I. PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Graduates can

- Apply their technical competence in computer science to solve real world problems, with technical and people leadership.
- Conduct cutting edge research and develop solutions on problems of social relevance.
- Work in a business environment, exhibiting team skills, work ethics, adaptability and lifelong learning.

II. PROGRAM OUTCOMES (POs)

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 modeling 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.

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.

### III. PROGRAM SPECIFIC OUTCOMES (PSOs)

The Students will be able to

- Exhibit design and programming skills to build and automate business solutions using cutting edge technologies.
- Strong theoretical foundation leading to excellence and excitement towards research, to provide elegant solutions to complex problems.
- Ability to work effectively with various engineering fields as a team to design, build and develop system applications.
### ANNA UNIVERSITY, CHENNAI
NON- AUTONOMOUS AFFILIATED COLLEGES
REGULATIONS 2021
B. E. COMPUTER SCIENCE AND ENGINEERING
CHOICE BASED CREDIT SYSTEM
CURRICULA FOR SEMESTERS I TO VIII AND SYLLABI FOR SEMESTERS I TO IV

#### SEMESTER I

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<th>COURSE CODE</th>
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$ Skill Based Course

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# NCC Credit Course level 1 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA.
$ Skill Based Course
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$^*$ Skill Based Course

### SEMESTER IV

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**PRACTICALS**

|        |             |                                                  |          |      |    |    |                   |          |
| 8.     | CS3461      | Operating Systems Laboratory                     | PCC      | 0    | 0   | 3  | 3                 | 1.5      |
| 9.     | CS3481      | Database Management Systems Laboratory           | PCC      | 0    | 0   | 3  | 3                 | 1.5      |
| **TOTAL** |             |                                                  |          | 20   | 0   | 10 | 30                | 22       |

$^*$ NCC Credit Course level 2 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA.
### SEMESTER V

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* Mandatory Course-I is a Non-credit Course (Student shall select one course from the list given under Mandatory Course-I)

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*Open Elective – I Shall be chosen from the list of open electives offered by other Programmes

* Mandatory Course-II is a Non-credit Course (Student shall select one course from the list given under Mandatory Course-II)

* NCC Credit Course level 3 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA
### SEMESTER VII / VIII*

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*If students undergo internship in Semester VII, then the courses offered during semester VII will be offered during semester VIII.

** Open Elective II – IV (Shall be chosen from the list of open electives offered by other Programmes).

* Elective - Management shall be chosen from the Elective Management courses.

### SEMESTER VIII / VII*

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**TOTAL**  
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*If students undergo internship in Semester VII, then the courses offered during semester VII will be offered during semester VIII.

**TOTAL CREDITS: 162**

### ELECTIVE – MANAGEMENT COURSES

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**PROFESSIONAL ELECTIVE COURSES: VERTICALS**

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<td>Software Defined Networks</td>
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<td>Game Theory</td>
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<td>Computer Vision</td>
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<td>Security and Privacy in Cloud</td>
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<td>Multimedia Data Compression and Storage</td>
<td>3D Printing and Design</td>
<td>Ethics And AI</td>
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**Registration of Professional Elective Courses from Verticals:**

Professional Elective Courses will be registered in Semesters V and VI. These courses are listed in groups called verticals that represent a particular area of specialisation / diversified group. Students are permitted to choose all the Professional Electives from a particular vertical or from different verticals. Further, only one Professional Elective course shall be chosen in a semester horizontally (row-wise). However, two courses are permitted from the same row, provided one course is enrolled in Semester V and another in Semester VI.

The registration of courses for B.E./B.Tech (Honours) or Minor degree shall be done from Semester V to VIII. The procedure for registration of courses explained above shall be followed for the courses of B.E./B.Tech (Honours) or Minor degree also. For more details on B.E./B.Tech (Honours) or Minor degree refer to the Regulations 2021, Clause 4.10.
### PROFESSIONAL ELECTIVE COURSES: VERTICALS

#### VERTICAL 1: DATA SCIENCE

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**OPEN ELECTIVES**

(Students shall choose the open elective courses, such that the course contents are not similar to any other course contents/title under other course categories).

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**ENROLLMENT FOR B.E. / B. TECH. (HONOURS) / MINOR DEGREE (OPTIONAL)**

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honours) or Minor Degree.

For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only.

For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes. Moreover, for minor degree the student can register for courses from any one of the following verticals also.

Complete details are available in clause 4.10 of Regulations 2021.
### VERTICALS FOR MINOR DEGREE

(In addition to all the verticals of other programmes)

<table>
<thead>
<tr>
<th>Vertical I</th>
<th>Vertical II</th>
<th>Vertical III</th>
<th>Vertical IV</th>
<th>Vertical V</th>
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<tbody>
<tr>
<td>Fintech and Block Chain</td>
<td>Fintech and Entrepreneurship</td>
<td>Financial Management</td>
<td>Foundations of Entrepreneurship</td>
<td>Principles of Public Administration</td>
</tr>
<tr>
<td>Fundamentals of Investment</td>
<td>Team Building &amp; Leadership Management for Business</td>
<td>Fundamentals of Investment</td>
<td>Constitution of India</td>
<td>Datamining for Business Intelligence</td>
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<tr>
<td>Banking, Financial Services and Insurance</td>
<td>Creativity &amp; Innovation in Entrepreneurship</td>
<td>Banking, Financial Services and Insurance</td>
<td>Public Personnel Administration</td>
<td>Human Resource Analytics</td>
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<tr>
<td>Introduction to Blockchain and its Applications</td>
<td>Principles of Marketing Management for Business</td>
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<td>Marketing and Social Media Web Analytics</td>
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<td>Fintech Personal Finance and Payments</td>
<td>Human Resource Management for Entrepreneurs</td>
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<td>Indian Administrative System</td>
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(choice of courses for Minor degree is to be made from any one vertical of other programmes or from anyone of the following verticals)

**VERTICAL 1: FINTECH AND BLOCK CHAIN**

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<tr>
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<th>COURSE CODE</th>
<th>COURSE TITLE</th>
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<th>PERIODS PER WEEK</th>
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**VERTICAL 2: ENTREPRENEURSHIP**

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<tbody>
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### VERTICAL 4: BUSINESS DATA ANALYTICS

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## VERTICAL 5: ENVIRONMENT AND SUSTAINABILITY

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IP3151

INDUCTION PROGRAMME

This is a mandatory 2 week programme to be conducted as soon as the students enter the institution. Normal classes start only after the induction program is over.

The induction programme has been introduced by AICTE with the following objective:

“Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond. The graduating student must have knowledge and skills in the area of his/her study. However, he/she must also have a broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he/she would understand and fulfill his/her responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed.”

“One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character.”

Hence, the purpose of this programme is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

(i) Physical Activity

This would involve a daily routine of physical activity with games and sports, yoga, gardening, etc.

(ii) Creative Arts

Every student would choose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it everyday for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, grow into engineering design later.

(iii) Universal Human Values

This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, make decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do’s and don’ts, but get students to explore and
think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing. Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It would be effective that the faculty mentor assigned is also the faculty advisor for the student for the full duration of the UG programme.

(iv) Literary Activity

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

(v) Proficiency Modules

This would address some lacunas that students might have, for example, English, computer familiarity etc.

(vi) Lectures by Eminent People

Motivational lectures by eminent people from all walks of life should be arranged to give the students exposure to people who are socially active or in public life.

(vii) Visits to Local Area

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the underprivileged.

(viii) Familiarization to Dept./Branch & Innovations

They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

(ix) Department Specific Activities

About a week can be spent in introducing activities (games, quizzes, social interactions, small experiments, design thinking etc.) that are relevant to the particular branch of Engineering / Technology / Architecture that can serve as a motivation and kindle interest in building things (become a maker) in that particular field. This can be conducted in the form of a workshop. For example, CSE and IT students may be introduced to activities that kindle computational thinking, and get them to build simple games. ECE students may be introduced to building simple circuits as an extension of their knowledge in Science, and so on. Students may be asked to build stuff using their knowledge of science.

**Induction Programme is totally an activity based programme and therefore there shall be no tests / assessments during this programme.**

References:
Guide to Induction program from AICTE
OBJECTIVES:

- To improve the communicative competence of learners
- To learn to use basic grammatic structures in suitable contexts
- To acquire lexical competence and use them appropriately in a sentence and understand their meaning in a text
- To help learners use language effectively in professional contexts
- To develop learners’ ability to read and write complex texts, summaries, articles, blogs, definitions, essays and user manuals.

UNIT I INTRODUCTION TO EFFECTIVE COMMUNICATION

What is effective communication? (Explain using activities) Why is communication critical for excellence during study, research and work? What are the seven C’s of effective communication? What are key language skills? What is effective listening? What does it involve? What is effective speaking? What does it mean to be an excellent reader? What should you be able to do? What is effective writing? How does one develop language and communication skills? What does the course focus on? How are communication and language skills going to be enhanced during this course? What do you as a learner need to do to enhance your English language and communication skills to get the best out of this course?

UNIT I INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION

Reading - Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails. Writing - Writing emails / letters introducing oneself. Grammar - Present Tense (simple and progressive); Question types; Wh/ Yes or No/ and Tags. Vocabulary - Synonyms; One word substitution; Abbreviations & Acronyms (as used in technical contexts).

