COMPUTER SCIENCE AND ENGINEERING
(Internet of Things) – CSO
DEPARTMENT OF COMPUTER SCIENCE AND TECHNOLOGY

COURSE STRUCTURE AND SYLLABUS

for

B. Tech Computer Science and Engineering

with specialization in

Internet of Things (IoT)

(Applicable for batches admitted from 2020-2021)
## COURSE STRUCTURE

### Definition of Credit (C)

- 1 Hour Lecture (L) per week  1 Credit
- 1 Hour Tutorial (T) per week  1 Credit
- 1 Hour Practical (P) per week  0.5 Credit

### Structure of B. Tech program Regulation R20

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Category</th>
<th>Code</th>
<th>Breakup of Credits</th>
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<tbody>
<tr>
<td>1</td>
<td>Humanities and Social Sciences including Management courses</td>
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<td>2</td>
<td>Basic Science courses</td>
<td>BS</td>
<td>21</td>
</tr>
<tr>
<td>3</td>
<td>Engineering Science courses including workshop, drawing, basics of electrical/ mechanical/ computer etc</td>
<td>ES</td>
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<tr>
<td>4</td>
<td>Professional core courses</td>
<td>PC</td>
<td>51</td>
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<td>5</td>
<td>Professional Elective courses relevant to chosen specialization/ branch</td>
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<td>6</td>
<td>Open subjects – Electives from other technical and /or emerging subjects</td>
<td>OE</td>
<td>12</td>
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<tr>
<td>7</td>
<td>Project work, seminar and internship in industry or elsewhere</td>
<td>PR</td>
<td>16.5</td>
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<td>Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge]</td>
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<td>Non-Credit</td>
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SEMESTER-WISE STRUCTURE OF CURRICULUM

Course structure for eight semesters during four years of study is as follows

I Year I Semester (Semester-1)

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<tr>
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<td>ES1101</td>
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<td>ES1102</td>
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I Year II Semester (Semester-2)

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<td>ES</td>
<td>Engineering Science Courses</td>
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<tr>
<td>HS</td>
<td>Humanities and Social Science Courses</td>
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<td>MC</td>
<td>Mandatory Course (AICTE)</td>
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<tr>
<td>1</td>
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<td>Mathematics – III</td>
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<td>3</td>
<td>PC2102</td>
<td>Data Structures</td>
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<td>4</td>
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<td>Java Programming</td>
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<td>Data Communications and Networking for IoT</td>
<td>3</td>
<td>0</td>
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<td>PC2102L</td>
<td>Data Structures Lab</td>
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<tr>
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<td>Data Communications and Networking for IoT Lab</td>
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<td>Introduction to Electronics Hardware and Software</td>
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<td>Essence of Indian Traditional Knowledge</td>
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**Total Credits:** 21.5

### Category Credits

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<tbody>
<tr>
<td>BS Basic Science Course</td>
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<tr>
<td>PC Professional Core Courses</td>
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**Total Credits:** 21.5

### II Year II Semester (Semester-4)

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<tr>
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<td>Probability and Statistics</td>
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<td>PC2201</td>
<td>Operating Systems</td>
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<td>5</td>
<td>PC2203</td>
<td>Introduction to IoT</td>
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<td>6</td>
<td>ES2201L</td>
<td>Computer Organization and IoT Lab</td>
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<td>1.5</td>
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<td>7</td>
<td>PC2201L</td>
<td>Operating Systems Lab</td>
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<td>PC2202L</td>
<td>Database Management Systems Lab</td>
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<td>Sensors and Actuators for IoT</td>
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**Internship / Community Service Project**

2 Months (Mandatory) during summer vacation

**Honors/Minor courses**

<table>
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<tr>
<th>S. No</th>
<th>Course code</th>
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<th>L</th>
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<th>P</th>
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<td>Internship / Community Service Project</td>
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**Total Credits:** 21.5

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<tr>
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**Total Credits:** 21.5
### III Year I Semester (Semester-5)

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<td>1</td>
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<td>PC3102</td>
<td>Artificial Intelligence</td>
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<td>PC3103</td>
<td>Automata Theory and Compiler Design</td>
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<td>PR</td>
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**Total** 21.5

**Category**

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<td><strong>PE</strong></td>
<td>Professional Elective Courses</td>
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<td><strong>OE</strong></td>
<td>Open Elective Courses/Job Oriented Elective Courses</td>
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<td><strong>SAC</strong></td>
<td>Skill Advanced Course/Soft Skills Course</td>
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**Total Credits** 21.5

### III Year II Semester (Semester-6)

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**Industrial/Research Internship**<br>2 Months (Mandatory) during summer vacation<br>Honors/Minor courses 3 0 2 4

**Total** 21.5
## Category and Credits

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Total Credits: 21.5

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<td>8</td>
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<td>Industrial/Research Internship 2 Months (Mandatory)</td>
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Total: 23

Honors/Minor courses: 3

### IV Year II Semester (Semester-8)

<table>
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<tr>
<th>S. No</th>
<th>Course code</th>
<th>Course Name</th>
<th>L</th>
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<tr>
<td>1</td>
<td>PROJ4201</td>
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<td>Project work, seminar, and internship in industry</td>
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<td>Internship (6 months)</td>
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Total Credits: 12
## Open Elective Courses

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<thead>
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<th>Course Title</th>
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<tbody>
<tr>
<td>OE3101</td>
<td>Microprocessor and Microcontrollers</td>
<td>E-Waste Management</td>
<td>Green Buildings</td>
<td>Optimization Techniques</td>
</tr>
<tr>
<td>OE3201</td>
<td>Data Warehousing and Data Mining</td>
<td>Machine Learning</td>
<td>Software Project Management</td>
<td>Environment Pollution and Control</td>
</tr>
<tr>
<td>OE4101</td>
<td>Cyber Security</td>
<td>Disaster Management</td>
<td>Supply Chain Management</td>
<td>Big Data Analytics</td>
</tr>
<tr>
<td>OE4102</td>
<td>Cryptography and Network Security</td>
<td>Block Chain Technologies</td>
<td>High Performance Computing</td>
<td>Cloud Computing</td>
</tr>
</tbody>
</table>

## Professional Elective Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Course Title</th>
<th>Course Title</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Design and Analysis of Algorithms</td>
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<tr>
<td>PE3201</td>
<td>(NPTEL/SWAYAM) Duration: 12 Weeks minimum</td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>PE4101</td>
<td>Industrial and Medical IoT</td>
<td>Wireless Sensor Networks</td>
<td>No SQL Databases</td>
<td>Mobile Computing</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>IoT Privacy &amp; Security</td>
</tr>
<tr>
<td>PE4102</td>
<td>Advanced tools for IoT</td>
<td>Deep Learning</td>
<td>Mean Stack Technologies</td>
<td>Wearable Computing</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Cyber Security and Forensics</td>
</tr>
<tr>
<td>PE4103</td>
<td>IoT Malware Analysis</td>
<td>Data Science</td>
<td>DevOps</td>
<td>Human Machine Interaction</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Software Testing Methodologies</td>
</tr>
</tbody>
</table>

## Courses for Honors degree

### POOL-1

- Advanced Python Programming
- Advanced Operating Systems
- RFID and Micro Controllers
- Internet of Robotics
- Next Generation IoT Networks

### POOL-2

- Software Testing Methodologies
- Security Governance Risk and Compliance
- Information Assurance and Security
- Social Mobile Analytics and Cloud
- Ethical Hacking

### POOL-3

- Advanced JAVA Programming
- Advanced Database Systems
- Database Security
- Cloud Essentials
- Storage Area Networks

### POOL-4

- Natural Language Processing
- Sentiment Analysis
- Perception and Computer Vision
- SDN and NFV for IOT
- FOG Computing

### MOOC-1*

(NPTEL/SWAYAM) Duration: 12 Weeks minimum

### MOOC-2*

(NPTEL/SWAYAM) Duration: 12 Weeks minimum

*Course/subject title can’t be repeated

**Note:**

1. A student has to acquire 16 credits with minimum one subject from each pool.
2. Compulsory MOOC/NPTEL course for 4 credits (2 course, each 2 credited)
General Minor degree courses offered by CSO department

1. Introduction to IoT
2. Introduction to Open-Source Tools for IoT
3. Mobile Application Development for IoT
4. Advanced Computer Architecture
5. Industrial and Medical IoT
6. Internet of Robotics
7. Advanced tools for IoT
8. IoT Malware Analysis

Note:

i. A Student can select four subjects from the above eight subjects @ 3-0-2-4 credits per subject.
ii. Compulsory MOOC/NPTEL courses for 04 credits (02 courses @ 02 credits each)

VVIT Life skill courses

The following courses are admitted to be the courses beyond curriculum to improve individual life skills. These courses will be demonstrated in the class room and will be having an internal assessment for satisfactory.

<table>
<thead>
<tr>
<th>S. No</th>
<th>Year and Semester</th>
<th>Course Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I Year I Semester (Semester-1)</td>
<td>Quantitative Aptitude</td>
</tr>
<tr>
<td>2</td>
<td>I Year II Semester (Semester-2)</td>
<td>Verbal Ability</td>
</tr>
<tr>
<td>3</td>
<td>II Year I Semester (Semester-3)</td>
<td>Understanding Self for Effectiveness</td>
</tr>
<tr>
<td>4</td>
<td>II Year II Semester (Semester-4)</td>
<td>Design Thinking</td>
</tr>
<tr>
<td>5</td>
<td>III Year I Semester (Semester-5)</td>
<td>Stress and Coping Strategies</td>
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<tr>
<td>6</td>
<td>III Year II Semester (Semester-6)</td>
<td>Research Skills</td>
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</table>
SYLLABUS
I-Year-I Semester | Mathematics-I | L | T | P | C
---|---|---|---|---|---
BS1101 | | 2 | 1 | 0 | 3

**Course objectives:**
The main objectives are

1. To enlighten the learners in the concept of differential equations and multivariable calculus.
2. To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications.

### Unit–1: (10 hrs)
**Differential equations of first order and first degree**
Linear differential equations-Bernoulli’s equations - Exact equations and equations reducible to exact form.

### Unit–2: (9 hrs)
**Linear differential equations of higher order**
Non-homogeneous equations of higher order with constant coefficients – with non-homogeneous term of the type \(e^{ax}, \sin ax, \cos ax\), polynomials in \(x^n\), \(e^{ax} V(x)\) and \(x^n V(x)\) - Method of Variation of Parameters.
**Applications:** LCR circuit – Simple harmonic motion

### Unit–3: (9 hrs)
**Mean value theorems**
Mean value theorems (without proofs): Rolle’s Theorem – Lagrange’s mean value theorem – Cauchy’s mean value theorem – Taylor’s and Maclaurin’s theorems with remainders.

### Unit–4: (10 hrs)
**Partial differentiation**
**Applications:** Maxima and Minima of functions of two variables without constraints and Lagrange’s method (with constraints).

### Unit–5: (10 hrs)
**Multiple integrals**
Double integrals (Cartesian and Polar) – Change of order of integration – Change of variables (Cartesian to Polar) –Triple integrals.
**Applications:** Areas by double integrals and Volumes by triple integrals.
Course Outcomes: Upon successful completion of the course, the student will be able to

| CO1 | solve the differential equations related to various engineering fields. |
| CO2 | utilize mean value theorems to real life problems. |
| CO3 | familiarize with functions of several variables which is useful in optimization. |
| CO4 | apply double integration techniques in evaluating areas bounded by region. |
| CO5 | learn important tools of calculus in higher dimensions. Students will become familiar with 2-dimensional and 3 - dimensional coordinate systems. |

Text books:

Reference books:
### I-Year-I Semester

<table>
<thead>
<tr>
<th>BS1102</th>
<th>Applied Chemistry</th>
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<tbody>
<tr>
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<td>L T P C</td>
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<td>2 1 0 3</td>
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</tbody>
</table>

#### Course objectives:
The main objectives are

1. Significance of various types of plastic materials in household appliances and composites (FRP) in aerospace and automotive industries.
2. Understand the basic concepts of electrochemistry, which are useful to construct the electrochemical cells, batteries and fuel cells.
3. Illustrate the theories and mechanism of corrosion and its prevention.
4. Importance of advanced materials and their engineering applications.
5. Make use of molecular machines in supramolecular chemistry and need of green chemistry.
6. Design and construction of advanced instrumental techniques and recall their importance.

#### Unit – 1: Polymer Technology (11 hrs)

**Polymerisation:** Introduction-Methods of polymerisation-(emulsion and suspension)-Physical and mechanical properties.

**Plastics:** Compounding-Fabrication (compression, injection, blown film, extrusion)-Preparation, properties and applications of PVC, ploycarbonates and Bakelite-Mention some examples of plastic materials used in electronic gadgets, recycling of e-plastic waste.

**Elastomers:** Natural rubber-Drawbacks-Vulcanization-Preparation-Properties and applications of synthetic rubbers (Buna S, thiokol and polyurethanes)

**Composite Materials:** Fiber reinforced plastics-CFRP and GFRP

**Conducting polymers:** Polyacetylene, doped conducting polymers -p-type and n-type doping.

**Bio degradable polymers:** Biopolymers and biomedical polymers.

#### Unit-2: Electrochemical Cells and Corrosion (9 hrs)

Single electrode potential-Electrochemical series and uses of series-Standard hydrogen electrode, calomel electrode, concentration cell, construction of glass electrode, Batteries: Dry cell, Ni-Cd cells, Ni-Metal hydride cells, Li-ion battery, Zinc air cells, Fuel cells-H$_2$ –O$_2$, CH$_3$OH-O$_2$, phosphoric acid, molten carbonate.

**Corrosion:** Definition-theories of corrosion (chemical and electrochemical)-galvanic corrosion, differential aeration corrosion, stress corrosion, water-line corrosion- passivity of metals-galvanic series-factors influencing rate of corrosion-corrosion control: (proper designing, cathodic protection)-protective coatings: cathodic and anodic coatings, electroplating, electroless plating (nickel), paints (constituents and its functions).

#### Unit-3: Material Chemistry (9 hrs)

**Non-elemental semiconducting materials:** Stoichiometric, controlled valency & chalcogen photo/semiconductors-preparation of semiconductors (distillation, zone refining, Czochralski crystal pulling technique) – Semiconductor devices (p-n junction diode as rectifier, junction transistor)

**Nano materials:** Introduction, sol-gel method, characterization by BET, SEM and TEM methods, applications of graphene-carbon nanotubes and fullerenes: Types, preparation of carbon nanomaterials by carbon-arc, laser ablation methods.

**Liquid crystals:** Introduction-types-applications.

**Superconductors:** Meissner effect, type- I and type- II superconductors, characteristics and applications.
Unit-4: Advanced Concepts and Green Chemistry (9 hrs)
**Molecular switches and machines**: Introduction to supramolecular chemistry, characteristics of molecular motors and machines. Rotaxanes and Catenanes as artificial molecular machines. Prototypes linear motions in Rotaxanes, and acid-base controlled molecular shuttle, a molecular elevator, an autonomous light–powered molecular motors, natural molecular motors and machine.

