Bachelor of Science in Computer Science and Information Technology (B.Sc. CSIT)

1. Introduction:

Computer science and information technology provide the foundation for all the magnificent achievements of human discovery, exploration, progress and prosperity that have radically transformed our quality of life and understanding of our universe in past few decades. Computer use within our civilization has exploded exponentially within the last few years. Computer science and information technology have become essential parts of well-round academic preparation in every human domain like education, health, industry, entertainment, creativity research and innovations. They offer many types of lucrative careers and job opportunities every-where in the world regardless of localities. Whatever the future holds for us, whatever human endeavors await to be undertaken, computer science and information technology will continue to play at center stage.

2. Details of Program:

B.Sc. CSIT program duration is for four years (eight semesters). B.Sc. CSIT program evolves around the field of Information Technology, which is essentially about storing, processing, securing, and managing information, networks, software development and testing, information databases, computer architecture, data structure, theory of computation and programming etc. are some of the courses of study covered in the course.

2.1 Program description:

In addition to the core computer science courses and elective courses, the B.Sc. CSIT program offers courses to meet the need of high technology applications that are key requirements for modern industries and projects, manufacturing and service Industries. Foundation and allied courses are designed to meet the need of undergraduate academic program, needs of market, and fast changing Computer Science and Information Technology.

2.2 OBJECTIVES:

B.Sc. CSIT program has been designed to achieve following objectives:

- To synergize Information Technology in its entire ramification.
- To provide basic inputs in various aspects of IT and its other interdisciplinary interfaces.
- Focus of the program is Information Technology and Management of Information Technology.
- To cater to the needs of effectively managing the business by bridging the gap between managerial practices in vogue and Information Technology.
- To study analysis, design, and development of software and hardware used to solve problems in a variety of business, scientific and social contexts.

2.3 Medium of teaching and examination-

The medium of instruction, text books and examination of the course will be English.

3. Admission and Examinations

3.1 Entry requirement for new student

Intermediate/ PCL or +2 level in science stream passed with minimum 40% marks or C grade (at least 1.61 CGPA).

3.2 Admission procedure

Student must qualify the entrance test held by the University. The students will be admitted on merit basis.

3.3 Student evaluation

The student's academic performance during a semester will be evaluated internally (session work) and externally (the final examination).

3.4 Examination pattern for Theory and practical:

University Exam: 60%
Internal assessment: 20%
Assignments/practical: 20%
Candidate has to pass separately in Theory and Practical by scoring a minimum of 40% marks (equivalent grade) in the aggregate marks obtained in internal assessment, assignments/lab works/ practical and final university examination.

4. Attendance Requirement

The attendance requirement shall be a minimum of 75% of the classes in any particular subject.

5. Course Admission and Registration

Admission for courses is done at the beginning of each semester. The academic record of a student is maintained in terms of the grade for each course.
Student will be registered once in the university during his course duration for which he/she shall have to apply for as per the rule of university.

6. Final Examination

At the end of semester, final examination will be conducted by the university, according to the examination rules of the university.

GRADING SYSTEM

The letter grade awarded to a student in a subject is based on their consolidated performance in internal and final evaluations/examinations. The letter grade in any particular subject is an indication of a student's relative performance in that course. The pattern of grading is as follows:

EQUIVALENT MARKS %	LETTER GRADE	GRADE VALUE	REMARKS
90 and above	A+	4.00	
80 and below 90	A	3.75	
70 and below 80	B+	3.50	
60 and below 70	B	3.00	
50 and below 60	C	2.50	
Below 50	F	0.00	Fail
Not Qualified (NQ)/Absent	I	-	Incomplete

Grade Point Average (GPA):
Each course letter grade is converted into the specific number of grade value associated with the grade. Grade Point Average (GPA) is calculated by multiplying the grade value of earned grade by the number of credits for each course and dividing the total grade point by the total number of semester credits. The semester wise GPA is indicated as Semester Grade Point Average (SGPA).

Cumulative Grade Point Average (CGPA):
Cumulative Grade Point Average (CGPA) is the grade point average for all completed semesters. CGPA is a weighted average and calculated at the end of the program as:

$CGPA = (c_1g_1+c_2g_2+c_3g_3+\ldots\ldots\ldots\ldots)/(c_1+c_2+c_3+\ldots\ldots\ldots)$

Where c_1, c_2, $c_{3,\ldots\ldots\ldots}$ denote credits associated with the course and g_1, g_2, $g_{3,}\ldots\ldots\ldots\ldots$ denote grade values of the grades earned by the student in the respective course.

The CGPA defines the overall performance category as shown below:

CGPA	**Equivalent Division**
3.75 – Above 4.00	First Division with Excellence
3.50 – Below 3.75	First Division with Distinction
3.00 – Below 3.50	First Division
2.50 – Below 3.00	Second Division
2.00 – Below 2.50	Pass Division
Below 2.00	Fail

Degree Requirements:
For graduation a student should have:

- A 'D' or better grade in each of the subject as specified in the curricular structure section,
- Complete all the courses and dissertation as specified in the curricular structure section within the maximum time period mentioned in the duration of the study section, and
- A CGPA of 2.00 or higher.

RAJARSHI JANAK UNIVERSITY
CURRICULUM STRUCTURE
Bachelor of Science in Computer Science and Information Technology (BSC CSIT)

FIRST YEAR
FIRST SEMESTER

Course Code	Course Titles	Credit Hours	Full Marks
SCIT 101	Fundamental of Computer and IT	3	100
SCIT 102	Analog and Digital Electronics	3	100
SCIT 103	Mathematics-I	3	100
SCIT 104	Statistics-I	3	100
SCIT 105	Physics	4	100
Total		**16**	**500**

FIRST YEAR
SECOND SEMESTER

Course Code	Course Titles	Credit Hours	Full Marks
SCIT 110	Technical Communication English	3	100
SCIT 111	Operating System	3	100
SCIT 112	Introduction to programming concept with C	3	100
SCIT 113	Mathematics-II	3	100
SCIT 114	Statistics-II	3	100
Total		**15**	**500**

SECOND YEAR
THIRD SEMESTER

Course Code	Course Titles	Credit Hours	Full Marks
SCIT 201	Object-Oriented programming with C++	3	100
SCIT 202	Computer Organization & Architecture	3	100
SCIT 203	Discrete Mathematics	3	100
SCIT 204	System Analysis and Design	3	100
SCIT 205	Data Communication and Computer Network	3	100
Total		**15**	**500**

SECOND YEAR
FOURTH SEMESTER

Course Code	**Course Titles**	**Credit Hours**	**Full Marks**
CSIT 210	Numerical Methods	3	100
CSIT 211	Microprocessor	3	100
CSIT 212	Data Structure and Algorithms	3	100
CSIT 213	Computer Graphics	3	100
CSIT 214	Database Management System	3	100
Total		**15**	**500**

THIRD YEAR
FIFTH SEMESTER

Course Code	Course Titles	Credit Hours	Full Marks
SCIT 301	Design and Analysis of Algorithm	3	100
SCIT 302	Web Technology	3	100
SCIT 303	Management and Entrepreneurship for IT Industry	3	100
SCIT 304	Theory of Computation	3	100
SCIT 305	Artificial Intelligence	3	100
Total		15	500

THIRD YEAR
SIXTH SEMESTER

Course Code	Course Titles	Credit Hours	Full Marks
SCIT 310	E-Governance	3	100
SCIT 311	Cryptography and Network Security	3	100
SCIT 312	Software Engineering	3	100
SCIT 313	Java Programming	3	100
SCIT 314	Wireless Communication	3	100
Total		**15**	**500**

FOURTH YEAR
SEVENTH SEMESTER

Course Code	Course Titles	Credit Hours	Full Marks
SCIT 401	Compiler Design and Construction	3	100
SCIT 402	Distributed and Cloud Computing	3	100
SCIT 403	Advanced Java	3	100
SCIT 404	Data Warehousing and Data Mining	3	100
SCIT 405	Project work	3	100
	Elective-I	3	100
Total		**18**	**600**

Elective-I

SCIT 422: .Net Technology
SCIT 423: E-Commerce
SCIT 424: Mobile Application Development
SCIT 425: Operations Research
SCIT 426: Software Architecture and Design Patterns
SCIT 427: Advanced Computer Architecture
SCIT 428: Microprocessor Based Design

FOURTH YEAR
EIGHTTH SEMESTER

Course Code	Course Titles	Credit Hours	Full Marks
SCIT 410	Simulation and Modeling	3	100
SCIT 411	Internet of Things	3	100
SCIT 412	Social and Professional issues in IT	3	100
SCIT 413	Internship	6	100
	Elective-II	3	100
Total		**18**	**600**

Elective-II

SCIT 429: Embedded System
SCIT 430: Software Quality Assurance
SCIT 431: Software project Management
SCIT 432: GIS
SCIT 433: Machine learning
SCIT 434: Image processing
SCIT 435: Natural Language Processing

BSC CSIT

First Year

First Semester

Rajarshi Janak University
Faculty of Science and Technology
Course of Study for B.Sc. CSIT
(First Semester/First Year)

Course Title: Fundamental of Computer and IT
Nature of Course: Theory + Practical
Credit hrs. : 3
L. hrs. : 45

Course Code: SCIT-101
Full Marks: 60+20+20
Pass Marks: 24+8+8

Course Objectives:
This course will enable students:

- To familiarize the important parts of computer system and important tools used in information technology.
- To develop the knowledge of operation of computer and different office applications in different organization.

Course Contents

Unit-1
Computer Basics **[4 hrs.]**
Introduction, Evolution of Computers, Computer Generations, Classification of Computers, Computer Applications, Hardware, software and its types

Unit-2
Computer Organization, Memory and Storage **[5 hrs.]**
Introduction, Basic Computer Organization, Input Devices, Output Devices, Central Processing Unit, The System Bus Architecture, Memory or Storage Unit, interface and ports in computer system

Unit-3
Information Technology Basics **[3 hrs.]**
Introduction, Need for Information Storage and Processing, Information Technology Components, Role of Information Technology, Information Technology and the Internet

Unit-4
Internet and its Tools **[7 hrs.]**
Introduction, Internet Evolution, Basic Internet Terminology, Data over Internet, Modes of Data Transmission, Types of Networks, Types of Topologies, Protocols used in the Internet, Getting Connected to Internet Applications, Internet Applications, Computer Ethics

Unit-5
Emerging Trends in IT **[3 hrs.]**
Introduction, Electronic Commerce (E-Commerce), Electronic Data Interchange (EDI), Smart Cards, Mobile Communication, Internet Protocol TV

Unit-6
Operating System **[5 hrs.]**
Introduction, role and functions of operating system, Types of operating system, Booting, Working Knowledge of GUI Based Operating System, Working with Windows 10.

Unit-7
Database Management Systems **[3 hrs.]**
Data processing, Introduction to Database Management systems, Database design

Unit-8
MS Office Tools **[15 hrs.]**
Introduction to Office Packages, MS Word, MS PowerPoint, MS Excel

Laboratory Work:
The main objective is familiarizing students with operating system and desktop applications using current version of windows and office packages

Text Books/ Reference Books:
1. PK Sinha, "**Computer Fundamentals**", BPB Publications, India.
2. Anita Goel, "**Computer Fundamental**", Pearson.
3. Rajaraman V, Adabala N, "**Fundamental of Computer**", PHI.
4. Alexis Leon, Mathews Leon, **Fundamentals of Information Technology**, Leon Tech-World.

Rajarshi Janak University
Faculty of Science and Technology
Course of Study for B.Sc. CSIT
(First Semester/First Year)

Course Title: Analog and Digital Electronics
Nature of Course: Theory +Practical
Credit hrs. : 3
L. hrs. : 45

Course Code: SCIT-102
Full Marks: 60+20+20
Pass Marks: 24+8+8

Course Objectives:
This course will enable students:

- To develop the knowledge of operation and design of combinational, sequential and data processing circuit.

Course Contents

Unit-1
Introduction to Basic Electronics **[2 hrs.]**
FET and JFET: construction and Working Principle, Types of JFET, MOSFET, Types of MOSFET, construction and Working Principle of MOSFET, Integrated Circuits(ICs)

Unit-2
Number System and Computer Codes **[8 hrs.]**
Introduction, Types of number system, Applications, Weighted Number Systems, Conversions among number Systems, Binary Arithmetic,1's and 2's Complement,9's and 10's complement, Non-Weighted Number Systems: BCD code, Gray code, XS-3 code, Parity, Even and Odd Parity, BCD adder, Error detection and correction technique

Unit-3
Boolean algebra and Logic Gates **[8 hrs.]**
Introduction, Boolean Algebra, Truth Tables, Basic laws of Boolean Algebra, Representation of Boolean Functions, Review of Basic Logic gates, Universal Gates, Arithmetic Gates, Implementations using Logic Gates, NAND and NOR Implementations, Positive and Negative Logic, Introduction to HDL.

Unit-4
Combinational Logic Circuits **[8 hrs.]**
Sum-of-Products Method, Truth Table to Karnaugh Map, Pairs Quads, and Octets, Karnaugh Simplifications, Don't-care Conditions, Product-of-sums Method, conversion of SOP to POS and Vice-versa, Multi-Level NAND and NOR Circuits, Product-of-sums simplifications, Simplification by Quine-McClusky Method, HDL Implementation Models.

Unit-5
Data-Processing Circuits **[9 hrs.]**
Adders:Half Adder, Full Adder, Parallel Adder, Parallel Adder with ripple carry Subtractors: Half Subtractor, Full Subtractors, Multiplexers, Demultiplexers, Decoder, BCD to Decimal Decoders, Seven Segment Decoders, Encoders, Exclusive-OR Gates, Parity Generators and Checkers, Magnitude Comparator, Programmable Array Logic, Programmable Logic Arrays, Read-Only Memory(ROM)

Unit-6

Sequential Circuits **[10 hrs.]**

RS Flip-Flops, Gated Flip-Flops, Edge-triggered RS FLIP-FLOP, Edge-triggered D FLIP-FLOPs, Edge-triggered JKFLIP-FLOPs , FLIP-FLOP Timing, JK Master-slave FLIP-FLOP, Switch Contact Bounce Circuits, Various Representation of FLIP-FLOPs, Conversions of Flip-Flops, Design using state equation and state reduction table.

Registers: Types of Registers, Serial In - Serial Out, Serial In - Parallel out, Parallel In - Serial Out, Parallel In - Parallel Out, Universal Shift Register, Applications of Shift Registers, Register implementation in HDL.

Counters

Asynchronous Counters, Decoding Gates, Synchronous Counters, Changingthe Counter Modulus. Decade Counters, Presetable Counters, Counter Design as a Synthesis problem, A Digital Clock, Counter Design using HDL.

Unit-7

Finite State Machines **[2 hrs.]**

Mealy State Machine, Moore State Machine, Components of ASM charts,

Laboratory Work:

The laboratory work includes implementing the concept of digital electronics using different kit

1. Familiarization of logic gates and different kit
2. Combinational circuits
3. Code converters
4. Proof of De-Morgan's Theorem
5. Adder and Subtractors
6. Sequential Circuits
7. Flip-Flops
8. Counters

Text Books/Reference Books:

1. Floyd,"**Digital Fundamentals**", PHI
2. Donald P Leach, Albert Paul Malvino&GoutamSaha, "**Digital principles and applications"**, 8th Edition, Tata McGraw Hill, 2015
3. M Morris Mano,"**Digital Logic and Computer Design**", 10th Edition, Pearson, 2008.
4. Stephen Brown, ZvonkoVranesic,"**Fundamentals of Digital Logic Design with VHDL**", 2nd Edition, Tata McGraw Hill,2005.
5. R D Sudhaker Samuel, "**Illustrative Approach to Logic Design**", Sanguine-Pearson, 2010.

Rajarshi Janak University
Faculty of Science and Technology
Course of Study for B.Sc. CSIT
(First Semester/First Year)

Course Title: Mathematics-I
Nature of Course: Theory
Credit hrs. : 3
L. hrs. : 45

Course Code: SCIT-103
Full Mark: 60+20+20
Pass Mark: 24+8+8

Course Objectives:
Upon completion of course students will be able to:

- Develop in-depth knowledge and good theoretical and problem solving background in calculus and differential equations.
- Develop the application skill in various branches of Mathematics and social sciences.
- Compare with graduates from various other universities in the field of calculus and differential equations.

Course Contents

Unit-1
Review of Elementary Concept of Sets and Functions **[4 hrs.]**
Sets, Function, Representation of a function, Types of functions, Algebraic and transcendental functions, Inverse and composite functions domain and range of different functions and their graphs.

Unit-2
Derivatives and Mean Value Theorem **[6 hrs.]**
Evaluation of limits, Continuity, Discontinuity, Limits at infinity, Properties of continuous functions, Review of derivatives, Differentiability condition of a function , Higher order derivatives, Following theorems (without proof|), Rolle's, Lagrange's, Cauchy, Maclaurin's and Taylor's theorems and their application in solving numerical.

Unit-3
Application of Derivatives **[6 hrs.]**
Rate measures, Indeterminate forms, L- Hospital's rule (without proof) Asymptotes, Types of asymptotes, Curve tracing techniques, Standard curves and their tracing. Review of maxima and minima of a variable, Optimization problems, Newton method.

Unit-4
Integration Concepts, Standard Formulae **[4 hrs.]**
Integration, Concepts, Standard formulae, integration as the limit of sum, Definite integral and fundamental theorem of integral calculus (without proof) Properties of definite integral.

Unit-5
Application of Antiderivatives **[6 hrs.]**
Area between the curves, Rectification, Arc, Length, Volume and surface area of solid revolution. Approximate integration.

Unit-6

Double Integrals **[6 hrs.]**

Double and iterated integrals in rectangular coordinates, Change of variables in double integrals (polar and curvilinear coordinates). Application of double integrals in mechanics, (mass, moments of a lamina and C.G.)

Unit-7

Ordinary Differential Equation **[5 hrs.]**

Introductions, first order differential equation, Variables separation equations, Homogeneous and non-homogeneous equation of first order exact equation, integrating factors.

Unit-8

Partial Derivatives **[4 hrs.]**

Introduction, Partial differentiation, Geometrical interpretation of partial derivatives of first order. Homogeneous function, Euler's theorem (without proof) on homogeneous functions. Verification of Euler's theorem with examples.

Unit-9

Vector Analysis **[4 hrs.]**

Introduction, Review of dot and cross product of two vectors, Product of three vectors, Differentiation and integration of vectors, Gradient divergence and curl of a vector function. Line and surface integrations normal and binormal vectors.

Text books/ Reference books:

1. James Stewart, "**Calculus Early Transcendentals**", 7E CENGAGE Learning.
2. George B. Thomas, "**Early Transcendentals**", 12thEd. Wesley.
3. M.B. Singh, M. B. Singh, B.C. Bajracharya "**Differential Calculus**", SukundaPustakBhavan.

Rajarshi Janak University
Faculty of Science and Technology
Course of Study for B.Sc. CSIT
(First Semester/First Year)

Course Title: Statistics-I
Nature of course: Theory + Practical
Credit hrs. : 3
L. hrs. : 45

Course Code: SCIT-104
Full Marks: 60+20+20
Pass Marks: 24+8+8

Course Objectives:
The main objective of this course is to impart the knowledge of descriptive statistics, correlation, regression, theoretical as well as applied knowledge of probability and some probability distributions.

Course Contents

Unit-1
Introduction **[3 hrs.]**
Meaning, scope and limitations of Statistics; Application of Statistics in the field of Computer Science & Information technology; Scales of measurement; Variables; Types of Data; Notion of a statistical population

Unit-2
Classification and Presentation of data **[5 hrs.]**
Data classification (need, meaning, objectives and types of classification); Construction of frequency distributions and its principles
Presentation of data: Tabular presentation, Diagrammatic presentation (Bar diagrams, Pie diagram), Graphic presentation (Histogram, frequency polygon, frequency curve and ogive curves) and application with illustrative examples

Unit-3
Descriptive Statistics **[12 hrs.]**
Measures of central tendency; Measures of dispersion; Measures of skewness; Measures of kurtosis; Moments; Applications of descriptive Statistics; five number summary; box plot Problems and illustrative examples related to computer Science and IT

Unit-4
Correlation and Linear Regression **[7 hrs.]**
Bivariate data; Bivariate frequency distribution; Correlation between two variables; Karl Pearson's coefficient of correlation(r); Probable Error; Spearman's rank correlation; Regression Analysis: Fitting of lines of regression by actual mean method and the least squares method; coefficient of determination and it's applications with illustrative examples.

Unit-5
Introduction to Probability **[8 hrs.]**
Concepts of probability; Definitions of probability; Laws of probability; Bayes' theorem; prior and posterior probabilities and it's applications with illustrative examples.

Unit-6

Random Variables and Mathematical Expectation **[5 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; Moment generating function; Characteristic function; Probability mass function and density function and it's applications with illustrative examples.

Unit-7

Probability distributions **[8 hrs.]**

Probability distribution function, Joint probability distribution of two random variables; Discrete distributions: Bernoulli trial, Binomial and Poisson distributions; Continuous distribution: Normal distributions; Standardization of normal distribution and it's applications with illustrative examples.

Laboratory Work:

The laboratory work includes using any statistical software such as Microsoft Excel, SPSS, STATA etc. whichever convenient using Practical problems to be covered in the Computerized Statistics laboratory. The lists are:

1. Diagrammatic and graphic representation of statistical data
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
3. Computation measures of dispersion (ungrouped and grouped data) and Computation of coefficient of variation.
4. Measures of skewness and kurtosis using method of moments, Measures of Skewness using Box and whisker plot.
5. Scatter diagram, correlation coefficient (ungrouped data) and interpretation. Compute manually and check with computer output.
6. Fitting of lines of regression (Results to be verified with computer output)
7. Fitting of lines of regression and computation of correlation coefficient, Mean residual sum of squares, residual plot.
8. Conditional probability and Bayes' theorem
9. Obtaining descriptive statistics of probability distributions
10. Fitting probability distributions in real data (Binomial, Poisson distribution) Normal Distribution)

Text Books/ Reference 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.
3. S.C. Gupta and V. K Kapoor (2010), "**Fundamentals of Mathematical Statistics**", 7thEd. , Sultan Chand and Sons.
4. Binod Kumar Sah (2018), "**Business Statistics**", Revised Edition, Khanal Publication.

Rajarshi Janak University
Institute of Science and Technology
Course of Study for B.Sc. CSIT
(First Semester/First Year)

Course Title: Physics
Nature of Course: Theory + Practical
Credit hrs. : 3+1
L. hrs. : 60

Course Code: SCIT-105
Full Marks: 60+20+20
Pass Marks: 24+8+8

Course Objectives:

At the end of this course the students should be able:

- To acquire sufficient basic knowledge in mechanics, electrodynamics and electronics.
- To apply this knowledge base for studying major courses in CSIT.
- To introduce the concepts and methods of mechanics , electrodynamics and electronics needed for application in various branch of CSIT
- To apply this knowledge base for studying major courses in CSIT.
- Students will be introduced to listed practical works
    - Measure correctly the basic physical quantities
    - Determine errors in measurements
    - Analyze raw data and make valid conclusions
    - Validate corresponding theoretical component
    - Develop proper laboratory skills
    - Design basic physics experiments
    - Interpret experimental results and draw logical conclusions
    - Relate theoretical concepts to practical skills

Course Contents

Unit-1

Review **[2 hrs.]**

Newton's laws of motion, Conservation Laws, potential energy, Gravitational fields, Collisions.

Unit-2

Particle Dynamics **[5 hrs.]**

Equation of motion of uncharged and charged particles, Charged particles in constant and alternating electric field, Charged particles in a magnetic field - cyclotron, magnetic focusing, Charge particles in combined electric and magnetic field.

Unit-3

Harmonic Oscillator **[6 hrs.]**

Harmonic oscillator, example of a diatomic molecule, pendulum with large oscillation, Damped oscillations, power factor, Q – factor, Driven oscillations, resonance, LCR and parallel resonance circuits.

Unit-4

Electrostatics **[6 hrs.]**

Electric field and electric potential, Gauss's law and its applications, Solution of electrostatic problems, Poisson's and Laplace's equations, Examples conducting sphere in a uniform E field, method of images, point charge and a conducting sphere, line charge and line images, systems of conductors, Electrostatic Energy - Potential energy of a group of charges and charge distributions, energy density, energy of a system of charged conductors.

Unit-5

Magnetostatics **[5 hrs.]**

Vector potential and magnetic field, Magnetic forces between currents, Magnetic effects on charged particles, Biot-Savart law and its applications, Energy density in the magnetic field, magnetic energy of coupled circuits.

Unit-6

Maxwell's Equation **[4 hrs.]**

Maxwell's equations - displacement current, Electromagnetic energy, Wave equations without and with source, boundary conditions

Unit-7

Circuit Analysis **[5 hrs.]**

Kirchoff's current and voltage law, concept of current source, voltage source, application of Kirchoff's current and voltage law to simple circuits, Thevenin's and Norton's theorems and their applications.

