PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

1. To enable the graduates to demonstrate their skills in design and develop medical devices for health care system through the core foundation and knowledge acquired in engineering and biology.

2. To enable the graduates to exhibit leadership in health care team to solve health care problems and make decisions with societal and ethical responsibilities.

3. To carry out multidisciplinary research, addressing human healthcare problems and sustain technical competence with ethics, safety and standards.

4. To ensure that graduates will recognize the need for sustaining and expanding their technical competence and engage in learning opportunities throughout their careers.

PROGRAM OUTCOMES (POs)

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

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

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

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

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

6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

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

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

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

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

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

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

III. PROGRAM SPECIFIC OUTCOMES (PSOs)

1. To design and develop diagnostic and therapeutic devices that reduces physician burnout and enhance the quality of life for the end user by applying fundamentals of Biomedical Engineering.

2. To apply software skills in developing algorithms for solving healthcare related problems in various fields of Medical sector.

3. To adapt to emerging information and communication technologies (ICT) to innovate ideas and solutions for current societal and scientific issues thereby developing indigenous medical instruments that are on par with the existing technology
## SEMESTER I

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*Skill Based Course

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

§ Skill Based Course
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<sup>a</sup> Skill Based Course

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<sup>b</sup> NCC Credit Course level 2 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA.
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*Open Elective – I Shall be chosen from the list of open electives offered by other Programmes

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

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

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

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

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

### SEMESTER VIII / VII*

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

TOTAL CREDITS : 163

### ELECTIVE – MANAGEMENT COURSES

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### MANDATORY COURSES II

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### PROFESSIONAL ELECTIVE COURSES: VERTICALS

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<th>Vertical IV</th>
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<td>Medical Device Innovation and Development</td>
<td>Management (Healthcare)</td>
<td>Mechanics</td>
<td>Signal and Image Processing</td>
<td>Communication</td>
<td>Advanced Healthcare Devices</td>
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<tr>
<td>Artificial Organs and Implants</td>
<td>Medical Device Design</td>
<td>Hospital Planning and Management</td>
<td>Rehabilitation Engineering</td>
<td>Computer Vision</td>
<td>Wearable Devices</td>
<td>Critical Care Equipment</td>
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<tr>
<td>Biomedical Optics and Photonics</td>
<td>Patient safety, Standards and Ethics</td>
<td>Medical Waste Management</td>
<td>Physiological Modelling</td>
<td>Speech and Audio Signal Processing</td>
<td>Body Area Networks</td>
<td>Human Assist Devices</td>
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<td>Genetic Engineering</td>
<td>Rapid Prototyping</td>
<td>Forensic Science in Healthcare</td>
<td>Haptics</td>
<td>Biometrics</td>
<td>Medical Informatics</td>
<td>Therapeutic Equipment</td>
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</table>

**Registration of Professional Elective Courses from Verticals:**

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

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

## VERTICAL 1: BIO ENGINEERING

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## VERTICAL 2: MEDICAL DEVICE INNOVATION AND DEVELOPMENT

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## VERTICAL 7: ADVANCED HEALTHCARE DEVICES

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

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<td>45.</td>
<td>OPE354</td>
<td>Unit Operations in Petro Chemical Industries</td>
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<td>46.</td>
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<td>47.</td>
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<td>48.</td>
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<tr>
<td>49.</td>
<td>OEC354</td>
<td>Industrial IoT and Industry 4.0</td>
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<td>50.</td>
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## SUMMARY

### Name of the Programme: B.E. Biomedical Engineering

<table>
<thead>
<tr>
<th>S.No</th>
<th>Subject Area</th>
<th>Credits per Semester</th>
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<tr>
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<td>PEC</td>
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<td>(Mandatory)</td>
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</table>

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

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

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

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

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

(In addition to all the verticals of other programmes)

