Processor Design Options, Introduction to Virtual Machines (VM), Emulation, basic Interpretation, Threaded Interpretation, Interpreting a complex instruction set – binary translation.

UNIT IV VIRTUAL MACHINES

Virtual Machines: Pascal P-Code, VM Object-Oriented VMs, Java VM Architecture – Common Language Infrastructure, Dynamic Class Loading.

UNIT IV VIRTUAL MACHINES

Virtual Machines: Pascal P-Code, VM Object-Oriented VMs, Java VM Architecture – Common Language Infrastructure, Dynamic Class Loading.

UNIT V ADVANCED FEATURES

Instruction Set Issues, Profiling, Migration, Grids , Code optimizations, Garbage Collection, Examples of real world implementations of system software.

TEXT BOOKS:

1. Leland L. Beck, "System Software", 3rd ed., Pearson Education, 1997.
2. John R. Levine, "Linkers & Loaders", Morgan Kauffman, 2003. 3. James E Smith and Ravi Nair, "Virtual Machines", Elsevier, 2005.
3. Srimanta Pal, " Systems Programming " , Oxford University Press, 2011. 2. John J.Donovan, " "Systems Programming", Tata McGraw-Hill, 1991

DEPARTMENT OF COMPUTER SCIENCE

AWADHESH PARATAP SINGH UNIVERSITY, REWA (M.P.)

B.Sc. (HONS) COMPUTER SCIENCE VII SEM

702(C): ARTIFICIAL INTELLIGENCE

Course Learning Outcomes

1. Explain what constitutes "Artificial" Intelligence and how to identify systems with Artificial Intelligence.
2. Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem.
3. Formalise a given problem in the language/framework of different AI methods (e.g., as a search problem, as a constraint satisfaction problem, as a planning problem, etc).
4. Implement basic AI algorithms (e.g., standard search or constraint propagation algorithms).
5. Design and perform an empirical evaluation of different algorithms on a problem formalization, and state the conclusions that the evaluation supports.
6. Explain the limitations of current Artificial Intelligence techniques.

SYLLABUS

A. Theory **4 credits**

UNIT-I

Introduction to Artificial Intelligence: Definition of AI, Turing Test, Brief History of AI, Problem Solving and Search: Problem Formulation; Search Space, States vs. Nodes, Tree Search: Breadth-First, Uniform Cost, Depth-First, Depth-Limited, Iterative Deepening; Graph Search.

Informed Search: Greedy Search, A* Search; Heuristic Function; Admissibility and Consistency, Deriving Heuristics via Problem Relaxation. Local Search: Hill-Climbing, Simulated Annealing; Genetic Algorithms; Local Search in Continuous Spaces.

UNIT-II

Playing Games: Game Tree, Utility Function; Optimal Strategies, Minimax Algorithm, Alpha-Beta Pruning; Games with an Element of Chance. Beyond Classical Search: Searching with Nondeterministic Actions; Searching with Partial Observations, Online Search Agents; Dealing with Unknown Environments.

UNIT-III

Knowledge Representation and Reasoning: Ontologies, Foundations of Knowledge Representation and Reasoning, Representing and Reasoning about Objects, Relations, Events, Actions, Time, and Space; Predicate Logic, Situation Calculus, Description Logics, Reasoning with Defaults, Reasoning about Knowledge, Sample Applications.

UNIT IV

Representing and Reasoning with Uncertain Knowledge: Probability, Connection to Logic, Independence, Bayes Rule, Bayesian Networks, Probabilistic Inference, and Sample Applications, Planning: The STRIPS Language, Forward Planning, Backward Planning, Planning Heuristics, Partial-Order Planning, Planning using Propositional Logic, Planning vs. Scheduling

UNIT-V

Constraint Satisfaction Problems (CSPs): Basic Definitions; Finite vs. Infinite vs. Continuous Domains, Constraint Graphs, Relationship With Propositional Satisfiability, Conjunctive Queries, Linear Integer Programming, and Diophantine Equations, NP-Completeness of CSP, Extension to Quantified Constraint Satisfaction (QCSP), Constraint Satisfaction as a Search Problem, Backtracking Search, Variable and Value Ordering Heuristic, Degree Heuristic; Least-Constraining Value Heuristic, Forward Checking, Constraint Propagation; Dependency-Directed Backtracking

TEXT BOOKS

1. Elaine Rich, Kevin Knight, Shivashankar B Nair, Artificial Intelligence, Third Edition, McGraw Hill Edition.

REFERENCE BOOKS

2. Russell Stuart Jonathan and Norvig Peter, Artificial Intelligence: A Modern Approach, 3rd Edition, Prentice Hall, 2010

