TRIBHUVAN UNIVERSITY

INSTITUTE OF SCIENCE AND TECHNOLOGY

*

*

*

*

*

*

BACHELORS IN INFORMATION TECHNOLOGY (BIT)

(COURSE OF STUDY)

*

*

*

*

*

*

*

*

2075

Tribhuvan University

Institute of Science and Technology

Course of Study

Bachelors in Information Technology

(BIT)

2018

Prepared by

Computer Science and Information Technology Subject Committee

Introduction:

The Bachelors in Information Technology (BIT) curriculum is designed by closely following the courses practiced in accredited international universities, subject to the condition that the intake students are twelve years of schooling in any stream or equivalent from any recognized board. In addition to the foundation and core Information Technology courses, the program offers several elective courses to meet the undergraduate academic program requirement and to fulfill the demand for development and implementation of new technology.

Students enrolled in the four year BIT program are required to take foundation and core courses of Information technology, courses of mathematics, statistics, management, economics, sociology, psychology, research methodology and technical writing, and some elective courses. All undergraduate students are required to complete 120 credit hours of Information Technology and allied courses, and will have opportunity in the field of software development, information security, database administration, network and system administration, and in all the sectors that develop and/or use Information Technology.

Objective:

The main objective of BIT program is to provide students intensive knowledge and skill to design, develop, and use information technology in different areas. It is envisaged that graduate of this program will be equipped with necessary knowledge of Information Technology to compete in this global world.

Eligibility Condition for Admission

A student who seeks admission to BIT program:

- Should have successfully completed twelve years of schooling in any stream.
- Should have secured a minimum of second division.
- Should have successfully passed the entrance examination conducted by Institute of Science and Technology (IOST), TU.
- Complied with all the application procedures.

Course Duration:

The entire course is of eight semesters (four academic years). There is a separate semester examination after the end of each semester.

Hours of Instruction:

a) **Working days:** 90 days in a semester

b) **Class hours:**

- 3 credit hours courses with theory and labs is equivalent to 3 hours lecture and 3 hours lab = 6 working hrs per week.
- 3 credit hours theory-only course is equivalent to 3 hours lecture and 2 hours tutorial = 5 working hrs per week.

Evaluation

Theory course should have internal weightage of 20% and external weightage of 80%. For the course having lab work, the internal weightage is 20%, lab work weightage is 20% and external weightage is 60%. A student should secure minimum of 40% in each category to pass a course. The final score in each course will be the sum of overall weightage of in all categories. There will be a separate practical examination for the 20% weightage of lab work conducted by concerned college in the presence of an external examiner.

The project work and internship are evaluated by different evaluators. To pass project work and internship, students should secure at least 40% marks in the evaluation of each evaluator and final score will be the sum of all the evaluations. For the evaluation of final presentation, an external examiner will be assigned from the IOST.

The Grading System

A student having passed his/her 8 semesters (4 years) of study will be graded as follows:

- **Distinction:** 80 % and above (8 semester's average)
- **First Division:** 70 % and above (8 semester's average)
- **Second Division:** 55 % and above (8 semester's average)
- **Pass Division:** 40 % and above (8 semester's average)

Attendance Requirement:

Students are required to attend regularly all theory and practical classes and should maintain 80 percent attendance in each course separately.

Final Examination:

Institute of science and technology, Tribhuvan University, will conduct the final examination at the end of each semester. 80% weightage will be given to the final examination for theory course and 60% will be given for the course having both theory and practical.

Course Structure:

Semester I

Course Code	Course Title	Credit Hours	Full Marks
BIT101	Introduction to Information Technology	3	100
BIT102	C Programming	3	100
BIT103	Digital Logic	3	100
MTH104	Basic Mathematics	3	100
SCO105	Sociology	3	100
Total		**15**	**500**

Semester II

Course Code	Course Title	Credit Hours	Full Marks
BIT151	Microprocessor and Computer Architecture	3	100
BIT152	Discrete Structure	3	100
BIT153	Object Oriented Programming	3	100
STA154	Basic Statistics	3	100
ECO155	Economics	3	100
Total		**15**	**500**

Semester III

Course Code	Course Title	Credit Hours	Full Marks
BIT201	Data Structures and Algorithms	3	100
BIT202	Database Management System	3	100
BIT203	Numerical Methods	3	100
BIT204	Operating Systems	3	100
MGT205	Principles of Management	3	100
Total		**15**	**500**

Semester IV

Course Code	Course Title	Credit Hours	Full Marks
BIT251	Web Technology I	3	100
BIT252	Artificial Intelligence	3	100
BIT253	Systems Analysis and Design	3	100
BIT254	Network and Data Communications	3	100
ORS255	Operations Research	3	100
Total		**15**	**500**

Semester V

Course Code	Course Title	Credit Hours	Full Marks
BIT301	Web Technology II	3	100
BIT302	Software Engineering	3	100
BIT303	Information Security	3	100
BIT304	Computer Graphics	3	100
ENG305	Technical Writing	3	100
Total		**15**	**500**

Semester VI

Course Code	Course Title	Credit Hours	Full Marks
BIT351	NET Centric Computing	3	100
BIT352	Database Administration	3	100
BIT353	Management Information System	3	100
RSM354	Research Methodology	3	100
	Elective I	3	100
Total		**15**	**500**

List of Electives:

1. Geographical Information System (BIT355)
2. Multimedia Computing (BIT356)
3. Wireless Networking (BIT357)
4. Society and Ethics in IT (BIT358)
5. Psychology (PSY359)

Semester VII

Course Code	Course Title	Credit Hours	Full Marks
BIT401	Advanced Java Programming	3	100
BIT402	Software Project Management	3	100
BIT403	E-commerce	3	100
BIT404	Project work	3	100
	Elective II	3	100
Total		**15**	**500**

List of Electives:

1. DSS and Expert System (BIT405)
2. Mobile Application Development (BIT406)
3. Simulation and Modeling (BIT407)
4. Cloud Computing (BIT408)
5. Marketing (MGT409)

Semester VIII

Course Code	Course Title	Credit Hours	Full Marks
BIT451	Network and System Administration	3	100
BIT452	E Governance	3	100
BIT453	Internship	6	200
	Elective III	3	100
Total		**15**	**500**

List of Electives:

1. Data Warehousing and Data Mining (BIT454)
2. Knowledge Management (BIT455)
3. Image processing (BIT456)
4. Network Security (BIT457)
5. Introduction to Telecommunications (BIT458)

Introduction to Information Technology

Course Title: Introduction to Information Technology
Course No: BIT101
Nature of the Course: Theory + Lab
Semester: I

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description:
This course covers basic concepts of computers, computer hardware, memory, input/output devices, computer software, data representation, database, computer networks, internet, computer security and applications of IT.

Course Objectives:
The main objective of this course is to provide basic knowledge of fundamental concepts of computer system and Information Technology.

Course Contents:

Unit 1: Introduction to Computer (4 Hrs.)
Introduction of Computer; Characteristics of Computer; History of Computer; Generations of Computer; Digital and Analog Computers; Classification of Computer based on size; The Computer System; Application of Computers

Unit 2: Computer Hardware (8 Hrs.)
Introduction; Central Processing Unit; Components of CPU, Instruction Format; Instruction Set; Instruction Cycle; Microprocessor; Computer Bus, Components of Computer Cabinet(power supply, motherboard, memory chips, expansion slots, ports and interface, processor, cables and storage devices)

Computer Memory: Memory Representation; Memory Hierarchy; CPU Registers; Cache Memory; Primary Memory(RAM, ROM); Secondary Memory (Magnetic Tape; Magnetic Disk; Optical Disk; Magneto-Optical Disk, Flash Memory Device), Access Types of Storage Devices (sequential and direct)

Input and Output Devices: Input-Output Unit; Input Devices; Human Data Entry Devices; Source Data Entry Devices; Output Devices; I/O Port; I/O System

Unit 3: Computer Software (6 Hrs.)
Introduction; Types of Software; System Software; Application Software; Operating System (Introduction, Objectives of Operating System, Types of OS, Functions of OS, Process Management, Memory Management, File Management, Device Management, Protection and Security, User Interface, Examples of Operating Systems); Device Drivers and Utility Software; Programming Languages, Language Translators: assembler, compiler; Software Licensing, Open Source Software; Case study: Unix Vs Windows

Unit 4: Data Representation (5 Hrs.)
Introduction; Number System; Conversion from Decimal to Binary, Octal, Hexadecimal; Conversion of Binary, Octal, Hexadecimal to Decimal; Conversion of Binary to Octal, Hexadecimal; Conversion of Octal, Hexadecimal to Binary; Binary Arithmetic

Unit 5: Computer Networks and Internet Services (10 Hrs.)
Introduction; Importance of Networking; Data Transmission Media (Twisted pair, coaxial cable, optical fiber, RF transmission, microwave transmission, satellite transmission); Data Transmission across Media; Data Transmission and Data Networking; Computer Network; Network Types; Network Topology; Communication Protocol; Network Devices; Wireless Networking
Internet; History of Internet; Internetworking Protocol; The Internet Architecture; Managing the Internet; Internet Connections; Internet Address; WWW, Domain Name System, Internet Services; E-mail and its working principle; E-commerce and E-governance; Web 2.0; Internet of Things (IoT); Wearable Computing; Cloud Computing; Smart City; Case Study: ISP in Nepal and their services

Unit 6: Database Systems (5 Hrs.)
Introduction; Database; Database System; Database Management System; Database System Architectures; Data Models, Database Applications; Introduction to Data Warehousing, Data mining, and BigData

Unit 7: Computer Security (4 Hrs.)
Introduction; Security Threat and Security Attack; Malicious Software; Security Mechanisms (Cryptography, Digital Signature, Firewall, Users Authentication, Intrusion Detection Systems); Security Awareness; Security Policy

Unit 8: Application and Impact of IT (3 Hrs.)
Applications of IT; Impact of IT on Organization and individuals; Societal Impacts of IT, IT Strategic Planning, IT and Business Alignment

Laboratory Works:
The laboratory work includes realizing hardware components of computer, using operating systems, Word Processors, Spreadsheets, Presentation Graphics, Database Management Systems, and Internet and its services.

Text Books:
1. Computer Fundamentals, Anita Goel, Pearson Education India

Reference Books:
1. Introduction to Computers, Peter Norton, 7th Edition, McGraw Hill Education
2. Fundamentals of Information Technology, Leon and Leon
3. Computer Fundamental, Pradeep K. Sinha and Priti Sinha
4. Introduction to Information Technology, E. Turban
5. Information Technology for Management, E.Turban, C. Pollard, G. Wood, Wiley Publication
6. Information Technology for Management, Henry C. Lucas, Jr.

C Programming

Course Title: C Programming
Course No: BIT102
Nature of the Course: Theory + Lab
Semester: I

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description:
This course familiarizes students with basic principles of programming. It introduces structured programming paradigm using a high level language called C. It covers the concept of problem solving techniques, program design, and basic elements of C along with the detailed concept of operators, statements, arrays, functions, pointers, structures and file handling.

Course Objective:
The main objective of this course is to acquaint the students with good program design through structured programming paradigm for developing programs for specific tasks using C Programming Language as well as to present the syntax and semantics of the "C" language.

Course Contents:

Unit 1: Introduction (3 Hrs.)
History and advantages of C; Problems analysis, algorithm and flowchart; Structure of a C Program; Writing, compiling, debugging, executing and testing a C Program in windows and Unix/Unix like environment

Unit 2: Elements of C (3 Hrs.)
C Tokens; C Character Sets; Data types, Constants and Variables; Expression, statements and comments; Escape sequences and Delimiters

Unit 3: Input/output function (2 Hrs.)
Conversion Specifiers; I/O functions; Formatted I/O

Unit 4: Operators and Expression (4 Hrs.)
Arithmetic operators; Relational operators; Logical operators; Assignment operators; Type conversion in assignment; Increment and decrement operators; Ternary operator; Bitwise operator; Other operators (comma, sizeof); Expression evaluation; Operator precedence and associativity

Unit 5: Control Structures (8 Hrs.)
Introduction to selection and iterative statements; GOTO and labels; Selection statements: if, if..else, if..else if ladder, nested if, switch case; Conditional operator; Iterative statement: For Loop, While Loop, Do while Loop, Nested Loop; The odd loop; Controlling the loop execution – break and continue

Unit 5: Arrays and Strings (5 Hrs.)
Introduction to Arrays; Initializing Arrays; The meaning of array indexing; One dimensional and Multidimensional Arrays; String and Basic functions dedicated to string manipulation

Unit 6: Functions (6 Hrs.)
Introduction and types of functions; Declaring, Defining and calling functions; Arguments and Return Statement; Recursive functions; Function call by value and reference; Variables' scope, local variables and function parameters; Arrays as function parameter; Void as a parameter; Parameterizing the main function; External function and variables; Header files; Static variables; Register Variables

Unit 7: The C Preprocessor (2 Hrs.)
Features of C Preprocessor; Macro Expansion; Macros with Arguments; Macros versus Functions; File Inclusion; Conditional Compilation; #if and #elif Directives; #undef Directive; #pragma Directive; The Build Process; Preprocessing; Compiling; Assembling; Linking; Loading

Unit 8: Pointers (5 Hrs.)
Introduction of Pointers, declaration and initialization of pointer variables; An address, a reference, a dereference and the sizeof operator; Pointer to nothing (NULL); Pointer assignment; Pointer Arithmetic; Pointer as argument and Pointer as return values; Pointers vs. arrays; Dynamic memory allocation

Unit 9: Structure and Unions (5 Hrs.)
Definition of Structure; Array of structures; Passing structure and array of structure to function; Pointers to structures and arrays of structures; Self-referential structures; Typedef; Table Lookup; Unions

Unit 10: File Handling (2 Hrs.)
Files vs. streams; Header files needed for stream operations; Opening and closing a stream, open modes, errno variable; Reading and writing to/from a stream; Predefined streams: stdin, stdout and stderr; Stream manipulation: fgetc(), fputc(), fgets() and fputs() functions; Raw input/output: fread() and fwrite() functions; Random access to files

Laboratory Works:
Laboratory work emphasizes the verification of programming concepts learned in class. Therefore, each unit should include sufficient practical lab exercise.

Text / Reference Books:

1. Let Us C, Yashavant P. Kanetkar
2. Brian Kernighan and Dennis Ritchie, The C Programming Language
3. Byron Gottfried, Programming with C, McGraw Hill Education

Digital Logic

Course Title: Digital Logic
Course No: BIT103
Nature of the Course: Theory + Lab
Semester: I

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description:
This course familiarizes students with Number System, Digital Design Fundamentals, Understand and Design Functions of Combinational Logic, Sequential Logic (Counters, Registers and Finite State Machine), Memories, Programmable Logic Devices Integrated Circuit Technologies.

Course Objective:
To provide the concepts used in the design and analysis of digital systems and introduces the principles of digital computer organization and design.

Course Contents:

Unit 1: Number Systems, Operations and Codes (6 Hrs.)
Introduction to Number System, Decimal, Binary, Octal, Hexadecimal Number Systems, Conversion from one number system to another, Complements of Numbers, Addition and Subtraction of Binary Numbers, Binary Codes and Error Detection Codes

Unit 2: Digital Design Fundamentals and Boolean algebra (8 Hrs.)
Digital and Analog Signals, Logic Operations, Introduction to the System Concept, Logic Gates (Basic Gates, Derived Gates, Universal Gates), Logic Function and Boolean Algebra

Unit 3: Simplification of Boolean Functions (5 Hrs.)
K-map, Two and Three variable maps, Four variable maps, product of sum simplification, NAND and NOR implementation, Don't Care conditions

Unit 4: Combinational Logic (7 Hrs.)
Adders and Subtractors, Parallel Binary Adders, Multiplexers and Demultiplexers, Encoders and Decoders, Seven segment decoder, Code Converters

Unit 5: Sequential Logic (4 Hrs.)
Latches, Edge-Triggered Flip-Flops, Flip-Flop Operating Characteristics, Flip-Flop Application

Unit 6: Counters, Registers and Memory (9 Hrs.)
Asynchronous Counters, Synchronous Counters, Up/Down Counters, Counter Applications, Basic Shift Register Operations, Shift Register Types, Bidirectional Shift Registers, Shift Register Counters, Basic Memory Operations and memory types

Unit 7: Processor Logic Design (6 Hrs.)
Processor Organization, Arithmetic Logic Unit, Design of Arithmetic Circuit, Design of Logic Circuit, Design of Arithmetic Logic Unit, Status Register, Design of Shifter

Laboratory Works:

- Familiarization with Logic Gates
- Encode and Decodes
- Multiplexer and De-Multiplexer
- Design of simple combination Circuits
- Design of Adder/combination Circuits
- Design of Flip Flop
- Clock driven sequential circuits
- Conversion of parallel data into serial format
- Generation of timing signal for sequential system

Text Book:

- Mano M.M., *Digital logic and Computer Design*, Pearson Education

References Books:

- Mano M.M. and Ciletti M. M, *Digital Design*, 4thedition
- Brown S. and Vranesic Z., *Fundamentals of Digital Logic with VHDL Design*, 3rd edition, McGraw Hill
- Rafiquzzaman M., *Fundamentals of Digital Logic and Microcomputer Design,* 5th edition, JohnWiley & Sons, Inc.
- Holdsworth B. and Woods C., *Digital Logic Design,* 4th edition
- Mano M. M, Kime C. R , *Logic and computer design fundamentals*, 2nd edition

Basic Mathematics

Course Title: Basic Mathematics
Course No: MTH104
Nature of the Course: Theory
Semester: I

Full Marks: 60 +40
Pass Marks: 24 + 16
Credit Hrs: 3

Course Description:
This course familiarizes students with functions, limits, continuity, differentiation, integration of function of one variable, logarithmic, exponential, applications of derivative and antiderivatives, differential equations, partial derivatives.