Unit-8

Bipolar Junction Transistor **[7 hrs.]**

Structure and working of bipolar junction transistor, CB, CC, CE configurations, CE mode characteristics, relation between α and β, DC load line and Q point **,** CB, CE, and CC amplifiers and their DC and AC equivalent circuits, amplifier gain (voltage, current, power) calculations, AC-input and output impendances of different amplifiers, phase inversion in CE amplifier

Unit-9

Operational amplifiers **[5 hrs.]**

Differential amplifiers, ac analysis of differential amplifier, differential gain, input impedance, common mode gain, common mode rejection ratio (CMRR), Operational amplifier, inverting and non-inverting mode of Op-Amp

Laboratory Work: **[15 hrs.]**

1. To draw I-V characteristics of Ohmic and non Ohmic resisters and find voltage current ratio.
2. To study the junction diode and LED characteristics.
3. To study the temperature dependence of resistance of a given semiconductors
4. To determine the impedance of a given LCR circuit.
5. To study characteristics of NPN transistor.
6. To determine dielectric constant by using Lissagous pattern.
7. To construct CE amplifier for the determination of the voltage gain of the amplifier.
8. To study the characteristic of a Zener a diode (Switches) and use it to regulate power supply.
9. To construct and study the working of NOT-AND-OR, NAND, NOR, EX-OR and EX-NOR gates.
10. To determine the band gap of given sample
11. To determine the nature of charge carrier of a given simple by Hall apparatus
12. To study the characteristic of simple junction diode and Zener diode
13. To construct and study CE amplifier
14. To construct and study CC amplifier
15. To construct and study CB amplifier
16. To study output input and transfer characteristics of NPN transistor.
17. To determine the value of acceleration due to gravity by using Bar Pendulum.
18. To determine the value of acceleration due to gravity by using Kater's pendulum.
19. To determine the moment of inertia of a flywheel.
20. To determine the angular acceleration of a flywheel.
21. To determine the Young's modulus of the material by bending beam method.
22. To determine of modulus of rigidity of wire by Maxwell's vibration needle.
23. To study the conservation of momentum using Newton's Cradle.
24. To determine the surface tension of liquid by Jaeger's method.
25. To determine the sensitivity and constant of Ballistic galvanometer.
26. To determine the capacitance by Ballistic galvanometer.
27. To determine the high resistance by the method of leakage.
28. To determine the low resistance by Carey Foster bridge.
29. To determine the magnetic field using search coil.
30. To determine the impedance of LCR series circuit.
31. To determine the time constant for RL, RC and LCR circuit.

32. To determine the efficiency of an electric kettle (or heating element) under varying input voltages.

Note:

Course instructor can conduct experiments according to the requirement.

Text Books/ References Books:

1. D. S. Mathur, "**Mechanics",** S. Chand and Company Ltd
2. David J. Griffith, "**Introduction to Electrodynamics:**", Prentice Hall of India
3. A. P. Malvino, "**Principles of Electronics**", Tata Mc-Graw Hill Publication, 7th Edition
4. John R. Ritz, Frederick J. Milford and Robert W. Christy, "**Foundations of Electromagnetic Theory**", Narosa Publishing House
5. Charles Kittel, Walter Knight, MalvinRuderman, Carl Helmholz, Burton Moyer, "**Berkeley Physics Course, Vol. 1, Mechanics**", McGraw-Hill / Dev Publishers, New Delhi
5. Newtonian Mechanics, P. French, "**MIT Introductory Physics Series**", Viva Bools Pvt Ltd
6. D. Halliday, R. Resnick, J. R. Christman and J. Walker, "**Fundamentals of Physics**", wiley
7. B. L. Theraja, "**Basic Electronics**",S.Chand& Company Ltd
8. T. F. Bogart, "**Electronic Devices and Circuits**", Universal Book Stall, New Delhi
9. V. K. Meheta,"**Principles of Electronics**",S.Chand& company Ltd. 5th Edition
10. Arora C. L. "**B.Sc. Practical Physics"**, S. Chand and Company Ltd. (2010)
11. Squires G. L. "**Practical Physics",** Cambridge University Press (1999)

BSC CSIT

First Year

Second Semester

Rajarshi Janak University
Faculty of Science and Technology
Course of Study for B.Sc. CSIT
(Second Semester/First Year)

Course Title: Technical Communication English
Nature of Course: Theory
Credit hrs. : 3
L. hrs. : 45

Course Code: SCIT 111
Full Marks: 60+20+20
Pass Marks: 24+8+8

Course Objectives:
After taking this course, students will be able to:

- produce technical documents that use tools commonly employed by engineering and computer science professionals;
- communicate effectively in a professional context, using appropriate rhetorical approaches for technical documents, adhering to required templates, and complying with constraints on documents format;
- adapt content and rhetorical strategies according to the audience and purpose for each document;
- select appropriate, credible sources to support the claims, findings or recommendations made in technical documents;
- Incorporate ideas from source material, including images and figures.

Course Contents

Unit-1
Communication Process **[5 hrs.]**
Concept, nature and Significance of Communication Process; Types of Communication; Models of Communication; Verbal and Non-verbal Communication; Barriers of Communication.

Unit-2
Basic Communication Skills **[5 hrs.]**
Introduction to Communication Skills: Oral Presentation; Reading, listening, and note taking skills; writing skills: Field Diary and Laboratory record.

Unit-3
Technical Skills for Effective Communication **[9 hrs.]**
Technical and Scientific Writing /Reporting; Forms of Scientific and technical writing; Features and Style of technical Writing; Mechanics of Style: Abbreviations; Footnotes; Indexing and Bibliographic Procedures; Precise Writing / Abstracting / Summarizing; Curriculum Vitae / Resume Writing

Unit-4

Oral Communication and Organizational Skills **[7 hrs.]**

Impromptu presentation and extempore; Individual/group presentations; Group discussion; Organizing seminar and conferences.

Unit-5

Applications of Technical Writing **[12 hrs.]**

Letters; Memos; E-mail; Reports; The Job Search; Instructions; Web Pages; PowerPoint Presentation; Brochures; Newsletters; Fliers; Graphics.

Unit-6

Structural and Functional Grammar **[7 hrs.]**

Sentence structure; Modifiers, connecting words and verbal; Phrases and clauses; Case; Subjective case; Possessive case; Objective case; Correct usage of Nouns; Correct usage of Pronouns and Antecedents; Correct usage of Adjectives; Correct usage of Adverbs; Correct usage of Articles; Agreement of Verb with the subject: Tense, Mood, Voice, Effective Sentences; Basic Sentences Faults.

Text Books/ Reference Books:

1. Jha, S. K. & Meena Malik, "**Communication Skills**"
2. Gerson, Dr. Steven M., "**Writing That Works:A Teacher's Guide to Technical Writing",** Developed and Published by Kansas Curriculum Centre, Washburn University, Topeka, KS.(For Unit-5)
3. Raman, Meenakshi and Prakash Singh, "**Business Communication",**2nd Edition OXFORD UNIVERSITY PRESS
4. Rutherfoord, Andrea J**.,"Basic Communication Skills for Technology",** 2nd Edition, PEARSON EDUCATION.

Rajarshi Janak University
Institute of Science and Technology
Course of Study for B.Sc. CSIT
(Second Semester/First Year)

Course Title: Operating System
Nature of Course: Theory + Practical
Credit hrs. : 3
L. hrs. : 45

Course Code: SCIT- 112
Full Mark: 60+20+20
Pass Marks: 24+8+8

Course Objectives:
The students will be able to:

- Demonstrate need for OS and different types of OS
- Discuss suitable techniques for management of different resources
- Illustrate processor, memory, storage and file system commands
- Explain the different concepts of OS in platform of usage through case studies

Course Contents

Unit–1
Introduction to operating systems, System structures **[9 hrs.]**
What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and Security; Distributed system; Special-purpose systems; Computing environments. Operating System Services; User - Operating System interface; System calls; Types of system calls; System programs; Operating system design and implementation; Operating System structure; Virtual machines; Operating System generation; System boot. **Process Management** Process concept; Process scheduling; Operations on processes; Inter process communication

Unit–2
Multi-threaded Programming **[9 hrs.]**
Overview; Multithreading models; Thread Libraries; Threading issues. Process Scheduling: Basic concepts; Scheduling Criteria; Scheduling Algorithms; Multiple-processor scheduling; Thread scheduling. **Process Synchronization:** Synchronization: The critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors.

Unit–3
Deadlocks **[9 hrs.]**
Deadlocks; System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock. **Memory Management:** Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation.

Unit–4

Virtual Memory Management **[9 hrs.]**

Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing.

File System, Implementation of File System: File system: File concept; Access methods; Directory structure; File system mounting; File sharing; Protection: Implementing File system: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management.

Unit – 5

Secondary Storage Structures, Protection **[9 hrs.]**

Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; Swap space management. Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix, Implementation of access matrix, Access control, Revocation of access rights, Capability- Based systems.

Laboratory Work:

Implementation of all the algorithms of the syllabus using C/C++.

Case Study: The Linux

Operating System: Linux history; Design principles; Kernel modules; Process management; Scheduling; Memory Management; File systems, Input and output; Inter-process communication.

Text book/ Reference Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, **"Operating System Principles"** 7th edition, Wiley-India, 2006.
2. Ann McHoes Ida M Fylnn, **"Understanding Operating System"**, Cengage Learning, 6th Edition
3. D.M Dhamdhere, **"Operating Systems: A Concept Based Approach"**, 3rd Edition, McGraw- Hill, 2013.
4. P.C.P. Bhatt, **"An Introduction to Operating Systems: Concepts and Practice"**, 4th Edition, PHI (EEE), 2014.
5. William Stallings, **"Operating Systems: Internals and Design Principles"**, 6th Edition, Pearson.

Rajarshi Janak University
Faculty of Science and Technology
Course of Study for B.Sc. CSIT
(Second Semester/First Year)

Course Title: Introduction to Programming Concept with C
Nature of Course: Theory +Practical
Credit hrs. : 3
L. hrs. : 45

Course Code: SCIT-113
Full Mark: 60+20+20
Pass Mark: 24+8+8

Course Objectives:

- This course will enable students to:
- Familiarize with writing of algorithms, fundamentals of C and philosophy of problem solving.
- Implement different programming constructs and decomposition of problems into functions.
- Use and implement data structures like arrays and structures to obtain solutions.
- Define and use of pointers with simple applications.
- Define different modes of graphics with simple application

Course Contents

Unit-1
Computer Programming and Languages **[3 hrs.]**
Introduction, Planning a Computer Program, Steps for Program Development, Problem Solving Tools, Program Control Structures, Generations of Computer Languages, Program Methodology, Programming Models

Unit-2
Over view of C Language **[4 hrs.]**
Introduction, C Character Set, Tokens, Identifiers, Keywords, Constants, Variables, Data Types, Type Conversion, Operators and Expressions, Structure of a C program, Managing Input and Output Operations, Storage Classes.

Unit-3
Control Structures **[6 hrs.]**
Introduction, Decision Making Statements, Looping Statements, Branching Statements.

Unit-4
Arrays and Strings **[6 hrs.]**
Introduction, Types of Arrays, One-Dimensional Array, Multidimensional Arrays, String as Array of Characters, String handling functions

Unit-5

Functions **[8 hrs.]**

Introduction, User Defined Functions, Return Statement, Function Call, Types of Functions based on their Return Type and Function Call, Arrays and Functions, Preprocessor Directives and Standard Library Functions

Unit-6

Structures and Unions **[5 hrs.]**

Introduction, Structure Declaration and Accessing Structure Elements, Initialization of a Structure, Array and Structures, Nested Structures, Structure and Function, Unions

Unit-7

Pointers **[5 hrs.]**

Introduction, Pointer Declaration, Initializing Pointers, Arithmetic Operations with Pointer, Pointers and Arrays, Pointers and Strings, Pointers and Functions, Pointer to a Pointer, Pointer to void, Pointer to Structures and Unions, Dynamic Memory Allocation

Unit-8

File Handling in C **[5 hrs.]**

Introduction, Basic Terminology Associated with Files, Types of Files, Streams and Files, File System Structures, Various Types of File Access Methods, Input and Output Operations on Files and Standard Devices, File Operations, Error Handling in Files, Command Line Arguments

Unit-9

Introduction to Graphics **[3 hrs.]**

Modes, Initialization, Graphics Function

Laboratory Work:

The Laboratory work must cover programming part of all the topics covered in the course. The instructor can conduct the programming as required. Mini project can be assigned by Course Instructor covering the content from the syllabus taught.

Text Books/Reference Books:

- Dennis M. Ritchie, Brian W. Kernighan, **"The C Programming Language"**, Prentice Hall.
- Balagurusamy, E. (2007), **"Programming in ANSI C",** New Delhi, India: Tata McGraw-Hill.
- Kanetkar, Y. P. (2008), **"Let us C"**, 8th Ed, New Delhi, BPB Publication

Rajarshi Janak University
Institute of Science and Technology
Course of Study for B.Sc. CSIT
(Second Semester/First Year)

Course Title: Mathematics-II
Nature of Course: Theory+ Practical
Credit hrs. : 3
L. hrs. : 45

Course Code: SCIT- 114
Full Mark: 60+20+20
Pass Marks: 24+8+8

Course Objectives:
The main objective of the course is:

- To develop in-depth knowledge of concepts and theories of Linear Algebra,
- To enable students to pursue applications of Linear Algebra to social, economic and engineering areas,
- To make students well practiced with problems manually and in MATLAB.

Course Contents

Unit-1
Matrices and System of equations **[8 hrs.]**
Systems of linear equations; Row Echelon Form; Matrix Arithmetic; Matrix Algebra; Elementary Matrices; Partitioned Matrices. Related ordinary and MATLAB exercises.

Unit-2
Determinants **[6 hrs.]**
The Determinant of a matrix; Properties of Determinants; Additional topics and Applications. Related ordinary and MATLAB exercises.

Unit-3
Vector Spaces **[8 hrs.]**
Definition and Examples of Vector Space; Subspaces; Linear Independence; Basis and Dimension; Change of Basis; Row Space and Column Space. Related ordinary and MATLAB exercises.

Unit-4
Linear Transformations **[6 hrs.]**
Definition and Examples of Linear Transformation; Matrix Representations of Linear Transformations; Similarity. Related ordinary and MATLAB exercises.

Unit-5

Orthogonality **[8 hrs.]**

The Scalar Product in $\mathbb{R}^n$; Orthogonal Subspaces; Least Square Problems; Inner Product Space; Orthonormal sets; The Gram-Schmidt Orthogonalization Process; Orthogonal Polynomials. Related ordinary and MATLAB exercises.

Unit-6

Eigenvalues **[9 hrs.]**

Eigen Values and Eigen Vectors; System of Differential Equations; Diagonalization; Hermitian Matrices; The Singular Value Decomposition; Quadratic Forms; Positive Definite Matrices; Non-negative Matrices. Related ordinary and MATLAB exercises.

Laboratory Work:

Implementation of solved numericals covering all the topics using MATLAB/Octave.

Text Book/ Reference Books:

1. Leon, Steven J, "**Linear Algebra with Applications"**, 9th Edition, Pearson
2. Lay, David C, "**Linear Algebra and its Applications"**, 4th Edition, Pearson Edition Wesley.
3. Nepal, TP., Ghimire, JL., et al, "**Mathematics-II for B.Sc. CSIT",** Heritage Publisher & Distributors Pvt. Ltd. Nepal.

Rajarshi Janak University
Institute of Science and Technology
Course of Study for B.Sc. CSIT
(Second Semester/First Year)

Course Title: Statistics-II
Nature of Course: Theory+ Practical
Credit hrs. : 3
L. hrs. : 45

Course Code: SCIT- 115
Full Mark: 60+20+20
Pass Marks: 24+8+8

Course Objectives:
The main objective of the course is to acquire the theoretical as well as practical knowledge of estimation, testing of hypothesis, application of parametric and non- parametric statistical tests, design of experiments, multiple regression analysis, and basic concept of stochastic process with special focus to data/problems related with computer science and information technology

Course Contents

Unit - 1
Sampling Distribution and Estimation **[6 hrs.]**
Meaning of Population and Sample ; Probability sampling and Non Probability sampling techniques; Sampling distribution; sampling distribution of mean and proportion; Central Limit Theorem; Concept of inferential Statistics; Estimation; Methods of estimation; Properties of good estimator; Determination of sample size; Standard Error of sample statistics; Relationship of sample size with desired level of error , application with illustrated examples.

Unit - 2
Testing of hypothesis **[8 hrs.]**
Types of statistical hypotheses; Power of the test, concept of p-value and use of p -value in decision making, steps used in testing of hypothesis, one sample tests for mean of normal population (for known and unknown variance), test for single proportion, test for difference between two means and two proportions, paired sample t-test; F-test; Linkage between confidence interval and testing of hypothesis, application with illustrative examples.

Unit - 3
Non parametric test **[8 hrs.]**
Parametric Vs. non-parametric test; Needs of applying non-parametric tests; One-sample test: Run test, Binomial test, Kolmogorov-Smirnov test; Two independent sample test: Median test, Wilcoxon Mann Whitney test, Chi-square test; Paired-sample test: Wilcoxon signed rank test; Cochran's Q test; Friedman two way analysis of variance test; Kruskal Wallis test, application with illustrative examples.

Unit -4

Multiple correlation and regression **[6 hrs.]**

Multiple and partial correlation; Introduction of multiple linear regression; Hypothesis testing of multiple regression; Test of significance of regression; Test of individual regression coefficient; Model adequacy tests and it's applications with illustrative examples.

Unit – 5

Design of Experiment **[10 hrs.]**

Experimental design; Basic principles of experimental designs; Completely Randomized Design (CRD); Randomized Block Design (RBD); ANOVA table, Efficiency of RBD relative to CRD, Estimations of missing value (one observation only), Advantages and disadvantages; Latin Square Design (LSD): Statistical analysis of m x m LSD for one observation per experimental unit, ANOVA table, Estimation of missing value in LSD (one observation only), Efficiency of LSD relative to RBD, Advantage and disadvantages, applications with illustrative examples.

Unit – 6

Stochastic Process **[7 hrs.]**

Definition and classification; Markov Process: Markov chain, Matrix approach, Steady- State distribution; counting process: Binomial process, Poisson process; Simulation of stochastic process; Queuing system: Main component of queuing system, Little's law; Bernoulli single server queuing process: system with limited capacity; M/M/l system: Evaluating the system performance.

Laboratory Work:

The laboratory work includes implementing concepts of statistics using statistical software tools such as SPSS, STATA, R- Computing, etc.

1. Sampling distribution, random number generation, and computation of sample size.
2. Methods of estimation (including interval estimation)
3. Parametric tests (covering most of the tests)
4. Non-parametric test(covering most of the tests)
5. Partial correlation
6. Multiple regression
7. Design of Experiments
8. Stochastic process

Text Books/ Reference Books:

1. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, & Keying Ye (2012), **"Probability & Statistics for Engineers & Scientists"**, 9th Ed., Prentice Hall
2. S.C. Gupta and V. K Kapoor (2010), **"Fundamentals of Mathematical Statistics"**, 7th Ed., Sultan Chand and Sons.
3. S.C. Gupta and V.K. Kapoor (2010),**"Fundamental of Applied Statistics"**, New edition, Sultan Chand and Sons.
4. Sheldon M. Ross, **"Introduction to Probability and Statistics for Engineers and Scientists"**, 3rd edition, Academic Press.

5. J. Medhi, **"Stochastic Processes"**, New Edition, Wiley Eastern Limited.
6. Michael Baron (2013), **"Probability and Statistics for Computer Scientists"**, 2nd Ed., CRC Press, Taylor & Francis Group, A Chapman & Hall Book.

BSC CSIT

Second Year

Third Semester

Rajarshi Janak University
Faculty of Science and Technology
Course of Study for B.Sc. CSIT
(Third Semester, Second Year)

Course Title: Object-Oriented programming with C++ **Course Code:** SCIT 201
Nature of Course: Theory and Practical **Full Mark:** 60+20+20
Credit hrs. : 3 **Pass Mark:** 24+8+8
L. hrs. : 45

Course Objectives:
The main objective is to learn the basics concept and technique which form the object oriented programming paradigm.

Course Contents

Unit-1
Introduction **[2 hrs.]**
Introduction to programming concept, Evolution of programming methodologies –procedural oriented versus object oriented programming, characteristics of OOPS, basics of OOPS, merits and demerits of OOPs.

Unit-2
Data types, loops, Array **[6 hrs.]**
Different data types, operators and expression in C++, keyword in C++, input and output: comparison by stdio.h and iostream.h, cin and cout, decision band loops: conditional statements –if-else statement, nested if-else statements, switch, break, continue and goto statements, looping statements: for loop, while loop, do while loop, Arrays: fundamental –single dimensional, multidimensional arrays, fundamental of strings, different string manipulations, array of strings.

Unit-3
Object classes and structures **[6 hrs.]**
Definition-Defining the class, defining the members and member function, Access specifier private, public, protected, objects as function arguments, returning objects from the function, scope resolution, operators, and member function on defined outside the class, different between clan and structure, Array as class member data, Array of objects , Basics of structure declaration and defining structure –accessing structures members, array of structure ,Unions, different between structures and unions Enumerated data types-declaration and their uses.

Unit-4

Functions in C++ **[6 hrs.]**

Function definition, function declaration, Built-in functions, users defined function, calling the function, passing parameter actual and formal, different methods of calling the function –call by value, call by reference using reference as parameter and pointer as parameter, overload function, different types of arguments, different number of arguments, inline function , Default arguments, storage classes: automatic, external, static, register.

Unit-5

Constructor and Destructors **[5 hrs.]**

Constructers' constructor with argument, constructor without arguments, constructor with default arguments, Dynamics Constructor, constructer overloading, copy constructor, destructors, manipulating private data members.

Unit-6

Operator overloading and inheritance **[5 hrs.]**

Defining operator overloading ,overloading unary operators , overloading binary operator ,manipulating of string using overloaded operators, rules for overloading operators, Data conversion : conversion between basic types ,conversion between object & basis types, conversion between object of different classes, inheritance : base class and derived class, protected access specifier , public inheritance and private inheritance – member accessibility ,constructor and destructor in derived classes, level of inheritance – single inheritance , multiple inheritance, multi-level inheritance, hierarchical hybrid inheritance.

Unit-7

Pointer, virtual function and friends function **[5 hrs.]**

Pointer: pointer declaration and access, pointer to void, pointer and array, pointer constant and pointer variable, pointer and function, pointer, call by pointer arrays, array of pointer to string, pointer sort, memory management –new and delete, pointer object –referencing members using pointers, self -containing class, this pointer, returning values using this pointer. Virtual function: Normal member function access with pointers, virtual member functions access, late binding, pure virtual function, abstract class, virtual base class, friends function and static function: purpose, definition of friend function, friends, classes, static function, accessing static function numbering positive objects.

Unit-8

IO operators and exception **[5 hrs.]**

Templates and exception handing: Introduction to template, class templates, function templates, member function templates. Templates arguments, Exception handing. Console IO operator: C++ stream and C++ stream classes, unformatted I/O operators, formatted I/O operators – manipulators user defined manipulators.

Unit-9

Files **[5 hrs.]**

Class for file stream operators, opening and closing a file, file nodes , writing an object to disk , reading an object from disk , binary versus character files, I/O with multiple object, stream clam, file pointer specifying the position, specifying the position, specifying the objects, tellg () function, seekg () function, command line arguments.

Laboratory Work:

There will be about 10 lab exercises covering the course. After completing the lab students should be able to develop a small project on their interested field covering most of the concept of C++.

Text Book/ Reference Books:

1. E. Balaguruswamy, **"Object oriented programming with C++"**, Tata Mcgraw Hill.
2. Strousstrup, **"The C++ programming language"**, Pearson Edition.
3. Larfore Robert, **"Object Oriented Programming lint turbo C++"**, Galgotioa publications.
4. Lippman, **"C++ primer"**, Pearson
5. Herbert Schildt , **"C++ Completer Reference"** , Tata MCGRAW Hill
6. Yashwanth Kanetkar, **"Let us C++"**, BPB publication.

Rajarshi Janak University
Faculty of Science and Technology
Course of Study for B.Sc. CSIT
(Third Semester/ Second Year)

Course Title: Computer Organization and Architecture
Nature of Course: Theory + Practical
Credit hrs. : 3
L. hrs. : 45

Course Code: SCIT 202
Full Mark: 60+20+20
Pass Mark: 24+8+8

Course Objectives:

- To learn different architectures & organizations of memory systems, processor organization and control unit.
- To develop independent learning skills and be able to learn more about different computer architectures and hardware.
- To learn about design issues in the development of Multiprocessor organization & architecture.

Course Contents

Unit -1
Introduction to Computer organization and architecture **[4 hrs.]**
Computer Organization &Architecture, Computer Components and Functions, Interconnection Structures, Designing for Performance, Bus Interconnection, PCI

Unit -2
Processor Organization **[8 hrs.]**
Instruction Formats, Instruction Sets, Addressing Modes, Processor Organization, Structure and Function. Register Organization, Instruction Cycle, Instruction Pipelining. Introduction to RISC and CISC Architecture, Instruction Level Parallelism and Superscalar Processors: Design Issues.

Unit-3
Control Unit **[8 hrs.]**
Control Memory, Address Sequencing, Computer Configuration, Microinstruction Format, Symbolic microinstruction, Symbolic Micro Program, CU Operations, Design of Control unit, Micro-Operations, Hardwired Implementation, Micro-programmed Control

Unit-4
Computer Arithmetic **[8 hrs.]**
Addition Algorithm, Subtraction Algorithm, Multiplication Algorithm, Booth Multiplication algorithm, Floating point arithmetic operations, restoring and non-restoring division Algorithms

Unit-5

Memory System Organization **[6 hrs.]**

Memory Hierarchy, Internal Memory: RAM, SRAM and DRAM, Interleaved and Associative Memory. Cache Memory: Design Principles, Memory mappings, Replacement Algorithms, Cache performance, Cache Coherence. Virtual Memory, External Memory: RAID Levels

Unit-6

Input-Output Organization **[6 hrs.]**

Peripheral Devices, I/O Modules, I/O Interface, Modes of Transfer: Programmed, Interrupt Driven and DMA, I/O Processor, Data Communication Processor

Unit-7

Multiprocessors [5 hrs.]