B. Practical

The students are expected to explore the foundational skills on AI techniques acquired in theory in solving problems and using sample data sets and various tools prepare themselves for careers in AI industry. The following is an indicative list of assignme nts for the semester. However students should be encouraged to take-up mini-project using the techniques and tools explored in the lab to understand the true potential

1. Using simple Hill-climbing compute an approximate solution to the travelling salesperson problem.
2. Using Naïve bayes method learn a text classifier using training data and using test set evaluate the quality of the classifier.
3. Implement gradient descent and backpropagation in Python.
4. Using Scikit learn for Logistic regression, Support Vector Machines, Building Neural Networks.
5. Using inbuilt Tensor Flow functionality to build a Neural Network and train on MNIST Dataset for classification.
6. Installation of Prolog and practicing queries using Prolog.

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AWADHESH PARATAP SINGH UNIVERSITY, REWA (M.P.)

B.Sc. (HONS) COMPUTER SCIENCE VII SEM

702(D): INTERNET OF THINGS

Course Learning Outcomes

1. To learn the concepts of Sensors, Wireless Network and Internet
2. To learn and implement use of Devices in IoT technology.
3. To learn the different IoT Technologies like Micro-controller, Wireless communication like Blue Tooth, GPRS, Wi-Fi and Storage and embedded systems
4. To understand how to program on embedded and mobile platforms including different Microcontrollers like ESP8266, Raspberry Pi, Arduino and Android programming
5. To understand how to make sensor data available on the Internet (data acquisition) and understand how to analyze and visualize sensor data
6. To understand, analysis and evaluate different protocols used in IoT.
7. To learn basic python programming for IoT applications
8. To learn and design different applications in IoT.
9. To design, develop and test different prototypes in IoT.

UNIT-I

(Introduction to IoT, Sensors and Actuators) Introduction to IoT: Definition, Characteristics, Applications, Evolution, Enablers, Connectivity Layers, Addressing, Networking and Connectivity Issues, Network Configurations, Multi-Homing, Sensing: Sensors and Transducers, Classification, Different Types of Sensors, Errors, Actuation: Basics, Actuator Types- Electrical, Mechanical Soft Actuators

UNIT-II

(Introduction to Networking, Communication Protocols and Machine-to-Machine Communication) Basics of Networking, Communication Protocols, Sensor Network, Machine to Machine Communication (IoT Components, Inter-Dependencies, SoA, Gateways, Comparison Between IoT & Web, Difference Protocols, Complexity of Networks, Wireless Networks, Scalability, Protocol Classification, MQTT & SMQTT, IEEE 802.15.4, Zigbee)

UNIT-III

(Arduino Programming) Interoperability in IoT, Introduction to Arduino Programming, Integration Of Sensors And Actuators With Arduino, (Python Programming and Raspberry Pi) Introduction to Python Programming, Introduction to Raspberry Pi, Implementation of IoT with Raspberry Pi, Implementation of IoT with Raspberry Pi

UNIT-IV

(Data Analytics and Cloud Computing) Data Handling and Analytics, Cloud Computing Fundamentals, Cloud Computing Service Model, Cloud Computing Service Management and Security, Sensor-Cloud Architecture, View and Dataflow

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UNIT-V

(FOG Computing and Case Studies) FOG Computing: Introduction, Architecture, Need, Applications and Challenges, Industrial IoT, Case Studies: Agriculture, Healthcare, Activity Monitoring

REFERENCE BOOKS

1. The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press).
2. Internet of Things: A Hands-on Approach", by A Bahga and Vijay Madisetti (Universities Press)

DEPARTMENT OF COMPUTER SCIENCE

AWADHESH PARATAP SINGH UNIVERSITY, REWA (M.P.)

B.Sc. (HONS) COMPUTER SCIENCE VII SEM

703: RESEARCH METHODOLOGY

Course Learning Outcomes

1. Students should understand a general definition of research design.
3. Students should know why educational research is undertaken, and the audiences that profit from research studies.
4. Students should be able to identify the overall process of designing a research study from its inception to its report.
5. Students should be familiar with ethical issues in educational research, including those issues that arise in using quantitative and qualitative research.
6. Students should know the primary characteristics of quantitative research and qualitative research.
7. Students should be able to identify a research problem stated in a study.
8. Students should be familiar with how to write a good introduction to an educational research study and the components that comprise such an introduction.