Course Objectives:

1. Students will be able to understand and formulate real world problems into mathematical statements.
2. Students will be able to develop solutions to mathematical problems at the level appropriate to the course.
3. Students will be able to describe or demonstrate mathematical solutions either numerically or graphically.

Course Contents:

Unit 1: Functions Limits and Continuity (5 Hrs.)
Functions and Their Graphs, Combining Functions; Shifting and Scaling Graphs, Trigonometric Functions, Graphing with Calculators and Computers, Exponential Functions, Inverse Functions and Logarithms, Rates of Change and Tangents to Curves.

Unit 2: Limits and Continuity (3 Hrs.)
Limit of a Function and Limit Laws, The Precise Definition of a Limit, One-Sided Limits, Continuity, Limits Involving Infinity; Asymptotes of Graphs.

Unit 3: Differentiations (5 Hrs.)
Tangents and the Derivative at a Point, The Derivative as a Function, The Derivative as a Rate of Change, Derivatives of Trigonometric Functions, The Chain Rule, Implicit Differentiation, Derivatives of Inverse Functions and Logarithms, Inverse Trigonometric Functions, Related Rates.

Unit 4: Applications of Derivatives (5 Hrs.)
Extreme values of functions, The Mean value theorem, Monotonic functions and the first derivative test, Concavity and Curve sketching, Indeterminate forms and L'Hôpital's rule, Applied optimization, Newton's method.

Unit 5: Integration (5 Hrs.)
Antiderivatives, Area and estimating with finite sums, Sigma notation and Limits of finite sums, The definite integral, The Fundamental theorem of calculus, Indefinite integrals and the substitution method, Substitution and Area between curves.

Unit 6: Applications of Definite Integrals (3 Hrs.)
Volumes using cross-sections, Volumes using cylindrical Shells, Arc length, Areas of surfaces of revolution, Work and fluid forces, Moments and centers of mass

Unit 7: Techniques of Integrations (5 Hrs.)
Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fractions, Integral tables and computer algebra systems, Numerical integration, Improper integrals.

Unit 8: First Order Differential Equations (4 Hrs.)
Solutions, Slope Fields, and Euler's method, First order linear equations, Applications, Graphical solutions of Autonomous equations, Systems of equations and phase planes.

Unit 9: Infinite Sequence and Series (5 Hrs.)
Sequences, Infinite series, The Integral test, Comparison tests, The Ratio and root tests, Alternating series, Absolute and Conditional convergence, Power series, Taylor and Maclaurin series, Convergence of Taylor series.

Unit 10: Partial Derivatives (5 Hrs.)
Functions of several variables, Limits and continuity in higher dimensions, Partial derivatives, The Chain rule, Directional derivatives and gradient vectors, Tangent planes and differentials, Extreme values and saddle points Lagrange multipliers, Taylor's formula for two variables, Partial derivatives with constrained variables.

Text/Reference Book:
Maurice D. Weir and Joel Hass, Thomas' Calculus, Early Transcendentals, 12th Edition, 2009.

Sociology

Course Title: Sociology
Course No: SCO105
Nature of the Course: Theory
Semester: I

Full Marks: 60 + 40
Pass Marks: 24 + 16
Credit Hrs: 3

Course Description:
This course familiarizes students with the subject matter of sociology in terms of broader understanding of society in relation to information technology. It helps students understand the importance of sociology as its relationship to other sciences. More importantly, it enhances the capability of understanding and analyzing society so that they can apply information technology with better understanding of social structure, social system, social processes, and social institutions to bring social change using new information technology.

Course Objectives:
At the end of this course, students will be able to:

- Describe sociology and discuss its relationship to other sciences (social sciences; history, psychology, anthropology, economics and political science including management and education as well as pure sciences; information technology, biology, and so on).
- Comprehend and explain the fundamental sociological concepts.
- Discuss social structure, social system, social processes, etc. in relation to information technology
- Analyze social structure, social system, cultural practices and develop a framework of applying new information technology in proper way.

Course Contents:
Unit 1: Introduction (9 Hrs.)

a) What is sociology? Sociological viewpoint; the origins of sociology; perspectives within sociology; sociology and social concerns; sociology's four realms.
b) Relationship between sociology and other social and natural sciences: focus on sociology and information technology; biology; chemistry; anthropology; psychology; management; education; law, etc.
c) Traditional society and technological society
d) Sociology and the twenty first century

Unit 2: The Fundamentals of Society (9 Hrs.)

a) Culture: culture and human intelligence; culture, nation, and society
b) The components of culture: symbols; language; values and beliefs; norms; ideal and real culture; material culture and technology; new information technology and culture
c) Development of culture around the world: cultural universals; globalization, diffusion, and technology

Unit 3: The Social Structure (12 Hrs.)

a) The sustaining forces of codes and custom: the more and social control; the major forms of social codes; social codes and the individual life
b) The major forms of social structure: types of social groups; the family; the community; city, country, and region; social class and caste; ethnic and racial groups; herd, crowd, and mass communication; associations and interests; the great association: political and economic; functional systems
c) Information technology and social structure

Unit 4: Social Institutions and Processes (9 Hrs.)

a) Social structure, societies and civilizations
b) Science, technology and society
c) Economic institutions,
d) Political institutions,
e) The family and kinship
f) Social differentiation and stratification

Unit 5: Social Change (6 Hrs.)

a) Change, development, progress
b) Factors in social change
c) Modernity
d) Post-modernity
e) Globalization and changing world

Unit 6: Application of Sociology (3 Hrs.)

a) Sociology, social policy and social planning,
b) Social problems

Required Readings:

Unit 1: Introduction

Curry, Tim, Jiobu, Robert and Schwirian, Kent. 2008. *Sociology for the Twenty First Century*. Fifth Edition. Pp. 1-25.New Jersey: Pearson Prentice Hall.

Schaefer, Richard T. 2006. *Sociology: A Brief Introduction*. Sixth Edition. Pp. 3-26. New Delhi: TATA MCGRAW-HILL.

Inkeles, Alex. 2001. *What is sociology? An introduction to the discipline and profession*. Pp. 1-17; 18-24; 28-46. New Delhi: Prentice Hall of India pvt. Ltd.

Macionis, John J. 1987. *Sociology.* Eighth Edition. Pp. 1-24. New Jersey: Prentice Hall of India.

Haralambos, M. And Heald, R. M. 2009. *Sociology: Themes and Perspective*s. Thirty-fourth Impression. Pp. 1-23. New Delhi: Oxford University Press.

MacIver, R.M. & Page, C.H. 2001. *Society: An Introductory Analysis*. Reprinted. Pp. 1-23. New Delhi: MACMILLAN.

Rocher, Guy. 2004. *A General Introduction to Sociology: A Theoretical Perspective*. Pp. 2-5; 210-255. Calcutta, India: Academic Publishers.

McQuail, Denis. 1985. Sociology of Mass Communication. *Annual Review of Sociology*, Vol. 11 (1985), pp. 93-111. Stable URL: http://www.jstor.org/stable/2083287; Accessed: 05-10-2017 07:12 UTC.

Buttel, Frederick H. 1991 September. Beyond Deference and Demystification in the Sociology of Science and Technology: A Reply to Otero. *Sociological Forum*, Vol. 6, No. 3 (Sep., 1991), pp. 567-577. Stable URL: http://www.jstor.org/stable/684519; Accessed: 05-10-2017 07:18 UTC.

Castells, Manuel. 2000, Sep. Toward a Sociology of the Network Society. *Contemporary Sociology*, Vol. 29, No. 5 (Sep., 2000), pp. 693-699. Stable URL: http://www.jstor.org/stable/2655234; Accessed: 05-10-2017 07:19 UTC.

Wynn, Jonathan R. 2009 June. Digital Sociology: Emergent Technologies in the Field and the Classroom. *Sociological Forum*, Vol. 24, No. 2 (Jun., 2009), pp. 448-456. Stable URL: http://www.jstor.org/stable/40210412; Accessed: 05-10-2017 07:23 UTC.

Woolgar, Steve. 1985 November. Why not a Sociology of Machines? The Case of Sociology and Artificial Intelligence. *Sociology*, Vol. 19, No. 4 (November 1985), pp. 557-572. Stable URL: http://www.jstor.org/stable/42853468; Accessed: 05-10-2017 07:22 UTC.

Rafael, Erwin F. 2013 July-December. Technology as a Social System: A Systems Theoretical Conceptualization. *Philippine Sociological Review*, Vol. 61, No. 2, Classical Sociological Theory in Contemporary Practice. (July-December 2013), pp. 319-347. Stable URL: http://www.jstor.org/stable/43486378; Accessed: 05-10-2017 07:30 UTC.

Unit 2: The Fundamentals of Society

MacIver, R.M. & Page, C.H. 2001. *Society: An Introductory Analysis*. Reprinted. Pp. 136-507. New Delhi: MACMILLAN.

Macionis, John J. 1987. *Sociology*. Eighth Edition. Pp. 59-88. New Jersey: Prentice Hall of India.

Schaefer, Richard T. 2006. *Sociology: A Brief Introduction*. Sixth Edition. Pp. 55-78. New Delhi: TATA MCGRAW-HILL.

Curry, Tim, Jiobu, Robert and Schwirian, Kent. 2008. *Sociology for the Twenty First Century*. Fifth Edition. Pp. 46-60.New Jersey: Pearson Prentice Hall.

MacIver, R.M. & Page, C.H. 2001. *Society: An Introductory Analysis*. Reprinted. Pp. 41-71. New Delhi: MACMILLAN.

Luthar, Breda and Samo Kropivnik. 2011. Class, Cultural Capital, and the Mobile Phone. *Sociologický Časopis / Czech Sociological Review*, Vol. 47, No. 6 (2011), pp. 1091-1118. Stable URL: http://www.jstor.org/stable/23535016; Accessed: 05-10-2017 07:30 UTC.

Unit 3: The Social Structure

MacIver, R.M. & Page, C.H. 2001. *Society: An Introductory Analysis*. Reprinted. Pp. 136-507. New Delhi: MACMILLAN.

Mckee, James B. 1981. *Sociology: The Study of Society*. Pp. 287-408. New York: Holt, Rinehart and Winston.

Pfeffer, Jeffrey and Huseyin Leblebici. 1977 Apr. Information Technology and Organizational Structure. *The Pacific Sociological Review*, Vol. 20, No. 2 (Apr., 1977), pp. 241-261. Stable URL: http://www.jstor.org/stable/1388934; Accessed: 05-10-2017 07:12 UTC.

Lyon, David. 1987 August. Information Technology and Information Society: A response to Fincham. *Sociology*, Vol. 21, No. 3 (August 1987), pp. 467-468. Stable URL: http://www.jstor.org/stable/42854004; Accessed: 05-10-2017 07:15 UTC.

Unit 4: Social Institutions and Processes

Bottomore, T. B. 1986. *Sociology: A Guide to Problems and Literature*. New Edition. Pp. 113-216. New Delhi: Blackie & Son (India).

Davis, Kingsley. 1981. Human Society. First Indian Reprint. Pp. 435-550. New Delhi: Surjeet Publications.

Mckee, James B. 1981. *Sociology: The Study of Society*. Pp. 287-408. New York: Holt, Rinehart and Winston.

Mellor, Philip A. 2004 Winter. Religion, Culture and Society in the 'Information Age'. *Sociology of Religion*, Vol. 65, No. 4, Special Issue: [Culture and Constraint in the Sociology of Religion] (Winter, 2004), pp. 357-371. Stable URL: http://www.jstor.org/stable/3712319; Accessed: 05-10-2017 07:29 UTC.

Unit 5: Social Change

Bottomore, T. B. 1986. *Sociology: A Guide to Problems and Literature*. New Edition. Pp. 283-314. New Delhi: Blackie & Son (India).

Curry, Tim, Jiobu, Robert and Schwirian, Kent. 2008. *Sociology for the Twenty First Century*. Fifth Edition. Pp. 61-79.New Jersey: Pearson Prentice Hall.

Macionis, John J. 1987. *Sociology*. Eighth Edition. Pp. 623-647. New Jersey: Prentice Hall of India.

Giddens, Anthony. 2006. Sociology. Fifth Edition. Pp. 30-71. New Delhi: Polity Press.

Unit 6: Application of Sociology

Guthrie, Doug. 1999 Winter. A Sociological Perspective on the Use of Technology: The Adoption of Internet Technologyin U.S. Organizations. *Sociological Perspectives*, Vol. 42, No. 4 (Winter, 1999), pp. 583-603. Stable URL: http://www.jstor.org/stable/1389575; Accessed: 05-10-2017 07:12 UTC.

Bottomore, T. B. 1986. *Sociology: A Guide to Problems and Literature*. New Edition. Pp. 315-343. New Delhi: Blackie & Son (India).

Diebold, John. 1962 March. The Application of Information Technology. *The Annals of the American Academy of Political and Social Science*, Vol. 340, Automation (Mar., 1962), pp. 38-45. Stable URL: http://www.jstor.org/stable/1033697; Accessed: 05-10-2017 07:11 UTC.

Fox, Nick, Katie Ward and Alan O'Rourke. 2006 April. A Sociology of Technology Governance for the Information Age: The Case of Pharmaceuticals, Consumer Advertising and the Internet. *Sociology*, Vol. 40, No. 2 (APRIL 2006), pp. 315-334. Stable URL: http://www.jstor.org/stable/42858172; Accessed: 05-10-2017 07:17 UTC.

Microprocessor and Computer Architecture

Course Title: Microprocessor and Computer Architecture
Course No: BIT151
Nature of the Course: Theory + Lab
Semester: II

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description:
This course aims at providing fundamental knowledge about computer architecture, Instruction cycle, components of Microprocessor, Intel 8085 and assembly programming.

Course Objectives:
The main objective of this course is to provide basic knowledge of components of Microprocessor, block diagram and assembly language programming using Intel 8085, SAP1 and SAP2 computer architecture, timing diagrams, instruction cycles, machine cycles, control unit, central processing unit, RISC, CISC, Direct Memory Access, Interrupts, serial and parallel interfaces.

Course Contents:

Unit 1: Introduction to Microprocessor (6 Hrs.)
Components of a Microprocessor: Registers, ALU, Control and Timing, System Buses, Microprocessor Systems with Bus Organization, Introduction to SAP1 and SAP2

Unit 2: Intel 8085 (8 Hrs.)
Functional Block Diagram and Pin Configuration, Timing and control Unit, Registers, Data and Address Bus, Intel 8085 Instructions, Operation Code and Operands, Addressing Modes, Interrupts, Flags, Institutions and Data Flow inside 8085, Basic Assembly Language Programming Using 8085 Instruction Sets

Unit 3: Microoperations (3 Hrs.)
Arithmetic Microoperations, Logic Microoperations, Shift Microoperations, Arithmetic Logic Shift Unit

Unit 4: Control Unit and Central Processing Unit (9 Hrs.)
Control Unit of Basic Computer, Computer Arithmetic (Adder, Subtractor, Divider, and Multiplicator), Timing Signal, Micro-Instruction and Micro-Operation Format, Symbolic Microinstructions, Symbolic Micro-program, Binary Micro-Program, Register Organization, Register Stack and Memory Stack, Data transfer and Manipulation, Introduction to RISC and CISC

Unit 5: Fixed point Computer Arithmetic (5 Hrs.)
Addition and Subtraction, Multiplication, Division Algorithm

Unit 6: Input and Output Organization (5 Hrs.)
Introduction to Peripheral Devices, I/O interface, Direct Memory Access (DMA), I/O Processor, Data communication processor

Unit 7: Memory Organization (5 Hrs.)
Hierarchy of Memory System, Primary and Secondary Memory, Virtual Memory, Memory Management hardware

Unit 8: Pipelining (4 Hrs.)
Concept of Pipelining, Arithmetic Pipeline, Instruction Pipeline, Data Dependency, Handling of branch Instruction

Laboratory Works:
The laboratory works should be carried out in 8085 trainer kit. The programming should include arithmetic operation, base conversion, conditional branching etc.

Text Books:
1. Ramesh S. Gaonkar: Microprocessor Architecture, Programming, and Applications with 8085, prentice Hall
2. Morris Mano: Computer system Architecture, Third Edition, prentice Hall

Reference Books:
1. Malvino: Digital Computer system Electronics (An introduction to Microcomputers)
2. Douglas V. Hall: Microprocessor and Interfacing programming and Hardware, McGraw Hill

Discrete Structure

Course Title: Discrete Structure
Course No: BIT152
Nature of Course: Theory + Lab
Semester: II

Full Marks: 60+20+20
Pass Marks: 24+8+8
Credit hours: 3

Course Description: The course introduces the basic concepts of discrete mathematics such as introductory logic, proofs, sets, relations, functions, counting and probability, with an emphasis on applications in information technology.

Course Objectives: The main objective of the course is to introduce basic concepts of discrete mathematics, understand the concepts of graphs, functions, relations and number theory respectively and explore applications of discrete mathematics in information technology.

Course Contents:

Unit 1: Logic and Proof Methods (6 Hrs.)

Propositional Logic: Propositional Logic, Propositional Equivalences, Rule of inferences, Valid Arguments.

Predicate Logics: Predicates and Quantifiers, Negation of Quantified Statements, Proof of quantified statements, Nested Quantifiers, Rules of Inferences, Translating English Sentence to predicate logic expressions.

Proof Methods: Basic Terminologies, Proof Methods (Direct Proof, Indirect Proof, Proof by Contradiction, Proof By Contraposition, Exhaustive Proofs and Proof by Cases), Mistakes in Proof

Unit 2: Sets, Relations and Functions (7 Hrs.)