Characteristics of Multiprocessor, Interconnection Structures for Multiprocessor, Inter Processor Communication and Synchronization

Laboratory Work:

The laboratory work includes implementing and simulation the algorithms studied in the course by using high level languages like C, C++, MATLAB, VHDL,etc.

Text Book/ Reference Books:

1. William Stallings "**Computer Organization & Architecture**", 8thEdition, Pearson Education.
2. John P. Hayes, "**Computer Architecture & Organization**", 3rd edition, Tata McGraw Hill.
3. Carl Hamacher, Zconko Vranesic & SafwatZaky "**Computer Organization**", 5 Edition, Tata McGraw Hill.
4. Bartee C. Thomas **"Digital Computer Fundamentals**",6th Edition, McGraw-Hill International Edition
5. M. Morris Mano "**Computer System Architecture**", Pearson Education.
6. Nicholas Carter "**Computer Architecture & Organization**", McGraw Hill.
7. Miles Murdocca & Vincent Heuring "**Computer Architecture & Organization**", 2 Edition, Wiley India.

Rajarshi Janak University
Faculty of Science and Technology
Course of Study for B.Sc. CSIT
(Third Semester/ Second Year)

Course Title: Discrete Mathematics
Nature of Course: Theory + Practical
Credit hrs. : 3
L. hrs. : 45

Course Code: SCIT 203
Full Mark: 60+20+20
Pass Mark: 24+8+8

Course Objectives:
The objective of this course is familiarize on numerous counting techniques and abstract structures which appear frequently in many areas such as an algorithm analysis, data structure, data base management system . Discrete mathematics plays a crucial role in enabling student of computer science to tackle there problems. Graph theory has tremendous application in computer network, switching, group theory has enormous applications coding theory and related areas.

Course Contents

Unit-1
Set Theory and Propositional Logic **[10 hrs.]**
Set theory: Set and Subsets, power set and its properties, Set Operations, Principle of Inclusion and Exclusion, computer Representation of sets, Fuzzy sets and Membership Function, Fuzzy Set Operations

Logic: Introduction, Propositional Equivalences, Predicates and Quantifiers, Negation of Quantified Statements, Nested Quantifiers, Rules of Inference and related Problems. Connectives well-formed formula (WFF), Quantification, examples and properties of WFF into causal form, Resolution and refutation, answer extraction and simple examples.

Unit-2
Relation and Function **[6 hrs.]**
Relations: Relations and their Properties, N-ary Relations with Applications, Representing Relations, Closure of Relations, Equivalence Relations, Partial Ordering, Hasse diagram, Lattice
Functions: Basic Concepts, Injective and Bijective Functions, Inverse and Composite Functions, Graph of Functions, Functions for Computer Science (Ceiling Function, Floor Function, Boolean Function, Exponential Function, logarithmic function)

Unit-3
Group Theory and Graph Theory **[10 hrs.]**
Group theory: Group, subgroup, permutation group with simple examples, cosets, normal subgroup, burn sides theorem and its simple application, codes, prefix codes and group codes

Graphs: Definition and examples, Graphs diagraphs, walk, path cycle, sub graph, complements, and graph isomorphism, vertex degree, Representation of graphs, Euler Trails and circuits, connectivity in Graphs, Euler and Hamiltonian Paths and Circuits, Matching Theory, Shortest Path Algorithm (Dijkstra's Algorithm), Travelling Salesman Problem, Graph Coloring

Trees: Definition, properties and examples, Rooted trees, Tress and sorting, weighted trees, cycle connectedness tree, computer representation of relations, relation diagraph and graphs, transitive closer and Warshall's Algorithm, Spanning Trees, Minimum Spanning Trees (Kruskal's Algorithm)

Network Flows: Graph as Models of Flow of Comodities, Flows, Maximal Flows and Minimal Cuts, the Max Flow-Min Cut Theorem

Unit-4

Number Theory and Counting **[10 hrs.]**

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

Counting: Elementary configuration: - Permutations, and Combinations, Generating functions, Counting Subsets of Set, Binomial Coefficients, Generalized Permutations and Combinations, Basics, Pigeonhole Principle, Generalized Pigeonhole Principle, Lexicographical and Fike's ordering of Permutations, Algorithms for Lexicographical, Reverse Lexicographical and Fike's ordering of Permutation.

Advances in Counting: Recurrence Relations, Solving Recurrence Relations (Homogeneous and Non-Homogeneous Equations), Introduction to Divide and Conquer Relations

Unit-5

Mathematical Induction and Proof Techniques **[9 hrs.]**

Induction: Introduction to Mathematical Induction, Strong Induction, Well ordering, Recursive Definition and structural Induction, Recursively Defined Functions Recursive Algorithms, , Proving Correctness of Recursive Algorithms

Proof Techniques: Basic Terminologies, Different Method: Direct Proof, Indirect Proof, Proof by Contradiction, Proof by contraposition, Proof of Equivalence, vacuous and Trivial Proof, Exhaustive Proof and Proof by cases, Mistakes in Proof

Laboratory Work:

Laboratory works should consist of program development and testing of all the topics discussed in theory class software's like C, C++, MATLAB or any other appropriate programming language platform. Separate lab report should be submitted for each lab applicable unit on individual basis.

Text Books/Reference Books:

1. Rosen, K.H.: **"Discrete Mathematics and its applications"**, 7th Edition, McGraw Hill Education Pvt. Ltd., Chennai
2. Jean- Paul Tremblay and Manohar, R: **"Discrete Mathematical structure with application to Computer Science"**, McGraw Hill.
3. C.L. Liu, **"Elements of discrete Mathematics"**, International Edition
4. Nara Singh Deo, **"Graph theory with application to computer science**", PHI.
5. B. Kolmon, R.C Busby & S. Ross, **"Discrete mathematical structure"**, Pearson.
6. Nils .J. Nilsson, **"Principle of Artificial intelligence"** ,Morgan kaufman Publishers, Inc
7. E.S page and L.B. Willson,"**An introduction to computational"**, Cambridge University.
8. Ralph P. Grimaldi, **"Discrete and combinatorial mathematics**", 5th edition, Pearson education, 2004.

Rajarshi Janak University
Faculty of Science and Technology
Course of Study for B.Sc. CSIT
(Third Semester/Second Year)

Course Title: System Analysis and Design
Nature of Course: Theory + Practical
Credit hrs. : 3
L. hrs. : 45

Course Code: SCIT 204
Full Mark: 60+20+20
Pass Mark: 24+8+8

Course Objectives:
After completing the course students will be able to:

- Analyze and design Information systems using structured system analysis and design modeling tools
- Explain and use object oriented analysis and design modeling tools
- Use Microsoft Visio software and IBM Rational Rose software to develop analysis and design models

Course Contents

Unit-1
Overview of Systems Analysis and Design **[4 hrs.]**
Introduction to system analysis and design, Types of Information Systems(Transaction Processing system, Management Information System, Decision Support System and Expert System), Systems Development Lifecycle(SDLC), System analysis and design tools : Prototyping, Joint Application Design

Unit-2
Modeling Tools for System Analysis **[5 hrs.]**
System Analyst (Introduction, Roles, and Skills), Context Diagram, Data Flow Diagram (Level 0, Level 1, and Level2), CASE tools, E-R Diagram

Unit-3
Structured Methodologies **[5 hrs.]**
The need for a Structured Methodology, Role of CASE in data modeling, Advantages and Disadvantages of Modeling, Data Dictionaries, Modeling tools: Structure English, Decision Table and Decision Tree

Unit-4
System Analysis **[6 hrs.]**
Systems planning and initial Investigation, Information Gathering Techniques (Interviews and Questionnaires), The tools of Structured Analysis, Feasibility Study, Cost-Benefit Analysis (Direct and Indirect Cost, Tangible and Intangible Benefit), Payback Period

Unit-5

Systems Design **[5 hrs.]**

The process and Stages of systems Design, Structure Chart, Designing Forms, Designing Reports, An overview of Database Design

Unit-6

System Implementation **[6 hrs.]**

System Implementation: Introduction, (The process of Coding, Testing and Installation), The Process of Documenting the System, Training Users and Supporting Users, Software Application Testing, Types of Testing, Types of Maintenance, Managing Maintenance

Unit-7

Object-Oriented Analysis and Design **[8 hrs.]**

Object-Oriented Development Life Cycle, The Unified Modeling Language, Use-Case Modeling, Object Modeling: Class Diagrams, Dynamic Modeling: State Diagramming,
Dynamic Modeling: Sequence Diagramming

Unit-8

Object Oriented Implementation **[6 hrs.]**

Object Oriented Implementation, Structured Versus Object oriented based Implementation, Class Diagram to Object Oriented Code, Interaction Diagram to Object Oriented Code

Laboratory Work:

Laboratory works consist of analyzing and designing an Information system using Structured System Analysis and Design. Students are required to use Microsoft Visio to draw different analysis and design models such as DFDs, ERD, and Structure Charts for the Information system under study. Students are also required to use IBM Rational Rose software to analyze and design the same Information system using Object Oriented Analysis and Design, and thereby develop use case models, class diagrams, object diagrams, state diagrams, sequence diagrams, and component diagrams.

Text books/ Reference Books:

1. Jeffrey A. Hoffer, Joey F. George, Joseph S.Valacich, Modern Systems Analysis and Design, Pearson Education, Second Edition
2. Grady Booch, Object Oriented Analysis and Design with Applications, Pearson Education
3. V.Rajaraman, Analysis and Design of Information System, Prentice-Hall, Second Edition

Rajarshi Janak University
Faculty of Science and Technology
Course of Study for B.Sc. CSIT
(Third Semester/ Second Year)

Course Title: Data Communication and Computer Network
Course Code: SCIT 205
Nature of Course: Theory + Practical
Full Mark: 60+20+20
Credit hrs. : 3
Pass Mark: 24+8+8
L. hrs. : 45

Course Objectives:
The main objective of this course is to introduce the underlying of concept of computer networking with its layers topologies, protocols & standers. etc.

Course Contents

Unit-1
Overview of Data Communication and Networking **[12 hrs.]**
Introduction:- Data communication: components, data representation(ASII, ISO etc.) direction of data flow(simplex, half duplex), Network, advantage, disadvantage, physical structure(types of topology), categories of network(LAN, MAN, WAN), internet, brief history, internet today, protocol and standards, Reference model: OS, Reference model, TCP/IP reference model, their comparative study.

Physical layer
Overview of data (analog and digital), signal (analog & digital), transmission (analog & digital) and transmission media (guided and unguided), TDM, FDM, WDM, circuit switching: time division space division switch, TDM bus, Telephone network.

Unit-2
Data Link Layer: **[12 hrs.]**
Types of errors, framing (character and bit stuffing), error detection & correction methods, flow control, protocols stop & Wait ARQ, Go-Back-N ARQ, selective repeat ARQ, HDLC.

Medium access sub layer
Point to point protocol, LCP, NCP, FDDI, Token bus, token ring, Reservation, polling, concentration: Multiple access protocols: pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, FDMA, TDMA, CDMA

Unit-3
Network Layer **[11 hrs.]**
Internetworking & devices: Repeaters, Hubs, bridges, switches, Router, Gateway, Addressing: Internet address, classful address, sub-netting, Routing: techniques, static vs. dynamic routing, routing table for doomful address,, Routing algorithm: Shortest path algorithm , flooding, distance vector routing, protocols: ARP, RARP, IP, ICONP, IPV6.

Transport Layer:
Process to process salivary, UDP, TCP, Congestion algorithm, Leaky bucket algorithm, Token bucket algorithm, choke packets,

Unit-4

Application Layer **[10 hrs.]**

DNS, SMTP, SNMP, FTP, HTTP & WWW; Security: Cryptography, user authentication, security protocols in internet, Firewall.

Modern topics

ISDN Services & ATM: ADSL Technology, Cable modem, SONET, Wireless LAN: IEEE802.11: Introduction to Bluetooth, VLAN'S, Cellular telephony and Satellite network.

Laboratory Work:

The laboratory work under this subject should complete at lease following areas using different tools.

1. Understanding network equipment, wiring and LAN setup
2. OS (LINUX/Windows) server installation and basic networking commands.
3. Overview of IP addressing and sub-netting and static IP setting on LINUX/ windows server.
4. Basic Router Configuration
5. Static and Dynamic Routing
6. Creating VLAN
7. Firewall Implementation and Router access-list configuration
8. Packet capture and header analysis by wire-shark(TCP, UDP, IP)
9. Setup of Web Server, DNS Server, DHCP Server
10. Virtualizations

Text book/ Reference books:

1. B.A. Forouzan , " **Data Communication and Networking"**- TMH
2. A.S. Tanenbaum, **"Computer Network"**, Pearson Education/ PHI
3. N. Stallings, "**Data and Computer Communication",** PHI/ Pearson Education.
4. Zheng & Akthar, **"Network for Computer Scientists and Engineer**" , OUP
5. Black, "**Data and Communication**", PHI
6. Miller, **"Data Communication and network**", Vikas
7. Miller, "**Digital and Data Communication",** Jaico
8. Shay, **"Understanding Data Communication & Network**", Vikas
9. Kurose and Rose **"Computer networking- A top down approach featuring the internet"**, Pearson Education.
10. Leon, Garica, Widjj a , **"Communication network"**, TMH
11. Walrand, **"Communication Networks"** ,TMH
12. Cerner, **"Internetworking with TCP/IP, VOL 1, 2"**, Pearson Education/ PHP.

BSC CSIT

Second Year

Fourth Semester

Rajarshi Janak University
Institute of Science and Technology
Course of Study for B.Sc. CSIT
(Fourth Semester/ Second Year)

Course Title: Numerical Methods
Nature of Course: Theory and Practical
Credit hrs. : 3
L. hrs. : 45

Course Code: SCIT 210
Full Mark: 60+20+20
Pass Mark: 24+8+8

Course Objectives:
After studying this course, students will be able to:

- Explain different types of numerical analysis for solving algebraic and transcendental equations, solution of ordinary and partial differential equations, numerical differentiation and integration in computer programming.

Course Contents

Unit-1

Errors in numerical computing **[3 hrs.]**

Exact and approximate numbers, rounding of numbers, Significant digits, correct digits, various types of errors encountered in computations, Propagation of errors.

Unit-2

Solution of nonlinear equations **[6 hrs.]**

Introduction, Types of Equations, numerical solution of algebraic and transcendental equations by Bisection method, Regula- Falsi method, Newton-Raphson method, and Secant method, convergence of bisection and Newton-Raphson method.

Unit- 3

Solution of system of linear equations **[7 hrs.]**

Review of the existence of solutions and properties of matrices, Consistency of a Linear System of Equations, Direct methods (Gaussian Elimination Method, Gauss-Jordan Method, and Method of factorization), Iterative Methods (Gauss-Jacobi & Gauss-Seide lIteration), Eigen values and Eigen vectors by power method.

Unit-4

Interpolation **[10 hrs.]**

Introduction to interpolation, Forward and backward differences, Interpolation by Newton's forward and backward interpolation formulae. Divided differences- Newton's divided difference formula. Lagrange's interpolation formula and inverse interpolation formula (all formulae without proof), Least Squares Method for Linear (straight line) and Non-linear (quadratic and exponential) Data.

Unit-5

Numerical differentiation and integration [7 hrs.]

Introduction to Numerical Differentiation, first order and second order derivative using Newton's forward and backward difference formulas, Numerical Integration (Trapezoidal Rule, Simpson's 1/3 rule, 3/8 rule with errors); Romberg Integration; integration by Gauss Legendre 2-points and 3-points formulae, Numerical Doub1e Integration.

Unit-6

Solution of Ordinary Differential Equations [7 hrs.]

Introduction to Differential Equation, initial Value Problem, Taylor Series1ethod, Euler's Methodsand its accuracy, ,Heun's Method, Runge-Kutta methods, Solution of system of ordinary differential equations and Solution of Higher Order differential equations by Heun's method, Boundary Value Problems.

Unit-7

Solution of Partial Differential Equations [5 hrs.]

Introduction to Partial Differential Equations, Deriving Difference Equations, Laplace Equation and Poisson's equation, Five point formula, Solution of Laplace and Poisson's equation by Gauss Jacobi and Gauss-Sidel iterative method.

Laboratory Work:

By using any high level language, students must do 12 lab exercises related to this subject. The list of lab Exercises are as follows:

1. Bisection method
2. Newton-Raphson method
3. Gauss elimination method
4. Factorization method
5. Gauss siedel method
6. Interpolation by forward difference method
7. Lagrange interpolation method
8. Least square method(straight line)
9. Trapezoidal rule
10. Simpson's 1/3 rule
11. Euler's method
12. Fourth order Runge-Kutta method

Text Books/ Reference Books:

1. E Balagurusamy,"**NumericalMethods** ",McGraw Hill Education Private Limited , New Delhi
2. S. S Sastry, **"Introduction to Methods of Numerical Analysis"**- Prentice- Hall India
3. Dr. B.S.Grewal, **"Numerical Methods in Engineering and Science"**, 7th Edition, Khanna Publication,

Rajarshi Janak University
Institute of Science and Technology
Course of Study for B.Sc. CSIT
(Fourth Semester/Second Year)

Course Title: Microprocessor
Nature of Course: Theory + Practical
Credit hrs. : 3
L. hrs. : 45

Course Code: SCIT 211
Full Mark: 60+20+20
Pass Mark: 24+8+8

Course Objectives:
After completing the course, students will be able to:

- Study the Architecture of 8085 & 8086 microprocessor.
- Learn the design aspects of I/O and Memory Interfacing circuits.
- Study about communication and bus interfacing.
- Study about the advanced microprocessor

Course Contents

Unit-1
Introduction **[4 hrs.]**

Introduction and Evolution of microprocessor and its types, Microprocessor and Microcontrollers, Organization of Microprocessor Based System, Stored program Concept and Von Neumann Machine, Processing Cycle of a Stored Program Computer, Harvard Architecture and introduction to SAP I and SAP II Architecture.

Unit-2
Programming with 8085 Microprocessor **[12 hrs.]**

Internal architecture of 8085 microprocessor and its working, 8085 pin diagram and functions, Flag and flag registers, Instruction formats, Addressing Modes**, Instructions Set**: Data Transfer Instructions Set, Arithmetic Instructions Set, Logical Instructions Set, Branching Instructions Set, Miscellaneous Instructions Set, Stack and Sub Routines , Delay and Delay Routines, Types of Delay , **Various programs**: Simple Programs with Arithmetic and Logical Operations, Conditions and Loops, Array and Table Processing, Decimal BCD Conversion, Multiplication and Division, program to generate delay, Square wave generation program

Unit-3
Machine cycle and Timing diagram **[5 hrs.]**

Definition: instruction cycle, machine cycle, fetch cycle and execution cycle, Machine cycle of 8085, Timing Diagram of :Op-code fetch , Memory read /write , I/O read/write , Timing diagram of 8085 instructions like LDA,MVI,ADD, CALL etc

UNIT-4
Programming with 8086 Microprocessor **[12 hrs.]**

Internal Architecture and Features of 8086 Microprocessor: BIU and Components, EU and Components, EU and BIU Operations, Segment and Offset Address. Addressing Modes of 8086, Flags, Maximum mode configuration, minimum mode configuration, Assembly Language Syntax: Comments, Reserved words, Identifiers, Statements, Directives, Operators, and Instructions. EXE and COM programs, Assembling,

Linking and Executing, One Pass and Two Pass Assemblers, Keyboard and Video Services, Various Programs in 8086: Simple Programs for Arithmetic, Logical, String Input/Output, Conditions and Loops, Array and String Processing, Read and Display ASCII and Decimal Numbers, Displaying Numbers in Binary and Hexadecimal Formats

Unit-5

Basic I/O, Memory R/W and Interrupt operations [5 hrs.]

Memory devices and classification, Memory mapped I/O,I/O Mapped I/O ,Address decoding:-Unique and non-unique address decoding, Address decoding for I/O and memory , Memory Interfacing, Direct memory access ,8237 DMA controller, Transfer Modes of 8237, Interrupt:-8085 Interrupts and its need Mask able and non-mask able interrupts, 8085 vectored interrupts, Restart and software instructions, 8259 Programmable Interrupt Controller, Priority modes of 8259

Unit-6

Input/output Interfaces [4 hrs.]

Parallel Communication :- Introduction and Applications, Serial communication:- Introduction and Applications, 8255 Programmable peripherals interface, 8251 USART,RS-232 Introduction ,pin configuration and functions of each pin, Interconnection between DTE-DTE and DTE-DCE

Unit-7

Advanced Microprocessor [3 hrs.]

80286: Architecture, Registers, (Real/Protected mode), Privilege levels, descriptor cache, Memory access in GDT and LDT, multitasking, addressing modes

Laboratory Work:

There will be at least 12 lab exercises to program 8085 and 8086 Microprocessors.

Text book/ Reference Book:

1. Ramesh S. Gaonkar, **Microprocessor Architecture, Programming, and Applications with 8085**, Prentice Hall
2. A. P. Malvino and J, A. Brown, **Digital Computer Electronics**, 3rd Edition, Tata McGrawHill
3. D. V. Hall, Microprocessors and Interfacing - Programming and Hardware, McGraw Hill
4. Walter A. Triebel and Avtar Singh, **"The 8088 and 8086 Microprocessors, Programming, Interfacing, Software, Hardware and Applications"**, 4th Edition 2003, Prentice Hall
5. Walter A. Triebel, "The 80286 Microprocessor: Hardware, Software and Interfacing 1st Edition"
6. Barry B. Brey**, "The Intel Microprocessors"**, 8th Edition", Pearson

Rajarshi Janak University
Institute of Science and Technology
Course of Study for B.Sc. CSIT
(Fourth Semester/ Second Year)

Course Title: Data Structure and Algorithms **Course Code:** SCIT 212
Nature of Course: Theory + Practical **Full Mark:** 60+20+20
Credit hrs. : 3 **Pass Mark:** 24+8+8
L. hrs. : 45

Course objectives:
After studying this course, students will be able to:

- Explain different types of data structures, operations on them, and their algorithms
- Make use of elementary data structures such as stack, queue, linked list, tree and graph in problem solving
- Apply searching and sorting operations
- Implement different types of data structures

Course Contents

Unit-1
Introduction **[5 hrs.]**
Data Structures, Abstract data type, Data Structure Operations, Review of Arrays, Structures, Self-Referential Structures, and Unions, Pointers and Dynamic Memory Allocation in C, Representation of Linear Arrays in Memory, Asymptotic notations, Programming Examples.

Unit-2
Stacks and Queues **[11 hrs.]**
Stacks: Definition, Stack Operations, Array Representation of Stacks, Stacks using Dynamic Arrays, Stack Applications: Polish notation, Infix to postfix conversion, evaluation of postfix/prefix expressions, **Queues:** Definition, Array Representation, Queue Operations, Circular Queues, Circular Queues using Dynamic arrays, Dequeues, Priority Queues, Multiple Stacks and Queues. **Recursion** - Factorial, GCD, Fibonacci sequence, Tower of Hanoi (TOH), Programming Examples.

Unit-3
Linked Lists **[9 hrs.]**
Definition, Representation of Linked Lists in Memory, Memory allocation; Garbage Collection, Linked List Operations: Node Creation, Node Insertion Deletion from beginning, and specified position, Doubly Linked list, Circular Linked List, Stacks and Queues as Linked List. Applications of Linked Lists – Polynomials, Sparse matrix representation. Programming Examples

Unit-4
Sorting and Searching **[11 hrs.]**
Selection Sort, Insertion Sort, Bubble Sort, Merge Sort, Quick Sort, Heap Sort, Time complexity of Sorting Algorithms **Searching:** Sequential Search, Binary Search, Time Complexity of Searching Algorithms **Hashing:** Hash Table organizations, Hashing Functions, Static and Dynamic Hashing. **Files and Their Organization*:*** Data Hierarchy, File Attributes Text Files and Binary Files, Basic File Operations, File Organizations and Indexing

Unit-5

Trees **[5 hrs.]**

Terminology, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals, Additional Binary tree operations. Threaded binary trees, Binary Search Trees – Definition, Insertion, Deletion, Traversal, AVL Tree and Balancing algorithm, Application of Trees- Evaluation of Expression, Programming Examples

Unit-6

Graphs **[4 hrs.]**

Definitions, Matrix and Adjacency List Representation of Graphs, Elementary Graph Operations, Traversal methods: Breadth First Search and Depth First Search, Minimum Spanning Trees: Kruskal's and Prim's Algorithm, Shortest Path Algorithms (Dijkstra's Algorithm)

Laboratory Work:

Laboratory work consists of implementing the various types of data structures and algorithms studied in the course using either C or C++. Laboratory work includes the following:

- Implementation of stack
- Implementation of linear and circular queues
- Solution of TOH and Fibonacci Recursion
- Implementation of linked list: singly and doubly linear and circular linked list
- Implementation of trees: AVL trees, balancing of AVL
- Implementation of merge sort
- Implementation of search: sequential, tree and binary
- Implementation of graphs: graph traversals

Text Books/ Reference Books:

1. Ellis Horowitz and SartajSahni **"Fundamentals of Data Structures in C"**, 2nd edition, Universities Press,2014
2. Seymour Lipschutz "**DataStructures"**,Schaum'sOutlines,Revised1st edition,McGrawHill,2014
3. Y. Langsam, M. J. Augenstein and A. M. Tenenbaum, **"Data Structures using C and C++"**, Second Edition, PHI, 2015
4. Gilberg&Forouzan, **"Data Structures: A Pseudo-code approach with C"**, 2nd edition, Cengage Learning,2014
5. ReemaThareja **"Data Structures using C"**, 3rd edition Oxford press,2012
6. Jean-Paul Tremblay & Paul G. Sorenson ,**"An Introduction to Data Structures with Applications"**, 2nd Edition, McGraw Hill, 2013
7. Robert Kruse , **"Data Structures and Program Design in C"**, 2nd edition, PHI,1996

Rajarshi Janak University
Institute of Science and Technology
Course of Study for B.Sc. CSIT
(Fourth Semester/ Second Year)

Course Title: Computer Graphics
Nature of Course: Theory + Practical
Credit hrs. : 3
L. hrs. : 45

Course Code: SCIT 213
Full Mark: 60+20+20
Pass Mark: 24+8+8

Course objectives:
Upon completing the course, students will be able to:

- Design and implement algorithms for 2D graphics primitives and attributes.
- Understand the concepts of clipping and visible surface detection in 2D and 3D viewing, and Illumination Models.
- Illustrate Geometric transformations on both 2D and 3Dobjects.
- Discuss about suitable hardware and software for developing graphics packages using OpenGL.