UNIT II NARRATION AND SUMMATION

Reading - Reading biographies, travelogues, newspaper reports, Excerpts from literature, and travel & technical blogs. Writing - Guided writing-- Paragraph writing Short Report on an event (field trip etc.) Grammar –Past tense (simple); Subject-Verb Agreement; and Prepositions. Vocabulary - Word forms (prefixes & suffixes); Synonyms and Antonyms. Phrasal verbs.

UNIT III DESCRIPTION OF A PROCESS / PRODUCT

Reading – Reading advertisements, gadget reviews; user manuals. Writing - Writing definitions; instructions; and Product /Process description. Grammar - Imperatives; Adjectives; Degrees of comparison; Present & Past Perfect Tenses. Vocabulary - Compound Nouns, Homonyms; and Homophones, discourse markers (connectives & sequence words).

UNIT IV CLASSIFICATION AND RECOMMENDATIONS

Reading – Newspaper articles; Journal reports –and Non Verbal Communication (tables, pie charts etc.). Writing – Note-making / Note-taking (*Study skills to be taught, not tested); Writing recommendations; Transferring information from non verbal (chart, graph etc., to verbal mode)
Grammar – Articles; Pronouns - Possessive & Relative pronouns. Vocabulary - Collocations; Fixed / Semi fixed expressions.

UNIT V EXPRESSION

Reading – Reading editorials; and Opinion Blogs; Writing – Essay Writing (Descriptive or narrative). Grammar – Future Tenses, Punctuation; Negation (Statements & Questions); and Simple, Compound & Complex Sentences. Vocabulary - Cause & Effect Expressions – Content vs Function words.

TOTAL : 45 PERIODS

LEARNING OUTCOMES :
At the end of the course, learners will be able

- To use appropriate words in a professional context
- To gain understanding of basic grammatical structures and use them in right context.
- To read and infer the denotative and connotative meanings of technical texts
- To write definitions, descriptions, narrations and essays on various topics

TEXT BOOKS :
1. English for Engineers & Technologists Orient Blackswan Private Ltd. Department of English, Anna University, (2020 edition)
2. English for Science & Technology Cambridge University Press, 2021. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

REFERENCES:

ASSESSMENT PATTERN

Two internal assessments and an end semester examination to test students’ reading and writing skills along with their grammatical and lexical competence.
MA3151 MATRICES AND CALCULUS

COURSE OBJECTIVES:
- To develop the use of matrix algebra techniques that are needed by engineers for practical applications.
- To familiarize the students with differential calculus.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To make the students understand various techniques of integration.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.

UNIT I MATRICES 9 + 3

UNIT II DIFFERENTIAL CALCULUS 9 + 3

UNIT III FUNCTIONS OF SEVERAL VARIABLES 9 + 3

UNIT IV INTEGRAL CALCULUS 9 + 3
Definite and Indefinite integrals - Substitution rule - Techniques of Integration: Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals - Applications: Hydrostatic force and pressure, moments and centres of mass.

UNIT V MULTIPLE INTEGRALS 9 + 3

TOTAL: 60 PERIODS

COURSE OUTCOMES:
At the end of the course the students will be able to
- Use the matrix algebra methods for solving practical problems.
- Apply differential calculus tools in solving various application problems.
● Able to use differential calculus ideas on several variable functions.
● Apply different methods of integration in solving practical problems.
● Apply multiple integral ideas in solving areas, volumes and other practical problems.

TEXT BOOKS:
3. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 8th Edition, New Delhi, 2015. [For Units II & IV - Sections 1.1, 2.2, 2.3, 2.5, 2.7 (Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1 (Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].

REFERENCES:

PH3151 ENGINEERING PHYSICS

COURSE OBJECTIVES:
● To make the students effectively achieve an understanding of mechanics.
● To enable the students to gain knowledge of electromagnetic waves and its applications.
● To introduce the basics of oscillations, optics and lasers.
● Equipping the students to successfully understand the importance of quantum physics.
● To motivate the students towards the applications of quantum mechanics.

UNIT I MECHANICS
UNIT II  ELECTROMAGNETIC WAVES  9
The Maxwell’s equations - wave equation; Plane electromagnetic waves in vacuum, Conditions on the wave field - properties of electromagnetic waves: speed, amplitude, phase, orientation and waves in matter - polarization - Producing electromagnetic waves - Energy and momentum in EM waves: Intensity, waves from localized sources, momentum and radiation pressure - Cell-phone reception. Reflection and transmission of electromagnetic waves from a non-conducting medium-vacuum interface for normal incidence.

UNIT III  OSCILLATIONS, OPTICS AND LASERS  9

UNIT IV  BASIC QUANTUM MECHANICS  9
Photons and light waves - Electrons and matter waves –Compton effect - The Schrodinger equation (Time dependent and time independent forms) - meaning of wave function - Normalization –Free particle - particle in a infinite potential well: 1D,2D and 3D Boxes- Normalization, probabilities and the correspondence principle.

UNIT V  APPLIED QUANTUM MECHANICS  9
The harmonic oscillator(qualitative)- Barrier penetration and quantum tunneling(qualitative)- Tunneling microscope - Resonant diode - Finite potential wells (qualitative)- Bloch’s theorem for particles in a periodic potential –Basics of Kronig-Penney model and origin of energy bands.

TOTAL : 45 PERIODS

COURSE OUTCOMES:
After completion of this course, the students should be able to
  • Understand the importance of mechanics.
  • Express their knowledge in electromagnetic waves.
  • Demonstrate a strong foundational knowledge in oscillations, optics and lasers.
  • Understand the importance of quantum physics.
  • Comprehend and apply quantum mechanical principles towards the formation of energy bands.

TEXT BOOKS:
2. E.M.Purcell and D.J.Morin, Electricity and Magnetism, Cambridge Univ.Press, 2013.
REFERENCES:

CY3151 ENGINEERING CHEMISTRY

COURSE OBJECTIVES:
- To inculcate sound understanding of water quality parameters and water treatment techniques.
- To impart knowledge on the basic principles and preparatory methods of nanomaterials.
- To introduce the basic concepts and applications of phase rule and composites.
- To facilitate the understanding of different types of fuels, their preparation, properties and combustion characteristics.
- To familiarize the students with the operating principles, working processes and applications of energy conversion and storage devices.

UNIT I WATER AND ITS TREATMENT

UNIT II NANOCHEMISTRY
Basics: Distinction between molecules, nanomaterials and bulk materials; Size-dependent properties (optical, electrical, mechanical and magnetic); Types of nanomaterials: Definition, properties and uses of – nanoparticle, nanocluster, nanorod, nanowire and nanotube. Preparation of nanomaterials: sol-gel, solvothermal, laser ablation, chemical vapour deposition, electrochemical deposition and electro spinning. Applications of nanomaterials in medicine, agriculture, energy, electronics and catalysis.

UNIT III PHASE RULE AND COMPOSITES
Phase rule: Introduction, definition of terms with examples. One component system - water system; Reduced phase rule; Construction of a simple eutectic phase diagram - Thermal analysis; Two component system: lead-silver system - Pattinson process.
Composites: Introduction: Definition & Need for composites; Constitution: Matrix materials (Polymer matrix, metal matrix and ceramic matrix) and Reinforcement (fiber, particulates, flakes and whiskers). Properties and applications of: Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites. Hybrid composites - definition and examples.
UNIT IV  FUELS AND COMBUSTION  9
Fuels: Introduction: Classification of fuels; Coal and coke: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). Petroleum and Diesel: Manufacture of synthetic petrol (Bergius process), Knocking - octane number, diesel oil - cetane number; Power alcohol and biodiesel.
Combustion of fuels: Introduction: Calorific value - higher and lower calorific values, Theoretical calculation of calorific value; Ignition temperature: spontaneous ignition temperature, Explosive range; Flue gas analysis - ORSAT Method. CO₂ emission and carbon footprint.

UNIT V  ENERGY SOURCES AND STORAGE DEVICES  9
Stability of nucleus: mass defect (problems), binding energy; Nuclear energy: light water nuclear power plant, breeder reactor. Solar energy conversion: Principle, working and applications of solar cells; Recent developments in solar cell materials. Wind energy; Geothermal energy; Batteries: Types of batteries, Primary battery - dry cell, Secondary battery - lead acid battery and lithium-ion-battery; Electric vehicles - working principles; Fuel cells: H₂-O₂ fuel cell, microbial fuel cell; Supercapacitors: Storage principle, types and examples.

COURSE OUTCOMES:
At the end of the course, the students will be able:
- To infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.
- To identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.
- To apply the knowledge of phase rule and composites for material selection requirements.
- To recommend suitable fuels for engineering processes and applications.
- To recognize different forms of energy resources and apply them for suitable applications in energy sectors.

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVES:

- To understand the basics of algorithmic problem solving.
- To learn to solve problems using Python conditionals and loops.
- To define Python functions and use function calls to solve problems.
- To use Python data structures - lists, tuples, dictionaries to represent complex data.
- To do input/output with files in Python.

UNIT I  COMPUTATIONAL THINKING AND PROBLEM SOLVING  9

UNIT II  DATA TYPES, EXPRESSIONS, STATEMENTS  9
Python interpreter and interactive mode, debugging; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III  CONTROL FLOW, FUNCTIONS, STRINGS  9
Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV  LISTS, TUPLES, DICTIONARIES  9
Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation.

UNIT V  FILES, MODULES, PACKAGES  9
Files and exceptions: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file, Voter’s age validation, Marks range validation (0-100).