Sets: Sets and Subsets, Power Set, Cartesian Product, Set Operations, Venn Diagram, Inclusion-Exclusion Principle, Computer Representation of Sets.
Relations: Relations and their Properties, N-ary Relations with Applications, Representing Relations, Closure of Relations, Equivalence Relations, Partial Ordering
Functions: Basic Concept, Injective and Bijective Functions, Inverse and Composite Functions, Graph of Functions, Functions for Computer Science (Ceiling Function, Floor Function, Boolean Function, Exponential Function)

Unit 3: Induction and Recursion (5 Hrs.)

Induction: mathematical Induction, Strong Induction and Well Ordering, Induction in General
Recursive Definitions and Structural Induction, Recursive Algorithms, Proving Correctness of Recursive Algorithms.

Unit 4: Number Theory (6 Hrs.)

Integers: Integers and Division, Primes and Greatest Common Divisor, Extended Euclidean Algorithm, Integers and Algorithms, Applications of Number Theory (Linear Congruencies, Chinese Remainder Theorem, Computer Arithmetic with Large Integers)
Matrices: Zero-One Matrices, Boolean Matrix Operations

Prime Number and its applications

Unit 5: Counting and Discrete Probability (9 Hrs.)

Counting: Basics of Counting, Pigeonhole Principle, Permutations and Combinations, Two Element Subsets, Counting Subsets of a Set, Binomial Coefficients, Generalized Permutations and Combinations, Generating Permutations and Combinations with examples.

Discrete Probability: Introduction to Discrete Probability, Probability Theory, Probability Calculation in Hashing, Expected Value and Variance, Randomized Algorithms

Advanced Counting: Recurrence Relations, Solving Recurrence Relations (Homogeneous and Non-Homogeneous equations),

Unit 6: Tree and Graphs (11 Hrs.)

Graphs: Graphs Basics, Graph Types, Graph Models, Graph Representation, Graph Isomorphism, Connectivity in Graphs, Euler and Hamiltonian Path and Circuits, Matching Theory, Shortest Path Algorithm (Dijkstra's Algorithm), Travelling Salesman Problem, Graph Coloring

Trees: Introduction and Applications, Tree Traversals, Spanning Trees, Minimum Spanning Trees (Kruskal's Algorithm)

Laboratory Works:

The laboratory work consists of implementing the algorithms and concepts discussed in the class. Student should implement problems with following concepts;

- Set Operations, relations and functions
- Primality Testing, Number Theory Algorithms, and Operations on Integers
- Counting and Some Recursive Algorithms
- Predicate Logic
- Algorithms for Tree, Graphs

Text / Reference Books:

1. Kenneth H. Rosen, Discrete mathematics and its applications, Seventh Edition McGraw Hill Publication, 2012.
2. Bernard Kolman, Robert Busby, Sharon C. Ross, Discrete Mathematical Structures, Sixth Edition Pearson Publications, 2015
3. Joe L Mott, Abraham Kandel, Theodore P Baker, Discrete Mathematics for Computer Scientists and Mathematicians, Printice Hall of India, Second Edition, 2008

Object Oriented Programming

Course Title: Object Oriented Programming
Course No: BIT153
Nature of Course: Theory + Lab
Semester: II

Full Marks: 60+20+20
Pass Marks: 24+8+8
Credit hours: 3

Course Description: The course familiarizes students with the concepts of object oriented programming using C++.

Course Objective: The main objective of this course is to understand the basics of object oriented programming. This course covers the C++ concepts such as objects, class, operator overloading, inheritance and polymorphism, file I/O, exception handling and templates.

Course Contents:

Unit 1: Introduction to Object Oriented Programming (3 Hrs.)
Overview of structured and object oriented programming approach, Characteristics of object oriented languages

Unit 2: Basics of C++ programming (5 Hrs.)
C++ Program Structure, Character Set and Tokens, Data Type, Type Conversion, Preprocessor Directives, Namespace, Input/Output Streams and Manipulators, Dynamic Memory Allocation with new and delete, Control Statements.
Functions: Function Overloading, Inline Functions, Default Argument, Pass by Reference, Return by Reference, Scope and Storage Class.
Pointers: Pointer variables declaration & initialization, Operators in pointers, Pointers and Arrays, Pointer and Function.

Unit 3: Class and Objects (8 Hrs.)
Class and Object, Accessing members of class, Initialization of class object (Constructor), Destructor, Default Constructor, Parameterized Constructor, Copy Constructor, The Default Copy Constructor, Objects as Function Arguments, Returning Objects from Functions, Structures and Classes, Memory allocation for Objects, Static members, Member functions defined outside the class.

Unit 4: Operator Overloading (7 Hrs.)
Fundamental of operator overloading, Restriction on operator overloading, Operator functions as a class members, Overloading unary and binary operator, Data Conversion (basic to basic, basic to user-defined, user-defined to basic, user-defined to user-defined)

Unit 5: Inheritance (7 Hrs.)
Introduction to inheritance, Derived Class and Base Class, Access Specifiers (private, protected, and public), Types of inheritance, Public and Private Inheritance, Constructor and Destructor in derived classes, Aggregation, Ambiguity

Unit 6: Virtual Function, Polymorphism, and other C++ Features (5 Hrs.)
Concept of Virtual functions, Late Binding, Abstract class and pure virtual functions, Virtual Destructors, Virtual base class, Friend function and Static function, Assignment and copy initialization, Copy constructor, This pointer, Concrete classes, Polymorphism and its roles.

Unit 7: Function Templates and Exception Handling (4 Hrs.)
Function templates, Function templates with multiple arguments, Class templates, templates and inheritance, Exceptional Handling (Try, throw and catch), Use of exceptional handling.

Unit 8: File and Streams (6 Hrs.)
Stream Class Hierarchy, String I/O (Reading I/O, Writing I/0, Detecting end of file), Character I/O, Object I/O (Writing an object to Disk, Reading an object from Disk), File pointers

Laboratory Works:
Students should be able to implement the above mentioned concepts of Object Oriented Programming using C++ language.

Text Book:
1. Robert Lafore, Object Oriented Programming in C++, Fourth Edition, SAMS publications.

Reference Books:
1. Deitel and Deitel, C++ How to Program, Third Edition, Pearson Publication.
2. Joyce Farrell, Object-oriented programming using C++, Fourth Edition, Cengage Learning.
3. Herbert Schildt, C++ The Complete Reference, Fourth Edition, Tata McGraw Hill Publication.

Basic Statistics

Course Title: Basic Statistics
Course No: STA154
Nature of the Course: Theory + Lab
Semester: II

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description:
The course familiarizes students with the basic concepts of statistics including introduction, diagrammatical and graphical representation, descriptive statistics, probability, random variables, sampling, and correlation and regression.

Course Objective:
To impart the knowledge of descriptive statistics, correlation, regression, concept of sampling and sampling distribution, theoretical as well as applied knowledge of probability and some probability distributions.

Course Contents:

Unit 1: Introduction (5 Hrs.)
Basic concept of statistics; Application of Statistics in different fields including information technology; Scales of measurement; Variables; Types of Data and data source; Data preparation-editing, coding, and transcribing.

Unit 2: Diagrammatical and Graphical Presentation of Data (3 Hrs.)
Bar diagrams; Pie diagrams; Pareto chart; Graph of frequency distribution

Unit 3: Descriptive Statistics (7 Hrs)
Measures of central tendency; Measures of dispersion; Measures of skewness; Measures of kurtosis; Moments; Steam and leaf display; five number summary; box plot.
Problems and illustrative examples related to IT

Unit 4: Introduction to Probability (7 Hrs.)
Concepts of probability; Definitions of probability; Laws of probability; Bayes theorem; prior and posterior probabilities
Problems and illustrative examples related to IT

Unit 5: Random Variables and Mathematical Expectation (3 Hrs.)
Concept of a random variable; Types of random variables; Probability distribution of a random variable; Mathematical expectation of a random variable; Addition and multiplicative theorems of expectation(without proof).
Problems and illustrative examples related to IT

Unit 6: Probability Distributions (6 Hrs.)
Probability distribution function**;** Binomial distribution; Poisson distribution; Normal distribution and their characteristic features. Applications of these distributions in IT related data problems.

Problems and illustrative examples related to computer Science and IT

Unit 7: Sampling and Sampling Distribution (7 Hrs.)
Definitions of population; sample survey vs. census survey; sampling error and non sampling error; Types of sampling; Standard error of mean; standard error of proportion; sampling distribution of mean and proportion; Need of inferential Statistics; Concept of estimation; confidence interval estimation for mean and proportion.
Problems and illustrative examples related to IT

Unit 8: Correlation and Linear Regression (7 Hrs.)
Bivariate data; Bivariate frequency distribution; Correlation between two variables; Karl Pearson's coefficient of correlation(r); Spearman's rank correlation; Regression Analysis: Fitting of lines of regression by the least squares method; coefficient of determination

Problems and illustrative examples related to IT

Laboratory Works:
Practical (Computational Statistics):
Practical problems to be covered in the Computerized Statistics laboratory

Practical problems

S. No.	**Title of the practical problems** (Using any statistical software such as Microsoft Excel, SPSS, STATA etc. whichever convenient).	**No. of practical problems**
1	Diagrammatical and graphical presentation of data	1
2	Computation of measures of central tendency (ungrouped and grouped data) Use of an appropriate measure and interpretation of results and computation of partition Values	1
3	Computation measures of dispersion (ungrouped and grouped data) and computation of coefficient of variation.	1
4	Measures of skewness and kurtosis using method of moments, Measures of Skewness using Box and whisker plot.	2
5	Scatter diagram, correlation coefficient (ungrouped data) and interpretation. Compute manually and check with computer output.	1
6	Fitting of simple linear regression model (Results to be verified with computer output), Mean residual sum of squares, residual plot	1
7	Conditional probability and Bayes theorem	3
8	Problems related to Binomial, Poisson and Normal probability distributions	2
9	Problems related sampling and sampling distribution of mean and proportion, confidence interval estimation for mean and proportion	3
	Total number of practical problems	**15**

Text Books:

1. Michael Baron (2013). Probability and Statistics for Computer Scientists. 2nd Ed., CRC Press, Taylor & Francis Group, A Chapman & Hall Book.

2. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, & Keying Ye(2012). Probability & Statistics for Engineers & Scientists. 9th Ed., Printice Hall.

Reference Books:

1. Douglas C. Montgomery & George C. Ranger (2003). Applied Statistics and Probability for Engineers. 3rd Ed., John Willey and Sons, Inc.
2. Richard A. Johnson (2001). Probability and Statistics for Engineers. 6th Ed., Pearson Education, India

Economics

Course Title: Economics
Course No: ECO155
Nature of the Course: Theory
Semester: II

Full Marks: 60 + 40
Pass Marks: 24 + 16
Credit Hrs: 3

Course Description:
This course covers the basic concepts of microeconomics and macroeconomics. In encompasses basic economic problems, demand, supply, market equilibrium, elasticity of demand and supply, consumer choice, production, cost, revenue, market structure, concept of national product and income and its measurement, monetary and fiscal policies.

Course Objectives:
The main objective of this course is to make students familiar with the basic concepts of economics.

Course Content:

Unit 1: Economic Issues and Concepts (4 Hrs.)
Introduction to economics with reference to Alfred Marshall and Lionel Robbins' definitions ; Concept of microeconomics and its scope; Main characteristics of free market, centrally planned and mixed economic systems; Society's production possibility curve/frontier, and choice, scarcity and opportunity cost

Unit 2: Demand, Supply and Price (10 Hrs.)
Meaning of demand and supply; Law of demand and supply; Individual and market demand and supply (with schedule and graph/curve); movement along and shift of a demand and supply curves; market equilibrium: the interplay of demand and supply; change in market equilibrium due to factors shifting the demand and supply curves; price, income and cross-price elasticities of demand and their measurement by percentage and arc/mid-point methods; price elasticity of supply; concept of consumer and producer surpluses; government intervention in the market through price floor ,price ceiling and taxand effect

Unit 3: Consumer Choice: Indifference Theory (6 Hrs.)
Concept of utility, total utility and marginal utility; Law of diminishing marginal utility; Indifference curve analysis: Meaning and assumptions of indifference curve analysis; basic properties of indifference curves; right-angled (L-shaped) and linear (straight line) indifference curves, marginal rate of substitution (MRS); consumer's budget line; consumer's equilibrium, income consumption curve (ICC) and price consumption curve (PCC) for normal, inferior, and Giffen goods.

Unit 4: Production (6 Hrs.)

Meaning of production and production function (Cobb-Douglas production function) ; production with one variable input: the law of diminishing marginal productivity/returns; production with two variable inputs: concept of isoquant; property of isoquants ;right-angled(L-shaped) and linear(straight line) isoquants; concept of isocost curve (meaning, equation, slope); producer's equilibrium ,condition for optimum employment of one, two and many inputs/factors of production; Production in the long run: Concepts of returns to scale with possible causes of each

Unit 5: Costs and Revenue (5 Hrs.)

Concept of economic cost as a sum of explicit and implicit costs; concept of short run total costs (fixed and variable) and unit costs (average fixed, average variable, average total, and marginal) and their curves; relation between average variable, average total and marginal costs; costs in the long run: average and marginal costs; causes of U-shaped and L-shaped long run average cost curves

Concepts of total, average and marginal revenues and their curves in the perfect competition and imperfect competition markets

Unit 6: Market Structure (8 Hrs.)

Perfect competition: characteristics, and price and output determination in the short and long run using the total and marginal approaches; Monopoly market: Characteristics, sources of monopoly, and price and output determination in the short and long run using the total and marginal approaches; Monopolistic competition: Features and price –output determination using total and marginal approaches; Oligopoly market: Basic features/characteristics; centralised cartel

Unit 7: National Product and its Measurement (4 Hrs.)

Concept of macroeconomics and its scope; Concepts of gross domestic product (GDP), gross national income (GNI), net national product (NNP),national income(NI), personal income(PI),disposable personal income(DPI); measurement of national income and output by expenditure, income (cost of production) and value added approaches.

Unit 8: Macroeconomic Policies (2 Hrs.)

Concept of expansionary and contractionary fiscal and monetary policies; tools of fiscal and monetary policies

Text / Reference Books:

1. Lipsey, R.G., &Chrystal, K.A. (2008). ***Economics***, 11th ed., (Indian Edition).New Delhi: Oxford University Press.
2. Samuelson, P.A. & Nordhaus, W.D. (2005). ***Economics***, 18thed. New Delhi: Tata McGraw-Hill Publishing Company Ltd.

Data Structures and Algorithms

Course Title: Data Structures and Algorithms
Course No: BIT201
Nature of the Course: Theory + Lab
Semester: III

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description:
The course familiarizes students with different concepts of data structures, abstract types, and algorithms.

Course Objective:
This course aims to provide sufficient theoretical and practical knowledge of data structure and algorithms required to build efficient programs.

Course Contents:

Unit 1: Background and Concept of Data Structures (2 Hrs.)
- Introduction: Data Types, Data Structure, Abstract Data Type
- Background for Data Structure: Array, Array as an ADT, Structure, Pointer, Class in C++

Unit 2: Algorithms (2 Hrs.)
- Fundamentals of Algorithm
- Elementary Analysis of algorithm with asymptotic notations and their properties, time and space complexities

Unit 3: Stack (4 Hrs.)
- Definition
- Primitive Operations, Stack as an ADT
- Stack Applications: Evaluation of Infix, Postfix and Prefix expressions, converting from infix to postfix

Unit 3: Queue (3 Hrs.)
- Definition
- Primitive Operations, Queue as an ADT
- Circular and Priority Queues

Unit 4: Recursion (2 Hrs.)
- Definition and Principle
- Application of recursion with TOH problem, Factorial, Fibonacci Sequences

Unit 5: List (9 Hrs.)

- Definition, Static and Dynamic List Structure
- Operations on Linked List
- Linked implementation of a stack
- Linked implementation of a queue
- Circular Linked List
- Doubly Linked List
- Doubly Circular Linked List

Unit 6: Tree (7 Hrs.)

- Definition and basic terminologies
- Binary Tree: Introduction, Types of Binary Tree, Operations
- Binary Search Tree: Insertion, Deletion, Searching
- Tree Traversal: Pre-order traversal, In-order traversal, Post-order traversal
- Applications of Binary Tree

Unit 7: Sorting (6 Hrs.)

- Introduction and types of sorting
- Algorithm and implementation of Bubble Sort, Insertion Sort, Selection Sort, Quick Sort, Merge Sort
- Comparison and Efficiency of sorting algorithms

Unit 8: Searching (5 Hrs.)

- Introduction
- Sequential Search, Binary Search and Tree Search
- Comparison and Efficiency of Searching
- Hashing

Unit 9: Graph (5 Hrs.)

- Definition, Representation of Graph, Types of Graph
- Graph Traversal: Depth First Search, Breadth First Search
- Spanning Tree, Prim's Algorithm, Kruskal's algorithm and Round Robin Algorithm
- Shortest Path Algorithm, Greedy and Dijkstra's Algorithm

Laboratory works:

Data Structure and Algorithm is highly practical oriented course. Each unit should include plenty of programming practices. Laboratory work should include implementation of Stack, Queue, Lists, Tree, Graphs, and Recursive functions as well as implementation of Sorting Algorithms and Searching Algorithms.