Course Contents

Unit–1
Introduction to Computer Graphics **[5 hrs.]**
Computer Graphics: Basics of computer graphics, Application of Computer Graphics,
Video Display Devices: Random Scan and Raster Scan displays, color CRT monitors, Flat panel displays. Raster-scan systems: video controller, raster scan Display processor, graphics workstations and viewing systems, Input devices, graphics networks, graphics on the internet, graphics software.

Unit-2
Scan Conversion Algorithms **[5 hrs.]**
Line Drawing Algorithms: Basic Terminologies, DDA Line Algorithm, Bresenham'sLineAlgorithm with derivations and numerical.
Circle and Ellipse Drawing Algorithms: Mid Point Circle and Ellipse Algorithm with derivations and Numericals

Unit–3
Fill area Primitives, 2D Geometric Transformations and 2D viewing **[5 hrs.]**
Fill area Primitives: Polygon fill-areas, OpenGL polygon fill area functions, fill area attributes, general scan line polygon fill algorithm,
2DGeometric Transformations: Basic 2D Geometric Transformations, matrix representations and homogeneous coordinates. Inverse transformations, 2DComposite transformations, other 2D transformations, raster methods for geometric transformations, 2D viewing: 2D viewing pipeline,

Unit-4
Clipping, 3D Geometric Transformations, Color and Illumination Models **[8 hrs.]**
Clipping: clipping window, normalization and viewport transformations, clipping algorithms, 2Dpoint clipping, 2D line clipping algorithms: Cohen-sutherland line clipping, Liang Barsky Clipping Algorithm, Polygon fill area clipping: Sutherland-Hodgeman polygon clipping algorithm and Weiler-Atherton Polygon Clipping.

3DGeometric Transformations: 3D translation, rotation, scaling, composite 3D transformations, other 3D transformations, affine transformations,
Color Models: Properties of light, color models, RGB and CMY color models. Illumination Models: Light sources, basic illumination models-Ambient light, diffuse reflection, specular and phong model.

Unit–5
D Viewing and Visible Surface Detection [8 hrs.]
3DViewing:3D viewing concepts, 3D viewing pipeline, 3D viewing coordinate parameters, Transformation from world to viewing coordinates, Projection transformation, orthogonal projections, perspective projections, The viewport transformation and 3D screen coordinates.
Visible Surface Detection Methods: Classification of visible surface Detection algorithms, Image Space and Object Space Techniques, back face detection, depth buffer Method, A-buffer method, Scan-line Method, Painter's Algorithm, Octree and Ray tracing
Polygon Rendering Methods: Flat Shading, Gouraud Shading and Phong Shading

Unit–6
Input& interaction, Curves and Computer Animation [8 hrs.]
Input and Interaction: Input devices, clients and servers, Display Lists, Display Lists and Modeling, Programming Event Driven Input, Menus Picking, Building Interactive Models, Animating Interactive programs, Design of Interactive programs, Logic operations.
Curved surfaces, Polygon tables, Plane Equations, Polygon Meshes, quadric surfaces(sphere and Ellipsoid), Bezier Spline Curves, Bezier surfaces, Hermite Curve, B-Spline Curve and Surfaces.

Virtual Reality: Basic concepts, components of VR system, Types of VR system, 3D position Trackers, Navigation and manipulation Interfaces

Unit-7
Introduction to OpenGL [6 hrs.]
OpenGL: Introduction to OpenGL ,coordinate reference frames, specifying two-dimensional world coordinate reference frames in OpenGL, OpenGL point functions, OpenGL line functions, point attributes, line attributes, curve attributes, OpenGL point attribute functions, OpenGL line attribute functions, OpenGL raster transformations, OpenGL geometric transformations function, OpenGL 2D viewing functions. OpenGL Transformation functions

Laboratory Work:
The laboratory course consists of implementing following algorithms using high level languages and OpenGL.

1. DDA Line Algorithm using OpenGL
2. Bresenham's line drawing algorithm using OpenGL
3. Mid Point Circle Algorithm using OpenGL
4. Mid Point Ellipse Algorithm using OpenGL
5. Basic transformation on 2D including Translation, Rotation and Scaling using OpenGL
6. Simple 3D Object with basic transformations including Translation, Rotation and Scaling using OpenGL

Text Books/ Reference Books:

1. Donald Hearn & Pauline Baker, **"Computer Graphics with OpenGL",** Version,3rd/ 4thEdition, Pearson Education, 2011
2. Edward Angel, **"Interactive Computer Graphics- A Top Down approach with OpenGL"**, 5th

edition. Pearson Education, 2008
3. James D Foley, Andries Van Dam, Steven K Feiner, John F Huges, **"ComputerGraphics with OpenGL"**, Pearson Education
4. Xiang, Plastock ,Xiang,Zhignag, **"Schaum's Outline Computer Graphics"**, 2nd edition,TMG.
5. Kelvin Sung, Peter Shirley, steven Baer, **"Interactive Computer Graphics, concepts and applications"**, Cengage Learning
6. M MRaiker, **"Computer Graphics using OpenGL"**, Filiplearning/Elsevier

Rajarshi Janak University
Institute of Science and Technology
Course of Study for B.Sc. CSIT
(Fourth Semester/Second Year)

Course Title: Database Management System
Nature of Course: Theory + Practical
Credit hrs.: 3
L. hrs.: 45

Course Code: SCIT 214
Full Mark: 60+20+20
Pass Mark: 24+8+8

Course Objectives:
After completing the course, students will be able:

- To enrich the students with the concept of database management systems using RDBMS.
- To let students demonstrate SQL for database manipulation.
- To make students able to design simple database systems
- To impart skills required to develop applications interacting with DBMS.

Unit-1
DBMS Fundamental **[9 hrs.]**
Characteristics of Database, Advantage of DBMS, History of Database Application. Data Model, Schema, architecture and Instance. Data Independence, Database Language, Data Interface, Database System Environment. Entity Type, Set, Attribute, Role, Structural Constraint, Weak Entity, ER diagram, Specialization and Generalization.

Unit–2
Relational Model and Algebra **[9 hrs.]**
Relational Model Concept, Constraint and Relational Database Schema, Update operation, Transaction, Constraint violation. Unary and Binary Relational Operation, Additional operations like Aggregation, Grouping, Queries in Relational Algebra, Mapping Conceptual Design to Logical Design.

Unit –3
SQL **[9 hrs.]**
SELECT, INSERT, DELETE, and UPDATE statements in SQL, Constraint in SQL, Type of SQL Commands, Data Definition, Data Manipulation Language, Sub Queries, Function, GROUP BY Feature, Updating the Database, Data Definition Facility, Embedded SQL in VIEW, Declaring Variable and Exception, Transaction Processing, Consistency and Isolation, Atomicity and Durability.

Unit –4
Normalization **[9 hrs.]**
Normalization using Functional and Multi-valued Dependency, Functional Dependency, Normal Form based on Primary Key, Second and Third Normal Form, Boyce-Codd Normal Form, Multi-valued Dependency and Fourth Normal Form, Join Dependency and Fifth Normal Form. Other dependencies and Normal Forms, Inference Rule, Equivalence, and Minimal Cover, Properties of Relational Decomposition, Algorithm for Relational Database Schema Design, Null, Dangling Tuple, Alternate Relational Design.

Unit –5

Transaction Processing and Concurrency **[9 hrs.]**

Transaction and System Concept, Desirable Properties of Transactions, Transactions based on Recoverability and Serializability, Transaction support in SQL, Concurrency Control, 2PL, Concurrency based on Timestamp, Multi-version Concurrency, Validation Concurrency, Granularity of Data Items, Multiple Granularity Locking. Database Recovery Concept, Deferred Update Immediate Update, Shadow Paging, Backup and Recovery from Failures.

Laboratory Work:

The laboratory course consists of implementing following concept using the different database tools:

- Database Server Installation and Configuration (MySQL and/or Oracle)
- DB Client Installation and Connection to DB Server.
- CRUD operations by using SQL Command with the existing DB
- Working on DDL, DML Commands (Create, Update Database and Tables)
- Exercise of Procedure/Trigger and DB Administration using MySQL, PostgreSQL, DB2 etc.
- Group Project Work and Presentation along with Viva-voce

Text Book/ Reference Book:

1. Silberschatz Korth and Sudharshan, **"Database System Concepts"**, 6th Edition, Mc- Graw Hill, 2013.
2. Ramakrishnan, and Gehrke,**"Database management systems"**, 3rd Edition, 2014, McGraw Hill

1. RamezElmasri and Shamkant B. Navathe ,**"Fundamentals of Database Systems"**, 7th Edition, 2017, Pearson.
2. Coronel, Morris, and Rob, **"Database Principles Fundamentals of Design, Implementation and Management"**, Cengage Learning2012.

BSC CSIT

Third Year

Fifth Semester

Rajarshi Janak University
Faculty of Science and Technology
Course of Study for B.Sc. CSIT
(Fifth Semester/Third Year)

Course Title: Design and Analysis of Algorithms
Nature of Course: Theory +Practical
Credit hrs. : 3
L. hrs. : 45

Course Code: SCIT 301
Full Mark: 60+20+20
Pass Mark: 24+8+8

Course Objectives:
After studying this course, students will be able to:

- Explain various methods and tools for analyzing algorithms
- Describe different approaches for designing efficient algorithms
- Describe computational solution to well-known problems like searching, sorting, shortest path, spanning trees, etc.
- Estimate the computational complexity of different algorithms
- Design and implement algorithms using appropriate design strategies for solving various kinds of problems, mentioned in the syllabus.

Course Contents

Unit-1
Introduction **[10 hrs.]**
Definition of Algorithm, Algorithm Specification, Performance Analysis: Space complexity, Time complexity, Asymptotic Notations**:** Big-oh notation (*O*), Big-omega notation (Ω), Theta notation (θ), and Little-oh notation (*o*), Mathematical analysis recursive Algorithms using Iteration, Recursion Tree, and Master Methods with Examples**.**

Unit-2
Divide and Conquer **[8 hrs.]**
General method, Binary search, Recurrence equation for Divide and Conquer, Merge sort, Quick sort, Strassen's matrix multiplication, Convex Hull, Advantages and Disadvantages of Divide and Conquer

Unit-3
Greedy Method **[9 hrs.]**
General method, Knapsack Problem, Job Sequencing with Deadlines, Minimum cost spanning trees**:** Prim's Algorithm, Kruskal's Algorithm, Single Source Shortest Paths**,** Huffman Codes.

Unit-4
Dynamic Programming **[6 hrs.]**
General, Multistage Graph Problem, All Pairs Shortest Paths, 0/1 Knapsack Problem, Flow Shop Scheduling

Unit-5

Backtracking **[12 hrs.]**

General method, N-Queens problem, Sum of Subsets Problem, Graph Coloring, Hamiltonian Cycles, Knapsack Problem

Branch and Bound

0/1 Knapsack Problem, Travelling Salesperson Problem,

P, NP, NP-Hard, NP-Complete Problems

Nondeterministic Algorithms, Definition of P, NP, NP-Hard, and NP-Complete Problems with suitable examples, Cook's Theorem, Clique Decision Problem, Chromatic Number Decision Problem, Traveling Salesperson Decision Problem

Laboratory Work:

Laboratory work consists of implementing the following algorithms using either C or C++.

- Implement Recursive Binary search and Linear search and determine the time taken to search an element
- Sort a given set of elements using the Heap sort method and determine the time taken to sort the elements
- Sort a given set of elements using Merge sort method and determine the time taken to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n.
- Sort a given set of elements using Selection sort and find the time required to sort elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n.
- Implement All Pair Shortest paths problem using Floyd's Algorithm
- Implement 0/1 Knapsack problem using dynamic programming.
- From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.
- Sort a given set of elements using Quick sort method and determine the time taken to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n.
- Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm

Text Books/ Reference Books:

1. Ellis Horowitz, Satraj Sahni and S. Rajasekaran, **"Fundamentals of Computer Algorithms"**, 2nd Edition, 2014, Universities Press
2. Anany Levitin,**"Introduction to the Design and Analysis of Algorithms"**, 2nd Edition, 2009, Pearson
3. Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, **"Introduction to Algorithms",** 3rd Edition,PHI
4. S. Sridhar,**"Design and Analysis of Algorithms "**, Oxford (HigherEducation)

Rajarshi Janak University
Institute of Science and Technology
Course of Study for B.Sc. CSIT
(Fifth Semester/Third Year)

Course Title: Web Technology
Nature of Course: Theory + Practical
Credit hrs. : 3
L. hrs. : 45

Course Code: SCIT 302
Full Mark: 60+20+20
Pass Mark: 24+8+8

Course Description:
This course covers concepts of Web and Web design, HTML, CSS, JavaScript, XML, and PHP.

Course Objectives:
The main objective of this course is to cover different concepts of web technologies so that students will be able to develop web sites using HTML, CSS, JavaScript, XML and PHP.

Course Contents

Unit-1 **[6 hrs.]**

Introduction: Web Basics: Internet, WWW, Static and Dynamic Web Page; Web Clients; Web Servers; Client Server Architecture: Single Tier, Two-Tier, Multi-Tier; HTTP: HTTP Request and Response; URL; Client Side Scripting; Server Side Scripting; Web 1.0, Web 2.0, and Web 3.0

Web Design: Concepts of effective web design, Web design issues including Browser, Bandwidth and Cache, Display resolution, Look and Feel of the Website, Page Layout and linking, User centric design, Sitemap, Planning and publishing website, Designing effective navigation

Unit-2 **[9 hrs.]**

Introduction to HTML: The development process, formatting and fonts, writing comments, color, hyperlink, lists, tables, images, Html tags and simple HTML forms, web site structure, Meta tag,
Introduction to XHTML: XML, Move to XHTML, Meta tags, Character entities, frames and frame sets, Browser architecture and Web site structure. Overview and features of HTML5

Unit-3 **[6 hrs.]**

Style sheets: Need for CSS, introduction to CSS, basic syntax and structure, using CSS, background images, colors and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning using CSS, CSS2, Overview and features of CSS3

Unit-4 **[10 hrs.]**

JavaScript: Client side scripting, what is JavaScript, How to develop JavaScript, JavaScript, variables, functions, conditions, loops and repetition

Advanced script: JavaScript and objects, JavaScript own objects, the DOM and web browser environments, forms and validations; Introduction to JQuery

DHTML: Combining HTML, CSS and JavaScript, events and buttons, controlling your browser
Ajax: Introduction, advantages & disadvantages, Purpose of it, Ajax based web application, alternatives of Ajax; Introduction to client side frameworks.

Unit-5 **[4 hrs.]**

XML: Introduction to XML, uses of XML, simple XML, XML key components, DTD and Schemas, Using XML with application. Transforming XML using XSL and XSLT

Unit-6 **[6 hrs.]**

PHP: Starting to script on server side, Arrays, function and forms, advanced PHP

Unit-7 **[4 hrs.]**

Databases : Basic command with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, PHP myadmin and database bugs, Introduction to server side frameworks

Laboratory Work:

The laboratory work includes creating web pages and applications with using HTML, CSS, JavaScript, XML, and PHP. Students have to prepare a web based application, using above mentioned technologies, as a project work.

Text Book/ Reference Book:

1. Jon Duckett, **"Web Design with HTML, CSS, JavaScript and jQuery Set"**, John Wiley & Sons
2. Jeffrey C. Jackson, **"Web Technologies: A Computer Science Perspective"**, Pearson Prentice Hall
3. Robin Nixon, **"Learning PHP, MySQL & JavaScript: with jQuery, CSS & HTML5"**, O'Reilly
4. JonDucket, **"PHP & MySQL: Server-side Web Development"**, Wiley
5. Estelle Weyl, Louis Lazaris, Alexis Goldstein, **"HTML5 and CSS3 for the Real World"**, Sitepoint
6. Jon Duckett, **"HTML & CSS: Design and Build Websites",** John Wiley & Sons
7. Paul S. Wang,**"Dynamic Web Programming and HTML5"**,CRC Press
8. John Paul Mueller, **"HTML5 Programming with JavaScript for Dummies",** Copyright material.
9. Comprehensive problem solver, **"Web Technologies: HTML, JAVASCRIPT, PHP, JAVA, JSP, ASP.NET, XML and AJAX, Black Book"**, Dreamtech Press
10. Reference website:www.w3schools.com

Rajarshi Janak University
Institute of Science and Technology
Course of Study for B.Sc. CSIT
(Fifth Semester/Third Year)

Course Title: Management and Entrepreneurship for IT industry **Course No:** SCIT 303
Nature of Course: Theory +Practical **Full Mark:** 60+20+20
Credit hrs. : 3 **Pass Mark:** 24+8+8
L. hrs. : 45

Course Objectives:

- To deliver the concepts of management, organization, entrepreneurs, planning, staffing and ERP in context of IT industry
- To demonstrate the use of ERP in utilizing resources effectively in an IT enterprise
- To impart students with knowledge required to start an MSME in IT industry

Course Contents

Unit-1
Introduction to Management [9 hrs.]
Nature and Characteristics of Management, Scope and Functional areas of Management, Goal of Management, Levels of Management, Management Theories, Nature and Importance of Planning, Types of plans, Planning Steps, Nature and Objectives of Organizing, Types of Organization, Staffing concepts, Recruitment and Selection Procedure.

Unit–2
Directing and Controlling [9 hrs.]
Concepts of Directing and its Nature, Leadership concepts and its Styles, Motivation Theories, Communication concepts and its Significance, Coordination Concepts and its Importance, Meaning of Controlling, Steps in Controlling, Methods of Establishing Control.

Unit–3
Entrepreneur [9 hrs.]
Meaning and Characteristics of Entrepreneurs, Classification of Entrepreneurs, Entrepreneurial Process, Role of Entrepreneurs in Economic Development, Opportunity and Barrier to Entrepreneurship. Market Feasibility, Technical Feasibility, Financial Feasibility, Social Feasibility.

Unit–4
Project and ERP [9 hrs.]
Project Concepts, Identification and Selection of Project, Project Report, Significance of Project Report, Project Report Contents, Formulation of Project Report, ERP and its Importance in Management, Components of ERP and Functional Areas of Management, ERP in Sales / Marketing, ERP in Supply Chain Management, ERP in Finance and Accounting, ERP in Human Resource Management, Types of Reports in ERP, Report Generation through ERP software.

Unit–5
Micro, Small and Medium Enterprises [9 hrs.]
Definition and Characteristics of MSME, Advantages of MSME, Establishing an MSME or an IT Startup, Micro and Small Level Enterprises in Nepal, Institutional Support for MSME, Overview of Intellectual

Property Rights, Case Study: at least two cases of IT Companies.

Lab Work:
Project using an ERP Software or any other tool available

Text Books/Reference Books:

1. P. C. Tripathi, P. N. Reddy, **"Principles of Management"**, 4th / 6th Edition, 2010, Tata McGraw Hill,
2. Vasant Desai, **"Dynamics of Entrepreneurial Development & Management"**, Himalaya Publishing House.
3. PoornimaM. Charantimath, **"Entrepreneurship Development -Small Business Enterprises",** Pearson Education –2006.
4. Kanishka Bedi, **"Management and Entrepreneurship"**, Oxford University Press-2017
5. Robert Lusier, **"Management Fundamentals -Concepts, Application, Skill Development"** , Thomson.
6. S. S. Khanka, **"Entrepreneurship Development"**, S Chand &Co.
7. Stephen Robbins, **"Management"**, 17thEdition,Pearson Education /PHI,2003
8. Various papers, articles and case studies from journals, conferences and IT industries.

Rajarshi Janak University
Institute of Science and Technology
Course of Study for B.Sc. CSIT
(Fifth Semester/Third Year)

Course Title: Theory of Computation
Nature of Course: Theory +Practical
Credit hrs. : 3
L. hrs. : 45

Course Code: SCIT 304
Full Mark: 60+20+20
Pass Mark: 24+8+8

Course Objectives:
The main objective of this course is to make students familiar with the theoretical computer science areas that includes mathematical foundation of the computation as Automata theory, theory of formal language and grammars, computability, decidability and complexity.

Course Contents

Unit–1
Introduction **[4 hrs.]**
Basic concept of computability and complexity, Introduction to Set theory, Relations and functions, Fundamental prove techniques, Alphabets, String, Language, and Regular Expressions.

Unit-2
Finite Automata **[9 hrs.]**
Deterministic Finite Automata (DFA), Non deterministic finite automata (NFA), Configuration, Minimization of DFA, equivalence of NFA and DFA, e-NFA, Closure properties, Regular expression and FA, relationship of language automata and grammar, Pumping Lemma, Decision algorithms

Unit–3
Context Free Grammars **[6 hrs.]**
Context free grammar, Language and grammar, derivation and tree, simplification of CFG, CNF and GNF, Ambiguity, Sentential Forms, closure properties of CFL, Pumping Lemma for CFL's

Unit–4
Pushdown Automata **[6 hrs.]**
Introduction, Configuration, Deterministic and Non-deterministic PDAs, Language and PDA, Equivalence of CFG and PDA, decision algorithms

Unit–5
Turing Machine **[9 hrs.]**
Introduction, Notation, deterministic and non-deterministic TM, computing with TM, Language and TM, Extension, two tape TM, TM and halting problem, Turing machine and Computers, Unrestricted Grammar, Random Access TM, Numerical functions

Unit-6
Recursive and Recursively enumerable language **[6 hrs.]**
Decidable and Recognizable language. Recursive and recursively enumerable language and properties, Recursive function theory, Undecidability, Universal Turing Machine, Church Turing thesis, Unsolvable problems about TM and Grammar

Unit-7

Concept of Complexity theory **[5 hrs.]**

Introduction, Class P problems and Class NP problems, Polynomial time reduction, NP Complete problems, NP Hard problems, Cook's Theorem,

Laboratory Work:

The laboratory work consists of design and implementation of Automata like DFA, NFA, PDA, and Turing Machine. Construction of Tokenizers/ Lexers are highly recommended and any high level language and be used.

Text Books/Reference Books:

1. Harry R. Lewis, Christos H. Papadimitriou, **"Elements of Theory of Computation"**, Second Edition, Prentice Hall
2. Elaine Rich, **"Automata, Computability and Complexity"**, 1st Edition, Pearson Education
3. Michael Sipser, **"Introduction to the Theory of Computation"**, 3rd edition, Cengage learning,2013
4. John E Hopcroft, Rajeev Motwani, Jeffery D Ullman, **"Introduction to Automata Theory, Languages, and Computation"**, 3rd Edition, Pearson Education
5. John C Martin, **"Introduction to Languages and The Theory of Computation"**, 3rd Edition, Tata McGraw –Hill

Rajarshi Janak University
Institute of Science and Technology
Course of Study for B.Sc. CSIT
(Fifth Semester/Third Year)

Course Title: Artificial Intelligence
Nature of Course: Theory and Practical
Credit hrs. : 3
L. hrs. : 45

Course Code: SCIT 305
Full Mark: 60+20+20
Pass Mark: 24+8+8

Course Objectives:
After studying this course, students will be able to:

- Describe computer systems that exhibit intelligent behavior
- Acquire the knowledge concerning intelligent agents
- Solve AI related problems
- Design knowledge representation and expert systems
- Design neural networks for solving problems
- Implement simple AI applications

Course contents

Unit-1
Introduction **[3 hrs.]**
Definition of Artificial Intelligence, Artificial Intelligence Perspectives (acting and thinking humanly, acting and thinking rationally), Brief history and Importance of Artificial Intelligence, Artificial Intelligence foundation and Its Applications.

Unit-2
Intelligent Agents **[4 hrs.]**
Introduction of agents, Structure of Intelligent agent, Properties of Intelligent Agents, Configuration of Agents, PEAS description of Agents, Types of Agents**:** Simple Reflexive, Model Based, Goal Based, Utility Based, Environment Types: Deterministic, Stochastic, Static, Dynamic, Observable, Semi-observable, Single Agent, Multi Agent.

