# Department of Information Technology

## Structure & Syllabi

## S. Y. B. Tech (2019 Pattern)

### w. e. f. Academic Year 2021-2022

RSCOE

**Dr. Ram Joshi**
**BoS Chairman & Dean Academics**

J.S.P.M.'s Rajarshi Shahu College of Engineering Pune University I.D. No. PU/PN/Engg./173/(2001) Tathawade, Pune-33

**Dr. Rakesh K. Jain**
**Director**

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# Department of Information Technology

**Vision**

"To create quality information technology professionals through superior academic environment."

**Mission**

- To incorporate the IT fundamentals in students to be successful in their career.
- To motivate students for higher studies, research and entrepreneurship.
- To provide IT services to society.


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## Department of Information Technology

### Program Outcomes (POs)

Engineering Graduates will be able to:

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

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

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

**4. Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**5. Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

**6. The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. JSPM's Rajarshi Shahu College of Engineering Department of IT Engineering

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

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

**9. Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

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

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

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

### Program Specific Outcomes (PSOs):

Upon successful completion of UG course in Information Technology, the students will attain following PSOs:

1. Utilize discrete principles of mathematics along with programming paradigms to expedite solution building in the IT domain.
2. Apply computational techniques using core aspects of network and system programming to deliver secured application in the arena of analytics and computing.
3. Develop team spirit with project management skills to handle multidisciplinary complex tasks proficiently and utilize these skills for entrepreneurship

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# *Highlights of the Syllabus*

**Curriculum of Information Technology Department is designed in consultation with experts like:**


Academic Experts


Industry/Corporate Experts


Distinguished Alumni

Following are the features of the curriculum of the **Information Technology Department** designed in association with the **Persistent Systems Pvt. Ltd. Pune and Tata Consultancy Services, Pune**


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## Unique features of the curriculum

1. **Curriculum centered at Outcome Based Education:**

   The new Curriculum is based on student-centered instruction models that focus on measuring student performance through outcomes. The outcomes include subject knowledge, industry required skills and attitudes.

2. **Emphasize on Fundamentals:**

   The nature of the new curriculum is rigorous and well prescribed so that the students can spend more time on preparation and self-study. The students have to learn core subjects, solve practical based assignments and must attempt periodical quizzes. This will benefit them to grasp and keep a strong hold on fundamentals of Engineering in the most effective way.

3. **Experiential Learning:**

   The curriculum emphasizes on hands-on sessions along with theoretical information. The new curriculum considers Problem Based Learning (PBL) as a teaching pedagogy and includes different subjects that encourage the students for hands on learning through virtual labs, mini-projects, etc. Accordingly, the curriculum maintains good balance between theory and laboratory credits.

4. **Promote Creativity and Innovation:**

   Along with experiential learning, the curriculum also motivates the students to inculcate creativity and innovation. Apart from conventional lab, the curriculum provides a freedom for students to perform industry assignments, pilot projects, innovative development, etc.

5. **Inculcating Ethics and Values:**

   To improvise student's behavior, the curriculum has included systematic courses on ethics and values. The moral principles can help students to make right decisions, lead their professional lives and become ethical citizen.

6. **Blend of Curricular and Noncurricular Activities**

   The curriculum also gives importance of different activities like co-curricular, extra-curricular, sports, culture, etc. This will help to do all round development of students in all possible ways.

7. **Four Tracks in B-Tech:**

   The curriculum provides four tracks in the curriculum as

   I. Industry Internship
   II. Entrepreneur
   II. Higher Studies and Research
   IV. In house Project

8. **Global Competence:**

   The curriculum provides a unique opportunity for students to learn and engage in open and effective interaction with people from diverse and interconnected world. The combination of foreign languages (German, Japanese, English) and international internships in the curriculum help the students to build a capacity to examine global and intercultural issues and to propose perspectives and views.

9. **Industry Induced Internship Program**

   To support ever demanding industry requirements, the curriculum has included an industry internship with an objective to learn technologies pertaining to their discipline and enhance their technical knowledge with a support of the live platform of Industry.

10. **Motivation for Self Learning:**

    The curriculum also offers a freedom to students to take the initiatives in their learning needs and set the goals with the help of online learning platforms like MOOCs, NPTEL, Swayam, etc.

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# A.Y. 2021-2022
## S. Y. B. Tech. (Department of Information Technology)
## Semester-III- Syllabus Structure

| Course Code | Course | Teaching Scheme | | | Semester Examination Scheme of Marks | | | | | | *Credits* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | TH | TU | Lab | ISE (15) | MSE (25) | TH | TW | Lab | Total | |
| **IT2101/ IT2121** | Fundamentals of Data Communication/ Software Engineering | 3 | 1 | 0 | 15 | 25 | 60 | 25 | - | 125 | 4 |
| **IT2102/ IT2122** | Database Management System/ Object Oriented Programming | 3 | 0 | 4 | 15 | 25 | 60 | - | 50 | 150 | 5 |
| **IT2103/ IT2123** | Computer System and Organization/ Computer Organization & Architecture | 3 | 0 | 0 | 15 | 25 | 60 | - | - | 100 | 3 |
| **IT2104/ IT2124** | Programming Paradigms/ Computational Statistics | 3 | 0 | 2 | 15 | 25 | 60 | - | 25 | 125 | 4 |
| **IT2105/ IT2125** | Computer Graphics/ Computer Graphics and Animation | 3 | 0 | 2 | 15 | 25 | 60 | - | 25 | 125 | 4 |
| **HS2104** | Human Values and Ethics | 0 | 0 | 2 | - | - | - | - | 25 | 25 | 1 |
| **IT2106** | Python Programming | 0 | 0 | 2 | - | - | - | - | 25 | 25 | 1 |
| **IT2107 HS2101 HS2102 HS2103 HS2109** | #Engineering Design and Innovation I **OR** #Language Proficiency II: English/ German/ Japanese/ French | 0 | 0 | 2 | - | - | - | - | 25 | 25 | 1 |
| **$$** | **Audit Course- I** | **Non Credit Course** | | | | | | | | | |
| | **Total** | **15** | **1** | **14** | **75** | **125** | **300** | **25** | **175** | **700** | **23** |

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## Audit Course 1 Options

| $$ | Audit Course I Title |
|---|---|
| EC2107 | Intellectual Property Rights and Patents |
| CE2106B | Road Safety Management |
| HS2106 | Indian Constitution |
| IT2108 | Online Certification Course |

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**S. Y. B. Tech. (Department of Information Technology) Semester-IV- Syllabus Structure**

| Course Code | Course | Teaching Scheme | | | Semester Examination Scheme of Marks | | | | | | *Credits* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | TH | TU | Lab | ISE (15) | MSE (25) | TH | TW | Lab | Total | |
| **ES2104**<br>**ES2103** | Engineering Mathematics-III / Calculus and Transform | 4 | 1 | 0 | 15 | 25 | 60 | 25 | - | 125 | 5 |
| **IT2109**<br>**IT2126** | Formal Language and Automata Theory / Formal Language and Automata Theory | 3 | 0 | 0 | 15 | 25 | 60 | - | - | 100 | 3 |
| **IT2110**<br>**IT2127** | Advanced Database Management System / Database Management System | 3 | 0 | 4 | 15 | 25 | 60 | - | 50 | 150 | 5 |
| **IT2111**<br>**IT2128** | Computer Networks and Applications / Computer Networks | 3 | 0 | 2 | 15 | 25 | 60 | - | 25 | 125 | 4 |
| **IT2112**<br>**IT2129** | Software Engineering and Agile development/ Operation Research | 3 | 0 | 0 | 15 | 25 | 60 | - | - | 100 | 3 |
| **IT2113/**<br>**HS2105** | Web Technology / Business Communication and Value Science –III | 0 | 0 | 2 | - | - | - | - | 50 | 50 | 1 |
| **IT2114**<br>**IT2130** | Skill Development / Project Ideation and Intellectual Property Right | 0 | 0 | 2 | - | - | - | 25 | - | 25 | 1 |
| **IT2107**<br>**HS2101**<br>**HS2102**<br>**HS2103**<br>**HS2109** | #Engineering Design and Innovation-I<br>**OR**<br>#Language Proficiency II: English/ German/ Japanese/ French | 0 | 0 | 2 | - | - | - | - | 25 | 25 | 1 |
| **$$** | **Audit Course- II** | **Non Credit Course** | | | | | | | | | |
| | **Total** | **16** | **01** | **12** | **75** | **125** | **300** | **25** | **175** | **700** | **23** |

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## Audit Course 2 Options

| $$ | Audit Course II Title |
|---|---|
| CE2113B | Environmental awareness |
| HS2108 | Indian Traditional Knowledge |
| ME2111C | Innovation in Agricultural Engineering |
| IT2115 | Online Certification Course |

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**Instructions:**

1. Lab/Tutorial should be conducted in minimum three batches (batch size 22 maximum) per division
2. # Every student should appear for language Proficiency-II and Engineering Design & Innovation-I (EDD) during the year.
3. Credit for language Proficiency-II and Engineering Design & Innovation-I (EDD) has to be awarded on the basis of internal continuous assessment and evaluation at the end of Semester.
4. ISE, MSE and ESE indicates In-semester Evaluation to be carried out by teacher on continuous basis, Mid Semester Examination and End Semester examination respectively.

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## S. Y. B. Tech (Department of Information Technology)
## Semester -III
## [IT2101]: Fundamentals of Data Communication

| Teaching Scheme: | Credits: | Examination Scheme: |
|---|---|---|
| TH : 03 Hours/Week<br>TU : 01 Hours/Week | TH : 03<br>TW : 01 | In Sem. Evaluation : 15 Marks<br>Mid Sem. Exam : 25 Marks<br>End Sem. Exam : 60 Marks<br>Lab Evaluation :25 Marks<br>Total : 125 Marks |

**Course Prerequisites:** : Discrete Structures, Engineering Mathematics I and II.

**Course Objectives:**

- To understand the concept of Data communication and digital data transmission.
- To acquire the knowledge of different modulation techniques such as AM, FM.
- To study the basic principles and techniques used digital communications.
- To study the Sampling theorem and Pulse Analog and Digital Modulation techniques.
- To learn the concepts of Digital modulation techniques such as PCM, DM, ADM and multiplexing techniques.
- To understand the concept of spread spectrum techniques.

**Course Outcomes: After successful completion of the course, students will able to-**

**CO1:** Understand basic concepts of data communication system.
**CO2:** Identify the concepts of Transmission Media for data communication system.
**CO3:** Apply different modulation techniques for analog and digital signals.
**CO4:** Analyze signal multiplexing de-multiplexing techniques for analog and digital signals.
**CO5:** Analyze error detection and error correction algorithms methods for Data communication.
**CO6:** Apply the concepts of Spread Spectrum Techniques and switching techniques for networks.

## Course Contents

| UNIT-I | Basics of Communication System | 07 Hours |
|---|---|---|

Data Transmission: Communication model Simplex, half duplex and full duplex transmission - Periodic Analog signals: Sine wave, phase, wavelength, time and frequency domain, bandwidth – Digital Signals Digital data Transmission:- Analog & Digital data, Analog & Digital signals.
Analog &Digital transmission – Transmission Impairments: Attenuation, Delay distortion, Channel capacity: Nyquist Bandwidth, Shannon's Capacity formula, Frequency spectrum of electromagnetic waves, Sampling theorem, Noise types, Sources.

| UNIT-II | Transmission media | 07 Hours |
|---|---|---|

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| | | |
|---|---|---|
| Guided Transmission Media: Twisted pair, Coaxial cable, optical fiber, Un-guided Transmission Media: Terrestrial microwave, Satellite microwave. Signal Encoding techniques. | | |
| **UNIT-III** | **Digital Systems** | **07 Hours** |
| Bandwidth and rate of pulse transmission, Pulse spreading and interference, PSD of digital signals. Digital Data Analog Signals : ASK, FSK, PSK - Analog Data Digital Signals: Sampling theorem, PCM, Delta Modulation - Analog Data Analog Signals: AM, FM, PM. | | |
| **UNIT-IV** | **Multiplexing** | **07 Hours** |
| Space Division Multiplexing-Frequency Division Multiplexing: Wave length Division Multiplexing - Time Division multiplexing: Characteristics, Digital Carrier system, SONET/ SDH Statistical time division multiplexing: Cable Modem - Code Division Multiplexing. | | |
| **UNIT-V** | **Digital Data Communication Techniques** | **07 Hours** |
| Asynchronous transmission, Synchronous Transmission-Detecting and Correcting Errors-Types of Errors-Error Detection: Parity check, Cyclic Redundancy Check (CRC) - Error Control Error Correction: Forward Error Correction and Hamming Distance. | | |
| **UNIT-VI** | **Spread Spectrum Techniques** | **07 Hours** |
| Direct Sequence Spread Spectrum (DSSS), Frequency Hopping Spread Spectrum (FHSS). Basic principles of switching - Circuit Switched Networks, Structure of Circuit Switch - Packet Switching: Datagram Networks, Virtual Circuit Networks. | | |
| **Text Books:**<br>**T1 :** Web Computer Networks by Andrew S. Tanenbaum (Fifth Edition), Pearson Education<br>**T2:** Data Communication and Networking by Behrouz A. Forouzan (Fourth Edition), Tata McGraw Hill<br>**T3:** R.P. Singh, S.D. Sapre : "Communication Systems: Analog and Digital", McGraw Hill Publications | | |
| **Reference Books:**<br>**R1:** Simon Haykin and Michael Moher, "Introduction to Analog and Digital Communications" John Wiley & Sons, Inc.<br>**R2 :** Louis E. Frenzel, "Principles Of Electronic Communication Systems (SIE)", 3rd Edition, ISBN: 9780070667556.<br>**R3:** Communication Systems by A. B. Carlson.<br>**R4 :** Principle of Communication System by Taub & Schilling.<br>**R5 :** Communication Electronics by Kennedy. | | |

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## S. Y. B. Tech (Department of Information Technology)
## Semester -III
## [ IT2121 ]: Software Engineering

| Teaching Scheme: | Credits: | Examination Scheme: |
|---|---|---|
| TH: 03 Hours/Week<br>TU: 02 Hours/Week | TH:03<br>TW:01 | In Sem. Evaluation : 15 Marks<br>Mid Sem. Exam : 25 Marks<br>End Sem. Exam : 60 Marks<br>Lab Evaluation : 25 Marks |

**Course Prerequisites :**

- Programming Paradigms
- Data Structures

**Course Objectives:**

- To understand basics of Software engineering
- To understand different architectural designs and to transform them into proper model.
- To transform requirement document to appropriate design.
- To understand testing strategies.
- To choose and use modern design tools for project development and implementation

**Course Outcomes: After successful completion of the course, students will able to-**

**CO1:** Choose appropriate process model depending on the user requirement.
**CO2:** Apply design engineering principles and techniques to develop a software system.
**CO3:** Describe Software Quality and Reliability.
**CO4:** Analyze and design software model using UML.
**CO5:** Describe Object Oriented Analysis, Design and Construction concepts.
**CO6:** Design test cases for a software system and describe the software testing concepts.

**Course Contents**

| UNIT-I | Introduction | 07 Hours |
|---|---|---|

Programming in the small vs. programming in the large; software project failures and importance ofsoftware quality and timely availability; engineering approach to software development; role ofsoftware engineering towards successful execution of large software projects; emergence of softwareengineering as a discipline.

| UNIT-II | Software Project Management | 07 Hours |
|---|---|---|

Basic concepts of life cycle models – different models and milestones;Process Models: Generic Process Model, Prescriptive ProcessModels- The Waterfall, Incremental Process (RAD), Evolutionary Process, Unified Process, Concurrent. Software project planning –identification of activities and

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| | | |
|---|---|---|
| resources; concepts of feasibility study; techniques for estimation ofschedule and effort; software cost estimation models and concepts of software engineering economics; techniques of software project control and reporting; introduction to measurement of software size; introduction to the concepts of risk and its mitigation; configuration management. | | |
| **UNIT-III** | **Software Quality and Reliability** | **07 Hours** |
| Internal and external qualities; process and product quality; principles to achieve software quality; introduction to different software quality models like McCall, Boehm, FURPS / FURPS+, Dromey, ISO – 9126; introduction to Capability Maturity Models (CMM and CMMI); introduction to softwarereliability, reliability models and estimation. | | |
| **UNIT-IV** | **Software Requirements Analysis, Design and Construction** | **07 Hours** |
| Introduction to Software Requirements Specifications (SRS) and requirement elicitation techniques;techniques for requirement modeling – decision tables, event tables, state transition tables, Petri nets;requirements documentation through use cases; introduction to UML, introduction to softwaremetrics and metrics based control methods; measures of code and design quality. | | |
| **UNIT-V** | **Object Oriented Analysis, Design and Construction** | **07 Hours** |
| Concepts -- the principles of abstraction, modularity, specification, encapsulation and information hiding; concepts of abstract data type; Class Responsibility Collaborator (CRC) model; quality of design; design measurements; concepts of design patterns; Refactoring; object oriented construction principles; object oriented metrics. | | |
| **UNIT-VI** | **Software Testing** | **07 Hours** |
| Introduction to faults and failures; basic testing concepts; concepts of verification and validation; black box and white box tests; white box test coverage – code coverage, condition coverage, branch coverage; basic concepts of black-box tests – equivalence classes, boundary value tests, usage of state tables; testing use cases; transaction based testing; testing for non-functional requirements – volume, performance and efficiency; concepts of inspection. | | |

## Lab Contents

**Guidelines for Laboratory Assessment**

1) Continuous assessment shall be based on experiments performed, submission of results of practical assignments in the form of journal / reports, timely completion, attendance, understanding, performance.
2) Practical / Oral examination shall be based on the practical's performed in the lab.
3) Lab assessment marks shall be based on continuous assessment and performance in Practical/Oral examination

**List of Laboratory Assignments/Experiments**

| | |
|---|---|
| **1** | Construct Software Requirement Specification (SRS) document for any system. |
| **2** | Develop DFD Model (Level 0, Level 1 DFD and data dictionary) of the sample problem |
| **3** | Develop Structured design for the DFD model developed. |

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| | |
|---|---|
| **4** | Develop UML Use case model for a problem |
| **5** | Develop Sequence Diagrams |
| **6** | Develop Class diagrams. |
| **7** | Write the test cases for a given system |
| **8** | Study of Program Analysis Tool |

**Text Books:**


**T1.** Roger Pressman, Software Engineering: A Practitioner's Approach, McGraw Hill, ISBN 0–07–337597–7.

**T2.** Ian Sommerville, Software Engineering, Addison and Wesley, ISBN 0-13-703515-2.

**T3.** Bernd Bruegge and Allen H. Dutoit "Object-Oriented Software Engineering: using UML, Patterns, and Java".

**T4.** Hassan Gomaa, "Software Modeling and Design- UML, Use cases, Patterns and Software Architectures" Cambridge University Press, 2011, ISBN 978-0-521-76414-8.


**Reference Books:**


**R1.** Carlo Ghezzi, Fundamentals of Software Engineering", Prentice Hall India, ISBN-10: 0133056996.

**R2.** Rajib Mall, Fundamentals of Software Engineering, Prentice Hall India, ISBN-13: 978-8120348981.

**R3.** Pankaj Jalote, An Integrated Approach to Software Engineering, Springer, ISBN 13:9788173192715.

**R4.** S K Chang, Handbook of Software Engineering and Knowledge Engineering, World Scientific, Vol I, II, ISBN: 978-981-02-4973-1.

**R5.** Erich Gamma, Richard Helm, Ralph Johnson, and John M. Vlissides "Design Patterns: Elements of Reusable Object-Oriented Software".

**R6.** GardyBooch, James Rambaugh, Ivar Jacobson," The unified modeling language user guide", Pearson Education, Second edition, 2008, ISBN 0-321-24562-8.


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## Semester -III

## [IT2102]: Database Management Systems

| Teaching Scheme: | Credits: | Examination Scheme: |
|---|---|---|
| TH : 03 Hours/Week<br>PR : 04 Hours/Week | TH : 03<br>LAB : 02 | In Sem. Evaluation : 15 Marks<br>Mid Sem. Exam : 25 Marks<br>End Sem. Exam : 60 Marks<br>Lab Evaluation : 50 Marks |

**Course Prerequisites:** Data Structures ,Discrete structures.

**Course Objectives:**

- Learn the fundamental concepts of database management.
- Provide a strong formal foundation in database concepts, technology and practice.
- Study the basic issues of transaction processing and concurrency control.
- Learn and understand concepts of Query Processing and Query Optimization.

**Course Outcomes: After successful completion of the course, students will able to-**

**CO1:** Describe database concepts and analyze database models.
**CO2:** Design a database schema for a given problem-domain.
**CO3:** Create, populate and query a database using SQL and PL/SQL.
**CO4:** Describe the concept of transaction and transaction schedules.
**CO5:** Describe and compare concurrency control techniques and recovery methods.
**CO6:** Elaborate concepts of Query Processing and Query Optimization.

## Course Contents

| UNIT-I | Introduction | 07 Hours |
|---|---|---|

Database Concepts, Database System Architecture, Data Modeling : Data Models, Basic Concepts, entity, attributes, relationships, constraints, keys, E-R and EER diagrams: Components of E-R Model, conventions, converting E-R diagram into tables, EER Model components, converting EER diagram into tables, Relational Model: Basic concepts, Attributes and Domains,
Relational Integrity: Domain, Entity, Referential Integrities, Enterprise Constraints, Views, Schema Diagram

| UNIT-II | Database Design, Normalization And Relational Algebra | 07 Hours |
|---|---|---|

Database Design: Functional Dependency, Purpose of Normalization, Data Redundancy and Update Anomalies, Functional Dependency-Single Valued Dependencies.

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Single Valued Normalization: 1NF, 2NF, 3NF, BCNF. Decomposition: lossless join decomposition and dependency preservation.

Relational Algebra: Basic Operations, Selection, projection, joining, outer join, union, difference, intersection, Cartesian product, division operations

| UNIT-III | SQL And PL/SQL | 07 Hours |
|---|---|---|

Introduction to SQL: Characteristics and advantages, SQL Data Types and Literals, DDL, DML, DCL, TCL, SQL Operators, Tables: Creating, Modifying, Deleting, Views: Creating, Dropping, Updating using Views, Indexes, Nulls SQL DML Queries: SELECT Query and clauses, Set Operations, Predicates and Joins, Set membership, Tuple Variables, Set comparison, Ordering of Tuples, Aggregate Functions, Nested Queries, Database Modification using SQL Insert, Update and Delete Queries, roles and privileges , concept of Stored Procedures, Cursors, Triggers

| UNIT-IV | DATABASE TRANSACTIONS | 07 Hours |
|---|---|---|

Basic concept of a Transaction, Transaction Management, Properties of Transactions, Concept of Schedule, Serial Schedule,

Serializability: Conflict and View, Cascaded Aborts, Recoverable and Non recoverable Schedules, Checkpoints

| UNIT-V | CONCURRENCY CONTROL | 07 Hours |
|---|---|---|

Concurrency Control: Need, Locking Methods, Deadlocks, Time-stamping Methods, and Optimistic Techniques. Recovery Methods: Shadow-Paging and Log-Based Recovery, Checkpoints, Performance Tuning

| UNIT-VI | QUERY PROCESSING | 07 Hours |
|---|---|---|

Query Processing: Overview, Measures of query cost, Evaluation of expression, Materialization and Pipelining algorithm.

Query Optimization:- Introduction ,Transformation of Relational Expressions,Catalog Information for Cost Estimation,Statistical Information for Cost Estimation,Cost-based optimization,Dynamic Programming for Choosing Evaluation Plans,Materialized views

## Lab Contents

**Guidelines for Lab Assessment**

1) Continuous assessment shall be based on experiments performed, submission of results of practical assignments in the form of journal / reports, timely completion, attendance, understanding, performance.