Text Book:

1. Data structure using C and C++, Langsam, Augenstein, Tenenbaum

References Books:

1. Horowitz and Sahni, Fundamentals of Data Structures
2. Aho, Hopcroft and Ullman, Data Structure and Algorithms

Database Management System

Course Title: Database Management System
Course No: BIT202
Nature of the Course: Theory + Lab
Semester: III

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description:
The course covers the basic concepts of databases, database system concepts and architecture, data modeling using ER diagram, relational model, SQL, relational algebra and calculus, normalization, transaction processing, concurrency control, and database recovery.

Course Objective:
The main objective of this course is to introduce the basic concepts of database, data modeling techniques using entity relationship diagram, relational algebra and calculus, basic and advanced features SQL, normalization, transaction processing, concurrency control, and recovery techniques.

Course Contents:

Unit 1: Database Concepts and Architecture (4 Hrs.)
Database, Database Management System, Database Users, and Benefits of Databases; Data Models, Schemas, and Instances; Three-Schema Architecture and Data Independence; Database Languages and Interfaces; the Database System Environment; Centralized and Client/Server Architectures for DBMSs; Classification of Database Management Systems

Unit 2: Data Modeling Using the Entity-Relational Model (5 Hrs.)
Using High-Level Conceptual Data Models for Database Design; Entity Types, Entity Sets, Attributes, and Keys; Relationship Types, Relationship Sets, Roles, and Structural Constraints; Weak Entity Types; ER Diagrams, Naming Conventions, and Design Issues; Relationship Types of Degree Higher Than Two; Subclasses, Superclasses, and Inheritance; Specialization and Generalization; Constraints and Characteristics of Specialization and Generalization

Unit 3: The Relational Data Model and Relational Database Constraints (5 Hrs.)
Relational Model Concepts; Relational Model Constraints and Relational Database Schemas; Update Operations, Transactions, and Dealing with Constraint Violations; Basic Relational Algebra Operations

Unit 4: SQL (10 Hrs.)
Data Definition and Data Types; Specifying Constraints; Basic Retrieval Queries; Complex Retrieval Queries; INSERT, DELETE, and UPDATE Statements; Views

Unit 5: Relational Database Design (7 Hrs.)
Relational Database Design Using ER-to-Relational Mapping; Informal Design Guidelines for Relational Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; General Definitions of Second and Third Normal Forms; Boyce-Codd Normal Form; Multivalued Dependency and Fourth Normal Form; Properties of Relational Decomposition

Unit 6: Transaction Processing and Concurrency Control, and Recovery (8 Hrs.)
Introduction to Transaction Processing; Transaction and System Concepts; Desirable Properties of Transactions; Serializable Schedule; Two-Phase Locking and Timestamp Ordering Concurrency Control Techniques

Unit 7: Database Recovery Techniques (3 Hrs.)
Recovery Concepts; NO-UNDO/REDO Recovery Based on Deferred Update; Recovery Technique Based on Immediate Update; Shadow Paging; Database Backup and Recovery from Catastrophic Failures

Unit 8: NoSQL (3 Hrs.)
Structured and Unstructured Data, Introduction to NoSQL Databases, Discussion of basic architecture of Hbase, Cassandra and MongoDb.

Laboratory Works:
The laboratory work includes writing database programs to create and query databases using basic and advanced features of structured query language (SQL).

Text Books:
1. Fundamentals of Database Systems; Seventh Edition; RamezElmasri, Shamkant B. Navathe; Pearson Education
2. Database System Concepts; Sixth Edition; AviSilberschatz, Henry F Korth, S Sudarshan; McGraw-Hill
3. NoSQL for Dummies; Adam Fowler; John Wiley & Sons, Inc.

Reference Books:
1. Database Management Systems; Third Edition; Raghu Ramakrishnan, Johannes Gehrke; McGraw-Hill
2. A First Course in Database Systems; Jaffrey D. Ullman, Jennifer Widom; Third Edition; Pearson Education Limited

Numerical Methods

Course Title: Numerical Methods
Course No: BIT203
Nature of the Course: Theory + Lab
Semester: III

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description:
This course covers different concepts of numerical techniques of solving non-linear equations, system of linear equations, integration and differentiation, and ordinary and partial differential equations.

Course Objective:
The main objective of this course is to provide concepts of numerical techniques for solving different types of equations and developing algorithms for solving scientific problems.

Course Contents:

Unit 1: Solution of Nonlinear Equations (7 Hrs.)

Errors in Numerical Calculations, Sources of Errors, Propagation of Errors, Review of Taylor's Theorem

Concept of Non-linear Equations, Solving Non-linear Equations: Trial and Error Method, Bisection Method, Newton Raphson Method, Secant Method, Fixed Point Method, False Position Method, Newton's Method for Calculating Multiple Roots, Evaluating Polynomials with Horner's Method

Unit 2: Interpolation and Regression (8 Hrs.)

Concept of Interpolation and Extrapolation, Lagrange's Interpolation, Newton's Interpolation using divided differences, forward differences and backward differences.

Concept of Regression, Regression vs. Interpolation, Least Squares Methods, Linear Regression, Non-linear Regression: Exponential and Polynomial

Unit 3: Numerical Differentiation and Integration (9 Hrs.)

Concept of Differentiation, Differentiating Continuous Functions (Two-Point and Three-Point Formula), Differentiating Tabulated Functions by using Newton’s Differences, Maxima and minima of Tabulated Functions

Concept of Integration, Newton-Cote's Quadrature Formulas, Trapezoidal rule, Multi-Segment Trapezoidal rule, Simpson's 1/3 rule, Multi-Segment Simpson's 1/3 rule, Simpson's 3/8 rule, Multi-Segment Simpson's 3/8 rule

Unit 4: Solving System of Linear Equations (8 Hrs.)

Existence of Solutions, Properties of Matrices, Matrix Representation, Gaussian Elimination Method, Partial and Complete Pivoting, Gauss-Jordan method, Inverse of matrix using Gauss-Jordan method

Matrix factorization and Solving System of Linear Equations by using Do-little and Cholesky'salgorithm

Iterative Solutions of System of Linear Equations, Jacobi Iteration Method, Gauss-Seidal Method

Eigen Values and Eigen Vectors Problems, Power Method.

Unit 5: Solution of Ordinary Differential Equations (8 Hrs.)

Concept of Differential Equations, Initial Value Problem, Taylor Series Method, Euler's Method, Heun's Method, Runge-Kutta Methods

Solving System of Ordinary Differential Equations, Solution of the Higher Order Equations, Boundary Value Problems, Shooting Method

Unit 6: Solution of Partial Differential Equations (5 Hrs.)

Concept of Partial Differential Equations, Classification of PDE, Deriving Difference Equations, Laplacian Equation and Poisson's Equation.

Laboratory works:

The laboratory exerciseshould consist programs for implementing

- Non-linear equations
- System of linear equations
- Interpolation and Regression
- Numerical integration and differentation
- Solving ordinary and partial differential equations

Text Books:

1. W. Chency and D. Kincaid, "*Numerical Mathematics and Computing*", 7thEdition, Brooks Cole Publisher
2. C.F. Gerald and P.O. Wheatley, *"Applied Numerical Analysis*", ^{9th}Edition, Addison Wesley Publisher

Reference Books:

1. W.H. Press, B.P. Flannery et al., "*Numerical Recipes: Art of Scientific Computing*", 3rd Edition, Cambridge Press.
2. J. M. Mathews and K. Fink, "Numerical Methods using MATLAB ", 4rd Edition, Prentice Hall Publication

Operating Systems

Course Title: Operating Systems
Course No: BIT204
Nature of the Course: Theory + Lab
Semester: III

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description:
The course covers fundamental concepts of operating system as well as, Process management, Memory management, File systems, and I/O Managements and Disk Managements.

Course Objectives:
The main objective of this course is to introduce fundamental concepts of operating system and its components and functions.

Course contents:

Unit 1: Introduction and Evolution (6 Hrs.)

Background of Operating system, Operating System as an Extended Machine and Resource Manager, hardware review.

Evolution of Operating System: batch system, multiprogramming, time-sharing, real-time, mainframe operating systems, handheld, embedded, smart-card, distributed and personal computer operating systems.

Operating system Concepts: Hardware Review, Booting Computer, System Calls, Address Spaces, Files, Client-Server Model.

Unit 2: System Structures (4 Hrs.)

Operating system Components: Process Managements, Memory Managements, I/O managements, Operating system services and system calls

Operating system structures: Monolithic system, Layered system, Micro Kernels, Exo Kernels, Virtual Machines, Storage Structures, I/O structures, Files structures, and system Protections:

Unit 3: Process Management and Synchronization (10 Hrs.)

Process management: Process Model, Process creation, process termination, process states, attributes; Thread Model: thread creation, termination, User Thread and Kernel Thread., Process scheduling and Context Switch, Scheduling Algorithms: First Come First Serve, Shortest Job First, Priority, Round Robin and Shortest time Remaining First.

Inter-process communication and synchronization: race conditions, critical regions, mutual exclusion, busy waiting, sleep and wakeup, semaphores, monitors, message passing, classical IPC problems and Deadlock Modelling, Deadlock Handling: Prevention, detection and Recovery.

Unit 4: Memory Management and File system (13 Hrs.)

Memory management: address spaces, multiprogramming, swapping, overlays, Memory allocations, Fragmentations, virtual memory, paging, page replacements algorithms: Principle of optimality, First in First out, LRU, LFU, NRU, Clock, Second Chance Page replacement, Working set, segmentation, and segmentation with paging.

File systems: File operations, Access Methods, Directories and Levels, Directories Operations, file system mounting and sharing, protection, access Control, File system layout, File system Implementation, File system Examples.

Unit 4: Input/output Management (12 Hrs.)

Input Output management: I/O devices, Devices Controller, Memory Mapped I/O, Direct Memory Access (DMA), I/O software Principles: programmed I/O, Interrupt driven I/O, DMA based I/O, I/O Software Layers.

Disk management: Disk structure, Disk scheduling, error handling and formatting, stable storage management.

Text / Reference Books:

1. Andrew S. Tanenbaum, Modern Operating Systems, 2nd Edition, Prentice-Hall.
2. Silberschatz, Galvin and Gagne, Operating System Concepts, 6th Edition, Addition Wesley.

Principles of Management

Course Title: Principles of Management
Course No: MGT205
Nature of the Course: Theory
Semester: III

Full Marks: 60 + 40
Pass Marks: 24 + 16
Credit Hrs: 3

Course Description:
The course covers fundamental concepts of management including organization, decision making, planning, controlling, and concepts of motivation, leadership, and communication.

Course Objectives:
Upon completion of this course, students are expected to be able to:
1. Focus on the foundations of management, covering the essential concepts in management.
2. Reflection of contemporary trends in management.
3. It offers strong practical focus and also covering latest research studies in the field.

Course contents:

Unit 1: Introduction to Managers and Management (5 Hrs.)
What is Management and what do managers do? Defining management; Management functions; Management roles; Management skills; History of management

Unit 2: Organizational Culture and Environment (5 Hrs.)
The manager: Omnipotent or symbolic? The organization's culture; Environment: Defining environment, specific environment, general environment, Influence on management practice

Unit 3: Decision Making the Essence of Manager's Job (5 Hrs.)
The decision making process; the rational decision maker; Decision making styles; analyzing decision alternatives: Certainty, Risk, Uncertainty, Group decision making

Unit 4: Planning (5 Hrs.)
The foundations of planning; The definition of planning; Purposes of planning; Types of plans; Contingency factors on planning; Objectives: The foundation for planning; Multiplicity of objectives; Real versus stated objectives; Traditional objective setting; Management by objectives

Unit 5: Organization Structure and Design (5 Hrs.)
Defining organization structure and design; Building the vertical dimension of organizations; Building the horizontal dimension of organizations; The contingency approach to organization design; Application of organization design

Unit 6: Motivation (5 Hrs.)
Motivating employees; what is motivation? Contemporary approaches to motivation; Contemporary issues in motivation; from theory to practice: suggestions for motivating employees

Unit 7: Leadership (4 Hrs.)
Managers verses leaders; Trait theories; Behavioral theories; Contingency theories; Emerging approaches to leadership; Contemporary issues in leadership

Unit 8: Communication (4 Hrs.)
Communication and interpersonal skills; Understanding communication; Communication styles of men and women; Feedback skills; Delegation skills'; Conflict management skills; Negotiation skills

Unit 9: Controlling **(4 Hrs.)**
Foundations of control: What is control? The importance of control; The control process; Types of control; Qualities of effective control; The dysfunctional side of control; Ethical issues in control

Unit 10: Controlling tools and techniques (3 Hrs.)
Information controls; financial controls; Operations controls; Behavioral controls

Text/Reference Books:

1. Robbins, S.P. & Coulter, Mary (1996) Management; Prentice Hall.
2. Robbins, S.P. & Decenzo, David A. (2001) Fundamentals of Management, Pearson.
3. Robbins, S.P., Coutler, M. & Bohara, N. (2010). Management (10 th ed.) New Delhi: Prentice Hall.

Web Technology I

Course Title: Web Technology I
Course No: BIT251
Nature of the Course: Theory + Lab
Semester: IV

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description: This course covers the concepts of HTML, CSS, JavaScript and XML.

Course Objectives: The main objective of this course is to provide basic knowledge of HTML, CSS and client side scripting using JavaScript. In addition, the course covers the concepts of XML.

Course Contents:

Unit 1: Introduction (4 Hrs.)

Web Basics: Internet, Intranet, WWW, Web Page; Web Site: Static and Dyanamic; Client Server Architecture: Single Tier, Two-Tier, Multi-Tier; Web Clients; Web Servers; HTTP: HTTP Request and Response; URL, Client Side Scripting, Server Side Scripting, Web 1.0, Web 2.0

Unit 2: Markup Language (11 Hrs.)

Introduction to HTML; Elements of HTML Document: HTML, Head, and Body tags; HTML Elements and HTML Attributes, Document Type Declaration; Comments in HTML; Entity and Character References; Headings, Paragraph, Divison, Formatiing: b, i, small, sup, sub; Spacing: Pre, Br; Formatting Text Phrases: span, strong, tt; Image element; Anchors; Lists: Ordered and Unordered and Definition; Tables; Frames; Forms: Form Elements, Meta Tag, HTML Events: Window Events, Form Element Events, Keyboard Events, Mouse Events, HTML5 Basics: Audio, Video, Canvas, Main, Section, Article, Header, Footer, Aside, Nav, Figure Tags

Unit 3: Style Sheets (10 Hrs.)

Introduction; Cascadding Style Sheets (CSS); CSS Syntax; Inserting CSS: Inline, Internal, External, ID and Class Selectors; Colors; Backgrounds; Borders; Text; Font; List; Table; CSS Box Model; Normal Flow Box Layout: Basic Box Layout, Display Property, Padding, Margin; Positioning: Relative, Float, Absolute; CSS Media Queries; Basics of Responsive Web Designs, Slicing: Converting image design into HTML

Unit 4: Client Side Scripting (12 Hrs.)

Introduction to JavaScript; Basic Syntax; Structure of JavaScript Program; Variables and Data Types; Statements: Expression, Keyword, Block; Operators; Flow Controls, Looping, Functions; Popup Boxes: Alert, Confirm, Prompt; Objects and properties; Constructors; Arrays; Built-in Objects: Window, String, Number, Boolean, Date, Math, RegExp, Form, User Defined Objects; Event Handling and Form Validation, Error Handling, Handling Cookies, Basics of AJAX and jQuery

Unit 5: XML (8 Hrs.)

Introduction; XML Documents; Syntax Rules; XML Elements; XML Attributes; XML Tree; XML Namespace XML schema languages: Document Type Definition(DTD), XML Schema Definition (XSD); XSD Simple Types, XSD Attributes; XSD Complex Types; XML Style Sheets (XSLT), XQuery

Laboratory Works:

The laboratory work includes creating web pages and applications with client side scripting using HTML, CSS, JavaScript and XML technologies.

Text Books:

1. Web Technologies: A Computer Science Perspective, Jeffrey C. Jackson , *Pearson Prentice Hall*

Reference Books:

1. HTML5 and CSS3 for the Real World", Estelle Weyl, Louis Lazaris, Alexis Goldstein, *Sitepoint*
2. Dynamic Web Programming and HTML5, Paul S. Wang, *CRC Press*
3. HTML5 Programming with JavaScript for Dummies, John Paul Mueller
4. JavaScript: The Web Technologies Series, Don Gosseli, *Course Technology Cengage Learning*
5. Web Technologies: Html, Javascript, Php, Java, Jsp, Asp.Net, Xml And Ajax, Black Book, *Dreamtech Press*
6. An Introduction to XML and Web Technologies Anders Møller and Michael I. Schwartzbach *Addison-Wesley*
7. www.w3schools.com

Artificial Intelligence

Course Title: Artificial Intelligence
Course No: BIT252
Nature of the Course: Theory + Lab
Semester: IV

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description:
The course introduces the concepts artificial intelligent. It includes the basics of artificial intelligence, intelligent agents, problem solving, searching, knowledge representation systems, probabilistic reasoning, neural networks, machine learning and natural language processing.

Course Objectives:
The main objective of the course is to introduce fundamental concepts of artificial intelligence and to learn intelligent agents, identify AI problems and solve the problems using searching, design knowledge representation and expert systems, understand concepts of machine learning and natural language processing.