**Green chemistry**: Principles of green chemistry, green synthesis – aqueous phase, microwave assisted chemical reactions and phase transfer catalysis (PTC).

Unit-5: Spectroscopic Techniques & Non-Conventional Energy Sources (10 hrs)
**Spectroscopic Techniques**: Electromagnetic spectrum-types of molecular spectra and their absorption criteria.
- **IR** spectroscopy – functional group and finger print region – molecular vibrations – stretching and bending vibrations – *applications of IR.
- **NMR** (Nuclear magnetic resonance): Working principle and instrumentation of NMR – chemical shift(δ) – *applications of NMR.
  (*only general applications – without any spectroscopic problems regarding quantitative and qualitative analysis.)

**Non-conventional energy sources**: Design, working, schematic diagram, advantages and disadvantages of photovoltaic cell, organic photo-voltaic, hydropower, geothermal power, tidal, ocean thermal energy conversion (OTEC) – open cycle OTEC, closed cycle OTEC and hybrid cycle OTEC.

**Course Outcomes**: Upon successful completion of the course, the student will be able to

| CO1 | explain the preparation, properties and applications of thermoplastics, thermosettings, elastomers and conducting polymers. |
| CO2 | know the importance of various materials and their uses in the construction of batteries and fuel cells |
| CO3 | know the applications of advanced materials in various industries |
| CO4 | apply the principles of supramolecular chemistry in the applications of molecular machines, need of green chemistry. |
| CO5 | explain the principles of spectrometry such as UV, IR, and NMR |

**Text books**:

**Reference books**:
### Course Objectives:
The main objectives are:

1. To introduce basics of electric circuits and to teach DC and AC electrical circuit analysis.
2. To explain the working principles DC machines and speed control of various DC motors.
3. To explain the working principles of transformers and AC machines and its applications.
4. To introduce the basics of semiconductor physics and operation and applications of Diodes.
5. To introduce the basics of transistors and explain the transistor configurations.

### Unit 1: DC & AC Circuits (10 hrs)
**DC Circuits:** Electrical circuit elements (R - L and C) – Kirchhoff’s laws - Voltage and Current division rules-series, parallel circuits and star-delta and delta-star transformations- [Elementary treatment only]

**AC Circuits:** Representation of sinusoidal waveforms - Peak and RMS values - phasor representation - real power - reactive power - apparent power - power factor.[Elementary treatment only]

### Unit 2: DC Machines (10 hrs)
**DC Generator:** Construction-Principle and operation of DC Generator - EMF equation -Types—Applications [Elementary treatment only]

**DC Motor:** Principle and operation of DC Motor – types-Torque equation - Speed control of DC Motor-Break test- Swinburne’s test-Applications. [Elementary treatment only]

### Unit 3: AC Machines (10 hrs)
**Single Phase Transformer:** Construction, Principle and operation of Single Phase Transformer –EMF Equation-Losses-Efficiency. [Elementary treatment only]

**Three Phase Induction Motor:** Construction- Principle and operation of three phase Induction Motor-Types- Applications. [Elementary treatment only].

### Unit 4: IoT Semiconductor Devices (10 hrs)
Semiconductor Physics, PN Junction Diode & Zener Diode-characteristics- Applications: Rectifiers (Half Wave Rectifier & Full Wave Rectifier) [Elementary treatment only], Clippers and Clampers.

### Unit 5: Bipolar Junction Transistors (8 hrs)
Construction and working of bipolar junction transistor, CB, CE and CC Configurations and characteristics. [Elementary treatment only], Transistors as amplifiers, op-amp basics.

### Course Outcomes:
Upon successful completion of the course, the student will be able to:

| CO1 | Apply concepts of KVL/KCL in solving DC circuits. |
| CO2 | Choose correct machine for a specific application. |
| CO3 | Illustrate working principles of DC and AC Machines. |
| CO4 | Describe working principles of diodes and transistors. |
| CO5 | Understand the applications of diodes and transistors. |

### Textbooks:
<table>
<thead>
<tr>
<th>Reference books:</th>
</tr>
</thead>
</table>

## Course objectives:
The main objectives are
1. To make the students aware of the basic hardware components of a computer and installation of operating system.
2. To introduce Raptor Tool for flowchart creation.
3. Each student will familiar with Productivity tool: LaTeX and Microsoft (MS) office
4. To get knowledge in awareness of cyber hygiene that is protecting the personal computer from getting infected with the viruses, worms and other cyber-attacks.
5. To introduce the usage of Productivity tools in crafting professional word documents, excel spreadsheets and power point presentations using open office tools.

### Unit – 1: (10 hrs)
Simple Computer System: Central processing unit, the further need of secondary storage, Types of memory, Hardware, Software and people. Peripheral Devices: Input, Output and storage, Data Preparation, Factors affecting input, Input devices, Output devices, Secondary devices, Communication between the CPU and Input/ Output devices.

### Unit-2: (9 hrs)
Problem Solving and Programming: Algorithm development, Flowcharts, Looping, some programming features, Pseudo code, the one-zero game, some structured programming concepts, documents. Programming Languages: Machine Language and assembly language, high -level and low level languages, Assemblers, Compilers, and Interpreters.

### Unit-3: (10 hrs)
Operating systems: Introduction, Evolution of operating systems, Command Interpreter, Popular operating systems- Microsoft DOS, Microsoft Windows, UNIX and Linux. Introduction to Unix Shell Commands, directory management commands, file operations, users commands, Time and Date commands.

### Unit-4: (9 hrs)

### Unit-5: (10 hrs)

### List of Tasks
**TASK 1: PC Hardware:** PC Hardware introduces the students to a personal computer and its basic peripherals, the process of assembling a personal computer, installation of system
software like MS Windows, Linux and the required device drivers. In addition hardware and software level troubleshooting process, tips and tricks would be covered. Every student should identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor. Every student should disassemble and assemble the PC back to working condition.

**TASK 2: Hardware Troubleshooting:** Students have to be given a PC which does not boot due to improper assembly or defective peripherals. They should identify the problem and fix it to get the computer back to working condition.

**Software Troubleshooting:** Students have to be given a malfunctioning CPU due to system software problems. They should identify the problem and fix it to get the computer back to working condition.

**TASK 3: Drawing flowcharts (Raptor Tool)**
1. Create flowcharts for take-off landing of an Aeroplane.
2. Create a flowchart to validate an email id entered by user.
3. Create flowchart to print first 50 prime numbers.

**TASK 4: Productivity tool: LaTeX and Microsoft (MS) office:** Importance of MS office, Details of the three tasks and features that should be covered in each, MS word, Power Point, Excel.

**TASK 5: Operating System Installation:** Every student should individually install operating system like Linux or MS windows on the personal computer. The system should be configured as dual boot with both windows and Linux.

**TASK 6: Basic Commands:** Unix Shell Commands, directory management commands, file operations, users commands, Time and Date commands.

**TASK 7: Orientation & Connectivity Boot Camp:** Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally students should demonstrate how to access the websites and email.

**TASK 8:** Networking Commands:
- ping, ssh, ifconfig, scp, netstat, ipstat, nslookup, traceroute, telnet, host, ftp, arp, wget, route

**TASK 9: Basic HTML tags**
1. Head Section and Elements of Head Section, Paragraphs, Formatting Styles.
2. Colour tags, Creating Hyperlinks, Images, Tables, lists
3. HTML Forms, Form Attributes, Form Elements.

**TASK 10:** Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured. Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. Usage of search engines like Google, Yahoo, ask.com and others should be demonstrated by student.

**TASK 11:** Cyber Hygiene: Students should learn about viruses on the internet and install antivirus software. Student should learn to customize the browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

**Course Outcomes:** Upon successful completion of the course, the student will be able to

<table>
<thead>
<tr>
<th>CO1</th>
<th>Identify various hardware components of a system and apply their knowledge about computer peripherals to identify / rectify problems onboard.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO2</td>
<td>Assemble the computer.</td>
</tr>
<tr>
<td>CO3</td>
<td>Use various Microsoft tools.</td>
</tr>
<tr>
<td><strong>CO4</strong></td>
<td>Integrate the PCs into local area network and re-install operating system and various application programs.</td>
</tr>
<tr>
<td>---------</td>
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</tr>
<tr>
<td><strong>CO5</strong></td>
<td>Manage data backup and restore operations on computer and update application software.</td>
</tr>
</tbody>
</table>

**Text books:**
1. Fundamentals of Computers – Reema Thareja-Oxford higher education
3. PC Hardware Trouble Shooting Made Easy, TMH

**Reference books:**
2. An Introduction to Computer studies – Noel Kalicharan-Cambridge
Course objectives:
The main objectives are
1. To learn about the computer systems, computing environments, developing of a computer program and Structure of a C Program
2. To gain knowledge of the operators, selection, control statements and repetition in C
3. To learn about the design concepts of arrays, strings, enumerated structure and union types. To learn about their usage.
4. To assimilate about pointers, dynamic memory allocation and know the significance of Pre-processor.
5. To assimilate about File I/O and significance of functions

Unit – 1: (11 hrs)
**Introduction to Computers:** Creating and running Programs, Computer Numbering System, Storing Integers, Storing Real Numbers
**Introduction to the C Language:** Background, C Programs, Identifiers, Types, Variable, Constants, Input/output, Programming Examples, Scope, Storage Classes and Type Qualifiers.
**Structure of a C Program:** Expressions Precedence and Associativity, Side Effects, Evaluating Expressions, Type Conversion Statements, Simple Programs, Command Line Arguments.

Unit-2: (9 hrs)
**Bitwise Operators:** Exact Size Integer Types, Logical Bitwise Operators, Shift Operators.
**Selection & Making Decisions:** Logical Data and Operators, Two Way Selection, Multiway Selection, More Standard Functions
**Repetition:** Concept of Loop, Pretest and Post-test Loops, Initialization and Updating, Event and Counter Controlled Loops, Loops in C, Other Statements Related to Looping, Looping Applications, Programming Examples

Unit-3: (9 hrs)
**Arrays:** Concepts, Using Array in C, Array Application, Two Dimensional Arrays, Multidimensional Arrays, Programming Example – Calculate Averages
**Strings:** String Concepts, C String, String Input / Output Functions, Arrays of Strings, String Manipulation Functions String/ Data Conversion, A Programming Example – Morse Code
**Enumerated, Structure, and Union:** The Type Definition (Type def), Enumerated Types, Structure, Unions, and Programming Application

Unit-4: (11 hrs)
**Pointers:** Introduction, Pointers to pointers, Compatibility, L value and R value
**Pointer Applications:** Arrays, and Pointers, Pointer Arithmetic and Arrays, Memory Allocation Function, Array of Pointers, Programming Application
**Processor Commands:** Processor Commands

Unit-5: (8 hrs)
**Functions:** Designing, Structured Programs, Function in C, User Defined Functions, Inter-Function Communication, Standard Functions, Passing Array to Functions, Passing Pointers to Functions, Recursion
**Text Input / Output:** Files, Streams, Standard Library Input / Output Functions, Formatting Input / Output Functions, Character Input / Output Functions
**Binary Input / Output:** Text versus Binary Streams, Standard Library, Functions for Files, Converting File Type.

**Course Outcomes:** Upon successful completion of the course, the student will be able to

<table>
<thead>
<tr>
<th>CO1</th>
<th>Understand algorithms and basic terminology of C</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO2</td>
<td>Solve problems using control structures and modular approach</td>
</tr>
<tr>
<td>CO3</td>
<td>Demonstrate 1D and 2D arrays along with strings for linear data handling</td>
</tr>
<tr>
<td>CO4</td>
<td>Determine the use of pointers and structures</td>
</tr>
<tr>
<td>CO5</td>
<td>Implement various operations on data files.</td>
</tr>
</tbody>
</table>

**Text books:**

1. Programming for Problem Solving, Behrouz A. Forouzan, Richard F. Gilberg, CENGAGE
2. The C Programming Language, Brian W. Kernighan, Dennis M. Ritchie, 2e, Pearson

**Reference books:**

Course objectives:
The main objectives are
1. To furnish the students with a solid foundation in Chemistry Laboratory required to solve the Engineering problems.
2. To expose the students in practical aspects of the theoretical concepts like pH, hardness of water etc.
3. To guide the students on how to handle the instruments like UV-visible spectrophotometer, potentiometer and conductometer.

List of Experiments

Students should do any 10 experiments listed below
1. Determination of HCl using standard Na₂CO₃ solution.
2. Determination of alkalinity of a sample containing Na₂CO₃ and NaOH.
3. Determination of Mn (II) using standard oxalic acid solution.
4. Determination of ferrous iron using standard K₂Cr₂O₇ solution.
5. Determination of Copper (II) using standard EDTA solution.
7. Determination of Iron (III) by colorimetric method.
8. Determination of the concentration of acetic acid using sodium hydroxide (pH-metric method).
9. Determination of concentration of strong acid vs strong base (by conductometric method).
10. Determination of strong acid vs strong base (by potentiometric method).
11. Determination of Mg²⁺ present in an antacid.
12. Determination of CaCO₃ presence in an egg shell.
13. Estimation of vitamin- C.
15. Adsorption of acetic acid by charcoal.
16. Preparation of nylon-6, 6 and Bakelite (demonstration only)

Course Outcomes: Upon successful completion of the course, the student will be able to

| CO1 | estimate the amount of metal ions present in different solutions |
| CO2 | analyze the quality parameters of water |
| CO3 | determine the strength of different solutions by using different instrumentation techniques |

Text books:
Course objectives:
The main objectives are
1. To Verify Kirchhoff’s laws, Voltage and Current division rules.
2. To learn speed control and testing of DC Shunt Motor.
3. To learn and understand the operation of induction motor.
4. To learn applications of diodes and transistors.

List of Experiments

Cycle-1

1. Verification of Kirchhoff laws.
2. Verification of Voltage division rule and current division rule.
3. Speed control of DC Shunt Motor.
4. Perform Brake test on DC Shunt Motor.
5. Conduct Swinburne’s test on DC Shunt Motor.

Cycle-2

1. V-I characteristics of P-N Junction Diode.
2. Understand Zener Diode Characteristics.
3. Understand Half wave rectifier and Full wave rectifier with and without filter.
5. Characteristics of BJT in Common Emitter Configuration.
6. Zener diode as voltage regulator.

Course Outcomes: Upon successful completion of the course, the student will be able to

<table>
<thead>
<tr>
<th>CO1</th>
<th>Verify Kirchhoff’s Laws and voltage and current division rules for DC supply.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO2</td>
<td>Analyze the performance of AC and DC Machines by testing.</td>
</tr>
<tr>
<td>CO3</td>
<td>Perform speed control of DC shunt motor.</td>
</tr>
<tr>
<td>CO4</td>
<td>Perform the half wave and full wave rectifier.</td>
</tr>
</tbody>
</table>

Text books:

Reference books:
Course objectives:
The main objectives are
1. Apply the principles of C language in problem solving.
2. To design flowcharts, algorithms and knowing how to debug programs.
3. To design & develop of C programs using arrays, strings pointers & functions.
4. To review the file operations, pre-processor commands.