TOTAL : 45 PERIODS
COURSE OUTCOMES:
Upon completion of the course, students will be able to
CO1: Develop algorithmic solutions to simple computational problems.
CO2: Develop and execute simple Python programs.
CO3: Write simple Python programs using conditionals and loops for solving problems.
CO4: Decompose a Python program into functions.
CO5: Represent compound data using Python lists, tuples, dictionaries etc.
CO6: Read and write data from/to files in Python programs.

TEXT BOOKS:

REFERENCES:
5. https://www.python.org/

CO’s- PO’s & PSO’s MAPPING

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UNIT I LANGUAGE AND LITERATURE 3

UNIT II HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE 3

UNIT III FOLK AND MARTIAL ARTS 3
Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT IV THINAI CONCEPT OF TAMILS 3
Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

UNIT V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE 3
Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS
1. தமிழக வரலொறு – மக்களும் பண்பொடும் – இலகுக்குறியல் பொடநூல் (தவளியீடு: தமிழ்நொடு பொடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கீழடி கம்பியியல் (சுந்தரம் (விகடன் பிரசுரம்)).
3. செயலுடன் தமிழ் கல்வியியல் – ராமர் தாதுயர் (சுந்தரம் பிரசுரம்).
4. எம். லியான் – எம். லியான் தாதுயர் (சுந்தரம் பிரசுரம்).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - ‘Sangam City Civilization on the banks of river Vaigai’ (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

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அலகு I காரண மரபு துறவியல்:  3
TEXT-CUM-REFERENCE BOOKS

1. Tamil History – The Central Part of Konfam – 5th. Century AD (Ist Edition: Dr. K.K. Pillay) (Published by: Department of Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).


3. Keeladi – Sangam City Civilization on the banks of river Vaigai’ (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).

4. The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by: International Institute of Tamil Studies).

5. Social Life of Tamils (Dr. K.K. Pillay) A joint publication of TNTB & ESC and RMRL – (in print)

6. Social Life of the Tamils - The Classical Period (Dr. S. Singaravelu) (Published by: International Institute of Tamil Studies).

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8. Keeladi - ‘Sangam City Civilization on the banks of river Vaigai’ (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).

9. Studies in the History of India with Special Reference to Tamil Nadu (Dr. K. K. Pillay) (Published by: The Author).

10. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).


TOTAL: 15 PERIODS

COURSE OBJECTIVES:

- To understand the problem solving approaches.
- To learn the basic programming constructs in Python.
- To practice various computing strategies for Python-based solutions to real world problems.
To use Python data structures - lists, tuples, dictionaries.
To do input/output with files in Python.

EXPERIMENTS:
Note: The examples suggested in each experiment are only indicative. The lab instructor is expected to design other problems on similar lines. The Examination shall not be restricted to the sample experiments listed here.

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)
2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).
3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)
4. Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building –operations of list & tuples)
5. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)
6. Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
7. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
8. Implementing programs using written modules and Python Standard Libraries (pandas, numpy, Matplotlib, scipy)
9. Implementing real-time/technical applications using File handling. (copy from one file to another, word count, longest word)
10. Implementing real-time/technical applications using Exception handling. (divide by zero error, voter’s age validity, student mark range validation)
12. Developing a game activity using Pygame like bouncing ball, car race etc.

TOTAL: 60 PERIODS

COURSE OUTCOMES:
On completion of the course, students will be able to:
CO1: Develop algorithmic solutions to simple computational problems
CO2: Develop and execute simple Python programs.
CO3: Implement programs in Python using conditionals and loops for solving problems.
CO4: Deploy functions to decompose a Python program.
CO5: Process compound data using Python data structures.
CO6: Utilize Python packages in developing software applications.

TEXT BOOKS:

REFERENCES:
5. https://www.python.org/

CO’s- PO’s & PSO’s MAPPING

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1 - low, 2 - medium, 3 - high, '-' - no correlation

BS3171 PHYSICS AND CHEMISTRY LABORATORY L T P C

PHYSICS LABORATORY : (Any Seven Experiments)

COURSE OBJECTIVES:
- To learn the proper use of various kinds of physics laboratory equipment.
- To learn how data can be collected, presented and interpreted in a clear and concise manner.
- To learn problem solving skills related to physics principles and interpretation of experimental data.
- To determine error in experimental measurements and techniques used to minimize such error.
- To make the student an active participant in each part of all lab exercises.

1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of regular and irregular objects.
2. Simple harmonic oscillations of cantilever.
3. Non-uniform bending - Determination of Young’s modulus
4. Uniform bending – Determination of Young’s modulus
5. Laser - Determination of the wavelength of the laser using grating
6. Air wedge - Determination of thickness of a thin sheet/wire
7. a) Optical fibre - Determination of Numerical Aperture and acceptance angle
   b) Compact disc - Determination of width of the groove using laser.
8. Acoustic grating - Determination of velocity of ultrasonic waves in liquids.
9. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids
11. Photoelectric effect
12. Michelson Interferometer.
13. Melde’s string experiment
14. Experiment with lattice dynamics kit.

TOTAL: 30 PERIODS

COURSE OUTCOMES:
Upon completion of the course, the students should be able to
- Understand the functioning of various physics laboratory equipment.
- Use graphical models to analyze laboratory data.
- Use mathematical models as a medium for quantitative reasoning and describing physical reality.
- Access, process and analyze scientific information.
- Solve problems individually and collaboratively.

CHEMISTRY LABORATORY: (Any seven experiments to be conducted)

COURSE OBJECTIVES:
- To inculcate experimental skills to test basic understanding of water quality parameters, such as, acidity, alkalinity, hardness, DO, chloride and copper.
- To induce the students to familiarize with electroanalytical techniques such as, pH metry, potentiometry and conductometry in the determination of impurities in aqueous solutions.
- To demonstrate the analysis of metals and alloys.
- To demonstrate the synthesis of nanoparticles

1. Preparation of Na₂CO₃ as a primary standard and estimation of acidity of a water sample using the primary standard
2. Determination of types and amount of alkalinity in a water sample.
- Split the first experiment into two
3. Determination of total, temporary & permanent hardness of water by EDTA method.
4. Determination of DO content of water sample by Winkler’s method.
5. Determination of chloride content of water sample by Argentometric method.
6. Estimation of copper content of the given solution by iodometry.
7. Estimation of TDS of a water sample by gravimetry.
8. Determination of strength of given hydrochloric acid using pH meter.
9. Determination of strength of acids in a mixture of acids using conductivity meter.
10. Conductometric titration of barium chloride against sodium sulphate (precipitation titration)
11. Estimation of iron content of the given solution using potentiometer.
12. Estimation of sodium /potassium present in water using a flame photometer.
13. Preparation of nanoparticles (TiO$_2$/ZnO/CuO) by Sol-Gel method.
14. Estimation of Nickel in steel
15. Proximate analysis of Coal

TOTAL : 30 PERIODS

COURSE OUTCOMES:
- To analyse the quality of water samples with respect to their acidity, alkalinity, hardness and DO.
- To determine the amount of metal ions through volumetric and spectroscopic techniques
- To analyse and determine the composition of alloys.
- To learn simple method of synthesis of nanoparticles
- To quantitatively analyse the impurities in solution by electroanalytical techniques

TEXT BOOKS:

GE3172 ENGLISH LABORATORY

OBJECTIVES:
- To improve the communicative competence of learners
- To help learners use language effectively in academic/work contexts
- To develop various listening strategies to comprehend various types of audio materials like lectures, discussions, videos etc.
- To build on students' English language skills by engaging them in listening, speaking and grammar learning activities that are relevant to authentic contexts.
- To use language efficiently in expressing their opinions via various media.

UNIT I INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION 6
Listening for general information-specific details- conversation: Introduction to classmates - Audio / video (formal & informal); Telephone conversation; Listening to voicemail & messages; Listening and filling a form. Speaking - making telephone calls-Self Introduction; Introducing a friend; - politeness strategies- making polite requests, making polite offers, replying to polite requests and offers-understanding basic instructions( filling out a bank application for example).

UNIT II NARRATION AND SUMMATION 6
Listening - Listening to podcasts, anecdotes / stories / event narration; documentaries and interviews with celebrities. Speaking - Narrating personal experiences / events-Talking about current and temporary situations & permanent and regular situations* - describing experiences and feelings-engaging in small talk- describing requirements and abilities.
UNIT III DESCRIPTION OF A PROCESS / PRODUCT 6

Listening - Listen to product and process descriptions; a classroom lecture; and advertisements about products. Speaking – Picture description- describing locations in workplaces- Giving instruction to use the product- explaining uses and purposes- Presenting a product- describing shapes and sizes and weights- talking about quantities(large & small)-talking about precautions.

UNIT IV CLASSIFICATION AND RECOMMENDATIONS 6

Listening – Listening to TED Talks; Listening to lectures - and educational videos. Speaking – Small Talk; discussing and making plans-talking about tasks-talking about progress- talking about positions and directions of movement-talking about travel preparations- talking about transportation-

UNIT V EXPRESSION 6

Listening – Listening to debates/ discussions; different viewpoints on an issue; and panel discussions. Speaking –making predictions- talking about a given topic-giving opinions- understanding a website-describing processes

TOTAL : 30 PERIODS

LEARNING OUTCOMES:
At the end of the course, learners will be able
- To listen and comprehend complex academic texts
- To speak fluently and accurately in formal and informal communicative contexts
- To express their opinions effectively in both oral and written medium of communication

ASSESSMENT PATTERN
- One online / app based assessment to test listening /speaking
- End Semester ONLY listening and speaking will be conducted online.
- Proficiency certification is given on successful completion of listening and speaking internal test and end semester exam.