<table>
<thead>
<tr>
<th>Vertical I</th>
<th>Vertical II</th>
<th>Vertical III</th>
<th>Vertical IV</th>
<th>Vertical V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fintech and Block Chain</td>
<td>Foundations of Entrepreneurship</td>
<td>Principles of Public Administration</td>
<td>Statistics for Management</td>
<td>Sustainable infrastructure Development</td>
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<tr>
<td>Financial Management</td>
<td>Team Building &amp; Leadership Management for Business</td>
<td>Constitution of India</td>
<td>Datamining for Business Intelligence</td>
<td>Sustainable Agriculture and Environmental Management</td>
</tr>
<tr>
<td>Fundamentals of Investment</td>
<td>Creativity &amp; Innovation in Entrepreneurship</td>
<td>Public Personnel Administration</td>
<td>Human Resource Analytics</td>
<td>Sustainable Bio Materials</td>
</tr>
<tr>
<td>Banking, Financial Services and Insurance</td>
<td>Principles of Marketing Management For Business</td>
<td>Administrative Theories</td>
<td>Marketing and Social Media Web Analytics</td>
<td>Materials for Energy Sustainability</td>
</tr>
<tr>
<td>Introduction to Blockchain and its Applications</td>
<td>Human Resource Management for Entrepreneurs</td>
<td>Indian Administrative System</td>
<td>Operation and Supply Chain Analytics</td>
<td>Green Technology</td>
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<tr>
<td>Fintech Personal Finance and Payments</td>
<td>Financing New Business Ventures</td>
<td>Public Policy Administration</td>
<td>Financial Analytics</td>
<td>Environmental Quality Monitoring and Analysis</td>
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<tr>
<td>Introduction to Fintech</td>
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<td>-</td>
<td>-</td>
<td>Integrated Energy Planning for Sustainable Development</td>
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<td>-</td>
<td>-</td>
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<td>Energy Efficiency for Sustainable Development</td>
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(choice of courses for Minor degree is to be made from any one vertical of other programmes or from anyone of the following verticals)

**VERTICAL 1: FINTECH AND BLOCKCHAIN**

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<tr>
<th>S. NO.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
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<th>PERIODS PER WEEK</th>
<th>TOTAL CONTACT PERIODS</th>
<th>CREDITS</th>
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<tbody>
<tr>
<td>1.</td>
<td>CMG331</td>
<td>Financial Management</td>
<td>PEC</td>
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<td>2.</td>
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<td>Fundamentals of Investment</td>
<td>PEC</td>
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<tr>
<td>3.</td>
<td>CMG333</td>
<td>Banking, Financial Services and Insurance</td>
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<td>4.</td>
<td>CMG334</td>
<td>Introduction to Blockchain and its Applications</td>
<td>PEC</td>
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<td>5.</td>
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<td>6.</td>
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**VERTICAL 2: ENTREPRENEURSHIP**

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<tr>
<th>S. NO.</th>
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<tbody>
<tr>
<td>1.</td>
<td>CMG337</td>
<td>Foundations of Entrepreneurship</td>
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<td>2.</td>
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<td>Team Building &amp; Leadership Management for Business</td>
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<td>3.</td>
<td>CMG339</td>
<td>Creativity &amp; Innovation in Entrepreneurship</td>
<td>PEC</td>
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<td>4.</td>
<td>CMG340</td>
<td>Principles of Marketing Management For Business</td>
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<td>5.</td>
<td>CMG341</td>
<td>Human Resource Management for Entrepreneurs</td>
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<td>Financing New Business Ventures</td>
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**VERTICAL 3: PUBLIC ADMINISTRATION**

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<th>S. NO.</th>
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<td>CMG344</td>
<td>Constitution of India</td>
<td>PEC</td>
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<td>3.</td>
<td>CMG345</td>
<td>Public Personnel Administration</td>
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<td>4.</td>
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<td>Administrative Theories</td>
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<td>5.</td>
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<td>Indian Administrative System</td>
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**VERTICAL 4: BUSINESS DATA ANALYTICS**