2) Practical / Oral examination shall be based on the practical's performed in the lab.

3) Lab assessment marks shall be based on continuous assessment and performance in Practical/Oral examination

**List of Laboratory Assignments**

| | |
|---|---|
| 1 | Study and design a database with suitable example using following database systems:<br>• Relational: SQL / PostgreSQL / MySQL<br>• Key-value: Riak / Redis<br>• Columnar: Hbase<br>• Document: MongoDB / CouchDB<br>Compare the different database systems based on points like efficiency, scalability, |

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| | |
|---|---|
| | characteristics and performance. |
| 2 | Install and configure client and server for MySQL (Show all commands and necessary steps for installation and configuration) |
| 3 | Design any database with at least 3 entities and relationships between them. Apply DCL and DDLcommands. Draw suitable ER/EER diagram for the system |
| 4 | Design and implement a database and apply at least 10 different DML queries for the following task.For a given input string display only those records which match the given pattern or a phrase in theSearch string. Make use of wild characters and LIKE operator for the same. Make use of Boolean andArithmetic operators wherever necessary |
| 5 | Execute the aggregate functions like count, sum, avg etc. on the suitable database. Make use of builtin functions according to the need of the database chosen. Retrieve the data from the databasebased on time and date functions like now (), date (), day (), time () etc. Use group by and having clauses |
| 6 | Implement nested sub queries. Perform a test for set membership (in, not in), set comparison and set cardinality |
| 7 | Write and execute triggers with suitable database. Consider row level and statement level triggers |
| 8 | Write and execute PL/SQL stored procedures and functions using cursor with suitable database |

**Text Books:**


**T1.** Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", 6thEdition, McGraw Hill Publishers, ISBN 0-07-120413-X
S.K.Singh, "Database Systems : Concepts, Design and Application", 2nd Edition, Pearson, 2013,ISBN 978-81-317-6092-5.

**T2.** Connally T., Begg C., "Database Systems", 3rd Edition, Pearson Education, 2002, ISBN 81-7808-861-4


**Reference Books:**


**R1.** Kristina Chodorow, Michael Dirolf, "MangoDB: The Definitive Guide" ,O'Reilly Pubications
**R2.** Tom White, "Hadoop: The Definitive Guide", O'Reilly Pubications
**R3.** Jiawei Han, Micheline Kamber, Jian Pei, "Data Mining: Concepts and Techniques", Elsevier
**R4.** Bill Schmarzo, "Big Data:Understanding How Data Powers Big Business", Wiley,ISBN:978-81-265-4545-2 Alex Holmes, "Hadoop in Practice", DreamTech Press, ISBN : 978-93-5119-150-6


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## S. Y. B. Tech (Department of Information Technology)
## Semester -III
## [IT2122]: Object Oriented Programming

| Teaching Scheme: | Credits: | Examination Scheme: |
|---|---|---|
| TH: 03 Hours/Week | TH:03 | In Sem. Evaluation : 15 Marks |
| PR: 04 Hours/Week | PR:02 | Mid Sem. Exam : 25 Marks |
| | | End Sem. Exam : 60 Marks |
| | | Lab Evaluation : 50 Marks |

**Course Prerequisites :** Basic knowledge of Computer Programming

**Course Objectives:**

- To understand different types of programming paradigms.
- To understand basics of programming languages, design and implementation
- To understand and apply object oriented programming techniques and acquaint with and implement object oriented techniques using C++ language features.

**Course Outcomes: After successful completion of the course, students will able to-**

**CO1:** Discuss and contrast a different range of programming paradigms.
**CO2:** Design the problem solution by applying logical techniques along with functional approach.
**CO3:** Explore the design concepts and apply object oriented techniques for problem solving.
**CO4:** Model the concept of reusability and polymorphism.
**CO5:** Analyze and identify all the features of object oriented paradigm.
**CO6:** Discuss and Demonstrate concepts of file handling in OOP.

**Course Contents**

| UNIT-I | The Nature Of Programming Languages And Programming Environments | 07 Hours |
|---|---|---|

Programming Paradigms, Imperative languages and non-imperative languages, Scripting languages, Data-oriented languages, Object oriented languages, Event-driven Programming Language Standardization. Compilers and Interpreters, An Overview of C, Necessity for OOP, difference between C and C++, function declaration, function overloading, stronger type checking, Reference variable, parameter passing – value Vs reference, passing pointer by value or reference, Operator new and delete, the typecasting operator.

| UNIT-II | Functional Programming and Objective Oriented Programming | 07 Hours |
|---|---|---|

Definition of a function: domain and range, total and partial functions, strict functions. Recursion Referential transparency Side effects of functions, Definition and semantics of a logic program,

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Recursive programming, Object Oriented Programming Paradigm, Basic Concepts of Object Oriented Programming, Benefits of Object Oriented Programming, Object Oriented Languages, Applications of Object Oriented Programming, Tokens, Keywords, Identifiers and Constants, Data Types, Type Compatibility, Variables, Operators in C++, Scope of Class and Scope Resolution Operator,

| UNIT-III | Classes , Objects and OOP Facilities | 07 Hours |
|---|---|---|

The Main Function, Function Prototyping, Call by Reference, Return by Reference, Inline Functions, Function Overloading, Friend and Virtual Functions. Specifying a class, Member Functions, Arrays within a class, Static Member Functions, Arrays of Objects and Friend Functions and friend class Constructors, Parameterized Constructors, Copy Constructors, Dynamic Constructors, Destructors Mutable keyword, Type Conversions, Pointers, Pointers to Objects, this pointer.

| UNIT-IV | Essentials of Object Oriented Programming | 07 Hours |
|---|---|---|

Defining Operator Overloading, Overloading Operators, Rules for Overloading Operators, Overloading Unary/Binary Operators, Data Conversion, Type casting (implicit and explicit), Pitfalls of Operator Overloading and Conversion, Introduction to Inheritance, Types of inheritance: Single inheritance, Multiple inheritance, Multilevel inheritance, Hierarchy inheritance, Hybrid Inheritance, Virtual Class, Abstract Class, Constructor in Derived Classes, Pointers to Objects, Pointer To Derived Classes, Virtual Functions.

| UNIT-V | Object Oriented Design and Modeling | 07 Hours |
|---|---|---|

**Template**: Concept, Class Template, Function Template, Member Function Template, template specialization.

**Exception Handling**: Basics of Exception Handling, Exception Handling Mechanism, Throwing Mechanism, Caching Mechanism, Re-Throwing Mechanism, Standard Template Library (STL).

**Object Oriented Design and Modeling**: UML concept, Use case for requirement capturing, Class diagram, Activity diagram and Sequence Diagram for design, Corresponding C++ code from design

**Self-Study: System exceptions**

| UNIT-VI | File Handling | 07 Hours |
|---|---|---|

Classes for File Stream Operations, Opening and Closing a File, File Modes, File Pointers, and Error Handling in File I/O, Library functions and formatted output, File I/O with Member Functions, Overloading the Extraction and Insertion Operators, memory as a Stream Object, Command- Line Arguments

**Self-Study: seekg ( )**

## Lab Contents

**Guidelines for Lab Assessment**

1) Continuous assessment shall be based on experiments performed, submission of results of practical assignments in the form of journal / reports, timely completion, attendance, understanding, performance.

2) Practical / Oral examination shall be based on the practical's performed in the lab.

3) Lab assessment marks shall be based on continuous assessment and performance in Practical/Oral

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| | |
|---|---|
| examination | |
| **List of Laboratory Assignments/Experiments** | |
| **1** | Design a calculator for arithmetic operation using CPP programming. |
| **2** | Develop an object-oriented program in C++ to create a database of student information system using constructor, default constructor, copy constructor, destructor, static member functions, friend class, this pointer, inline code and dynamic memory allocation operators-new and delete. |
| **3** | Write a C++ program to perform different operations on Matrix objects using unary and binary operator overloading. ( with and without friend function ) |
| **4** | Write a C++ program to find volume of cylinder cube and cuboid using function overloading |
| **5** | Write a C++ program to enter name age salary of 5 employees using array of objects |
| **6** | Write a C++ program to swap private data member of two different classes using friend function |
| **7** | Crete User defined exception to check the following conditions and throw the exception if the criterion does not meet.<br>a. User has age between 18 and 55<br>b. User stays has income between Rs. 50,000 – Rs. 1,00,000 per month<br>c. User stays in Pune/ Mumbai/ Bangalore / Chennai<br>d. User has 4-wheeler<br>Accept age, Income, City, Vehicle from the user and check for the conditions mentioned above. If any of the condition not met then throw the exception. |
| **8** | Write a C++ menu driven program that will create a data file and implement the following operations on data:<br>a. Search the specific item<br>b. Display the item<br>c. Update the item |

**Text Books:**

**T1.** Scott M L, Programming Language Pragmatics, 3rd Edn., Morgan Kaufmann Publishers, 2009.

**T2.**Object Oriented Design by Rambaugh (Pearson publication)

**Reference Books:**

**R1**. David A Watt, Programming Language Design Concepts, Wiley Dreamtech, 2004

**R2**. Ghezzi C and M. Jazayeri, Programming Language Concepts, 3rd Edn, Wiley.1997

**R3.** Kenneth C Louden, Programming Languages: Principles and Practice, 3rd Edn., Cengage Learning, 2011.

**R4**. Pratt T W, M V Zelkowitz, and T. V. Gopal, Programming Languages: Design and Implementation, 4th Edn., Pearson Education, 2001

**R5.** Data R W Sebesta, Concepts of Programming Languages, 11th Edn., Pearson Education, 2015

**R6**.Ravi Sethi, Programming Languages: Concepts & Constructs**, 2nd Edn., Pearson** Education, 2006

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# S. Y. B. Tech (Department of Information Technology)
## Semester -III
## [IT2103]: Computer System and Organization

| **Teaching Scheme:** | **Credits:** | **Examination Scheme:** |
|---|---|---|
| TH: 03 Hours/Week | TH: 03 | In Sem. Evaluation : 15 Marks<br>Mid Sem. Exam : 25 Marks<br>End Sem. Exam : 60 Marks |

**Course Prerequisites :** Basic knowledge of Electrical Engineering

**Course Objectives:**

- To understand the computer evolution and number system.
- To understand the design of the various functional units and components of the Central processing unit, Control unit, input/output systems, types of memory and its applications
- To study parallel organization of multi-processor systems and basics of IoT processor.

**Course Outcomes: After successful completion of the course, students will able to-**

**CO1:** Solve problems based on computer arithmetic.
**CO2:** Describe processor structure and its functions.
**CO3:** Compare and contrast the Hardwired control unit and Micro programmed control unit.
**CO4:** Categorize different memory types like internal and external memory.
**CO5:** Compare different Input/output systems and describe I/O organization.
**CO6:** Acquire knowledge about parallel organization and architectures required for IoT.

**Course Contents**

| **UNIT-I** | **Computer Evolution and Number System** | **07 Hours** |
|---|---|---|

A Brief History of Computers, Von Neumann Architecture, Number Systems - Binary, Octal, Hexadecimal, Signed Binary number representation and Arithmetic: Signed, 1's complement, 2's complement representation and arithmetic. Booth's Algorithm for Signed Multiplication, Restoring and Non Restoring Division Algorithms.

| **UNIT-II** | **The Central Processing Unit** | **07 Hours** |
|---|---|---|

Machine Instruction Characteristics, Types of Operands and Types of Operations, Addressing Modes, Instruction Formats, Instruction Types Processor Structure and Function - Processor Organization, Register Organization of 8086, the Instruction Cycle and Instruction Pipelining. Case Study Processor: 8086

| **UNIT-III** | **The Control Unit** | **07 Hours** |
|---|---|---|

Micro-Operations-Fetch Cycle, Indirect Cycle, Interrupt Cycle, Execute Cycle ,Instruction Cycle, Control of the Processor-Functional Requirements, Control Signals, A Control Signals Example

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| | | |
|---|---|---|
| Internal Processor Organization, Hardwired control unit, Micro-programmed control- micro instructions, Micro programmed Control Unit, Case Study: Wilke's Control unit | | |
| **UNIT-IV** | **Computer Memory System** | **07 Hours** |
| Characteristics of Memory System, The Memory Hierarchy. Cache Memory- Elements of Cache Design- Cache Address, Size, Cache Mapping Techniques and Case Studies:-Intel IV Cache Memory Internal Memory- Semiconductor Main Memory, Advanced DRAM Organization. External Memory- Magnetic Disk, RAID, Optical Memory. | | |
| **UNIT-V** | **Input and Output System** | **07 Hours** |
| I/O Modules- Module Function and I/O Module Structure, Programmed I/O- Overview, I/O Commands, I/O Instructions, Interrupt Driven I/O- Interrupt Processing, Design Issues, Example:8259A, Direct Memory Access- Drawbacks of Programmed and Interrupt Driven I/O, DMA Functions, Case Study- DMA Controller Intel 8237. | | |
| **UNIT-VI** | **Parallel Organization and Introduction to IoT** | **07 Hours** |
| Parallel Organization – Multiprocessors, Flynn's Taxonomy for Multiple Processor Organizations, Closely and Loosely Coupled Multiprocessors Systems, Cluster Configuration, UMA, NUMA & CC-NUMA. Architecture Study: Raspberry Pi, Beaglebone Black. | | |

**Text Books:**


**T1.** W. Stallings, "Computer Organization and Architecture: Designing for Performance", 8th Edition, Prentice Hall of India, 2010, ISBN 13: 978-0-13-607373-4

**T2.** D. Patterson, J. Hennessy, "Computer Organization and Design: The Hardware Software Interface", 4th Edition, Morgan Kaufmann, Oct 2013, ISBN 978-0-12-374750-1

**T3.** Internet of Things: A Hands-On Approach Arshdeep Bahga, Vijay Madisetti VPT – Paperback 2015 978- 0996025515 628/- 2

**T4.** "Modern Digital Electronics ", R.P. Jain, 3rd Edition, Tata McGraw-Hill, ISBN: 0–07– 049492–4


**Reference Books:**


**R1.** C. Hamacher, V. Zvonko, S. Zaky, "Computer Organization", 5th edition, McGraw Hill, 2002, ISBN: 007-120411-3

**R2.** IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things David Hanes, Gonzalo Salgueiro, Patrick Grossetete Cisco Press – Paperback – 16 Aug 2017 978-1-58714-456- 1 599.

**R3.** A. S. Tanenbaum "Structured Computer Organization", 4th Edition, Prentice Hall of India, 1991 ISBN: 81–203–1553–7


**e-Book:-**

http://inspirit.net.in/books/academic/Computer%20Organisation%20and%20Architecture%208e%20by%20William%20Stallings.pdf

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# S. Y. B. Tech (Department of Information Technology)
## Semester -III
## [IT2123]: Computer Organization & Architecture

| Teaching Scheme: | Credits: | Examination Scheme: |
|---|---|---|
| TH: 03 Hours/Week | TH:03 | In Sem. Evaluation : 15 Marks<br>Mid Sem. Exam : 25 Marks<br>End Sem. Exam : 60 Marks |

**Course Prerequisites :** Boolean logic and Combinational / Sequential Circuits

**Course Objectives:**

- To understand the computer evolution and number system.
- To understand the design of the various functional units and components of Central processing unit.
- To acquaint with the design of the various functional units and components of Control unit.
- To understand the working and applications of types of memory.
- To learn different Input/output systems and its applications.
- To study parallel organization of multi- processor systems and basics of IoT processor.

**Course Outcomes: After successful completion of the course, students will able to-**

**CO1**: Describe the structure, function and characteristics of computer systems, solve problems based on computer arithmetic.

**CO2**: Describe processor structure & its functions.

**CO3**: Explain methods of Control unit design and list out corresponding control signals for given instruction.

**CO4**: Categorize different memory types like internal and external memory.

**CO5**: Compare different Input/output systems and describe I/O organization.

**CO6:** Explain parallel organization and architectures required for IoT.

**Course Contents**

| UNIT-I | Computer Evolution, Performance Measurement & Arithmetic | 07 Hours |
|---|---|---|

**Functional blocks of a computer:** CPU, memory, input-output subsystems, control unit.

**Instruction set architecture of a CPU:** Registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Outlining instruction sets of some common CPUs.

**Data representation:** Signed number representation, fixed and floating point representations, character

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representation.

**Computer arithmetic:** Integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication – shift-and-add, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, floating point arithmetic, IEEE 754 format.

| UNIT-II | The Central Processing Unit | 07 Hours |
|---|---|---|

Machine Instruction Characteristics, Types of Operands and Types of Operations, Addressing Modes, Instruction Formats, Instruction Types Processor Structure and Function - Processor Organization, Register Organization of 8086, The Instruction Cycle and Instruction Pipelining. Introduction to x86 architecture.

| UNIT-III | Control Unit | 07 Hours |
|---|---|---|

**CPU control unit design:** Hardwired and micro-programmed design approaches, design of a simple hypothetical CPU, Self-Study: Single CPU Bus interconnection

**Memory system design:** Semiconductor memory technologies, memory organization

| UNIT-IV | Memory Organization | 07Hours |
|---|---|---|

**Memory organization:** Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policies. Case-Study: RAID.

| UNIT-V | I/O Peripheral devices | 07 Hours |
|---|---|---|

**Peripheral devices and their characteristics:** Input-output subsystems, I/O device interface, I/O transfers – program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes – role of interrupts in process state transitions, I/O device interfaces – SCII, USB Case-Study: 82C59A DMA Controller

| UNIT-VI | Parallel Organization | 07 Hours |
|---|---|---|

Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache coherency Multiprocessors, Flynn's Taxonomy for Multiple Processor Organizations, Closely and Loosely Coupled Multiprocessors Systems, Cluster Configuration, UMA, NUMA & CC-NUMA

**Text Books:**

**T1**. Computer System Architecture M. M. Mano:, 3rd ed., Prentice Hall of India, New Delhi, 1993.

**T2**. Computer Organization and Design: The Hardware/Software Interface, David A. Patterson and John L. Hennessy.

**T3** Computer Organization and Embedded Systems, Carl Hamacher.

**Reference Books:**

**R1**. Computer Architecture and Organization, John P. Hayes.

**R2** Computer Organization and Architecture: Designing for Performance, William Stallings.

**R3** Computer System Design and Architecture, Vincent P. Heuring and Harry F. Jordan..

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# S. Y. B. Tech (Department of Information Technology)
## Semester -III
## [IT2104]: Programming Paradigms

| Teaching Scheme: | Credits: | Examination Scheme: |
|---|---|---|
| TH: 03 Hours/Week | TH:03 | In Sem. Evaluation : 15 Marks |
| PR: 02 Hours/Week | PR:01 | Mid Sem. Exam : 25 Marks |
| | | End Sem. Exam : 60 Marks |
| | | Lab Evaluation : 25 Marks |

**Course Prerequisites :** Basic knowledge of Computer Programming

**Course Objectives:**

- To understand different types of programming paradigms.
- To understand basics of programming languages, design and implementation
- To understand and apply object oriented programming techniques and acquaint with and implement object oriented techniques using C++ language features.

**Course Outcomes: After successful completion of the course, students will able to-**

**CO1:** Discuss and Compare contrast a range of programming paradigms.

**CO2:** Evaluate programming language features critically with respect to the way they support good software engineering practice.

**CO3:** Discuss the appropriateness of the use of a given programming paradigm within a given environment.

**CO4:** Allow programmers to think in terms of the structure of the problem rather than in terms of the structure of the computer.

**CO5:** Create new type of objects to model elements from the problem space.

**CO6:** Apply concept of File i/o and Generic programming.

**Course Contents**

| UNIT-I | The Nature Of Programming Languages And Programming Environments | 07 Hours |
|---|---|---|

Imperative languages and non-imperative languages, Scripting languages, Data-oriented languages, Object oriented languages, Event-driven Programming Language Standardization. Compilers and Interpreters, Interactive development tools, Run-time support environments, Debugging Tools, Testing Tools, Configuration Management

| UNIT-II | Functional And Logic Programming | 07 Hours |
|---|---|---|

Definition of a function: domain and range, total and partial functions, strict functions. Recursion

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|---|---|---|
| Referential transparency Side effects of functions , Basic constructs ,Facts: queries, existential queries, conjunctive queries and rules, Definition and semantics of a logic program, Recursive programming: Computational model of logic programming, Goal reduction, Negation in logic programming | | |
| **UNIT-III** | **Principles Of Objective Oriented Programming** | **07 Hours** |
| Object Oriented Programming Paradigm, Basic Concepts of Object Oriented Programming, Benefits of Object Oriented Programming, Object Oriented Languages, Applications of Object Oriented Programming, Beginning with C++. Tokens, Keywords, Identifiers and Constants, Data Types, Type Compatibility, Variables, Operators in C++,Implicit Conversions, Operator Overloading, Operator Precedence, Control Structures | | |
| **UNIT-IV** | **Functions In C++, Classes & Objects** | **07 Hours** |
| The Main Function, Function Prototyping, Call by Reference, Return by Reference, Inline Functions, Function Overloading, Friend and Virtual Functions. Specifying a class, Member Functions, Arrays within a class, Static Member Functions, Arrays of Objects and Friend Functions. | | |
| **UNIT-V** | **Constructors & Destructors, Operator Overloading, Inheritance** | **07 Hours** |
| Constructors, Parameterized Constructors, Copy Constructors, Dynamic Constructors, Destructors, Defining Operator Overloading, Overloading Operators, Rules for Overloading Operators, Type Conversions, Inheritance | | |
| **UNIT-VI** | **Pointers, Virtual Functions & Polymorphism, Working With Files, Exception Handling** | **07 Hours** |
| Pointers, Pointers to Objects, this pointer, Pointer to Derived Classes, Virtual Functions, Classes for File Stream Operations, Opening and Closing a File, File Modes, File Pointers, Input Output Operations, Updating a File. | | |

## Lab Contents

**Guidelines for Lab Assessment**

1) Continuous assessment shall be based on experiments performed, submission of results of practical assignments in the form of journal / reports, timely completion, attendance, understanding, performance.
2) Practical / Oral examination shall be based on the practical's performed in the lab.
3) Lab assessment marks shall be based on continuous assessment and performance in Practical/Oral examination

**List of Laboratory Assignments/Experiments**

| | |
|---|---|
| **1** | Write a C++ Program to find the average of 5 numbers. (Imperative) |
| **2** | Raising a number to a power p is the same as multiplying n by itself p times.<br>->Write a function called power that takes two arguments, a double value for n and an int value for p, and return the result as double value.<br>->Use default argument of 2 for p, so that if this argument is omitted the number will be |

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|---|---|
| | squared.<br>-> Write the main function that gets value from the user to test power function. (Functional) |
| **3** | A college offers a course that prepares students for the state licensing exam for real estate brokers. Last year, ten of the students who completed this course took the exam. The college wants to know how well its students did on the exam. You have been asked to write a program to summarize the results. You have been given a list of these 10 students. Next to each name is written a 1 if the student passed the exam or a 2 if the student failed.<br>Write a program in C++ to analyze the results of the exam as follows:<br>->Input each test result (i.e., a 1 or a 2). Display the prompting message "Enter result" each time the program requests another test result.<br>->Count the number of test results of each type.<br>->Display a summary of the test results indicating the number of students who passed and the number who failed.<br>->If more than eight students passed the exam, print the message "Raise tuition."(Structured) |
| **4** | Write a C++ program to find volume of cylinder cube and cuboid using function overloading |
| **5** | Write a C++ program to enter name age salary of 5 employees using array of objects |
| **6** | Write a C++ program to swap private data member of two different classes using friend function |
| **7** | Crete User defined exception to check the following conditions and throw the exception if the criterion does not meet.<br>a. User has age between 18 and 55<br>b. User stays has income between Rs. 50,000 – Rs. 1,00,000 per month<br>c. User stays in Pune/ Mumbai/ Bangalore / Chennai<br>d. User has 4-wheeler<br>Accept age, Income, City, Vehicle from the user and check for the conditions mentioned above. If any of the condition not met then throw the exception. |
| **8** | Write a C++ menu driven program that will create a data file and implement the following operations on data:<br>d. Search the specific item<br>e. Display the item<br>f. Update the item |

**Text Books:**

**T1** Scott M L, Programming Language Pragmatics, 3rd Edn., Morgan Kaufmann Publishers, 2009.

**T2** Object Oriented Design by Rambaugh (Pearson publication)

**Reference Books:**

**R1**. David A Watt, Programming Language Design Concepts, Wiley Dreamtech, 2004

**R2**. Ghezzi C and M. Jazayeri, Programming Language Concepts, 3rd Edn, Wiley.1997

**R3.** Kenneth C Louden, Programming Languages: Principles and Practice, 3rd Edn., Cengage Learning, 2011.

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**R4**. Pratt T W, M V Zelkowitz, and T. V. Gopal, Programming Languages: Design and Implementation, 4th Edn., Pearson Education, 2001
**R5.** Data R W Sebesta, Concepts of Programming Languages, 11th Edn., Pearson Education, 2015
**R6**.Ravi Sethi, Programming Languages: Concepts & Constructs**,** 2nd Edn., Pearson Education,2006

RSCOE

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# S. Y. B. Tech (Department of Information Technology)
## Semester -III
## [IT2124]: Computational Statistics

| Teaching Scheme: | Credit | Examination Scheme: |
|---|---|---|
| TH: 3 Hours/Week | TH:03 | In Sem. Evaluation :15 Marks |
| PR: 2 Hours/Week | PR:01 | Mid Sem. Exam : 25 Marks |
| | | End Sem. Exam : 60 Marks |
| | | Lab Evaluation : 25 Marks |

**Course Prerequisites:** Introductory topics in Statistics, Probability and Calculus,Linear Algebra, Statistical Modeling

**Course Objective:**

- To learn multivariate statistical analysis
- To develop different regression models for real life problems.
- To understand and apply Discriminant Analysis
- To understand the concept of dimensionality reduction and use PCA and factor analysis
- Understand clustering and its application.