SYLLABUS **Credit 4**

UNIT-I

Foundations of Research: Meaning, Objectives, Motivation, Utility, Concept of theory, empiricism, deductive and inductive theory, Characteristics of scientific method, Understanding the language of research – Concept, Construct, Definition, Variable, Research Process, Research in Computer Science, Journals & Publication in Computer Science

UNIT-II

Problem Identification & Formulation: Research Question, Investigation Question, Measurement Issues, Representing Mathematical Relationship, Ontology, State, Time and Behaviours, Space and Shape, Compositional Modelling, Hypothesis, Qualities of a good Hypothesis –Null Hypothesis & Alternative, Hypothesis, Hypothesis Testing, Logic & Importance

UNIT-III

Research Design: Concept and Importance in Research, Features of a good research design, Exploratory Research Design, concept, types and uses, Descriptive Research Designs, concept, types and uses, Experimental Design: Concept of Independent & Dependent variables.

UNNI-IV

Qualitative and Quantitative Research: Qualitative research – Quantitative research – Concept of measurement, causality, generalization, replication, merging the two approaches,

Measurement: Concept of measurement– what is measured? Problems in measurement in research validity and Reliability, Levels of measurement - Nominal, Ordinal, Interval, Ratio

UNIT-V

Basis of Computer Science Research**:** Introduction to Formal Models and Computability: Turing Machine & Computability, Undecidability, Diagonalization and Self-Reference, Reductions, **Thesis Writing:** Planning the thesis, Writing the thesis, Thesis structure, Writing up schedule, The Oral examination and Viva Voce. Writing Papers and the Review Process: Preparing and presenting your paper. The conference review process, making use of the referees' reports, the journal review process, Group exercise in reviewing research papers, Use of Encyclopaedias, Research Guides, Handbook etc., Academic Databases for Computer Science Discipline.

BOOKS

1. Business Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition
9. Business Research Methods – Alan Bryman & Emma Bell, Oxford University Press.
10. Research Methodology – C.R.Kothari
11. The Computer Science and Engineering Handbook by Allen B. Tucker, jr. CRC Press

DEPARTMENT OF COMPUTER SCIENCE

AWADHESH PARATAP SINGH UNIVERSITY, REWA (M.P.)

B.Sc. (HONS) COMPUTER SCIENCE VIII SEM

801: THEORY OF COMPUTATION (TOC)

Course Learning Outcomes

1. To provide a formal connection between algorithmic problem solving and the theory of languages and automata and develop them into a mathematical (abstract) view towards algorithmic design and in general computation itself.
2. The course should in addition clarify the practical view towards the applications of these ideas in the engineering part as well.
3. Become proficient in key topics of theory of computation, and to have the opportunity to explore the current topics in this area

PREREQUISITE

Students should have a background in discrete mathematics, data structures, and programming languages.

SYLLABUS **Credit 6**

A. THEORY

UNIT-I

Automata: Introduction to Formal Proof, Additional Forms of Proof, Inductive Proofs, Finite Automata (FA), Deterministic Finite Automata (DFA), Non-Deterministic Finite Automata (NFA), Finite Automata with Epsilon Transitions

UNIT-II

Regular Expressions and Languages: Regular Expression, FA and Regular Expressions, Proving Languages not to be Regular, Closure Properties of Regular Languages, Equivalence and Minimization of Automata

UNIT-III

Context Free Grammars and Languages: Context Free Grammar (CFG), Parse Trees , Ambiguity in Grammars and Languages, Definition of The Pushdown Automata, Languages of a Pushdown Automata, Equivalence of Pushdown Automata and CFG Deterministic Pushdown Automata.

UNIT-IV

Properties of Context Free Languages: Normal Forms for CFG, Pumping Lemma for CFL, Closure Properties of CFL, Turing Machines, Programming Techniques for TM, Variations of TM, Non Universal TM, Universal TM.

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UNIT-V

Undecidability: A Language that is not Recursively Enumerable (RE), an Undecidable Problem that is RE, Undecidable Problems about Turing Machine, Post's Correspondence Problem, The Classes P and NP.

REFERENCE BOOKS

1. J.E. Hopcroft, R. Motwani and J.D. Ullman, "Introduction to Automata Theory, Languages and Computations", second Edition, Pearson Education, 2007.
2. H.R. Lewis and C.H. Papadimitriou, "Elements of the theory of Computation", Second Edition, Pearson Education, 2003.
3. Thomas A. Sudkamp," An Introduction to the Theory of Computer Science, Languages and Machines", Third Edition, Pearson Education., 2007.
4. J. Martin, "Introduction to Languages and the Theory of computation, Third Edition, TataMc Graw Hill, 2007.