HS3251 PROFESSIONAL ENGLISH -II

OBJECTIVES :
- To engage learners in meaningful language activities to improve their reading and writing skills
- To learn various reading strategies and apply in comprehending documents in professional context.
- To help learners understand the purpose, audience, contexts of different types of writing
- To develop analytical thinking skills for problem solving in communicative contexts
- To demonstrate an understanding of job applications and interviews for internship and placements
UNIT I  MAKING COMPARISONS  
Reading - Reading advertisements, user manuals, brochures; Writing – Professional emails, Email etiquette - Compare and Contrast Essay; Grammar – Mixed Tenses, Prepositional phrases

UNIT II  EXPRESSING CAUSAL RELATIONS IN SPEAKING AND WRITING  
Reading - Reading longer technical texts– Cause and Effect Essays, and Letters / emails of complaint, Writing - Writing responses to complaints. Grammar - Active Passive Voice transformations, Infinitive and Gerunds

UNIT III  PROBLEM SOLVING  
Reading - Case Studies, excerpts from literary texts, news reports etc. Writing – Letter to the Editor, Checklists, Problem solution essay / Argumentative Essay. Grammar – Error correction; If conditional sentences

UNIT IV  REPORTING OF EVENTS AND RESEARCH  

UNIT V  THE ABILITY TO PUT IDEAS OR INFORMATION COGENTLY  
Reading – Company profiles, Statement of Purpose, (SOP), an excerpt of interview with professionals; Writing – Job / Internship application – Cover letter & Resume; Grammar – Numerical adjectives, Relative Clauses.

TOTAL : 30 PERIODS

OUTCOMES:
At the end of the course, learners will be able
- To compare and contrast products and ideas in technical texts.
- To identify cause and effects in events, industrial processes through technical texts
- To analyse problems in order to arrive at feasible solutions and communicate them orally and in the written format.
- To report events and the processes of technical and industrial nature.
- To present their opinions in a planned and logical manner, and draft effective resumes in context of job search.

TEXT BOOKS :
3. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

REFERENCE BOOKS:

ASSESSMENT PATTERN
Two internal assessments and an end semester examination to test students’ reading and writing skills along with their grammatical and lexical competence.

MA3251 STATISTICS AND NUMERICAL METHODS

COURSE OBJECTIVES:
● This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.
● To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
● To introduce the basic concepts of solving algebraic and transcendental equations.
● To introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
● To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

UNIT I TESTING OF HYPOTHESIS 9 + 3
Sampling distributions - Tests for single mean, proportion and difference of means (Large and small samples) – Tests for single variance and equality of variances – Chi square test for goodness of fit – Independence of attributes.

UNIT II DESIGN OF EXPERIMENTS 9 + 3
One way and two way classifications - Completely randomized design – Randomized block design – Latin square design - $2^2$ factorial design.

UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9 + 3

UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION 9 +3
Lagrange’s and Newton’s divided difference interpolations – Newton’s forward and backward difference interpolation – Approximation of derivates using interpolation polynomials – Numerical single and double integrations using Trapezoidal and Simpson’s 1/3 rules.
UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 9 +3

TOTAL: 60 PERIODS

COURSE OUTCOMES:
Upon successful completion of the course, students will be able to:

- Apply the concept of testing of hypothesis for small and large samples in real life problems.
- Apply the basic concepts of classifications of design of experiments in the field of agriculture.
- Appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.
- Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
- Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

TEXT BOOKS:

REFERENCES:

PH3256 PHYSICS FOR INFORMATION SCIENCE L T P C
3 0 0 3

COURSE OBJECTIVES:
- To make the students understand the importance in studying electrical properties of materials.
- To enable the students to gain knowledge in semiconductor physics
- To instill knowledge on magnetic properties of materials.
- To establish a sound grasp of knowledge on different optical properties of materials, optical displays and applications
- To inculcate an idea of significance of nano structures, quantum confinement, ensuing nano device applications and quantum computing.
UNIT I  ELECTRICAL PROPERTIES OF MATERIALS


UNIT II  SEMICONDUCTOR PHYSICS


UNIT III  MAGNETIC PROPERTIES OF MATERIALS


UNIT IV  OPTICAL PROPERTIES OF MATERIALS

Classification of optical materials – carrier generation and recombination processes - Absorption emission and scattering of light in metals, insulators and semiconductors (concepts only) - photo current in a P-N diode – solar cell - LED – Organic LED – Laser diodes – Optical data storage techniques.

UNIT V  NANODEVICES AND QUANTUM COMPUTING


TOTAL :45 PERIODS

COURSE OUTCOMES:
At the end of the course, the students should be able to
- gain knowledge on classical and quantum electron theories, and energy band structures
- acquire knowledge on basics of semiconductor physics and its applications in various devices
- get knowledge on magnetic properties of materials and their applications in data storage,
- have the necessary understanding on the functioning of optical materials for optoelectronics
- understand the basics of quantum structures and their applications and basics of quantum computing
TEXT BOOKS:

REFERENCES:

BE3251 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING L T P C 3 0 0 3

COURSE OBJECTIVES:
- To introduce the basics of electric circuits and analysis
- To impart knowledge in the basics of working principles and application of electrical machines
- To introduce analog devices and their characteristics
- To educate on the fundamental concepts of digital electronics
- To introduce the functional elements and working of measuring instruments

UNIT I ELECTRICAL CIRCUITS
DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm’s Law - Kirchhoff’s Laws –Independent and Dependent Sources – Simple problems- Nodal Analysis, Mesh analysis with Independent sources only (Steady state)
Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor – Steady state analysis of RLC circuits (Simple problems only)

UNIT II ELECTRICAL MACHINES
UNIT III ANALOG ELECTRONICS

UNIT IV DIGITAL ELECTRONICS
Review of number systems, binary codes, error detection and correction codes, Combinational logic - representation of logic functions-SOP and POS forms, K-map representations - minimization using K maps (Simple Problems only).

UNIT V MEASUREMENTS AND INSTRUMENTATION

TOTAL: 45 PERIODS

COURSE OUTCOMES:
After completing this course, the students will be able to
CO1: Compute the electric circuit parameters for simple problems
CO2: Explain the working principle and applications of electrical machines
CO3: Analyze the characteristics of analog electronic devices
CO4: Explain the basic concepts of digital electronics
CO5: Explain the operating principles of measuring instruments

TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:

- Drawing engineering curves.
- Drawing a freehand sketch of simple objects.
- Drawing orthographic projection of solids and section of solids.
- Drawing development of solids
- Drawing isometric and perspective projections of simple solids.

CONCEPTS AND CONVENTIONS (Not for Examination)
Importance of graphics in engineering applications — Use of drafting instruments — BIS conventions and specifications — Size, layout and folding of drawing sheets — Lettering and dimensioning.

UNIT I  PLANE CURVES
Basic Geometrical constructions, Curves used in engineering practices: Conics — Construction of ellipse, parabola and hyperbola by eccentricity method — Construction of cycloid — construction of involutes of square and circle — Drawing of tangents and normal to the above curves.

UNIT II  PROJECTION OF POINTS, LINES AND PLANE SURFACE
Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III  PROJECTION OF SOLIDS AND FREEHAND SKETCHING
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes and parallel to the other by rotating object method. Visualization concepts and Free Hand sketching: Visualization principles —Representation of Three Dimensional objects — Layout of views- Freehand sketching of multiple views from pictorial views of objects. Practicing three dimensional modeling of simple objects by CAD Software (Not for examination)

UNIT IV  PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES
Sectioning of above solids in simple vertical position when the cutting plane is inclined to one of the principal planes and perpendicular to the other — obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids — Prisms, pyramids cylinders and cones. Practicing three dimensional modeling of simple objects by CAD Software (Not for examination)

UNIT V  ISOMETRIC AND PERSPECTIVE PROJECTIONS
Principles of isometric projection — isometric scale — isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids - Prisms, pyramids and cylinders by visual ray method.
Practicing three dimensional modeling of isometric projection of simple objects by CAD Software (Not for examination)

TOTAL: (L=30+P=60) 90 PERIODS

OUTCOMES:
On successful completion of this course, the student will be able to
- Use BIS conventions and specifications for engineering drawing.
- Construct the conic curves, involutes and cycloid.
- Solve practical problems involving projection of lines.
- Draw the orthographic, isometric and perspective projections of simple solids.
- Draw the development of simple solids.

TEXT BOOK:

REFERENCES:

Publication of Bureau of Indian Standards:

Special points applicable to University Examinations on Engineering Graphics:
1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit a solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day.
CS3251 PROGRAMMING IN C

COURSE OBJECTIVES:
- To understand the constructs of C Language.
- To develop C Programs using basic programming constructs
- To develop C programs using arrays and strings
- To develop modular applications in C using functions
- To develop applications in C using pointers and structures
- To do input/output and file handling in C

UNIT I BASICS OF C PROGRAMMING
Introduction to programming paradigms – Applications of C Language - Structure of C program - C programming: Data Types - Constants – Enumeration Constants - Keywords – Operators: Precedence and Associativity - Expressions - Input/Output statements, Assignment statements – Decision making statements - Switch statement - Looping statements – Preprocessor directives - Compilation process

UNIT II ARRAYS AND STRINGS
Introduction to Arrays: Declaration, Initialization – One dimensional array – Two dimensional arrays - String operations: length, compare, concatenate, copy – Selection sort, linear and binary search.