**Course Outcome:**

**After successful completion of the course, students will able to:**

**CO1:** Analyze the properties of Multivariate Data.
**CO2:** Apply regression models to solve real life problems.
**CO3:** Apply Discriminant Analysis to solve real life problems.
**CO4:** Apply Principal Component Analysis (PCA) to reduce dimensionality.
**CO5:** Identify key features using factor analysis methods.
**CO6:** Apply various clustering techniques to identify patterns in data.

## Course Contents

| UNIT-I | Multivariate Normal Distribution | 7 Hours |
|---|---|---|

Data Types, Multivariate data analysis, Benefits and Drawbacks, Bivariate and Multivariate Normal Distribution, Properties of multivariate normal distribution function, Conditional Distribution and its relation to regression model, Estimation of parameters. Multivariate Data Visualization, Case Study: Iris dataset

| UNIT-II | Regression Model | 7 Hours |
|---|---|---|

Classical Linear Regression and its assumptions, Multiple Linear Regression: Standard multiple regression models with emphasis on detection of collinearity, outliers, non-normality and autocorrelation, Validation of model assumptions. Multivariate Regression: Assumptions of Multivariate Regression Models, Parameter estimation, Multivariate Analysis of variance and covariance, Logistic Regression, Case Study: Boston Housing Dataset

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| UNIT-III | Discriminant Analysis | 7 Hours |
|---|---|---|
| Statistical background, Bayes Rule and Classification Problem, Linear discriminant analysis, Estimating linear discriminant functions and their properties, Fisher's LDA Method Case Study: Insect Data | | |
| **UNIT-IV** | **Principal Component Analysis** | **7 Hours** |
| Principal components, Algorithm for conducting principal component analysis, deciding on how many principal components to retain, interpretation of principal components, H-plot.<br>Case Study: Places Rated Data | | |
| **UNIT-V** | **Factor Analysis** | **7 Hours** |
| Factor analysis model, extracting common factors, determining number of factors, Transformation of factor analysis solutions, Communalities, Maximum like hood estimation model, Goodness of fit, Factor scores. Case Study: Places Rated Data | | |
| **UNIT-VI** | **Cluster Analysis** | **7 Hours** |
| Introduction, Types of clustering, Correlations and distances, clustering by partitioning methods, hierarchical clustering: Single Linkage, Complete Linkage and Average linkage, overlapping clustering, K-Means Clustering-Profiling and Interpreting Clusters<br>Case Study: Telecom Case Study | | |

**Lab Contents**

**Guidelines for Lab Assessment**

1) Continuous assessment shall be based on experiments performed, submission of results of practical assignments in the form of journal / reports, timely completion, attendance, understanding, performance.
2) Practical / Oral examination shall be based on the practical's performed in the lab.
3)Lab assessment marks shall be based on continuous assessment and performance in Practical/Oral examination

**List of Laboratory Assignments**

| | |
|---|---|
| **1** | Using python, calculate mean, standard deviation, and variance, correlation, Pearson correlation<br>coefficients and covariance matrix of two given arrays without using library functions. Visualize the data using suitable plots. |
| **2** | Statistical Data Analysis and Data Visualization: Download a standard dataset and perform do statistical analysis of data and plot data Visualization<br>I. Use python to perform following:<br>a. Identify number of features and their types (nominal or numeric).<br>b. Compute and display summary statistics for multivariate data<br>c. Multivariate Data visualization<br>II. Using any tool, perform statistical analysis of data and plot data Visualization |
| **3** | Using standard dataset, apply Multiple linear regression technique and make prediction. |
| **4** | Consider a standard dataset to perform Discriminant Analysis. |
| **5** | Consider a standard dataset to perform Principal Components Analysis (PCA). |

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| | |
|---|---|
| **6** | Consider a standard dataset and use statistical tool to perform Factor Analysis |
| **7** | Consider a standard dataset and write a program in python to apply K means clustering technique. |
| **8** | Consider a standard dataset and write a program to apply single linkage hierarchical clustering technique. |

**Text Books:**


**T1.** Alvin C. Rencher, “Methods of Multivariate Analysis”, Second Edition, Wiley Publication

**T2.** Richard Johnson and Dean Wichern, “Applied multivariate Statistical Methods”, Sixth Edition, Person

**T3.** Magnus Lie Hetland “Beginning Python: From Novice to Professional” Edition, 2005.

**T4.** T.W. Anderson "An Introduction to Multivariate Statistical Analysis", Wiley Publication, Third edition.


**Reference Books:**


R1. Han, Jiawei Kamber, Micheline Pei and Jian, “Data Mining: Concepts and Techniques”, Elsevier Publishers Second Edition .

R2. Thomas Haslwanter, "An Introduction to Statistics with Python with Applications in the Life Sciences", Springer International Publishing Switzerland 2016, ISBN 978-3-319-28315-9, ISBN 978-3-319-28316-6 (eBook)

R3. Magnus Lie Hetland “Beginning Python: From Novice to Professional” Edition, 2005

R4. Alvin C. Rencher, “Methods of Multivariate Analysis”, Second Edition, Wiley Publication

R5. Han, Jiawei Kamber, Micheline Pei and Jian, “Data Mining: Concepts and Techniques”, Elsevier Publishers Second Edition Claus Weihs, Olaf Mersmann, Uwe Ligges, "Foundations of Statistical Algorithms", CRC Press, ISBN-978-1-4398-7887-3 (eBook - PDF)


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# S. Y. B. Tech (Department of Information Technology)
## Semester -III
## [IT2105]: Computer Graphics

| Teaching Scheme: | Credits: | Examination Scheme: |
|---|---|---|
| TH: 03 Hours/Week<br>PR: 02 Hours/Week | TH:03<br>PR:01 | In Sem. Evaluation : 15 Marks<br>Mid Sem. Exam : 25 Marks<br>End Sem. Exam : 60 Marks<br>Lab Evaluation : 25 Marks |

**Course Prerequisites:** Engineering Drawing and Computer Aided Graphics, Basic Geometry, Trigonometry, Vectors and Matrices, Basics of Data Structures and Algorithms.

**Course Objectives:**

- To familiarize students with mathematics behind graphics, the process of graphics displaying on screen.
- To understand algorithms used to draw line and circle.
- To understand different 2D/3D transformations like translation, scaling, rotation and reflection.
- To study polygon filling and polygon clipping methods.
- To study different color models of computer graphics.
- To understand curves and fractals.

**Course Outcomes: After successful completion of the course, students will able to-**

**CO1:** Analyze and demonstrate different methods for line drawing and circle drawing algorithm.
**CO2:** Demonstrate method for two-dimensional transformations.
**CO3:** Distinguish different 3D transformation and Projections.
**CO4:** Understand and demonstrate Polygon filling and Clipping Algorithm.
**CO5:** Analyze different color models of computer graphics and animation concept
**CO6:** Understand different curve and fractal generation methods

## Course Contents

| UNIT-I | Basics of Computer Graphics | 07 Hours |
|---|---|---|

Introduction of CG, Overview of graphics systems – Video display devices, Raster scan systems, Random scan systems. Basics of CG-Pixel, Aspect Ratio, Frame buffer, Graphics card and its importance. Plotting Primitives: Scan conversions, lines, line segments, vectors, pixels and frame buffers, Display file and its role. Line Drawing Basics- Line, line Types. Line Drawing algorithms- DDA and Bresenham.Circle drawing algorithms- Mid point and Bresenham, Character Generation Methods, Applications of Computer Graphics

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| UNIT-II | Two-Dimensional Graphics | 07 Hours |
|---|---|---|
| Two dimensional geometric transformations – Translation, Rotation, scaling, shearing. Matrix representation of all transformations. and homogeneous coordinates, composite transformations; | | |
| **UNIT-III** | **3D Transformations and Projections** | **07 Hours** |
| Three dimensional geometric and modeling transformations – Translation, Rotation, Scaling, composite transformations. Rotation about X, Y, Z and arbitrary axis reflection about XY, YZ, XZ and arbitrary plane. Projections: Types Parallel - Oblique: Cavalier, Cabinet and orthographic: Isometric, Diametric, Trimetric and Perspective - Vanishing Points as 1 point, 2 point and 3 point. | | |
| **UNIT-IV** | **Windowing And Clipping** | **07 Hours** |
| Two-dimensional viewing – viewing pipeline, viewing coordinate reference frame; widow-to-viewport coordinate transformation, Two dimensional viewing functions, Polygon Filling Algorithms clipping operations – point, line, and polygon clipping algorithms. | | |
| **UNIT-V** | **Color Models, Shading And Animation** | **07 Hours** |
| Intuitive color concepts – RGB color model – YIQ color model – CMY color model – HSV color model – HLS color model; Color selection. Shading: Halftoning, Gouraud and Phong Shading. Design of Animation sequences – animation function – raster animation – key frame systems – motion specification –morphing – twining. | | |
| **UNIT-VI** | **Curves and Fractals** | **07 Hours** |
| Introduction, Curve generation, Interpolation, interpolating algorithms, interpolating polygons, B-Splines and corners, Bezier curves, Fractals, fractal lines and surfaces Interactive Graphics & usage of the tools of computer graphics – 3D Studio and Maya. | | |
| **Text Books:**<br>**T1** : S. Harrington, "Computer Graphics", 2nd Edition, McGraw-Hill Publications, 1987, ISBN 0 – 07 –100472 – 6.<br>**T2** :D. Rogers, "Procedural Elements for Computer Graphics", 2nd Edition, Tata McGraw-Hill Publication, 2001, ISBN 0 – 07 – 047371 – 4. | | |
| **Reference Books:**<br>**Reference Books:**<br>**R1:** Peter Shirley, Michael Ashikhmin, Michael Gleicher, Stephen R Marschner, Erik Reinhard, KelvinSung, and AK Peters, Fundamental of Computer Graphics, CRC Press, 2010.<br>**R2 :** Donald Hearn and M. Pauline Baker, Warren Carithers,"Computer Graphics With Open GL", 4th Edition, Pearson Education, 2010.<br>**R3 :** Donald Hearn and M. Pauline Baker, Warren Carithers,"Computer Graphics With Open GL", 4th Edition, Pearson Education, 2010. | | |
| **eBooks:** https://g.co/kgs/LW5do1 | | |

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| **Other Sources( URLs):** http://aima.cs.berkeley.edu/ |

## Lab Contents

**Guidelines for Lab Assessment**

1) Continuous assessment shall be based on experiments performed, submission of results of practical assignments in the form of journal / reports, timely completion, attendance, understanding, performance.

2) Practical / Oral examination shall be based on the practical's performed in the lab.

3)Lab assessment marks shall be based on continuous assessment and performance in Practical/Oral examination

**List of Laboratory Assignments**

| | |
|---|---|
| **1.** | Implementation of Line drawing algorithms: DDA Algorithm, Bresenham's Algorithm |
| **2.** | Implementation of Circle drawing algorithm: Bresenham's Algorithm. |
| **3.** | Implementation of Transformations – 1.Translation 2.Scaling |
| **4.** | Implementation of Transformations - 1.Rotation 2 Reflection. |
| **5.** | Implementation of Polygon Filling using Scan Line Algorithm. |
| **6.** | Implementation of Line clipping using Cohen Sutherland algorithm |
| **7.** | Implementation of Polygon clipping using Sutherland Hodgman algorithm. |
| **8.** | Implementation of Bezier curve. |

**Text Books:**

T1 : S. Harrington, "Computer Graphics", 2nd Edition, McGraw-Hill Publications, 1987, ISBN 0 – 07 –100472 – 6.

T2 :D. Rogers, "Procedural Elements for Computer Graphics", 2nd Edition, Tata McGraw-Hill Publication, 2001, ISBN 0 – 07 – 047371 – 4.

**Reference Books:**

R1: Peter Shirley, Michael Ashikhmin, Michael Gleicher, Stephen R Marschner, Erik Reinhard, KelvinSung, and AK Peters, Fundamental of Computer Graphics, CRC Press, 2010.

R2 : Donald Hearn and M. Pauline Baker, Warren Carithers,"Computer Graphics With Open GL", 4th Edition, Pearson Education, 2010.

R3 : Donald Hearn and M. Pauline Baker, Warren Carithers,"Computer Graphics With Open GL", 4th Edition, Pearson Education, 2010.

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# S. Y. B. Tech (Department of Information Technology)
## Semester -III
## [IT2125]: Computer Graphics and Animation

| Teaching Scheme: | Credits: | Examination Scheme: |
|---|---|---|
| TH: 03 Hours/Week | TH:03 | In Sem. Evaluation : 15 Marks |
| PR: 02 Hours/Week | PR:01 | Mid Sem. Exam : 25 Marks |
| | | End Sem. Exam : 60 Marks |
| | | Lab Evaluation : 25 Marks |

**Course Prerequisites:** Engineering Drawing and Computer Aided Graphics, Basic Geometry, Trigonometry, Vectors and Matrices, Basics of Data Structures and Algorithms.

**Course Objectives:**

- To familiarize students with mathematics behind graphics, the process of graphics displaying on screen.
- To understand algorithms used to draw line and circle.
- To understand different 2D/3D transformations like translation, scaling, rotation and reflection.
- To study polygon filling and polygon clipping methods.
- To study different color models of computer graphics.
- To understand curves and fractals.
- To understand Animation Process.

**Course Outcomes: After successful completion of the course, students will able to-**

**CO1:** Analyze and demonstrate different methods for line drawing and circle drawing algorithm.
**CO2:** Demonstrate method for two-dimensional transformations.
**CO3:** Distinguish different 3D transformation and projections.
**CO4:** Understand and demonstrate Polygon filling and Clipping Algorithm.
**CO5:** Understand different curve and fractal generation methods.
**CO6:** Analyze different shading and animation concepts.

## Course Contents

| UNIT-I | Basics of Computer Graphics | 07 Hours |
|---|---|---|

Introduction of CG, Overview of graphics systems – Video display devices, Raster scan systems, Random scan systems. Basics of CG-Pixel, Aspect Ratio, Frame buffer, Graphics card and its importance. Plotting Primitives: Scan conversions, lines, line segments, vectors, pixels and frame buffers, Display file and its role. Line Drawing Basics- Line, line Types. Line Drawing algorithms-DDA and Bresenham. Circle drawing algorithms- Mid point and Bresenham, Character Generation Methods,

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| | | |
|---|---|---|
| Applications of Computer Graphics | | |
| **UNIT-II** | **Two-Dimensional Graphics** | **07 Hours** |
| Two dimensional geometric transformations – Translation, Rotation, scaling, shearing. Matrix representation of all transformations. and homogeneous coordinates, composite transformations; | | |
| **UNIT-III** | **3D Transformations and Projections** | **07 Hours** |
| Three dimensional geometric and modeling transformations – Translation, Rotation, Scaling, composite transformations. Rotation about X, Y, Z and arbitrary axis reflection about XY, YZ, XZ and arbitrary plane. Projections: Types Parallel - Oblique: Cavalier, Cabinet and orthographic: Isometric, Diametric, Trimetric and Perspective - Vanishing Points as 1 point, 2 point and 3 point. | | |
| **UNIT-IV** | **Windowing And Clipping** | **07 Hours** |
| Two-dimensional viewing – viewing pipeline, viewing coordinate reference frame; widow-to-viewport coordinate transformation, Two dimensional viewing functions, Polygon Filling Algorithms clipping operations – point, line, and polygon clipping algorithms. | | |
| **UNIT-V** | **Curves and Fractals** | **07 Hours** |
| Introduction, Curve generation, Interpolation, interpolating algorithms, interpolating polygons, B-Splines and corners, Bezier curves, Fractals, fractal lines and surfaces Interactive Graphics & usage of the tools of computer graphics – 3D Studio and Maya | | |
| **UNIT-VI** | **Shading And Animation Techniques** | **07 Hours** |
| Shading: Half toning, Gouraud and Phong Shading.<br>**Animation** –Introduction of Animation, Type of animation, Design of Animation sequences – animation function, Shape animation, Key frame animation, Movie clip.<br>Some Techniques of Animation – Animation on the WEB – 3D Animation – Special Effects -Creating Animation. | | |
| **Text Books:**<br>**T1** : S. Harrington, "Computer Graphics", 2nd Edition, McGraw-Hill Publications, 1987, ISBN 0 – 07 – 100472 – 6.<br>**T2 :**D. Rogers, "Procedural Elements for Computer Graphics", 2nd Edition, Tata McGraw-Hill Publication, 2001, ISBN 0 – 07 – 047371 – 4. | | |
| **Reference Books:**<br>**R1:** Peter Shirley, Michael Ashikhmin, Michael Gleicher, Stephen R Marschner, Erik Reinhard, | | |

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KelvinSung, and AK Peters, Fundamental of Computer Graphics, CRC Press, 2010.
**R2 :** Donald Hearn and M. Pauline Baker, Warren Carithers,“ Computer Graphics With Open GL”, 4th Edition, Pearson Education, 2010.

**eBooks:** https://g.co/kgs/LW5do1

**Other Sources( URLs):** http://aima.cs.berkeley.edu/

## Lab Contents

**Guidelines for Assessment**

1) Continuous assessment shall be based on experiments performed, submission of results of practical assignments in the form of journal / reports, timely completion, attendance, understanding, performance.
2) Practical / Oral examination shall be based on the practical’s performed in the lab.
3)Lab assessment marks shall be based on continuous assessment and performance in Practical/Oral examination

**List of Laboratory Assignments**

| | |
|---|---|
| **9.** | Implementation of Line drawing algorithms: DDA Algorithm, Bresenham's Algorithm |
| **10.** | Implementation of Circle drawing algorithm: Bresenham's Algorithm. |
| **11.** | Implementation of Transformations – 1.Translation 2.Scaling |
| **12.** | Implementation of Transformations - 1.Rotation 2 Reflection. |
| **13.** | Implementation of Polygon Filling using Scan Line Algorithm. |
| **14.** | Implementation of Line clipping using Cohen Sutherland algorithm |
| **15.** | Implementation of Polygon clipping using Sutherland Hodgman algorithm. |
| **16.** | Implementation of Bezier curve. |
| **17.** | Implementation of Animation sequence like Clock. |

**Text Books:**
**T1** : S. Harrington, “Computer Graphics”, 2nd Edition, McGraw-Hill Publications, 1987, ISBN 0 – 07 – 100472 – 6.
**T2** :D. Rogers, “Procedural Elements for Computer Graphics”, 2nd Edition, Tata McGraw-Hill Publication, 2001, ISBN 0 – 07 – 047371 – 4.

**Reference Books:**
R1: Peter Shirley, Michael Ashikhmin, Michael Gleicher, Stephen R Marschner, Erik Reinhard, KelvinSung, and AK Peters, Fundamental of Computer Graphics, CRC Press, 2010.
R2 : Donald Hearn and M. Pauline Baker, Warren Carithers,“Computer Graphics With Open GL”, 4th Edition, Pearson Education, 2010.
R3 : Donald Hearn and M. Pauline Baker, Warren Carithers,“Computer Graphics With Open GL”, 4th Edition, Pearson Education, 2010.

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# S. Y. B. Tech (Department of Information Technology)
## Semester -III
## [HS2104]: Human Values and Ethics

| Teaching Scheme: | Credits: | Examination Scheme: |
|---|---|---|
| LAB: 02 Hours/Week | LAB:01 | Lab Evaluation : 25 Marks |

**Course Objectives:**

- To help students distinguish between values and skills and understand the need, basic guidelines, content and process of value education.
- To help students initiate a process of dialog within themselves to know what they 'really want to be' in their life and profession.
- To help students understand the meaning of happiness and prosperity for a human being.
- To facilitate the students to understand harmony at all the levels of human living, and live accordingly.

**Course Outcomes: After successful completion of the course, students will able to-**

**CO1:** Identify the significance of value inputs in a classroom, distinguish between values and skills, understand the need, basic guidelines, content and process of value education, explore the meaning of happiness and prosperity and do a correct appraisal of the current scenario in the society.

**CO2:** Distinguish between the Self and the Body, understand the meaning of Harmony in the Self the Coexistence of Self and Body.

**CO3:** Discuss the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human-human relationships and explore their role in ensuring a harmonious society.

**CO4:** Explain the harmony in nature and existence, and work out their mutually fulfilling participation in the nature.

## Course Contents

| UNIT-I | Course Introduction - Need, Basic Guidelines, Content and Process for Value Education | 03 Hours |
|---|---|---|

Understanding the need, basic guidelines, content and process for Value Education, Self-Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for

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| | | |
|---|---|---|
| fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels. | | |
| **UNIT-II** | **Understanding Harmony in the Human Being - Harmony in Myself** | **03 Hours** |
| Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Swasthya. | | |
| **UNIT-III** | **Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship** | **03 Hours** |
| Understanding harmony in the Family- the basic unit of human interaction , Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship, Understanding the meaning of Vishwas; Difference between intention and competence, Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals, Visualizing a universal harmonious order in society Undivided Society (AkhandSamaj), Universal Order (SarvabhaumVyawastha )- from family to world family!. | | |
| **UNIT-IV** | **Implications of the above Holistic Understanding of Harmony on Professional Ethics** | **03 Hours** |
| Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in Professional Ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers, b) At the level of society: as mutually enriching institutions and organizations. | | |

**Text Books:**

**T1.** R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics

**Reference Books:**

**R1.** Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA

**R2.** E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.

**R3.** Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991

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**R4.** Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
**R5.** A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
**R6.** P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
**R7.** A N Tripathy, 2003, Human Values, New Age International Publishers.
**R8.** Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantraShodh, Amravati.
**R9.** E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press
**R10.** M Govindarajan, S Natarajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
**R11.** B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books. Mode of Evaluation: Assignment/ Seminar/Continuous Assessment Test/Semester End Exam

RSCOE

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# S. Y. B. Tech (Department of Information Technology)
## Semester -III
## [IT2106]: Python Programming

| Teaching Scheme: | Credits: | Examination Scheme: |
|---|---|---|
| LAB: 02 Hours/Week | LAB: 01 | Lab Evaluation : 25 Marks |

**Course Prerequisites:** Programming fundamentals, Problem solving skills.

**Laboratory Objective:**

- To understand different types of python in-built data structures, sequences, high-order functions such as lambda, map, its applications and complexity analysis
- To learn different libraries such as NumPy for numerical calculations, Pandas for data manipulation and MatPlotLib for data visualization

**Laboratory Outcomes:**

**LO1:** Demonstrate the use of built-in data structures and sequences in data slicing.
**LO2:** Expertise in high-order functions and functional programming.
**LO3:** Perform data analysis, manipulation and visualization.
**LO4:** Analyze computational complexity of Python data-structures.