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<th>S. NO.</th>
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<td>PEC</td>
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<td>2.</td>
<td>CMG350</td>
<td>Data mining for Business Intelligence</td>
<td>PEC</td>
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<td>3.</td>
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<td>4.</td>
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<td>Marketing and Social Media Web Analytics</td>
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<tr>
<td>5.</td>
<td>CMG353</td>
<td>Operation and Supply Chain Analytics</td>
<td>PEC</td>
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<td>6.</td>
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<td>Financial Analytics</td>
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**VERTICAL 5: ENVIRONMENT AND SUSTAINABILITY**

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<th>COURSE TITLE</th>
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<tr>
<td>1.</td>
<td>CES331</td>
<td>Sustainable infrastructure Development</td>
<td>PEC</td>
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<td>2.</td>
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<td>3.</td>
<td>CES333</td>
<td>Sustainable Bio Materials</td>
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<td>4.</td>
<td>CES334</td>
<td>Materials for Energy Sustainability</td>
<td>PEC</td>
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<td>5.</td>
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<td>PEC</td>
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<td>6.</td>
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<td>7.</td>
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<td>PEC</td>
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<td>8.</td>
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</table>
This is a mandatory 2 week programme to be conducted as soon as the students enter the institution. Normal classes start only after the induction program is over.

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

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

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

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

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

(i) Physical Activity

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

(ii) Creative Arts

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

(iii) Universal Human Values

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

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

(v) Proficiency Modules

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

(vi) Lectures by Eminent People

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

(vii) Visits to Local Area

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

(viii) Familiarization to Dept./Branch & Innovations

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

(ix) Department Specific Activities

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

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

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

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

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

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

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

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

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

TOTAL : 45 PERIODS
LEARNING OUTCOMES:
At the end of the course, learners will be able
- To use appropriate words in a professional context
- To gain understanding of basic grammatic structures and use them in right context.
- To read and infer the denotative and connotative meanings of technical texts
- To write definitions, descriptions, narrations and essays on various topics

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

REFERENCES:

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

MA3151 MATRICES AND CALCULUS
L T P C
3 1 0 4

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

UNIT I MATRICES 9 + 3

UNIT II DIFFERENTIAL CALCULUS 9 + 3
Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules (sum, product, quotient, chain rules) - Implicit differentiation - Logarithmic differentiation - Applications:
Maxima and Minima of functions of one variable.

UNIT III        FUNCTIONS OF SEVERAL VARIABLES          9 + 3

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

UNIT V        MULTIPLE INTEGRALS                        9 + 3

TOTAL: 60 PERIODS

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

- Use the matrix algebra methods for solving practical problems.
- Apply differential calculus tools in solving various application problems.
- Able to use differential calculus ideas on several variable functions.
- Apply different methods of integration in solving practical problems.
- Apply multiple integral ideas in solving areas, volumes and other practical problems.

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

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

UNIT I  MECHANICS

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

UNIT III  OSCILLATIONS, OPTICS AND LASERS

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

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

TOTAL : 45 PERIODS

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

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

REFERENCES:

CY3151 ENGINEERING CHEMISTRY L T P C 3 0 0 3

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

UNIT I WATER AND ITS TREATMENT 9

UNIT II NANO CHEMISTRY 9
Basics: Distinction between molecules, nanomaterials and bulk materials; Size-dependent properties (optical, electrical, mechanical and magnetic); Types of nanomaterials: Definition, properties and uses of – nanoparticle, nanocluster, nanorod, nanowire and nanotube. Preparation of nanomaterials: sol-gel, solvothermal, laser ablation, chemical vapour deposition, electrochemical deposition and electro spinning. Applications of nanomaterials in medicine, agriculture, energy, electronics and catalysis.

UNIT III PHASE RULE AND COMPOSITES 9
Phase rule: Introduction, definition of terms with examples. One component system - water system;
Reduced phase rule; Construction of a simple eutectic phase diagram - Thermal analysis; Two component system: lead-silver system - Pattinson process.

Composites: Introduction: Definition & Need for composites; Constitution: Matrix materials (Polymer matrix, metal matrix and ceramic matrix) and Reinforcement (fiber, particulates, flakes and whiskers). Properties and applications of: Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites. Hybrid composites - definition and examples.