List of Experiments

Exercise 1
1. Write a C program to print a block F using hash (#), where the F has a height of six characters and width of five and four characters.
2. Write a C program to compute the perimeter and area of a rectangle with a height of 7 inches and width of 5 inches.
3. Write a C program to display multiple variables.

Exercise 2
1. Write a C program to calculate the distance between the two points.
2. Write a C program that accepts 4 integers p, q, r, s from the user where r and s are positive and p is even. If q is greater than r and s is greater than p and if the sum of r and s is greater than the sum of p and q print "Correct values", otherwise print "Wrong values".

Exercise 3
1. Write a C program to convert a string to a long integer.
2. Write a program in C which is a Menu-Driven Program to compute the area of the various geometrical shape.
3. Write a C program to calculate the factorial of a given number.

Exercise 4
1. Write a program in C to display the n terms of even natural number and their sum.
2. Write a program in C to display the n terms of harmonic series and their sum. \[1 + 1/2 + 1/3 + 1/4 + 1/5 \ldots 1/n\] terms.
3. Write a C program to check whether a given number is an Armstrong number or not.

Exercise 5
1. Write a program in C to print all unique elements in an array.
2. Write a program in C to separate odd and even integers in separate arrays.
3. Write a program in C to sort elements of array in ascending order.

Exercise 6
1. Write a program in C for multiplication of two square Matrices.
2. Write a program in C to find transpose of a given matrix.

Exercise 7
1. Write a program in C to search an element in a row wise and column wise sorted matrix.
2. Write a program in C to print individual characters of string in reverse order.

Exercise 8
1. Write a program in C to compare two strings without using string library functions.
2. Write a program in C to copy one string to another string.
Exercise 9
1. Write a C Program to Store Information Using Structures with Dynamically Memory Allocation
2. Write a program in C to demonstrate how to handle the pointers in the program.

Exercise 10
1. Write a program in C to demonstrate the use of & (address of) and *(value at address) operator.
2. Write a program in C to add two numbers using pointers.

Exercise 11
1. Write a program in C to add numbers using call by reference.
2. Write a program in C to find the largest element using Dynamic Memory Allocation.

Exercise 12
1. Write a program in C to swap elements using call by reference.
2. Write a program in C to count the number of vowels and consonants in a string using a pointer.

Exercise 13
1. Write a program in C to show how a function returning pointer.
2. Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using malloc( ) function.

Exercise 14
1. Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using calloc( ) function. Understand & write the difference.
2. Write a program in C to convert decimal number to binary number using the function.

Exercise 15
1. Write a program in C to check whether a number is a prime number or not using the function.
2. Write a program in C to get the largest element of an array using the function.

Exercise 16
1. Write a program in C to append multiple lines at the end of a text file.
2. Write a program in C to copy a file in another name.
3. Write a program in C to remove a file from the disk.

Course Outcomes: Upon successful completion of the course, the student will be able to

<table>
<thead>
<tr>
<th>CO1</th>
<th>Comprehend the various concepts of a C language</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO2</td>
<td>Develop algorithms and flowcharts</td>
</tr>
<tr>
<td>CO3</td>
<td>Design and development of C problem solving skills.</td>
</tr>
<tr>
<td>CO4</td>
<td>Acquire modular programming skills</td>
</tr>
</tbody>
</table>
Course objectives:
The main objectives are
1. To elucidate the different numerical methods to solve nonlinear algebraic equations
2. To disseminate the use of different numerical techniques for carrying out numerical integration
3. To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real world problems and their applications

Unit – 1: Iterative methods (9 hrs)

Unit-2: Interpolation (10 hrs)

Unit-3: Numerical integration and solution of ordinary difference equations (10 hrs)

Unit-4: Laplace Transforms (11 hrs)
Laplace transforms of standard functions – Shifting theorems – Transforms of derivatives and integrals – Unit step function – Dirac’s delta function –Periodic function - Inverse Laplace transforms – Convolution theorem (without proof)

Unit-5: Fourier series and Fourier Transforms (8 hrs)

Course Outcomes: Upon successful completion of the course, the student will be able to

<p>| CO1 | Evaluate approximate in the roots of polynomial and transcendental equations by different algorithms |
| CO2 | Solve system of linear algebraic equations using Gauss Jacobi, Gauss Seidel and apply Newton’s forward and backward interpolation and Lagrange’s formulae for equal and unequal intervals |
| CO3 | Apply different algorithms for approximating the solutions of ordinary differential equations to its analytical computations and also by Laplace the transforms for solving differential equations |
| CO4 | Find or compute the Fourier series of periodic signals |</p>
<table>
<thead>
<tr>
<th><strong>CO5</strong></th>
<th>Know and be able to apply integral expressions for the forwards and inverse Fourier transform to range of non-periodic waveforms</th>
</tr>
</thead>
</table>

**Text books:**


**Reference books:**

Course objectives:
The main objectives are
1. Impart Knowledge of Physical Optics phenomena like Interference and Diffraction required to design instruments with higher resolution.
2. Understand the physics of Semiconductors and their working mechanism for their utility in electronic devices.
3. Impart the knowledge of materials with characteristic utility in appliances.

Unit – 1: Wave Optics (10 hrs)

Unit-2: LASERs and Holography (10 hrs)
Holography: Introduction – principle – differences between photography and holography – construction and reconstruction of hologram – applications of holograms

Unit-3: Magnetism and Dielectrics (10 hrs)
Dielectrics: Introduction- Dielectric polarization-Dielectric polarizability, Susceptibility and Dielectric constant- Types of polarizations: Electronic and Ionic (Quantitative), Orientation Polarizations (Qualitative) - Lorentz Internal field- Claussius – Mossotti’s equation- Frequency dependence of polarization - Applications of dielectrics.

Unit-4: Quantum Mechanics (9 hrs)

Unit-5: Semiconductor Physics (9 hrs)
Origin of energy bands (qualitative) –Classification of solids based on energy bands–Intrinsic semiconductors-density of charge carriers –Electrical conductivity-Fermi level – extrinsic semiconductors-P-type & N-type – Density of charge carriers- Dependence of Fermi energy on carrier concentration and temperature- Hall effect-Hall coefficient- Applications of Hall effect-Drift and Diffusion currents - Einstein’s equation.
**Course Outcomes:** Upon successful completion of the course, the student will be able to

| CO1  | Understand the principles such as interference and diffraction to design and enhance the resolving power of various optical instruments. |
| CO2  | Learn the basic concepts of LASER light Sources and Apply them to holography |
| CO3  | Study the magnetic and dielectric materials to enhance the utility aspects of materials. |
| CO4  | Learn the fundamental concepts of Quantum behaviour of matter. |
| CO5  | Identify the type of semiconductors using Hall Effect. |

**Text books:**


**Reference books:**

**Course objectives:**
The main objectives are

1. Adopt activity-based teaching-learning methods to ensure that learners would be engaged in use of language both in the classroom and laboratory sessions.
2. Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native speakers.
3. Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials.
4. Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations.
5. Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information.
6. Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing.

**Unit – 1: (10 hrs)**
**Detailed Study:** A Proposal to Girdle the Earth (Excerpt) by Nellie Bly
**Theme:** Exploration
**Listening:** Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions.
**Speaking:** Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.
**Reading:** Skimming to get the main idea of a text; scanning to look for specific pieces of information.
**Reading for Writing:** Beginnings and endings of paragraphs - introducing the topic, summarizing the main idea and/or providing a transition to the next paragraph.
**Grammar and Vocabulary:** Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns: countable and uncountable; singular and plural; basic sentence structures; simple question form - wh-questions; word order in sentences.
**Non-Detailed Study:**
1. “How to Fashion Your Own Brand of Success” by Howard Whitman
2. “How to Recognize Your Failure Symptoms” by Dorothea Brande

**Unit-2: (10 hrs)**
**Detailed Study:** An excerpt from The District School as It Was by One Who Went to It by Warren Burton
**Theme:** On Campus
**Listening:** Answering a series of questions about main idea and supporting ideas after listening to audio texts.
**Speaking:** Discussion in pairs/ small groups on specific topics followed by short structured talks.
**Reading:** Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.
**Writing:** Paragraph writing (specific topics) using suitable cohesive devices; mechanics of writing - punctuation, capital letters.
**Grammar and Vocabulary:** Cohesive devices - linkers, signposts and transition signals; use of articles and zero article; prepositions.
| Non-detailed Study:                                                                 |
| 3. “How to Conquer the Ten Most Common Causes of Failure” by Louis Binstock       |
| 4. “How to Develop Your Strength to Seize Opportunities” by Maxwell Maltz          |

| Unit-3: (10 hrs)                                                                 |
| Detailed Study: The Future of Work?                                              |
| Theme: Working Together                                                          |
| Listening: Listening for global comprehension and summarizing what is listened to.|
| Speaking: Discussing specific topics in pairs or small groups and reporting what is discussed |
| Reading: Reading a text in detail by making basic inferences - recognizing and interpreting specific context clues; strategies to use text clues for comprehension. |
| Writing: Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions. |
| **Grammar and Vocabulary:** Verbs - tenses; subject-verb agreement; direct and indirect speech, reporting verbs for academic purposes. |

| Non-Detailed Study:                                                               |
| 5. “How to Make the Most of Your Abilities” by Kenneth Hildebrand                |

| Unit-4: (10 hrs)                                                                 |
| Detailed Study: H.G Wells and the Uncertainties of Progress by Peter J. Bowler   |
| Theme: Fabric of Change                                                          |
| Listening: Making predictions while listening to conversations/transactional dialogues without video; listening with video. |
| Speaking: Role-plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions. |
| Reading: Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data. |
| Writing: Information transfer; describe, compare, contrast, identify significance/trends based on information provided in figures/charts/graphs/tables. |
| **Grammar and Vocabulary:** Quantifying expressions - adjectives and adverbs; comparing and contrasting; degrees of comparison; use of antonyms |

| Non-Detailed Study:                                                               |
| 7. “How to Win Your War against Negative Feelings” by Dr Maxwell Maltz            |
| 8. “How to Find the Courage to Take Risks” by Drs. Tom Rusk and Randy Read       |

| Unit-5: (8 hrs)                                                                  |
| Detailed Study: Leaves from the Mental Portfolio of a Eurasian by Sui Sin Far     |
| Theme: Tools for Life                                                            |
| Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension. |
| Speaking: Formal oral presentations on topics from academic contexts - without the use of PPT slides. |
| Reading: Reading for comprehension.                                              |
| Writing: Writing structured essays on specific topics using suitable claims and evidences |
| **Grammar and Vocabulary:** Editing short texts – identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement) |

| Non-Detailed Study:                                                               |
| 9. “How to Become a Self-Motivator” by Charles T Jones                           |
| 10. “How to Eliminate Your Bad Habits” by OgMandino                               |
Course Outcomes: Upon successful completion of the course, the student will be able to

| CO1 | identify the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English and formulate sentences using proper grammatical structures and correct word forms |
| CO2 | speak clearly on a specific topic using suitable discourse markers in informal discussions |
| CO3 | write summaries based on global comprehension of reading/listening texts |
| CO4 | produce a coherent paragraph interpreting a figure/graph/chart/table |
| CO5 | take notes while listening to a talk/lecture to answer questions |

Text books:
1. English All Round: Communication Skills for Undergraduate Learners-Volume 1, Orient Black Swan, 2019
2. University of Success by OgMandino, Jaico, 2015.

Reference books:
3. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.

AICTE Recommended Books

Sample Web Resources
Grammar / Listening / Writing
1-language.com
http://www.5minuteenglish.com/
https://www.englishpractice.com/

Grammar/Vocabulary
English Language Learning Online
http://www.bbc.co.uk/learningenglish/
http://www.better-english.com/
http://www.nonstopenglish.com/
https://www.vocabulary.com/
BBC Vocabulary Games
Free Rice Vocabulary Game

Reading
https://www.usingenglish.com/comprehension/
https://www.english-online.at/

Listening
https://learningenglish.voanews.com/z/3613
http://www.englishmedialab.com/listening.html

Speaking
https://www.talkenglish.com/
BBC Learning English – Pronunciation tips
Merriam-Webster – Perfect pronunciation Exercises

**All Skills**

https://www.englishclub.com/
http://www.world-english.org/
http://learnenglish.britishcouncil.org/
**Course objectives:**
The main objectives are

1. To learn about Python programming language syntax, semantics, and the runtime environment
2. To be familiarized with universal computer programming concepts like data types, containers
3. To be familiarized with general computer programming concepts like conditional execution, loops & functions
4. To be familiarized with general coding techniques and object-oriented programming

<table>
<thead>
<tr>
<th>Unit – 1: (10 hrs)</th>
<th><strong>Introduction:</strong> Introduction to Python, Program Development Cycle, Input, Processing, and Output, Displaying Output with the Print Function, Comments, Variables, Reading Input from the Keyboard, Performing Calculations, Operators. Type conversions, Expressions, More about Data Output.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Data Types, and Expression:</strong></td>
<td>Strings Assignment, and Comment, Numeric Data Types and Character Sets, Using functions and Modules.</td>
</tr>
<tr>
<td><strong>Decision Structures and Boolean Logic:</strong></td>
<td>if, if-else, if-elif-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables. Repetition Structures: Introduction, while loop, for loop, Calculating a Running Total, Input Validation Loops, Nested Loops.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unit-2: (9 hrs)</th>
<th><strong>Control Statement:</strong> Definite iteration for Loop Formatting Text for output, Selection if and if else Statement Conditional Iteration, While Loop</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strings and Text Files:</strong></td>
<td>Accessing Character and Substring in Strings, Data Encryption, Strings and Number Systems, String Methods Text Files.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unit-3: (9 hrs)</th>
<th><strong>List and Dictionaries:</strong> Lists, Defining Simple Functions, Dictionaries</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Design with Function:</strong></td>
<td>Functions as Abstraction Mechanisms, Problem Solving with Top Down Design, Design with Recursive Functions, Case Study Gathering Information from a File System, Managing a Program’s Namespace, Higher Order Function.</td>
</tr>
<tr>
<td><strong>Modules:</strong></td>
<td>Modules, Standard Modules, Packages.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unit-4: (10 hrs)</th>
<th><strong>File Operations:</strong> Reading config files in python, Writing log files in python, Understanding read functions, read(), readline() and readlines(), Understanding write functions, write() and writelines(), Manipulating file pointer using seek, Programming using file operations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Object Oriented Programming:</strong></td>
<td>Concept of class, object and instances, Constructor, class attributes and destructors, Real time use of class in live projects, Inheritance, overlapping and overloading operators, Adding and retrieving dynamic attributes of classes, Programming using Oops support</td>
</tr>
<tr>
<td><strong>Design with Classes:</strong></td>
<td>Objects and Classes, Data modeling Examples, Case Study An ATM, Structuring Classes with Inheritance and Polymorphism</td>
</tr>
</tbody>
</table>

| Unit-5: (10 hrs) | **Errors and Exceptions:** Syntax Errors, Exceptions, Handling Exceptions, Raising Exceptions, |
User-defined Exceptions, Defining Clean-up Actions, Redefined Clean-up Actions.