UNIT III FUNCTIONS AND POINTERS

UNIT IV STRUCTURES AND UNION

UNIT V FILE PROCESSING
Files – Types of file processing: Sequential access, Random access – Sequential access file - Random access file - Command line arguments.

COURSE OUTCOMES:
Upon completion of the course, the students will be able to
CO1: Demonstrate knowledge on C Programming constructs
CO2: Develop simple applications in C using basic constructs
CO3: Design and implement applications using arrays and strings
CO4: Develop and implement modular applications in C using functions.
CO5: Develop applications in C using structures and pointers.
CO6: Design applications using sequential and random access file processing.

TOTAL : 45 PERIODS

TEXT BOOKS:

REFERENCES:

GE3252 TAMILS AND TECHNOLOGY L T P C
1 0 0 1

UNIT I WEAVING AND CERAMIC TECHNOLOGY
Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY
Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

UNIT III MANUFACTURING TECHNOLOGY

UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY
Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING

TOTAL : 15 PERIODS
TEXT-CUM-REFERENCE BOOKS
2. தமிழக வரலொறு – மக்களும் பண பத்தும் (சிற்றிருந்துது).
3. சிற்றிருந்து தமிழககரமலிக இடம்பெற்று காரைகுழு (எஸ்சிபோர்: சிற்றிருந்து தமிழககரமலிக இடம்பெற்று காரைகுழு).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - ‘Sangam City Civilization on the banks of river Vaigai’ (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

GE3252 தமிழரும் மதொழியுணர்வு L T P C 1 0 0 1

அலகு I பசேர் மதொழியுணர்வு முற்பகுதியில் தின்பகுதியுணர்வு: 3
சங்கக் காவல்களில் தின்பகுதி ஜிறுத்து – பாண்டியர் காவல்களில் நிறமும் - காவல்களில் தின்பகுதி ஜிறுத்து – பாண்டியர் காவல்களில் நிறமும்.

அலகு II முற்பகுதியுணர்வு முற்பகுதியில் தின்பகுதியுணர்வு: 3
சங்கக் காவல்களில் முற்பகுதியிலும் தின்பகுதியிலும் காவல்களில் பாண்டியர் காவல்களில் நிறமும் - காவல்களில் முற்பகுதியிலும் தின்பகுதி ஜிறுத்து – பாண்டியர் காவல்களில் நிறமும்.

அலகு III முற்பகுதியுணர்வு முற்பகுதியில் தின்பகுதியுணர்வு: 3
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TEXT-CUM-REFERENCE BOOKS
2. கல்வியியல் கதாமாம் – பொளிராம் டிசல் பதிப்பு. (கினிகள் பதிப்பு).
3. சிறப்பு – கல்வி கல்வியியல்பியில் சுந்தர நதிக்கள் தந்தகாம் (தகாலியியல் கமன் பதிப்பு)
4. போருங்கடல் – ஹாசல் கடல் கொள்ளிகள். (கல்வியியல் கமன் பதிப்பு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
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11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
   Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

TOTAL : 15 PERIODS
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### NCC GENERAL

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<td>NCC 2</td>
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### NATIONAL INTEGRATION AND AWARENESS

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### PERSONALITY DEVELOPMENT

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### LEADERSHIP

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### SOCIAL SERVICE AND COMMUNITY DEVELOPMENT

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**TOTAL: 30 PERIODS**
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COURSE OBJECTIVES:
The main learning objective of this course is to provide hands on training to the students in:

1. Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planing; making joints in wood materials used in common household work.

2. Wiring various electrical joints in common household electrical wire work.

3. Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipments; Making a tray out of metal sheet using sheet metal work.

4. Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.

GROUP – A (CIVIL & ELECTRICAL)

PART I CIVIL ENGINEERING PRACTICES

PLUMBING WORK:
   a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.
   b) Preparing plumbing line sketches.
   c) Laying pipe connection to the suction side of a pump
   d) Laying pipe connection to the delivery side of a pump.
   e) Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

WOOD WORK:
   a) Sawing,
   b) Planing and
   c) Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.

Wood Work Study:
   a) Studying joints in door panels and wooden furniture
   b) Studying common industrial trusses using models.
PART II  ELECTRICAL ENGINEERING PRACTICES

a) Introduction to switches, fuses, indicators and lamps - Basic switchboard wiring with lamp, fan and three pin socket
b) Staircase wiring
c) Fluorescent Lamp wiring with introduction to CFL and LED types.
d) Energy meter wiring and related calculations/ calibration
e) Study of Iron Box wiring and assembly
f) Study of Fan Regulator (Resistor type and Electronic type using Diac/Triac/quadrac)
g) Study of emergency lamp wiring/Water heater

GROUP – B (MECHANICAL AND ELECTRONICS)

PART III  MECHANICAL ENGINEERING PRACTICES

WELDING WORK:
a) Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.
b) Practicing gas welding.

BASIC MACHINING WORK:
a) (simple)Turning.
b) (simple)Drilling.
c) (simple)Tapping.

ASSEMBLY WORK:
a) Assembling a centrifugal pump.
b) Assembling a household mixer.
c) Assembling an airconditioner.

SHEET METAL WORK:
a) Making of a square tray

FOUNDRY WORK:
a) Demonstrating basic foundry operations.
SOLDERING WORK:
   a) Soldering simple electronic circuits and checking continuity.

ELECTRONIC ASSEMBLY AND TESTING WORK:
   a) Assembling and testing electronic components on a small PCB.

ELECTRONIC EQUIPMENT STUDY:
   a) Study an elements of smart phone..
   b) Assembly and dismantle of LED TV.
   c) Assembly and dismantle of computer/ laptop

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
   • Draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household wood work.
   • Wire various electrical joints in common household electrical wire work.
   • Weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipments; Make a tray out of metal sheet using sheet metal work.
   • Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.

TOTAL : 60 PERIODS

CS3271 PROGRAMMING IN C LABORATORY

COURSE OBJECTIVES:
   • To familiarise with C programming constructs.
   • To develop programs in C using basic constructs.
   • To develop programs in C using arrays.
   • To develop applications in C using strings, pointers, functions.
   • To develop applications in C using structures.
   • To develop applications in C using file processing.

LIST OF EXPERIMENTS:
Note: The lab instructor is expected to design problems based on the topics listed. The Examination shall not be restricted to the sample experiments designed.

1. I/O statements, operators, expressions
2. decision-making constructs: if-else, goto, switch-case, break-continue
3. Loops: for, while, do-while
4. Arrays: 1D and 2D, Multi-dimensional arrays, traversal
5. Strings: operations
6. Functions: call, return, passing parameters by (value, reference), passing arrays to function.
7. Recursion
8. Pointers: Pointers to functions, Arrays, Strings, Pointers to Pointers, Array of Pointers
10. Files: reading and writing, File pointers, file operations, random access, processor directives.

COURSE OUTCOMES:
Upon completion of the course, the students will be able to
CO1: Demonstrate knowledge on C programming constructs.
CO2: Develop programs in C using basic constructs.
CO3: Develop programs in C using arrays.
CO4: Develop applications in C using strings, pointers, functions.
CO5: Develop applications in C using structures.
CO6: Develop applications in C using file processing.

TEXT BOOKS:

REFERENCES:

OBJECTIVES
- To identify varied group discussion skills and apply them to take part in effective discussions in a professional context.
- To be able to communicate effectively through writing.
UNIT I  12
Speaking: Role Play Exercises Based on Workplace Contexts, - talking about competition- discussing progress toward goals-talking about experiences- talking about events in life- discussing past events-Writing: writing emails (formal & semi-formal).

UNIT II  12
Speaking: discussing news stories-talking about frequency-talking about travel problems- discussing travel procedures- talking about travel problems- making arrangements-describing arrangements-discussing plans and decisions- discussing purposes and reasons- understanding common technology terms-Writing: - writing different types of emails.

UNIT III  12
Speaking: discussing predictions-describing the climate-discussing forecasts and scenarios- talking about purchasing-discussing advantages and disadvantages- making comparisons-discussing likes and dislikes-discussing feelings about experiences-discussing imaginary scenarios Writing: short essays and reports-formal/semi-formal letters.

UNIT IV  12
Speaking: discussing the natural environment-describing systems-describing position and movement-explaining rules-(example discussing rental arrangements)- understanding technical instructions-Writing: writing instructions-writing a short article.

UNIT V  12
Speaking: describing things relatively-describing clothing-discussing safety issues (making recommendations) talking about electrical devices-describing controlling actions- Writing: job application( Cover letter + Curriculum vitae)-writing recommendations.

TOTAL: 60 PERIODS

LEARNING OUTCOMES
- Speak effectively in group discussions held in a formal/semi formal contexts.
- Write emails and effective job applications.

Assessment Pattern
- One online / app based assessment to test speaking and writing skills
- Proficiency certification is given on successful completion of speaking and writing.

MA3354  DISCRETE MATHEMATICS  L T P C
3 1 0 4

COURSE OBJECTIVES:
- To extend student’s logical and mathematical maturity and ability to deal with abstraction.
- To introduce most of the basic terminologies used in computer science courses and application of ideas to solve practical problems.
- To understand the basic concepts of combinatorics and graph theory.
- To familiarize the applications of algebraic structures.
- To understand the concepts and significance of lattices and boolean algebra which are widely used in computer science and engineering.