UNIT IV FUELS AND COMBUSTION 9

Fuels: Introduction: Classification of fuels; Coal and coke: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). Petroleum and Diesel: Manufacture of synthetic petrol (Bergius process), Knocking - octane number, diesel oil - cetane number; Power alcohol and biodiesel.

Combustion of fuels: Introduction: Calorific value - higher and lower calorific values, Theoretical calculation of calorific value; Ignition temperature: spontaneous ignition temperature, Explosive range; Flue gas analysis - ORSAT Method. CO$_2$ emission and carbon footprint.

UNIT V ENERGY SOURCES AND STORAGE DEVICES 9

Stability of nucleus: mass defect (problems), binding energy; Nuclear energy: light water nuclear power plant, breeder reactor. Solar energy conversion: Principle, working and applications of solar cells; Recent developments in solar cell materials. Wind energy; Geothermal energy; Batteries: Types of batteries, Primary battery - dry cell, Secondary battery - lead acid battery and lithium-ion-battery; Electric vehicles - working principles; Fuel cells: H$_2$-O$_2$ fuel cell, microbial fuel cell; Supercapacitors: Storage principle, types and examples.

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:

GE3151  PROBLEM SOLVING AND PYTHON PROGRAMMING  L  T  P  C
3 0 0 3

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

UNIT I   COMPUTATIONAL THINKING AND PROBLEM SOLVING  9

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

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

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

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

TOTAL : 45 PERIODS

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

TEXT BOOKS:

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

GE3152 HERITAGE OF TAMILS L T P C
1 0 0 1

UNIT I LANGUAGE AND LITERATURE

UNIT II HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE
Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

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

UNIT IV THINAI CONCEPT OF TAMILS
Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.
UNIT V  CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS

1. தமிழில் மரபு - மனநாயக பயாரத்தில் - தக்தக்க பொக்கல் (தமிழில்: தமிழில் மரபு - மனநாயக பயாரத்தில்
   மனநாயக பயாரத்தில் தக்தக்க பொக்கல்).
2. தமிழில் தமிழ் - பலகையில் என்ற குறுக்கு (கசிவால் பிரிக்க).
3. செயல் - கலாச்சார நிகழ்வுகளில் குறுக்கு குறுக்கு (தமிழில் தமிழ் குறுக்கு).
4. போருத்தெரு அரசியல் கருத்தில். (தமிழில் தமிழ் குறுக்கு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - ‘Sangam City Civilization on the banks of river Vaigai’ (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
அவர்கள தமிழ்க் கல்லண்டு பவள்ளுகள், பவள்ளுகள் - தூதல் வெப்பமுக கனவு - கும்பையும் தவன்களில் - தவன்களில் குமாரிகள் - வினையூடு, பாரு, அங்கை, புவியும் தமிழிலான கல்லண்டுவன்றுக் கல்லண்டு வருகை: 

அலகு III பார்ப்புக் காண்டத் தமிழாக சின்னபாலிகள்: 3
தோற்றங்கள், கரங்கள், சிவாப்பரின், கதிரவாக குழாய், துசோற்றன், பொன்னூர்கள், தபொருட்கள் - கதொல்லன் சுடுமண், சிற்பங்கள் - நொட்டுப்புறத் ததய்வங்கள் - நொட்டுப்புறக் கறலகள், மற்றும் வீரவிறளையூடு கூத்து, கரகொட்டம், வில்லுப்பொட்டு, கணியொன்கூத்து, ஒயிலொட்டம், கதொல்பொளவக் கூத்து, சிலம்பொட்டம், வளரி, புலியொட்டம், தமிழர்களின் விளளயொட்டுகள்.

அலகு IV தமிழ்களின் கிளியம் மாவட்டகள்: 3
தமிழகம்கள் தங்கள் மாவட்டங்களில், விளங்கவியல்: தோற்றங்களில் வாழ்வு சமையல்களில் அடுத்து பார்ப்புக் காண்டத் தமிழக்கள் - தமிழகக் குமாரிகள் கொண்டு காட்டுப்பட்டுள்ளன, கொண்டுள்ள - காத்துக்கு நாடத்தில் சுற்று பார்ப்புகள் - காட்டுக்கு நாடத்தில் சுற்று பார்ப்புகள் - கல்வியும் - வெட்டாக்கியது. 