**Graphical User Interfaces:** The Behavior of Terminal Based Programs and GUI-Based, Programs, Coding Simple GUI-Based Programs, Other Useful GUI Resources.

**Programming:** Introduction to Programming Concepts with Scratch.

**Course Outcomes:** Upon successful completion of the course, the student will be able to

<table>
<thead>
<tr>
<th>CO1</th>
<th>Develop essential programming skills in computer programming concepts like data types, containers</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO2</td>
<td>Solve coding tasks related to conditions, loops and String processing</td>
</tr>
<tr>
<td>CO3</td>
<td>Experiment with various Data structures in interpreted Language and to build modules and packages for real software needs.</td>
</tr>
<tr>
<td>CO4</td>
<td>Implement Files and object oriented principles in Python</td>
</tr>
<tr>
<td>CO5</td>
<td>Identify solutions using GUI in Python</td>
</tr>
</tbody>
</table>

**Text books:**

**Reference books:**

<table>
<thead>
<tr>
<th>Simple GUI-Based Programs and other useful GUI Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction to Programming</td>
</tr>
<tr>
<td>Scratch Programming</td>
</tr>
</tbody>
</table>
Course objectives:
The main objectives are
  1. To understand common forms of number representation in digital circuits and Boolean algebra.
  2. To learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems and simplify logic expressions using basic theorems, K-map and Tabular methods.
  3. To understand the concept of Combinational logic design and realize logic expressions using MUXand Decoder
  4. Illustrate the concept of sequential logic design; analyze the operation of flip-flop and conversion from one flip-flop to another, and application of flip-flop.
  5. To impart to student the concepts of sequential machines of digital system.

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</tr>
<tr>
<td>5. To impart to student the concepts of sequential machines of digital system.</td>
</tr>
</tbody>
</table>

### Unit – 1: Number Systems and Boolean Algebra (10 hrs)
**Number systems:** Introduction to different number system and their conversions, complement of number system and subtraction using complement method, Floating-Point Representation, Weighted and Non-weighted codes and its Properties.

**Boolean Algebra:** Boolean algebra and logic gates, Basic theorems and properties of Boolean Algebra, Boolean functions, canonical and standard forms, Universal Gates.

### Unit – 2: Minimization Methods of Boolean functions (8 hrs)
Minimization of logic expressions by algebraic method, Sum of Products (SOP), Product of Sums (POS), K-Map Method, Don’t Care Combinations, Multilevel NAND/NOR realizations, Prime and essential Prime Implicants, Tabular Method, Prime Implicants Chart, Simplification Rules.

### Unit – 3: Combinational Circuits (10 hrs)

### Unit – 4: Sequential Circuits (10 hrs)
Sequential Circuits Fundamentals: Basic Architectural Distinctions between Combinational and Sequential circuits, SR Latch, Flip Flops: SR, JK, JK Master Slave, D and T Type Flip Flops, Excitation Table of all Flip Flops, Timing and Triggering Consideration, Conversion from one type of flip-flop to another.
Registers and Counters: Shift Registers Left, Right and Bidirectional Shift Registers, Applications of Shift Registers, Design and Operation of Ring and Twisted Ring Counter, Operation of Asynchronous and Synchronous Counters.

### Unit – 5: Sequential Machines (10 hrs)
Finite State Machines, Synthesis of Synchronous Sequential Circuits, Serial Binary Adder, Sequence Detector, Parity bit Generator, Synchronous Modulo N – Counters, Finite state machine capabilities and limitations, Mealy and Moore models.
**Course Outcomes**: Upon successful completion of the course, the student will be able to

| CO1 | Distinguish the analog and digital systems, apply positional notations, number systems, computer codes in digital systems. |
| CO2 | Understand the Boolean Algebra theorems, simplify and design logic circuits. |
| CO3 | Implemented combinational logic circuit design and modular combinational circuits using encoders, decoders, multiplexers and demultiplexers. |
| CO4 | Understand the basic elements of sequential logic circuits. |
| CO5 | Design and analyze sequential circuits. |

**Text books:**
1. Digital Design by Mano, PHI
2. Modern Digital Electronics by RP Jain, TMH
3. Switching Theory and Logic Design by A. Anand Kumar, PHI.

**Reference books:**
2. Fundamentals of Logic Design by Charles H. Roth Jr, Jaico Publishers
Course objectives:
The main objectives are
1. **Understand** the concepts of interference and diffraction and their applications.
2. **Apply** the concept of LASER in the determination of wavelength.
3. **Recognize** the importance of energy gap in the study of conductivity and Hall Effect.
4. **Illustrate** the magnetic and dielectric materials applications.
5. **Apply** the principles of semiconductors in various electronic devices.

LIST OF EXPERIMENTS
(Any 10 of the following listed 15 experiments)
3. Determination of thickness of a spacer using wedge film and parallel interference fringes.
4. Magnetic field along the axis of a current carrying coil – Stewart and Gee’s apparatus.
5. Energy Band gap of a Semiconductor p - n junction.
6. Characteristics of Thermistor – Temperature Coefficients
7. Determination of dielectric constant by charging and discharging method
8. Variation of dielectric constant with temperature
9. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
10. LASER - Determination of wavelength by plane diffraction grating
11. Determination of resistivity of semiconductor by Four probe method.
12. Determine the radius of gyration using compound pendulum
13. Rigidity modulus of material by wire-dynamic method (torsional pendulum)
14. Dispersive power of diffraction grating.
15. Determination of Hall voltage and Hall coefficients of a given semiconductor using Hall Effect.

Course Outcomes: Upon successful completion of the course, the student will be able to

| CO1 | Operate optical instruments like microscope and spectrometer |
| CO2 | Determine thickness of a paper with the concept of interference |
| CO3 | Estimate the wavelength of different colours using diffraction grating and resolving power |
| CO4 | Plot the intensity of the magnetic field of circular coil carrying current with distance |
| CO5 | Calculate the band gap of a given semiconductor |
Course objectives:
The main objectives are
1. Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native and non-native speakers
2. Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials like newspapers, magazines, periodicals, journals, etc.
3. Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations
4. Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information
5. Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing

Introduction to Sound system of English
Articulation - Airstream mechanism, Manners of Articulation, Places of Articulation, English phonetic symbols.
Accent - Syllabification, word stress and accent, stress rules and stress shift, exceptions to rules.
Intonation - Stress and accent in connected speech. Types and functions of Intonation in English.
I. A. Speaking: Introducing Yourself and Others
B. Listening: Conversation between two and more people.
II. A. Speaking: Speak for a minute in response to a question about personal experience / wish.
B. Listening: Identifying the main idea of a talk or a conversation
III. A. Speaking: Group discussion – 5 minutes followed by a summary –1 or 2 minutes:
   Topics-1. Features that make a place beautiful, 2. The most challenging job you can think of, 3. Some skills that everyone should learn, 4. The best criteria to measure success, 5. A recent news story that is interesting, 6. Impact of technology on the music industry, 7. An app that has helped society, 8. Pros and Cons of after school tutorials, 9. How to stay safe on Social Media, 10. The most common reasons why friendships fall apart, 11. Interactions with seniors on campus, 12. Coping with peer pressure, 13. Others’ opinion vs your belief, 14. Feeling that plants would express if they could, 15. Growing up alone vs Growing up with siblings, 16. Uniforms stifle individuality, 17. In India summer is the best and worst of times, 18. A good sense of humour is a definite perk, 19. All fast food is not junk food and 20. Ideas to make your common room in college more inviting.
   Question Answer sessions – 1. Idea of a Tech Startup, 2. Training programme of T&P Cell, 3. Inter-college Cultural Fest, 4. 3-day Foreign University delegation visit to the campus, 5. Computer training programme by a reputed MNC, 6. Shifting your Dept or Classrooms to new location on campus, 7. How to manage attendance while attending additional courses (Minors/Honors), 8. How to choose placement offers? 9. Involvement in Student Affairs through SAC, 10. Planning an excursion.
B. Listening: 1. Comprehension Exercise on Teamwork, 2. Predicting what the speaker would say from the title of the talk, 3. Comprehension based on a narrative or a short video, TED Talks
IV. A. Speaking: Preparing speech using picture clues, asking Q&A using pictures.
B. Listening: Listening Comprehension using short films, audio files, interviews of famous personalities

**B. Listening:** Listening Comprehension, Speeches by Famous personalities
Pair work, Role-play, conversational practice and Individual speaking activities based on following essays from University of Success.
1. “How to Fashion Your Own Brand of Success” by Howard Whitman
2. “How to Recognize Your Failure Symptoms” by Dorothea Brande
3. “How to Conquer the Ten Most Common Causes of Failure” by Louis Binstock
4. “How to Develop Your Strength to Seize Opportunities” by Maxwell Maltz
5. “How to Make the Most of Your Abilities” by Kenneth Hildebrand
7. “How to Win Your War against Negative Feelings” by Dr Maxwell Maltz
8. “How to Find the Courage to Take Risks” by Drs. Tom Rust and Randy Reed
9. “How to Become a Self-Motivator” by Charles T Jones
10. “How to Eliminate Your Bad Habits” by Og Mandino

**Course Outcomes:** Upon successful completion of the course, the student will be able to

<table>
<thead>
<tr>
<th>CO1</th>
<th>identify the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English and speak clearly on a specific topic using suitable discourse markers in informal discussions</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO2</td>
<td>take notes while listening to a talk/lecture; to answer questions in English; formulate sentences using proper grammatical structures and correct word forms; and use language effectively in competitive examinations</td>
</tr>
<tr>
<td>CO3</td>
<td>write summaries based on global comprehension of reading/listening texts; produce a coherent write-up interpreting a figure/graph/chart/table; and use English as a successful medium of communication</td>
</tr>
</tbody>
</table>

**Text books:**
1. English All Round: Communication Skills for Undergraduate Learners-Volume 1, Orient Black Swan, 2019
2. University of Success by OgMandino, Jaico, 2015.

**Reference books:**
3. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.

AICTE Recommended Books

Sample Web Resources
Grammar / Listening / Writing
1. 1-language.com
2. http://www.5minuteenglish.com/

Grammar/Vocabulary
1. English Language Learning Online
2. http://www.bbc.co.uk/learningenglish/
5. https://www.vocabulary.com/
6. BBC Vocabulary Games
7. Free Rice Vocabulary Game

Reading
1. https://www.usingenglish.com/comprehension/
3. https://www.english-online.at/

Listening
1. https://learningenglish.voanews.com/z/3613

Speaking
1. https://www.talkenglish.com/
2. BBC Learning English – Pronunciation tips
3. Merriam-Webster – Perfect pronunciation Exercises

All Skills
1. https://www.englishclub.com/
Course objectives:
The main objectives are
1. To acquire programming skills in core Python.
2. To acquire Object Oriented Skills in Python
3. To develop the skill of designing Graphical user Interfaces in Python
4. To develop the ability to write database applications in Python

List of Problems
1. Write a program that asks the user for a weight in kilograms and converts it to pounds. There are 2.2 pounds in a kilogram.
2. Write a program that asks the user to enter three numbers (use three separate input statements). Create variables called total and average that hold the sum and average of the three numbers and print out the values of total and average.
3. Write a program that uses a for loop to print the numbers 8, 11, 14, 17, 20, . . . , 83, 86, 89.
4. Write a program that asks the user for their name and how many times to print it. The program should print out the user’s name the specified number of times.
5. Use a for loop to print a triangle like the one below. Allow the user to specify how high the triangle should be.
   *
   **
   ***
   ****
6. Generate a random number between 1 and 10. Ask the user to guess the number and print a message based on whether they get it right or not.
7. Write a program that asks the user for two numbers and prints Close if the numbers are within .001 of each other and Not close otherwise.
8. Write a program that asks the user to enter a word and prints out whether that word contains any vowels.
9. Write a program that asks the user to enter two strings of the same length. The program should then check to see if the strings are of the same length. If they are not, the program should print an appropriate message and exit. If they are of the same length, the program should alternate the characters of the two strings. For example, if the user enters abcdE and ABCDE the program should print out AaBbCcDdEe.
10. Write a program that asks the user for a large integer and inserts commas into it according to the standard American convention for commas in large numbers. For instance, if the user enters 1000000, the output should be 1,000,000.
11. In algebraic expressions, the symbol for multiplication is often left out, as in 3x+4y or 3(x+5). Computers prefer those expressions to include the multiplication symbol, like 3\*x+4\*y or 3\*(x+5). Write a program that asks the user for an algebraic expression and then inserts multiplication symbols where appropriate.
12. Write a program that generates a list of 20 random numbers between 1 and 100.
   a. Print the list.
   b. Print the average of the elements in the list.
   c. Print the largest and smallest values in the list.
d. Print the second largest and second smallest entries in the list
e. Print how many even numbers are in the list.

12. Write a program that asks the user for an integer and creates a list that consists of the factors of that integer.

13. Write a program that generates 100 random integers that are either 0 or 1. Then find the longest run of zeros, the largest number of zeros in a row. For instance, the longest run of zeros in [1,0,1,0,0,0,1,0,0] is 4.

14. Write a program that removes any repeated items from a list so that each item appears at most once. For instance, the list [1,1,2,3,4,3,0,0] would become [1,2,3,4,0].

15. Write a program that asks the user to enter a length in feet. The program should then give the user the option to convert from feet into inches, yards, miles, millimeters, centimeters, meters, or kilometers. Say if the user enters a 1, then the program converts to inches, if they enter a 2, then the program converts to yards, etc. While this can be done with if statements, it is much shorter with lists and it is also easier to add new conversions if you use lists.

16. Write a function called \textit{sum\_digits} that is given an integer num and returns the sum of the digits of num.

17. Write a function called \textit{first\_diff} that is given two strings and returns the first location in which the strings differ. If the strings are identical, it should return -1.

18. Write a function called \textit{number\_of\_factors} that takes an integer and returns how many factors the number has.

19. Write a function called \textit{is\_sorted} that is given a list and returns True if the list is sorted and False otherwise.

20. Write a function called root that is given a number \( x \) and an integer \( n \) and returns \( x^{1/n} \). In the function definition, set the default value of \( n \) to 2.

21. Write a function called primes that is given a number \( n \) and returns a list of the first \( n \) primes. Let the default value of \( n \) be 100.

22. Write a function called merge that takes two already sorted lists of possibly different lengths, and merges them into a single sorted list.
   a. Do this using the sort method. b) Do this without using the sort method.