Course Contents:

Unit I: Introduction (3 Hrs.)
Artificial Intelligence (AI), History of AI, AI Perspectives, Turing Test, Foundations of AI, Scope of Symbolic AI, Applications of AI

Unit II: Agents (5Hrs.)
Introduction of Agents; Configuration of Agents: PEAS description of Agents; Types of Agents: Simple Reflexive, Model Based, Goal Based, Utility Based, Learning Agent; Environment Types: Deterministic, Stochastic, Static, Dynamic, Observable, Semi-observable, Single Agent, Multi Agent

Unit III: Problem Solving by Searching (10 Hrs.)
Problem Solving; State Space Representation; Problem Formulation; Constraint Satisfaction Problems
Solving Problems by Searching; Performance evaluation of search techniques; Uninformed Search: Depth First Search, Breadth First Search, Depth Limited Search, Iterative Deepening Search, Bidirectional Search;
Informed Search: Greedy Best first search, A* search, Hill Climbing;
Game playing: Adversarial search techniques, Mini-max Search, Alpha-Beta Pruning
Problem Decomposition: Goal Trees, AO*

Unit IV: Knowledge Representation (14 Hrs.)

Knowledge; Knowledge Representation; Issues in Knowledge Representation, Knowledge Representation Systems; Properties of Knowledge Representation Systems

Logic Based: Propositional and Predicate; Propositional Logic: Syntax, Semantics; CNF Form; Inference using Resolution; Backward Chaining and Forward Chaining; Predicate Logic: FOPL: Syntax, Semantics; Quantification; Inference with FOPL: Unification and Lifting; Inference using Resolution

Semantic Nets, Frames, Rule Based Systems, Scripts, Conceptual Dependency

Statistical Reasoning: Uncertain Knowledge, Random Variables, Prior and Posterior Probability, Bayes' Rule, Bayesian Networks, Reasoning in Belief Networks, Dempster-Shafer Theory

Unit V: Neural Network (2 Hrs.)

Neural Networks: Introduction; Mathematical Model of ANN, Designing a neuron, Types of ANN: Feed-forward, Recurrent, Single Layered, Multi-Layered, Learning Rule, Learning Rate, Application of Artificial Neural Networks

Unit VI: Machine Learning (5 Hrs.)

Machine Learning; Concepts of Learning: Supervised, Unsupervised and Reinforcement Learning; Leaning by Analogy; Learning by Genetic Algorithm; Learning by Back-propagation

Unit VII: Expert System (3 Hrs.)

Expert Systems; Architecture of Expert System; Development of Expert Systems; Applications of Expert Systems

Unit VIII: Natural Language Processing (3 Hrs.)

Natural Language Processing: Natural Language Understanding and Natural Language Generation

Steps in NLP: Lexical Analysis, Syntactic Analysis, Semantic Analysis, Discourse and Pragmatic Analysis; Ambiguities in NLP

Laboratory Works:

The laboratory work consists of implementation of intelligent agents and expert systems, searching techniques, knowledge representation systems and machine learning techniques. Students are advised to use LISP, PROLOG, or any other high level language.

Text Books:

1. Stuart Russel and Peter Norvig, *Artificial Intelligence A Modern Approach*, Pearson

Reference Books:

1. E. Rich, K. Knight, Shivashankar B. Nair, *Artificial Intelligence*, Tata McGraw Hill.
2. George F. Luger, *Artificial Intelligence: Structures and Strategies for Complex Problem Solving*, Benjamin/Cummings Publication
3. D. W. Patterson, *Artificial Intelligence and Expert Systems*, Prentice Hall.
4. P. H. Winston, *Artificial Intelligence*, Addison Wesley.
5. Tutorials for LISP and PROLOG

Systems Analysis and Design

Course Title: Systems Analysis and Design
Course No: BIT253
Nature of the Course: Theory + Lab
Semester: IV

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description:
This course familiarizes students with the concepts of information systems development including foundations, planning, analysis, design, implementation and maintenance.

Course Objectives:
The main objective of this course is to provide knowledge of different concepts of system analysis and design so that students will be able to develop information systems using different methodologies, tools and techniques.

Course Contents:

Unit 1: Foundations for Systems Development (12 Hrs.)

The Systems Development Environment: Introduction; A Modern Approach to Systems Analysis and Design; Developing Information Systems and the Systems Development Life Cycle; The Heart of the Systems Development Process and Traditional Waterfall SDLC; CASE Tools

Other Approaches: Prototyping; Spiral; Rapid Application Development; Introduction to Agile Development

Introduction to Object Oriented Development

Managing the Information Systems Project: Introduction; Managing the Information Systems Project; Representing and Scheduling Project Plans; Using Project Management Software

Unit 2: Planning (5 Hrs.)

Identifying and Selecting Systems Development Projects: Introduction; Identifying and Selecting Systems Development Projects; Corporate and Information Systems Planning

Initiating and Planning Systems Development Projects: Introduction; Initiating and Planning Systems Development Projects; Process of Initiating and Planning IS Development Projects, Assessing Project Feasibility; Building and Reviewing the Baseline Project Plan

Unit 3: Analysis (13 Hrs.)

Determining System Requirements: Introduction; Performing Requirements Determination; Traditional Methods for Determining Requirements; Contemporary Methods for Determining System Requirements; Radical Methods for Determining System Requirements

Structuring System Process Requirements: Introduction; Process Modeling; Data Flow Diagrams; Modeling Logic with Decision Tables, Decision Trees, and Pseudocodes

Structuring System Data Requirements: Introduction; Conceptual Data Modeling; Gathering Information for Conceptual Data Modeling; Introduction to E-R Modeling

Unit 4: Design (7 Hrs.)

Designing Databases: Introduction; Database Design; Relational Database Model; Normalization; Transforming E-R Diagrams Into Relations; Merging Relations; Physical File and Database Design; Designing Fields; Designing Physical Tables

Designing Forms and Reports: Introduction; Designing Forms and Reports; Formatting Forms and Reports; Assessing Usability

Designing Interfaces and Dialogues: Introduction; Designing Interfaces and Dialogues; Interaction Methods and Devices; Designing Interfaces; Designing Dialogues; Designing Interfaces and Dialogues in Graphical Environments

Unit 5: Implementation and Maintenance (4 Hrs.)

System Implementation: Introduction, System Implementation, Software Application Testing, Installation, Documenting the System, Training and Supporting Users, Organizational Issues in Systems Implementation

Maintaining Information Systems: Introduction, Maintaining Information Systems, Conducting Systems Maintenance

Project Work: Students should prepare a project report that includes at least analysis, design, and implementation phase of system analysis and design. The project can be done in groups with at most four members in each group.

Text Books:

1. Joseph S. Valacich and Joey F. George, *Modern Systems Analysis and Design*, 8th Edition, Pearson

References Books:

1. Kenneth E. Kendall and Julie E. Kendall, System Analysis and Design, 9th Edition, Pearson
2. Jeffrey Whitten and Lonnie Bently, System Analysis and Design Methods, 7th Edition
3. Scott Tilley and Harry J. Rosenblatt, System Analysis and Design, 11th Edition

Network and Data Communications

Course Title: Network and Data Communications
Course No: BIT254
Nature of the Course: Theory + Lab
Semester: IV

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description:
The course covers fundamental concepts about Data communication, Data Transmission and Computer Network with their functionalities at Physical, Data, Network, Transport and Application Layer respectively.

Course Objective:
The main objective of this course to introduce analog and digital signals with their conversion and transmission; Protocols: OSI, TCP/IP; Medium of transmission; Multiplexing Techniques; Switching Techniques; Error Detection and Correction; Data Link Control; Routing Algorithms; Transport Protocols; Congestion Control; Domain Name System, Electronic Mail, File Transfer.

Course Contents:

Unit 1: Fundamental of Data Communication (6 Hrs.)
Components, Data Representation, Data Flow, Distributed Processing, Network Criteria, Physical Structures, Network Models, Categories of Networks; Basic Concepts about Bridge, Hub, Swtich, Router, NIC, MAC-address, Gateway; The Internet, Protocols and Standards, OSI, TCP/IP; Addressing.

Unit 2: Physical Layer and Media (12 Hrs.)
Analog and Digital; Periodic Analog Signals, Digital Signals; Basic Concepts about Noise, Distortion, Attenuation, Nyquist Bit Rat, Shannon Capacity, Bandwidth, Throughput, Latency; Conversion: Analog to Analog, Digital to Digital, Analog to Digital , Digital to Analog; Transmission modes; Multiplexing: Time Division Multiplexing, Frequency Division Multiplexing, Wavelength Division Multiplexing; Guided Media, Unguided Media; Switching: Circuit Switching and Packet Switching.

Unit 3: Data link layer (8 Hrs.)
Functionality of Data link Layer; Error detection and Correction: Introduction, Block Coding, Linear Block Codes, Cyclic codes, Checksum; Data Link Control: Framing, Flow and Error Control, Protocols, Noiseless Channels, Noisy Channels; Multiple Access: Random Access. ALOHA, Controlled Access; Basic concepts about Cellular telephony and Satellite network.

Unit 4: Network layer (8 Hrs.)
Functionality of Network Layer; Internetworking; IPv4, IPv6; Directing; Forwarding; Routing: Static vs. Dynamic Routing; Routing Algorithms: Shortest-path, Flooding, Flow-based, Distance-vector, Link-state; Congestion control and prevention: Leaky-bucket algorithm, Token-bucket algorithm; Network layer protocols: IP, NAT, ICMP, IGMP, RIP, ARP, RARP, OSPF, IGRP, EIGRP, BGP.

Unit 5: Transport layer (6 Hrs.)
Functionality of Transport layer; Client Server Paradigm, Multiplexing and De-multiplexing, Connectionless vs. Connection Oriented Service, Reliable vs. Unreliable; Basic Overview of TCP and UDP; Congestion Control and Quality of Service: Network Performance; Congestion Control: Open-loop and Closed loop.

Unit 6: Application layer (5 Hrs.)
Functionality of Application Layer; Domain Name System: Namespace, Domain Name Space, Distribution of Name Space, DNS in the Internet: Generic Domains, Country Domains, Inverse Domain, Resolution: Resolver, Mapping Names to Addresses, Address to Names, Recursive Resolution, Caching; Electronic mail: SMTP, POP, IMAP; File transfer: FTP, Telnet; Dynamic host configuration protocol (DHCP), HTTP, WWW, SNMP.

Laboratory Works:
Students should be able to configure network hardware and software; should be able to design and set up networks by using simulators and devices.

Text Book:
1. Behrouz A. Forouzan; "Data Communications and Networking", 4th Edition, McGraw Hill.

Reference Books:
1. William Stallings; "Data And Computer Communications", 8th Edition Prentice Hall of India, New Delhi.
2. A.S. Tanenbaum; "Computer Network", 4th Edition, Pearson Education International.

Operations Research

Course Title: Operations Research
Course No: ORS255
Nature of the Course: Theory
Semester: IV

Full Marks: 60 + 40
Pass Marks: 24 + 16
Credit Hrs: 3

Course Description:
The course covers fundamental concepts of operations research including introduction, optimization, queuing models theory of games, decision theory, and networking analysis.

Course Objective:
The main objective of this course is to develop knowledge and skill to the students on the Operations research tools and techniques such as optimization, queuing theory, theory of games, decision theory and networking analysis

Unit 1: Introduction (3 Hrs.)
History, Development of operations research, Objective of OR, Scope of OR, Nature and Definition of OR, Characteristics of OR, Scientific Method in OR, Models and Modeling in OR, Limitation of OR, Applications of OR

Unit 2: Optimization

Linear programming I: Formulation and Graphic Solution (3 Hrs.)
Introduction to Linear programming problem, Formulation of linear programming problem, general statement of linear programming problem, Assumptions underlying linear programming, solution to linear programming-graphic method ,some special cases in linear programming

Linear programming II: Simplex Method (6 Hrs.)
Simplex method, Solution to maximization problems, solution to minimization problems, Big-M method, some special cases in linear programming

Transportation problem (5 Hrs.)
VAM method for generating initial basic feasible solution, Testing Optimality condition by using MODI Method, Balanced and unbalanced transportation problem.

Assignment problem (3 Hrs.)
Introduction, Hungarian Assignment Method (HAM), some special cases: Unbalanced assignment problems, constrained assignment problem.

Unit 3: Queuing Models (6 Hrs.)
Introduction, economies of the queuing problem, queuing system and its essential elements, types of queuing model (focused on only Single channel system and multi-channel system), operating characteristics of single channel system (Poisson-exponential single server model-infinite population),Poisson-exponential, multiple server model-infinite population.

Unit 4: Theory of Games (6 Hrs.)
Introduction, Basic terminologies, Two persons zero-sum game, pure strategy and mixed strategy, dominance rule, algebraic method, arithmetic method and graphical method.

Unit 5: Decision Theory (5 Hrs.)
Introduction, decision making environment, Decision making criteria under risk: EMV criterion, EOL criterion, EVPI, Decision tree analysis, Marginal analysis, Decision making criteria under uncertainty.

Unit 6: Networking Analysis (8 Hrs.)
PERT/CPM networks, scheduling the activities: Earliest and Latest Times, Time-cost trade off analysis.

Text / Reference Books:

- Sharma, J.K. (2013). *Operations Research Theory and application.*(5^{th}ed). New Delhi:Laxmi Publications
- Operations Research: An Introduction, Handy A. Taha, 10/e, Pearson

Web Technology II

Course Title: Web Technology II
Course No: BIT301
Nature of the Course: Theory + Lab
Semester: V

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description:
This course covers the concepts of server side scripting using the PHP programming language.

Course Objectives:
The main objective of this course is to provide basic concepts of PHP including handling of functions, arrays, strings, class and objects, forms, databases, cookies, sessions, exceptions and file handling so that students should be able to develop dynamic web applications.

Course Contents:

Unit 1: Introduction (8 Hrs.)
Server Side Scripting, Introduction to PHP, Language Basics: Lexical Structure, Data Types, Variables, Expression and Operators, Flow Control Statements, Including PHP Code, Embedding PHP in Web Pages

Unit 2: Functions (5 Hrs.)
Functions, Defining and Calling Functions, Variable Scope, Function Parameters, Return Values, Variable Functions, Anonymous Functions, Date and Time functions

Unit 3: Strings and Arrays (8 Hrs.)
String Constants, Printing Strings, Accessing Characters in Strings, Cleaning Strings, Encoding and Escaping, Comparing, Manipulating and Searching Strings, Regular Expressions, Array, Indexed vs. Associative Arrays, Defining Array, Storing Data in Array, Multidimensional Array, Extracting Multiple Values, Conversion between Array and Variables, Traversing Arrays

Unit 4: Objects (6 Hrs.)
Objects, Creating Object, Accessing Properties and Methods, Declaring Class, Anonymous Class, Examining Class and Object

Unit 5: Handling Forms (4 Hrs.)
Building forms, Retrieving Form Data, Processing Forms, Setting Response Headers

Unit 6: Working with Database (5 Hrs.)
Using PHP to Access Database, Querying a Database with PHP, CRUD Operations Using Forms

Unit 7: Cookies, Sessions and Authentication (3 Hrs.)
Using Cookies in PHP, HTTP Authentication, Using Sessions

Unit 8: Debugging PHP (3 Hrs.)
The PHP.ini Settings, Error Handling, Error Reporting, Exceptions, Error Suppression, Triggering Errors, Error Handlers, Error Logs

Unit 9: File Handling (3 Hrs.)
File Read, Write, Close, File upload, Parsing CSV File, Parsing JSON File

Laboratory Works:
Laboratory work includes implementing all of the concepts in each chapter. Students have to create a dynamic website using core PHP concepts studied in this course.

References:

1. Kevin Tatroe , Peter MacIntyre, Programming PHP: Creating Dynamic Web Pages, O′Reilly, 2021
2. Robin Nixon , Learning PHP, MySQL & JavaScript: A Step-by-Step Guide to Creating Dynamic Websites, O'Reilly Media, 2021

Software Engineering

Course Title: Software Engineering
Course No: BIT302
Nature of the Course: Theory + Lab
Semester: V

Full Marks: 60+20+20
Pass Marks: 24+8+8
Credit Hrs: 3

Course Description:
This course familiarizes students with different concepts and techniques of software engineering mainly focusing on software practices, different process models, requirements engineering, project management, project planning, quality assurance and software testing techniques.

Course Objectives:
The main objective of this course is to give knowledge of software engineering so that the students will be able to use different methodologies and techniques to develop high quality software.

Course Contents:

Unit 1: Introduction (2 Hrs.)
Professional Software Development**,** Software Engineering Ethics, Case Studies

Unit 2: Software Process Model (8 Hrs.)
Software Process Models, Process Activities, Coping with Change, Process Improvement, Agile Software Development

Unit 3: Requirements Engineering (3 Hrs.)
Functional and Non-Functional Requirements, Requirements Engineering Processes, Requirements Elicitation, Requirements Validation, Requirements Change

Unit 4: System Modeling (6 Hrs.)
Context Models, Interaction Models, Structural Models, Behavioral Models, Model Driven Architecture

Unit 5: Architectural Design (6 Hrs.)
Architectural Design Decisions, Architectural Views, Architectural Patterns, Application Architectures

Unit 6: Design and Implementation (5 Hrs.)
Object-Oriented Design Using the UML, Design Patterns, Implementation Issues, Open-Source Development

Unit 7: Software Testing (5 Hrs.)
Introduction to Software Testing, Development Testing, Test-Driven Development, Types of Testing

Unit 8: Project Management and Planning (5 Hrs.)
Introduction to Project Management, Management Activities, Introduction to Project Planning, Software Pricing, Plan-Driven Development, Project Scheduling, Agile Planning, Estimation Techniques, COCOMO Cost Modeling

Unit 9: Software Quality Assurance (3 Hrs.)
Introduction to Software Quality, Software Quality Assurance, Software Reviews

Unit 10: Configuration Management (2 Hrs.)
Introduction to Version Management, Change Management and Release Management

Laboratory Works:
Student should use project management tools focusing on resource management, project scheduling and people management. They should be use CASE tools for drawing UML diagrams. They should use tools for realizing agile development, version control and change control respectively. They should be able to develop test cases and use tools to demonstrate different types of testing.