## Lab Contents

**Guidelines for Assessment**

Continuous assessment of laboratory work is to be done based on overall performance and lab practicals /assignments performance of student. Each lab practical/assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness.

**List of Laboratory Assignments/Experiments**

**1.** Write a Python program to create user defined lists and execute operations:

**A.** myList= [10, 40, 50, 20, 30,10,40,10]
**B.** yourList = ['saw','small','foxes','he','six']

**Use built in methods to perform following operations on the list:**

**1)** Append integer 60 into myList
**2)** Insert 70 on 2nd Position
**3)** Sort myList in ascending and descending order.
**4)** Sort yourList in ascending and descending according to length of strings.

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| | |
|---|---|
| | **5)** Add float value 3.5 into yourList.<br>**6)** Use POP and remove method to remove 3.5<br>**7)** Create ourList by merging myList and yourList<br>**8)** Find sum of elements in mylist.<br>**9)** Find smallest, largest and second largest number in a myList.<br>**10)** Count occurrences of all element in a list<br>**11)** Perform Data slicing to display string elements from ascending sorted yourList as: -<br>**a.** Display - 'saw','six','small'<br>**b.** Use negative indices to display - . 'six','small', 'foxes'<br>**c.** All elements after mid of the list (In both directions).<br>Alternate elements in both direction middle of list.. |
| **2.** | Write a Python program to create tuples as<br>**A.** myTuple= (10, 20, 30)<br>**B.** yourTuple = ("Pune", 'Mumbai', "Delhi")<br>**C.** mixTuple= ('Foo',[1,2,3],'True')<br>**D.** nestedTuple=((' **Wes McKinney**',' **Python for Data Analysis**',' **O'Reilly Media**'),<br>('**Mark Lutz**',' **Programming Python**',' **O'Reilly Media**'),<br>('**Charles Severance**',' **Python for Everybody**',' **Blumenberg**'))<br><br>**Use built in methods to perform following operations on the tuple:**<br>**1)** Merge myTuple and yourTuple into ourTuple.<br>**2)** Convert myTuple into list myList and reverse.<br>**3)** Unpack yourTuple values into three variables - District, State, and National.<br>**4)** Display all elements of mixTuple.<br>**5)** Add 4 into list element of mixTuple<br>**6)** Perform algebraic operations addition and multiplication on myTuple and yourTuple.<br>**7)** Access information from nestedTuple and display the information as:<br>Name of Author = ' **Wes McKinney**',<br>Name of Book = ' **Python for Data Analysis**',<br>Name of Publisher= ' **O'Reilly Media**' |
| 3. | Write a Python program which read the **Particulars.txt** file contains the elements in the string format.<br>**Particular.txt :** Diary CCards DCards VCards CCards DCards VCards VCards VCards VCards<br>Create a dictionary myWallet by reading the elements and get() method.<br>**myWallet={'Diary': 1, 'CCards': 2, 'DCards': 2, 'VCards': 5}**<br><br>Perform following operations on myWallet dictionary: |

| | |
|---|---|
| | 1) A new credit card is added in myWallet<br>2) Check that any Photograph available in myWallet or not in True or False output.<br>3) Add four Photographs in myWallet.<br>4) Remove Photographs using del() method and pop() method.<br>5) Represent the particulars of dictionary in the form of tuple.<br>6) Sort the item of myWallet in ascending order based on items.<br>7) Sort the items of myWallet in the ascending order based on item quantity |
| 4. | Write a Python program to construct Python built-in data structure Set.<br>1) Create empty set 'Engineers' and 'Managers'.<br>2) Using input method add elements in 'Engineers' and 'Managers':<br>Engineers={'Jane', 'John', 'Janice', 'Jack'}<br>Managers ={'Jane', 'Jack', 'Susan', 'Zack'}<br>3) Display all engineers in this format : "Name of Engineer is --- " Jane<br>4) Copy all managers and construct a tuple myManagers =('Jane', 'Jack', 'Susan', 'Zack')<br>5) Copy all engineers and construct a list myEngineers ={'Jane', 'John', 'Janice', 'Jack'}<br>6) Add new manager 'Jenifer'<br>7) Create a third set Engineer_Manager by merging both Engineers and Managers sets.<br>8) Display the name of engineers who are not managers<br>9) Display the name of engineers who also serving as managers.<br>Display the name of person who is either engineer or manager only but not performing both jobs. |

**Text Books:**

**T1.** Charles Severance, "Python for Everybody: Exploring Data in Python 3", 2nd Edition, Elliott Hauser, Sue Blumenberg, ISBN 9781530051120, 1530051126

**T2.** Allen Downey, "Think Python How to Think Like a Computer Scientist ",, 2nd Edition, ISBN 9781491939420, 1491939427

**Reference Books:**

**R1.** Wes McKinney —Python for Data Analysis, ISBN: 9781449319793, 1449319793. O'Reilly Media

**R2.** Mark Lutz, Programming Python, O`Reilly, 4th Edition, 2010.

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## S. Y. B. Tech (Department of Information Technology)
## Semester -III
## [IT2107]: Engineering Design and Innovation-I

| Teaching Scheme: | Credits: | Examination Scheme: |
|---|---|---|
| LAB: 2Hours/Week | LAB: 1 | Lab Evaluation : 25 Marks |

**Course Prerequisites :** Knowledge of any programming Language

**Course Objectives:** To make students implement their ideas / real time problem/current applications from their engineering domain. Students should be able to develop plans, break the work down into tasks and determine appropriate procedures, estimate the cost of human and physical resources required with help of team members to achieve the project's goals. Students should learn to allocate roles with clear lines of responsibility, accountability, learn team work ethics and apply communication skills to effectively promote ideas, goals or products

**Course Outcomes: After successful completion of the course, students will able to -**

**CO1:** Understand the differences between a project-based approach and conventional teaching. Review the research-based benefits of project-based learning.

**CO2:** Apply different technologies to solve life readiness skills and targeted learning objectives that support student learning.

**CO3:** Show enthusiasm to study independently in chosen domain of Information Technology and programming languages and apply their acquired knowledge to variety of real time problem scenarios.

**CO4:** Design and develop different methods and tools for assessment during projects.

**CO5:** Develop a collection of web-based PBL resources to support project planning.

**CO6:** Develop techniques to effectively participate in Project-Based Learning and project presentation.

## Course Contents

| UNIT-I | Overview of Problem | 04 Hours |
|---|---|---|

In this module, participants explore the principles of problem-based learning. They learn about the differences between a project-based approach and conventional teaching, and review the research-based benefits of project-based learning. As they view examples of different projects and hear from teachers doing projects, they come to understand the characteristics that projects have in common.

| UNIT-II | Requirement Analysis | 04 Hours |
|---|---|---|

In this module, participants begin thinking about designing their own projects. They are introduced to the four major steps of project design and apply these steps to consider their own learning goals, Curriculum-Framing Questions, assessment, and student activities.

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| UNIT-III | Project Business Model Analysis | 04 Hours |
|---|---|---|

**Blue Ocean Strategy:** - *Blue ocean strategy* is the simultaneous pursuit of differentiation and low cost to open up a new market space and create new demand.

**PEST analysis:** - *PEST Analysis* (political, economic, social and technological) is a management method whereby students can assess major external factors that influence its operation in order to become more competitive in the market.

**SWOT analysis:** SWOT analysis is a strategic planning technique used to help students to identify strengths, weaknesses, opportunities, and threats related to business competition or project planning.

Business canvas: The business model canvas is a great tool to help you understand a business model in a straightforward, structured way.

| UNIT-IV | Project Planning and Design | 04 Hours |
|---|---|---|

Planning the day-to-day work of a project is just as important as planning the big picture. In this module, participants learn how to plan project details to keep a project organized, using project timelines and implementation plans. They consider management strategies to support their students' self-direction and success and ensure their projects run smoothly. Teachers also discuss ways to keep students on task during projects and strategies for project time management. In Project designing phase the project's key features, structure, criteria for success and major deliverables are all planned out.

| UNIT-V | Project Assessment | 04 Hours |
|---|---|---|

The project work is completed by an examination which assesses students' individual performances in the project work. Emphasis is on the assessment of the individual student's knowledge, skills and Competences. The assessment takes place in connection with the students' presentation and discussion of their project, including the approach taken and the results achieved by the group.

**Project Presentation:**

Finish and present your final project. Provide feedback for your classmates and participate in a final project survey.

**Text Books:**

T1.Arduino101 Beginners Guide: How to Get Started with Your Arduino by Erik Savasgard published by Create space Independent Pub.

T2. Internet of things hands on approach by ArshdeepBahga, Vijay Madisetti-5 copies published by Arshdeep Bagga

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## S. Y. B. Tech (Department of Information Technology)
## Semester -III
## [HS2101]: Language Proficiency –II English

| Teaching Scheme | Credits: | Examination Scheme: |
|---|---|---|
| LAB: 02 Hours/Week | LAB:01 | Lab Evaluation :25 Marks |

**Course Prerequisites :** Language Proficiency –I English

**Course Objectives:**

- Inculcate the importance of Technical English Communication Skills
- Enhance their communicative competence
- Enable the students to communicate with clarity and precision
- Prepare the students to acquire structure and written expression required for their profession And enable them to acquire proper behavioral skills

**Course Outcomes: After successful completion of the course, students will able to-**

**CO1:** Identify errors in sentences and correct them. Practice solving questions related to sentence correction.

**CO2:** Recognize the significance of proper grooming. Learn how grooming plays a key role in personal presentation and confidence.

**CO3:** Learn how to introduce yourself confidently and clearly. Gain the skills to introduce others effectively in various situations.

**CO4:** Present PowerPoint presentations confidently during group meetings or seminars. Stand firm in expressing and defending personal beliefs.

**CO5:** Take part in vocal competitions with confidence. Speak and perform effectively to engage the audience and showcase your skills.

### Course Contents

| | | |
|---|---|---|
| **UNIT-I** | **Application of Grammar to solve questions and to form sentences correctly.** | **04 Hours** |
| Sentence Correction- Subject -Verb agreement, Modifiers, Parallelism, Pronoun-antecedent agreement, Verb time sequence, Prepositions | | |
| **UNIT-II** | **Soft Skills** | **04 Hours** |
| Corporate Etiquettes, Body Language, communication (Importance/Skills/Behaviors) Grooming (Dressing/Styling), Proxemics: Space Distance | | |
| **UNIT-III** | **Oral Communication** | **04 Hours** |

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|---|---|---|
| Speeches for different Occasion, Self-Introduction, Welcome Speech, Introductory Speech, Vote of Thanks Speech | | |
| **UNIT-IV** | **Presentation** | **06 Hours** |
| Power point Presentation (Individual/ Group), (On current trends/Travel Destinations/ Upcoming Opportunities etc..), Extempore- Orientation & Mock (Individual Extempore on current affairs/Abstract Topics/ Controversial topics/ Political Views) | | |
| **UNIT-V** | **Placement Essentials** | **06 Hours** |
| Orientation of Group Discussion, Mock Group Discussion, Interview, Mock Interview, Debate, Mock Debate | | |

**Reference Books:**


**R1.** K.R.Laxminarayanan, English for Technical Communication, Scitech, Sixth Edition, 2008

**R2.** William Sanborn Pfeiffer ,T.V.S. Padmaja ,Technical Communication: A Practical Approach, Pearson, Sixth Edition 2012

**R3.** A.K.Jain, Praveen Bhatia, A.M.Shaikh, Professional Communication Skills, S. Chand and Co: Fifth edition ,2009

**R4.** Ashraf Rizvi ,Effective Technical Communication, Tata McGraw Hills publishing Company 2006

**R5.** F.T.Wood,Remedial English Grammar, Macmillan, 2007

**R6.** Andrea J.Rutherford,Phd. Basic Communication Skills for Technology, Pearson Education Asia,2001

**R7.** Exercises in Spoken English, Parts 1 and II CIEFL, Hyderabad , Oxford University Press

**R8.** Sanjay Kumar, Pushplata , Communication Skills, Oxford University Press, First edition ,2012


Mode of Evaluation:

**Assignment/ Seminar/Continuous Assessment Test/Semester End Exam**

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# S. Y. B. Tech (Department of Information Technology)
## Semester -III
## [HS2102]: Language Proficiency –II German

| Teaching Scheme | Credits: | Examination Scheme: |
|---|---|---|
| LAB: 02 Hours/Week | LAB:01 | Lab Evaluation :25 Marks |

**Course Prerequisites : Language Proficiency –I German**

**Course Objectives:** Introduction of Germany, Greetings, phrases, vocabulary, Understanding of numbers till 100, Grammar- Introductory Sentence Formation, Articles, Pronouns, Tense, Prepositions, Question Formation

**Course Outcomes: After successful completion of the course, students will able to-**

**CO1:** Gain an understanding of Germany's culture, geography, history, and key aspects of its society.

**CO2:** Learn and practice the correct pronunciation of German letters, sounds, and common greetings used in everyday conversation.

**CO3:** Develop the ability to count from 1 to 100 in German, including understanding the structure of numbers.

**CO4:** Acquire the skills to introduce themselves in German, including providing basic personal information such as name, age, and nationality.

**CO5:** Learn how to form and ask basic questions in German, enabling simple communication in everyday situations.

## Course Contents

| UNIT-I | Start auf Deutsch: (Begin in German) | 4 Hours |
|---|---|---|
| Deutschland, Deutschsehen und hören, ersteKontakte, Texte: Lied, Postkarte, Wortfelder: internationaleWörter, deutsche Namen | | |
| **UNIT-II** | **Café** | **4 Hours** |
| Gesprächeim Café, Texte: Getränkekarte, Telefonbuch, Rechnungen, Wortfelder:Gesprächeim Café, Zahlenbis 100, Strukturwörter | | |
| **UNIT-III** | **Städte, Länder, Sprachen: (Cities, Countries, Languages)** | **2 Hours** |
| Sehenswürdigkeiten in Europa, Sprachen in Europa, Nachbarsprachen,Texte:Landkarten, einStatistik, Wortfelder: Himmelsrichtungen, Sprachen | | |
| **UNIT-IV** | **Menschen und Haüser: (People and Houses)** | **2 Hours** |
| Wohnwelten, Texte: Möbelkatalog, E-Mail, Wohnungsgrundriss, Wortfelder: Räume und Möbel, Wohnformen | | |

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**Text Books:**

**T1.** Funk, Kuhn, &Demme. Studio d A1. Deutsch alsFremdsprache. 2011. Goyal Publishers & Distributors Pvt. Ltd. Delhi, India.

**Mode of Evaluation:Assignment/ Seminar/Continuous Assessment Test/Semester End Exam**

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## S. Y. B. Tech (Department of Information Technology)
## Semester -III
## [HS2103]: Language Proficiency –II Japanese

| Teaching Scheme | Credits: | Examination Scheme: |
|---|---|---|
| LAB: 02 Hours/Week | LAB:01 | Lab Evaluation :25 Marks |

**Course Prerequisites :** Language Proficiency –I Japanese

**Course Objective:** The objective of this course is to develop foundational proficiency in reading, writing, and pronouncing Hiragana and Katakana scripts while enhancing basic conversational skills in Japanese. By the end of the course, students will be able to confidently communicate essential personal and situational information, including dates, numbers, self-introduction, and time-related expressions, using correct pronunciation and script conventions.

**Course Outcomes: After successful completion of the course, students will able to-**

**CO1:** Master the Hiragana script, including understanding and writing modified kana, contracted sounds and long vowels, while learning how to state the date in Year/Month/Date format in Japanese.

**CO2:** Gain proficiency in the pronunciation of specific Hiragana sounds such as "ん" (N) and "つ" (Tsu), and practice stating one's birthday in Japanese.

**CO3:** Learn the Katakana script and become familiar with its basic syllabary, enabling students to ask for and state telephone numbers in Japanese.

**CO4:** Master the modified Kana in Katakana and practice self-introduction by stating one's age and nationality in Japanese.

**CO5:** Learn to use Katakana for contracted sounds and long vowels, with the correct pronunciation of "Tsu", and practice stating time in Japanese.

## Contents

**UNIT-I**

Hiragana - Modified Kana, Contracted sounds, Long vowels
To state the date in Year / Month / Date form

**UNIT-II**

Hiragana - Pronunciation of " ん " ( N ), Pronunciation of " つ " ( Tsu )
To state one's Birthday

**UNIT-III**

Katakana : Basic syllabary

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|---|
| Asking and stating Telephone numbers. |
| **UNIT-IV** |
| Katakana - Modified Kana<br>Self-Introduction with Age and Nationality |
| **UNIT-V** |
| Katakana - Contracted sounds, Long vowel, Pronunciation of " Tsu "<br>Stating " Time " |
| Mode of Evaluation:<br>**Assignment/ Seminar/Continuous Assessment Test/Semester End Exam** |

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## S. Y. B. Tech CSBS (Department of Information Technology)
## Semester -III
## [HS2109]: Language Proficiency –II French

| Teaching Scheme: | Credit | Examination Scheme: |
|---|---|---|
| PR: -2 Hours/Week<br>24 hours Program | PR: 1 | Lab Evaluation : 25 Marks<br>Total : 25 Marks |

**Course Prerequisites:**

1. Student should be good with basic Understanding of English Language.
2. Attendance in all the sessions is mandatory.

**Course Objective**:

1. To make the students understand the importance of learning a foreign language.
2. This module will help students learn the A1 level of French Language.
3. The learners should be able to engage in a simple buy and sell situation, day, date & time identification, accept or refuse a request and simple form filling and write a simple post card.
4. This A1.2 level will lay the foundation to the next B1 level learning of the language.

**Course Outcome:**

After successful completion of the course, students will able to:

**CO1:** Read/Write and understand French at an elementary level
**CO2:** Listen to basic spoken French and demonstrate understanding by responding appropriately.

### Course Contents

| UNIT-I | VOCABULARY | 4 Hours |
|---|---|---|

1. Family
2. Time
3. Prices
4. Weather / Climate
5. Date
6. Days of the week
7. Descriptions (small, big, old, young, etc)
8. Colours
9. Seasons

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| | | |
|---|---|---|
| **10.** Places | | |
| **UNIT-II** | **GRAMMAR TOPICS** | **8 Hours** |

1. Affirmative and Negative sentences
2. Negation (not)
3. Possessive 's to show belonging
4. Possessive adjectives
5. Partitive articles (of the)
6. Adverbs of quantity (a few, a lot)
7. Uncountable
8. Countable
9. Impersonal 'it' for the weather
10. Expressions of time (now, this morning, tomorrow)
11. Expressions of time (days, months, seasons, year)
12. Expressions of Place: go to / come from + a city or country; live in + a city or country
13. There is / There are
14. Connectors: and, or, but

| | | |
|---|---|---|
| **UNIT-III** | **SPEAKING TOPICS** | **8 Hours** |

1. Talk about when something happensTell the date
   Tell the time
2. Talk about where something happens
3. Give directions about a city / a country
4. Give instructions or advice
5. Accept something: Agree to something
6. Refuse something: Disagree
7. Participate in a conversation
8. Say what you don't understand

| | | |
|---|---|---|
| **UNIT-IV** | **SOCIO CULTURAL KNOWLEDGE** | **4 Hours** |

1. Difference between I want & I would like
2. How to write an informal letter
3. How to write a postcard

**Guidelines for Assessment**

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|---|---|
| 1) Continuous assessment shall be based on experiments performed, submission of results of practical assignments in the form of journal / reports, timely completion, attendance, understanding, performance.<br>2) Practical / Oral examination shall be based on the practical's performed in the lab.<br>3) Lab assessment marks shall be based on continuous assessment and performance in Practical/Oral examination | |
| **List of Assignments** | |
| 1. | Multiple choice questions online assessment after completion of every unit to evaluate the understanding of the grammar. |
| 2. | Spoken exercises to evaluate the learning in the conversational aspect of the language. |
| **Text Books:** | |
| **Reference Books:**<br>**R1.** Saison 1 (méthode de Français- Livre de l'eleve)(textbook)<br>**R2.** Saison 1 (cahier d'activités)(workbook)<br>**R3.** Collins dictionary (French-English) (French-French) | |

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# S. Y. B. Tech (Department of Information Technology)
## Semester -III
## Audit Course-I
## [EC2107]: Intellectual Property Rights and Patents

**Course Objectives:**

- To introduce fundamental aspects of Intellectual property Rights (IPR)
- To disseminate knowledge about types of IP like Patents, Copyrights, Trade Secrets
- To make students aware about current trends in IPR and their importance
- To motivate students for innovative thinking and making inventions

**Course Outcomes: After successful completion of the course, students will able to-**

**CO1:** Exhibit the concepts of Intellectual Property Rights
**CO2:** Differentiate among different IPR
**CO3:** Formulate and characterize innovative ideas and inventions into IPR
**CO4:** Demonstrate knowledge of advances in patent law and IP regulations

**Course Contents**

| | | |
|---|---|---|
| **UNIT-I** | **Overview Of Intellectual Property** | **02 Hours** |
| Introduction and the need for intellectual property right (IPR) - Types of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties and Layout Design – Genetic Resources and Traditional Knowledge – Trade Secret. | | |
| **UNIT-II** | **Patents** | **02 Hours** |
| What is invention? Patentability criteria: Novelty, Non-Obviousness (Inventive Steps), Industrial Application, Non- Patentable Subject Matter, Patent Search, Patent Registration Procedure, Rights and Duties of Patentee, Assignment and license, Infringement | | |
| **UNIT-III** | **Copyrights** | **02 Hours** |
| Concept of Copyright –Copyright Subject matter: original literary, dramatic, musical, artistic works; cinematograph films and sound recordings - Registration Procedure, Term of protection, Ownership of copyright, Assignment and license of copyright – Infringement | | |
| **UNIT-IV** | **Trademarks** | **06 Hours** |
| Nature of Trademarks - Different kinds of trademarks (, logos, signatures, symbols, well known marks, brand names, certification and service marks) – Trademarks that can't be registered– Trademarks registration procedure - Rights of holder and assignment and licensing of marks – Infringement | | |
| **UNIT-V** | **Advances in IP Laws and Government policies** | **06 Hours** |

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|---|
| Amendments and India`s New National IP Policy, Promoting IPR policy for Start-ups, Career Opportunities in IP - IPR in current scenario |
| **Reference Books:**<br>**R1.** Niraja Pandey, Khush deep Dharni (2014), "Intellectual Property Rights", PHI<br>**R2.** Nithyananda K V. (2019). Intellectual Property Rights: Protection and Management. India, IN: Cengage Learning India Private Limited<br>**R3.** Mishra, "An introduction to Intellectual property Rights", Central Law Publications<br>**R4.** Ahuja, V K. (2017). Law relating to Intellectual Property Rights. India, IN: Lexis Nexis |

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## S. Y. B. Tech. (Department of Information Technology)
## Semester -III
## [CE2106B]: Audit Course-I: Road Safety Management

**Course Objectives:**

1. To provide basic overview on road safety & traffic management issues in view of the alarming increase in vehicular population of the country.
2. To explain the engineering & legislative measures for road safety.
3. To discuss measures for improving road safety education levels among the public.