Unit-3
Problem Solving by Searching **[9 hrs.]**
Defining problems as a state space search, Problem formulation, Problem types, Well- defined problems, Constraint satisfaction problem, and Production systems, Solving Problems by Searching, Search Strategies, 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, Simulated Annealing, Game playing, Adversarial search techniques, Mini-max Search, Alpha-Beta Pruning.

Unit-4

Knowledge Representation, inference and reasoning **[12 hrs.]**

Definition and importance of Knowledge, Issues in Knowledge Representation, Knowledge Representation Systems, Properties of Knowledge Representation Systems

Types of Knowledge Representation Systems: Decision Tree, Semantic Nets, Frames, Conceptual Dependencies, Scripts, Rule Based Systems, Propositional Logic, Predicate Logic

Propositional Logic(PL): Syntax, Semantics, Formal logic-connectives, truth tables, tautology, validity, well-formed-formula, Inference using Resolution, Backward Chaining and Forward Chaining

Predicate Logic: FOPL, Syntax, Semantics, Quantification, horn clauses, Inference with FOPL: By converting into PL (Existential and universal instantiation), Rules of inference, Unification and lifting, Inference using resolution, rule based deduction system

Statistical Reasoning: Uncertain Knowledge, Radom Variables, Prior and Posterior Probability, Inference using Full Joint Distribution, Bayes' Rule and its use, Bayesian Networks, Reasoning in Belief Networks

Unit-5

Machine Learning **[9 hrs.]**

Introduction to Machine Learning, Concepts of Learning, Supervised, Unsupervised and Reinforcement Learning

Learning by Genetic Algorithm

Fuzzy learning

Learning with Neural Networks: Introduction, Biological Vs. Artificial Neural Networks (ANN), Mathematical Model of ANN, Types of ANN: Feed-forward, Recurrent, Radial basis function, Kohonen Self Organizing, Single Layered, Multi-Layered, Application of Artificial Neural Networks, Learning by Training ANN, Supervised vs. Unsupervised Learning, Hebbian Learning, Perceptron Learning, Back-propagation Learning

Unit-6

Applications of AI **[8 hrs.]**

Expert system: Expert System, Architecture of an expert system, Knowledge acquisition, induction, Knowledge representation, Declarative knowledge, Procedural knowledge, Development of expert systems.

Natural Language Processing: Natural Language Understanding and Natural Language Generation, Steps of Natural Language Processing, Levels of analysis: Phonetic, Syntactic, Semantic, Pragmatic.

Machine Vision Concepts

Robotics

Laboratory Work:

The laboratory work consists of implementation of programs using PROLOG or LISP to solve the following problems.

- Solve 8 queens problem
- Solve any problem using depth first search.
- Solve any problem using best first search.
- Solve 8-puzzle problem using best first search

- Solve Robot (traversal) problem using means End Analysis
- Solve traveling salesman problem

Text Books/References Books:

1. Stuart J. Russel and Peter Norvig, **"Artificial Intelligence: A Modern Approach"**, Pearson
2. E. Rich and Knight, **"Artificial Intelligence"**, McGraw Hill
3. D. W. Patterson, **"Artificial Intelligence and Expert Systems"**, Prentice Hall
4. P. H. Winston, **"Artificial Intelligence"**, Addison Wesley

BSC CSIT

Third Year

Sixth Semester

Rajarshi Janak University
Faculty of Science and Technology
Course of Study for B.Sc. CSIT
(Sixth Semester/Third Year)

Course Title: E-Governance
Nature of Course: Theory + Practical
Credit hrs. : 3
L. hrs. : 45

Course Code: SCIT 310
Full Mark: 60+20+20
Pass Mark: 24+8+8

Course Objectives:
The students will be able to:

- provide the knowledge of good governance using information and communication technologies
- observe the case studies of different countries

Course Contents

Unit-1
Introduction **[6 hrs.]**

E-Governance: Needs of E-Governance, Issues in E-Governance applications and the Digital Divide; Evolution of E-Governance, Its scope and content; Present global trends of growth in E-Governance: Other issues.

Unit-2
Models of E-Governance **[10 hrs.]**

Introduction; Model of Digital Governance: Broadcasting/ Wilder Dissemination Model, Critical Flow Model, Comparative Analysis Model, Mobilization and Lobbying Model, Interactive-service Model/Government-to-Citizen-to-Government Model (G2C2G); Evolution in E-Governance and Maturity Models: Five Maturity Levels, Characteristics of Maturity Levels, Key areas, Towards Good Governance through E-Governance Models.

Unit-3
E-Governance Infrastructure and Strategies **[10 hrs.]**

Network infrastructure, Computing Infrastructure, Data centers infrastructure, Role of data center, Cloud data center, e-Government strategy and planning

E-readiness: Digital System Infrastructure, Legal Infrastructural Preparedness, Institutional Infrastructural Preparedness, Human Infrastructural Preparedness, Technological Infrastructural Preparedness; Evolutionary Stages in E-Governance.

Unit-4
Data Warehousing and Data Mining in Government **[9 hrs.]**

Introduction; National Data Warehouses: Census Data, Prices of Essential Commodities; Other areas for Data Warehousing and Data Mining: Agriculture, Rural Development, Health, Planning, Education, Commerce and Trade, Other Sectors.

Unit-5

Managing and Implementing of Government [10 hrs.]

Managing public Data, e-Government management issues, e-Government system life cycle and project assessment, e-Government Risk assessment and mitigation, e-Government system construction and implementation developing e-Government hybrids

Laboratory Work:

Case Studies

Nepalese Context: Cyber Laws, Implementation in the Land Reform, Human Resource Management Software, E-government Master plan.; India: NICNET, Collectorate, Computer-aided Administration of Registration Department (CARD), Smart Nagarpalika, National Reservoir Level and Capacity Monitoring System, Computerization in AndraPradesh, EkalSevaKentra, SachivalayaVahini, Bhoomi, IT in Judiciary, E-Khazana, DGFT, PRAJA, E-Seva, E-Panchyat, General Information Services of National Informatics Centre; E-Governance initiative in USA; E-Governance in China; E- Governance in Brazil and Sri Lanka.

Text Books/ Reference books:

1. Richard Heeks, **"Implementing and managing e-Government",** Copyright Material
2. C.S.R. Prabhu, **"E-Governance: Concepts and Case Studies"**, Prentice-Hall of India Private Limited, 2004.
3. Backus, Michiel, **"E-Governance in Developing Countries"**, IICD Research Brief, No.1, March2001.

Rajarshi Janak University
Faculty of Science and Technology
Course of Study for B.Sc. CSIT
(Sixth Semester/ Third Year)

Course Title: Cryptography and Network Security
Course Code: SCIT 311
Nature of Course: Theory + Practical
Full Mark: 60+20+20
Credit hrs. : 3
Pass Mark: 24+8+8
L. hrs. : 45

Course Objectives:

- To discuss various cryptographic schemes and its use in different applications
- To design simple encryption and decryption algorithm
- To understand cyber security and study the cyber law

Course Contents

Unit–1
Introduction **[6 hrs.]**
Active and Passive Cyber Attacks, Defense from Attacks, Mathematical Foundation of Cryptography - Modular Arithmetics, Greatest Common Divisor and Extended Euclid's Algorithm, Chinese Remainder Theorem, Finite Fields etc.

Unit-2
Symmetric Cryptography **[10 hrs.]**
Cryptography Basics, Elementary Cipher, Secret Key Cryptography, Symmetric Key Cryptography – Data Encryption Standard, Advanced Encryption Standard.

Unit–3
Asymmetric Cryptography **[10 hrs.]**
Public Key Cryptography, Euler Totient Function, Prime Factorization, RSA algorithm, Discrete Logarithmic Problem, Diffie-Helmann Key Exchange.

Unit–4
LAN Security **[6 hrs.]**
Confidentiality, Integrity and Availability, Viruses, Worms and other Malware. Intrusion Detection and Prevention, Types of Instruction Detection System, Techniques of Intrusion Detection, Intrusion Prevention - Firewall.

Unit–5
Web Security **[8 hrs.]**
Motivation of Web Security, Web Service & Security, Internet Security Protocols, Secure Socket Layer, HTTPS, E-mail Security, S/MIME, Wireless Application Protocol (WAP) Security, Security in GSM.

Unit–6

IT Law and Policy **[5 hrs.]**

Major Concepts, Important Provisions, Attribution, Acknowledgment, Dispatch of Electronic Records, Certifying Authorities – Regulating CA and Issuing Digital Certificates, Cyber Regulations and Offences, Liability of Network Service Providers. IT Policy and Cyber Law of Nepal.

Laboratory Work:

Following lab work can be implemented using any software platforms:

- Implement algorithms to illustrate cryptographic mathematics like Modular arithmetic, Euclid's Algorithm, Euler Totient Function etc.
- Simulate DES and AES by using appropriate programming languages and tools.
- Illustrate RSA algorithm with a suitable tool and language.
- Demonstrate LAN and WAN security violations wherever possible.

Text Book/Reference Book:

1. Bernard Menezes, **"Cryptography, Network Security and Cyber Laws"**, Cengage Learning, 2010 edition
2. Behrouz A Forouzan, DebdeepMukhopadhyay, **"Cryptography and Network Security"**, Mc-GrawHill, 3rd Edition, 2015
3. William Stallings ,**"Cryptography and Network Security"**, Pearson Education, 7th Edition
4. VivekSood ,**"Cyber Law simplified"**, Mc-GrawHill, 11th reprint ,2013
5. Alfred Basta, Nadine Basta, Mary brown, RavindraKumar,**"Cyber security and Cyber Laws**",Cengagelearning

Rajarshi Janak University
Institute of Science and Technology
Course of Study for B.Sc. CSIT
(Sixth Semester/ Third Year)

Course Title: Software Engineering
Nature of Course: Theory + Practical
Credit hrs. : 3
L. hrs. : 45

Course Code: SCIT 312
Full Mark: 60+20+20
Pass Mark: 24+8+8

Course Objectives:

- To develop methods and procedures for software development that can scale up for large systems that can be used consistently to produce high quality software with cost effective.
- To Learn the systematic Approach to the design, development, operation, and maintenance of a software system

Course Contents

Unit–1 **[10 hrs.]**

Introduction: Software crisis, need for software engineering, Professional software Development, Software engineering Ethics.

Software processes and Software process models: Software Process, Models of software engineering, Process activities. Comparison between software process and software process models, Agile software development

Unit–2

Software requirements specifications **[8 hrs.]**

Requirements engineering processes, System modeling, Software prototyping, Formal specification

Unit –3

Advanced Software Engineering. **[10 hrs.]**

Software reuse, Components -based software engineering, distributed software engineering, Service-oriented software engineering, real time software engineering, embedded system design, Object oriented software engineering

Unit–4

Verification and validation: **[8 hrs.]**

Planning, software inspection, clean room software development (process component).

Software testing: Development testing, Test Driven development, white box, Black box testing, Test Automation.

Software evolution: Evolution process, program evolution dynamic, software maintenance. Legacy system management,

Unit–5 **[9 hrs.]**

Project Planning: COCOMO model, software pricing, plan driven development, project scheduling, estimation techniques.

Quality management: Software quality, Reviews and inspection, software management and matrices. Software standards.

Laboratory Work:

The Practical exercises shall include projects on requirements, analysis and designing of software system. Choice of project depends upon teacher and student discussion and one case study shall be included too.

Text Books/ Reference Book:

1. Ian Somerville, **"software engineering**", 9th edition, person education, 2012.
2. Roger s. pressman, **"Software engineering – A Practioners approach"**, 7th edition, Tata McGraw Hill
3. Pankaj jalote,**"An Integrates Approach to Software Engineering"**, Springer

Web Reference for E-Books on agile

1. www.Agilemanifesto.org .
2. www.famesshre.com/agile/book/

Rajarshi Janak University
Institute of Science and Technology
Course of Study for B.Sc. CSIT
(Sixth Semester/Third Year)

Course Title: Java Programming
Nature of Course: Theory + Practical
Credit hrs. : 3
L. hrs. : 45

Course Code: SCIT 313
Full Mark: 60+20+20
Pass Mark: 24+8+8

Course Objectives:

The main objective of this course is to provide advanced concepts of Java programming and make students familiar with their uses and applications.

Course Contents

Unit-1

Language Preliminaries **[12 hrs.]**

An Overview of Java: Object-Oriented Programming, A First Simple Program, A Second Short Program, Two Control Statements, Using Blocks of Code, Lexical Issues, The Java Class Libraries, Data Types, Variables, and Arrays: Java Is a Strongly Typed Language, The Primitive Types, Integers, Floating-Point Types, Characters, Booleans, A Closer Look at Literals, Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays, A Few Words About Strings

Operators: Arithmetic Operators, The Bitwise Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The ? Operator, Operator Precedence, Using Parentheses, Control Statements: Java's Selection Statements, Iteration Statements, Jump Statements.

Unit-2

Methods, Arrays, Classes, Objects and Inheritance **[16 hrs.]**

Introducing Classes: Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The this Keyword, Garbage Collection, The finalize( ) Method, A Stack Class, A Closer Look at Methods and Classes: Overloading Methods, Using Objects as Parameters, A Closer Look at Argument Passing, Returning Objects, Recursion, Introducing Access Control, Understanding static, Introducing final, Arrays Revisited, Inheritance: Inheritance, Using super, Creating a Multilevel Hierarchy, When Constructors Are Called, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, The Object Class.

Unit-3

Packages, Interfaces, Exceptions, and Threads **[9 hrs.]**

Packages and Interfaces: Packages, Access Protection, Importing Packages, Interfaces, Exception Handling: Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses, Chained Exceptions, Using Exceptions. Introduction to multithreading

Unit-4

Wrappers, Strings and Characters, and I/O **[5 hrs.]**

Enumerations, TypeWrappers, Handling Strings and Characters, Introduction to String Buffer and StringBuilder Classes, I/O Basics, Reading Console Input, Writing Console Output, Command Line Arguments.

Unit-5

File Handling **[3 hrs.]**

Byte Stream, character stream, file IO Basics, File Operations , Creating file, Reading file (Character, byte), Writing File (Character, byte)

Laboratory Work:

The laboratory work includes writing Java programs to implement

- Basic language concepts like data types, operators, control statements, methods and arrays.
- Classes, objects, inheritance, interfaces, and packages.
- Packages, exceptions, and multithreading.
- Type wrappers and strings.
- Reading and writing files.

Text Books/Reference Books:

1. Herbert Schildt, **"Java: The Complete Reference"**, 7th Edition, Tata McGraw Hill, 2007.
2. Cary S. Horstmann, **"Core java Volume I – Fundamentals"**, Tenth Edition,Prentice Hall

1. Mahesh Bhave and Sunil Patekar, **"Programming with Java"**, First Edition, Pearson Education, 2008, ISBN:9788131720806.
2. RajkumarBuyya,SThamarasiselvi, xingchenchu, **"Object Oriented Programming with java"**, Tata McGraw Hill education private limited.
3. E Balagurusamy,**" Programming with Java A primer"**, Tata McGraw Hillcompanies.
4. Anita Seth and B L Juneja, **"JAVA One step Ahead"**, Oxford University Press, 2017.

Rajarshi Janak University
Institute of Science and Technology
Course of Study for B.Sc. CSIT
(Sixth Semester/Third Year)

Course Title: Wireless Communications
Nature of Course: Theory + Practical
Credit hrs. : 3
L. hrs. : 45

Course No: SCIT 314
Full Mark: 60+20+20
Pass Mark: 24+8+8

Course Objectives:
The students will be able to:

- Understand the various mobile communication systems.
- Describe various wireless systems.
- Explain the use and importance of multiple access technique

Course Contents

Unit–1
Introduction **[3 hrs.]**
Evolution of mobile radio communication fundamentals, chronology of significant development in Mobile Communication, Different Generation of mobile communication

Unit–2
Mobile radio propagation **[7 hrs.]**
free-space propagation: basic methods , Wireless case , Random channel characterization , Terminal mobility and rate of fading , Multipath and frequency-selective fading, fading Mitigation Technique, Fresnel Zone geometry, Scattering, Practical Link Budget Model: OKUMURA, HATA, small scale fading and multipath, coherence and bandwidth

Unit–3
Cellular concept and channel allocation **[6 hrs.]**
Introductionof cells, clusters frequency reuse, Channel assignment strategies: FCA, DCA, Handover Process, Interference & System Capacity, Trunking and Grade of Services, SIR calculations, one-dimensional case, Two-dimensional cell clusters and SIR , Traffic handling capacity: Erlang performance and cell sizing. Cell splitting and sectoring.

Unit–4
Modulation and Demodulation Techniques **[7 hrs.]**
Analog Modulation, Digital Modulation, Modulation in Cellular wireless networks: QAM, QPSK, OQPKS, MSK, GMSK, Spread Spectrum Modulation Technique, PN Sequence

Unit–5
Speech and Channel coding Fundamentals **[7 hrs.]**
Speech Coding, Vocoder and its Types,Linear Predictive code, Multi-pulse Excited LPC, Code Excited LPC, Residual Excited LPC, GSM Code Excited LPC, Coding for Error Detection and Correction: Block coding for error correction and detection , Convolutional coding

Unit-6

Multiple access techniques **[5 hrs.]**

Frequency-division Multiple Access (FDMA), Time-division multiple access (TDMA), Code-division multiple access (CDMA). CDMA compared with TDMA

Unit-7

Cellular systems **[8 hrs.]**

Narrowband cellular systems: GSM, Wideband systems: CDMA, OFDM

Unit-8

Wireless LANs and personal-area networks **[2 hrs.]**

IEEE 802.11 wireless LANs, Wireless personal-area networks: Bluetooth/IEEE 802.15.1

Laboratory Work:

Implementation of all the methods and concepts of wireless communication using MATLAB/Simulink

Text Books/ Reference Books:

1. Mischa Schwartz,**"Mobile Wireless Communications"**, Cambridge Publications
2. Andreas F. Molisch,"**Wireless Communications"**, Second Edition.
3. Theodore S. Rappaport,**"Wireless Communications: Principles and Practice**", 2nd Edition
4. David Tse , PramodViswanath,**"Fundamentals of Wireless Communication"** 1st Edition

BSC CSIT

Fourth Year

Seventh Semester

Rajarshi Janak University
Faculty of Science and Technology
Course of Study for B.Sc. CSIT
(Seventh Semester/Fourth Year)

Course Title: Compiler Design and Construction **Course Code:** SCIT 401
Nature of Course: Theory +Practical **Full Mark:** 60+20+20
Credit hrs. : 3 **Pass Mark:** 24+8+8
L. hrs. : 45

Course Description:
This course covers fundamental concepts and phases of compiler design including lexical analysis, syntax analysis, semantic analysis, intermediate code generation, code optimization, and code generation.

Course Objectives:
The main objective of this course is to provide knowledge on different concepts and phases of compiler design so that students will be able to design small compilers using general purpose programming languages.

Course Contents

Unit-1 **[3 hrs.]**
Introduction to Compiling: What is Compiler? Analysis and Synthesis Model of Compilation, Phases of a Compiler, Cousins of the Compiler, Compiler Construction Tools

Unit -2 **[22 hrs.]**
Lexical Analysis: Role of Lexical Analyzer, Input Buffering, Specification and Recognition of Tokens, Lexical Analysis Tools, Finite Automata Relevant to Lexical Analysis, Optimization of DFA based pattern matchers

Syntax Analysis: Role of Parser, Context-Free Grammar, Top-Down Parsing, Buttom-Up Parsing, Operator-Precedence Parsing, LR parsers, Parser Generators

Semantic Analysis: Static & Dynamic Checks, Typical Semantic Errors, Scoping, Type Checking; Syntax Directed Definitions (SDD) & Translation (SDT), Attribute Types: Synthesized & Inherited, Annotated Parse Tree, S-attributed and L-attributed Grammar, Applications of Syntax Directed Translation, Type Systems, Type Checking and Conversion

Unit-3 **[4 hrs.]**
Symbol Table Design: Function of Symbol Table, Information provided by Symbol Table, Attributes and Data Structures for symbol table
Run–time storage management

Unit-4 **[13 hrs.]**

Intermediate Code Generator: High-level and Low-level Intermediate representation, Syntax tree & DAG representations, Three-address code, Quadruples, Triples, SDT for intermediate code, Intermediate code generation for Declarations, Assignments, Control Flow, Boolean Expressions and Procedure Calls; Back patching

Code Generator: Factors affecting a code generator, Target Language, Basic blocks and flow graphs, Dynamic programming code-generation algorithm

Code Optimization: Need and criteria of Code Optimization, Basic optimization techniques

Unit-5 **[3 hrs.]**

Case Studies of compilers like C compiler, C++ compiler etc.

Laboratory Work:

The laboratory work includes

- Creating a project by using lexical analyzer generator or any high level language
- Creating a parser by using parser generator or any high level language
- Writing programs for intermediate code generation and machine code generation
- Creating simple compilers using general purpose programming languages

Text Books/ Reference Books:

1. Alfred V. Aho, Ravi Sethi, and Jeffrey D. Ullman, **"Compilers: Principles, Techniques, and Tools"**, Pearson Education
2. Johne E. Hopcroft, Rajeev Motwani, and Jeffrey D. Ulman, **"Introduction to Automata Theory, Languages, and Computation"**, Pearson Education
3. Steven Muchnick, **"Advanced Compiler Design and Implementation"**, Morgan Kaufman Publication
4. Samdeep Saxena and Rajkumar Sing Rathore, **"Compiler Design"**, S.Chand

Rajarshi Janak University
Faculty of Science and Technology
Course of Study for B.Sc. CSIT
(Seventh Semester/Fourth Year)

Course Title: Distributed and Cloud Computing
Nature of Course: Theory +Practical
Credit hrs. : 3
L. hrs. : 45

Course Code: SCIT 402
Full Mark: 60+20+20
Pass Mark: 24+8+8

Course Objectives:
The major objectives of this course are:

- To understand the concepts and terminologies of distributed and cloud computing
- To understand the distributed communication models
- To understand about rituality and its applications
- Demonstrate cloud applications

Course Contents

Unit-1
Introduction **[4 hrs.]**
Introduction to distributed systems and cloud computing, Distributed system challenges, distributed system vs centralized system, Cloud architectures: SaaS, PaaS, IaaS. End-to-end system design. Networks and protocol stacks. The Enterprise Cloud Computing Paradigm

Unit-2
Communication Model **[6 hrs.]**
Communication between Distributed Objects, Sockets and remote procedure call, remote method invocation, Group communication. Multicast communication. Network virtualization. Publish-subscribe systems

Unit-3 **[8 hrs.]**
Fundamental of cloud computing: Design of cloud computing. Mechanisms and architectures. Models, technologies and security. Cloud service and applications. Service quality metrics. Service oriented architectures. Security in the cloud. Implementation levels of virtualization

Unit-3
Distributed file systems and cache consistency **[6 hrs.]**
Stateful and Stateless services, NFS, AFS. Storage in the Cloud: Google/ Hadoop file system

Unit-4
Infrastructure as a Service (IAAS) & Platform and Software as a Service (PAAS / SAAS) **[8 hrs.]**
Virtual machines provisioning and Migration services, On the Management of Virtual machines for Cloud Infrastructures, Enhancing Cloud Computing Environments using a cluster as a Service, Secure Distributed Data Storage in Cloud Computing. Aneka, Comet Cloud, T-Systems', Workflow Engine for Clouds, Understanding Scientific Applications for Cloud Environments.

Unit-5

Monitoring, Management and Applications **[8 hrs.]**

An Architecture for Federated Cloud Computing, SLA Management in Cloud Computing, Performance Prediction for HPC on Clouds, Best Practices in Architecting Cloud Applications in the AWS cloud, Building Content Delivery networks using Clouds, Resource Cloud Mashups

Unit-6

Cloud Infrastructure security **[5 hrs.]**

Network, host and application level – aspects of data security, provider data and its security, Identity and access management architecture, IAMpractices in the cloud, SaaS, PaaS, IaaS availability in the cloud, Key privacy issues in the cloud.

Laboratory Work:

1. Install Virtual box/VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8.
2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
3. Install Google App Engine. Create hello world app and other simple web applications using python/java.
4. Use GAE launcher to launch the web applications.
5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
6. Find a procedure to transfer the files from one virtual machine to another virtual machine.
7. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)
8. Install Hadoop single node cluster and run simple applications like word count.

Text Books/ References books:

1. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi **"Mastering CloudComputing"**, McGraw HillEducation
2. A.S. Tanenbaum, M. VanSteen, **"Distributed Systems"**, Pearson Education
3. George Coulouris, Jean Dollimore, Tim Kindberg, **"Distributed Systems Concepts and Design"**, Third Edition, Pearson Education.
4. John W. Rittinghouse and James F. Ransome,**"Cloud Computing: Implementation Management and Security"**,CRC Press
5. Borko Furht, Armando Escalante, **"Handbook of cloud computing"**, Springer
6. John W. Rittinghouse and James F.Ransome, **"Cloud Computing: Implementation Management and Security"**, CRC Press
7. George Reese, **"Cloud Application architecture"**, O RELLY
8. Judith Hurwitz, Robin Bloor, Marcia Kaufman, FernHalper, **"Cloud Computing for Dummies"**, Copyrighted Material

Rajarshi Janak University
Faculty of Science and Technology
Course of Study for B.Sc. CSIT
(Seventh Semester/Fourth Year)

Course Title: Advanced Java
Nature of Course: Theory +Practical
Credit hrs. : 3
L. hrs. : 45

Course Code: SCIT 403
Full Mark: 60+20+20
Pass Mark: 24+8+8

Course Description:
This course covers advanced features of Java programming language including applets, GUI programming, database programming, network programming, JavaBeans, JSP and Servlet, Remote Method Invocation and CORBA.