References:

1. Software Engineering, 10th Edition, Ian Sommerville, Pearson Education 2016
2. Software Engineering: A Practitioner's Approach, 8th Edition, Roger S. Pressman and Bruce R. Maxim, McGraw-Hill Education 2015
3. C. Ghezzi, M. Jazayeri and D. Mandrioli, Fundamentals of Software Engineering Prentice Hall of India, Ltd.
4. G. Booch, J. Rambaugh, J. Jacobson, The unified Modeling Language – User Guide Addison - Wesley

Information Security

Course Title: Information Security
Course No: BIT303
Nature of Course: Theory + Lab
Semester: V

Full Marks: 60+20+20
Pass Marks: 24+8+8
Credit Hrs: 3

Course Description:
This course familiarizes with basic concepts of information security. This course includes cryptographic algorithms, authentication systems, access controls, malicious logics, network security and security audits and ethical issues.

Course Objectives:
The objective of this course is to familiarize the students with the concepts of information security, different security measures, policies and security mechanisms, security auditsso that students will be able to design, implement and manage the information and computers securely.

Course Contents:

Unit 1: Introduction (4 Hrs.)
1.1. Computer Security Concepts
1.2. Threats, Attacks and Assets
1.3. Security Functional Requirements
1.4. Security Design Principles
1.5. Attack Surfaces and Attack Trees
1.6. Computer Security Strategy

Unit 2: Symmetric and Asymmetric Encryption Algorithms (10 Hrs.)
2.1. Classical Cryptosystems: Substitution and Transposition Ciphers
2.2. Symmetric Encryption Principles
2.3. Data Encryption Standards (DES),
2.4. Basic concepts of fields, Modular Arithmetic, Galois Fields, Polynomial Arithmetic,
2.5. Advanced Encryption Standards (AES)
2.6. Prime Numbers, Fermat's Theorem, Primality Testing: Miller-Rabin Algorithm, Euclidean Algorithm, Extended Euclidean Algorithm, Euler Totient Function
2.7. Asymmetric Encryption
2.8. Diffie-Hellman Protocol , RSA Algorithm

Unit 3: Message Authentication (6 Hrs.)
3.1. Message Authentication
3.2. Secure Hash Functions
3.3. Message Digests: MD5
3.4. Secure Hash Algorithms: SHA-1, SHA-2
3.5. Digital Signature

Unit 4: User Authentication (5 Hrs.)

4.1. User Authentication Principles
4.2. Password-Based Authentication
4.3. Token-Based Authentication
4.4. Biometric Authentication
4.5. Two Factor Authentication
4.6. Security Issues for User Authentication

Unit 5: Access Control (5 Hrs.)

5.1. Access Control Principles
5.2. Subjects, Objects and Access Rights
5.3. Discretionary Access Control
5.4. Role Based Access Control
5.5. Attribute Based Access Control
5.6. Identity, Credential and Access Management
5.7. Trust Frameworks

Unit 6: Malicious Software (6 Hrs.)

6.1. Malicious Software
6.2. Types of Malicious Software
6.3. Advanced Persistent Threat
6.4. Virus
6.5. Worms
6.6. Spam E-mail, Trojans
6.7. System Corruption,
6.8. Zombie, Bots
6.9. Key loggers, Phishing, Spyware
6.10. Backdoors, Rootkits
6.11. Countermeasures for Malwares

Unit 7: IT Security Management, Risk Assessment and Security Auditing (5 Hrs.)

7.1.IT Security Management
7.2.Organizational Context and Security Policy
7.3. Security Risk Assessment
7.4. Security Risk Analysis
7.5. Security Auditing Architecture
7.6. Security Audit Trails
7.7. Implementing Logging Function
7.8. Audit Trail Analysis

Unit 8: Legal and Ethical Issues (4 Hrs.)

8.1.Cybercrime and Computer crime
8.2.Intellectual Property
8.3. Privacy
8.4. Ethical Issues

8.5. Cyber Law in Nepal

Laboratory Works:

The laboratory work includes implementing and simulating the concepts of cryptographic algorithms, hash functions, digital signatures, authentication & authorization systems, and malicious logics. The laboratory work covers implementing programs for following;

- Classical ciphers like Caeser, Railfence
- DES, AES
- Primality Testing, Euclidean Algorithms, Deffie-Hellman RSA
- MD5, SHA-1, SHA-2
- Authentication systems like password based, token based, two factor authentication etc.
- Access control and capability lists
- Malicious Logics

In addition, students have to perform case studies including preparation of security policies for some system and perform the security audits.

References:

1. William Stallings and Lawrie Brown, Computer Security: Principles and Practice, Pearson, Latest Edition
2. William Stallings, Cryptography and Network Security: Principles and Practice, Pearson
3. Mark Stamp, Information Security: Principles and Practices, Wiley
4. Matt Bishop, Introduction to Computer Security, Addison Wesley
5. Matt Bishop, Computer Security, Art and Science, Addison Wesley
6. Charles P. Pfleeger and Shari Lawrence Pfleeger, Security in Computing, Pearson
7. William Stallings, Information Privacy Engineering and Privacy by Design, Pearson

Computer Graphics

Course Title: Computer Graphics
Course No: BIT304
Nature of the Course: Theory + Lab
Semester: V

Full Marks: 60+20+20
Pass Marks: 24+8+8
Credit Hrs: 3

Course Description:
This course covers the basic concepts of Computer Graphics, various algorithms for basic graphics primitives, 2-D geometric transformations on graphical objects, various Clipping algorithms on graphical objects, 3-D geometric transformations, curve representation techniques and projections methods, object surface modeling, visible surface detection, application of illumination and rendering algorithms, virtual reality and animation technique along with basic concept of Open GL.

Course Objectives:
The main Objective of this course is to equip students with the fundamental knowledge and basic technical competence in the field of Computer Graphics, to emphasize on implementation aspect of Computer Graphics Algorithms and to prepare the student for advance areas and professional avenues in the field of Computer Graphics.

Course Contents:

Unit 1: Introduction and Overview of Graphics System (3 Hrs.)
Definition and Representative uses of Computer Graphics, Computer Graphics vs. Image Processing, Application Areas, Overview of Coordinate System, Definition of Scan Conversion, Rasterization and Rendering, Raster Scan & Random Scan Displays, Architecture of Raster Graphics System with Display Processor, Architecture of Random Scan Systems

Unit 2: Output Primitives (6 Hrs.)
Scan conversions of point, line, circle and ellipse: DDA algorithm and Bresenham algorithm for line drawing, midpoint algorithm for circle, midpoint algorithm for ellipse drawing (Mathematical derivation for above algorithms is expected), Filled Area Primitive: Scan line Polygon Fill algorithm, inside outside tests, Boundary Fill and Flood fill algorithm.

Unit 3: Two Dimensional Geometric Transformations (3 Hrs.)
Basic transformations: Translation, Scaling, Rotation, Matrix representation and Homogeneous Coordinates, Composite transformation, Other transformations: Reflection and Shear

Unit 4: Two-Dimensional Viewing and Clipping (3 Hrs.)
Viewing transformation pipeline and Window to Viewport coordinate transformation, Clipping operations: Point clipping, Line clipping algorithms: CohenSutherland, Liang: Barsky, Polygon Clipping Algorithms: Sutherland Hodgeman

Unit 5:Three-Dimensional Graphics (6 Hrs.)
3D Transformations: Translation, Rotation, Scaling, Reflection and Shear, Composite transformations: Rotation about an arbitrary axis, Projections – Parallel, Perspective. (Matrix Representation)

Unit 6: Three-Dimensional Object Representation and Curve Modeling (6 Hrs.)
Boundary Surface Representation Vs Space Partitioning Representation, Polygon Surface Representation: Polygon Table and Polygon Meshes, Wireframe and Sweep Representation, Octree Representation, Bezier Curve, B-Spline Curve, Fractal-Geometry: Fractal Dimension, Koch Curve

Unit 7: Visible Surface Detection (6 Hrs.)
Image Space and Object Space techniques, Back Face Detection, Z-Buffer, A-Buffer, Scan-Line method, Painter's Algorithms, Area Subdivision method

Unit 8: Illumination and Surface Rendering methods (6 Hrs.)
Introduction, Ambient, Diffuse and Specular reflections illumination Model, Constant, Gouraud and Phong shading models

Unit 9: Virtual Reality and Animation (3 Hrs.)
Virtual Reality : Concept of Virtual Reality, Components of VR System, Types of VR System, 3D position Tracker, Navigation and Manipulation Interface, Application of VR, Animation: Introduction to Animation, Traditional Animation Techniques, Principles of Animation, Key framing: Character and Facial Animation, Deformation, Motion capture

Unit 10: Introduction to Open GL (2 Hrs.)
Introduction to OpenGL, Callback Functions, Color Commands, Drawing Pixels, Lines, and Polygons using OpenGL, Viewing, Lighting

Laboratory Works:
Scan conversions: lines, circles, ellipse, filling algorithms, clipping algorithms, 2D and 3D transformation Curves Visible surface determination, Simple animations, Application of these through exercises using appropriate programming languages. List of experiment are:

1. Implement DDA Line Drawing algorithm
2. Implement Bresenham's Line algorithm
3. Implement midpoint Circle algorithm.
4. Implement midpoint Ellipse algorithm.
5. Implement Area Filling Algorithm: Boundary Fill, Flood Fill.
6. Implement Scan line Polygon Filling algorithm
7. Implement 2D Transformations: Translation, Scaling, Rotation, Reflection, Shear.

8. Implement Line Clipping Algorithm: Cohen Sutherland / Liang Barsky.
9. Implement 3D transformation.
10. Implement Curve: Bezier for n control points, B Spline
11. Perform Animation (such as Rising Sun, Moving Vehicle, Smileys, Screen saver etc.)

References:

1. Hearn & Baker, “Computer Graphics C version”, 2nd Edition, Pearson Publication
2. James D. Foley, Andries van Dam, Steven K Feiner, John F. Hughes, “Computer Graphics Principles and Practice in C”, 2nd Edition, Pearson Publication
3. D. Rogers, “Procedural Elements for Computer Graphics”, Tata McGraw-Hill Publications
4. Zhigang Xiang, Roy Plastock, “Computer Graphics”, Schaum‟s Outlines McGraw-Hill Education
5. Rajesh K. Maurya, “Computer Graphics”, Wiley India Publication
6. F. S. Hill, “Computer Graphics using OpenGL”, Third edition, Pearson Publications

Technical Writing

Course Title: Technical Writing
Course No: ENG305
Nature of the Course: Theory + Lab
Semester: V

Full Marks: 60+40
Pass Marks: 24+16
Credit Hrs: 3

Course Description:
This course is designed for students to enhance their skills for workplace writing. This course aims in helping students to produce practical writing in specialized topics necessary for them in their professional life. Furthermore, this course provides students with practical approach to producing their own proposal content, memos, emails, instructions, procedures, manuals, informative briefs, presentations and other pragmatic documents.

Course Objectives:
To enable students to identify the importance and characteristics of technical writing and produce some quality technical pieces of workplace writing

Course Contents:

Unit 1: Why Technical People Needn't Fear Writing (3 Hrs.)
Writing in the Technical Workplace, Why Technical People Can Master Technical Writing, Attributes of Technical Writing, The Writing Process, Exercises: Writing in the Workplace

Unit 2: Technical Sentences Introduction (3 Hrs.)
Find the Real Subject, Find the Real Verb (Avoid Nominalizations), Edit for Conciseness, Edit for Clarity, Check for Inclusive Language, Check the Grammar and Mechanics, Exercises: Editing Technical Sentences

Unit 3: Emails, Letters, and Memos (4 Hrs.)
Letter Format, Memo and Email Formats, Email Etiquette ("Netiquette"), Professional Correspondence: Style and Tone54, Exercises: Standard Correspondence

Unit 4: Short Reports, Proposals, and Technical Documents (4 Hrs.)
Report Structure, Documents That Report on Past Events or Completed Tasks Documents That Report on Ongoing Tasks: Progress Reports, Documents That Recommend Future Actions, Documents That Define Standards: Specifications Lab Reports, Engineering or Project Logs, Exercises: Informal Reports

Unit 5: Formal Reports (3 Hrs.)
Parts of a Formal Report, Formal Report Pagination, Exercises: Formal Reports

Unit 6: Intercultural Communication, Collaborative Writing, and Document Control (4 Hrs.)
Intercultural Communication, Writing in Teams Document Sharing and Control, Exercises: Intercultural Considerations

Unit 7: Technical Graphics (5 Hrs.)
Types and Uses of Graphics Putting Graphics into Reports Rules for Incorporating Report Graphics Avoiding Graphical Misrepresentation Exercises: Technical Graphics

Unit 8: Technical Definitions and Descriptions (3 Hrs.)
Technical Definitions, Technical Descriptions, Exercises: Technical Definitions and Descriptions

Unit 9: Instructions, Procedures, and Manuals55 (5 Hrs.)
The Introduction, the Step-by-Step Instructions, the Conclusion, Notes, Cautions, Warnings, and Danger Alerts, Usability, Manuals, Exercises: Writing and Editing Instructions

Unit 10: Oral Presentations (4 Hrs.)
Planning the Presentation, Making Speech Notes, Using Presenter View, Designing and Using Slides, Practicing the Presentation, Overcoming Stage Fright and Answering Questions, Exercises: Oral Presentations

Unit 11: Ethics (2 Hrs)
Ethics in the Professions, Ethics for Students, Ethics in Technical Writing, Exercises: Ethics

Unit 12: Job Application Packages (3 Hrs.)
The Myth of the Experience Trap, Résumés, Application Letters, Finding Job Openings, Exercises: Job Application Packages

Unit 13: Grammar and Usage (2 Hrs.)
Punctuation and Grammar, Mechanics and Conventions, Glossary of Commonly Misused Words and Phrases

References:

1. Ewald, Thorsten. Writing in the Technical Fields: A Practical Guide. 3rd ed. Canada: Oxford University Press, 2020
2. Anderson, Paul V. Technical Communication: A Reader-Centered Approach. 7th ed. USA: Wadsworth Publishing, 2010
3. Markel, Mike and Stuart A. Selber. Technical Communication. 12th edition. USA: Bedford Books, 2017
4. Smith-Worthington, Daelene and Sue Jefferson. Technical Writing for Success. 3rd ed. USA: Cengage Writing, 2011
5. Tebeaux, Elizabeth and Sam Dragga. The Essentials of Technical Communication. 4th ed. London: Oxford University Press, 2010

NET Centric Computing

Course Title: NET Centric Computing
Course no: BIT351
Nature of the Course: Theory + Lab
Semester: VI

Full Marks: 60+20+20
Pass Marks: 24 +8+8
Credit Hrs: 3

Course Description:
The course covers the concepts of cross-platform web application development using the ASP.NET Core MVC framework using C# programming Language.

Course Objectives:
The objective of this course is to understand the theoretical foundation as well as its practical aspects of ASP.NET Core web application framework and C# language features.

Course Contents:

Unit 1: Language Preliminaries (8Hrs.)
Overview of .Net framework, Compilation and execution of .Net applications, Constructor, Properties, Arrays and String, Indexers, Inheritance, use of "base" keyword, Method hiding and overriding, applying polymorphism in code extensibility, abstract class sealed class, interface, Delegate and Events, Partial class, Collections, Generics, File IO, Try statements and Exceptions, Attributes: Attribute Classes, Named and Positional Attribute Parameters, Attribute Targets, Specifying Multiple Attributes

Unit 2: Introduction to ASP.NET (3 Hrs.)
.NET andASP.NET frameworks: .NET, .NET Core, Mono, ASP.NET Web Forms, ASP.NET MVC, ASP.NET Web API, ASP.NET Core, .NET Architecture and Design Principles, Compilation and Execution of .NET applications: CLI, MSIL and CLR, .NET Core in detail, .NET CLI: build, run, test and deploy .NET Core Applications

Unit 3: HTTP and ASP.NET Core (3 Hrs.)
HTTP, Request and Response Message Format, Common web application architectures, MVC Pattern, ASP.NET Core Architecture Overview, Projects, and Conventions, ASP.NET and ASP.NET MVC

Unit 4: Creating ASP.NET core MVC applications (7 Hrs.)
Setting up the Environment, Controllers and Actions: Create Controllers, Create Actions and Action Results Types, Rendering HTML with Views: Razor Syntax, Understanding Tag Helpers, Models: Binding and Validations, URL Routing and features, Web API Applications: API Controllers, JSON, Dependency Injection and IOC containers

Unit 5: Working with Database (6 Hrs.)
ADO.NET basics: Connection, Command, Reader and Adapter classes, Entity Framework (EF) Core, Object-Relational Mapper (ORM), Adding EF Core to an application: Choosing database provider, data models and data context, Querying and Saving data to database: Create, read, update and delete records

Unit 6: State Management on ASP.NET Core Application (4 Hrs.)
State Management on stateless HTTP, Server-side strategies: Session State, TempData, Using HttpContext, Cache Client-side strategies: Cookies, Query Strings, Hidden Fields

Unit 7: Client-side Development in ASP.NET Core (4 Hrs.)
Common client-side web technologies, JQuery, Forms and Validation, Single Page Application (SPA) Frameworks: Angular, React

Unit 8: Building Applications with React and ASP.NET Core (3 Hrs.)
Creating Forms in React, Making REST API Calls from React to ASP.NET Core for integration

Unit 9: Securing in ASP.NET Core Application (5 Hrs.)
Authentication: ASP.NET Core Identity, Adding authentication to apps and identity service configurations, Authorization: Roles, Claims and Policies, Securing Controllers and Action Methods, Common Vulnerabilities: Cross-site Scripting attacks, SQL Injection attacks, Cross-site Request Forgery (CSRF), Open Redirect Attacks

Unit 10: Hosting and Deploying ASP.NET Core Application (2 Hrs.)
App Servers and Hosting models: IIS, Nginx, Apache, ASP.NET Core Module, Kestrel, Docker and Containerization, Publish toAzure cloud

References:

1. C# 8.0 and .NET Core 3.0 – Modern Cross-Platform Development, Fourth Edition, by Mark J. Price, 2019
2. ASP.NET Core in Action, by Andrew Lock, 2018
3. Learning ASP.NET Core 2.0, Michel Bruchet, Jason De Oliveira, 2017
4. Learn ASP.NET Core 3 - Second Edition, Kenneth Yamikani Fukizi, Jason De Oliveira, Michel Bruchet, 2019
5. ASP.NET Core 5 and React By Carl Rippon

Laboratory works:
Students will have to complete a project covering most of the features of above course using ASP.NET Core and C#.