**Course Outcomes: After successful completion of the course, students will able to-**

CO1: Summarize the existing road transport scenario of our country.
CO2: Explain the method of road accident investigation.
CO3: Describe the regulatory provisions needed for road safety.
CO4: Identify the safety issues for a road and make use of IRC's road safety manual for conducting road safety audit

**Course Contents**

| UNIT-I | Existing Road Transport Scenario |
|---|---|

Introduction, national & international statistics related to road transport. Factors responsible for increase in vehicle growth. Share of public transport: importance and current scenario (national &international) Suggestion for effective content delivery: Displaying updated and authentic statistics & real time scenario images during the session.

| UNIT-II | Road Accidents & its Investigation |
|---|---|

Definition of road accident. National & international statistics related to road accidents. Causes of road accident. Remedies / Measures for control road accidents. Methods for accident investigation. Condition diagram & collision diagram. Black spots & its identification based on accident data.

Suggestion for effective content delivery:
1. Activity related to drawing condition & collision diagram based on actual accident data.
2. Activity related to identification of black spots based on actual accident data.

| UNIT-III | Motor Vehicle Act & Central Motor Vehicle Rules |
|---|---|

The Motor Vehicle Act of 1988. Central Motor Vehicle Rules (CMVR) of 1989. Amendments to CMVR – 2017 & 2019.
Suggestion for effective content delivery:
1. Guest lecture by RTO Officer / Traffic Police Officer.

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|---|---|
| 2. Public awareness campaign. | |
| **UNIT-IV** | **Road Safety Audit (RSA)** |
| Introduction & importance of RSA. Methodology, phases and checklists for Road Safety Audit as per IRC SP: 88 – 2010 (Manual on Road Safety Audit)<br>Suggestion for effective content delivery:<br>Mini project – Conducting Road Safety Audit on minimum 2 km (both directions included) road stretch in the nearby vicinity. | |
| **Guidelines for Lab Assessment** | |
| 1) Continuous assessment shall be based on experiments performed, submission of results of practical assignments in the form of journal / reports, timely completion, attendance, understanding, performance.<br>2) Practical / Oral examination shall be based on the practical's performed in the lab.<br>3) Lab assessment marks shall be based on continuous assessment and performance in Practical/Oral examination. | |
| **Reference Books:**<br>**R1.** Kadiyali L.R., Traffic Engineering & Transport Planning, Khanna Publishers, 2003 CROWN AGENTS Ref: TEA/A369, 1995. (Unpublished contractors report for Ministry of Transport and Communications, Ghana). Road safety study and the institutional strengthening of the vehicle examination and licensing division.<br>**R2.** TRRL OVERSEAS UNIT, 1991. Towards safer roads in developing countries: a guide for planners and engineers. Crow Thorne: Transport and Road Research Laboratory<br>**R3.** Indian Roads Congress, Highway Safety Code, IRC: SP-44:1996<br>**R4.** Indian Roads Congress, Road Safety Audit Manual, IRC:SP-88-2010 | |

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# S. Y. B. Tech (Department of Information Technology)
## Semester -III
## Audit Course-I
## [HS2106]: Indian Constitution

**Course Prerequisites:** Enthusiasm to learn the subject.

**Course Objective:**

- To create an awareness on Government and Administration.
- Create awareness among engineers about their social responsibilities.
- To know features of our constitution.

**Course Outcome:**
**After successful completion of the course, students will able to:**
**CO1:** Understand Indian Constitution.
**CO2:** Aware of Rights and Responsibilities.
**CO3:** Aware of working of government bodies.

## Course Contents

| UNIT-I | Introduction |
|---|---|
| 'Constitution', meaning of the term, Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy. | |
| **UNIT-II** | **Union Government and its Administration** |
| Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha. | |
| **UNIT-III** | **State Government and its Administration** |
| Governor: Role and Position, CM and Council of ministers, State Secretariat: Organization, Structure and Functions. | |
| **UNIT-IV** | **Local Administration** |
| District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Panchayati raj: Introduction, PRI: Zila Panchayat, Elected officials and their roles, CEO Zila Panchayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy. | |
| **UNIT-V** | **Election Commission** |
| Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women. | |

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| UNIT-VI | Administrative Organization and constitution |
|---|---|
| Federalism in India – Features, Local Government -Panchayats –Powers and functions; 73rd and 74th amendments, Election Commission – Organization and functions, Citizen oriented measures – RTI and PIL – Provisions and significance. | |
| **Text Books:**<br>T1.Constitution of India (Full Text), India.gov.in., National Portal of India, https://www.india.gov.in/sites/upload_files/npi/files/coi_part_full.pdf<br>T2.Durga Das Basu, Bharatada Samvidhana Parichaya, Gurgaon; LexisNexis Butterworths Wadhwa, 2015.<br>T3.Kb Merunandan, Bharatada Samvidhana Ondu Parichaya, Bangalore, Meragu Publications, 2015.<br>T4.D.D. Basu, 'Indian Constitution'.<br>T5.Avasti and Avasti ,'Indian Administration' | |
| **Reference Books:**<br>R1.Das Basu, Introduction to the Constitution of India, Gurgaon; LexisNexis, 2018 (23rd edn.)<br>R2.M.V.Pylee, India's Constitution, New Delhi; S. Chand Pub., 2017 (16th edn.)<br>R3.J.N. Pandey, The Constitutional Law of India, Allahabad; Central Law Agency, 2018 (55th ed.) | |

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# S. Y. B. Tech. (Department of Information Technology)
## Semester -III
## Audit Course-I
## [IT2108]: Online Certification Course

| |
|---|
| **Course Prerequisites:** Basics analysis or design concepts of the selected course. |
| **Course Objective:** The objective of this course is, to prepare students to learn the courses using online teaching aids |
| **Course Outcomes: After successful completion of the course, students will able to-**<br>**CO1:** Use modern ICT tools for self-learning<br>**CO2:**Demonstrate the ability of self- learning<br>**CO3:** Demonstrate the ability to abreast with advance technologies. |
| **Course Contents** |
| The students should complete at least one Certification course which will be offered by NPTEL/Spoken tutorial/ Swayam/ IIT Bombay/ MOOC/or any other approved agency by the department during the same semester. The students should select the subjects relevant to Computer Engineering and which should not be included in the specified curriculum. Minimum duration of course should be 4 weeks and all assignments should be submitted. Certification done would be appreciated but not mandatory. Certification done would be appreciated but not mandatory. **In case a student does not go for certification, he/she should pass the internal test organized by the department for the said course.** |

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# SEMESTER IV

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# S. Y. B. Tech (Department of Information Technology)
## Semester -IV
## [ES2104]: Engineering Mathematics-III

| **Teaching Scheme:** | **Credits:** | **Examination Scheme:** |
|---|---|---|
| TH: 04 Hours/Week<br>TU: 01 Hours/Week | TH: 04<br>TU: 01 | In Sem. Evaluation : 15 Marks<br>Mid Sem. Exam : 25 Marks<br>End Sem. Exam : 60 Marks<br>Lab Evaluation :25 Marks |

**Course Prerequisites:** Differential & Integral Calculus, Taylor series, Differential equations of first order and first degree, Fourier series, Collection, Classification and Representation of data, Permutations & Combinations, Vector algebra.

**Course Objectives:** To familiarize the students with concepts and techniques in Linear differential equations, Fourier transform & Z-transform, Statistical methods, Probability theory, Vector Calculus and Numerical Methods. The aim is to equip them with the techniques to understand advanced level mathematics and its applications that would enhance thinking power, useful in their disciplines.

**Course Outcomes: After successful completion of the course, students will able to-**

**CO1:** Solve Linear differential equations, essential in modeling and design of computer based systems.

**CO2:** Apply concept of Fourier transform and Z-transform and its applications to continuous and discrete systems, image processing.

**CO3:** Apply statistical methods like correlation & regression analysis and probability theory for data analysis and prediction in machine learning.

**CO4:** Obtain Interpolating polynomials, numerical differentiation and integration, numerical solutions of ordinary differential equations used in modern scientific computing.

**CO5:** Apply Vector calculus to modernized techniques in various computing systems.

## Course Contents

| **UNIT-I** | **Linear Differential Equations (LDE)** | **09 Hours** |
|---|---|---|

LDE of $n^{th}$ order with constant coefficients, Complementary Function, Particular Integral, General method, Short methods, Method of variation of parameters, Cauchy's & Legendre's DE, Simultaneous & Symmetric simultaneous DE.

| **UNIT-II** | **Transforms** | **09 Hours** |
|---|---|---|

Fourier Transform (FT): Complex exponential form of Fourier series, Fourier integral theorem,

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Fourier Sine & Cosine integrals, Fourier transform, Fourier Sine & Cosine transforms and their inverses, Discrete Fourier Transform.
Z - Transform (ZT): Introduction, Definition, Standard properties, ZT of standard sequences and their inverses. Solution of difference equations.

| UNIT-III | Statistics | 09 Hours |
|---|---|---|

Measures of central tendency, Measures of dispersion, Coefficient of variation, Moments, Skewness and Kurtosis, Curve fitting: fitting of straight line, parabola and related curves, Correlation and Regression, Reliability of Regression Estimates.

| UNIT-IV | Probability and Probability Distributions | 09 Hours |
|---|---|---|

Probability, Theorems on Probability, Bayes theorem, Random variables, Mathematical Expectation, Probability density function, Probability distributions: Binomial, Poisson, Normal and Hypergeometric, Sampling distributions, Test of Hypothesis: Chi-Square test, t-test.

| UNIT-V | Numerical Methods | 09 Hours |
|---|---|---|

Interpolation: Finite Differences, Newton's and Lagrange's Interpolation formulae, Numerical Differentiation. Numerical Integration: Trapezoidal and Simpson's rules, Bound of truncation error. Solution of Ordinary differential equations: Euler's, Modified Euler's, Runge-Kutta $4^{th}$ order methods and Predictor-Corrector methods.

| UNIT-VI | Vector Calculus | 09 Hours |
|---|---|---|

Vector differentiation, Gradient, Divergence and Curl, Directional derivative, Solenoidal and Ir-rotational fields, Vector identities. Line, Surface and Volume integrals, Green's Lemma, Gauss's Divergence theorem and Stoke's theorem.

## Lab Contents

**Guidelines for Tutorial and Term Work:**

1. Tutorial shall be engaged in four batches (batch size of 20 students maximum) per division.
2. Term work shall be based on continuous assessment of six assignments (one per each unit).

**Text Books:**

T1: Higher Engineering Mathematics by B.V. Ramana (Tata McGraw-Hill).
T2: Higher Engineering Mathematics by B. S. Grewal (Khanna Publication, Delhi).

**Reference Books:**


**R1.** Advanced Engineering Mathematics, 10e, by Erwin Kreyszig (Wiley India).
**R2.** Advanced Engineering Mathematics, 2e, by M. D. Greenberg (Pearson Education).
**R3.** Advanced Engineering Mathematics, 7e, by Peter V. O'Neil (Cengage Learning).
**R4.** Differential Equations, 3e by S. L. Ross (Wiley India).
**R5.** Introduction to Probability and Statistics for Engineers and Scientists, 5e, by Sheldon M. oss (Elsevier Academic Press).
**R6.** Numerical Methods for Scientific and Engineering Computation, by M. K. Jain, S. R. K. Iyengar And R. K. Jain1, 5e, (New Age International Publication)


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# S. Y. B. Tech (Department of Information Technology)
## Semester -IV
## [ES2103]: Calculus and Transforms

| Teaching Scheme: | Credit | Examination Scheme: |
|---|---|---|
| TH: 4 Hours/Week | TH:4 | In Sem. Evaluation:15 Marks |
| TU: 2 Hours/Week | TU:1 | Mid Sem. Exam : 25 Marks |
| | | End Sem. Exam : 60 Marks |
| | | Lab Evaluation :25 Marks |

**Course Prerequisites:** Differentiation & Integration, Partial differentiation, Multiple integrals and Vector algebra.

**Course Objective:** To familiarize the students with concepts and techniques in Differential calculus, Vector calculus, Ordinary differential equations, Numerical methods, Laplace transform, Fourier transform and Z-transform. The aim is to equip them with the techniques to understand advanced level mathematics and its applications that would enhance analytical thinking power, useful in their disciplines.

**Course Outcome:**
**After successful completion of the course, students will able to:**
**CO1:** Apply concepts of Mean value theorems and its generalizations leading to Taylors and Maclaurin's series useful in the analysis of engineering problems.
**CO2:** Apply Vector calculus to modernized techniques in various computing systems.
**CO3:** Solve Linear differential equations, essential in modelling and design of computer based systems.
**CO4:** Obtain Interpolating polynomials, numerical differentiation and integration, numerical solutions of ordinary differential equations used in modern scientific computing.
**CO5:** Apply concepts of Laplace transform, Fourier transform & Z-transform and its applications to continuous & discrete systems and Image processing.

## Course Contents

| UNIT-I | Differential Calculus | 8 Hours |
|---|---|---|
| Rolle's Theorem, Mean Value Theorems, Taylor's Series and Maclaurin's Series, Expansion of functions using standard expansions | | |
| **UNIT-II** | **Vector Calculus** | **8 Hours** |
| Vector differentiation, Gradient, Divergence and Curl, Directional derivative, Solenoidal and Irrotational fields, Vector identities. Line, Surface and Volume integrals, Green's Lemma, Gauss's Divergence theorem and Stoke's theorem | | |
| **UNIT-III** | **Ordinary Differential Equations (ODE)** | **8 Hours** |

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| | | |
|---|---|---|
| First Order ODE: Exact DE and equations reducible to exact form. Linear Differential equations (LDE): LDE of $n^{th}$ order with constant coefficients, Complementary Function, Particular Integral: General method, Short methods, Method of variation of parameters, Cauchy's and Legendre's DE. | | |
| **UNIT-IV** | **Numerical Methods** | **8 Hours** |
| Interpolation: Finite Differences, Newton's and Lagrange's Interpolation formulae, Numerical Differentiation. Numerical Integration: Trapezoidal and Simpson's rules, Bound of truncation error. Solution of Ordinary differential equations: Euler's, Modified Euler's, Runge-Kutta $4^{th}$ order methods and Predictor-Corrector methods | | |
| **UNIT-V** | **Laplace Transforms** | **8 Hours** |
| Laplace Transform (LT): LT of standard functions, properties and theorems, Inverse LT, Application of LT to solve LDE | | |
| **UNIT-VI** | **Fourier and Z Transforms** | **8 Hours** |
| Fourier Transform (FT): Complex exponential form of Fourier series, Fourier integral theorem, Fourier Sine and Cosine integrals, Fourier transform, Fourier Sine and Cosine transforms and their inverses, Discrete Fourier Transform. Z - Transform (ZT): Introduction, Definition, Standard properties, ZT of standard sequences and their inverses. Solution of difference equations. | | |

**Text Books:**

**T1.**Higher Engineering Mathematics by B.V. Ramana (Tata McGraw-Hill).

**T2.**Higher Engineering Mathematics by B. S. Grewal (Khanna Publication, Delhi)

**Reference Books:**

**R1.**Advanced Engineering Mathematics, 10e, by Erwin Kreyszig (Wiley India).

**R2.**Advanced Engineering Mathematics, 2e, by M. D. Greenberg (Pearson Education).

**R3.**Advanced Engineering Mathematics, 7e, by Peter V. O'Neil (Cengage Learning).

**R4.**Differential Equations, 3e by S. L. Ross (Wiley India).

**R5.**Introductory Methods of Numerical Analysis, 5e, by S S Sastry (PHI Learning Pvt. Ltd., 2012)

**R6.**Numerical Methods for Scientific and Engineers Computation,5e by M. K. Jain, S. R. K. Iyengar and R. K Jain (New Age international Publishers, Delhi)

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# S. Y. B. Tech (Department of Information Technology)
## Semester -IV
## [IT2109]: Formal Language & Automata Theory

| Teaching Scheme: | Credits: | Examination Scheme: |
|---|---|---|
| TH: 03 Hours/Week | TH: 03 | In Sem. Evaluation : 15 Marks<br>Mid Sem. Exam : 25 Marks<br>End Sem. Exam : 60 Marks |

**Prerequisites Courses :** Discrete mathematics

**Course Objectives:** To make the students understand in depth abstract computing models, grammar, Turing Machine, the theory of computability and complexity and different complexity classes.

**Course Outcomes: After successful completion of the course, students will able to-**

**CO1:** Describe formal computational models such as finite automata, and recognize relationships between formal languages and regular expressions.

**CO2:** Apply the concepts of Context-Free Grammar (CFG) and derive strings, construct parse trees.

**CO3:** Design push down automata for formal languages.

**CO4:** Design and construct Turing machines to solve various Recursively Enumerable language problems.

**CO5:** Design Turing machines to address problems related to undecidability.

**CO6:** Apply NP-completeness concepts to construct proofs determining the computational complexity of given problems.

## Course Contents

| UNIT-I | Regular languages and finite automata | 07 Hours |
|---|---|---|

Introduction: Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages.

Regular expressions and languages, deterministic finite automata (DFA) and equivalence with regular expressions, nondeterministic finite automata (NFA) and equivalence with DFA, regular grammars and equivalence with finite automata, properties of regular languages, Kleene's theorem, pumping lemma for regular languages, minimization of finite automata.

| UNIT-II | Context-free languages | 07 Hours |
|---|---|---|

Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, parse trees, ambiguity in CFG, pumping lemma for context-free languages, closure properties of CFLs.

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| | | |
|---|---|---|
| **Context-sensitive languages:** Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG. | | |
| **UNIT-III** | **Pushdown automata** | **07 Hours** |
| Introduction to PDA, formal definition of PDA, deterministic pushdown automata, nondeterministic pushdown automata (PDA) and equivalence with CFG, introduction to post machine | | |
| **UNIT-IV** | **Turing machines** | **07 Hours** |
| The basic model for Turing machines (TM), Turing recognizable(recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs, unrestricted grammars and equivalence with Turing machines | | |
| **UNIT-V** | **Un-decidability** | **07 Hours** |
| Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice s theorem, undecidable problems about languages. | | |
| **UNIT-VI** | **Computational Complexity** | **07 Hours** |
| Introductory ideas on Time complexity of deterministic and nondeterministic Turing machines, P and NP, NP- completeness, Cook's Theorem, other NP -Complete problems, concurrency, natural computing | | |
| **Textbook:**<br>Introduction to Automata Theory, Languages, and Computation John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman. | | |
| **Reference Books:**<br>**R1.** Elements of the Theory of Computation, Harry R. Lewis and Christos H. Papadimitriou.<br>**R2.** Automata and Computability, Dexter C. Kozen.<br>**R3.** Introduction to the Theory of Computation, Michael Sipser.<br>**R4.** Introduction to Languages and the Theory of Computation, John Martin. | | |

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# S. Y. B. Tech (Department of Information Technology)

## Semester -IV

## [IT2126 ]: Formal Language & Automata Theory

| **Teaching Scheme:** | **Credits:** | **Examination Scheme:** |
|---|---|---|
| TH: 03 Hours/Week | TH:03 | In Sem. Evaluation : 15 Marks<br>Mid Sem. Exam : 25 Marks<br>End Sem. Exam : 60 Marks |

**Course Prerequisites :** Discrete Mathematics and Graph Theory

**Course Objectives:** To make the students understand in depth abstract computing models, grammar,Turing Machine, the theory of computability and complexity and different complexity classes.

**Course Outcomes: After successful completion of the course, students will able to-**

**CO1**: Describe formal computational models such as finite automata, and recognize relationships between formal languages and regular expressions

**CO2**: Apply the concepts of Context-Free Grammar (CFG) and derive strings, construct parse trees.

**CO3**: Design push down automata for formal languages.

**CO4**: Design and construct Turing machines to solve various Recursively Enumerable language problems.

**CO5**: Design Turing machines to address problems related to undecidability.

**CO6**:Apply NP-completeness concepts to construct proofs determining the computational complexity of given problems.

**Course Contents**

| **UNIT-I** | **Finite Automata (FA)** | **07 Hours** |
|---|---|---|

Introduction, Need of Automata Theory, Alphabets and languages, Finite representation of language, Finite Automata (FA): An Informal Picture of FA, Finite State Machine (FSM), Language accepted by FA, Definition of Regular Language, Deterministic and Nondeterministic FA(DFA and NFA), epsilon- NFA, NFA to DFA, FA with output: Moore and Mealy machines -Definition, models, and inter-conversion.

| **UNIT-II** | **Regular Expressions (RE)** | **07 Hours** |
|---|---|---|

Introduction, Operators of RE, Building RE, Precedence of operators, Algebraic laws for RE, Conversions: language to RE, RE to Language, RE to DFA, DFA to RE Conversions: Arden's theorem, Properties of Regular Languages: Pumping Lemma for Regular languages, Closure and Decision properties.

| **UNIT-III** | **Context Free Grammars (CFG) and Languages** | **07 Hours** |
|---|---|---|

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| | | |
|---|---|---|
| Introduction, Regular Grammar, **Context Free Grammar**- Definition, Derivation, Language of grammar, sentential form, parse tree, inference, derivation, parse trees, ambiguity in grammar and Language- ambiguous Grammar, **Simplification of CFG:** Eliminating unit productions, useless production, useless symbols, and Є-productions, **Normal Forms-** Chomsky normal form, Greibach normal form, Closure properties of CFL, Decision properties of CFL, Chomsky Hierarchy, **Application of CFG:** Parser, Markup languages, XML and Document Type Definitions. | | |
| **UNIT-IV** | **Pushdown Automata(PDA)** | **07 Hours** |
| Basic Definitions, Equivalence of Acceptance by Finite State & Empty stack, PDA & Context Free Language, Equivalence of PDA and CFG, Parsing & PDA: Top-Down Parsing, Top-down Parsing Using Deterministic PDA, Bottom-up Parsing, Closure properties and Deterministic PDA. | | |
| **UNIT-V** | **Turing Machines (TM)** | **07 Hours** |
| Turing Machine Model, Representation of Turing Machines, Language Acceptability by Turing Machines, Design of TM, Description of TM, Techniques for TM Construction, Variants of Turing Machines, The Model of Linear Bounded Automata , TM & Type 0 grammars, TM's Halting Problem. | | |
| **UNIT-VI** | **Undecidability & Intractable Problems** | **07 Hours** |
| A Language that is not recursively enumerable, An un-decidable problem that is RE, Post Correspondence Problem, The Classes P and NP : Problems Solvable in Polynomial Time, An Example: Kruskal's Algorithm, Nondeterministic Polynomial Time, An NP Example: The Traveling Salesman Problem, Polynomial-Time Reductions NP Complete Problems, An NP-Complete Problem: The Satisfiability Problem, Tractable and Intractable, Representing Satisfiability, Instances, NP Completeness of the SAT Problem, A Restricted Satisfiability Problem: Normal Forms for Boolean Expressions, Converting Expressions to CNF, The Problem of Independent Sets, The Node-Cover Problem. | | |

**Text Books:**

**T1.** John E. Hopcroft, Rajeev Motwani, Jeffrey D.Ullman, "Introduction to Automata Theory Languages and Computation", Addison-Wesley, ISBN 0-201-44124-1.