B. Practical

The students are expected to understand the Hierarchy of formal languages with reference to their varying degrees of complexity in recognising them. Programs can be designed after designing suitable automata to recognize the following formal languages. Given an input the recognizer shall output a Yes/No answer depending on whether the string is part of the language or not.

1. Language of Binary strings which ends with the pattern 101.
2. Language of Binary strings such that the third symbol from the end is a Zero
3. Language of parenthesised expressions with matching left and right parenthesis
4. Language of Binary strings with equal number of Zeros and Ones
5. Language generated by the grammar $\{a^n b^n c^n \mid n^3\ 1\}$
6. Language $\{ a^p \mid p$ is prime$\}$

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B.Sc. (HONS) COMPUTER SCIENCE VIII SEM

802: QUANTUM MECHANICS

Course learning outcome:

This course will enable the student to get familiar with quantum mechanics formulation.

1. After an exposition of inadequacies of classical mechanics in explaining microscopic phenomena, quantum theory formulation is introduced through Schrodinger equation.
2. The interpretation of wave function of quantum particle and probabilistic nature of its location and subtler points of quantum phenomena are exposed to the student.
3. Through understanding the behavior of quantum particle encountering a i) barrier, ii) potential, the student gets exposed to solving non-relativistic hydrogen atom, for its spectrum and eigenfunctions.
4. Study of influence of electric and magnetic fields on atoms will help in understanding
5. Stark effect and Zeeman Effect respectively. The experiments using Sci-lab will enable the student to appreciate nuances involved inthe theory.
6. This basic course will form a firm basis to understand quantum many body problems

Syllabus **Credit 6**

UNIT-I

Time dependent Schrodinger equation- Time dependent Schrodinger equation and dynamical evolution of a quantum state, Properties of Wave Function, Interpretation of Wave Function Probability and probability current densities in three dimensions, Conditions for Physical Acceptability of Wave Functions, Normalization, Linearity and Superposition Principles, Eigenvalues and Eigenfunctions, Position, momentum and Energy operators, commutator of position and momentum operators, Expectation values of position and momentum, Wave Function of a Free Particle

UNIT-II

Time independent Schrodinger equation- Hamiltonian, stationary states and energy eigenvalues, expansion of an arbitrary wavefunction as a linear combination of energy eigenfunctions, General solution of the time dependent Schrodinger equation in terms of linear combinations of stationary states; Application to spread of Gaussian wave-packet for a free particle in one dimension; wave packets, Fourier transforms and momentum space wavefunction, Position-momentum uncertainty principle

UNIT-III

General discussion of bound states in an arbitrary potential- continuity of wave function, boundary condition and emergence of discrete energy levels, application to one dimensional problem-square well potential, Quantum mechanics of simple harmonic oscillator-energy

levels and energy eigenfunctions using Frobenius method, Hermite polynomials, ground state, zero point energy & uncertainty principle

UNIT-IV

Quantum theory of hydrogen-like atoms: time independent Schrodinger equation in spherical polar coordinates, separation of variables for second order partial differential equation, angular momentum operator & quantum numbers, Radial wavefunctions from Frobenius method, shapes of the probability densities for ground and first excited states, Orbital angular momentum quantum numbers l and m, s, p, dshells.

UNIT-V

Atoms in Electric and Magnetic Fields: Electron angular momentum, Angular momentum quantization, Electron Spin and Spin Angular Momentum, Larmor's Theorem, Spin Magnetic Moment, Stern-Gerlach Experiment. Normal Zeeman Effect: Electron Magnetic Moment and Magnetic Energy.

Many electron atoms: Pauli's Exclusion Principle, Symmetric and Antisymmetric Wave Functions, Spin orbit coupling, Spectral Notations for Atomic States, Total angular momentum, Spin-orbit coupling in atoms-L-S and J-J couplings.

REFERENCE BOOKS

1. A Text book of Quantum Mechanics, P.M.Mathews and K.Venkatesan, 2nd Ed., 2010, McGraw Hill
2. Quantum Mechanics, Robert Eisberg and Robert Resnick, 2nd Edn., 2002, Wiley.
3. Quantum Mechanics, Leonard I. Schiff, 3rd Edn. 2010, Tata McGraw Hill.
4. Quantum Mechanics for Scientists & Engineers, D.A.B. Miller, 2008, Cambridge University Press
5. Quantum Mechanics, Eugen Merzbacher, 2004, John Wiley and Sons, Inc.
6. Introduction to Quantum Mechanics, D.J. Griffith, 2nd Ed. 2005, Pearson Education