Homework Assignments:
Homework assignments can be given according to the course covered throughout the semester.

Computer Usage:
Windows PC or workstation installed with Latest Visual Studio Code or Visual Studio, .NET core SDK (3.0 or above) and Database: SQL Server.

Database Administration

Course Title: Database Administration
Course No: BIT352
Nature of the Course: Theory + Lab
Semester: VI

Full Marks: 60+ 20+20
Pass Marks: 24+8+8
Credit Hrs: 3

Course Description:

This course introduces the database administration techniques in Oracle. Most of the DBA's tasks are covered. Topics covered include principles of DBA Roles, Oracle Database Architecture and storage management, Database backup, restoration and recovery, connectivity and user management for database security, Tuning of database and overall DB administration which could be useful for administrator in the future.

Course Objectives:

To understand the basic role, task and responsibilities of Database Administrator, understand the Oracle database architecture, be able to install and configure an Oracle Database, be able to create database objects like tables, views, indexes etc. and able to write PL/SQL Procedures, be able to administer the Oracle Database, create and manage storage structures, create and manage the users, be able to perform backup and recovery, tuning the oracle database for the better performance.

Course Contents:

Unit 1: Introduction Administration Basics (7Hrs.)

1.1. Introduction: Overview of the Oracle Database, Relational Database Concepts, Overview of Oracle Database Architecture, Overview of Oracle Multitenant Architecture, Overview of Oracle Data Guard, Oracle RAC, Oracle ASM, Oracle Cloud, Database Administration Tasks.
1.2. Oracle Architecture: Oracle Database Architecture, the Oracle Database Instance, Memory Structures, Process Architecture and Structures, Server and Client Processes, Database Storage Architecture, Connect to the Oracle Database Instance.
1.3. Administer Database Instance: Administrative Tools Available to a DBA, Use SQL*Plus in Oracle to Manage a Database Instance, use SQL Developer to Manage a Database Instance, Administer the Database using Enterprise Manager (EM), Overview of the Enterprise Manager Framework, Enterprise Manager Cloud Control, Initialization Parameter Files

Unit 2: Network Environment and Storage Structures (5 Hrs.)

2.1. Configuring Network Environment: Overview of Network Configuration, Oracle Net Listener Configuration and Management, Oracle Net Naming Methods, Tools for Configuring and Managing the Oracle Network, using the Net Configuration Assistant,

Configure Client Connections with Net Manager, View Listener Configuration, Start and Stop the Oracle Listener, use TNSPING to Test Oracle Net Connectivity, Connect to the Database, Configure Net Services with Enterprise Manager.

2.2. Storage Structures: Overview of Data Storage, the Database Block, Overview of Tablespaces and Datafiles, use Enterprise Manager to view the Storage Structure of the Database, Create and Alter Tablespace Commands, Temporary Tablespaces, Create and Manage Datafiles, use OMF, Drop Tablespaces and Datafiles

Unit 3: Users and Privileges (5 Hrs.)

3.1. Manage Users: Predefined Database Administration Accounts, User Accounts, Create a User Account, User Authentication, Change a User's Password, Manage a User Account, Drop a User Account, Monitor User Information, Terminate User Sessions, Create a Schema Only Account

3.2. Mange Privileges: Database Access, Oracle Supplied Roles, System and Object Level Privileges, the Grant and Revoke Commands, Create, Modify and Drop Roles, Use Predefined Roles

Unit 4: Profiles, Resources, and Auditing (4 Hrs.)

4.1. Profiles And Resources: Overview of User Profiles, Profile Resource Parameters, Create Profile Command, Manage Passwords with Profiles, Control Resource Usage with Profiles, Maintain Profiles

4.2. Database Auditing: Overview of Database Security, Overview of Database Auditing, Security Compliance, Standard Auditing, Unified Audit Trail, Separation of Audit Responsibilities with The AUDIT_ADMIN And AUDIT_VIEWER Roles, Configure the Audit Trail, Specify Audit Options.

Unit 5: Concurrency, Backup and Recovery (7 Hrs.)

5.1. Concurrency: Levels of Locking in Oracle, Methods Used to Acquire Locks, Data Concurrency, Possible Causes of Contention, DML Locks, Prevent Locking Problems, Detect Lock Contention, Resolve Conflicts

5.2. Undo Management: Undo Data Overview, Monitor and Administer Undo, Configure Undo Retention, Switch Undo Tablespaces, Specify the Retention Period, Guarantee Undo Retention, Retention Period tor Flashback Queries, View Undo Space Information, use the Undo Advisor, Size the Undo Tablespace, Alter an Undo Tablespace to a Fixed Size

5.3. Backup And Recovery: Oracle Backup Solutions, Oracle Suggested Backup Strategy, Overview of Database Backup, Restore and Recover, Flashback Technology, Types of Failure, Instance Recovery, Tune Instance Recovery, The MTTR Advisor, Media Failure, Configure a Database for Recoverability

Unit 6: Database Maintenance and Performance Management (4 Hrs.)

6.1. Database Maintenance: Overview, View the Alert Log, the Automatic Workload Repository, Statistic Levels, the Automatic Database Diagnostic Monitoring, Monitor an Oracle Database, use the Advisors, Set Up Notification Rules
6.2. Performance Management: Tuning Information Sources, Performance Monitoring, Tuning Activities, Performance Planning, Instance Tuning, Performance Tuning Methodology, Performance Tuning Data, Monitoring Performance, Managing Memory, Manage Private Temporary Tables

Unit 7: Tuning and Moving (5 Hrs.)

7.1. Tuning: SQL Tuning, Cancel a SQL Statement in a Session, the Oracle Optimizer, SQL Plan Directives, Adaptive Execution Plans, SQL Advisors, Automatic SQL Tuning Results, Implement Automatic Tuning Recommendations, SQL Tuning Advisor
7.2. Moving Data: Create Directory Objects, Data Pump Architecture, Data Pump Data Dictionary Views, Data Pump Interactive Mode, Data Pump API, use Data Pump to Export Data, Use Data Pump to Import Data, Overview of SQL Loader, Command Line Parameters, Record Filtering, Control File Keywords, Data files, SQL Loader Data Paths, External Tables

Unit 8: Managing Resources and Scheduling Tasks (4 Hrs.)

8.1 Managing Resources: Overview of the Database Resource Manager, use the Resource Manager, Create Resource Plans, the Default Maintenance Resource Manager Plan, Create Resource Plan Directives, Allocate Resources for Resource Plans
8.2 Scheduling Tasks: Introduction to The Scheduler, Access Rights, Scheduler Components and Workflow, Create a Job, Job Classes, use Time Based, Event Based Schedules, Create an Event Based Schedule

Unit 9: Space Management and Oracle Support (4 Hrs.)

9.1. Managing Space: Overview of Space Management, Block Space Management within Segments, Segment Types, Allocate Extents, Allocate Space, Row Chaining and Migration, Create Tables without Segments
9.2. Oracle Support: The Enterprise Manager Support Workbench, Register for Security Updates, Work with Oracle Support, My Oracle Support Integration, Log Service Requests, Manage Patches, Apply a Patch

Laboratory Works:

Student should prepare lab sheet for most of the units in the syllabus. They should practice, design database and implement database administration activities that demonstrates different concepts discussed is the class.

.

References:

1. Oracle Database 19c DBA By Examples: Installation and Administration, Ravindra Gupta, 2021.
2. https://docs.oracle.com/en/database/oracle/oracle-database/19/administration.html
3. Pro Oracle Database 18c Administration: Manage and Safeguard Your Organization's Data, Michelle Malcher and Darl Kuhn, Third Edition.
4. Oracle Database 12c DBA Handbook, Manage a Scalable, Secure Oracle Enterprise Database Environment, Bob Bryla.
5. Oracle DBA Mentor: Succeeding as an Oracle Database Administrator, Brian Peasland.

Management Information System

Course Title: Management Information System
Course No: BIT353
Nature of the Course: Theory + Lab
Semester: VI

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description:
This course covers different concepts of management information system including information system in the global business, collaboration and tools, different types of information systems, ethical and social issues, concept of business intelligence, enterprise applications, and decision making.

Course Objectives:
The main objective of this course is to provide different concepts of management information system to manage business organizations and efficient decision making.

Course Contents:

Unit 1: Information Systems in Global Business Today (3 Hrs.)
What's New in Management Information System?, Globalization Challenges and Opportunities: A Flattened World, The Emerging Digital Firm, Strategic Business Objectives of Information System, Information System and its Dimensions, Business Perspective on Information Systems, Complementary Assets, Academic Disciplines used to Study Information Systems, Sociotechnical Systems

Unit 2: Global Business and Collaboration (6 Hrs.)
Business Process and their Relationship to Information System, Systems for Different Management Groups, Systems for Linking the Enterprise, E-business, E-commerce, and E-government, Collaboration, Social Business, and Benefits, Building Collaborative Culture and Business Processes, Tools and Technologies for Collaboration and Social Business, Information Systems Function in a Business – Information Systems Department, Organizing Information Systems Function

Unit 3: Information Systems, Organization, and Strategy (8 Hrs.)
Organization and its Features, Impact of Information System on Organizations – Economic Impacts, Organization and Behavioral Impacts, Internet and Organizations, and Implications for Design and Understanding of Information Systems, Porter's Competitive Forces Model, Dealing with Competitive Forces using Information Systems, Internet's Impact on Competitive Advantage and Business Value Chain Model, Challenges Posed by Strategic Information System

Unit 4: Ethical and Social Issues in Information Systems (7 Hrs.)
Ethical, Social, and Political Issues raised by Information Systems – Model, Five Moral Dimensions, Key Technology Trends that Raise Ethical Issues, Responsibility, Accountability, and Liability, Ethical Analysis, Candidate Ethical Principles, Professional Codes of Conduct,

Real World Ethical Dilemmas, Information Right, Property Right, Accountability, Liability, System Quality, Quality of Life, Health Risks

Unit 5: Foundations of Business Intelligence (8 Hrs.)
File Organization and Problems with Traditional File Environment, DBMS and its Capabilities, Designing Databases, Nonrelational Databases, Cloud Databases, and Blockchain, Tools and Technologies for accessing Information from Databases to Improve Business Performance and Decision Making, Big Data Challenges, Business Intelligence Infrastructure, Analytical Tools, Assuring Data Quality

Unit 6: Key System Applications for Digital Age (7 Hrs.)
Enterprise Systems, Enterprise Software and Business Value of Enterprise Systems, Supply Chain Management System and Software, Business Value of Supply Chain Management System, Customer Relationship Management System and Software, Business Value of CRM, Challenges of Enterprise Applications, Role of Knowledge Management System in Business, Artificial Intelligence and Machine Learning, Uses of AI in Business, Knowledge Work Systems

Unit 7: Enhancing Decision Making (6 Hrs.)
Types of Decisions, Decision Making Process, Business Value of Improved Decision Making, Information System, Management Activities, and Management Decision Making, Business Intelligence and Business Analytics Support for Decision Making, Decision Support for Operational, Middle and Senior Management with Business Intelligence

References:

1. Management Information Systems: Managing the Digital Firm, Kenneth C. Laudon and Jane P. Laudon, 17th Edition, Pearson, 2022.
2. Information Technology Essentials: Introduction to Information Systems Volume 1, Eric Frick, 2017.
3. Management Information Systems, James O'Brien and George Marakas, 10th Edition, McGraw Hill.

Research Methodology

Course Title: Research Methodology **Full Marks:** 60+40
Course No: RSM354 **Pass Marks:** 24+16
Nature of the Course: Theory **Credit Hrs:** 3
Semester: VI

Course Description:
This course introduces the concepts of research methodology. It also emphasizes on formulating research questions, conducting literature review, data collection, data analysis based on research questions and other various ethical issues, plagiarism.

Course Objectives:
This course focuses on the concept of research methodology; research design, formulation of research questions, process of review of literature, methods of data collection, measurement issues, ethical issues, plagiarism, data analysis and interpretations. After completion of the course, students will also be able to prepare a mini research report following standard notions of research methodology.

Course Contents:

Unit 1: Introduction to Research Methodology (4 Hrs.)
Meaning, objectives, motivation of research, concept of deductive and inductive theory, characteristics of scientific method, understanding of concept, construct, variable; research process

Unit 2: Research Design (6 Hrs.)
Concept of research design and its importance, features of a good research design, exploratory research design, descriptive research design, experimental research design, quantitative & qualitative research, empirical research, case study, applications of different research designs and their limitations, concept of dependent variable, independent variable and assessment of their relationships, issue of generalization of research findings

Unit 3: Identification and Formulation of Research Question (5 Hrs.)
Identification of research questions and its formulation, research objectives, statement of the problem, setting up the research hypothesis, sources of hypothesis and its utilities

Unit 4: Review of Literature (10 Hrs.)
Concept of review of literature, process of reviewing books, journal articles, reports; citation and referencing, an overview of different formats of citation and referencing, citation of books, reports, journal articles in American Psychological Association(APA) format, preparation of a small report based on review work on some relevant specific topic,use of encyclopedias, research guides, handbook, academic databases for computer Science and information technology field, use of reference management software such as Zotero/Mendeley, paper formatting such as LaTeX/MS Office, iThenticate Software for detection of Plagiarism

Unit 5: Methods of Data Collection and Sampling Techniques (7 Hrs.)

Primary and secondary data, method of collecting primary data, preparation of questionnaire, type of questions, characteristics of good questionnaire, concept of sampling, population, sampling frame, sampling and non-sampling error, probability and non-probability sampling, brief overview of simple random sampling, stratified sampling, cluster sampling, systematic sampling, multistage sampling and their practical applications in research problems, sample size estimation for estimating mean and proportion

Unit 6: Measurement and Scaling (3 Hrs.)

Concept of measurement, different levels of measurement, measurement of variables in likert scales, the issue of validity and reliability in research

Unit 7: Data Analysis and Report preparation (10 Hrs.)

Presentation of data through frequency tables, bar charts, pie charts, percentages, cross tabulations, summary measures, use of inferential statistical analysis in bivariate analysis(t-test, chi-square test, correlations, etc.) and concept of multivariate analysis, format of academic research report, preparation of a mini-research report following standard research methodology; ethical issues related to use of data, plagiarism, informed consent, self-privacy while collecting primary data, etc.

References:

1. Bryman A. & Bell E.(2015). *Business Research Methods*. Oxford University Press
2. Day R. A. &Gastel B. (2016).*How to write and publish a scientific paper*. (8thed.). Greenwood Publication.
3. Kerlinger F.N. (2004). *Foundations of Behavioral Research*.Surgeet Publications, New Delhi, India
4. Kothari C.R. (2004). *Research Methodology*. New Age International (P) Limited, Publishers, India
5. Kumar, Ranjit (2011). *Research Methodology*. SAGE Publications Pvt. Limited, India.

Geographical Information System

Course Title: Geographical Information System
Course Code: BIT355
Nature of the course: Theory + Lab
Semester: VI

Full Marks: 60+20+20
Pass Marks: 24+8+8
Credit Hrs: 3

Course Description:
The course covers about basic concepts of capturing and mapping real world, different spatial data model and structure, modeling and database design, spatial data manipulation, analysis and visualization, overview of open GIS, open source GIS data and application of GIS in different fields for communication and decision making process.

Course Objectives:
The main objective of this course is to provide students with knowledge of fundamental concepts of geographic information system.

Unit 1: The basics of geographic information system (5 Hrs.)
Definition of GIS, GIS Components and Functions, GIS and Cartography, Evolution of GIS in Relation to Computational and Information Technology, Benefits of GIS, GIS Application Areas, Introduction to Different GIS Software

Unit 2: Mapping the Real World with Vector and Raster Data (8 Hrs.)
Modeling and Representing the Real World, Vector Data Model, Vector Data Types, Vector Topology and Data Formats, Building Basic Topology, Comparison of Shapefile, Coverage and Geodatabase, Geo-relational and Object-relational Vector Data Models, TIN Data Model, Raster Data Model, Basic Elements of Raster Data, Raster Data Formats, Georeferencing Imagery, Creating Vector Data from Digitization, Map Scale, Precision and Accuracy, Spatial Resolution and Data Volume, Vector vs. Raster Data Model, Map Design and Layout, Map Elements

Unit 3: Data Acquisition Techniques in GIS (8 Hrs.)
Spatial and non-spatial data, Primary and Secondary Data Capture Techniques, Concepts of Field Survey for Large Scale Mapping, Scanning and Digitizing, Introduction to global navigation Satellite System (GNSS), Remote Sensing Technology, Satellite Orbits, Aerial Photography, Photogrammetry, Other emerging imaging techniques, Conversion and Integration of GPS and RS data with GIS

Unit 4: Map Projection and Coordinate System (6 Hrs.)
Concepts of Longitude and Latitude, Geographic and Projected Coordinate Systems, Mathematical Model of Earth, Geoid and Ellipsoids, Horizontal and Vertical Datum, Changing Projection and Coordinate Systems, Types of Projection Systems, Projection Parameters, Working with Map Projection

Unit 5: Vector Data Analysis (7 Hrs.)