**T2.** H.L. Lewis, Christos H. Papadimitriou, "Elements of the Theory of Computation", Prentice Hall, ISBN-10: 0132624788; ISBN-13: 978-0132624787

**Reference Books:**

**R1.** John Martin, "Introduction to Languages and The Theory of Computation", 2nd Edition, Mc Graw Hill Education, ISBN-13: 978-1-25-900558-9, ISBN-10: 1-25-900558-5

**R2.** Sanjeev Arora and Boaz Barak, "Computational Complexity: A Modern Approach", Cambridge University Pre ss, ISBN:0521424267 9780521424264

**R3.** Daniel Cohen, "Introduction to Computer Theory", Wiley & Sons, ISBN 9788126513345

**R4.** J. Carroll & D Long, "Theory of Finite Automata", Prentice Hall, ISBN 0-13-913708-4

**R5.** Kavi Mahesh, "Theory of Computation : A Problem-Solving Approach", Wiley India, ISBN10 8126533110

**R6.** Michael Sipser, "Introduction to the Theory of Computation", Cengage Learning, ISBN-13: 9781133187813

**R7.** Vivek Kulkarni "Theory of Computation", Oxford University Press, ISBN 0-19-808458

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## S. Y. B. Tech (Department of Information Technology)

## Semester -IV

## [IT2110]: Advanced Database Management Systems

| **Teaching Scheme:** | **Credits:** | **Examination Scheme:** |
|---|---|---|
| TH : 04 Hours/Week | TH : 03 | In Sem. Evaluation : 15 Marks |
| PR : 02 Hours/Week | LAB : 02 | Mid Sem. Exam : 25 Marks |
| | | End Sem. Exam : 60 Marks |
| | | Lab Evaluation : 50 Marks |

**Course Prerequisites :** Database Management System

**Course Objective:**

- To learn and understand Database Modeling, Database Architectures
- To learn and understand Object Oriented Databases
- To learn and understand web database language, XML
- To learn NoSQL Databases (Open source)
- To learn Data Warehousing and Data mining

**Course Outcome:**

**After successful completion of the course, students will able to:**

**CO1:** Elaborate concepts of parallel Database Modeling and query processing in parallel databases.
**CO2**: Elaborate concepts of distributed Database Modeling and query processing in parallel databases.
**CO3**: Describe the basics of object oriented database and Object relational databases.
**CO4**: Describe the Hadoop concept.
**CO5**: Design, create and query No SQL databases.
**CO6**: Describe the Data warehouse and Data Mining Concepts.

## Course Contents

| **UNIT-I** | **Parallel Database Concepts** | **7 Hours** |
|---|---|---|

**Database Architectures**: Centralized and Client-Server Architectures, 2 Tier and 3 Tier Architecture, Introduction to Parallel Databases, Key elements of Parallel Database Processing, Architecture of Parallel Databases, ,I/O Parallelism, Interquery Parallelism, Intraquery Parallelism, Intraoperation Parallelism, Interoperation Parallelism, Design of Parallel Systems, Basics of query processing in parallel databases

| **UNIT-II** | **Distributed Database Concepts** | **7 Hours** |
|---|---|---|

**Introduction to Distributed Databases**, Architecture of Distributed Databases, Distributed Database Design, Heterogeneous and Homogeneous Databases ,Distributed Data Storage, Distributed Transactions, Commit Protocols, Concurrency Control in Distributed Databases, Availability,

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| | | |
|---|---|---|
| Distributed Query Processing Heterogeneous Distributed Databases, Directory Systems Query processing in Distributed databases. | | |
| **UNIT-III** | **Object-Based Database And Xml** | **7 Hours** |
| Overview, Complex databases, Structured data types, operations on structured and unstructured data. Encapsulation and ADTs. Inheritance, Objects, OIDs and Reference types, Database Design, ORDBMS Implementation challenges-Storage and Access methods, Query Optimization, ODMS-Object model, XML Data Model ,DOM, XQuery, Efficient evaluation of XML Queries. | | |
| **UNIT-IV** | **Introduction to Hadoop** | **7 Hours** |
| Hadoop: Introduction , HDFS, Dealing with Massive Datasets-Map Reduce and Hadoop, Advantages of Hadoop<br>Introduction to HBase: Overview, HBase Data Model, HBase Region, Hive. | | |
| **UNIT-V** | **No Sql Databases** | **7 Hours** |
| **Introduction to No sql Databases**, Introduction to Big Data, XML: DTD, XML Schemas, XQuery, XPath, XML Databases, Mobile Databases, SQLite Database, MongoDB<br>**JSON**: Overview, Data Types, Objects, Schema | | |
| **UNIT-VI** | **Data Warehousing And Data Mining** | **7 Hours** |
| **Data Warehousing** : Introduction, Evolution of Data Warehouse, Characteristics, Benefits, Limitation of Data Warehousing, Main Components of Data Warehouse,<br>Conceptual Models, Data Mart, OLAP,<br>**Data Mining** : Process, Knowledge Discovery, Goals of Data Mining, Data Mining Tasks | | |

## Lab Contents

**Guidelines for Lab Assessment**

1) Continuous assessment shall be based on experiments performed, submission of results of practical assignments in the form of journal / reports, timely completion, attendance, understanding, performance.

2) Practical / Oral examination shall be based on the practical's performed in the lab.

3) Lab assessment marks shall be based on continuous assessment and performance in Practical/Oral examination.

List of Laboratory Assignments/Experiments

| | |
|---|---|
| 1 | Install and configure client and server for MongoDB |
| 2 | Create a database with suitable example using MongoDB and implement all data definition and manipulation operations |
| 3 | Execute at least 10 queries on any suitable MongoDB database that demonstrates following querying techniques:<br>• Find and findOne (specific values)<br>• Query criteria (Query conditionals, OR queries, $not, Conditional semantics)<br>• Type-specific queries (Null, Regular expression, Querying arrays)<br>$ where queries |
| 4 | Implement Map reduce example with suitable example |

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**Director**

| | |
|---|---|
| 5 | Implement the aggregation and indexing with suitable example in MongoDB |
| 6 | Study and Configure Hadoop for Big Data |
| 7 | Create XML, XML schemas , DTD for any database application and implement min 10 queries using XQuery FLOWR expression and XPath |

**Text Books:**


**T1.** Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", 6thEdition, McGraw Hill Publishers, ISBN 0-07-120413-X

**T2.** S.K.Singh, "Database Systems : Concepts, Design and Application", 2nd Edition, Pearson, 2013, ISBN 978-81-317-6092-5.

**T3.** Connally T., Begg C., "Database Systems", 3rd Edition, Pearson Education, 2002, ISBN 81-7808-861-4


**Reference Books:**


**R1.** Kristina Chodorow, Michael Dirolf, "MangoDB: The Definitive Guide" ,O'Reilly Pubications

**R2.** Tom White, "Hadoop: The Definitive Guide", O'Reilly Pubications

**R3.** Jiawei Han, Micheline Kamber, Jian Pei, "Data Mining: Concepts and Techniques", Elsevier

**R4.** Bill Schmarzo, "Big Data:Understanding How Data Powers Big Business", Wiley,ISBN:978-81-265-4545-2

**R5.** Alex Holmes, "Hadoop in Practice", DreamTech Press, ISBN : 978-93-5119-150-6


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**Director**

## S. Y. B. Tech (Department of Information Technology)

## Semester -IV

## [IT2127]: Database Management Systems

| Teaching Scheme: | Credit | Examination Scheme: |
|---|---|---|
| TH: - 3 Hours/Week | TH:03 | In Sem. Evaluation :15 Marks |
| PR:- 4 Hours/Week | LAB:-02 | Mid Sem. Exam : 25 Marks |
| | | End Sem. Exam : 60 Marks |
| | | Lab Evaluation : 50 Marks |

**Course Prerequisites :** Discrete Mathematics and Group Theory

**Course Objective:**

- Understand the fundamental concepts of database management
- Learn the foundation in database concepts, recent technologies and best industry practices
- Study the basic issues of transaction processing, concurrency and recovery system
- Learn and understand various Database Architectures
- Learn and understand Database security
- To learn a powerful, flexible and scalable general-purpose database to handle big data

**Course Outcome:**
**After successful completion of the course, students will able to:**
**CO1:** Analyze database models and design a database schema for a given problem-domain.
**CO2:** Design relational database and apply normalization technique.
**CO3**: Create, populate and query a database using SQL and PL/SQL.
**CO4:** Describe and compare transaction schedules and concurrency control techniques.
**CO5:** Describe database threats, database security techniques.
**CO6:** Explain advanced database techniques.

## Course Contents

| UNIT-I | Introduction | 7 Hours |
|---|---|---|

**Database Concepts:** Database System Architecture,
**Data Modeling** : Data Models, Basic Concepts, entity, attributes, relationships, constraints, keys, ER Model, Relational Model: Basic concepts, Attributes and Domains, Hierarchical Model, Network Model and object-oriented data models

**Relational Integrity**: Domain, Entity, Referential Integrities, Enterprise Constraints, Schema Diagram
Case Study: ER diagram on University Database

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| UNIT-II | Relational Database Design | 7 Hours |
|---|---|---|

**Database Design** : Domain and data dependency, Armstrong's axioms , Functional Dependency, Purpose of Normalization, Data Redundancy and Update Anomalies,
**Normalization**: 1NF, 2NF, 3NF, BCNF.
**Decomposition**: lossless join decomposition and dependency preservation
**Self-Study: Apply normalization for University Database**

| UNIT-III | Relational languages | 7 Hours |
|---|---|---|

**Relational Query languages:** Relational Algebra ,Tuple and domain relational calculus, SQL3:

**Introduction to SQL**: SQL Data Types and Literals, DDL, DML, DCL, TCL,SQL Operators,
Open source and Commercial DBMS : MYSQL,ORACLE, DB2, SQL server,
Roles and privileges, Embedded SQL, Dynamic SQL.
**PL/SQL:** concept of Stored Procedures, Cursors, Triggers

| UNIT-IV | Database Transactions And Query Processing | 7 Hours |
|---|---|---|

**Basic concept of a Transaction**, Transaction Management, Properties of Transactions, Concept of Schedule, Serial Schedule, Serializability: Conflict and View, Cascaded Aborts, Recoverable and Non recoverable Schedules,
**Concurrency Control**: Need, Locking Methods, Deadlocks, Time-stamping Methods, and Optimistic Techniques. Recovery Methods: Shadow-Paging and Log-Based Recovery
**Query processing and optimization**: Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms. Storage strategies: Indices, B-trees, Hashing.

| UNIT-V | Database Security | 7 Hours |
|---|---|---|

.
**Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.**

| UNIT-VI | Advances in Database Management System | 7 Hours |
|---|---|---|

Object oriented and object relational databases, Logical databases, Web databases
**Introduction to No sql Databases**, Types and examples of NoSQL Database- Key value store, document store, graph, Performance, Structured verses unstructured data,
**Introduction to Distributed Databases**, Architecture of Distributed Databases, Distributed Database Design, Query processing in Distributed databases
**Data Warehousing** : Introduction, Evolution of Data Warehouse, Characteristics, Benefits, Limitation of Data Warehousing, Main Components of Data Warehouse,
Conceptual Models, Data Mart, OLAP,
**Data Mining** : Process, Knowledge Discovery, Goals of Data Mining, Data Mining Tasks
**Case Study**-unstructured data from social media

## Lab Contents

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| Guidelines for Lab Assessment | |
|---|---|
| 1) Continuous assessment shall be based on experiments performed, submission of results of practical assignments in the form of journal / reports, timely completion, attendance, understanding, performance.<br>2) Practical / Oral examination shall be based on the practical's performed in the lab.<br>3) Lab assessment marks shall be based on continuous assessment and performance in Practical/Oral examination. | |
| List of Laboratory Assignments/Experiments | |
| 1 | Study and design a database with suitable example using following database systems:<br>• Relational: SQL / PostgreSQL / MySQL<br>• Key-value: Riak / Redis<br>• Columnar: Hbase<br>• Document: MongoDB / CouchDB<br>Compare the different database systems based on points like efficiency, scalability, characteristics and performance. |
| 2 | Design any database with at least 3 entities and relationships between them. Apply DCL and DDL commands. Draw suitable ER/EER diagram for the system |
| 3 | Design and implement a database and apply at least 10 different DML queries for the following task. For a given input string display only those records which match the given pattern or a phrase in the Search string. Make use of wild characters and LIKE operator for the same. Make use of Boolean and Arithmetic operators wherever necessary |
| 4 | Execute the aggregate functions like count, sum, avg etc. on the suitable database. Make use of built in functions according to the need of the database chosen. Retrieve the data from the database based on time and date functions like now (), date (), day (), time () etc. Use group by and having clauses |
| 5 | Implement nested sub queries. Perform a test for set membership (in, not in), set comparison and set cardinality |
| 6 | Write and execute triggers with suitable database. Consider row level and statement level triggers |
| 7 | Write and execute PL/SQL stored procedures and functions using cursor with suitable database |
| 8 | Create a database with suitable example using MongoDB and implement all data definition and manipulation operations.Execute at least 10 queries on created database that demonstrates following querying techniques:<br>• Find and findOne (specific values)<br>• Query criteria (Query conditionals, OR queries, $not, Conditional semantics)<br>• Type-specific queries (Null, Regular expression, Querying arrays)<br>$ where queries |
| 9 | Implement the aggregation and indexing with suitable example in MongoDB |

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| | |
|---|---|
| 10 | Development of a 2-tier application using a suitable front end |
| 11 | Suggested Virtual Lab Assignments<br>(http://vlabs.iitb.ac.in/bootcamp/labs/dbms/exp8/exp/index.php) |
| | |

**Text Books:**

**T1.** Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", 6thEdition, McGraw Hill Publishers, ISBN 0-07-120413-X

**Reference Books:**

**R1.** Principles of Database and Knowledge – Base Systems, Vol 1 by J. D. Ullman.
**R2.** R. Elmasri and S. Navathe, "Fundamentals of Database Systems", Pearson; 7 edition ISBN-13: 978- 0-13-397077-7
**R3.** Kristina Chodorow, Michael Dirolf, "MangoDB: The Definitive Guide", O'Reilly Publications, ISBN: 978-1-449-34468-9.

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# S. Y. B. Tech (Department of Information Technology)
## Semester -IV
## [IT2111]: Computer Networks and Applications

| Teaching Scheme: | Credits: | Examination Scheme: |
|---|---|---|
| TH : 03/Week<br>LAB : 02/Week | TH : 03<br>LAB: 01 | In Sem. Evaluation: 15 Marks<br>Mid Sem. Exam : 25 Marks<br>End Sem. Exam : 60 Marks<br>Laboratory Exam : 25 Marks |

**Course Prerequisites:** Basic knowledge of Computer Programming, Basic knowledge of Computer Organization, Fundamentals of Data Communication.

**Course Objectives:**

- To familiarize students with basic concepts and types of networks.
- To understand ISO/OSI model and TCP/IP model
- To understand data link, network layer of ISO/OSI Model.
- To understand transport and application layer ISO/OSI Model.
- To study Wireless network.

**Course Outcomes: After successful completion of the course, students will able to-**

**CO1:** Describe working of layered approach, Intranet, LAN, WAN, MAN and different topologies.
**CO2:** Analyze the various channel access mechanisms for DLL.
**CO3:** Apply IP address concept for routing algorithm.
**CO4:** Analyze TCP, UDP protocol for socket programming.
**CO5:** Analyze various protocols of application layer.
**CO6:** Summarizing component of wireless network and its applications.

## Course Contents

| UNIT-I | Basics of Data Communication | 07 Hours |
|---|---|---|

Overview of Networking, Need for Networking, network types, Protocols and standards, Reference models: OSI reference model, TCP/IP reference model. Evolution of Computer Networks, categories of network: LAN, WAN, MAN, Network Topology : bus, ring, star, mesh and hybrid.

| UNIT-II | Data Link Layer | 07 Hours |
|---|---|---|

**Data Link Layer**: Design Issues in Data Link Layer, **Channel access on links:** CDMA, TDMA, FDMA, SDMA, Flow Control: Stop- and- wait, Sliding Window, Error Control: Stop and wait ARQ, Sliding Window ARQ, Go-back-n and Selective reject.
**Media Access Control**: ALOHA, CSMA/CD, CSMA/CA, Wired LAN's: Ethernet, Token Ring,

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| | | |
|---|---|---|
| FDDI, Connecting devices: Hubs, Repeaters, Bridges, Switches | | |
| **UNIT-III** | **Network Layer** | **07 Hours** |
| Design Issues in Network Layer, Network Layer protocols: IPv4 ,ARP, IP, ICMP, IGMP, Classful and Classless addressing, Network address translation and Sub netting, Routing algorithms (Routing in the Internet: Introduction to Intra-domain and inter-domain routings, Static Routing Protocols, Dynamic Routing Protocols), Internetworking. Interior and exterior routing protocols. | | |
| **UNIT-IV** | **Transport Layer** | **07 Hours** |
| Design Issues in Transport Layer, Process to process Delivery, Transport Layer Protocols: UDP, TCP, Windows in TCP, Flow control, Error control, TCP congestion control (Leaky Bucket, Token Bucket), Quality of Service, Socket Programming (UDP, TCP). | | |
| **UNIT-V** | **Application Layer** | **07 Hours** |
| **Application Layer Protocols**: HTTP (Overview of HTTP, Non-persistent and Persistent Connections, HTTP Message Format, User-Server Interaction: Cookies, Web Caching), Telnet, File transfer (FTP Commands), E-Mail (SMTP, MIME, IMAP, POP), DHCP, DNS (Overview, Services Provided by DNS, How DNS Works? DNS Records and Messages), INMP. | | |
| **UNIT-VI** | **Introduction of Wireless Networks** | **07 Hours** |
| Introduction to wireless LAN –Introduction of Adhoc and Infrastructure Network Wireless LANs: Architectural Comparison, Characteristics, Access Control, IEEE 802.11: Applications of Networking, Case studies on Networking-Bluetooth. Satellite Network: Operation, GEO Satellites, MEO Satellites, LEO Satellites. | | |

**Text Books:**

**T1 :** George Kennedy, Brendan Davis, srm Prasanna, "Electronic Communication S Edition, ISBN: 9780071077828, MGH Education

**T2 :** Behrouz A. Forouzan, Data Communication and Networking, McGraw Hill Education, ISBN:78-125-906475-3, 5th Edition

**Reference Books :**

**R1.** Behrouz A. Forouzan, TCP/IP Protocol Suite, McGraw Hill Education, ISBN: 978-0-07-070652-1, 4th Edition.

**R2.** A. S. Tanenbaum, "Computer Networks", Pearson Education, 4th Edition.

**R3.** C. Siva Ram Murthy, B. S. Manoj, Adhoc Wireless Networks: Architecture and Protocols, Pearson Education, ISBN: 978-81-317-0688-6, 1st Edition.

**R4.** C. K. Toh, Ad Hoc Mobile Wireless Networks Protocols and Systems, Prentice Hall, ISBN: 978-01324

## Lab Contents

**Guidelines for Lab Assessment**

1) Continuous assessment shall be based on experiments performed, submission of results of practical assignments in the form of journal / reports, timely completion, attendance, understanding, performance.

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2) Practical / Oral examination shall be based on the practical's performed in the lab.

3) Lab assessment marks shall be based on continuous assessment and performance in Practical/Oral examination.

**List of Laboratory Assignments/Experiments**

| | |
|---|---|
| 1. | Study on Networks Cabling (Guided and Unguided) |
| 2. | Explore and Study of TCP/IP utilities and Network Commands on Linux.<br>1. Ping<br>2. Tracert/Traceroute/Tracepath<br>3. ipconfig / ifconfig<br>4. NSlookup<br>5. Hostname<br>6. Arp<br>7. Whois<br>8. Finger<br>9. Netstat<br>10. Port Scan / nmap<br>11. Route |
| **3.** | Implementation of small network using Hub, switch and Router using Cisco Packet Tracer. |
| **4.** | Using simulator build a small network (P2P, Client/Server) implement network topology (Star, Bus, Ring) and IP addressing and subnet masking. |
| **5.** | To write a C program to perform sliding window. |
| **6.** | Socket Programming in C/C++ a) TCP Client , TCP Server b) UDP Client , UDP Server |
| **7.** | Using any simulator configure: 1.Subnetting of a given network 2. Super netting of given network |
| **8.** | Simulation of Distance Vector/ Link State Routing algorithm. |

**Text Books:**

**T1 :** George Kennedy, Brendan Davis, srm Prasanna, "Electronic Communication S
Edition, ISBN: 9780071077828, MGH Education

**T2 :** Behrouz A. Forouzan, Data Communication and Networking, McGraw Hill Education, ISBN:78-125-906475-3, 5th Edition

**Reference Books :**

**R1.** Behrouz A. Forouzan, TCP/IP Protocol Suite, McGraw Hill Education, ISBN: 978-0-07-070652-1, 4th Edition.

**R2.** A. S. Tanenbaum, "Computer Networks", Pearson Education, 4th Edition.

**R3.** C. Siva Ram Murthy, B. S. Manoj, Adhoc Wireless Networks: Architecture and Protocols, Pearson Education, ISBN: 978-81-317-0688-6, 1st Edition.

**R4.** C. K. Toh, Ad Hoc Mobile Wireless Networks Protocols and Systems, Prentice Hall, ISBN: 978-01324

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# S. Y. B. Tech (Department of Information Technology)

## Semester -IV

## [IT2128]: Computer Networks

| Teaching Scheme: | Credits: | Examination Scheme: |
|---|---|---|
| TH: 03 Hours/Week | TH:03 | In Sem. Evaluation : 15 Marks |
| PR: 02 Hours/Week | PR:01 | Mid Sem. Exam : 25 Marks |
| | | End Sem. Exam : 60 Marks |
| | | Laboratory Exam : 25 Marks |

**Course Prerequisites :** Data Structure, Data Communication

**Course Objectives:**

- Build an understanding of the fundamental concepts of computer networking.
- To explore the inter-working of various layers of OSI.
- To explore the issues and challenges of protocols design while delving into TCP/IP protocol suite.
- To assess the strengths and weaknesses of various routing algorithms.
- To understand the transport layer and various application layer protocols.

**Course Outcomes: After successful completion of the course, students will able to-**

**CO1:** Explore the fundamental concepts computer networking and compare ISO – OSI model with TCP/IP model.
**CO2:** Explore the concepts of data at physical layer in case of wired and wireless network.
**CO3:** Demonstrate the knowledge of networking protocols at data link layer.
**CO4:** Design the network using IP addressing and sub netting / super netting schemes and analyse Various routing algorithms and protocols at network layer.
**CO5:** Analyze transport layer protocols and congestion control algorithms.
**CO6:** Explore protocols at application layer.

**Course Contents**

| UNIT-I | Overview of Computer Networking | 07 Hours |
|---|---|---|

Data communication and components, data flow, physical structures and categories of networks. Introduction to computer networks and its applications, network components, classification of networks, Network models:- Need of layered architecture, layers in the OSI model and TCP/IP protocol suite.

| UNIT-II | Physical Layer | 07 Hours |
|---|---|---|

Physical Layer services, Transmission Media: Twisted pair, Coaxial, Fiber optics. Unguided media (Wireless Transmission): Radio Waves, Microwave, Bluetooth, Infrared, Circuit and Packet

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| | | |
|---|---|---|
| Switching, Data encoding schemes. Digital Data Communication Techniques, Asynchronous and Synchronous Transmission,Frame relay, Fast Ethernet and Gigabit Ethernet, FDDI. | | |
| **UNIT-III** | **Data Link Layer** | **07 Hours** |
| Design issues of Data link layer, Framing, Flow & Error control Protocols, noiseless channels, Noisy channels, Multiple access techniques-random access, controlled access & Channelization, protocols: Stop & wait, ARQ, Go-Back –N ARQ, Selective repeat. Ethernet types-bridged, Switched, Full duplex, Fast & gigabit Ethernet. | | |
| **UNIT-IV** | **Network Layer** | **07 Hours** |
| Design issues of Network layer, IPv4 address, IPv6 address, Address mapping-ARP, RARP & DHCP, IPv4 datagram detail format, IPv6 datagram detail format, ICMP, IGMP, Intra domain and Inter domain routing, Routing algorithms like shortest path routing, Flooding, Distance Vector Routing, Link State Routing, Path vector routing etc., | | |
| **UNIT-V** | **Transport Layer** | **07 Hours** |
| Transport layer-Process to process delivery, Multiplexing and Demultiplexing, Connection oriented & Connectionless Transport, UDP, TCP, Connection establishment, connection release, Error control, flow control, congestion control and Quality of Service. Socket programming (UDP,TCP) | | |
| **UNIT-VI** | **Application Layer** | **07 Hours** |
| Application layer protocols and applications like Ping, FTP, telnet, HTTP (www), SMTP, SNMP, Trace route, DNS, E-mail (SMTP, POP) | | |

## Lab Contents

**Guidelines for Lab Assessment**

1) Continuous assessment shall be based on experiments performed, submission of results of practical assignments in the form of journal / reports, timely completion, attendance, understanding, performance.