59
UNIT I LOGIC AND PROOFS 9+3

UNIT II COMBINATORICS 9+3

UNIT III GRAPHS 9+3
Graphs and graph models – Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connectivity – Euler and Hamilton paths.

UNIT IV ALGEBRAIC STRUCTURES 9+3

UNIT V LATTICES AND BOOLEAN ALGEBRA 9+3

TOTAL: 60 PERIODS

COURSE OUTCOMES:
At the end of the course, students would:

CO1: Have knowledge of the concepts needed to test the logic of a program.
CO2: Have an understanding in identifying structures on many levels.
CO3: Be aware of a class of functions which transform a finite set into another finite set which relates to input and output functions in computer science.
CO4: Be aware of the counting principles.
CO5: Be exposed to concepts and properties of algebraic structures such as groups, rings and fields.

TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVES:

- To analyze and design combinational circuits.
- To analyze and design sequential circuits.
- To understand the basic structure and operation of a digital computer.
- To study the design of data path unit, control unit for processor and to familiarize with the hazards.
- To understand the concept of various memories and I/O interfacing.

UNIT I  COMBINATIONAL LOGIC


UNIT II  SYNCHRONOUS SEQUENTIAL LOGIC

Introduction to Sequential Circuits – Flip-Flops – operation and excitation tables, Triggering of FF, Analysis and design of clocked sequential circuits – Design – Moore/Mealy models, state minimization, state assignment, circuit implementation - Registers – Counters.

UNIT III  COMPUTER FUNDAMENTALS


UNIT IV  PROCESSOR

Instruction Execution – Building a Data Path – Designing a Control Unit – Hardwired Control, Microprogrammed Control – Pipelining – Data Hazard – Control Hazards.

UNIT V  MEMORY AND I/O


PRACTICAL EXERCISES:

1. Verification of Boolean theorems using logic gates.
2. Design and implementation of combinational circuits using gates for arbitrary functions.
3. Implementation of 4-bit binary adder/subtractor circuits.
4. Implementation of code converters.
5. Implementation of BCD adder, encoder and decoder circuits
7. Implementation of the synchronous counters
8. Implementation of a Universal Shift register.
9. Simulator based study of Computer Architecture
COURSE OUTCOMES:
At the end of this course, the students will be able to:
CO1: Design various combinational digital circuits using logic gates
CO2: Design sequential circuits and analyze the design procedures
CO3: State the fundamentals of computer systems and analyze the execution of an instruction
CO4: Analyze different types of control design and identify hazards
CO5: Identify the characteristics of various memory systems and I/O communication

TOTAL: 75 PERIODS

TEXT BOOKS:

REFERENCES:

CO’s- PO’s & PSO’s MAPPING

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CS3352 FOUNDATIONS OF DATA SCIENCE L T P C
3 0 0 3

COURSE OBJECTIVES:
- To understand the data science fundamentals and process.
- To learn to describe the data for the data science process.
- To learn to describe the relationship between data.
- To utilize the Python libraries for Data Wrangling.
- To present and interpret data using visualization libraries in Python
UNIT I  INTRODUCTION
Data Science: Benefits and uses – facets of data - Data Science Process: Overview – Defining research goals – Retrieving data – Data preparation - Exploratory Data analysis – build the model– presenting findings and building applications - Data Mining - Data Warehousing – Basic Statistical descriptions of Data

UNIT II  DESCRIBING DATA
Types of Data - Types of Variables - Describing Data with Tables and Graphs – Describing Data with Averages - Describing Variability - Normal Distributions and Standard (z) Scores

UNIT III  DESCRIBING RELATIONSHIPS

UNIT IV  PYTHON LIBRARIES FOR DATA WRANGLING

UNIT V  DATA VISUALIZATION

COURSE OUTCOMES:
At the end of this course, the students will be able to:
CO1: Define the data science process
CO2: Understand different types of data description for data science process
CO3: Gain knowledge on relationships between data
CO4: Use the Python Libraries for Data Wrangling
CO5: Apply visualization Libraries in Python to interpret and explore data

TOTAL:45 PERIODS

TEXT BOOKS

REFERENCES:
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CS3301 DATA STRUCTURES

COURSE OBJECTIVES:

- To understand the concepts of ADTs.
- To Learn linear data structures – lists, stacks, and queues.
- To understand non-linear data structures – trees and graphs.
- To understand sorting, searching and hashing algorithms.
- To apply Tree and Graph structures.

UNIT I LISTS
Abstract Data Types (ADTs) – List ADT – Array-based implementation – Linked list implementation – Singly linked lists – Circularly linked lists – Doubly-linked lists – Applications of lists – Polynomial ADT – Radix Sort – Multilists.

UNIT II STACKS AND QUEUES

UNIT III TREES
Tree ADT – Tree Traversals - Binary Tree ADT – Expression trees – Binary Search Tree ADT – AVL Trees – Priority Queue (Heaps) – Binary Heap.

UNIT IV MULTIWAY SEARCH TREES AND GRAPHS

UNIT V SEARCHING, SORTING AND HASHING TECHNIQUES
COURSE OUTCOMES:
At the end of this course, the students will be able to:

**CO1:** Define linear and non-linear data structures.

**CO2:** Implement linear and non-linear data structure operations.

**CO3:** Use appropriate linear/non-linear data structure operations for solving a given problem.

**CO4:** Apply appropriate graph algorithms for graph applications.

**CO5:** Analyze the various searching and sorting algorithms.

**TOTAL:** 45 PERIODS

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CS3391 OBJECT ORIENTED PROGRAMMING

**COURSE OBJECTIVES:**
- To understand Object Oriented Programming concepts and basics of Java programming language
- To know the principles of packages, inheritance and interfaces
- To develop a java application with threads and generics classes
- To define exceptions and use I/O streams
- To design and build Graphical User Interface Application using JAVAFX
### UNIT I  INTRODUCTION TO OOP AND JAVA


### UNIT II  INHERITANCE, PACKAGES AND INTERFACES


### UNIT III  EXCEPTION HANDLING AND MULTITHREADING


### UNIT IV  I/O, GENERICS, STRING HANDLING


### UNIT V  JAVAFX EVENT HANDLING, CONTROLS AND COMPONENTS


### COURSE OUTCOMES:

On completion of this course, the students will be able to

**CO1:** Apply the concepts of classes and objects to solve simple problems  
**CO2:** Develop programs using inheritance, packages and interfaces  
**CO3:** Make use of exception handling mechanisms and multithreaded model to solve real world problems  
**CO4:** Build Java applications with I/O packages, string classes, Collections and generics concepts  
**CO5:** Integrate the concepts of event handling and JavaFX components and controls for developing GUI based applications

**TOTAL:** 45 PERIODS

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CS3311 DATA STRUCTURES LABORATORY

COURSE OBJECTIVES:
- To demonstrate array implementation of linear data structure algorithms.
- To implement the applications using Stack.
- To implement the applications using Linked list
- To implement Binary search tree and AVL tree algorithms.
- To implement the Heap algorithm.
- To implement Dijkstra’s algorithm.
- To implement Prim’s algorithm
- To implement Sorting, Searching and Hashing algorithms.

LIST OF EXERCISES:
1. Array implementation of Stack, Queue and Circular Queue ADTs
2. Implementation of Singly Linked List
3. Linked list implementation of Stack and Linear Queue ADTs
4. Implementation of Polynomial Manipulation using Linked list
5. Implementation of Evaluating Postfix Expressions, Infix to Postfix conversion
6. Implementation of Binary Search Trees
7. Implementation of AVL Trees
8. Implementation of Heaps using Priority Queues
9. Implementation of Dijkstra’s Algorithm
10. Implementation of Prim’s Algorithm
11. Implementation of Linear Search and Binary Search
12. Implementation of Insertion Sort and Selection Sort
13. Implementation of Merge Sort
14. Implementation of Open Addressing (Linear Probing and Quadratic Probing)

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of this course, the students will be able to:
CO1: Implement Linear data structure algorithms.
CO2: Implement applications using Stacks and Linked lists
CO3: Implement Binary Search tree and AVL tree operations.
CO4: Implement graph algorithms.
CO5: Analyze the various searching and sorting algorithms.

CO’s- PO’s & PSO’s MAPPING

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CS3381 OBJECT ORIENTED PROGRAMMING LABORATORY

COURSE OBJECTIVES:
- To build software development skills using java programming for real-world applications.
- To understand and apply the concepts of classes, packages, interfaces, inheritance, exception handling and file processing.
- To develop applications using generic programming and event handling

LIST OF EXPERIMENTS:
1. Solve problems by using sequential search, binary search, and quadratic sorting algorithms (selection, insertion)
2. Develop stack and queue data structures using classes and objects.
3. Develop a java application with an Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club funds. Generate pay slips for the employees with their gross and net salary.
4. Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named printArea(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method printArea() that prints the area of the given shape.
5. Solve the above problem using an interface.
6. Implement exception handling and creation of user defined exceptions.
7. Write a java program that implements a multi-threaded application that has three threads. First thread generates a random integer every 1 second and if the value is even, the second thread
computes the square of the number and prints. If the value is odd, the third thread will print the value of the cube of the number.

8. Write a program to perform file operations.
9. Develop applications to demonstrate the features of generics classes.
10. Develop applications using JavaFX controls, layouts and menus.
11. Develop a mini project for any application using Java concepts.