Course Objectives:
The main objective of this course is to provide advanced concepts of Java programming and make students familiar with their uses and applications.

Course Contents

Unit-1
Applets and AWT **[9 hrs.]**
Applets: What are Applets?; The Applet Class; The Applet and HTML; Life Cycle of an Applet; The Graphics Class; Painting the Applet; User Interfaces for Applet; Adding Components to user interface; AWT (Abstract Windowing Toolkit) Controls.

Unit-2
User Interface Components with Swing **[9 hrs.]**
Swing and MVC Design Patterns: Design Pattern, MVC Pattern, MVC Analysis of Swing Buttons, Layout Management: Border Layout, Grid Layout, Gridbag Layout, Group Layout, Using No Layout managers, Custom layout Managers, Text Input: Text Fields, Password Fields, Text Areas, Scroll Pane, Label and Labeling Components, Choice Components: Check Boxes, Radio Buttons, Borders, Combo Boxes, Sliders, Menus: Menu Building, Icons in Menu Items, Check box and Radio Buttons in Menu Items, Pop-up Menus, Keyboard Mnemonics and Accelerators, Enabling and Design menu Items, Toolbars, Tooltips, Dialog Boxes: Option Dialogs, Creating Dialogs, Data Exchange, File Choosers, Color Choosers, Components Organizers: Split Panes, Tabbed Panes, Desktop Panes and Internal Frames, Cascading and Tiling, Advance Swing Components: List, Trees, Tables, Progress Bars

Unit-3
Database Connectivity **[4 hrs.]**
The JDBC Connectivity Model, Database Programming: Connecting to the Database, Creating a SQL Query, Getting the Results, Updating Database Data, Error Checking and the SQLException Class, The SQLWarning Class, The Statement Interface, PreparedStatement, CallableStatement The ResultSet Interface, Updatable Result Sets, JDBC Types, Executing SQL Queries, ResultSetMetaData, Executing SQL Updates, Transaction Management

Unit-4

Network Programming **[5 hrs.]**

Network Basics and Socket overview, TCP/IP client sockets, URL, TCP/IP server sockets, Datagrams, java.net package Socket, ServerSocket, InetAddress, URL, URLConnection.

Unit-5

Java Beans **[5 hrs.]**

Introduction, Creating, Updating and Reading From JAR Files, Java Beans, Advantages of Java Beans, Class vs Beans, BDK and Bean Box, Java Bean: Creating a Java Bean, Creating a Bean Manifest File, Creating a Bean JAR File, Using a New Bean, Adding Controls to Beans, Giving a Bean Properties, Creating Bound Properties, Giving a Bean Methods, Giving a Bean an Icon

Unit-6

Server Side Programming **[9 hrs.]**

Servelets: Introduction to Servlet Life cycle of servlets, Java Servlets Development Kit, Creating, Compiling and running servlet, The servlet API (javax.servlet package), Reading the servlet Parameters, Reading Initialization parameter, The javax.servlet.http.Package, Handling HTTP Request and Response (GET / POST Request), Using Cookies, Session Tracking

Java Server Pages: Advantage of JSP technology, Comparison of JSP and Servlet, JSP Architecture, JSP Access Model, JSP Syntax Basic (Directions, Declarations, Expression, Scriplets, Comments), JSP Implicit Object, Object Scope, Synchronization Issue, Exception Handling, Session Management, Creating and Processing Forms.

Unit-7

Remote Method Invocation **[4 hrs.]**

Remote Method Invocation: Introduction of RMI, Architecture of RMI, Remote Objects, Creating and Executing RMI Applications

CORBA: Introduction to CORBA, Architecture of CORBA, Functioning of CORBA Applications, CORBA Services

Laboratory Work:

The laboratory work includes writing Java programs

- To create GUI applications and applets using swing and AWT, event handling, and layout management
- To create applications to work with databases
- To create JavaBeans
- To write Java programs using network programming
- To create server side web programs using Servlet and JSP
- To create distributed applications using RMI

Text Books/Reference Books:

1. Herbert Schildt, **"Java: The Complete Reference"**, 10th Edition, McGraw-Hill
2. Jim Keogh, **"J2EE-TheCompleteReference"**, McGraw Hill.
1. Cary S. Horstmann, **"Core java Volume I – Fundamentals"**, Tenth Edition, Prentice Hall
2. Cary S. Horstmann, **"Core java Volume II – Advanced Features"**, Tenth Edition, Prentice Hall
3. Y. Daniel Liang, **"Introduction to JAVA Programming"**, 7thEdition, Pearson Education, 2007.
4. Stephanie Bodoff et al, **"The J2EE Tutorial"**, 2nd Edition, Pearson Education, 2004.
5. Uttam K Roy, **"Advanced JAVA programming"**, Oxford University press, 2015.

Rajarshi Janak University
Faculty of Science and Technology
Course of Study for B.Sc. CSIT
(Seventh Semester/Fourth Year)

Course Title: Data Warehousing and Data Mining
Nature of Course: Theory +Practical
Credit hrs. : 3
L. hrs. : 45

Course Code: SCIT 404
Full Mark: 60+20+20
Pass Mark: 24+8+8

Course Objectives:

- To be able to setup a Data Warehouse architecture and schema
- To implement various Data Mining algorithms and extract knowledge from data repository.
- To demonstrate classification problem in real world scenario

Course Contents

Unit–1
Introduction **[3 hrs.]**
Data Mining Concepts, Classification of Data Mining Systems, DBMS vs Data Mining, Issues and Challenges of Data Mining, Types of Data, Data Quality, Data Pre-processing, KDD and Data Mining Techniques, Data Mining Applications.

Unit–2
Data Warehousing **[6 hrs.]**
Multi-dimensional Data Modelling, Data Warehouse Schema - Star, Snowflake and Fact Constellation: Data Warehouse Architecture, Enterprise Warehouse, Data Mart, Virtual Warehouse, Extract-Transform-Load.

Unit–3
Data Cube Technology **[9 hrs.]**
Data Cube, Lattice of Cuboid, OLAP Operations- Slicing, Dicing, Drilling, Pivoting etc. OLAP Query Processing, Data Mining Query Language, ROLAP, MOLAP and HOLAP.

Unit–4
Association Rule Mining **[9 hrs.]**
Market-Basket Problem, Support and Confidence, Frequent Item Set Generation, Association Rule Generation. A-priori Algorithm, FP-Tree Growth Algorithm, Pattern Evaluation Methods.

Unit–5
Classification Algorithms **[9 hrs.]**
Decision Tree, Splitting Index, Information Gain, Gini Index, Supervisor Learning, Methods for Comparing Classifiers, Rule Based Classifiers, Nearest Neighbor Classifiers, Bayesian Classifiers.

Unit-6

Clustering Techniques **[9 hrs.]**

Measures of Similarity and Dissimilarity, Partition based Methods – kMeans and kMedoids, Hierarchical Clustering, DBSCAN, Cluster Evaluation, Density-Based Clustering, Graph-Based Clustering, Scalable Clustering Algorithms.

Laboratory Work:

- Build a data warehouse and/or data and do query processing using Business Intelligence tools like Pentaho or Mondrian etc..
- Perform data mining tasks using a data mining tools like Weka, Rapidminer etc.
- Implement algorithms for data mining techniques such as A-priori, kMeans, kMedoids, Decision Tree, kNN, NB classification etc.

Text Books/Reference Books:

1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar,**"Introduction to Data Mining"**, Pearson, First impression,2014.
2. Jiawei Han, MichelineKamber, Jian Pei, **"Data Mining -Concepts and Techniques"**, 3rd Edition, Morgan Kaufmann Publisher, 2012.
3. Sam Anahory, Dennis Murray, **"Data Warehousing in the Real World"**, Tenth Impression Pearson, 2012.
4. Michael.J.Berry, Gordon.S.Linoff, **"Mastering Data Mining"** , 2nd Edition, Wiley Edition

Rajarshi Janak University
Institute of Science and Technology
Course of Study for B.Sc. CSIT
(Seventh Semester/Fourth Year)

Course Title: Project Work
Nature of Course: Project
Credit hrs. : 3

Course Code: SCIT 405
Full Marks: 100
Pass Marks: 40

Course Description:
This course covers different theoretical and practical aspects needed to develop real world software application. Special focus will be given in enabling students with the skills pertaining to the planning, analysis, design, and implementation of a real world application. The project can be done in a groups preferably with **FOUR / FIVE** members in each group. Students are highly recommended to work in group projects as group projects help them develop a host of skills that are increasingly important in the professional world. Positive group experiences, moreover, have been shown to contribute to student learning, retention and overall success.

Course Objectives:
The main objective of this course is to develop both theoretical and practical skills needed to develop real world software application using different software development techniques and tools.

Phases: The overall project work is divided into three phases:

1. Proposal Submission and Presentation
2. Mid-Term Presentation
3. Final Report Submission and Presentation

1. **Proposal Submission and Presentation:**
   - The project team prepares proposal document in the prescribed format and submits to the college
   - The panel coordinated by Head / Program Coordinator evaluates the proposal along with presentation from the student(s)
   - If the proposal is accepted, a supervisor is assigned by the HOD / Program Coordinator depending upon the nature of the project

2. **Mid-Term Presentation:**
   - The project team has to present their progress on the project in front of Head / Program Coordinator, Supervisor, and Internal Evaluator in the middle of the semester after completing approximately 50% of the project work.

3. **Final Report Submission and Presentation:**
   - After submitting the final project report prepared in the prescribed format, the Project team has to present their final project in front of Head / Program Coordinator, Supervisor, Internal Evaluator and External Evaluator.

Proposal Contents:

- Title Page
- Introduction
  - Introduction
  - Problem Statement
  - Objective
  - Scope and limitation
- Methodology
  - Requirement Identification and Feasibility Study
  - Related Work / Literature Review
  - Analysis and Design Tools
  - Implementation tools (Front End, Back End)
- Expected Outcome
- Project Schedule
- References / Bibliography

Report Contents:

- Title Page
  - A standardized page for specifying the title and author of the work
- Certificate of Authorship
  - Declaration that the work reported is the original work
- Approval Sheet
  - Recommendation for approval from Head / Program Coordinator, Supervisor, External and Internal evaluators
- Acknowledgements
  - Thanking anyone who has helped you in any way
- Abstract
  - Giving a short overview of the work
- Table of Contents
  - Giving page numbers for all major section headings
- List of Figures
  - Giving page numbers for all the figures
- List of Tables
  - Giving page numbers for all the tables
- List of Abbreviations
  - List of abbreviations
- Introduction (Chapter I)
  - Introduction: Introduce the organization (if any) and the work
  - Problem Statement: Explain why you are doing this work and what is the problem being solved
  - Aims and Objectives: Clearly explain aims and objectives and scope of your work
  - System Development: Explain in brief about systems development, systems development methodology, and alternative approaches
  - Report Organization: Explain in brief about organization of your report
- Related Work / Literature Review (Chapter II)
  - Explain the current state of the art in your area

- Explain the works other have people done (published or commercial) that is relevant to yours

- Analysis (Chapter III)
  - Determining system requirements and studying feasibility
  - Chose suitable approach (structured or object-oriented)
- Design (Chapter IV)
  - Convert analysis document into design specifications
- Implementation (Chapter V)
  - Coding: Design specifications are turned into working computer code using suitable programming language, database technology, and interfacing technology
  - Testing: Tests are performed using various strategies; A master test plan is developed during the analysis phase; During the design phase, *unit*, *system* and *integration* test plans are developed; The actual testing is done during implementation
- Conclusion and Future Work (Chapter VI)
  - Explain what conclusions you have come to as a result of doing this work and any future plan to extend the work
- References / Bibliography
  - Provide a list of papers, books and other publications that are explicitly referred to in the text
  - Use IEEE citation style
- Appendices
  - Supplementary material should be included in appendices - these are optional, but they might contain:
  - Code listings – A listing of the code you have written for the project. You should NOT include code listings for code you have not written!! If your project involves modifying code previously written by others, then you may include this other code as long as you indicate clearly in the code listing what parts have been written by you.
  - Raw data – If your work involves data collection then this should usually be included in appendices. This should provide supporting evidence for claims made in the main part of the work (e.g., copies of a user evaluation questionnaire and some sample responses).
  - Examples of test data
  - Electronic material on a CD/DVD/Pen Drive inside the back cover. This might contain executable software, source code, graphics, slides used for your presentation, etc.Where the appendices are long (e.g. code listings) do not print them out, rather provide them on a CD/DVD/Pen Drive

Report Format:

- Page Number
  The pages containing certificate of approval to the page containing list of abbreviations should be numbered in roman starting from i. The pages starting from Chapter 1 onwards should be numbered in numeric starting from 1. Page numbers should be inserted at the bottom of the page and aligned centre.

- Paper Size and Margin
  The paper size should be A4 and the margins must be set as:

  - Top = 1 in (2.54 cm)
  - Bottom = 1 in (2.54 cm)

- Left = 1.25 in (3.17 cm)
- Right = 1 in (2.54 cm)

- Paragraph
  All paragraphs must be indented and justified (both left-justified and right-justified). All the paragraphs must be written using Times New Roman font with font size 12 and 1.5 paragraph spacing.

- Heading
  No more than 3 levels of headings should be used. Font size for the heading should be 16 for chapter title, 14 for section headings and 12 for subsection headings. All the headings should be bold faced.

- Figures and Tables
- Figure captions should be centred below the figures and table captions should be centred above the table.

Evaluation:

Head / Program Coordinator, Supervisor, Internal, and External evaluators will evaluate the overall project work. External evaluator will be assigned only for the final defense.

Marks Allocation:

- Supervisor – 60
- Internal Evaluator – 10
- Head / Program Coordinator – 10
- External – 20

Total – 100

Weight of each Phase:

- Proposal Submission and Presentation - 10%
  - Evaluated by Head / Program Coordinator (2 Marks), Supervisor (6 Marks), and Internal (2 Marks)
- Mid-Term Presentation - 20%
  - Evaluated by Head / Program Coordinator (3 Marks), Supervisor (14 Marks), and Internal evaluator (3 Marks)
- Final Report Submission and Presentation - 70%
  - Evaluated by Head / Program Coordinator (5 Marks), Supervisor (40 Marks), Internal evaluator (5 Marks), and External evaluator (20 Marks)

Text Books: None

Prerequisite: Depending upon types of project

Rajarshi Janak University
Institute of Science and Technology
Course of Study for B.Sc. CSIT
(Seventh Semester/Fourth Year)

Course Title: .NET Technology
Nature of Course: Theory +Practical
Credit hrs. : 3
L. hrs. : 45

Course Code: SCIT 422
Full Mark: 60+20+20
Pass Mark: 24+8+8

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

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

Course Contents

Unit-1
Language Preliminaries **[10 hrs.]**
Understanding .NET (.NET Framework, .NET Core, Xamarin, and .NET Standard), Basics of C# Programming Languages (Different Versions, Statements, Comments, Vocabulary, Blocks, Variables, null Values, Operators, Selection and Iteration Statements, Casting and Conversion, Arrays and Strings, and Functions), Object Oriented Programming, Interfaces and Inheritance, Files, Streams, Serialization, Exception Handling, Delegate and Events, Lambda Expressions, Exception Handling

Unit-2
Introduction to ASP.NET **[3 hrs.]**
.NET and ASP.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 **[8 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, Introduction to LNIQ

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

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-9

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 to Azure cloud

Laboratory Work:

The laboratory work includes writing programs covering most of the concepts of above units using C# and .NET core SDK (3.0 or above)

Text Books/ Reference Books:

1. Mark J. Price, **"C# 8.0 and .NET Core 3.0 – Modern Cross-Platform Development**", Fourth Edition, PACKT>,2019
2. Andrew Lock**,"ASP.NET Core in Action"**, HANNING, 2018
3. Michel Bruchet, Jason De Oliveira,**"Learning ASP.NET Core 2.0"**,PACKT>, 2017
4. Kenneth Yamikani Fukizi, Jason De Oliveira, Michel Bruchet,**"Learn ASP.NET Core 3 - Second Edition",**2019
5. Christian Nagel, **"Professional C#7 and .NET Core 2.0"**, John Wiley & Sons, Inc., 2018

Rajarshi Janak University
Faculty of Science and Technology
Course of Study for B.Sc. CSIT
(Seventh Semester/Fourth Year)

Course Title: E-Commerce
Nature of Course: Theory +Practical
Credit hrs. : 3
L. hrs. : 45

Course Code: SCIT 423
Full Mark: 60+20+20
Pass Mark: 24+8+8

Course Objectives:
After studying this course, students will be able to:

- Understand various elements of E-Commerce and its applications as an effective business tool
- Acquire a broad knowledge e-commerce
- Demonstrate the knowledge of E-Commerce security and E-Payment systems
- Implement an E-Commerce site
- Describe popular E-Commerce portals and payment gateways

Course contents

Unit-1 **[7 hrs.]**

Introduction to E-commerce: Definitions of E-commerce, Characteristics of E-commerce, Traditional Commerce versus E-commerce, E-commerce versus E-Business, Framework of E-commerce, Benefits and Limitations of E-commerce

Types of E-commerce: Based on parties (B2B, B2C, C2C), Based on transaction types (Brokerage, Aggregator, Info-mediary, Community, Value chain)

Unit-2

E-commerce security **[6 hrs.]**

Client-Server Network Security-Physical security holes, Software security holes, Inconsistent usage holes; Protection Methods-Trust-based, Security through Obscurity, Password Schemes, Biometrics; Security threats in client-server-Software Agents and Malicious Code Threats to Servers, Access Controls, Firewalls, Types of firewalls and network security, Security policies and firewall management.

Unit-3 **[6 hrs.]**

Consumer Oriented Electronic Commerce: Introduction, consumer oriented applications-Personal Finance and Home Banking Management: Basic Service, Intermediate Service, Advanced Service, Home Shopping, Home Entertainment, Desirable characteristics of an electronic marketplace, Mercantile process models, Mercantile models from the consumer's perspective, Mercantile models from the merchant's perspective-Order Planning and Order Generation, Cost Estimation and Pricing, Order Receipt and Entry, Order Selection and Prioritization, Order Scheduling, Order Fulfillment and Delivery, Order Billing ad Account/Payment Management, Post-sales services.

Unit-4

Electronic Payment Systems **[8 hrs.]**

Introduction, Need for Electronic Payment Systems, Requirements for E-Payments, Types of Electronic Payment Systems – digital token based electronic payment systems, e-cash (Digital cash), Properties of e-cash, e-cheques, Smart cards and electronic payment systems, Smart credit cards systems, Smart Card Readers, Credit Cards, Credit Card with Encryption, Digital/Electronic Wallets, Designing E-payment Systems

Unit-5

Inter-organizational Commerce & Electronic Data Interchange (EDI) **[10 hrs.]**

Introduction, EDI Layered Architecture, Benefits of EDI, EDI application in business, EDI: legal, security, and privacy issues: Legal Status of EDI Messages, Digital Signatures and EDI

Mobile Commerce: Definition of m-Commerce, Benefits of m-Commerce, Types of m-Commerce, Applications of m-Commerce, m-Commerce Technology

Unit-6

E-Marketing **[5 hrs.]**

Traditional Marketing, Introduction to E-Marketing, E-Marketing Techniques, E-Marketing Strategies, Techniques for Implementing E-Marketing Strategies, Advertising on Internet, Forms of Inter Advertising

Unit-7

Legal and Regulatory Environment of Electronic Commerce **[3 hrs.]**

Ethics in Electronic Commerce, Legal Issues versus Ethics, Ethical Issues, Protection Privacy, Web site self Registration, Cookies, Protection against Cookies, Privacy Protection Issues, Protecting Intellectual Property, Patents and Trademarks, Free speech, Internet Indecency, Spamming and Sensorship, Controlling Spamming, Frauds on the Internet

Case Studies:

Students are advised to undertake some of the following case studies pertaining to popular national and international e-commerce portals and payment gateways: Muncha.com, Hamrobazar.com, Thamel.com, eBay.com, Amazon.com, Dell.com, Esewa.com.np, Paynepal.com, PayPal, Authorize.net. Case Studies may also include electronic payment systems like: Mondex Smart Cards, CyberCoins, Cybercash, Digicash, Coin.net, Microsoft Digital Wallet.

Laboratory Work:

Every student is required to develop E-commerce site using freely available web development tools.

Text Books/Reference Books:

1. Frontiers of Electronic Commerce – Ravi Kalakota and Andrew B. Whinston – Pearson
2. E-commerce Business, Technology, Society – Kenneth C. Laudon, Carol G. Traver – Pearson
3. Cryptography & Network Security: Principles and practices, William Stalling
4. E-Commerce: A Managerial Perspective – P.T. Joseph – PHI

Rajarshi Janak University
Faculty of Science and Technology
Course of Study for B.Sc. CSIT
(Seventh Semester/Fourth Year)

Course Title: Mobile Application and Development
Nature of Course: Theory +Practical
Credit hrs. : 3
L. hrs. : 45

Course Code: SCIT 424
Full Mark: 60+20+20
Pass Mark: 24+8+8

Course objectives:
The students should be able to:

- Design and Develop Android application by setting up Android development environment
- Implement adaptive, responsive user interfaces that work across a wide range of devices.
- Explain long running tasks and background work in Android applications
- Demonstrate methods in storing, sharing and retrieving data in Android applications
- Discuss the performance of android applications and understand the role of permissions and security
- Describe the steps involved in publishing Android application to share with the world

Course Contents

Unit-1
Introduction to Android **[7 hrs.]**
Introduction to Android Architecture: Introduction, History, Features and Android Architecture. Android Application Environment, SDK, Tools: Application Environment and Tools, Android SDK. Programming paradigms and Application Components - Part 1: Application Components, Activity, Manifest File, Programming paradigms and Application Components Part 2: Intents, Content providers, Broadcast receivers, Services User

Unit-2
Interface Design **[9 hrs.]**
User Interface Design part 1: Views &View Groups, Views : Button, Text Field, Radio Button, Toggle Button, Checkbox, Spinner, Image View, Image switcher, Event Handling, Listeners, Layouts : Linear, Relative, List View, Grid View, Table View, Web View, Adapters. User Interface Design part 2: Menus, Action Bars, Notifications : Status, Toasts and Dialogs, Styles and Themes, Creating Custom Widgets, Focus, Touch Mode, Screen Orientation. Designing for Tablets – Working with tablets: Developing for different android platforms, Fragments, Manipulating objects with drag and drop, Optimizing applications for high screen resolution, combining fragments into a multilane UI. Resources, Assets, Localization: Resources and Assets, Creating Resources, Managing application resources and assets, Resource-Switching in Android. Localization, Localization Strategies, Testing Localized Applications, Publishing Localized Applications

Unit-3
Mobile Data Management **[7 hrs.]**
Content Providers: Contents provider, Uri, CRUD access, Browser, CallLog, Contacts, Media Store, and Setting. Data Access and Storage: Shared Preferences, Storage External, Network Connection.

Unit-4

SQLite - SQLite Databases Native Capabilities **[7 hrs.]**

Camera, Audio, Sensors and Bluetooth: Android Media API: Playing audio/video, Media recording. Sensors - how sensors work, listening to sensor readings. Bluetooth. Maps & Location: Android Communications: GPS, Working with Location Manager, Working with Google Maps extensions, Maps via intent and Map Activity, Location based Services. Location Updates, location-based services (LBS), Location Providers, Selecting a Location Provider, Finding Your Location, Map - Based Activities, How to load maps, To finding map API key.

Unit-5

Testing **[7 hrs.]**

Testing: Testing and Commercializing Applications - Basics of Testing, Testing from an IDE (Eclipse), Activity testing, Service testing, Content provider testing, Test Classes, Debugging using DDMS, How to get your app on the app store.

Unit-6

Mobile App Techniques in Emerging Technologies **[2 hrs.]**

Unit 7: Mobile Embedded Systems **[6 hrs.]**

Embedded Systems in Mobile Devices, Embedded Systems in Android, Power Management of Android, Embedded Systems in Mobile Apps, MESSAGING AND COMMUNICATION MECHANISMS, Message Mechanisms, Communication Mechanisms.

Lab works:

- **Develop an application that uses GUI components, Font and Colours**
- **Develop an application that uses Layout Managers and event listeners.**
- **Develop a native calculator application.**
- **Write an application that draws basic graphical primitives on the screen.**
- **Develop an application that makes use of database.**
- **Develop an application that makes use of RSS Feed.**
- **Implement an application that implements Multi-threading**
- **Develop a native application that uses GPS location information.**
- **Implement an application that writes data to the SD card.**

Text Books/ Reference Books:

1. Google Developer Training, "Android Developer Fundamentals Course – Concept Reference", Google Developer Training Team, 2017.
2. https://www.gitbook.com/book/google-developer-training/android-developer-fundamentals-course-concepts/details (Download pdf file from the above link)
3. Erik Hellman, "Android Programming – Pushing the Limits", 1st Edition, Wiley India Pvt Ltd, 2014.
4. Dawn Griffiths and David Griffiths, "Head First Android Development", 1st Edition, O'Reilly SPD Publishers, 2015.
5. J F DiMarzio, "Beginning Android Programming with Android Studio", 4th Edition, Wiley India Pvt Ltd, 2016. ISBN-13: 978-8126565580
6. Anubhav Pradhan, Anil V Deshpande, " Composing Mobile Apps" using Android, Wiley 2014, ISBN: 978-81-265-4660-2

Rajarshi Janak University
Faculty of Science and Technology
Course of Study for B.Sc. CSIT
(Seventh Semester/Fourth Year)

Course Title: Operations Research
Nature of Course: Theory
Credit hrs. : 3
L. hrs. : 45

Course Code: SCIT 425
Full Mark: 60+20+20
Pass Mark: 24+8+8

Course objectives:
The students should be able to:

- Explain optimization techniques for various problems.
- Understand the given problem as transportation and assignment problem and solve.
- Illustrate game theory for decision support system

Course Contents

Unit-1
Introduction to Operations Research **[4 hrs.]**
Origin of Operation Research, Historical Standpoint, Methodology, Different Phases, Characteristics, Scope and Application of Operations Research.