அலகு V இந்திய கதசியத்தில் இயக்கம் நகரங்களும் சங்ககொலத்தில் எழுத்தறிவும் 
இந்திய தமிழ்ப்பண்டி பொட்டின் தொக்கம் -சுயமரியொளத இயக்கம் -இந்திய மருத்துவத்தில், சித்தமருத்துவத்தின் பங்கு -கல்தவட்டுகள், பளறதயழுத்துப்படிகள் -தமிழ்ப்புத்தககள் அச்சுவரலொறு.

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS
1. தமிழ் பாணம் - மக்களும் ஷக்க்னம் - தொக்க. பிளாரச் (வரலொறு: தோற்றங்கள், பாணம் மற்றும் குமாரிகள் கணவு).
2. குடிகளில் குழாய் - பெருள் விளையாட்டு (சின்னபாலிகை).
3. சிலம்பொட்டம் -கல்லண்டு குமாரிகளில் சங்ககொல தொவர் பார்ப்பு (சுயோலேன் குமார் வெட்டாக்கியது).
4. வெட்டாக்கியது - கல்லண்டு பார்ப்பு (சுயோலேன் குமார் வெட்டாக்கியது).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
GE3171  PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY  L  T  P  C
0 0 4 2

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

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

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

TOTAL: 60 PERIODS

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

TEXT BOOKS:

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

BS3171          PHYSICS AND CHEMISTRY LABORATORY                L T P C
                                        0 0 4 2

PHYSICS LABORATORY: (Any Seven Experiments)

COURSE OBJECTIVES:

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

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

TOTAL: 30 PERIODS

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

- Understand the functioning of various physics laboratory equipment.
- Use graphical models to analyze laboratory data.
- Use mathematical models as a medium for quantitative reasoning and describing physical reality.
- Access, process and analyze scientific information.
- Solve problems individually and collaboratively.

CHEMISTRY LABORATORY: (Any seven experiments to be conducted)

COURSE OBJECTIVES:

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

1. Preparation of Na$_2$CO$_3$ as a primary standard and estimation of acidity of a water sample using the primary standard
2. Determination of types and amount of alkalinity in a water sample.
   - Split the first experiment into two
3. Determination of total, temporary & permanent hardness of water by EDTA method.
4. Determination of DO content of water sample by Winkler’s method.
5. Determination of chloride content of water sample by Argentometric method.
6. Estimation of copper content of the given solution by Iodometry.
7. Estimation of TDS of a water sample by gravimetry.
8. Determination of strength of given hydrochloric acid using pH meter.
9. Determination of strength of acids in a mixture of acids using conductivity meter.
10. Conductometric titration of barium chloride against sodium sulphate (precipitation titration)
11. Estimation of iron content of the given solution using potentiometer.
12. Estimation of sodium /potassium present in water using a flame photometer.
13. Preparation of nanoparticles (TiO$_2$/ZnO/CuO) by Sol-Gel method.
14. Estimation of Nickel in steel
15. Proximate analysis of Coal

TOTAL : 30 PERIODS

COURSE OUTCOMES:

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

GE3172 ENGLISH LABORATORY
0 0 2 1

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

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

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

UNIT III DESCRIPTION OF A PROCESS / PRODUCT 6
Listening - Listen to product and process descriptions; a classroom lecture; and advertisements about products. Speaking – Picture description- describing locations in workplaces- Giving instruction to use the product- explaining uses and purposes- Presenting a product- describing shapes and sizes and weights- talking about quantities(large & small)-talking about precautions.