Lab Requirements: for a batch of 30 students
Operating Systems: Linux / Windows
Front End Tools: Eclipse IDE / Netbeans IDE

COURSE OUTCOMES:
On completion of this course, the students will be able to

CO1: Design and develop java programs using object oriented programming concepts
CO2: Develop simple applications using object oriented concepts such as package, exceptions
CO3: Implement multithreading, and generics concepts
CO4: Create GUIs and event driven programming applications for real world problems
CO5: Implement and deploy web applications using Java

CO's- PO's & PSO's MAPPING

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CS3361 DATA SCIENCE LABORATORY

COURSE OBJECTIVES:
- To understand the python libraries for data science
- To understand the basic Statistical and Probability measures for data science.
- To learn descriptive analytics on the benchmark data sets.
- To apply correlation and regression analytics on standard data sets.
- To present and interpret data using visualization packages in Python.

LIST OF EXPERIMENTS:
1. Download, install and explore the features of NumPy, SciPy, Jupyter, Statsmodels and Pandas packages.
2. Working with Numpy arrays
3. Working with Pandas data frames
4. Reading data from text files, Excel and the web and exploring various commands for doing descriptive analytics on the Iris data set.
5. Use the diabetes data set from UCI and Pima Indians Diabetes data set for performing the following:
   a. Univariate analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis.
   b. Bivariate analysis: Linear and logistic regression modeling
   c. Multiple Regression analysis
   d. Also compare the results of the above analysis for the two data sets.
6. Apply and explore various plotting functions on UCI data sets.
   a. Normal curves
   b. Density and contour plots
   c. Correlation and scatter plots
   d. Histograms
   e. Three dimensional plotting
7. Visualizing Geographic Data with Basemap

LIST OF EQUIPMENTS : (30 Students per Batch)
Tools: Python, NumPy, Scipy, Matplotlib, Pandas, statmodels, seaborn, plotly, bokeh
Note: Example data sets like: UCI, Iris, Pima Indians Diabetes etc.

TOTAL: 60 PERIODS

COURSE OUTCOMES:
At the end of this course, the students will be able to:
   CO1: Make use of the python libraries for data science
   CO2: Make use of the basic Statistical and Probability measures for data science.
   CO3: Perform descriptive analytics on the benchmark data sets.
   CO4: Perform correlation and regression analytics on standard data sets
   CO5: Present and interpret data using visualization packages in Python.

CO's- PO's & PSO's MAPPING

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OBJECTIVES:

To be proficient in important Microsoft Office tools: MS WORD, EXCEL, POWERPOINT.

- To be proficient in using MS WORD to create quality technical documents, by using standard templates, widely acceptable styles and formats, variety of features to enhance the presentability and overall utility value of content.
- To be proficient in using MS EXCEL for all data manipulation tasks including the common statistical, logical, mathematical etc., operations, conversion, analytics, search and explore, visualize, interlink, and utilizing many more critical features offered
- To be able to create and share quality presentations by using the features of MS PowerPoint, including: organization of content, presentability, aesthetics, using media elements and enhance the overall quality of presentations.

MS WORD: 10 Hours

Create and format a document
Working with tables
Working with Bullets and Lists
Working with styles, shapes, smart art, charts
Inserting objects, charts and importing objects from other office tools
Creating and Using document templates
Inserting equations, symbols and special characters
Working with Table of contents and References, citations
Insert and review comments
Create bookmarks, hyperlinks, endnotes footnote
Viewing document in different modes
Working with document protection and security
Inspect document for accessibility

MS EXCEL: 10 Hours

Create worksheets, insert and format data
Work with different types of data: text, currency, date, numeric etc.
Split, validate, consolidate, Convert data
Sort and filter data
Perform calculations and use functions: (Statistical, Logical, Mathematical, date, Time etc.,)
Work with Lookup and reference formulae
Create and Work with different types of charts
Use pivot tables to summarize and analyse data
Perform data analysis using own formulae and functions
Combine data from multiple worksheets using own formulae and built-in functions to generate results
Export data and sheets to other file formats
Working with macros
Protecting data and Securing the workbook

**MS POWERPOINT:** 10 Hours
Select slide templates, layout and themes
Formatting slide content and using bullets and numbering
Insert and format images, smart art, tables, charts
Using Slide master, notes and handout master
Working with animation and transitions
Organize and Group slides
Import or create and use media objects: audio, video, animation
Perform slideshow recording and Record narration and create presentable videos

**TOTAL: 30 PERIODS**

**OUTCOMES:**
On successful completion the students will be able to

- Use MS Word to create quality documents, by structuring and organizing content for their day to day technical and academic requirements
- Use MS EXCEL to perform data operations and analytics, record, retrieve data as per requirements and visualize data for ease of understanding
- Use MS PowerPoint to create high quality academic presentations by including common tables, charts, graphs, interlinking other elements, and using media objects.
COURSE OBJECTIVES:
- To understand foundations of computation including automata theory
- To construct models of regular expressions and languages.
- To design context free grammar and push down automata
- To understand Turing machines and their capability
- To understand Undecidability and NP class problems

UNIT I AUTOMATA AND REGULAR EXPRESSIONS

UNIT II REGULAR EXPRESSIONS AND LANGUAGES
Regular expression – Regular Languages- Equivalence of Finite Automata and regular expressions – Proving languages to be not regular (Pumping Lemma) – Closure properties of regular languages.

UNIT III CONTEXT FREE GRAMMAR AND PUSH DOWN AUTOMATA

UNIT IV NORMAL FORMS AND TURING MACHINES

UNIT V UNDECIDABILITY

COURSE OUTCOMES:
At the end of this course, the students will be able to:
- CO1: Construct automata theory using Finite Automata
- CO2: Write regular expressions for any pattern
- CO3: Design context free grammar and Pushdown Automata
- CO4: Design Turing machine for computational functions
- CO5: Differentiate between decidable and undecidable problems

TOTAL:45 PERIODS
TEXT BOOKS:

REFERENCES:

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CS3491 ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING L T P C 3 0 2 4

COURSE OBJECTIVES:
The main objectives of this course are to:
- Study about uninformed and Heuristic search techniques.
- Learn techniques for reasoning under uncertainty
- Introduce Machine Learning and supervised learning algorithms
- Study about ensembling and unsupervised learning algorithms
- Learn the basics of deep learning using neural networks

UNIT I PROBLEM SOLVING

UNIT II PROBABILISTIC REASONING
UNIT III SUPERVISED LEARNING

UNIT IV ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING
Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, Unsupervised learning: K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization

UNIT V NEURAL NETWORKS
Perceptron - Multilayer perceptron, activation functions, network training – gradient descent optimization – stochastic gradient descent, error backpropagation, from shallow networks to deep networks –Unit saturation (aka the vanishing gradient problem) – ReLU, hyperparameter tuning, batch normalization, regularization, dropout.

PRACTICAL EXERCISES:
1. Implementation of Uninformed search algorithms (BFS, DFS)
2. Implementation of Informed search algorithms (A*, memory-bounded A*)
3. Implement naïve Bayes models
4. Implement Bayesian Networks
5. Build Regression models
6. Build decision trees and random forests
7. Build SVM models
8. Implement ensembling techniques
9. Implement clustering algorithms
10. Implement EM for Bayesian networks
11. Build simple NN models
12. Build deep learning NN models

COURSE OUTCOMES:
At the end of this course, the students will be able to:

CO1: Use appropriate search algorithms for problem solving
CO2: Apply reasoning under uncertainty
CO3: Build supervised learning models
CO4: Build ensembling and unsupervised models
CO5: Build deep learning neural network models

TEXT BOOKS:
REFERENCES:

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CS3492 DATABASE MANAGEMENT SYSTEMS

COURSE OBJECTIVES:
- To learn the fundamentals of data models, relational algebra and SQL
- To represent a database system using ER diagrams and to learn normalization techniques
- To understand the fundamental concepts of transaction, concurrency and recovery processing
- To understand the internal storage structures using different file and indexing techniques which will help in physical DB design
- To have an introductory knowledge about the Distributed databases, NOSQL and database security

UNIT I RELATIONAL DATABASES

UNIT II DATABASE DESIGN
Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form

UNIT III  TRANSATIONS  9

UNIT IV  IMPLEMENTATION TECHNIQUES  9

UNIT V  ADVANCED TOPICS  9

COURSE OUTCOMES:
Upon completion of this course, the students will be able to

CO1: Construct SQL Queries using relational algebra
CO2: Design database using ER model and normalize the database
CO3: Construct queries to handle transaction processing and maintain consistency of the database
CO4: Compare and contrast various indexing strategies and apply the knowledge to tune the performance of the database
CO5: Appraise how advanced databases differ from Relational Databases and find a suitable database for the given requirement.

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:

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ALGORITHMS

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COURSE OBJECTIVES:

- To understand and apply the algorithm analysis techniques on searching and sorting algorithms
- To critically analyze the efficiency of graph algorithms
- To understand different algorithm design techniques
- To solve programming problems using state space tree
- To understand the concepts behind NP Completeness, Approximation algorithms and randomized algorithms.