Unit-2
Linear Programming Problem **[8 hrs.]**
Introduction, Requirements of LPP, Basic Assumptions, Mathematical Formulation of LPP, Case Studies of LPP, General Statement of LP, Solution techniques of LP: Graphical Methods, Analytical Methods: Simplex, Big M and Two Phase, Sensitivity Analysis, Primal and Dual Problems, Economic Interpretation.

Unit-3
Transportation Problem **[8 hrs.]**
The transportation problem, Initial Basic Feasible Solution (IBFS) by North West Corner Rule method, Matrix Minima Method, Vogel's Approximation Method. Optimal solution by Modified Distribution Method (MODI). Minimization and Maximization varieties in transportation problems.

Unit-4
Assignment Problem **[6 hrs.]**
Introduction, Mathematical Formulation of the Problem, A Hungarian algorithm for the assignment problem. Minimization and Maximization varieties in assignment problems.

Unit–5
Game Theory **[7 hrs.]**
Introduction, Characteristics of Game Theory, The formulation of two persons, zero sum games; saddle point, maximin and minimax principle, Solving simple games- a prototype example; Games with mixed strategies; Graphical solution procedure.

Unit-6

Decision Theory **[5 hrs.]**

Introduction, Decision under certainty, Decision under risk, Decision under uncertainty: Laplace criterion, MaxiMin criterion, MiniMax criterion, savage MiniMax regret criterion, hurwicz criterion. Decision tree.

Unit-7

Project Management **[7 hrs.]**

Introduction to PERT and CPM, critical Path calculation, float calculation and its importance. Cost reduction by Crashing of activity.

Text Books/ Reference Books:

1. D.S. Hira and P.K. Gupta, Operations Research, (Revised Edition), Published by S.Chand & Company Ltd, 2014.
2. S Kalavathy, Operation Research, Vikas Publishing House Pvt Limited,01-Aug-2002
3. Operations Research by R. Paneerselvam, Prentice Hall of India Pvt. Ltd.
4. S D Sharma, Operation Research, Kedar Nath Ram Nath Publishers.
5. Operations Research: An Introduction by Hamdy Taha, Pearson

Rajarshi Janak University
Faculty of Science and Technology
Course of Study for B.Sc. CSIT
(Seventh Semester/Fourth Year)

Course Title: Software Architecture and Design Pattern
Course Code: SCIT 426
Nature of Course: Theory +Practical
Full Mark: 60+20+20
Credit hrs. : 3
Pass Mark: 24+8+8
L. hrs. : 45

Course Objectives:
The students should be able to:

- Design and implement codes with higher performance and lower complexity
- Demonstrate code qualities needed to keep code flexible
- Illustrate design principles and be able to assess the quality of a design with respect to these principles.
- Explain principles in the design of object oriented systems.
- Understand a range of design patterns.
- Discuss suitable patterns in specific contexts

Course Contents

Unit–1
Introduction **[9 hrs.]**
Introduction to design pattern, the catalog of design pattern, organizing the catalog, how design patterns solve design problems, design pattern selection, use of design pattern., key concepts of object oriented design other related concepts, benefits and drawbacks of the paradigm

Unit–2
Analysis of System **[9 hrs.]**
Overview of the analysis phase, stage 1: gathering the requirements functional requirements specification, defining conceptual classes and relationships, using the knowledge of the domain Design and Implementation

Unit–3
Design Pattern Catalog **[9 hrs.]**
Structural patterns, Adapter, bridge, composite, decorator, facade, flyweight, proxy.

Unit–4
Interactive systems and the MVC architecture **[9 hrs.]**
MVC architectural pattern, analyzing a simple drawing program , designing the system, designing of the subsystems, getting into implementation , implementing undo operation , drawing incomplete items, adding a new feature , pattern based solutions.

Unit–5 **[9 hrs.]**
Designing with Distributed Objects: Client server system, java remote method invocation, implementing an object oriented system on the web (discussions and further reading) a note on input and output, selection statements, loops arrays.

Laboratory Work:
Laboratory work should include all features of Software Architecture and Design Pattern.

Text Books/ Reference Books:

1. Brahmadathan, Sarnathrammath, **"Object-oriented analysis, design and implementation"**, universitiespress, 2013
2. Erich Gamma, Richard Helm, Ralph Johnson and John Vlissides, **"Design Patterns: Elements of Reusable Object-Oriented Software",** PEARSON Publication, 2013.
3. Frank Bachmann, Regine Meunier, Hans Rohnert, **"Pattern Oriented Software Architecture**–**Volume 1"**, Wiley, 1996.
4. William J Brown et al., **"Anti-Patterns: Refactoring Software, Architectures and Projects in Crisis"**, John Wiley, 1998.

Rajarshi Janak University
Faculty of Science and Technology
Course of Study for B.Sc. CSIT
(Seventh Semester/Fourth Year)

Course Title: Advanced Computer Architecture
Nature of Course: Theory +Practical
Credit hrs. : 3
L. hrs. : 45

Course Code: SCIT 427
Full Mark: 60+20+20
Pass Mark: 24+8+8

Course Objectives:

- To understand the concepts of parallel processing
- To illustrate and contrast the parallel architectures
- To recall parallel programming concepts

Course Contents

Unit–1
Theory of Parallelism **[9 hrs.]**
Parallel Computer Models, The State of Computing, Multiprocessors and Multicomputer, Multi vector and SIMD Computers ,PRAM and VLSI Models, Program and Network Properties ,Conditions of Parallelism, Program Partitioning and Scheduling, Program Flow Mechanisms, System Interconnect Architectures, Principles of Scalable Performance, Performance Metrics and Measures, Parallel Processing Applications, Speedup Performance
Laws, Scalability Analysis and Approaches.

Unit–2
Hardware Technologies **[9 hrs.]**
Processors and Memory Hierarchy, Advanced Processor Technology, Superscalar and Vector Processors, Memory Hierarchy Technology, Virtual Memory Technology.

Unit–3
Pipelining **[9 hrs.]**
Pipelining and Superscalar Techniques, Linear Pipeline Processors, Nonlinear Pipeline Processors, Instruction Pipeline Design, Arithmetic Pipeline Design, computer arithmetic principles, Static arithmetic pipeline, Multifunctional arithmetic pilelines.

Unit–4
Parallel and Scalable Architectures **[9 hrs.]**
Multiprocessors and Multicomputers, Multiprocessor System Interconnects, Cache Coherence and Synchronization Mechanisms, Three Generations of Multicomputers, Message-Passing Mechanisms , Multivector and SIMD Computers ,Vector Processing Principles, Multivector Multiprocessors ,Compound Vector Processing ,SIMD Computer Organizations (Up to 8.4),Scalable, Multithreaded, and Dataflow Architectures, Latency-Hiding Techniques, Principles of Multithreading, Fine-Grain Multicomputers, Scalable and Multithreaded Architectures, Dataflow and Hybrid Architectures.

Unit–5

Software for parallel programming **[9 hrs.]**

Parallel Models, Languages, and Compilers, Parallel Programming Models, Parallel Languages and Compilers, Dependence Analysis of Data Arrays, Parallel Program Development and Environments, Synchronization and Multiprocessing Modes. Instruction and System Level Parallelism, Instruction Level Parallelism ,Computer Architecture ,Contents, Basic Design Issues ,Problem Definition ,Model of a Typical Processor, Compiler-detected Instruction Level Parallelism ,Operand Forwarding ,Reorder Buffer, Register Renaming, Tomasulo's Algorithm ,Branch Prediction, Limitations in Exploiting Instruction Level Parallelism, Thread Level Parallelism.

Laboratory Work:

The Practical exercises shall include parallel processing, pipelining and parallel algorithms.

Text Books/Reference Books:

1. Kai Hwang and Naresh Jotwani, **"Advanced Computer Architecture (SIE): Parallelism, Scalability, Programmability"**, McGraw Hill Education 3/e. 2015
2. Er. Rajiv Chopra, **"Advanced computer architecture"**, S. Chand publishing
3. John L. Hennessy and David A. Patterson, **"Computer Architecture: A quantitative approach"**, 5th edition, Morgan Kaufmann Elseveir, 2013

Rajarshi Janak University
Faculty of Science and Technology
Course of Study for B.Sc. CSIT
(Seventh Semester/Fourth Year)

Course Title: Microprocessor Based Design
Nature of Course: Theory and Practical
Credit hrs. : 3
L. hrs. : 45

Course Code: SCIT 428
Full Mark: 60+20+20
Pass Mark: 24+8+8

Course Objectives:
The students should be able to:

- Apply the knowledge of microprocessor with other digital/analog system and interfacing to design a complete system.

Course Contents

Unit-1
Interfacing Concept **[4 hrs.]**
Interfacing, Interfacing Types, Address Decoding, I/O Mapping, Memory Mapping, I/O Memory Mapping, Registers and Input/output Registers, PC Interfacing Techniques.

Unit-2
Digital Interfacing **[12 hrs.]**
Input/output and Microcomputer, Simple input, Simple output, Programmable Parallel Ports, Handshaking, Single handshaking IO, Double handshaking IO, Introduction to Programmable Peripheral Interface 8255 A, Functional Block Diagram, Different Modes of Operations, Introduction to Programmable Interval Timer 8253 and Difference between 8253 and 8254, Functional Block Diagram, Different Modes of Operation, Keyboard Interfacing, Alphanumeric Display Interfacing, Microcomputer ports Interfacing to high-power devices.

Unit-3
Interrupts & Interrupt Controller **[6 hrs.]**
Interrupt Vector Tables, Types of Interrupts, Assembly Language program and Interrupt Procedure Hardware interrupts and Applications, Examples of Various ISR, Introduction to Programmable Interrupt Controller 8259, Functional Block Diagram, Operations of Interrupt, Programming of 8259

Unit-4
Analog Interfacing **[5 hrs.]**
Operational Amplifier Basics, Sensors and Transducers, Digital to Analog Conversion and Analog to Digital Conversion – Basics, Operations, Specification, Applications and Interfacing, A Microcomputer Based Industry-Process Control System.

Unit-5
Serial and Parallel Data Communication **[6 hrs.]**
Synchronous and Asynchronous Data Communication, Parity and other error control, Baud rates, Serial Interface Device, Serialization, RS 232 Interface Pin Description, Simplex Connection, Duplex Connection, Full Duplex Connection, Connection Between DTE to DTE, Connection to Printers and Zero Modem.

Unit-6

Microcontroller & Interfacing **[8 hrs.]**

General Microcontroller Concept, Pin Configuration, I/O Port Structure, Memory Organization, Special Function Registers, External Memory, Reset Operations, Instruction Set, Timer Operation, Serial Port Operation, Interrupt Design and Processing, Assembly Instructions and Programming.

Unit-7

Grounding and Shielding **[4 hrs.]**

Outline for grounding and shielding, Single point grounding and grouped loop, Noise, noise coupling mechanism and prevention, Filtering and smoothing, Different kinds of shielding mechanism, Protecting against electrostatic discharge, Line filters, isolators and transient suppressors

Laboratory Work:

Assembly language based programming. PPI, ADC and various interfacing with RS232, Printer Port should be experimented. At the semester end, individual project work based on microcontroller for industry process control should be done.

Lab exercise may comprise some of the followings:

1. Assembly language programming
2. Simple data transfer usingPPI
3. Handshake transfer usingPPI
4. Interfacing of A/D converter usingPPI
5. Interfacing of A/D using Microcontroller
6. Interfacing of A/D converter using Printerport
7. Demonstration of other interfacing techniques anddevices
8. Writing an interrupt ServiceRoutine

Text Book/ Reference Books:

1. D. V. Hall, "**Microprocessors and Interfacing - Programming and Hardware"**, McGraw Hill
2. K. J. Ayala, "**The 8051 Microcontroller: Architecture, Programming and Applications"**, WestPublishing
3. K.R. Fowler, "***Electronic Instrument Design***", New York Oxford,Oxford UniversityPress.
4. E.O. Duebelin, "**Measurement System Application and Design**" TataMcGraw Hill, NewDelhi

BSC CSIT

Fourth Year

Eighth Semester

Rajarshi Janak University
Faculty of Science and Technology
Course of Study for B.Sc. CSIT
(Eighth Semester/Fourth Year)

Course Title: Simulation and Modeling
Nature of Course: Theory + Practical
Credit hrs. : 3
L. hrs. : 45

Course Code: SCIT 410
Full Mark: 60+20+20
Pass Mark: 24+8+8

Course Objectives:
This course provides the discrete and continuous system, generation of random variables, analysis of simulation output and simulation languages.

Course Contents

Unit-1
Introduction to Simulation **[6 hrs.]**
Introduction to simulation and modeling , Continuous and discrete systems, System simulation, Real time simulation, Types of Simulation Models, Steps in simulation Study, Phases of a simulation study, Advantages of simulation, Limitations of the Simulation and modeling , applications of simulation and modeling

Unit-2
Physical and Mathematical models **[4 hrs.]**
Static and Dynamic physical model, Dynamic physical model, Static mathematical models, Comparisons

Unit-3
Simulation of Continuous Systems **[4 hrs.]**
Continuous system models, Analog computer, Analog methods, Hybrid simulation, Digital-Analog simulators, Continuous System simulation languages (CSSLs), Feedback systems example

Unit-4
Queuing system and Markov chains **[6 hrs.]**
Components of queuing system, Characteristics of queuing systems, Model and types of queuing system, notation use in Queuing system, queuing network, Measurement of system performance, Applications of queuing system, Markov chains key features , Markov process , Application of Markov chain

Unit-5
Random Numbers **[10 hrs.]**
Properties of random number, Random Number Tables, Pseudo Random Numbers, Generation of Random Number, Testing Numbers for Randomness, Uniformity Test, Chi-square test, testing for auto correlation, Poker Test

Unit-6
Verification and Validation of Simulation Models **[6 hrs.]**
Model building, verification and Validation, Verification of Simulation Models, Calibration and Validation of Models

Unit-7

Analysis of Simulation Output **[4 hrs.]**

Estimation methods, Simulation run statistics, Replication of runs, Elimination of internal bias

Unit-8

Simulation Software **[5 hrs.]**

Simulation in Java, Simulation in GPSS, Simulation in SSF, recent simulation software

Laboratory Work:

Laboratory exercises using simulation and modeling packages and student also develop their own simulation software.

Text Books/ Reference Books:

1. Jerry Banks, John S. Carson, Barry L. Nelson, David M. Nicol **"Discrete - Event system simulation"**, Pearson education.
2. G. Gorden, **"System Simulation"**, Prentice Hall of India
3. M. Law and R.F. Perry, **"Simulation: A problem-solving approach"**, Addison Wesley publishing company.
4. M. Law and W.D. Kelton, **"Simulation Modeling and analysis"**, McGraw Hill, 1991.

Rajarshi Janak University
Faculty of Science and Technology
Course of Study for B.Sc. CSIT
(Eighth Semester/Fourth Year)

Course Title: Internet of Things (IoT) **Course Code:** SCIT 411
Nature of Course: Theory + Practical **Full Mark:** 60+20+20
Credit hrs. : 3 **Pass Mark:** 24+8+8
L. hrs. : 45

Course Objectives:

- To understand the basics of Internet of things and protocols.
- To introduce the application areas where Internet of Things can be applied.
- To understand the concepts of Web of Things

Course Contents

Unit -1
Introduction **[4 hrs.]**
Introduction to IOT and its important, Components of an IoT ecosystem, Technology drivers, Business drivers, Trends and implications, Privacy and Security Issues.

Unit-2
Networking and Communication **[9 hrs.]**
Introduction, Different Aspects of Network and Communication, Wireless Medium Access, MAC protocol survey, sensor Networks, Sensor Deployment, Node Discovery, Data aggregation and dissemination, IOT PROTOCOLS - Protocol Standardization for IoT , SCADA and RFID Protocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE802.15.4–BACNet Protocol– Modbus – KNX – Zigbee– Network layer – APS layer – Security

Unit-3
Architecture of IoT **[9 hrs.]**
Open source architecture of IOT, OIC Architecture & Design principles- - IoTivity: An Open source IoT stack - Overview- IoTivity stack architecture- Resource model and Abstraction.
ARCHITECTURE of IOT, IoT Devices and deployment models, Reference models and architecture, IoT reference Model, IoT reference Architecture, Functional view, Deployment and Operational View

Unit-4
Web of Things **[9 hrs.]**
Web of Things versus Internet of Things – Two Pillars of the Web – Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence.

Unit-5
Applications of IoT **[5 hrs.]**
IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications. Study of existing IoT platforms /middleware, IoT- A, Hydra etc.

Unit-6

Challenges and Developments of IoTs **[9 hrs.]**

Design challenges, Deployment Challenges, Security Challenges, Additional Challenges, Applications of IoT: Developing Sensor based applications for Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Life Styles. Data Analytics for IoT- Software & Management Tools for IoT , Cloud Storage Models & Communication APIs, Cloud computing for IoT

Laboratory Work:

Laboratory work consists of IOT protocols, Open source IoT stack and web of things.

Text Books/ References Books:

- Vijay Madisetti, ArshdeepBagha, **" Internet of Things: A Hands-on Approach"**, Orient Blackswan Pvt. Ltd.,New Delhi,2015
- Honbo Zhou, **"The Internet of Things in the Cloud: A Middleware Perspective"**, CRC Press, Latest publications
- D. Jude Hemanth, SubarnaShakya, ZubairBaig,Editors, **" Intelligent Data communication Technologies and Internet of Things"** ICICI, 2019

Rajarshi Janak University
Institute of Science and Technology
Course of Study for B.Sc. CSIT
(Eighth Semester/Fourth Year)

Course Title: Social and Professional Issues in IT
Nature of Course: Theory + Practical
Credit hrs. : 3
L. hrs. : 45

Course Code: SCIT 412
Full Mark: 60+20+20
Pass Mark: 24+8+8

Course Objectives:

- To introduce students to the social implications of Information Technology
- To help change students' ethical behavior pertaining to Information technology by introducing them the issues arise in the field of IT.
- To make students responsible to their profession and in the work place.
- To make students aware of Intellectual Property Rights and other prevailing rules and laws related to IT.

Course Contents

Unit-1
History of Computing **[6 hrs.]**
History before 1946 AD, History after 1946 AD - computer hardware, software and networking. Pioneers of Computing.

Unit–2
Society and Technological Changes **[9 hrs.]**
Society and Technology, Social Implications of IT, Individual Aspects of IT, Growth, Control, and Access to the Internet, Implication of Information Networks, Gender-related Issues, International Issues.

Unit–3
Ethical Analysis **[9 hrs.]**
Ethical Issues Categorization, Philosophical Analysis, Ethical Relativism, Descriptive and Normative Claim, Intrinsic and Instrumental Values, Utilitarianism and Deontological Theories, Rights and Social Contract Theories, Rawlsian Justice, Virtue Ethics, Social Context of Design,

Unit–4
Professional Responsibilities **[9 hrs.]**
Definition of a Profession, Examination of Various Occupations/Professions, Confidential and Propriety Information, Conflict of Interest, Environment Ethics, Professional Rights, Codes of Ethics of IEEE and ACM, Whistle blowing – Types, Conditions and Prevention.

Unit–5
Risks and Liabilities of SW Systems **[6 hrs.]**
Characteristics of Risks, Terms Associated to Risks – Assessment, Management etc., Complex and Non-Complex Systems, Controlling Complexities, Implications of Software complexity -Therac-25 case.

Unit–6

Intellectual Property **[3 hrs.]**

Definition of Intellectual Property, Copyright, Patent, Trade Mark, Trade Secret, Software Piracy, Software Patents, International Issues, Copyright, Patent, Design and Trademark in Context of Nepal, Technology, Telecommunication and IT Policies of Nepal.

Unit–7

Privacy and Civil Liberties **[3 hrs.]**

Panopticon, Privacy - Then and Now, Computer and Privacy Issues, Personal Privay, Pricay and a Social Good, Privacy Protection.

Laboratory Work/ Case Study:

Class work and / or group discussions followed by presentation are carried out in each unit, wherever applicable. A few cases (may be added as and when necessary) and its relevant units are given here: -

S.N.	Case Name	Relevant Unit Nos.
1	Big Bank	Unit–II and Unit–V
2	Computer Crime	Unit–II and Unit–III
3	Conflict of Interest	Unit–IV
4	Control over the Internet	Unit–II
5	HELP System	Unit–II and Unit–V
6	Internet in Schools	Unit–II
7	Internet Use	Unit–II
8	Philosophical Ethics: German Citizens	Unit–III
9	The Intel Pentium Chip	Unit–IV
10	The Space Shuttle Challenger Accident	Unit–IV
11	The Trouble Ticketing System	Unit–II
12	The Virtual Professor	Unit–II
13	Therac-25 Accidents	Unit–V

Text Books/Reference Books:

1. Roshan Chitrakar and Deepanjal Shrestha, **"Social and Professional Issues in IT"**, PAI Publicaiton, First Edition, 2005
2. Johnson, D. G., **"Computer Ethics"**, Pearson Education Asia, Third Edition, 2001, ISBN: 81-7808-306-X.
3. Hussain, K. M., and Hussain, D. S., "**Computers; Technology, Applications, and Social Implications"**, PHI, New Delhi, ISBN: 81-203-0620-1.
4. Articles collected from various Journals and Periodicals, such as IEEE-Computer, BYTE, ACM Periodicals, etc.
5. Information collected and downloaded from the Internet/WWW.
6. IT Policies and Laws of the local government
7. International IT Policies and Laws (Source: ISO, SEI, IEEE, etc.)
8. Various papers, articles and case studies from journals, conferences and IT industries.

Rajarshi Janak University
Institute of Science and Technology
Course of Study for B.Sc. CSIT
(Eighth Semester/ Fourth Year)

Course Title: Internship
Nature of Course: Internship
Credit hrs. : 6

Course Code: SCIT 413
Full Marks: 200
Pass Marks: 80

Course Description:
This course is about learning professional experience that offers meaningful, practical work related to computer science and information technology study or career interest. This course gives a student the opportunity for career exploration and development, and to learn new skills in the related industry. It offers the employer the opportunity to bring new ideas and energy into the workplace, develop talent and potentially build a pipeline for future full-time employees.
The internship period will be minimum of **TEN** weeks to ensure enough professional experience and skill to a particular job or profession in the industry.
Many companies offer internship for computer science and information technology students. Students may choose to do their internship in different sectors that develop or use computer systems frequently like software/hardware development companies, telecommunications companies, network and internet service related companies, government sectors, financial sectors, health related sectors etc. Internship can be done in groups, but, each student must prepare a separate internship report on the basis of his/her part in the group work. Mentors are assigned to advise each student during internship in the company and a supervisor is also assigned to supervise each student during internship in the college.

Course Objectives:
The main objective of this course is to expose students to a particular job and a profession in the industry. It gives students the opportunity to re-examine their career objectives and explore the variety of opportunities in the field of computer science and information technology. An internship provides a variety of benefits for students who want to broaden their chances for landing a job and jump-starting their careers. Internships give students a taste of what a profession is like, help them meet people who can provide guidance, feedback, and support.

Role of Mentor:
Mentors are assigned to advise each student during internship in the company. Mentors are expected to share their experience, insight, and enthusiasm with the student throughout the internship. They should continually monitor the progress of the student, assessing written and oral communications and guiding the development of the student's technical and managerial skills, effectiveness and presentation of self. Advisors are expected to submit a post-internship evaluation of the student's accomplishments and abilities and of the internship program in general.

Role of Supervisor:
A supervisor is assigned to each student to supervise internship work and progress during the internship in the college. Supervisors help students by giving ideas to solve problems to the activities assigned to the students in the company. They also monitor the progress of the internship and give ideas to prepare final report of the internship in the prescribed format.

Role of Student:
In order for the internship to be beneficial, student should begin with a definition of his/her objectives and specific interests to ensure that appropriate activities and projects are assigned. The student will be responsible for the timely completion of all the activities and projects assigned and with professional quality. Student should inform the status of all assignments to the advisor and perform all the duties as assigned. The student is expected to speak frequently with the advisor on the progress and interest in other projects, as well as to discuss observations and questions about meetings, projects and other activities involved.

Phases: The overall internship work is divided into two phases:

4. Mid-Term Presentation
5. Final Report Submission and Presentation

7. **Mid-Term Presentation:**
   - Students have to present their progress in the middle of the semester after completing approximately 50% of the internship work.

8. **Final Report Submission and Presentation:**
   - Students prepare final report in the prescribed format and present their work for final evaluation.