23. Write a program that asks the user for a word and finds all the smaller words that can be made from the letters of that word. The number of occurrences of a letter in a smaller word can’t exceed the number of occurrences of the letter in the user’s word.

24. Write a program that reads a file consisting of email addresses, each on its own line. Your program should print out a string consisting of those email addresses separated by semicolons.

25. Write a program that reads a list of temperatures from a file called temps.txt, converts those temperatures to Fahrenheit, and writes the results to a file called ftemps.txt.

26. Write a class called Product. The class should have fields called name, amount, and price, holding the product’s name, the number of items of that product in stock, and the regular price of the product. There should be a method get\_price that receives the number of items to be bought and returns the cost of buying that many items, where the regular price is charged for orders of less than 10 items, a 10% discount is applied for orders of between 10 and 99 items, and a 20% discount is applied for orders of 100 or more items. There should also be a method called make\_purchase that receives the number of items to be bought and decreases amount by that much.

27. Write a class called Time whose only field is a time in seconds. It should have a method called convert\_to\_minutes that returns a string of minutes and seconds formatted as in the following example: if seconds is 230, the method should return ‘5:50’. It should also have a
method called convert_to_hours that returns a string of hours, minutes, and seconds formatted analogously to the previous method.

28. Write a class called Converter. The user will pass a length and a unit when declaring an object from the class—for example, c = Converter(9,'inches'). The possible units are inches, feet, yards, miles, kilometers, meters, centimeters, and millimeters. For each of these units there should be a method that returns the length converted into those units. For example, using the Converter object created above, the user could call c.feet() and should get 0.75 as the result.

29. Write a Python class to implement pow(x, n).

30. Write a Python class to reverse a string word by word.

31. Write a program that opens a file dialog that allows you to select a text file. The program then displays the contents of the file in a textbox.

32. Write a program to demonstrate Try/except/else.

33. Write a program to demonstrate try/finally and with/as.

Course Outcomes: Upon successful completion of the course, the student will be able to

<table>
<thead>
<tr>
<th>CO1</th>
<th>Comprehend how software easily to build right out of the box.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO2</td>
<td>Demonstrates the use of an interpreted language for problem solving through control statements including loops and conditionals.</td>
</tr>
<tr>
<td>CO3</td>
<td>Practice with data structures for quick programming solutions.</td>
</tr>
<tr>
<td>CO4</td>
<td>Demonstrates software building for real needs by breaking out code into reusable functions and modules.</td>
</tr>
<tr>
<td>CO5</td>
<td>Comprehend the software reliability through exception handling.</td>
</tr>
</tbody>
</table>
**Course objectives:**

The main objectives are

1. To make the students to get awareness on environment,
2. to understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day-to-day activities of human life
3. to save earth from the inventions by the engineers.

**Unit – 1: Multidisciplinary Nature of Environmental Studies (9 hrs)**
Definition, Scope and Importance – Need for Public Awareness.

**Natural Resources:** Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

**Unit-2: Ecosystems, Biodiversity, and Its Conservation (9 hrs)**

**Ecosystems:** Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem.

b. Grassland ecosystem

c. Desert ecosystem

d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

**Biodiversity And Its Conservation :** Definition: genetic, species and ecosystem diversity – Biogeographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

**Unit-3: Environmental Pollution and Solid Waste Management (10 hrs)**

**Environmental Pollution:** Definition, Cause, effects and control measures of:

a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

**Solid Waste Management:** Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.
**Unit-4: Social Issues and the Environment (10 hrs)**

**Unit-5: Human Population and the Environment (10 hrs)**

**Field Work:** Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc.

**Course Outcomes:** Upon successful completion of the course, the student will be able to

| CO1 | Understand the concepts of the ecosystem |
| CO2 | Understand the natural resources and their importance |
| CO3 | Learn the biodiversity of India and the threats to biodiversity, and apply conservation practices |
| CO4 | Learn various attributes of the pollution and their impacts |
| CO5 | Understand Social issues both rural and urban environment |

**Text books:**
2. Environmental Studies by Palaniswamy – Pearson education
3. Environmental Studies by Dr.S.Azeem Unnisa, Academic Publishing Company

**Reference books:**
3. Comprehensive Environmental studies by J.P.Sharma, Laxmi publications.
5. A Text Book of Environmental Studies by G.R.Chatwal, Himalaya Publishing House
6. Introduction to Environmental engineering and science by Gilbert M. Masters and Wendell P. Ela - Prentice hall of India Private limited.
# Course Objectives:
The main objectives are

1. Instruct the concept of Matrices in solving linear algebraic equations.
2. Familiarize the techniques in partial differential equations.
3. Furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real-world applications.

## Unit–1: Solving system of linear equations, Eigen values and Eigen Vectors (10 hrs)
Rank of a matrix by Echelon form and normal form–solving system of homogeneous and non-homogeneous linear equations–Gauss elimination, Gauss Jordan for solving system of equations-Eigen values and Eigen vectors and their properties.

## Unit–2: Cayley-Hamilton theorem and quadratic forms (10 hrs)
Cayley-Hamilton theorem (without proof)–Finding inverse and power of a matrix by Cayley-Hamilton theorem–Reduction to Diagonal form–Quadratic forms and nature of the quadratic forms–Reduction of quadratic form to canonical forms by orthogonal transformation.

**Application:** Free vibration of two mass systems.

## Unit–3: Vector Differentiation (8 hrs)

## Unit–4: Vector Integration (10 hrs)
Line integral – Work done – Circulation- Surface integral- Volume integral

Vector integral theorems (without proof): Green’s theorem in a plane- Stokes theorem- Gauss Divergence theorem.

## Unit–5: Solutions of Partial differential Equations (10 hrs)
Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solutions of first order linear (Lagrange) equation and nonlinear (standard types) equations.

Second order PDE: Solutions of linear partial differential equations with constant coefficients – RHS term of the type $e^{ax+by}, \sin(ax + by), \cos(ax + by), x^m y^n$.

## Course Outcomes:
Upon successful completion of the course, the student will be able to:

| CO1 | develop the use of matrix algebra techniques that is needed by engineers for practical applications |
| CO2 | solve system of linear algebraic equations using Gauss elimination, Gauss Jordan |
| CO3 | to interpret the physical meaning of different operators such as gradient, curl and divergence |
| CO4 | estimate the work done against a field, circulation and flux using vector calculus |
| CO5 | identify the solution methods for partial differential equation that model physical processes |

## Textbooks:


## Reference Books:

**e-resources:**

Course objectives:
The main objectives are
1. Introduce concepts of mathematical logic.
2. Introduce concepts and perform operations with sets, relations and functions.
3. Solve counting problems by applying elementary counting techniques.
4. Introduce algebraic structures, generating functions and recurrence relations.
5. Use graph theory for solving problems.

<table>
<thead>
<tr>
<th>Unit–1: Mathematical Logic &amp; Predicate Calculus (8 hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Predicate Calculus:</strong> Predicative Logic, Statement Functions, Variables and Quantifiers, Free and Bound Variables, Inference Theory for Predicate Calculus.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unit–2: Set Theory &amp; Relations (10 hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Set Theory:</strong> Introduction, Operations on Binary Sets, Principle of Inclusion and Exclusion.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unit–3: Algebraic Structures and Number Theory (10 hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Algebraic Structures:</strong> Algebraic Systems, Examples, General Properties, Semi Groups and Monoids, Homomorphism of Semi Groups and Monoids, Group, Subgroup, Abelian Group, Homomorphism, Isomorphism.</td>
</tr>
<tr>
<td><strong>Number Theory:</strong> Properties of Integers, Division Theorem, The Greatest Common Divisor, Euclidean Algorithm, and Least Common Multiple, Testing for Prime Numbers, The Fundamental Theorem of Arithmetic, Modular Arithmetic (Fermat’s Theorem and Euler’s Theorem).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unit–4: Combinatorics &amp; Recurrence Relations (10 hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combinatorics: Binomial and Multinomial Coefficients, Binomial and Multinomial Theorems, Pigeonhole Principle and its Application.</td>
</tr>
<tr>
<td>Recurrence Relations: Solving Recurrence Relations by Substitution and Generating Functions, Method of Characteristic Roots, Solving non homogeneous Recurrence Relations.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unit–5: Graph Theory (10 hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Graph Theory:</strong> Basic Concepts of Graphs, Sub graphs, Matrix Representation of Graphs: Adjacency Matrices, Incidence Matrices, Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs, Multi graphs, Planar Graphs, Euler’s Formula, Graph Colouring, Chromatic Number, Spanning Trees, Algorithms for Spanning Trees (Problems Only and Theorems without Proofs).</td>
</tr>
</tbody>
</table>
**Course Outcomes:** Upon successful completion of the course, the student will be able to

<table>
<thead>
<tr>
<th>CO1</th>
<th>Apply mathematical logic to solve problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO2</td>
<td>Understand sets, relations and discrete structures</td>
</tr>
<tr>
<td>CO3</td>
<td>Apply number theory to perform modulo arithmetic and computer arithmetic.</td>
</tr>
<tr>
<td>CO4</td>
<td>Solve problems on recurrence relations and counting principles.</td>
</tr>
<tr>
<td>CO5</td>
<td>Analyse and solve real world problems using graphs and trees.</td>
</tr>
</tbody>
</table>

**Text books:**


**Reference books:**

2. Discrete Mathematical Structures, Bernand Kolman, Robert C. Busby, Sharon CutlerRoss, PHI.

**e-resources:**

1. https://nptel.ac.in/courses/106/103/106103205/
2. https://nptel.ac.in/courses/106/106/106106183/

| Spanning Trees,BFS and DFS |
Course objectives:
The main objectives are
1. Impart the usage of linear list to students.
2. Help students understand the difference between dynamic memory using linked list.
3. Demonstrate the students about the operations Trees.
4. Make the student to understand various algorithms in graphs.
5. Make the students to learn the importance of hashing and sorting algorithms.

Unit–1: Algorithms and Linear Lists (10 hrs)
Algorithmic complexity, performance and Analysis, Linear lists (Arrays), Applications of Linear List: Searching and Sorting

Unit–2: Stacks and Queues, Linked Lists (10 hrs)
Single Linked List, Double Linked List, Circular Linked List, Stack and Queues using linked list

Unit–3: Trees (10 hrs)
Binary Trees Operations, Tree traversal, Threaded Binary Trees, Binary Search Trees, Binary Heap

Unit–4: Graphs (10 hrs)
Elementary Graph Operations, Graph Traversals, Minimum cost spanning tree Algorithms, Shortest paths algorithms.

Unit–5: Hashing and Pattern Matching (8 hrs)
Concept Hashing, Hash Functions, Collision Resolution Techniques, Pattern Matching algorithms

Course Outcomes: Upon successful completion of the course, the student will be able to

<table>
<thead>
<tr>
<th>CO1</th>
<th>CO2</th>
<th>CO3</th>
<th>CO4</th>
<th>CO5</th>
</tr>
</thead>
<tbody>
<tr>
<td>comprehend the implementation of linear lists</td>
<td>examine static and dynamic data structures with suitable applications.</td>
<td>determine trees applications.</td>
<td>appreciate the importance and significance of graph algorithms in building and solving real world applications.</td>
<td>comprehend and implement algorithms for text processing</td>
</tr>
</tbody>
</table>

Text books:
2. Data structures and Algorithm Analysis in Java, Mark Allen Weiss, Pearson Education. Ltd, Second Edition

Reference books:
2. Introduction to Algorithms, by Thomas H. Cormen, Charles E. Leiserson, Ronald L.


<table>
<thead>
<tr>
<th>e-resources:</th>
</tr>
</thead>
<tbody>
<tr>
<td>➢ Data Structures Visualizations: <a href="https://www.cs.usfca.edu/~galles/visualization/Algorithms.html">https://www.cs.usfca.edu/~galles/visualization/Algorithms.html</a></td>
</tr>
<tr>
<td>➢ Code Archery Youtube Channel: <a href="https://www.youtube.com/playlist?list=PLrKBf87Cy9CNZpzi3poq8BFWc0h4f0vL">https://www.youtube.com/playlist?list=PLrKBf87Cy9CNZpzi3poq8BFWc0h4f0vL</a></td>
</tr>
</tbody>
</table>
Course objectives:
The main objectives are
1. understand object oriented programming concepts, and apply them in solving problems.
2. make the students to learn the principles of inheritance and polymorphism; and to demonstrate how they relate to the design of abstract classes; to introduce the implementation of packages and interfaces.
3. make the students to learn the concepts of exception handling.
4. make the students to learn the concepts of multithreading.
5. make the students to develop GUI applications.

Unit–1: Introduction to OOPS Concepts, Classes and Strings (8 hrs)
Introduction to Object Oriented Programming, Java buzzwords, Java Programming Basics, Sample programs, Data types and operators, Control statements.
Classes: Classes, Objects, Methods, Constructors, this and static keywords, Method and Constructor Overloading, Access modifiers, arrays-One Dimensional and multi-dimensional arrays, Searching, Sorting.
Strings- Exploring the String class, String buffer class, Command-line arguments

Unit–2: Inheritance, Interfaces, Packages (10 hrs)
Inheritance: Need of inheritance, types, super keyword, abstract classes, interfaces, compile time and runtime polymorphism, Packages.

Unit–3: Exception Handling and I/O Streams (10 hrs)
Exception Handling: Concepts of Exception handling, Built-in exceptions, creating own exception sub classes, Assertions.
Stream based I/O (java.io) – The Stream classes-Byte streams and Character streams, Reading console Input and Writing Console Output, File class, Reading and writing Files, Random access file operations, Object Serialization, exploring java.nio

Unit–4: Multithreading (10 hrs)
Multithreading : Concepts of Multithreading, differences between process and thread, thread life cycle, Thread class, Runnable interface, creating multiple threads, Synchronization, thread priorities, inter thread communication, daemon threads, thread groups.

Unit–5: GUI Programming (10 hrs)
Event Handling- event delegation model, sources of event, Event Listeners, adapter classes, inner classes.