2) Practical / Oral examination shall be based on the practical's performed in the lab.

3) Lab assessment marks shall be based on continuous assessment and performance in Practical/Oral examination.

**List of Laboratory Assignments/Experiments**

| | |
|---|---|
| **1** | Study on Networks Cabling (Guided and Unguided) |
| **2** | Explore and Study of TCP/IP utilities and Network Commands like: ping, ipconfig, trace route, ns lookup, arp, telnet, ftp, netstat, DNS etc. |
| **3** | Network packet analysis using tools like Wireshark. |
| **4** | Introduction to Packet Tracer & implement simple 5 PC's network. |
| **5** | Using any simulator configure: 1.Subnetting of a given network 2. Supernetting of given network |
| **6** | Router Configuration Using Packet Tracer. |
| **7** | Implementation of Stop and Wait Protocol and Sliding Window Protocol |
| **8** | Implement Dijkstra's algorithm to compute the shortest routing path. |
| **9** | Write a program for congestion control using leaky bucket algorithm. |
| **10** | Socket programming using UDP and TCP |

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**Text Books:**

**T5.**B.A. Forouzan, ―Data Communications and Networking, TMH (5e)

**T6.**Andrew S Tanenbaum, David. J. Wetherall, "Computer Networks", Pearson Education, 5th Edition

**Reference Books:**

**R1**. S.Keshav: An Engineering Approach To Computer Networking, Pearson

**R2**. Natalia Olifer& Victor Olifer,―Computer Networks:Principles, Technologies & Protocols for Network Design‖, Wiley India, 2011.

**R3.**Kurose and Ross,Computer Networking- A Top-Down approach, Pearson, 5th edition

**R4**. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", Morgan Kaufmann Publishers, Fifth Edition, 2011.

**R5.**Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open Source Approach", Mc Graw Hill Publisher, 2011

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## S. Y. B. Tech (Department of Information Technology)
## Semester -IV
## [IT2112]: Software Engineering and Agile Development

| Teaching Scheme: | Credits: | Examination Scheme: |
|---|---|---|
| TH: 03 Hours/Week | TH: 03 | In Sem. Evaluation :15 Marks<br>Mid Sem. Exam : 25 Marks<br>End Sem. Exam : 60 Marks |

**Course Prerequisites:** Basic knowledge of Problem solving and object oriented programming, Basic knowledge of Fundamental of data structures.

**Course Objectives:**

- To understand the nature of software complexity in various application domains, disciplined way of software development, software lifecycle process models and different software development model
- To introduce principles of agile software development, the SCRUM process, agile practices. And current as well as future trends and practices in the IT industry.

**Course Outcomes:After successful completion of the course, students will able to-**

**CO1:** Understand the unique features of various software application domains and classify Software Applications to decide the model for development.
**CO2:** Apply requirements engineering tasks to gather requirements and apply UML tool to design them appropriately.
**CO3:** Analyse the project management activities with estimation and scheduling techniques.
**CO4:** Apply agile development principles and methods.
**CO5:** Analyse the SCRUM process and SPRINT process of Agile development.
**CO6:** Evaluate advances like SCM in software engineering with various tools like Git.

## Course Contents

| UNIT-I | Introduction To Software Engineering | 07 Hours |
|---|---|---|

Software Engineering Fundamentals- Software processes: Software life-cycle Analysis and comparison of Process Models: Waterfall Model, Incremental Models, Evolutionary Models, Concurrent, Specialized Process Models, Personal and Team Process Models, Software Engineering Practice, Software Myths, CMM Models.

| UNIT-II | Requirement Analysis | 07 Hours |
|---|---|---|

Requirements Capturing: requirements engineering (elicitation, specification, validation, negotiation, prioritizing requirements (Kano diagram) Requirements Analysis: basics, scenario based modeling, UML models: use case diagram and class diagram, data modeling, data and control flow model,

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behavioral modeling using state diagrams - real life application case study, software Requirement Specification.

| UNIT-III | Project Planning | 07 Hours |
|---|---|---|

Project initiation, Planning Scope Management, Creating the Work Breakdown Structure, Effort estimation and scheduling: Importance of Project Schedules, Estimating Activity Resources, Estimating Activity Durations, Developing the Schedule using Gantt Charts, Adding Milestones to Gantt Charts, Program Evaluation and Review Technique (PERT) with examples. Planning Cost Management, Estimating Costs, Types of Cost Estimates, Cost Estimation Tools and Techniques, Typical Problems with IT Cost Estimates.

| UNIT-IV | Introduction To Agile Development | 07 Hours |
|---|---|---|

Agile Development: Agile manifesto, agility and cost of change, agility principles, myth of planned development, toolset for the agile process. Agile Practices: test driven development, refactoring, pair programming, continuous integration, exploratory testing versus scripted testing Agile Methods: Lean Software Development, DSDM, Extreme Programming and TDD.

| UNIT-V | Agile : Scrum And Sprints | 07 Hours |
|---|---|---|

SCRUM - Agile Planning: Scrum Planning Principles, process flow, scrum roles, scrum cycle description, product backlog, SPRINT - Sprint planning meeting, sprint backlog, sprint execution, daily scrum meeting, maintaining sprint backlog and burn-down chart, sprint review and retrospective.

| UNIT-VI | Recent Trends In Software Engineering | 07 Hours |
|---|---|---|

Software configuration management: SCM basics, SCM repository, SCM process, SCM tools such as GitHub. Emerging software engineering trends: technology evolution, process trends, collaborative development, test-driven development, global software development challenges.

**Text Books:**

**T1.** Roger S. Pressman, "Software Engineering: A Practitioner's Approach" (6/e.) McGraw Hill, 2011

**T2.** James F. Peter, "Software Engineering - An Engineering Approach", John Wiley (2004).

**T3.** Pankaj Jalote, "Software Engineering: A Precise Approach", Wiley India, 2010.

**T4.** Ian Sommerville, "Software Engineering", Addison-Wesley Publishing Company, (2006) 8th edition.

**Reference Books:**

**R1.** A Shalloway and J Trott, "Design Patterns Explained: A new perspective on object oriented design" (2/e), Pearson, 2004.

**R2.** Rajib Mall, "Fundamentals Of Software Engineering" ,PHI Learning Pvt. Ltd 2009

**R3.** C. Michael Pilato, Ben Collins-Sussman and Brian Fitzpatrick, "Version Control with subversion", O'Relly, Shroff publishers, ISBN: 978-81-8404-728-8.

**R4.** P.C. Tripathi, P.N. Reddy, "Principles of Management", Tata McGrew Hill Education Private Limited, ISBN: 9780071333337, ISBN: 0071333339

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## S. Y. B. Tech (Department of Information Technology)

## Semester -IV

## [IT2129]: Operations Research

| Teaching Scheme: | Credit | Examination Scheme: |
|---|---|---|
| TH: - 03 Hours/Week | TH: 03 | In Sem. Evaluation:15 Marks<br>Mid Sem. Exam : 25 Marks<br>End Sem. Exam : 60 Marks |

**Course Prerequisites:** Introductory topics in Probability, Statistical Methods , Discrete Mathematics , Linear Algebra

**Course Objective:**

- Identify and develop Operation Research models from the verbal description of the real-world Problem.
- Develop various Linear Programming (LP) models
- Understand the mathematical tools that are needed to solve optimization problems.
- Use of CPM and PERT techniques, to plan, schedule, and control project activities.

**Course Outcome:**

**After successful completion of the course, students will able to:**

**CO1:** Describe characteristics and scope of OR.
**CO2:** Use appropriate decision-making approaches and tools.
**CO3:** Build various dynamic and adaptive models.
**CO4:** Apply Project scheduling techniques.
**CO5:** Develop critical thinking and objective analysis of decision problems.
**CO6:** Apply the OR techniques for efficacy.

## Course Contents

| UNIT-I | Introduction to OR | 07 Hours |
|---|---|---|

Origin of OR and its definition. Concept of optimizing performance measure, Types of OR problems, Deterministic vs. Stochastic optimization, Phases of OR problem approach – problem formulation, building mathematical models, deriving solutions, validating models, controlling and implementing solution.

| UNIT-II | Linear Programming | 07 Hours |
|---|---|---|

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Linear programming – Examples from industrial cases, formulation & definitions, Matrix form. Implicit assumptions of LPP. Some basic concepts and results of linear algebra – Vectors, Matrices, Linear Independence/Dependence of vectors, Rank, Basis, System of linear eqns., Hyperplane, Convex set, Convex polyhedron, Extreme points, Initial Basic Feasible Solutions (IBFS), Basic feasible solutions. Geometric method: 2-variable case, Special cases – infeasibility, unboundedness, redundancy & degeneracy, With examples. Simplex Algorithm – slack, surplus & artificial variables, computational details, big-M method, identification and resolution of special cases through simplex iterations. Duality – formulation, results, fundamental theorem of duality, dual-simplex and primal-dual algorithms.

| **UNIT-III** | **Transportation and Assignment problems** | **07 Hours** |
|---|---|---|

TP – Definitions, Examples – decision variables, supply & demand constraints, formulation of TP, Balanced & unbalanced situations, Solution methods –NWCM, minimum cost and VAM, test for optimality (MODI method), degeneracy and its resolution. AP - Definitions, Examples – decision variables, constraints, formulation of AP, Balanced & unbalanced situations, Solution method – Hungarian, test for optimality (MODI method), degeneracy & its resolution.

| **UNIT-IV** | **PERT – CPM** | **07 Hours** |
|---|---|---|

Project definition, Project scheduling techniques – Gantt chart, PERT & CPM, Determination of critical paths, Estimation of Project time and its variance in PERT using statistical principles, Concept of project crashing, time v/s cost trade-off. All estimates of Time, Examples from industrial cases.

| **UNIT-V** | **Inventory Control** | **7 Hours** |
|---|---|---|

Functions of inventory and its disadvantages, ABC analysis, Concept of inventory costs, Basics of inventory policy (order, lead time, types), Fixed order-quantity models – EOQ, POQ & Quantity discount models. EOQ models for discrete units, sensitivity analysis and Robustness, Special cases of EOQ models for safety stock with known/unknown stock out situations, models under prescribed policy, Probabilistic situations.

| **UNIT-VI** | **Queuing Theory and Simulation Methodology** | **07 Hours** |
|---|---|---|

Definitions – queue (waiting line), waiting costs, characteristics (arrival, queue, service discipline) of queuing system, queue types (channel vs. phase).

Kendall's notation, Little's law, steady state behavior, Poisson's Process & queue, Models with examples - M/M/1 and its performance measures; M/M/m and its performance measures; brief description about some special models. Examples from real world cases – Super Market, Network Router, etc.

Definition and steps of simulation, random number, random number generator, Truev/s pseudo random number generators, Examples where random numbers are required, Hashing, Encryption, etc.

Discrete Event Systems Simulation – clock, event list, Application in Scheduling, Queuing systems and Inventory systems.

**Text Books:**

**T1.** Operations Research: An Introduction. H. A. Taha.

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**Reference Books:**


**R1.**Linear Programming. K.G. Murthy.
**R2.**Linear Programming. G. Hadley.
**R3.**Principles of OR with Application to Managerial Decisions. H.M. Wagner.
**R4.**Introduction to Operations Research. F.S. Hiller and G.J. Lieberman.
**R5.**Elements of Queuing Theory. Thomas L. Saaty.
**R6.**Operations Research and Management Science, Hand Book: Edited By A. Ravi Ravindran.
**R7.**Management Guide to PERT/CPM. Wiest & Levy.
**R8.**Modern Inventory Management. J.W. Prichard and R.H. Eagle.


RSCOE

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# S. Y. B. Tech (Department of Information Technology)
## Semester -IV
## [IT2113] Web Technology

| Teaching Scheme: | Credits: | Examination Scheme: |
|---|---|---|
| LAB: 02 Hours/Week | LAB: 01 | Laboratory Exam : 50 Marks |

**Lab Prerequisites :** Basic knowledge of Computer Programming, Knowledge of any object-oriented language like C++ is helpful but not mandatory

**Lab Objectives:** To familiarize the students with fundamentals of object oriented programming. The aim is to make the students develop desktop and web applications using Java programming.

**Course Outcomes: After successful completion of the course, students will able to-**

**CO1:** Demonstrate integrated development environment to write, compile, run, and test simple object-oriented Java programs.
**CO2:** Apply and extend Java classes with inheritance and dynamic binding.
**CO3:** Design applications with threads in Java.
**CO4:** Design a graphical user interface (GUI) with Java Swing.
**CO5:** Demonstrate various collections in Java.
**CO6:** Develope web based application and establish database connection.

## Lab Contents

### Guidelines for Lab Assessment

1) Continuous assessment shall be based on experiments performed, submission of results of practical assignments in the form of journal / reports, timely completion, attendance, understanding, performance.
2) Practical / Oral examination shall be based on the practical's performed in the lab.
3) Lab assessment marks shall be based on continuous assessment and performance in Practical/Oral examination.

### List of Laboratory Assignments/Experiments
### PART A- Programs in Java

| | |
|---|---|
| **1** | Write a Java Program to Check Even or Odd Number |
| **2** | Write a program to find Fibonacci series of a given no. |
| **3** | Write a Java program that works as a simple calculator. |
| **4** | Develop an applet that displays a simple message. |
| **5** | Write a Java program that handles all mouse events |

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| | |
|---|---|
| **6** | Implementation of Inheritance. |
| **7** | Implementation of multithreading. |
| **8** | Write a Java program that reads a line of integers and then displays each integer and the sum of all integers.(classes). |
| **9** | Write a java program that connects to a database using JDBC and does add, delete, modify and retrieve operations. |
| **Part B- Web Technology (Website Design using (HTML5))** | |
| **1** | (Table Formatting): Design a mark sheet and display all your marks with subjects in a tabular format using table. |
| **2** | Write a program to demonstrate Event Handling -Validation of JSPM's RAJARSHI SHAHU COLLEGE OF ENGINEERING TATHAWADE, PUNE-33 Autonomous Institute Affiliated to Savitribai Phule Pune University Structure and Syllabi of S. Y. B. Tech IT Page 49 of 49 registration form -Open a Window from the current window -Change color of background at each click of button or refresh of a page -Display calendar for the month and year selected from combo box OnMouseover event |
| **3** | (JavaScript) Validate the Registration, user login, user profile and payment by credit card pages using JavaScript. |
| **4** | (JavaScript) Using javascript demonstrate Nested loop. |
| **5** | (database ) Write a suitable script which, inserts, update, deletes and display records from the database. |

**Reference Books for Part A:**

**R1.** Core Java Volume I – Fundamentals, Author – Cay S. Horstmann, Edition – 11th Edition, Publisher – Prentice Hall

**R2.** Java Complete Reference by Herbert Schildt, Seventh edition.

**R3.** Head First Java by Kathy Sierra & Bert Bates,2nd edition, Oreilly Publication

**R4.** Java: Programming Basics for Absolute Beginners by Nathan Clark,2nd edition, Pearson Publication

**Reference Books for Part B:**

**R1.** HTML, XHTML and CSS, Fourth Edition by Steven M. Schafer, Wiley India Edition. ISBN: 978- 81- 265-1635-3

**R2.** Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML and PHP, 4thEdition by Ivan Bayross, BPB Publications. ISBN: 9788183330084.

**R3.** Professional Word Press: Design and Development by Brad Williams, David Damstra, Hal Stern, Wrox publications Web Technologies Black Book: HTML, JavaScript, PHP, Java, JSP, XML and AJAX by Kogent Learning Solutions Inc. ISBN: 9788126554560, 8126554568.

**R4.** Practical Node. Js by Azat Mardan.

**R5.** Angular Js in your pocket Etta Roberts.

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## S. Y. B. Tech (Department of Information Technology)
## Semester -IV
## [HS2105] Business Communication & Value Science III

| Teaching Scheme: PR: 2 Hours/Week | Credit PR: 1 | Examination Scheme: Lab Evaluation : 50 Marks |
|---|---|---|

**Course Prerequisites:** Basic knowledge of high school English

**Course Objective:**

- Develop technical writing skills
- Introduce students to Self-analysis techniques like SWOT & TOWS
- Introduce students to key concepts of:
- Pluralism & cultural spaces
  a) Cross-cultural communication
  b) Science of Nation building

**Course Outcome:**

**After successful completion of the course, students will able to:**

**CO1:** Apply SWOT in real life scenarios.
**CO2:** Identify & respect pluralism in cultural spaces.
**CO3:** Differentiate between the different cultures of India.
**CO4:** Define & differentiate the terms global, local and trans locational.

### Course Contents

| UNIT-I | Learning and Implications of SWOT - Motivation |
|---|---|

Flash the projects they completed in the last semester &End with a Quiz in multiple format rounds testing the objectives. SWOT and Life Positions. https://www.youtube.com/watch?v=bbz2boNSeL0&t=24s Debrief on the video. How it relates to SWOT. SWOT Vs. TOWS The Balancing Act Ted talk on biomimicry: (Only first 8 mins): https://www.youtube.com/watch?v=RHrO4t86phA. Debrief on the Ted talk in which the facilitator gently guides the group towards the understanding that survival happens only when we seek ideas from the external world to turn the threat into opportunity. Motivation Stories. YouTube videos on Maslow's Theory. Scenario based activity on identifying and leveraging motivation. Present their findings and approaches as groups. They need to explain the idea of motivation with the help of examples. Rivers of India a. Divide participants into groups of 5. Each group should assign themselves a name from the Indian Rivers. These groups will continue throughout this Unit. b. Learn and Exchange Group activity in which participants need to learn the following four greetings of a state (different from their own) and exchange it with another group: Good morning, Thank you, Sorry

| UNIT-II | Rhythms |
|---|---|

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| |
|---|
| a. Awareness and respect for pluralism in cultural spaces. Announce the Rhythms of India activity to be held in the next session. The rules of the activity will be detailed at this point. Teams to prepare for the performance beyond class hours. Rhythms of India (Cultures in India) Group activity: Each group to perform a short dance piece (3 mins) from any of the Indian states (to be decided by lots). They have to present the background and unique features of the dance form (5 min). a. Global, global, translocation Use Ted and YouTube videos to show examples. Announce debate to be held in the next session. They |
| have to come prepared for the debate/discussion. Debate on Global, local, tans locational impacts (topics to be decided by the faculty or suggested by the students). Debate to be held in the presence of an external moderator. Eight groups will get four topics to debate upon. |
| **UNIT-III** **Cross-cultural communication** |
| Cross-cultural communication. Verbal and non-verbal communication (approach is through videos). Point out the obvious mistakes. From our perspective…how anyone would feel if someone else made mistakes about our culture. Let participants have a group discussion on the implications of cross-cultural communication. Suggested long-term activity: A VR game in which learners can visit different locations of the world and overcome challenges by using cross cultural skills. Culture shock Group activity to perform skits based on situations provided by the lecturer. Gender awareness Participants will view relevant scenarios in the class and then participate in a reflection activity in group. The scenarios can be presented using an Augmented Reality intervention. Gender awareness campaign Groups to present the detailed plan of Gender awareness campaigns with four different themes. College, Workplace, Family, Friends |
| **UNIT-IV** **Role of science in nation building** |
| Introduce the topic and discuss the role of scientists and mathematicians from ancient India. Break the students into groups and give them ten minutes to access internet and get information about ten eminent scientists and mathematicians of ancient India. Groups will be given five minutes to present on the next day. Groups will also frame two questions which they will ask after presenting.<br>This can also be taught through Augmented Reality, where images of the scientists will be put up around the class and they will be able to gather the information by using their phones and AR app. Groups present their findings. Other groups note down their learning. At the end there will be a quiz to assess their learning. Role of science post- independence Groups to present using multiple formats on any one of the four given topics: Inventions, Inventors, Institutes, Information technology |
| **UNIT-V** **Introduction to technical writing** |
| Introduction to technical writing. Basic rules of technical writing through examples. Practice activity on technical writing. Assessment on technical writing on the following topic: Explain the following to a visually impaired person: DNA, Rings of Saturn, Structure of an oxygen atom, Structure of heart. “Voice of the Future” Activity How will a voice assistant evolve in 25 years from now? Each group will present a skit. AI in Everyday Life Discussion in groups on given topics and then cross sharing of discussion points amongst the groups. Design your college in the year 2090 Groups need to create the college of future with the future teachers, teaching methods, types of students, etc. We will end the session with the question: How will offices/workplaces change in future? Who do you think would be your colleagues? |
| **UNIT-VI** **Communicating with machines** |

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Theory and Ted talk videos. Debate in the presence of an external moderator. Will machines control us in future? Applying technical writing in profession Theory with YouTube and Dr Bimal Ray's videos. Dr. Bimal Kumar Roy, a former Director of the Indian Statistical Institute, is a cryptologist from the Cryptology Research Group of the Applied Statistics Unit of ISI, Kolkata. Scenario-based Assessment on technical writing Each group will make a presentation on the following:

a) Sell Analytics and Insight to the local tea seller.
b) Explain the concept of Cloud to your 87-year-old grandmother.
c) Introduce the concept of friendly robots to a class 3 kid.
d) Explain IOT to your helping hand at home

## Lab Contents

**Guidelines for Lab Assessment**

1) Continuous assessment shall be based on experiments performed, submission of results of practical assignments in the form of journal / reports, timely completion, attendance, understanding, performance.

2) Practical / Oral examination shall be based on the practical's performed in the lab.

3) Lab assessment marks shall be based on continuous assessment and performance in Practical/Oral examination.

| | **List of Laboratory Assignments** |
|---|---|
| **1** | Guest lecture by a renowned personality to kick start this semester. |
| **2** | SWOT and Life Positions |
| **3** | SWOT Vs. TOWS |
| **4** | Presentation on what are the strengths they have identified to survive in the VUCA World. |
| **5** | Presentation of the concept of Motivation. |
| **6** | Identify pluralism and Respect pluralism in cultural spaces. |
| **7** | Differentiate between the different cultures of India. |
| **8** | Debate on Global, local, tans locational impacts |
| **9** | Cross-cultural communication |
| **10** | Group activity to perform skits based on situations provided by the lecturer |

**Text Books:**

**T1.** English vocabulary in use – Alan McCarthy and O'Dell
**T2.**APAART: Speak Well 1 (English language and communication)
**T3.**APAART: Speak Well 2 (Soft Skills)

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# S. Y. B. Tech (Department of Information Technology)
## Semester -IV
## [IT2114]: Skill Development Laboratory

| Teaching Scheme: | Credits: | Examination Scheme: |
|---|---|---|
| Lab :02 Hours/Week | TW : 01 | Lab Evaluation : 25 Marks |

**Course Prerequisites:** Basic communication and writing skills in English.

**Course Objectives:**

- To help the students in building interpersonal skills.
- To develop skill to communicate clearly.
- To enhance team building and time management skills.
- To learn active listening and responding skills.

**Course Outcomes: After successful completion of the course, students will able to-**

**CO1:** Apply techniques for self-awareness and self-development in personal and professional growth.
**CO2:** Apply the conceptual understanding of communication into everyday practice.
**CO3:** Demonstrate teamwork and group discussions skills with real time case study.
**CO4:** Develop time management and stress management.
**CO5:** Apply business etiquette skills effectively an engineer requires.