UNIT IV CLASSIFICATION AND RECOMMENDATIONS 6
Listening – Listening to TED Talks; Listening to lectures - and educational videos. Speaking – Small Talk; discussing and making plans-talking about tasks-talking about progress- talking about positions and directions of movement-talking about travel preparations- talking about transportation-

UNIT V EXPRESSION 6
Listening – Listening to debates/ discussions; different viewpoints on an issue; and panel discussions. Speaking –making predictions- talking about a given topic-giving opinions- understanding a website-describing processes

TOTAL : 30 PERIODS
LEARNING OUTCOMES:
At the end of the course, learners will be able
  • To listen and comprehend complex academic texts
  • To speak fluently and accurately in formal and informal communicative contexts
  • To express their opinions effectively in both oral and written medium of communication

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

HS3251 PROFESSIONAL ENGLISH - II
L T P C
2 0 0 2

OBJECTIVES :
  • To engage learners in meaningful language activities to improve their reading and writing skills
  • To learn various reading strategies and apply in comprehending documents in professional context.
  • To help learners understand the purpose, audience, contexts of different types of writing
  • To develop analytical thinking skills for problem solving in communicative contexts
  • To demonstrate an understanding of job applications and interviews for internship and placements

UNIT I MAKING COMPARISONS
Reading - Reading advertisements, user manuals, brochures; Writing – Professional emails, Email etiquette - Compare and Contrast Essay; Grammar – Mixed Tenses, Prepositional phrases

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

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

UNIT IV REPORTING OF EVENTS AND RESEARCH

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

TOTAL : 30 PERIODS
OUTCOMES:
At the end of the course, learners will be able
- To compare and contrast products and ideas in technical texts.
- To identify cause and effects in events, industrial processes through technical texts
- To analyse problems in order to arrive at feasible solutions and communicate them orally and in the written format.
- To report events and the processes of technical and industrial nature.
- To present their opinions in a planned and logical manner, and draft effective resumes in context of job search.

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

REFERENCES:

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

MA3251 STATISTICS AND NUMERICAL METHODS

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

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

UNIT II    DESIGN OF EXPERIMENTS 9 + 3
One way and two way classifications - Completely randomized design – Randomized block design – Latin square design - 2² factorial design.

UNIT III   SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9 + 3

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

UNIT V     NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 9 + 3

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

TEXT BOOKS:

REFERENCES:


BM3251 BIOSCIENCES FOR MEDICAL ENGINEERING L T P C
3 0 0 3

COURSE OBJECTIVES:
The student should be:
- To study structural and functional properties of carbohydrates, proteins, lipids and amino acids
- To emphasize the role of these biomolecules by providing basic information on specific metabolic diseases and disorders of these biomolecules
- Gain knowledge on the structural and functional aspects of living organisms.
- Know the etiology and remedy in treating the pathological diseases.

UNIT I FUNDAMENTALS TO BIOCHEMISTRY

UNIT II CARBOHYDRATES, LIPIDS, PROTEIN

UNIT III CELL DEGENERATION, REPAIR AND NEOPLASIA
Cell injury - Reversible cell injury and Irreversible cell injury and Necrosis, Apoptosis, Intracellular accumulations, Pathological calcification- Dystrophic and Metastatic. cellular adaptations of growth and differentiation, Inflammation and Repair including fracture healing, Neoplasia, Classification, Benign and Malignant tumours, carcinogenesis, spread of tumours Autopsy and biopsy.

UNIT IV FLUID AND HEMODYNAMIC DERANGEMENTS

UNIT V FUNDAMENTALS OF MICROBIOLOGY AND IMMUNOPATHOLOGY

TOTAL : 45 PERIODS
COURSE OUTCOMES:
At the end of the course, the student should be able to:
- Explain the fundamentals of biochemistry
- Analyze structural and functional aspects of living organisms.
- Explain the function of microscope
- Describe methods involved in treating the pathological diseases.

TEXT BOOKS:

REFERENCES:

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

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

UNIT I ELECTRICAL CIRCUITS 9
DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm’s Law - Kirchhoff’s Laws –Independent and Dependent Sources – Simple problems- Nodal Analysis, Mesh analysis with Independent sources only (Steady state)
Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor – Steady state analysis of RLC circuits (Simple problems only)

UNIT II ELECTRICAL MACHINES 9

UNIT III ANALOG ELECTRONICS 9
Resistor, Inductor and Capacitor in Electronic Circuits- Semiconductor Materials: Silicon & Germanium
UNIT IV DIGITAL ELECTRONICS
Review of number systems, binary codes, error detection and correction codes, Combinational logic -
representation of logic functions-SOP and POS forms, K-map representations - minimization using K maps (Simple Problems only).