Course Outcomes: Upon successful completion of the course, the student will be able to

| CO1 | Comprehend object-oriented programming concepts for problem solving. |
| CO2 | Build class hierarchy and packages for real world problems. |
| CO3 | Develop thread safe Java programs with appropriate Exception handling. |
| CO4 | Demonstrate multithreaded application programs through a language |
| CO5 | Design GUI applications using swings and multithreading. |
### Text books:


### Reference books:

1. “Java – How to Program”, Paul Deitel, Harvey Deitel, PHI.
3. “Thinking in Java”, Bruce Eckel, Pearson Education

### e-resources:

- https://www.coursera.org/courses?query=java
- https://www.coursera.org/courses?_facet_changed_=true&query=java%20programming
- https://nptel.ac.in/courses/106/105/106105191/
Course objectives:
The main objectives are

1. Study the basic taxonomy and terminology of the data communications & computer networking and enumerate the layers of OSI model and TCP/IP model.
2. Familiarize with the concepts of signals, transmission and its components.
3. Study data link layer concepts, design issues, and protocols
4. Gain core knowledge of Network layer routing protocols and IP addressing
5. Study transport layer services, protocols, and acquire knowledge of application layer paradigms and protocols.

| Unit–1: Introduction to data communications and Network Models (8 hrs) |
| Data Communications, Networks, The Internet, Protocols and Standards. |
| Network Models: Layered tasks, layers in the OSI model, TCP/IP protocol suite. |
| Network Technologies: Ethernet, Token ring, Token bus, RF, Wi-Fi, Bluetooth, and Zigbee. |

| Unit–2: Physical Layer (10 hrs) |
| Data and Signals: Analog and Digital, periodic analog signals, digital signals, transmission impairment, data rate limits, performance. |
| Data Transmission: Digital-to-Digital Conversion, Analog-To-Digital Conversion, Transmission Modes, Multiplexing. |
| Transmission Media: Guided and Unguided transmission media. |
| Switching in Networks: Circuit, Packet and Virtual Circuits (along with the structure of the switches). |

| Unit–3: Data Link Layer (10 hrs) |
| Error Detection and Correction: Block Coding, Linear Block Codes, Cyclic Codes, Checksum |
| Data Link Control: Framing, Error Control and Flow Control (For Both Noisy And Noiseless Channels). HDLC and Point-To-Point Networks. |
| Multiple Access: Random Access, Controlled Access And Channelization. Wired LANs, Wireless LANs and Connecting Devices |

| Unit–4: Network Layer (10 hrs) |

| Unit–5: Transport Layer and Internet Application (10 hrs) |
| Process-to-Process Delivery, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), Congestion Control and Quality of Service (QoS), Sockets. |
| Application Layer: Domain Naming System (DNS), DNS in Internet, Resolution, Remote Logging, Electronic Mail(SMTP), POP and File Transfer. WWW and HTTP. Security Services, Message confidentiality and integrity, Digital Signature, Entity Authentication and key and certificates management, firewalls. |
**Course Outcomes:** Upon successful completion of the course, the student will be able to

<table>
<thead>
<tr>
<th>Course (CO)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Illustrate the OSI and TCP/IP reference model.</td>
</tr>
<tr>
<td>CO2</td>
<td>Understand and explain the concept of signals, data transmission and switching networks.</td>
</tr>
<tr>
<td>CO3</td>
<td>Evaluate data communication link considering elementary concepts of data link layer for error detection and correction.</td>
</tr>
<tr>
<td>CO4</td>
<td>Implement routing and congestion control algorithms</td>
</tr>
<tr>
<td>CO5</td>
<td>Develop application layer protocols</td>
</tr>
</tbody>
</table>

**Text books:**

**Reference books:**

**e-resources:**
- https://nptel.ac.in/courses/106/105/106105183/
- https://www.coursera.org/learn/fundamentals-network-communications#syllabus
- https://www.coursera.org/specializations/computer-communications
Course objectives:
The main objectives are
1. Ability to apply computational thinking to a diverse set of problems.
2. Ability to adapt to new challenges and computational environments.
3. Proficiency in the design and implementation of algorithms.

Lab Prerequisites: Solve the following problems in Hackerrank
1. Time Conversion
2. Diagonal Difference
3. Stair case
4. Birthday Cake candles

UNIT I
1. Implement Binary Search using arrays
2. Implement Insertion Sort.
3. Implement Quick Sort
4. Implement Merge Sort
5. Implement Radix Sort

String Pairs
Anagram

UNIT II
6. Implement stack using arrays
7. Implement conversion of infix to postfix expression.
8. Implement queue using arrays.
9. Implement circular queue
10. Implement Singly Linked List
11. Implement Doubly Linked List
12. Implement Binary Heap Operations.

Minimize the Sum
Implement Expression Tree.

UNIT III
13. Implement Complete Binary Tree
14. Implement Binary Trees Traversal techniques (recursive and non-recursive)
15. Implement Binary Search Tree

UNIT IV
17. Implement Graph and its operations
18. Implement Breadth First Search
19. Implement Depth First Search
20. Implement Prims’ Algorithm
21. Implement Kruskal’s Algorithm

Implement Island Strikes.
Implement Pawn Moves.
UNIT V
22  Implement Linear Probing on a dictionary.
23  Implement Separate Chaining.
24  Implement Brute Force Pattern Matching.
25  Implement Boyer Moore Pattern Matching.

**Course Outcomes:** Upon successful completion of the course, the student will be able to

<table>
<thead>
<tr>
<th>CO1</th>
<th>Select the most appropriate data structure and defend the selection.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO2</td>
<td>Appropriately solve a variety of computational problems.</td>
</tr>
<tr>
<td>CO3</td>
<td>Communicate their results and describe an algorithm.</td>
</tr>
</tbody>
</table>
II-Year-I Semester
PC2103L  |  Java Programming Lab  |  L T P C
|      | 0 0 3 1.5 |

Course objectives:
The main objectives are
1. write programs using abstract classes.
2. write programs for solving real world problems using java collection frame work.
3. write multithreaded programs.
4. design GUI application using swing controls.
5. introduce java compiler and eclipse platform
6. impart hands on experience with java programming.

Note:
➢ Mandatory to follow test driven development with Eclipse IDE empowered JUnit testing framework and code coverage plugin.
➢ The list suggests the minimum program set. Hence, the concerned staff is requested to add more problems to the list as needed.

List of Experiments
1. Create a class called Invoice that a hardware store might use to represent an invoice for an item sold at the store. An Invoice should include four pieces of information as instance variables-a part number (type String),a part description(type String),a quantity of the item being purchased (type int) and a price per item (double). Your class should have a constructor that initializes the four instance variables. Provide a set and a get method for each instance variable. In addition, provide a method named get Invoice Amount() that calculates the invoice amount (i.e., multiplies the quantity by the price per item), then returns the amount as a double value. If the quantity is not positive, it should be set to 0. If the price per item is not positive, it should be set to 0.0. Write a test application named Invoice Test that demonstrates class Invoice’s capabilities. [CO1]

2. Develop a Java application to generate Electricity bill. Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, and type of EB connection (i.e. domestic or commercial). Compute the bill amount using the following tariff. [CO1]
If the type of the EB connection is domestic, calculate the amount to be paid as follows:
  a)  First 100 units - Rs. 1 per unit
  b)  101-200 units - Rs. 2.50 per unit
  c)  201 -500 units - Rs. 4 per unit
  d)  > 501 units - Rs. 6 per unit
If the type of the EB connection is commercial, calculate the amount to be paid as follows:
  a)  First 100 units - Rs. 2 per unit
  b)  101-200 units - Rs. 4.50 per unit
  c)  201 -500 units - Rs. 6 per unit
3. Create class Savings Account. Use a static variable annual Interest Rate to store the annual interest rate for all account holders. Each object of the class contains a private instance variable savings Balance indicating the amount the saver currently has on deposit. Provide method calculate Monthly Interest to calculate the monthly interest by multiplying the savings Balance by annual Interest Rate divided by 12 this interest should be added to savings Balance. Provide a static method modify Interest Rate that sets the annual Interest Rate to a new value. Write a program to test class Savings Account. Instantiate two savings Account objects, saver1 and saver2, with balances of $2000.00 and $3000.00, respectively. Set annual Interest Rate to 4%, then calculate the monthly interest and print the new balances for both savers. Then set the annual Interest Rate to 5%, calculate the next month’s interest and print the new balances for both savers. [CO1]

4. Create a class called Book to represent a book. A Book should include four pieces of information as instance variables-a book name, an ISBN number, an author name and a publisher. Your class should have a constructor that initializes the four instance variables. Provide a mutator method and accessor method (query method) for each instance variable. In addition, provide a method named getBookInfo that returns the description of the book as a String (the description should include all the information about the book). You should use this keyword in member methods and constructor. Write a test application named BookTest to create an array of object for 30 elements for class Book to demonstrate the class Book's capabilities. [CO1].

5. Write a JAVA program to search for an element in a given list of elements using binary search mechanism. [CO1]

6. Write a Java program that implements Merge sort algorithm for sorting and also shows the number of interchanges occurred for the given set of integers. [CO1]

7. Write a java program to make rolling a pair of dice 10,000 times and counts the number of times doubles of are rolled for each different pair of doubles. Hint: Math.random() [CO1].

8. Develop a java application with 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 fund. Generate pay slips for the employees with their gross and net salary. [CO1]

9. Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named print Area(). 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 print Area () that prints the area of the given shape. [CO2]

10. Develop a java application to implement currency converter (Dollar to INR, EURO to INR, Yen to INR and vice versa), distance converter (meter to KM, miles to KM and vice versa), time converter (hours to minutes, seconds and vice versa) using packages. [CO1]
11. Write a Java Program to Handle Arithmetic Exceptions and InputMismatchExceptions. [CO1]

12. Write a multi-threaded Java program to print all numbers below 100,000 that are both prime and Fibonacci number (some examples are 2, 3, 5, 13, etc.). Design a thread that generates prime numbers below 100,000 and writes them into a pipe. Design another thread that generates Fibonacci numbers and writes them to another pipe. The main thread should read both the pipes to identify numbers common to both. [CO3].

13. 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, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number. [CO3].

14. Write a Java program that correctly implements the producer – consumer problem using the concept of inter-thread communication. [CO3].

15. Write a Java program that reads a file name from the user, displays information about whether the file exists, whether the file is readable, or writable, the type of file and the length of the file in bytes. [CO1].

16. Write a Java program to build a Calculator in Swings/ [CO4]

17. Write a Java program to implement JMenu to draw all basic shapes using Graphics. [CO4]

18. Write a Java program to implement JTable and JTree. [CO4]

19. Write a Java program to implement JTabbedPane. [CO4]

20. Write a Java Program that implements a simple client/server application. The client sends data to a server. The server receives the data, uses it to produce a result and then sends the result back to the client. The client displays the result on the console. For ex: The data sent from the client is the radius of a circle and the result produced by the server is the area of the circle. [CO3]

**Course Outcomes:** Upon successful completion of the course, the student will be able to

<table>
<thead>
<tr>
<th>CO1</th>
<th>Develop programs for solving real world problems using java collection frame work</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO2</td>
<td>Develop and apply multithreaded programs in network applications</td>
</tr>
<tr>
<td>CO3</td>
<td>Develop GUI programs using swing controls in Java</td>
</tr>
</tbody>
</table>
Course objectives:
The main objectives are
1. Understand and apply different network commands
2. Analyze different networking functions and features for implementing optimal solutions.
3. Apply different networking concepts for implementing network solution
4. Implement different network protocols

List of Experiments
1. Implement the data link layer framing methods such as character stuffing and bit stuffing.
2. Write a C program to develop a DNS client server to resolve the given hostname.
3. Implement on a data set of characters the three CRC polynomials – CRC-12, CRC-16 and CRC-CCIP.
4. Implement Dijkstra’s algorithm to compute the shortest path in a graph.
5. Take an example subnet graph with weights indicating delay between nodes. Now obtain Routing table art each node using distance vector routing algorithm
6. Take an example subnet of hosts. Obtain broadcast tree for it.
7. Write a client-server application for chat using UDP
8. Implement programs using raw sockets (like packet capturing and filtering)
9. Write a C program to perform sliding window protocol.
10. Get the MAC or Physical address of the system using Address Resolution Protocol.
11. Simulate the Implementing Routing Protocols using border gateway protocol (BGP)
12. Simulate the OPEN SHORTEST PATH FIRST routing protocol based on the cost assigned to the path.

List of additional experiments:
14. Obtain broadcast tree for the given subnet of hosts.
15. Write a C program to determine the host Byte Order.
16. Write a program to set and get socket options.

Course Outcomes: Upon successful completion of the course, the student will be able to

<table>
<thead>
<tr>
<th>Course</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Apply the basics of Physical layer in real time applications</td>
</tr>
<tr>
<td>CO2</td>
<td>Apply data link layer concepts, design issues, and protocols</td>
</tr>
<tr>
<td>CO3</td>
<td>Apply Network layer routing protocols and IP addressing</td>
</tr>
<tr>
<td>CO4</td>
<td>Implement the functions of Application layer and Presentation layer paradigms and Protocols</td>
</tr>
<tr>
<td>II-Year-I Semester</td>
<td>Introduction to Electronics Hardware and Software</td>
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<tr>
<td>SOC2101</td>
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</table>

**Course objectives:**
The main objectives are
1. Gain knowledge of electronic components
2. Understand the concept on different digital electronics components and circuits.
3. Study about electronics and electrical devices
4. Familiarize student with the basic PCB designing concepts.
5. Study about different measuring and signal conditioning instruments.

**Unit–1: General Electronics Building Blocks (10 hrs)**
Study of resistors, capacitors, and inductor coils, Study of voltage and current rating of components
Description to Analog Electronics: Study of rectifier circuits, amplifiers, regulator ICs, Operational amplifiers, oscillators, clocks, ADC and DAC.

**Unit–2: Description to Digital Electronics (10 hrs)**
Role, Scope and Components of Digital Electronics
Study of digital circuits and gates: Logic gates using transistors, study of logic gate ICs, truth table verification using logic gate ICs,
Description to combinational circuits: Adder, Mux, Demux, Encoder, Decoder, BCD to Seven Segment Encoder.
Description to sequential circuits: Flip-flops, Latches, Registers, Counters.

**Unit–3: Power Supply Systems, electronic and electrical devices (8 hrs)**
Concept of positive and negative power supply, Study of voltage step up/down concept, Description of filter and regulators, fixed and variable +ve and –ve supply.

**Study of other electronics and electrical devices**
Description to permanent DC motors, stepper and servo motors
Concept of driving motors: H-bridge concept, High current driver ICs
Role of different motors in different applications: Robotic, door open/close, wheels driving.
Description of relays: Working mechanism, types of relays, controlling the motor direction.
Description of buzzer: Types, Piezoelectric, Mechanical, Interfacing buzzer, Uses of buzzer.
Description to optocoupler, applications.
Description to LEDs and Seven segment display: Types, common cathode, common anode.

**Unit–4: Introduction to PCB Designing concepts (11 hrs)**
PCB designing flow chart, Description of PCB layers, study of IPC standards.

**Unit–5: Study of measuring instruments and signal conditioning (9 hrs)**

**Measuring instruments**
Types, CRO, DSO, Digital Multimeter.

**Component interconnection and signal conditioning**
Introduction, Impedance, Impedance matching methods, Amplifiers, Analog filters, Modulators and Demodulators, Data Acquisition hardware, Bridge circuits, Linearizing devices, Miscellaneous signal modification hardware.