## Course Contents

| UNIT-I | Self-Awareness &Self-Development | 02 Hours |
|---|---|---|

a) Self Awareness: Self-Assessment, Self-Appraisal, SWOT, Goal setting: Personal &career: Self-Assessment, Self-Awareness, Perceptions and Attitudes, Positive Attitude,Values and Belief Systems, Self-Esteem, Self-appraisal, Personal Goal setting.

b) Self Development: Career Planning, Personal success factors, Handling failure,Depression and Habit, relating SWOT analysis & goal setting, prioritization.

| UNIT-II | Communication Skills | 06 Hours |
|---|---|---|

a) Communication: Importance, types, barriers of communication, effective communication.b) Speaking Skills: Public Speaking, Presentation skills, Group discussion: Importance ofspeaking effectively, speech process, message, audience, speech style, feedback,conversation and oral skills, fluency and self-expression, body language phonetics andspoken English, speaking techniques, word stress, correct stress patterns, voice quality,correct tone, types of tones, positive image projection techniques.c) Listening Skills: Law of nature: you have 2 ears and 1 tongue so listen twice and speakonce is the best policy, Empathic listening, and Avoid selective listening. d) Group Discussion:

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|---|---|---|
| characteristics, subject knowledge, oral and leadership skills, team management, strategies and individual contribution and consistency.e) Presentation skills: planning, preparation, organization, delivery. | | |
| **UNIT-III** | **Corporate / Business Etiquettes** | **02 Hours** |
| a) Corporate / Business Etiquettes: Corporate grooming & dressing, Email & telephone etiquettes, etiquettes in social & office setting: Understand the importance of professional behavior at the work place, Understand and Implement etiquettes in workplace, presenting oneself with finesse and making others comfortable in a business setting.b) Importance of first impression, Grooming, Wardrobe, Body language, Meeting etiquettes(targeted at young professionals who are just entering business environment) , Introduction to Ethics in engineering and ethical reasoning, rights and responsibilities. | | |
| **UNIT-IV** | **Interpersonal Relationship** | **04 Hours** |
| **a) Team work:** Team effectiveness, Group discussion, Decision making: Team Communication. Team, Conflict Resolution, Team Goal Setting, Team Motivation Understanding Team Development, Team Problem Solving, Building the team dynamics. Multicultural team activity. **b) Group Discussion (GD):** Preparation for a GD, Introduction and definitions of a GD, Purpose of a GD, Types of GD, Strategies in a GD , Conflict management, Do's and Don'ts in GD. | | |
| **UNIT-V** | **Leadership Skills** | **02 Hours** |
| a) Leadership: Leaders' role, responsibilities and skill required - Understanding GoodLeadership behaviors, Learning the difference between Leadership and Management,Gaining insight into your Patterns, Beliefs and Rules.b) Leadership Qualities: Defining Qualities and Strengths of leadership, Determining howwell you perceive what's going on around you, interpersonal Skills and Communication Skills, Learning about Commitment and How to Move Things Forward, Making Key Decisions, Handling Your and Other People's Stress, Empowering, Motivating and InspiringOthers, Leading by example, effective feedback. | | |
| **UNIT-VI** | **Other Skills** | **02 Hours** |
| a) Time management: The Time management matrix, apply the Pareto Principle (80/20Rule) to time management issues, to prioritize using decision matrices, to beat the most common time wasters, how to plan ahead, how to handle interruptions, to maximize your personal effectiveness, how to say "no" to time wasters, develop your own individualized plan of action.<br>b) Stress management: understanding the stress & its impact, techniques of handling stress<br>c) Skills: Problem solving skill, Confidence building Problem solving skill, Confidence building. | | |
| **Lab Contents** | | |
| **Guidelines for Lab Assessment**<br>1) Continuous assessment shall be based on experiments performed, submission of results of practical assignments in the form of journal / reports, timely completion, attendance, understanding, performance.<br>2) Practical / Oral examination shall be based on the practical's performed in the lab.<br>3) Lab assessment marks shall be based on continuous assessment and performance in Practical/Oral | | |

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examination

**1. SWOTanalysis**

The students should be made aware of their goals, strengths and weaknesses, attitude, moral values, self-confidence, etiquettes, non-verbal skills, achievements. through thisactivity.SWOTAnalysis,Confidence improvement, values, positive attitude,positive thinking and self-esteem. The concern teachers should prepare a questionnaire which evaluate students inall the above areas and make them aware about these aspects

**2. PersonalandCareerGoal setting–Short term and longterm**

The teacher should explain to the mon how to set goals and provide template to write their short term and long-term goals.

**3. Public Speaking**

Anyone of the following activities may be conducted:

**1.Prepared speech (**Topics are given in advance, students get 10 minutes to prepare thespeechand5minutestodeliver.)**2.Extempore speech(**Students deliver speeches spontaneously for 5 minutes each on a given topic) **3. Story telling** (Each student narrate safictional or reallife story for 5minutes each)**4.Oral review**(Each student presents a review on a story or a book read by them)

**4. Letter/Application writing**

Each student will write one formal letter, and one application. The teacher should teachthe students how to write the letter and application. The teacher should give proper format and layouts.

**5. Resume writing-**Guide students and instruct to write resume

**Text Books:**


**T1.** Communication Skills by Sanjay Kumar and Pushpa Lata, Oxford University Press.

**T2.** Developing Communication Skill by Krishna Mohan, Meera Banerji, McMillan IndiaLtd.

**T3.** English for Business Communication by Simon Sweeney, Cambridge University Press Srinivasa K G, “Internet of Things”,CENGAGE Leaning India, 2017


**Reference Books:**


**R1.** Ethics in Engineering Practice and Research by Caroline & Whitbeck, Cambridge University Press.

**R2.** NASSCOM-Global Business Foundation Skills: Accenture, Convergys, Dell et.al.Foundation Books: Cambridge University Press.

**R3.** Basic Managerial Skills by E. H. McGrath, Eastern Economy Edition, Prentice hall India.

**R4.** Personality Development and Group Discussions by Barun K. Mitra, Oxford UniversityPress.

**R5.** Group Discussions and Interview Skills by Priyadarshi Patnaik , Foundation Books,Cambridge University Press.

**R6.** Thinks and Grow Rich by Napoleon Hill, Ebury Publishing, ISBN 9781407029252.


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## S. Y. B. Tech (Department of Information Technology)
## Semester -IV
## [IT2130] : Project Ideation and Intellectual Property Rights

| Teaching Scheme: | Credit | Examination Scheme: |
|---|---|---|
| PR: 2 Hours/Week | TW:01 | Term Work : 25 Marks |

**Course Prerequisites:** Fundamentals of Management, Project Based Learning-I

**Course Objective:** The primary objective of this course is to develop critical thinking and problem-solving skills by exploring and proposing solutions to current computer engineering problems in real world. This course will help students begin to identify themselves as computer engineers and prepare them for opportunities for their undergraduate studies.

- Uncovering opportunities for innovation
- Building a business model to extract maximum value from your ideas
- Protecting intellectual property
- Financing new ventures.
- develop critical thinking and problem-solving skills by exploring and proposing solutions to current computer engineering problems in real world

**Course Outcome:**
**After successful completion of the course, students will able to:**
**CO1:** Demonstrate creative and innovative thinking capabilities.
**CO2:** Explain the process of foundation of a startup.
**CO3:** Compare various types of IPR to protect competitive advantage.
**CO4:** Identify/Prepare the dataset required for the system.
**CO5:** Implement the system.
**CO6:** Design test cases and test the system.

### Course Contents

| UNIT-I | Innovation: What and Why? | 4 Hours |
|---|---|---|
| Innovation as a core business process, Sources of innovation, Knowledge push vs. need pull innovations. Class Discussion- Is innovation manageable or just a random gambling activity? | | |
| **UNIT-II** | **Building an Innovative Organization** | **4 Hours** |
| Creating new products, a service, Exploiting open innovation and collaboration, Use of innovation for starting a new venture Class Discussion- Innovation: Co-operating across networks vs. 'go-it-alone' approach. | | |
| **UNIT-III** | **Entrepreneurship** | **4 Hours** |

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| | | |
|---|---|---|
| Opportunity recognition and entry strategies, Entrepreneurship as a Style of Management Maintaining Competitive Advantage- Use of IPR to protect Innovation. | | |
| **UNIT-IV** | **Entrepreneurship- Financial Planning** | **4 Hours** |
| Financial Projections and Valuation, Stages of financing, Debt, Venture Capital and other forms of Financing | | |
| **UNIT-V** | **Intellectual Property Rights (IPR)** | **4 Hours** |
| Introduction and the economics behind development of IPR: Business Perspective, IPR in India – Genesis and Development, International Context, Concept of IP Management, Use in marketing. | | |
| **UNIT-VI** | **Types of Intellectual Property** | **4 Hours** |
| Patent- Procedure, Licensing and Assignment, Infringement and Penalty, Trademark- Use in marketing, example of trademarks- Domain name, Geographical Indications- What is GI, Why protect them? Copyright- What is copyright, Industrial Designs- What is design? How to protect? Class Discussion- Major Court battles regarding violation of patents between corporate companies. | | |

## Tutor's Role

The fundamentals of problem-based learning, lies with the Tutors role.

2. Tutors are not the source of solutions rather they act as the facilitator and mentor.
3. The facilitator skills of the Tutors / Teacher are central to the success of PBL.
4. Students are not used to the constructivist approach to learning, it is important that they are carefully told what to expect in PBL.
5. Tutors need to explain the differences between PBL and traditional learning.
6. Tutors need to explain the principals involved and role of the students in PBL learning.

## Students Role in Project Based Learning

1. Prepare students for PBL before starting the sessions.
2. Students must have ability to initiate the task/idea. they should not be mere imitators.
3. They must learn to think.
4. Students working in PBL must be responsible for their own learning.
5. Throughout the PBL process, students have to define and analyze the problem, generate learning issues and apply what they have learned to solve the problem and act for them-selves and be free.
6. Students must quickly learn how to manage their own learning, Instead of passively receiving instruction.
7. Students in PBL are actively constructing their knowledge and understanding of the situation in groups.
8. Students in PBL are expected to work in groups.
9. They have to develop interpersonal and group process skills, such as effective listening or coping creatively with conflicts.

## Lab Contents

**Guidelines for Assessment**

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**Group A: Intellectual Property Rights**

Case study materials book will be given to students. Students are required to meet in groups before coming to class and prepare on the case for the day. Instructor may ask the student groups to present their analysis and findings to the class. Further, the topic for class discussion will be mentioned beforehand and students should be ready to discuss these topics (in groups) in class. Students are required to meet in groups before coming to class and prepare on the topic. Few topics are mentioned below as examples. Instructor can add or change any topic as per requirement.

Topic 1- Is innovation manageable or just a random gambling activity?

Topic 2- Innovation: Co-operating across networks vs. 'go-it-alone' approach

Topic 3- Major Court battles regarding violation of patents between corporate companies

**Group B: Project Based Learning**

PBL requires regular mentoring by faculty throughout the semester for successful completion of the idea/project tasks selected by the students per batch. PBL is monitored and continuous assessment is done by supervisor /mentor and authorities. It is recommended that all activities should to be recorded regularly, regular assessment of work need to be done and proper documents need to be maintained at college end by both students as well as mentor (PBL work book). In this PBL II, the student shall complete the work of the Project which will consist of problem statement, literature review, SRS, Model, design, implementation and testing. As a part of the progress report of PBL-II, the candidate shall deliver a presentation on the advancement in Technology pertaining to the selected project topic and its implementation. The student shall submit the duly certified progress report of project in standard format for satisfactory completion of the work by the concerned guide and head of the Department/Institute.

**List of Laboratory Assignments**

| | |
|---|---|
| **1** | Prepare/Collect Data |
| **2** | Perform Preprocessing |
| **3** | Implementation of project modules |
| **4** | Design test cases. |
| **5** | Evaluate performance of the project. |
| **6** | Prepare paper for indexed journal/copyright/file patent |

**Text Books:**


**T1.**A new model of problem-based learning. By Terry Barrett. All Ireland Society for higher education (AISHE). ISBN:978-0-9935254-6-9; 2017

**T2.**Problem Based Learning. By Mahnazmoallem, woe hung and Nada Dabbagh, Wiley Publishers. 2019.

**T3.**Stem Project based learning and integrated science, Technology, Engineering and mathematics approach. By Robert Capraro, Mary Margaret Capraro

**T4.**Hassan Gomaa, "Software Modeling and Design- UML, Use cases, Patterns and Software Architectures", Cambridge University Press, 2011, ISBN 978-0-521-76414-8.


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**Reference Books:**


**R1.** De Graaff E, Kolmos A., red.: Management of change: Implementation of problem-based and project-based learning in engineering. Rotterdam: Sense Publishers. 2007.

**R2.**Gopalan," Project management core text book", 2 Indian Edition

**R3.**James Shore and Shane Warden, "The Art of Agile Development"

**R4.**Gardy Booch, James Rambaugh, Ivar Jacobson,"The unified modeling language user guide" , Pearson Education, Second edition, 2008, ISBN 0-321-24562-8


RSCOE

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# S. Y. B. Tech (Department of Information Technology)
## Semester -IV
## AUDIT COURSES-II

A student will be awarded the bachelor's degree if he/she earns 170 credits and clears all the audit courses specified in the syllabus. The student will be awarded grade as AP (Audit Course Pass) on successful completion of audit course. The student may opt for one of the audit courses per semester, starting from second year first semester. List of options offered is provided. Each student has to choose one audit course from the list per semester. Evaluation of audit course will be done. Method of conduction and method of assessment for audit courses are suggested.

**Criteria:**

The student registered for audit course shall be awarded the grade AP (Audit Course Pass) and shall be included such AP grade in the Semester grade report for that course, provided student has at least 75% or above attendance and satisfactory in-semester performance and secured a passing grade in that audit course. No grade points are associated with this 'AP' grade and performance in these courses is not accounted in the calculation of the performance indices SGPA and CGPA.

**Evaluation Criteria:**

Guidelines for Conduction (Any one or more of following but not limited to)

| | |
|---|---|
| • Lectures/ Guest Lectures<br>• Visits (Social/Field) and reports<br>• Demonstrations | • Surveys<br>• Mini Project<br>• Hands on experience on |

Guidelines for Assessment (Any one or more of following but not limited to)

| | |
|---|---|
| • Written Test<br>• Demonstrations/ Practical Test<br>• Poster presentation | • Presentations<br>• IPR/Publication<br>• Report |

**Audit Course II**

| | |
|---|---|
| **CE2113B** | Environmental awareness |
| **HS2108** | Indian Traditional Knowledge |
| **ME2111C** | Innovation in Agricultural Engineering |
| **IT2115** | Online Certification Course |

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# S. Y. B. Tech (Department of Information Technology)
## Semester -IV
## AUDIT COURSES-II
## [CE2113B]: Environmental Awareness

**Course Objective:** The main objective of this course is to aware students about an environment and impact of human activities on environment

**Course Outcomes: After successful completion of the course, students will able to-**
**CO1:**To understand the scope of Environmental Engineering
**CO2:** Identify the Environmental impact due to Human activities
**CO3:** To understand the concept of Disaster Management
**CO4:** Identify the renewable and **non-renewable** sources of energy**.**

**Course Contents**

| UNIT-I | Environment and resources | 02Hours |
|---|---|---|

Definition of Environment, Ecology and Eco-system, Structure and functions of ecosystem, balanced ecosystem, Introduction to Environmental Impact Assessment.

Natural Resources: Material Cycles - Oxygen, Carbon, Nitrogen and Hydrological cycle. Importance of water quality, Water borne diseases, Water induced diseases, Significance of Fluoride in drinking water.

| UNIT-II | Conventional and Non-Conventional Energy | 03 Hours |
|---|---|---|

Energy - Different types of energy, Conventional and Non - Conventional sources – Advantages and Limitations of Wind Mills, Hydro Electric, Fossil fuel, Nuclear, Solar, Biomass and Bio-gas, Geothermal energy

| UNIT-III | Disaster And Pollution | 04 Hours |
|---|---|---|

Disasters - Natural Disasters: Meaning and nature of natural disasters, their types and effects (Floods, drought, cyclone, earthquakes, Tsunami). Man Made Disasters: Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire,
Disaster Management: International strategy for disaster reduction. Concept of disaster management and national disaster management framework
Air pollution, water pollution, deforestation, industrial waste water pollution and marine pollution

| UNIT-IV | Legal aspects in Environmental Protection | 03 Hours |
|---|---|---|

Environmental Protection: Role of Government, Legal aspects, Initiatives by Non - Governmental Organizations (NGO), Environmental Education, Women Education. E waste and solid waste

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| |
|---|
| management rules |
| **Lab Contents** |
| **Guidelines for Instructor's Manual** |
| Any one or more of following but not limited to<br>1. Guest Lectures.<br>2. Visits and reports.<br>3. Street play, case study etc.<br>4. Mini Project |
| **Guidelines for Assessment** |
| 1. Written Test<br>2. Practical Test<br>3. Poster Presentation<br>4. Report |
| **Text Books:**<br>**T1.** Benny Joseph, "Environmental Studies", Tata McGraw - Hill Publishing Company Limited (2005).<br>**T2.**Ranjit Daniels R.J. and Jagdish Kirshnaswamy, "Environmental Studies", Wiley India Private Ltd., New Delhi (2009).<br>**T3.**Rajagopalan R. "Environmental Studies – From Crisis to Cure", Oxford University Press (2005).<br>**T4.**Sanjay K. Sharma, "Environment **Engineering and Disaster Management", USP (2011).** |

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# S. Y. B. Tech CSBS (Department of Information Technology)

## Semester –IV

## AUDIT COURSES-II

## [HS2108]: Indian Traditional Knowledge

**Course Prerequisites:** Introduction of Indian Culture

**Course Objective:** The course aims at imparting basic principles of thought process, reasoning and inferencing. Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and Nature. Emergence of Indian society. Develop a better appreciation and understanding of Traditions and Practices of India.

**Course Outcomes: After successful completion of the course, students will able to-**

**CO 1:** Explain basics of Indian Traditional knowledge.

**CO 2:** Develop positive attitude towards Indian thoughts and traditions.

### Course Contents

| UNIT-I | Indian Society |
|---|---|

Structure of Indian Society, Indian Social Demography-Social and Cultural, Differentiations: caste, class, gender and tribe; Institutions of marriage, Indian constitution. Affirmative Action Program of the Government- various reservations and commissions

| UNIT-II | Yoga and Holistic Health Care |
|---|---|

Knowledge of the basic perspectives on health and disease from yoga and Ayurveda relevant to the practice of yoga therapy, including the concepts of subtle anatomy.

| UNIT-III | Social Development |
|---|---|

Scientific approach to the study of human beings. Evolution of human kind, social change and evolution. Industrial revolution. National policy on education, health and health care and human development.

**Text Books:**

**T1.** V. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition.

**T2.** Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan.

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# S. Y. B. Tech (Department of Information Technology)
## Semester –IV
## AUDIT COURSES-II
## [ME2111C]: Innovations in Agriculture Engineering

**Course Prerequisites :**Knowledge of Mathematics, Physics, and Chemistry is necessary, Out of box/ unconventional thinking for solving typical problems, Adapting analytical tools traditionally, Application oriented thinking of learnt topics

**Course Objectives:**

- To develop holistically built thinking habit needed for innovative ideas.
- To make students aware about key field of agriculture contributing to sustenance and development of a mankind.
- To expose students roles and responsibilities of building a nation through engineering insights in agriculture
- To update with innovations and technological advancements in respective fields of engineering

**Course Outcomes: After successful completion of the course, students will able to-**

**CO1:** Discuss what is thinking, its tools and process and its application to innovation
**CO2:** Explain and develop application of innovation in engineering
**CO3:** Use important terms like national productivity, sustainable development and inclusive growth
**CO4:** Demonstrate the various technologies in agriculture
**CO5:** Apply Interdisciplinary Engineering applications in Agriculture

## Course Contents

| UNIT-I | Thinking and thinking process |
|---|---|

Thinking and thinking tools: Thinking, Types of thinking, Top-Down (Analysis) & Bottom-Up (Synthesis) thinking and combination of, Judgment and Creativity, Concept Maps Connecting the ideas, Generating ideas. Communicating ideas. Systems thinking and beyond. Critical thinking. Definition of innovation. Example of application of thinking process to any one practical innovation

| UNIT-II | Engineering Innovation and its scope |
|---|---|

Incremental, radical and disruptive Innovation. Scope of innovation: Product innovation, Process innovation, Position innovation, Paradigm innovation. Innovation within the engineering profession. Awareness about latest technological advancements.

| UNIT-III | Agriculture and innovation |
|---|---|

Definition of agriculture, Role of Agriculture in our life and in national productivity. Concept of

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| | |
|---|---|
| sustainable development and inclusive growth. India's urban awakening. Innovation in agriculture and its types. Importance of agriculture innovation. | |
| **UNIT-IV** | **Developing technologies in agriculture** |
| Favorable conditions for Agriculture innovation. Dynamics of Innovation System. Role and responsibility of Engineers in agricultural innovations and making India the net exporter of major agricultural produces. FIN Ovation Awards. Ideas on developing technologies in agriculture viz. Vehicle automation, Engine emissions technology, Fire suppression technology etc. The future of robotics on farms. | |
| **UNIT-V** | **Interdisciplinary Engineering in Agriculture** |
| Technological innovations that are revolutionizing Indian agriculture. Case study presenting Interdisciplinary Engineering application in Agriculture. | |
| **Guidelines for Lab Assessment** | |
| 1) Continuous assessment shall be based on experiments performed, submission of results of practical assignments in the form of journal / reports, timely completion, attendance, understanding, performance.<br>2) Practical / Oral examination shall be based on the practical's performed in the lab.<br>3) Lab assessment marks shall be based on continuous assessment and performance in Practical/Oral examination. | |
| **Text Books:**<br>**T1.** Kasser, J., E., 2015. Holistic Thinking: Creating Innovative Solutions to Complex Problems: Volume 1 (Solution Engineering). Create Space Independent Publishing Platform; 2 edition.<br>**T2.** Wenwu Zhang, 2011. Intelligent Energy Field Manufacturing: Interdisciplinary Process Innovations. CRC Press, Taylor & Francis Group.<br>**T3.** Educating engineers to drive the innovation economy, 2012. Publisher: The Royal Academy of Engineering, London. | |
| **Reference Books:**<br>**R1.** Crowder, J., A., Carbone, J., N., Demijohn, R., 2016. Multidisciplinary Systems Engineering: Architecting the Design Process. Springer Publishing.<br>**R2.** India's urban awakening: Building inclusive cities, sustaining economic growth, 2010. Mckinsey Global Institute report. | |

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# S. Y. B. Tech (Department of Information Technology)

## Semester –IV

## AUDIT COURSES-II

## [IT2115]: Online Certification Course

**Course Prerequisites:** Basics analysis or design concepts of the selected course.

**Course Objective:** The objective of this course is, to prepare students to learn the courses using online teaching aids

**Course Outcomes: After successful completion of the course, students will able to-**

**CO1:** Use modern ICT tools for self-learning

**CO2:**Demonstrate the ability of self- learning

**CO3:** Demonstrate the ability to abreast with advance technologies.

## Course Contents

The students should complete at least one Certification course which will be offered by NPTEL/Spoken tutorial/ Swayam/ IIT Bombay/ MOOC/or any other approved agency by the department during the same semester. The students should select the subjects relevant to Computer Engineering and which should not be included in the specified curriculum. Minimum duration of course should be 4 weeks and all assignments should be submitted. Certification done would be appreciated but not mandatory. Certification done would be appreciated but not mandatory. **In case a student does not go for certification, he/she should pass the internal test organized by the department for the said course.**

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