UNIT V MEASUREMENTS AND INSTRUMENTATION
Functional elements of an instrument, Standards and calibration, Operating Principle , types -Moving
Coil and Moving Iron meters, Measurement of three phase power, Energy Meter, Instrument
Transformers-CT and PT,DSO- Block diagram- Data acquisition.

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:

BM3252 MEDICAL PHYSICS

COURSE OBJECTIVE:
- To provide understanding of the application of the radiation concepts and methods of Physics in Medical science
- To accentuate the principle, effects and clinical applications of ionizing, non-ionizing and electromagnetic radiation.
- To enunciate the fundamentals of acoustic waves and their interaction with human tissues.
- To explore the effects of radiation in matter and how isotopes are produced
- To study effects of sound and light in human body

UNIT I  LOW ENERGY ELECTROMAGNETIC SPECTRUM AND ITS MEDICAL APPLICATION

Physics of light, Intensity of light, limits of vision and color vision an overview, Non-ionizing Electromagnetic Radiation: Overview of non-ionizing radiation effects-Tissue as a leaky dielectric-Low Frequency Effects- Higher frequency effects., Thermography– Application

UNIT II  PRINCIPLES OF RADIOACTIVE NUCLIDES

Radioactive Decay – Spontaneous Emission – Isometric Transition – Gamma ray emission, alpha, beta, Positron decay, electron capture, Sources of Radioisotopes Natural and Artificial radioactivity, Radionuclide used in Medicine and Technology, Decay series, Production of radionuclides – Cyclotron produced Radionuclide- Reactor produced Radionuclide-fission and neutron capture reaction, radionuclide Generator-Technetium generator

UNIT III  INTERACTION OF RADIATION WITH MATTER LIPIDS

Interaction of charged particles with matter –Specific ionization, Linear energy transfer range, Bremsstrahlung, Annihilation, Interaction of X and Gamma radiation with matter- Photoelectric effect, Compton Scattering , Pair production, Attenuation of Gamma Radiation, Interaction of neutron with matter and their clinical significance

UNIT IV  RADIATION DOSE AND ITS EFFECTS

Dose and Exposure measurements – Units (SI), Inverse square law, Maximum permissible exposure, relationship between the dosimetric quantities, Radiation biology – effects of radiation, concept of LD 50, Stochastic and Non-stochastic effects, Radiation Syndrome.

UNIT V  PRINCIPLES AND APPLICATIONS OF SOUND IN MEDICINE

Physics of sound, Normal sound levels, ultrasound fundamentals, Generation of ultrasound (Ultrasound Transducer), Interaction of Ultrasound with matter- Cavitations, Reflection, Transmission, Scanning methods, Artifacts, Ultrasound- Doppler effect, Clinical Applications

TOTAL : 45 PERIODS

Course Outcomes:
Upon completion of the course, students will be able to:
- Interpret the properties of electromagnetic radiations and its effect on human.
- Apply the principles and understand the production of radioactive nuclides.
- Explain the interaction of radiation with matter.
- Identify and Analyse the radiation quantities and its effects
- Demonstrate the knowledge on the properties of sound and its application in medicine.

TEXT BOOKS:

REFERENCES:

e-RESOURCES:
1. http://www.nptel.ac.in/courses/115102017/, “Nuclear science and Engineering”, Dr. Santanu Gosh, Department of Physics, IIT, Delhi.

GE3251 ENGINEERING GRAPHICS L T P C 2 0 4 4

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
- Drawing engineering curves.
- Drawing freehand sketch of simple objects.
- Drawing orthographic projection of solids and section of solids.
- Drawing development of solids
- Drawing isometric and perspective projections of simple solids.