Report Contents:

- Title Page
  - A standardized page for specifying the title and author of the work
- Certificate of Authorship
  - Declaration that the work reported is the original work
- Approval Sheet
  - Recommendation for approval from Head / Program Coordinator, Supervisor, External and Internal evaluators
- Acknowledgements
  - Thanking anyone who has helped you in any way
- Abstract
  - Giving a short overview of the work
- Table of Contents
  - Giving page numbers for all major section headings
- List of Figures
  - Giving page numbers for all the figures
- List of Tables
  - Giving page numbers for all the tables
- List of Abbreviations
  - List of abbreviations
- Introduction (Chapter I)
  - Introduction: Introduce the organization and the work
  - Problem Statement: Explain why you are doing this work and what is the problem being solved
  - Aims and Objectives: Clearly explain aims and objectives and scope of your work
  - Report Organization: Explain in brief about organization of your report
- Related Work / Literature Review (Chapter II)
  - Explain the current state of the art in your area

- Explain the works other have people done (published or commercial) that is relevant to yours
- Internship Activities (Chapter III)
  - Explain different activities done during the internship period
- Conclusion (Chapter IV)
  - Explain what conclusions you have come to as a result of doing the internship work
- References / Bibliography
  - Provide a list of papers, books and other publications that are explicitly referred to in the text
  - Use IEEE citation style
- Appendices
  - Supplementary material should be included in appendices - these are optional, but they might contain:
  - Code listings – A listing of the code you have written for the project assigned during internship. You should NOT include code listings for code you have not written!! If your project involves modifying code previously written by others, then you may include this other code as long as you indicate clearly in the code listing what parts have been written by you.
  - Raw data – If your work involves data collection then this should usually be included in appendices. This should provide supporting evidence for claims made in the main part of the work (e.g., copies of a user evaluation questionnaire and some sample responses).
  - Examples of test data
  - Electronic material on a CD/DVD/Pen Drive inside the back cover. This might contain executable software, source code, graphics, slides used for your presentation, etc. Where the appendices are long (e.g. code listings) do not print them out, rather provide them on a CD/DVD/Pen Drive

Report Format:

- Page Number
  The pages containing certificate of approval to the page containing list of abbreviations should be numbered in roman starting from i. The pages starting from Chapter 1 onwards should be numbered in numeric starting from 1. Page numbers should be inserted at the bottom of the page and aligned centre.
- Paper Size and Margin
  The paper size should be A4 and the margins must be set as:
  - Top = 1 in (2.54 cm)
  - Bottom = 1 in (2.54 cm)
  - Left = 1.25 in (3.17 cm)
  - Right = 1 in (2.54 cm)
- Paragraph
  All paragraphs must be indented and justified (both left-justified and right-justified). All the paragraphs must be written using Times New Roman font with font size 12 and 1.5 paragraph spacing.
- Heading
  No more than 3 levels of headings should be used. Font size for the heading should be 16 for chapter title, 14 for section headings and 12 for subsection headings. All the headings should be bold faced.
- Figures and Tables

Figure captions should be centred below the figures and table captions should be centred above the table.

Evaluation:
Head / Program Coordinator, Supervisor, Mentor, and External evaluator will evaluate the overall internship work. External evaluator will be assigned only for the final defense.

Marks Allocation:

- Supervisor – 40
- Mentor – 100
- Head / Program Coordinator – 20
- External – 40

Total – 200

Weight of each Phase:

- Mid-Term Presentation - 15%
  - Evaluated by Head / Program Coordinator (10 Marks) and Supervisor (20 Marks)
- Final Report Submission and Presentation - 85%
  - Evaluated by Head / Program Coordinator (10 Marks), Supervisor (20 Marks), Mentor (100 Marks), and External evaluator (40 Marks)

Text Books: None
Prerequisite: Depending upon types of organization and internship activities

Rajarshi Janak University
Faculty of Science and Technology
Course of Study for B.Sc. CSIT
(Eighth Semester/Fourth Year)

Course Title: Embedded System
Nature of Course: Theory + Practical
Credit hrs. : 3
L. hrs. : 45

Course No: SCIT 429
Full Mark: 60+20+20
Pass Mark: 24+8+8

Course Objectives:
The major objective of this course is to make students familiar with applied computing principles in recent emerging technologies and the design and development process for dedicated computer

Course Contents

Unit-1
Introduction **[5 hrs.]**
Overview of Embedded system, Classification, Requirements, Dedicated and automated systems Hardware and Software, Purpose, Application, The product design cycle, System Specification and evaluation

Unit-2
Issues in Hardware and Software design **[10 hrs.]**
Combinational and Sequential Logic, Design and Optimize Custom Single-Purpose Processor, Compilers, Linkers, Debuggers, Sensors, Actuators Signal Conditioning, Architecture and Operation, Selecting a Microprocessor, General Purpose Processor Design, Instruction Set Processors, Development Environment

Unit-3
Memory and Interfacing **[8 hrs.]**
Types of Memory, Memory Hierarchy, I/O Addressing, Interrupts, DMA, Multilevel BUS Architectures

Unit-4
Real Time Operating System **[8 hrs.]**
Operating System, Types of RTOS, Task, Process and Threads, Multiprocessor and Multitasking, Scheduling goals in RTS, Clock driven and Priority Driven Scheduling Algorithms, Scheduling Criteria, Frame Size Constraints, Task Synchronization

UNIT-5
Control System **[6 hrs.]**
Open and Closed Loop, PID controllers, PID Tuning, Software Coding

UNIT-6
Microcontrollers and IC Technology **[8 hrs.]**
Intel 8051 Microcontrollers and its family, architecture and instruction set, Assembly language programming, Interfacing with 7 segment display, VLSI Technology, Programming Logic Device (PLD) IC Technology, Semi-Custom IC Technology, VHDL Overview and FSM design

Laboratory Work:
The Laboratory exercise will cover all the features design mentioned. Students are encouraged to do VHDL Programming

Text Books/Reference Books:

- David E. Simon, **"An Embedded Software Primer"**, Addison-Wesley, 2005
- Muhammad Ali Mazidi, **"8051 Microcontroller and Embedded Systems"**, Prentice Hall, 2006
- Frank Vahid, Tony Givargis, **"Embedded System Design"**, John Wiley & Sons, 2008
- Douglas L. Perry, **"VHDL Programming by example"**, McGraw Hill, 2002

Rajarshi Janak University
Faculty of Science and Technology
Course of Study for B.Sc. CSIT
(Eighth Semester/Fourth Year)

Course Title: Software Quality Assurance
Nature of Course: Theory + Practical
Credit hrs. : 3
L. hrs. : 45

Course Code: SCIT 430
Full Mark: 60+20+20
Pass Mark: 24+8+8

Course Objectives:
After the completion of course students will be able to:

- Identify test cases for any given problem.
- Compare the different testing techniques.
- Classify the problems according to a suitable testing model.
- Apply the appropriate technique for the design of flow graph.
- Create appropriate document for the software artefact.

Course Contents

Unit–1

Basics of Software Testing **[9 hrs.]**

Basic definitions, Software Quality , Requirements, Behaviour and Correctness, Correctness versus Reliability, Testing and Debugging, Test cases, Insights from a Venn diagram, Identifying test cases, Test-generation Strategies, Test Metrics, Error and fault taxonomies , Levels of testing, Testing and Verification, Static Testing.

Unit–2 **[9 hrs.]**

Problem Statements: Generalized pseudo code, the triangle problem, the NextDate function, the commission problem, the SATM (Simple Automatic Teller Machine) problem, the currency converter, Saturn windshield wiper

Functional Testing: Boundary value analysis, Robustness testing, Worst-case testing, Robust Worst testing for triangle problem, NextDate problem and commission problem, Equivalence classes, Equivalence test cases for the triangle problem, NextDate function, and the commission problem, Guidelines and observations, Decision tables, Test cases for the triangle problem, NextDate function, and the commission problem, Guidelines and observations.

Unit–3 **[9 hrs.]**

Fault Based Testing: Overview, Assumptions in fault based testing, Mutation analysis, Fault-based adequacy criteria, Variations on mutation analysis. **Structural Testing:** Overview, Statement testing, Branch testing, Condition testing, Path testing: DD paths, Test coverage metrics, Basis path testing, guidelines and observations, Data –Flow testing: Definition-Use testing, Slice- based testing, Guidelines and observations**.**

Unit–4 **[9 hrs.]**

Test Execution: Overview of test execution, from test case specification to test cases, Scaffolding, Generic versus specific scaffolding, Test oracles, Self-checks as oracles, Capture and replay **Process Framework :**Basic principles: Sensitivity, redundancy, restriction, partition, visibility, Feedback, the quality process, Planning and monitoring, Quality goals, Dependability properties, Analysis Testing, Improving the process, Organizational factors.

Planning and Monitoring the Process: Quality and process, Test and analysis strategies and plans, Risk planning, monitoring the process, Improving the process, the quality team.

Unit–5 **[9 hrs.]**

Integration and Component-Based Software Testing

Overview, Integration testing strategies, Testing components and assemblies. System, Acceptance and Regression Testing: Overview, System testing, Acceptance testing, Usability, Regression testing, Regression test selection techniques, Test case prioritization and selective execution. **Levels of Testing, Integration Testing:** Traditional view of testing levels, Alternative life-cycle models, The SATM system, Separating integration and system testing, A closer look at the SATM system, Decomposition-based, call graph-based, Path-based integrations**.**

Laboratory Work:

Different manual testing and automation testing should be done to demonstrate each unit.

Text Books/Reference Books:

1. Paul C. Jorgensen, **"Software Testing, A Craftsman's Approach"**, 3rd Edition, Auerbach Publications, 2008.
2. Mauro Pezze, Michal Young,**"Software Testing and Analysis – Process, Principles and Techniques**", Wiley India,2009.
3. Aditya P Mathur,**"Foundations of Software Testing"**, Pearson Education, 2008.
4. Gopalaswamy Ramesh, Srinivasan Desikan, **"Software testing Principles and Practices**", 2nd Edition, Pearson, 2007.
5. Ron Patton, **"Software Testing"**, 2nd edition, Pearson Education, 2004.
6. Brian Marrick,**"The Craft of Software Testing"**, Pearson Education, 1995.
7. AnirbanBasu, **"Software Quality Assurance, Testing and Metrics"**, PHI,2015
8. Naresh Chauhan, **"Software Testing"**, Oxford University press.

Rajarshi Janak University
Institute of Science and Technology
Course of Study for B.Sc. CSIT
(Eighth Semester/Fourth Year)

Course Title: Software Project Management
Nature of Course: Theory + Practical
Credit hrs. : 3
L. hrs. : 45

Course Code: SCIT 431
Full Mark: 60+20+20
Pass Mark: 24+8+8

Course Objectives:
After studying this course, students will be able to:

- Evaluate software projects
- Select appropriate Software Project Development approach
- Estimate Software efforts
- Acquire knowledge pertaining to Scheduling Software, allocating resources, and monitoring and controlling Software projects
- Explain different Software quality Standards
- Learn how to use Project Management Software

Course Contents

Unit-1 **[5 hrs.]**

Introduction to Software Project Management: Definition of Project, Software Projects versus other types of Project, Some ways of Categorizing Software Projects, Problems with Software Projects, Stakeholders, Information and Control in Organizations, An Overview of Project Planning, Selection of Appropriate Project Approach

Unit-2 **[8 hrs.]**

Project Evaluation: Strategic Assessment, Technical Assessment, Cost-benefit Analysis, Cash flow Forecasting, Cost-benefit evaluation Techniques, Risk evaluation

Effort Estimation: Software Effort Estimation Techniques, Expert Judgment, Estimation by analogy, Albrecht Function Point Analysis, Function point Mark II, object points, A procedural code-oriented approach, COCOMO

Unit-3 **[12 hrs.]**

Project scheduling: Project Schedule, Projects and activities, Scheduling activities, Network planning models, Formulating a network model, Critical Path Method (CPM), Program Evaluation Review Technique (PERT)

Risk Management: Nature of Risk, Managing Risk, Risk Identification, Risk analysis, Reducing the Risks, Evaluating Risks to the Schedule using PERT

Unit-4 **[9 hrs.]**

Resource Allocation: Nature of Resources, Identifying Resource Requirements, Scheduling Resources, Publishing the Resource Schedule

Managing People and Organizing Team: Organization Behaviour, Selecting the right person for the job, Instruction in the best methods, Motivation, Becoming a team, Decision Making, Leadership, Organization Structures, Publishing the resource schedule

Unit-5 **[11 hrs.]**

Monitoring and Control: Creating a Framework, Collecting Data, Visualizing Progress, Cost Monitoring, Change Control

Software Quality: Defining Software Quality, ISO 9126, An Overview of ISO 12207, Practical Software Quality Measures, Product versus Process Quality Management, BS EN ISO 9001, Techniques to enhance Software Quality, An Overview of PRINCE and BS 6079

Laboratory Work:

Laboratory work consists of learning how to use any one of the popular Project Management Softwares such as Microsoft Project, Workzone, ProofHub, Scoro, Britix24, etc., as applied to managing Software Projects.

Text Book/Reference Books:

1. Bob Hughes and Mike Cotterell, **"Software Project Management"**, The McGraw-Hill Companies
2. E. M. Bennatan, "**Software Project Management: A Practitioner's Approach"**, London, McGraw-Hill
3. Donald Yeates and James Candle, **"Project Management for Information Systems"**, London, Pitman Publications

Rajarshi Janak University
Institute of Science and Technology
Course of Study for B.Sc. CSIT
(Eighth Semester /Fourth Year)

Course Title: Geographical Information System
Nature of Course: Theory + Practical
Credit hrs. : 3
L. hrs. : 45

Course Code: SCIT 432
Full Mark: 60+20+20
Pass Mark: 24+8+8

Course Objectives:
After the completion student will be able to:

- Explain GIS, development and components of GIS
- Explain data capturing techniques
- Analyze spatial and non- spatial data
- Explain new development in GIS
-

Course Contents

Unit-1
Introduction **[4 hrs.]**
Definition, Historical Background of GIS , Scope and application areas of GIS , Benefits of GIS, Functional components of GIS, GIS in Organizations, Elements of GIS, importance of GIS in Nepal

Unit-2
Coordinate System **[4 hrs.]**
Geographic coordinate system, Map Projections, Commonly used map projection system, projected coordinate system

Unit-3
Data Models **[7 hrs.]**
Introduction, Common Spatial Data Models, Vector Data, Raster Data, Other Data Models: TINs, Object Data Model, 3-d Data Model, Data and File Structure

Unit-4
Maps, Digitization, and Output **[10 hrs.]**
Map concept: map elements, map layers, map scales and representation, Map Boundaries and Spatial Data, Digitizing: The Digitizing Process, Digitizing Errors, Node and Line Snapping, Reshaping: Line Smoothing and Thinning , Scan Digitizing, Editing Geographic Data ,Features Common to Several Layers, Coordinate Transformation: Control Points, The Affine Transformation, Other Coordinate Transformations , Caution When Evaluating Transformations, Projection Vs Transformation.
Output: Maps, Digital Data, Metadata

Unit-5
Capturing Real World **[4 hrs.]**
Different methods of data capture, data preparation, conversion and integration, GPS, Remote Sensing

Unit-6

Spatial Analysis and Terrain Analysis **[8 hrs.]**

Introduction, Selection and Classification, Proximity Functions and Buffering, Overlay: Raster Overlay, Vector Overlay, Terrain Analysis: Introduction, Slope and Aspect, Hydrologic Functions, Profile Plots, Contour Lines, Viewsheds, Shaded Relief Maps

Unit-7

Introduction to spatial data infrastructure **[6 hrs.]**

SDI concepts and its current trend, The concept of metadata and clearing house, Critical factors around SDIs

Unit-8 **[2 hrs.]**

New Developments in GIS

GNSS, Cloud-Based GIS, Open GIS

Laboratory Work:

The lab should cover all the concepts given the chapters

Text Books/ Reference books:

1. Rolf De By, Richard A. knippers, yuxian sun, **"Principles of geographic information systems: An introductory textbook**", international institute for Geoinformation science and Earth observation, the Netherlands
2. Andy Mitchell ,**"ESRI guide to GIS analysis"**, ESRI press, Red lands
3. Paul Bolstad, **"GIS Fundamentals: A First Text on Geographic Information Systems"**, Fifth Edition,
4. Kang-Tsung Chang ,**"Introduction to Geographic Information System"**,

Rajarshi Janak University
Faculty of Science and Technology
Course of Study for B.Sc. CSIT
(Eighth Semester/Fourth Year)

Course Title: Machine Learning
Nature of Course: Theory + Practical
Credit hrs. : 3
L. hrs. : 45

Course Code: SCIT- 433
Full Mark: 60+20+20
Pass Mark: 24+8+8

Course Objectives:

- To recall the problems for Machine Learning. And select Supervised, Unsupervised and Reinforcement learning.
- To understand wide variety of Algorithm
- To understand theory of probability and statistics related to Machine Learning
- To illustrate concept learning, ANN, Bayes classifier, k nearest neighbor.

Course Contents

Unit-1 **[9 hrs.]**

Introduction to Machine Learning: History and Evolution, Artificial Intelligence Evolution.
Different Forms: Statistics, Data Mining, Data Analysis, Data Science**,** Perspective and Issues in Machine Learning.
Machine Learning Categories: Supervised Learning**,** Unsupervised Learning, Reinforcement Learning.
Turning Data into Probabilities: Minimizing Risk**,** The Naïve Bayes Classifier-examples and numerical; Basic Statistics: Average, Variance and Covariance

Unit–2 **[5 hrs.]**

Featured Engineering:
Perspective of Data: Dealing with Missing Data, Handling with categorical Data, Normalizing Data, Feature Construction or Generation.
Exploratory Data Analysis: Univariate Analysis, Multivariate Analysis

Unit-3 **[12 hrs.]**

Supervised Learning:
Regression: Linear Regression, Non-Linear Regression, and Model Evaluation Method.
Classification: Logistic Regression, Support Vector Machine, K-Nearest Neighbors Methods**,**
Decision Tree Technique- Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, Hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning.

Unit-4

Unsupervised Learning: **[7 hrs.]**

K-means Algorithm- Dealing with noise, Elbow method to choose right value of 'k'. Problems with K-means Clustering.
Hierarchical Clustering, Principal Component Analysis (PCA).

Unit-5

Model Diagnosis and Tuning: **[6 hrs.]**

Bias and Variance, K-Fold Cross-Validation, Random Forests, Boosting, Hyperparameter tuning-GridSearch, RandomSearch.

Unit-6

Deep and Reinforcement Learning: **[6 hrs.]**

Artificial Neural Network: Introduction, Neural Network representation, Appropriate Problems, Perceptrons, Backpropagation Algorithm.

Reinforcement Learning: Introduction, Learning Task, Q Learning

Laboratory work:

- Introduction of different Tools and Libraries,
- Exploratory Data Analysis (EDA),
- Model Training,
- Final Training and Testing Models.
- Installation of Python.
- Data Loading for Machine Learning Projects.
- Building a Classifier in Python.
- Implementation of different algorithms (Classification) in Python.
- Small project of Machine Learning using Python Programming.
- Introduction of Weka Tools (Preferable) or any other appropriate tools.

Text Books/Reference Books:

1. Swamynathan Manohar, **"Mastering Machine Learning with Python in six steps. A practical Implementation Guide to Predictive Data Analytics Using Python"**
2. Tom M. Mitchell, **"Machine Learning",** India Edition 2013, McGraw Hill Education.
3. Trevor Hastie, RobertTibshirani, Jerome Friedman, **"The Elements of Statistical Learning"**, 2nd edition, springer series instatistics.
4. Ethem Alpaydın, **"Introduction to machine learning"**, second edition, MIT press.

Rajarshi Janak University
Faculty of Science and Technology
Course of Study for B.Sc. CSIT
(Eighth Semester/Fourth Year)

Course Title: Image Processing
Nature of Course: Theory + Practical
Credit hrs. : 3
Lecture hrs. : 45

Course Code: SCIT 434
Full Mark: 60+20+20
Pass Mark: 24+8+8

Course Objectives:
The major objectives of this course are to:

- Have a clear understanding of the principals the Digital Image Processing terminology used to describe features of images.
- Have a good understanding of the mathematical foundations for digital manipulation of images; image acquisition; preprocessing; segmentation; Fourier domain processing, compression and analysis.

Course Contents

Unit-1
Introduction **[5 hrs.]**
Introduction, Origin of digital image, Image representation, elements of visual perception, fundamental steps in digital image processing, applications, Image Sampling, Quantization, relationship between pixels, Connectivity, distance measure

Unit-2
Image Enhancement in Spatial domain **[8 hrs.]**
Basic gray level transformation, contrast stretching, negative, slicing bit extraction, Histogram processing and equalization, arithmetic and logic operation, Combining Spatial enhancement methods, basics of spatial filters, smoothing and sharpening filters, averaging, low pass, high pass and band pass filtering, high boost filter, high frequency emphasis filter, Laplacian filter

UNIT-3
Image Enhancement in Frequency domain **[8 hrs.]**
Fourier and Fast Fourier transform, visualizing 2D DFT, sine, cosine, Hadamard and Haar transform, Discrete Cosine transform, Smoothing and sharpening frequency domain filtering, Homomorphic filtering

Unit-4
Image Restoration **[5 hrs.]**
Periodic Noise Reduction by Frequency Domain Filtering, Linear Position-Invariant Degradations, Estimation of Degradation Function, Noise models and parameters, Restoration filters, Band pass and Band reject filters

Unit-5
Image Compression **[5 hrs.]**
Image compression models, Compression standards, Interpixel and psychovisual redundancy, Pixel coding: run length, bit plane, predictive and interframe coding

Unit-6

Image Segmentation **[6 hrs.]**

Point, Line and Edge detection, Gradient Operator, Edge Linking and Boundary Detection, Hough Transform, Thresholding, Region-oriented Segmentation

Unit-7

Morphological Image Processing **[3 hrs.]**

Logic Operations, Dilation and Erosion, Opening and Closing

Unit-8

Image Description and Recognition **[5 hrs.]**

Descriptors: Chain codes, Signatures, Shape Numbers, Fourier Descriptors, Patterns and pattern classes, Decision-Theoretic Methods, Overview of Neural Networks in Image Processing, Overview of pattern recognition

Laboratory Work:

The Lab should contain the programming from all the chapters using the high level Programming languages such as MATLAB, Python etc.

Text Books/Reference Books:

1. Rafael C. Gonzalez and Richard E. Woods, **"Digital Image Processing"**, Pearson Edition, Latest Edition.
2. I. Pitas, **"Digital Image Processing Algorithms"**, Prentice Hall, Latest Edition.
3. A. K. Jain, **"Fundamental of Digital Image processing"**, Prentice Hall of India Pvt. Ltd., Latest Edition.
4. K. Castlemann, **"Digital Image processing"**, Prentice Hall of India Pvt. Ltd., Latest Edition.
5. P. Monique and M. Dekker, **"Fundamentals of Pattern recognition"**, Latest Edition.

Rajarshi Janak University
Faculty of Science and Technology
Course of Study for B.Sc. CSIT
(Eighth Semester/Fourth Year)

Course Title: Natural Language Processing
Nature of Course: Theory + Practical
Credit hrs. : 3
L. hrs. : 45

Course Code: SCIT 435
Full Mark: 60+20+20
Pass Mark: 24+8+8

Course Objectives:
The main objective of this course is to provide students general overview of the basics as well as advanced concepts of Natural Language Processing (NLP) and apply the different concepts of NLP both theoretically and practically.

Course Contents

Unit-1
Introduction **[4 hrs.]**
What is Natural Language Processing (NLP), Origins of NLP, Language and Knowledge, Challenges, Language and Grammar, Processing Nepali Languages, NLP Applications; Some Successful Early NLP Systems, Information Retrieval

Unit-2
Language Modeling **[5 hrs.]**
Introduction, Various Grammar-based Language Models, Statistical Language Model.

Unit-3
Word Level Analysis **[7 hrs.]**
Introduction,Regular Expressions, Finite-State Automata, Morphological Parsing, Spelling Error Detection and correction, Words and Word classes, Part-of-Speech Tagging

Unit-4
Syntactic Analysis **[8 hrs.]**
Introduction, Context free Grammar, Constituency, Parsing, Probabilistic Parsing, Nepali Languages

Unit-5
Semantic Analysis **[8 hrs.]**
Introduction, Meaning Representation, Lexical Semantics, Ambiguity, Word Sense Disambiguation

Unit-6
Discourse Parsing **[7 hrs.]**
Introduction, Cohesion, Reference Resolution, Discourse Coherence and Structure

Unit-7
Applications of NLP **[6 hrs.]**
Question Answering, Natural Language Generation, Machine Translation, Information Retrieval, Sentiment Analysis, Summary Generation.

Laboratory Work:
Students will basically get practical concepts of NLP in the high level programming language like Python which includes writing the codes of to solve NLP problems.

Text Books/ Reference Books:

1. Tanveer Siddiqui, U.S. Tiwary, **"Natural Language Processing and Information Retrieval"**, Oxford University Press, 2008.
2. Anne Kao and Stephen R. Poteet (Eds), **"Natural Language Processing and Text Mining"**, Springer-Verlag London Limited, 2007.
3. Daniel Jurafsky and James H Martin, **"Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition"**, 2nd Edition, Prentice Hall, 2008.
4. James Allen, **"Natural Language Understanding"**, 2nd edition, Benjamin/Cummings publishing company, 1995.
5. Gerald J. Kowalski and Mark.T. Maybury, **"Information Storage and Retrieval systems"**, Kluwer academic Publishers, 2000.
6. Stephen Bird, Ewan Klein & Edward Loper (2009). "**Natural Language Processing with Python"**. O'Reilly Media,