Filtering Data using Queries, Vector Overlay Analysis, Geoprocessing Functions, Proximity and Buffer Analysis, Route Optimization and Shortest Path, Mapping Non-spatial Data, Creating ModelBuilder

Unit 6: Raster Data Analysis (7 Hrs.)

Overview of Raster Overlay, Map Algebra, Raster Calculator, Overlaying Raster, Introduction to Interpolation and Spatial Autocorrelation, DEM, Spatial Statistics, Local Raster Operations, Focal Raster Operations, Zonal Raster Operations, Global Raster Operations, Raster Weighted Overlay, Mosaic and Aggregate tools, Distance Measurement

Unit 7: Open GIS and Applications (4 Hrs.)

Introduction of open concept in GIS, Open source software for spatial data analysis, Open Vs Commercial GIS Program, GIS programming and customization, Python script tools, Customizing QGIS with Python, Web Based GIS system, Open source GIS data, Introduction to Google Earth Engine and Applications, GIS application case studies

Laboratory works: The lab should cover at least the concepts given in the chapters

References:

1. P. Lo and Albert K.W. Yeung, Concepts and Techniques of Geographic Information Systems, Pearson Prentice Hall
2. K. T. Chang, Introduction to geographic information systems. Ninth edition, Boston: McGraw-Hill.
3. Longley, P.A., Goodchild, M.F., Maguire, D.J. and Rhind, D.W., Geographic information systems and science. John Wiley & Sons.
4. Huisman, Otto, and Rolf A. de By. "Principles of geographic information systems." ITC Educational Textbook Series 1 (2009): 17.
5. Kerle, Norman, Lucas LF Janssen, and Gerrit C. Huurneman. Principles of remote sensing." ITC, Educational textbook series 2 (2004): 250.
6. Burrough, P. A., McDonnell, R. A., & Lloyd, C. D. (2015). Principles of geographical information systems. Oxford university press.
7. ESRI guide to GIS analysis Andy Mitchell, ESRI press, Red lands

Multimedia Computing

Course Title: Multimedia Computing
Course No: BIT356
Nature of the Course: Theory + Lab
Semester: VI

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description: This course familiarizes students with the concepts of multimedia computing including sound, image, video, animations, data compression, and multimedia applications.

Course Objectives: The main objective of this course is to provide knowledge of different concepts of multimedia computing and their applications.

Course Contents:

Unit 1: Introduction (2 Hrs.)
Multimedia Systems; Components of multimedia; Multimedia System, its characteristics and properties; Structure of Multimedia; Applications

Unit 2: Text / Sound / Audio System (7 Hrs.)
Text: Types of Text, Ways to Present Text, Aspects of Text Design, Character, Character Set, Codes, Unicode, Encryption
Sound / Audio: Basic Sound Concepts, Types of Sound, Digitizing Sound, Audio Formats, Audio tools, MIDI; Speech Generation, Speech Analysis and Speech Transmission

Unit 3: Image and Video (6 Hrs.)
Image: Digital Image Representation, Uses of Images, Formats, Image Color Scheme, Image Enhancement; Image Synthesis, Analysis and Transmission
Video: Analogue and Digital Video, Recording Formats and Standards (JPEG, MPEG, H.261) Transmission of Video Signals, Video Capture

Unit 4: Video and Animation (8 Hrs.)
Digital Video; Video Signal Representation; Computer Video Format; Computer-Based Animation; Animation Language; Timeline and Frame based animation; Timeline and Tween-Based Animation; Methods of controlling Animation; Display of Animation; Transmission of Animation

Unit 5: Data Compression (5 Hrs.)
Introduction; basics of compression; storage space; need of coding; Lossy and Lossless Compression Techniques; Source, Entropy and Hybrid Coding; Lossy Sequential DCT – based mode; Expanded Lossy DCT-based mode; JPEG and MPEG Compression

Unit 6: Abstraction for Programming (5 Hrs.)
Introduction to abstraction levels; Libraries; System Software; Toolkits; Higher Programming Languages; Object Oriented Approaches

Unit 7: Multimedia Design (4 Hrs.)
Development Phases and Development Teams; Analysis, Design, Development and Implementation Phase; Evaluation and Testing Phase

Unit 8: User Interfaces (4 Hrs.)
Basic Design Issues; Video and Audio at the User Interface; User-Friendliness as the Primary Goal

Unit 9: Multimedia Application (4 Hrs.)
Media Preparation and Composition; Media Integration and Communication; Media Entertainment; Telemedicine; E-learning; Digital Video Editing and Production Systems; Video Conferencing; Video-on-demand

Laboratory Works:
The laboratory works should focus on writing programs of different concepts of multimedia computing

References:

1. Multimedia: Computing, Communications and Applications, Ralf Steinmetz and Klara Nahrstedt, Pearson Education Asia
2. Multimedia Communications, Applications, Networks, Protocols and Standards, Fred Halsall, Pearson Education Asia
3. Multimedia Systems, John F. Koegel Buford, Pearson Education Asia
4. Multimedia Fundamentals: Vol. 1- Media Coding and Content Processing, Ralf Steinmetz and Klara Nahrstedt, PHI.

Wireless Networking

Course Title: Wireless Networking
Course No: BIT357
Nature of the Course: Theory + Lab
Semester: VI

Full Marks: 60+ 20+20
Pass Marks: 24+8+8
Credit Hrs: 3

Course Description:

The course addresses the fundamentals of wireless communications and provides an overview of existing and emerging wireless communications networks. It covers radio propagation and fading models, fundamentals of cellular communications, multiple access technologies, and various wireless networks, including past and future generation networks. Simulation of wireless systems under different channel environments will be integral part of this course.

Course Objectives:

To characterize fading multi-path radio channels, describe different types of diversity for mobile radio channels, explain propagation models for mobile and portable wireless communication, analyze simple wireless networks in terms of coverage and capacity, discuss multiple access techniques and slandered, describe mobility management strategies and traffic calculation, describe concept of mobile IP, protocols and routing in ad-hoc network.

Course Contents:

Unit 1: Overview of wireless communications and systems (2 Hrs.)

1.1. Introduction to Wireless Communications, Challenges in Wireless Communication Networks, Cellular Systems from 1G to 3G , Wireless 4G and 5G Systems

Unit 2: Wireless Channel Characterization (7 Hrs.)

2.1. Multipath Propagation Environment, Small Scale Fading, Fading Effects due to Multipath Time Delay Spread, Fading Effects due to Doppler Spread
2.2. Channel Models, Fading Models: Rayleigh Fading Distribution, Ricean Fading Distribution
2.3. Large Scale Path-Loss and Shadowing, Free-Space Path Loss Model, Propagation Over Reflecting Surface (Smoothing Plane), Long Distance Path loss with Shadowing: Okumura-Hara Path Loss Model

Unit 3: Band Pass Transmission Technique for Mobile Radio (9 Hrs.)

3.1. An overview of Digital Communication, Pulse Shaping Technique, Nyquist Pulse Shaping, Raised Cosine Roll-off Filter
3.2. Modulation Techniques for Mobile Radio, Analog and Digital Modulation – An overview, Criteria of Choosing Modulation Schemes, Geometric Representation of Modulated signal, Power Spectral Density, Probability of Error
3.3. Digital Modulation Techniques, Digital Linear Modulation (BPSK, DPSK, QPSK)
3.4. Minimum Shift Keying (MSK), Gaussian Minimum Shift Keying (GMSK), M-array (MPSK, MFSK, QAM and OFDM) Modulation and Demodulation

Unit 4: Equalization, Diversity and Channel Coding (4 Hrs.)

4.1. Basics of Equalization, Equalization in Communications Receivers, Linear Equalizers, Non-Linear Equalization, Decision Feedback and Maximum Likelihood Sequence Estimation Equalizations

4.2. Adaptive Equalization Algorithms, Zero Forcing, Least Mean Square, Recursive Least Squares Algorithms, Fractionally Spaced Equalizers

4.3. Diversity Methods, Advantages of Diversity, Basic Definitions, Space Diversity, Reception Methods (Selection, Feedback, Maximum Ratio and Equal Gain Diversity), Polarization, Frequency and Time Diversity, RAKE Receivers and Interleaving

Unit 5: Fundamental of Cellular Network (6 Hrs.)

5.1. Transmission Control Protocol (TCP), User Datagram Protocol (UDP), Ports, IP Address Network Classes in JDK

5.2. Socket Programming using TCP, Socket Programming using UDP, working with URL's, working with URL Connection Class

Unit 6: Multiple Access in Wireless Network (6 Hrs.)

6.1. Frequency Division Multiple Access (FDMA) Principle and Application, Time Division Multiple Access (TDMA) Principles and Applications

6.2. Spread Spectrum Multiple Access, Frequency Hopped Multiple Access, Code Division Multiple Access, hybrid spread spectrum multiple access techniques, Space Division Multiple Access, Standards for Wireless Local Area Networks

Unit 7: Mobility Management in Wireless Network (5 Hrs.)

7.1. Introduction to Mobility Management, Call Admission Control (CAC), Handoff Management, Handoff Strategies, Handoff Types

7.2. Location Management for Cellular Network, Location Management for PCS Network, Traffic Calculation

Unit 8: Wireless Internetworking (6 Hrs.)

8.1. Introduction to Internetworking for Wireless Networks

8.2. Concept of mobile IP, Architecture and Operation, Tunneling in mobile IP.

8.3. Mobility in IPv6, Transmission Control Protocol (TCP), Wireless Application Protocol (WAP), Wireless Markup Language (WML), Mobile AD HOC Network (MANET), ADHOC Routing Protocols

Laboratory Works:

Students should write programs and prepare lab sheet for most of the units in the syllabus. Majorly, students should practice design and implementation of wireless network. Students are advised to implement the modulator de-modulator, frequency planning, channel assignment as well as routing algorithms used in wireless network. Students are advised to use simulators. Students are advised to visit the mobile service operators, network service providers, internet

service providers and prepare the report including architecture, service, and functioning of the wireless network.

References:

1. Jon W. Mark and Weihua Zhuang, Wireless Communication and Networking, Prentice Hall
2. K. Feher, Wireless Digital Communications, Prentice Hall
3. T. Rappaport, Wireless Communications, Prentice Hall
4. J. Schiller, Mobile Communications, Pearson

Society and Ethics in IT

Course Title: Society and Ethics in IT
Course No: BIT358
Nature of the Course: Theory + Lab
Semester: VI

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description:
This course covers different concepts related with social and ethical concepts, morality, law, anonymity, security, privacy, and intellectual property rights. This course also covers social context of computing, software issues, new frontiers of computer ethics, cyberbullying, and computer crime investigation.

Course Objectives:
The main objective of this course is to provide fundamental knowledge on the concept of social and ethical issues related to information technology.

Course Contents:

Unit 1: Introduction (4 Hrs.)
Emergence of Social and Ethical Problems in Computing; Computer Ethics; Importance of Computer Ethics; Morality (Moral Theories, Moral Decision Making, Moral Codes, Moral Standards, Guilt and Conscience, and Morality and Religion); Law (Nature of Law, Conventional Law, Purpose of Law, Penal Code, Morality and Law); Morality, Etiquettes and Manners

Unit 2: Ethics, Ethical Analysis, and Professions (4 Hrs.)
Traditional Definition; Ethical Theories; Functional Definition of Ethics; Ethical Reasoning and Decision Making; Codes of Ethics; Reflections on Computer Ethics; Technology and Values; Evolution of Professions; Education and Licensing; Professional Decision Making and Ethics; Professionalism and Ethical Responsibilities

Unit 3: Anonymity, Security, Privacy, and Civil Liberties (5 Hrs.)
Introduction; Anonymity (Anonymity and Internet; Advantages, Disadvantages, and Legal Views); Security (Physical Security, Physical Access Control, Information Security Controls, Operational Security); Privacy (Definition, Types and Value of Privacy, Privacy Implications of Database System, Privacy Violations and Legal Implications, Privacy Protection and Civil Liberties); Ethical and Legal Framework for Information (Ethics and Privacy, Ethical and Legal Basis for Privacy Protection)

Unit 4: Intellectual Property Rights and Computer Technology (7 Hrs.)
Definitions; Computer Products and Services; Foundations of Intellectual Property; Ownership; Intellectual Property Crimes; Protection of Ownership Rights; Protecting Computer Software; Transnational Issues and Intellectual Property

Unit 5: Social Context of Computing (6 Hrs.)
Introduction; Digital Divide; Obstacles to Overcome the Digital Divide; ICT in the Workplace; Employee Monitoring; Workplace, Employee, Health, and Productivity

Unit 6: Software Issues (6 Hrs.)
Definitions; Causes of Software Failures; Risk; Consumer Protection; Improving Software Quality; Producer Protection

Unit 7: New Frontiers for Computer Ethics (6 Hrs.)
Artificial Intelligence and Ethics; Virtualization, Virtual Reality, and Ethics; Cyberspace and Ethics

Unit 8: Cyberbullying, Computer Crime Investigation, and Ethics (7 Hrs.)
Cyberbullying (Definition, Types of Cyberbullying, Areas of Society Most Affected by Cyberbullying, Legislation against Cyberbullying, Effects of Cyberbullying, and Dealing with Cyberbullying); Computer Crime; Digital Evidence; Preserving Evidence; Analysis of Digital Evidence; Relevance and Validity of Digital Evidence; Writing Investigation Reports; Ethical Implications and Responsibilities in Computer Forensic Investigation

Laboratory Works:
The laboratory works should focus on using tools to demonstrate virtualization and digital forensics

References:

4. Joseph Migga Kizza, Ethical and Social Issues in the Information Age, Springer International Publishing, 6th Edition, 2017
5. Michael J. Quinn, Ethics for the Information Age, 7th Edition, Pearson Education, 2017
6. Pratley Peter, "*The Essence of Business Ethics*", Prentice Hall of India, New Delhi

Psychology

Course Title: Psychology
Course No: PSY359
Nature of Course: Theory
Semester: VI

Full Marks: 60+40
Pass Marks: 24+16
Credit Hrs: 3

Course Description:
The course is designed to acquaint the students with the concepts, findings and approaches used by psychologists to provide explanations of underlying human behavior as a basis for understanding people in different life setting.

Course Objectives:
To familiarize the students with the basic processes and structures underlying human behavior as a basis for managing people in an organizational setting.

Course Contents:

Unit 1: Introduction (5 Hrs.)
Understanding Psychology: Meaning of Psychology and Development, Scope of Psychology, Major perspectives of Psychology, Goals and applications

Unit 2: Perception (5 Hrs.)
Concepts and Importance, Principles of Perceptual Organization, Constancies and Illusions, Key perceptual processes

Unit 3: Learning (5 Hrs.)
Concept, Models of Learning: Concept and Applications of Classical Conditioning, Operant Conditioning, Insight and Observational Learning, Application of Learning Theories: i) Shaping Behavior - Reinforcement, and Punishment, ii) Learned Helplessness

Unit 4: Memory and Forgetting (6 Hrs.)
Concept and Processes of Memory (Encoding, Storage, Retrieval), Types of memory: working and long term memory, Forgetting: Types and theories, Memory Distortion and Memory Construction, Improving Memory

Unit 5: Cognition (5 Hrs.)
Creative Thinking: Concept, Factors Influencing Creative Thinking, Problem Solving: Concept, Methods of Problem Solving (Trial and Error, Algorithm, Heuristics), Decision-Making: Concept, Common Biases and Errors in Problem Solving : i) Over- Confidence, ii) Anchoring Bias, iii) Availability Bias, iv) Confirmation Bias, v) Representative Bias, vi) Escalation Of Commitment, vii) Hindsight Bias

Unit 6: Emotion and Motivation (5 Hrs.)
Motivation: Concept and Types, Implication of Motivation for Managers, Emotion: Concept and Types. Application of Emotions in Organization (Ability and Selection, Decision-Making, Creativity, Interpersonal Conflict, Deviant Workplace Behaviors) Subjective Well Being, Stress

Unit 7: Intelligence (5 Hrs.)
Intelligence-Concept, Major Approaches of Intelligence: Gardner's Theory of Multiple Intelligence, Sternberg's Triarchic Theory, Cattell's Theory of Intelligence, Variations in Intellectual Ability: Intellectual Disability and Mentally Gifted. Emotional Intelligence: Concept, Goleman's Dimensions of Emotional Intelligence, Artificial Intelligence

Unit 8: Personality (5 Hrs.)
Concept, Determinants, Approaches to Personality: Psychodynamic Approaches to Personality, Traits Approaches to Personality, Learning Approaches to Personality, Humanistic Approaches to Personality, Measuring personality: Objective and projective approach

Unit 9: Social Thought and Behaviors (4 Hrs.)
Social Behavior: i) Persuasion, ii) Attitudes, iii) Prejudices and Techniques to Reduce it, Prosocial Behavior: Social Influences: i) Conformity, ii) Compliance, iii) Obedience (Milgram's Experiment)

References:

1. Baron, R. A. (Latest Edition).Psychology.Prentice-Hall of India.
2. Ciccarelli, Saundra K. & White, N. (2015). Psychology .4 th Edition. Pearson Education, Inc.
3. Feldman, R. S. (2015). Understanding Psychology.11th Edition. McGraw Hill Publication
4. Nolen, S, & A. Wagenaar.(2009). Atkinson & Hilgard's Introduction to Psychology, 15thEdition.Cengage Learning