**Software’s used:**
For PCB designing: PCBWeb Designer, ZenitPCB, TinyCAD, Osmond PCB, BSch3V, Express PCB, Kicad, Fritzing, DesignSpark PCB, EasyEDA.
For simulation: ORCAD PSPICE, Tina Pro

Course Outcomes: Upon successful completion of the course, the student will be able to

| CO1 | Identify and differentiate electronic components and designing simple analog circuits |
| CO2 | Identify digital electronic components and designing simple digital circuits |
| CO3 | Demonstrate the purpose of supply units and control of motor circuits. |
| CO4 | Describe the process of preparing PCB as per standards |
| CO5 | Use of instruments and conditioning devices for obtaining measurements. |

Text books:
4. “Complete PCB Design Using OrCAD Capture and PCB Editor”, Kraig Mitzner, 2009, Elsevier Science

Reference books:

e-resources:
1. http://www.emtech.in/courses/electronics-hardware-design-2/
Course objectives:
The main objectives are

1. Impart basic principle of third process reasoning and inference sustainability is at the course of Indian traditional knowledge system
2. Understand the legal framework and traditional knowledge and biological diversity act 2002 and geographical indication act 2003
3. Focus on traditional knowledge and intellectual property mechanism of traditional knowledge and protection
4. Know the student traditional knowledge in different sector

Unit–1:
Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal knowledge.

Unit–2:
Protection of traditional knowledge: the need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.

Unit–3:

Unit–4:
Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, global legal FORA for increasing protection of Indian Traditional Knowledge.

Unit–5:
Traditional knowledge in different sectors: Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK.
Course Outcomes: Upon successful completion of the course, the student will be able to

| CO1 | Understand the concept of Traditional knowledge and its importance |
| CO2 | Know the need and importance of protecting traditional knowledge |
| CO3 | Know the various enactments related to the protection of traditional knowledge |
| CO4 | Understand the concepts of Intellectual property to protect the traditional knowledge |
| CO5 | Understand the importance of Intellectual property in different sectors |

Text books:

Reference books:
1. “Knowledge Traditions and Practices of India”, 2012, Kapil Kapoor, Michel Danino

e-resources:
1. https://www.youtube.com/watch?v=LZP1StpYEPM
2. http://nptel.ac.in/courses/121106003/
II-Year-II Semester  
BS2201 Probability and Statistics  

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<td>3</td>
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</table>

Course objectives:
The main objectives are:
1. To classify the concepts of data science and its importance.
2. To interpret the association of characteristics and through correlation and regression tools.
3. To understand the concepts of probability and their applications, apply discrete and continuous probability distributions.
4. To design the components of a classical hypothesis test.
5. To infer the statistical inferential methods based on small and large sampling tests.

Unit-1: Descriptive statistics and methods for data science (9 hrs)

Unit-2: Correlation and Curve fitting (9 hrs)
Correlation-correlation coefficient-Rank correlation-Regression coefficient and properties-regression lines-Multiple regression-Method of least squares-Straight line-parabola-Exponential-Power curves.

Unit-3: Probability and Distributions (10 hrs)
Probability-Conditional probability and Baye’s theorem-Random variables-Discrete and Continuous random variables-Distribution function-Mathematical Expectation and Variance-Binomial, Poisson, Uniform and Normal distributions.

Unit-4: Sampling Theory (10 hrs)
Introduction-Population and samples-Sampling distribution of Means and Variance (definition only)-Central limit theorem (without proof)-Point and Interval estimations, Good estimator, Unbiased estimator, Efficiency estimator-Maximum error of estimate.

Unit-5: Test of Hypothesis (10 hrs)
Introduction-Hypothesis-Null and Alternative Hypothesis-Type I and Type II errors-Level of significance-One tail and two-tail tests-Tests concerning one mean, two means, and proportions using Z test, Tests concerning one mean, two means using t test, also chi-square and F tests use for small samples.

Course Outcomes: Upon successful completion of the course, the student will be able to

<table>
<thead>
<tr>
<th>CO1</th>
<th>Classify the concepts of data science and its importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO2</td>
<td>Understand the concepts of probability and their applications, &amp; apply discrete and continuous probability distributions</td>
</tr>
<tr>
<td>CO3</td>
<td>Interpret the association of characteristics and through correlation and regression tools</td>
</tr>
<tr>
<td>CO4</td>
<td>Design the components of a classical hypothesis test</td>
</tr>
<tr>
<td>CO5</td>
<td>Infer the statistical inferential methods based on small and large sampling tests</td>
</tr>
</tbody>
</table>

Text books:
### Reference books:


### e-resources:

1. https://www.youtube.com/watch?v=COI0BUmNHT8&list=PLyqSpQzTE6M_JcleDbrVyPnE0PixKs2JE
   (For Probability and Statistics)
2. https://www.youtube.com/watch?v=VVYLpmKRfQ8&list=PL6C92B335BD4238AB
   (For Probability and Statistics)
   (Information about Normal distribution)
   (Information about T- distribution)

Statistical Tables to be allowed in examinations:

a) Normal distribution table  
b) T- distribution table
Course objectives:
The main objectives are
1. To understand basic structures of computers and to understand various machine instructions.
2. To understand basic structures of computers and to understand various machine instructions.
3. To analyse ALU & I/O organization of a computer.
4. To understand various memory systems.
5. To analyse functionalities done by processing unit and also learn micro programmed control.

Unit–1: Basic Structure of a Computer and Machine Instructions (8 hrs)

Unit–2: Addressing modes and types of Instructions (10 hrs)
Addressing Modes, Basic Input/output Operations, and role of Stacks and Queues in computer programming equation.
Component of Instructions: Logical Instructions, shift and Rotate Instructions. Type of Instructions: Arithmetic and Logic Instructions, Branch Instructions, Addressing Modes, Input/output Operations

Unit–3: Basic building blocks for the ALU (10 hrs)

Unit–4: The Memory Systems (8 hrs)

Unit–5: Processing unit (12 hrs)
Fundamental Concepts: Register Transfers, Performing an Arithmetic or Logic Operation, Fetching a Word from Memory, Execution of Complete Instruction, Hardwired Control, MICRO PROGRAMMED CONTROL: Microinstructions, Micro program Sequencing, Wide Branch Addressing Microinstructions with next –Address Field.
### Course Outcomes

| CO1 | comprehend basic structures of computers and to understand various machine instructions |
| CO2 | learn and use the addressing modes and types of instructions |
| CO3 | analyze I/O organization of a computer. |
| CO4 | comprehend various memory systems |
| CO5 | analyze functionalities done by processing unit and also learn micro programmed control |

### Text books:


### Reference books:


### e-resources:

1. https://nptel.ac.in/courses/106/105/106105163/
Course Objectives:
The main objectives are
1. Study the basic concepts and functions of operating system
2. Learn about Processes, Threads and Scheduling algorithms
3. Understand the principles of concurrency and Deadlocks
4. Learn various memory management schemes
5. Study I/O management and File systems

Unit – 1: Introduction to Operating System Concepts (8 hrs)

Unit – 2: Process Management & Threads (10 hrs)

Unit – 3: Concurrency & Principles of deadlock (10 hrs)
Concurrency: Process Synchronization, The Critical- Section Problem, Peterson’s Solution, Synchronization Hardware, Semaphores, Monitors, and Classic Problems of Synchronization.

Unit – 4: Memory management & Virtual memory management (10 hrs)
Memory Management: Logical vs physical address space, Swapping, Contiguous Memory Allocation, Paging, Structures of the Page Table, Segmentation.
Virtual Memory Management: Virtual memory overview, Demand Paging, Page-Replacement & its algorithms, Allocation of Frames, Thrashing.

Unit – 5: File system interface, implementation and mass storage structure (10 hrs)
File system Interface: The concept of a file, Access Methods, Directory structure, files sharing, protection.
File System implementation: File system structure, Allocation methods, and Free-space management.
Mass-storage structure: overview of Mass-storage structure, Disk scheduling, Swap space management.

Course Outcomes: Upon successful completion of the course, the student will be able to

<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>CO1</td>
<td>Understand the structure and functionalities of Operating System</td>
</tr>
<tr>
<td>CO2</td>
<td>Demonstrate the concept of Process, Threads and CPU Scheduling Algorithms</td>
</tr>
<tr>
<td>CO3</td>
<td>Use the principles of Concurrency to solve Synchronization problems and methods of deadlocks</td>
</tr>
<tr>
<td>CO4</td>
<td>Infer various Memory Management Techniques</td>
</tr>
<tr>
<td>CO5</td>
<td>Illustrate File System Implementation</td>
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<td>Text books:</td>
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<th>Reference books:</th>
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<tr>
<th>e-resources:</th>
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<tbody>
<tr>
<td>➢ <a href="https://en.wikipedia.org/wiki/Operating_system">https://en.wikipedia.org/wiki/Operating_system</a></td>
</tr>
<tr>
<td>➢ <a href="https://www.tutorialspoint.com/operating_system/">https://www.tutorialspoint.com/operating_system/</a></td>
</tr>
</tbody>
</table>
## Course objectives:

The main objectives are

1. Study the basic concepts and importance of Database Management Systems
2. Learn and understand the conceptual design of database and information retrieval
3. Learn various commands and writing of queries for information retrieval
4. Understand the concepts of Database design
5. Study of internal storage and its access.

### Unit–1: Introduction (10 hrs)

Introduction to Database, Applications of Database, Purpose of Database, View of Data, Data Independence, Data Models, Users of Database, DBA, Query Processor, Storage Manager, Database Architecture

### Unit–2: Conceptual Design & Relational Query Languages (10 hrs)

Conceptual Design of Database using ER Model, Notations, Types of attributes, Relation, Mapping Constraints, Features of ER Diagram, Weak Entity Set, Examples of Conceptual Design

Relational Algebra: Selection, Projection, Set Operations, Rename, Cartesian-Product, Join, Outer Join, Examples,

Relational Calculus: Tuple Relational Calculus and Domain Relational Calculus, Safety Expressions

### Unit–3: SQL & PL/SQL (10 hrs)

SQL Commands: DDL, DML, TCL, DCL.

Types of Constraints (Primary, Alternate, Not Null, Check, Foreign), Basic form of SQL query, joins, outer joins, set operations, group operations, various types of queries, PL/SQL (Cursor, Procedures, Functions, Packages, Triggers…)

### Unit–4: Database Design (10 hrs)

Database Design: Normalization, Purpose of Normalization, Functional Dependency, Closure, 1NF, 2NF, 3NF, BCNF, MVFD, 4NF, Join Dependency, 5NF

Why NoSQL? Importance of NoSQL

### Unit–5: Transaction, Data Recovery & Storage Management (8 hrs)


Recovery Management: Types of failures, ideal storage, Log, Log records, log based recovery techniques, Shadow Paging, ARIES

File Organization & Indexing: Types of File Organizations, Primary Indexing, Secondary Indexing, Multi-level Indexing, Hash Indexing, Tree Indexing

### Course Outcomes:

Upon successful completion of the course, the student will be able to

<p>| CO1 | comprehend the basics of database systems and applications |
| CO2 | construct logical design of database and information retrieval |</p>
<table>
<thead>
<tr>
<th><strong>CO3</strong></th>
<th>demonstrate relational model practically (Structured Query Language)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CO4</strong></td>
<td>demonstrate and relate normalization for database design</td>
</tr>
<tr>
<td><strong>CO5</strong></td>
<td>outline the necessity of transaction management, recovery management, file organization &amp; indexing</td>
</tr>
</tbody>
</table>

**Text books:**
1. Database System Concepts, 5/e, Silberschatz, Korth, TMH
2. Introduction to Database Systems, CJ Date, Pearson

**Reference books:**
2. Fundamentals of Database Systems, ElmasriNavate Pearson Education
II-Year-II Semester
PC2203 Introduction to IoT

Course objectives:
The main objectives are
1. Introducing the IoT related sensors, infrastructural and networking technologies.
2. Understand various modules and protocols used in IoT environment.
3. Understand the core technologies behind IoT.
4. Encourage analysis, design, and development of IoT applications.
5. Identify the real-world scenarios and apply the IoT solutions for a better solution.

Unit-1: Introduction (10 hrs)

Unit-2: Control units (9 hrs)

Unit-3: Four Pillars of IoT Paradigm (10 hrs)

Unit-4: IoT System Design (10 hrs)

Unit-5: API Development Tools (9 hrs)
Python based API development, Set up cloud environment –Cloud access from sensors– Data Analytics for IoT- Case studies- Smart Healthcare – Smart Cities – Other recent projects.

Course Outcomes: Upon successful completion of the course, the student will be able to

| CO1  | Identify the basic building blocks of Internet of Things. |
| CO2  | Design and develop protocols and modules for IoT applications |
| CO3  | Understand and implement the technologies required for the development of IoT applications. |
| CO4  | Implement applications based on sensors and other microcontroller boards. |
| CO5  | Build cloud-based IoT applications in real-time. |

Text books:

Reference books:
1. Building Internet of Things with the Arduino, Charalampos Doukas, 2002, Create space.
2. Internet of Things: From research and innovation to market deployment, Dr. Ovidiu Vermesan and Dr. Peter Friess, 2014, River Publishers.

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</tr>
<tr>
<td>3. <a href="https://nptel.ac.in/courses/106/105/106105166/">https://nptel.ac.in/courses/106/105/106105166/</a></td>
</tr>
</tbody>
</table>
**Course objectives:**
The main objectives are
1. Understand the working of logic families and logic gates.
2. Interpreting the design of combinational and sequential circuits.
3. Understand the concept of IoT and its design procedures.
4. Study the IoT concepts and its applications.

**List of Experiments:**

**Related to computer organization**
1. Realization of Boolean Expressions using Gates.
2. Design and realization logic gates using universal gates.
3. Design a JK Flip-Flop, Edge triggered J-K NAND Flip Flop and show its functionality.
   Handle race condition and clock gating in your circuit.
7. Study of sequential logic circuits: Implementation of flip flops, Verify the excitation tables of various FLIP-FLOPS.

**Related to IoT**
8. Design and implementation of cloud based smart home automation system.
9. Real time monitoring of water level of storage tank using IoT.
10. IoT based smart agricultural monitoring and Irrigation system.
11. Intelligent gas leakage detection system with IoT.
12. Design and implementation of IoT based smart power management system.
13. An IoT based human intrusion detection and alerting system.

**List of additional experiments:**
15. Design and realization of an 8-bit parallel load and serial out shift register using flip flops.
17. Design and realization of 4x1 mux, 8x1mux using 2x1 mux.
18. Smart industry protection system using IoT.
19. IoT based smart health monitoring system.
20. IoT based fire accident alarming mechanism.
21. IoT based asses tracking mechanism.

**Note:** Experiments can be done using Logic board, EasyCPU, RTSlim, Little Man Computer (LMC), Arduino UNO, Arduino Nano, or NODEMCU using Arduino Open-Source IDE.

**Course Outcomes:** Upon successful completion of the course, the student will be able to

| CO1 | Know the characteristics of various components and logic circuits. |
| CO2 | Realize and design of combinational and sequential circuits. |
**CO3** Demonstrate the implementation of IoT designs.