UNIT I

INTRODUCTION


UNIT II

GRAPH ALGORITHMS


UNIT III

ALGORITHM DESIGN TECHNIQUES


UNIT IV

STATE SPACE SEARCH ALGORITHMS

Backtracking: n-Queens problem - Hamiltonian Circuit Problem - Subset Sum Problem – Graph colouring problem Branch and Bound: Solving 15-Puzzle problem - Assignment problem - Knapsack Problem - Travelling Salesman Problem

UNIT V

NP-COMPLETE AND APPROXIMATION ALGORITHM

Tractable and intractable problems: Polynomial time algorithms – Venn diagram representation - NP-algorithms - NP-hardness and NP-completeness – Bin Packing problem - Problem reduction: TSP – 3-
CNF problem. Approximation Algorithms: TSP - Randomized Algorithms: concept and application - primality testing - randomized quick sort - Finding $k^{th}$ smallest number

45 PERIODS

PRACTICAL EXERCISES:
30 PERIODS

Searching and Sorting Algorithms

1. Implement Linear Search. Determine the time required to search for an element. Repeat the experiment for different values of $n$, the number of elements in the list to be searched and plot a graph of the time taken versus $n$.
2. Implement recursive Binary Search. Determine the time required to search an element. Repeat the experiment for different values of $n$, the number of elements in the list to be searched and plot a graph of the time taken versus $n$.
3. Given a text txt [0...n-1] and a pattern pat [0...m-1], write a function search (char pat [], char txt []) that prints all occurrences of pat [] in txt []. You may assume that n > m.
4. Sort a given set of elements using the Insertion sort and Heap sort methods and determine the time required to sort the elements. Repeat the experiment for different values of $n$, the number of elements in the list to be sorted and plot a graph of the time taken versus $n$.

Graph Algorithms

1. Develop a program to implement graph traversal using Breadth First Search
2. Develop a program to implement graph traversal using Depth First Search
3. From a given vertex in a weighted connected graph, develop a program to find the shortest paths to other vertices using Dijkstra’s algorithm.
4. Find the minimum cost spanning tree of a given undirected graph using Prim’s algorithm.
5. Implement Floyd’s algorithm for the All-Pairs-Shortest-Paths problem.
6. Compute the transitive closure of a given directed graph using Warshall’s algorithm.

Algorithm Design Techniques

1. Develop a program to find out the maximum and minimum numbers in a given list of $n$ numbers using the divide and conquer technique.
2. Implement Merge sort and Quick sort methods to sort an array of elements and determine the time required to sort. Repeat the experiment for different values of $n$, the number of elements in the list to be sorted and plot a graph of the time taken versus $n$.

State Space Search Algorithms

1. Implement N Queens problem using Backtracking.

Approximation Algorithms Randomized Algorithms

1. Implement any scheme to find the optimal solution for the Traveling Salesperson problem and then solve the same problem instance using any approximation algorithm and determine the error in the approximation.
2. Implement randomized algorithms for finding the $k^{th}$ smallest number.

The programs can be implemented in C/C++/JAVA/ Python.

TOTAL:75 PERIODS
COURSE OUTCOMES:
At the end of this course, the students will be able to:
CO1: Analyze the efficiency of algorithms using various frameworks
CO2: Apply graph algorithms to solve problems and analyze their efficiency.
CO3: Make use of algorithm design techniques like divide and conquer, dynamic programming and greedy techniques to solve problems
CO4: Use the state space tree method for solving problems.
CO5: Solve problems using approximation algorithms and randomized algorithms

TEXT BOOKS:

REFERENCES:

CO's- PO's & PSO's MAPPING

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CS3451 INTRODUCTION TO OPERATING SYSTEMS L T P C 3 0 0 3

COURSE OBJECTIVES:
- To understand the basics and functions of operating systems.
- To understand processes and threads.
- To analyze scheduling algorithms and process synchronization.
- To understand the concept of deadlocks.
- To analyze various memory management schemes.
- To be familiar with I/O management and file systems.
- To be familiar with the basics of virtual machines and Mobile OS like iOS and Android.
UNIT I  INTRODUCTION

UNIT II  PROCESS MANAGEMENT

UNIT III  MEMORY MANAGEMENT
Main Memory - Swapping - Contiguous Memory Allocation – Paging - Structure of the Page Table - Segmentation, Segmentation with paging; Virtual Memory - Demand Paging – Copy on Write - Page Replacement - Allocation of Frames –Thrashing.

UNIT IV  STORAGE MANAGEMENT

UNIT V  VIRTUAL MACHINES AND MOBILE OS
Virtual Machines – History, Benefits and Features, Building Blocks, Types of Virtual Machines and their Implementations, Virtualization and Operating-System Components; Mobile OS - iOS and Android.

COURSE OUTCOMES:
At the end of this course, the students will be able to:

CO1 : Analyze various scheduling algorithms and process synchronization.
CO2 : Explain deadlock prevention and avoidance algorithms.
CO3 : Compare and contrast various memory management schemes.
CO4 : Explain the functionality of file systems, I/O systems, and Virtualization
CO5 : Compare iOS and Android Operating Systems.

TEXT BOOKS:

REFERENCES:

CO’s- PO’s & PSO’s MAPPING

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GE3451 ENVIRONMENTAL SCIENCES AND SUSTAINABILITY L T P C
2 0 0 2

UNIT I ENVIRONMENT AND BIODIVERSITY

UNIT II ENVIRONMENTAL POLLUTION

UNIT III RENEWABLE SOURCES OF ENERGY
Energy management and conservation, New Energy Sources: Need of new sources. Different types new energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy.

UNIT IV SUSTAINABILITY AND MANAGEMENT
Development, GDP, Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols-Sustainable Development Goals-targets, indicators and intervention areas Climate change- Global, Regional and local environmental issues and possible solutions-case studies. Concept of Carbon Credit, Carbon Footprint. Environmental management in industry-A case study.
UNIT V  SUSTAINABILITY PRACTICES


TOTAL: 30 PERIODS

TEXT BOOKS:
5. Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning.

REFERENCE BOOKS:

CS3461  OPERATING SYSTEMS LABORATORY  L  T  P  C
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COURSE OBJECTIVES:
- To install windows operating systems.
- To understand the basics of Unix command and shell programming.
- To implement various CPU scheduling algorithms.
- To implement Deadlock Avoidance and Deadlock Detection Algorithms
- To implement Page Replacement Algorithms
- To implement various memory allocation methods.
- To be familiar with File Organization and File Allocation Strategies.
LIST OF EXPERIMENTS:

1. Installation of windows operating system
2. Illustrate UNIX commands and Shell Programming
4. Write C programs to implement the various CPU Scheduling Algorithms
5. Illustrate the inter process communication strategy
6. Implement mutual exclusion by Semaphore
7. Write C programs to avoid Deadlock using Banker's Algorithm
8. Write a C program to Implement Deadlock Detection Algorithm
9. Write C program to implement Threading
10. Implement the paging Technique using C program
11. Write C programs to implement the following Memory Allocation Methods
    a. First Fit    b. Worst Fit    c. Best Fit
12. Write C programs to implement the various Page Replacement Algorithms
13. Write C programs to Implement the various File Organization Techniques
14. Implement the following File Allocation Strategies using C programs
    a. Sequential    b. Indexed    c. Linked
15. Write C programs for the implementation of various disk scheduling algorithms
16. Install any guest operating system like Linux using VMware.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of this course, the students will be able to:

CO1 : Define and implement UNIX Commands.
CO2 : Compare the performance of various CPU Scheduling Algorithms.
CO3 : Compare and contrast various Memory Allocation Methods.
CO5 : Implement various Disk Scheduling Algorithms.

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COURSE OBJECTIVES:
- To learn and implement important commands in SQL.
- To learn the usage of nested and joint queries.
- To understand functions, procedures and procedural extensions of databases.
- To understand design and implementation of typical database applications.
- To be familiar with the use of a front end tool for GUI based application development.

LIST OF EXPERIMENTS:
1. Create a database table, add constraints (primary key, unique, check, Not null), insert rows, update and delete rows using SQL DDL and DML commands.
2. Create a set of tables, add foreign key constraints and incorporate referential integrity.
3. Query the database tables using different ‘where’ clause conditions and also implement aggregate functions.
4. Query the database tables and explore sub queries and simple join operations.
5. Query the database tables and explore natural, equi and outer joins.
6. Write user defined functions and stored procedures in SQL.
7. Execute complex transactions and realize DCL and TCL commands.
8. Write SQL Triggers for insert, delete, and update operations in a database table.
9. Create View and index for database tables with a large number of records.
12. Develop a simple GUI based database application and incorporate all the above-mentioned features
13. Case Study using any of the real life database applications from the following list
   a) Inventory Management for a EMart Grocery Shop
   b) Society Financial Management
   c) Cop Friendly App – Eseva
   d) Property Management – eMall
   e) Star Small and Medium Banking and Finance
      ● Build Entity Model diagram. The diagram should align with the business and functional goals stated in the application.
      ● Apply Normalization rules in designing the tables in scope.
      ● Prepared applicable views, triggers (for auditing purposes), functions for enabling enterprise grade features.
      ● Build PL SQL / Stored Procedures for Complex Functionalities, ex EOD Batch Processing for calculating the EMI for Gold Loan for each eligible Customer.
      ● Ability to showcase ACID Properties with sample queries with appropriate settings

List of Equipments:(30 Students per Batch)
MYSQL / SQL : 30 Users

COURSE OUTCOMES:
At the end of this course, the students will be able to:
**CO1:** Create databases with different types of key constraints.
**CO2:** Construct simple and complex SQL queries using DML and DCL commands.
**CO3:** Use advanced features such as stored procedures and triggers and incorporate in GUI based application development.
**CO4:** Create an XML database and validate with meta-data (XML schema).
**CO5:** Create and manipulate data using NOSQL database.

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