**CO4** Develop the prototype models to solve real time problems.

2. “The Internet of Things-Do it Yourself at Home Projects for Arduino, Raspberry Pi and BeagleBone Black”, Donald Norris, 2015, TMH. |
|---|---|
| e-resources: | 1. http://vlabs.iitkgp.ernet.in/coa/#  
2. https://iotify.io/iot-virtual-lab/  
Course objectives:
The main objectives are
1. Ability to apply computational thinking to a diverse set of problems.
2. Ability to analyse the working of an OS as a resource manager, file system manager, process manager, memory manager and I/O manager and methods used to implement the different parts of OS.
3. Proficiency in the design and implementation of algorithms

List of Experiments
1. Simulate the following CPU scheduling algorithms [CO1]
   a. FCFS
   b. SJF (Preemptive, Non Preemptive)
   c. Priority (Preemptive, Non Preemptive)
   d. Round Robin
2. Simulate the following Process Synchronization techniques [CO1]
   a. Bounded-Buffer problem
   b. Readers-Writers problem
   c. Dining philosophers problem using semaphores
   d. Dining-Philosophers Solution using Monitors
3. Simulate Bankers Algorithm for [CO1]
   a. Dead Lock Avoidance
   b. Dead Lock Prevention
4. Simulate the following page replacement algorithms. [CO2]
   a. FIFO
   b. LRU
   c. LFU
   d. MFU
5. Simulate the following [CO2]
   a. Multiprogramming with a fixed number of tasks (MFT)
   b. Multiprogramming with a variable number of tasks (MVT)
6. Simulate the following File allocation strategies [CO3]
   a. Contiguous
   b. Linked
   c. Indexed
7. Simulate the following disk-scheduling algorithms [CO3]
   a. FCFS
   b. SSTF
   c. SCAN
   d. C-SCAN
   e. LOOK
   f. C-LOOK
**Course Outcomes:** Upon successful completion of the course, the student will be able to

<table>
<thead>
<tr>
<th>CO1</th>
<th>Examine various process management techniques like CPU scheduling, process synchronization and deadlocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO2</td>
<td>Prioritize various memory management techniques like page replacement algorithms</td>
</tr>
<tr>
<td>CO3</td>
<td>Analyse various storage management techniques like file allocation and disk scheduling</td>
</tr>
</tbody>
</table>
Course objectives:
The main objectives are
1. Familiarize the participant with the distinctions of database environments towards an information-oriented framework
2. Give a good formal foundation on the relational model of data
3. Present SQL and procedural interfaces to SQL comprehensively.

List of Experiments
SQL
1. Queries for Creating, Dropping, and Altering Tables, Views, and Constraints [CO1]
2. Queries to facilitate acquaintance of Built-In Functions, String Functions, Numeric Functions, Date Functions and Conversion Functions. [CO1]
3. Queries using operators in SQL [CO2]
4. Queries to Retrieve and Change Data: Select, Insert, Delete, and Update [CO2]
5. Queries using Group By, Order By, and Having Clauses [CO2]
6. Queries on Controlling Data: Commit, Rollback, and Save point [CO2]
7. Queries on Joins and Correlated Sub-Queries [CO2]
8. Queries on Working with Index, Sequence, Synonym, Controlling Access, and Locking Rows for Update, Creating Password and Security features [CO2]

PL/SQL
1. Write a PL/SQL Code using Basic Variable, Anchored Declarations, and Usage of Assignment Operation [CO3]
2. Write a PL/SQL Code Bind and Substitution Variables. Printing in PL/SQL [CO3]
3. Write a PL/SQL block using SQL and Control Structures in PL/SQL [CO3]
4. Write a PL/SQL Code using Cursors, Exceptions and Composite Data Types [CO3]
6. Write a PL/SQL Code Creation of forms for any Information System such as Student Information System, Employee Information System etc. [CO4]
7. Demonstration of database connectivity [CO4]

Course Outcomes: Upon successful completion of the course, the student will be able to

| CO1 | create database for user (Creation of Database) |
| CO2 | solve various SQL queries for user defined schemas |
| CO3 | generalize PL/ SQL blocks |
| CO4 | illustrate the usage of user defined packages |
### Course Objectives:
The main objectives are
1. Learning theory related to sensors and actuators.
2. Introducing the concept of estimation and measurement.
3. Learn the theory of analog sensors.
4. Learn the theory of digital sensors.
5. Describe the process of controlling actuators.

### Course Outcomes:
Upon successful completion of the course, the student will be able to

<table>
<thead>
<tr>
<th>CO1</th>
<th>Understanding basics and applications of sensors and actuators.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO2</td>
<td>Acquire knowledge on various estimation methods.</td>
</tr>
<tr>
<td>CO3</td>
<td>Understanding working principles of analog sensors.</td>
</tr>
<tr>
<td>CO4</td>
<td>Understanding working principles of digital sensors.</td>
</tr>
<tr>
<td>CO5</td>
<td>Outline the control strategies of actuators.</td>
</tr>
</tbody>
</table>

### Textbook:

### Reference Books:

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<table>
<thead>
<tr>
<th>Unit 1: Introduction (9 hrs)</th>
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</thead>
<tbody>
<tr>
<td>Role of sensors and actuators, application scenarios, human sensory system, mechatronic engineering, control system architecture, instrumentation process.</td>
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</table>

<table>
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<tr>
<th>Unit 2: Estimation from measurement (10 hrs)</th>
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<tbody>
<tr>
<td>Sensing and estimation, Least squares estimation, maximum likelihood estimation, static and dynamic Kalman filter.</td>
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</table>

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<tr>
<th>Unit 3: Analog sensors and Transducers (11 hrs)</th>
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</thead>
<tbody>
<tr>
<td>Sensors and Transducers terminology, types and selection, sensors for electromechanical applications, potentiometer, variable inductance transducers, permanent magnet and eddy current transducers, variable capacitance transducers, piezoelectric sensors, strain gauges, torque sensors, gyroscopic sensors, thermo fluid sensors.</td>
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<thead>
<tr>
<th>Unit 4: Digital and innovative sensors (9 hrs)</th>
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</thead>
<tbody>
<tr>
<td>Innovative sensor technology, shaft encoders, incremental optical encoder, motion sensor, data acquisition process, absolute optical encoder, optical sensors, lasers and cameras, miscellaneous sensor technologies, MEMS sensor, wireless sensor networks.</td>
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<table>
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<tr>
<th>Unit 5: Control strategies of actuators (9 hrs)</th>
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</thead>
<tbody>
<tr>
<td>Principle of operation, Actuator classification, requirement and applications, control of stepper motors, control of DC motors, control of induction motors, concept and control of hydraulic actuators</td>
</tr>
</tbody>
</table>

| Software’s used: CAD, ANSYS, COMSOL, 3D Printing, PLC, Proteus, |
2. Sensors and Actuators in Smart Cities, Mohammad Hammoudeh, 2018, Mdpi AG

**e-resources:**

1. https://nptel.ac.in/courses/108/108/108108147/
# SYLLABUS FOR HONORS

## II-Year-II Semester

**HO2201 Advanced Python Programming**

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## Course objectives:

The main objectives are:

1. teach advanced concepts in Python
2. to use advanced packages like numpy, scipy, opencv in Python for building data processing & visualizing applications.
3. to process digital imaging applications

<table>
<thead>
<tr>
<th>Unit–1: (10 hrs)</th>
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<tbody>
<tr>
<td><strong>Python Fundamentals</strong>: Introduction to Python, Data Structures – List, Dictionaries, Sets and Tuples.</td>
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<tr>
<th>Unit–2: (10 hrs)</th>
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<tbody>
<tr>
<td><strong>Python packages</strong>: Introduction to PIP, Installing Packages via PIP, Using Python Packages</td>
</tr>
<tr>
<td><strong>Data Visualization</strong> – Matplotlib - Loading the library and importing the data, How Mat plot lib works?, modifying the appearance of a plot, Plotting multiple plots, Modifying the tick marks, Scatter plots, Bar plots.</td>
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<tr>
<th>Unit–3: (10 hrs)</th>
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<tbody>
<tr>
<td><strong>File Handling</strong> – Introduction to Files, File modes, Reading, Writing data from files, Copy one file to another, deletion of files. Other file programs in Python.</td>
</tr>
<tr>
<td><strong>Text Processing</strong>: Word, character and line counting, Frequency count. Usage of with() and split(). Reading and writing into CSV formats.</td>
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<table>
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<tr>
<th>Unit–4: (10 hrs)</th>
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<tbody>
<tr>
<td><strong>Image Processing</strong> - Installing Jupiter notebook. Image &amp; Its properties. Image processing applications. Image I/O and display with Python, Reading, saving and displaying an image using Open CV - PyPI, matplotlib</td>
</tr>
<tr>
<td>Sample programs – Image statistics Croping, Converting images from RGB to Gray and resizing the image.</td>
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<table>
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<tr>
<th>Unit–5: (8 hrs)</th>
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<tbody>
<tr>
<td><strong>Using Databases and SQL</strong> – Introduction to Database Concepts, usage of SQLite, Create, Insert &amp; Retrieve data, Spidering twitter using a database. Sample Python codes</td>
</tr>
</tbody>
</table>

## Course Outcomes:

Upon successful completion of the course, the student will be able to:

| CO1 | Recall the usage of Python Concepts. |
| CO2 | Use different Python packages for Data Visualization |
| CO3 | Demonstrate File handling & text processing |
| CO4 | Demonstrate applications that performs Image processing |
| CO5 | Connect database with Python |
### Text books:

1. Python for Everybody: Exploring Data Using Python 3, Charles Severance
2. The Hitchiker’s Guide to Python, O’Reilly publication

### Reference books:

2. Think Python, Allen Downey, Green Tea Press

### e-resources:

1. https://nptel.ac.in/courses/117/105/117105079/
2. https://nptel.ac.in/courses/106/106/106106145/#
## Course Objectives:
The main objectives are:
1. Describe the principles and procedures for designing test cases.
2. Provide supports to debugging methods.
3. Acts as the reference for software testing techniques and strategies.

### Unit-1: (10 hrs)

### Unit-2: (9 hrs)

### Unit-3: (11 hrs)

### Unit-4: (9 hrs)

### Unit-5: (9 hrs)

### Course Outcomes:
Upon successful completion of the course, the student will be able to:
- **CO1** Understand the basic testing procedures.
- **CO2** Support in generating test cases and test suites.
- **CO3** Test the applications manually by applying different design testing methods.
- **CO4** Test the applications manually by applying different syntax testing methods.
- **CO5** Apply tools to resolve the problems in the real-time environment.

### Textbooks:

### Reference Books:
- None specified.
1. Software Testing Techniques – SPD(Oreille)
**II-Year-II Semester**

HO2201  **Advanced JAVA Programming**

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**Course objectives:**
The main objectives are

1. impart the knowledge on collection framework.
2. make the students to develop network-based applications
3. introduce XML and processing of XML Data with Java
4. introduce Server-side programming with Java Servlets and JSP

**Unit–1: (10 hrs)**


**Unit–2: (10 hrs)**

**Introduction to Networking:** Basics of Networking, Networking classes and Interfaces, Networking with URLs, exploring java.net package.

**JDBC Connectivity:** JDBC connectivity, types of Jdbc Drivers, connecting to the database, JDBC Statements, JDBC Exceptions, Manipulations on the database

**Unit–3: (10 hrs)**

**HTML Common tags**- List, Tables, images, forms, Frames; Cascading Style sheets;

**XML:** Introduction to XML, Defining XML tags, their attributes and values, Document Type Definition, XML Schemas, Document Object Model, and Extensible Style sheet Language and XSL Transformations, Parsing XML Data – DOM and SAX Parsers in java.

**Unit–4: (10 hrs)**

**Introduction to Servlets:** Life cycle of a Servlet, deploying a servlet, The Servlet API, Reading Servlet parameters, Reading Initialization parameters, Handling Http Request & Responses, Using Cookies and Sessions.

**Unit–5: (8 hrs)**


**Course Outcomes:** Upon successful completion of the course, the student will be able to

<table>
<thead>
<tr>
<th>CO1</th>
<th>Use various data structures using java collections</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO2</td>
<td>Comprehend the trade-offs of implementation of priority queues</td>
</tr>
<tr>
<td>CO3</td>
<td>Implement web based applications using features of HTML and XML</td>
</tr>
<tr>
<td>CO4</td>
<td>Appreciate the importance and significance of graph algorithms in building and solving real world applications</td>
</tr>
<tr>
<td>CO5</td>
<td>Comprehend and implement algorithms for pattern matching in a text</td>
</tr>
</tbody>
</table>

**Text books:**

2. Internet and World Wide Web – How to program, Dietel and Nieto, Pearson.

**Reference books:**

Course objectives:
The main objectives are
1. To understand the algorithms available for the processing of linguistic information and computational properties of natural languages.
2. To conceive basic knowledge on various morphological, syntactic and semantic NLP tasks.
3. To familiarize various NLP software libraries and data sets publicly available.
4. To develop systems for various NLP problems with moderate complexity
5. To learn various strategies for NLP system evaluation and error analysis.

Unit–1: (9 hrs)
Introduction to NLP: Introduction and applications, NLP phases, Difficulty of NLP including ambiguity; Spelling error and Noisy Channel Model; Concepts of Parts-of-speech and Formal Grammar of English.

Unit–2: (9 hrs)
Language Modelling: N-gram and Neural Language Models, Language Modelling with N-gram, Simple N-gram models, Smoothing (basic techniques), Evaluating language models; Neural Network basics, Training; Neural Language Model, Case study: application of neural language model in NLP system development.

Unit–3: (10 hrs)
Parts-of-speech Tagging Parts-of-speech Tagging: basic concepts; Tagset; Early approaches: Rule based and TBL; POS tagging using HMM, Introduction to POS Tagging using Neural Model.

Unit–4: (10 hrs)
Parsing Basic concepts: top down and bottom up parsing, treebank; Syntactic parsing: CKY parsing; Statistical Parsing basics: Probabilistic Context Free Grammar (PCFG); Probabilistic CKY Parsing of PCFGs.

Unit–5: (10 hrs)
Semantics Vector Semantics: Words and Vector; Measuring Similarity; Semantics with dense vectors; SVD and Latent Semantic Analysis; Embeddings from prediction: Skip-gram and CBOW; Concept of Word Sense; Introduction to WordNet.

Course Outcomes: Upon successful completion of the course, the student will be able to
- Describe the concepts of morphology, syntax, semantics, discourse & pragmatics of natural language.
- Demonstrate understanding of the relationship between NLP and statistics & machine learning.
- Discover various linguistic and statistical features relevant to the basic NLP task, namely, spelling correction, morphological analysis, parts-of-speech tagging, parsing and semantic analysis.
- Develop systems for various NLP problems with moderate complexity.
- Evaluate NLP systems, identify shortcomings and suggest solutions for these shortcomings.
Text books:


Reference books:

2. Goldberg Yoav “A Primer on Neural Network Models for Natural Language Processing”.