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

UNIT I PLANE CURVES 6+12
Basic Geometrical constructions, Curves used in engineering practices: Conics — Construction of ellipse, parabola and hyperbola by eccentricity method — Construction of cycloid — construction of involutes of square and circle — Drawing of tangents and normal to the above curves.

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE 6+12
Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS AND FREEHAND SKETCHING 6+12
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes and parallel to the other by rotating object method. Visualization concepts and Free Hand sketching: Visualization principles —Representation of Three Dimensional objects — Layout of views- Freehand sketching of multiple views from pictorial views of objects. Practicing three dimensional modeling of simple objects by CAD Software(Not for examination)

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 6+12
Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other — obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids — Prisms, pyramids cylinders and cones.
Practicing three dimensional modeling of simple objects by CAD Software (Not for examination)

UNIT V  ISOMETRIC AND PERSPECTIVE PROJECTIONS  6+12
Principles of isometric projection — isometric scale — Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones - combination of two solid objects in simple vertical positions - Perspective projection of simple solids - Prisms, pyramids and cylinders by visual ray method.
Practicing three dimensional modeling of isometric projection of simple objects by CAD Software (Not for examination)

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

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

TEXT BOOKS:

REFERENCES:

Publication of Bureau of Indian Standards:

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

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

UNIT I WEAVING AND CERAMIC TECHNOLOGY 3
Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY 3
Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

UNIT III MANUFACTURING TECHNOLOGY 3

UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY 3
Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING 3

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS
1. தமிழக வரலொறு – மக்களும் பண்பொடும் – கக. கக. பிளளள (ததொல்லியீடு: தமிழ்நொடுபொடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2. கணினித் தமிழ் – முளனவர் இல.சுந்தரம் (விகடன் பிரசுரம்)
3. கீழடி – தொல்லியல் சங்ககொலநகரிகம் (ததொல்லியல் துளறதவளியீடு)
4. பொருளந – ஆற்றங்களர் நொகரிகம் (ததொல்லியல் துளற)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by: International Institute of Tamil Studies.)

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

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

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

12. Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL – Reference Book.)
TEXT-CUM-REFERENCE BOOKS

1. கல்வி மற்றும் மேம்பாடு - மக்களும் பணமும் - சக்கரசம். (தமிழில்: கல்விக்குறிப்பு மற்றும் மேம்பாடு மேம்பாடுப்பினை)

2. கல்வி மற்றும் மேம்பாடு - மேம்பாடு மற்றும் கல்வி (சிலைச்சைக் விளக்கம்).

3. சிங்குரிய - கல்லாச்சாரத் துறைகள் சம்பந்தராகவும் துறையாளரும் (தொலைப்பிடிப்பு தொலைப்பிடிப்பு)

4. பொறுபாடு - அன்றுக்காக மாதிரிகள். (தொலைப்பிடிப்பு தொலைப்பிடிப்பு)

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**TOTAL: 30 PERIODS**
## NCC Credit Course Level 1*

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### NATIONAL INTEGRATION AND AWARENESS

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### SOCIAL SERVICE AND COMMUNITY DEVELOPMENT

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**TOTAL : 30 PERIODS**
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(AIR FORCE WING)

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<td>L 2 Case Studies: Shivaji, Jhasi Ki Rani</td>
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<td><strong>SOCIAL SERVICE AND COMMUNITY DEVELOPMENT</strong></td>
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<td>SS 7 Cyber and Mobile Security Awareness</td>
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**TOTAL : 30 PERIODS**
COURSE OBJECTIVES:
The main learning objective of this course is to provide hands on training to the students in:

1. Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planing; making joints in wood materials used in common household wood work.
2. Wiring various electrical joints in common household electrical wire work.
3. Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipments; Making a tray out of metal sheet using sheet metal work.
4. Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.

GROUP – A (CIVIL & ELECTRICAL)

PART I  CIVIL ENGINEERING PRACTICES  15
PLUMBING WORK:
a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.
b) Preparing plumbing line sketches.
c) Laying pipe connection to the suction side of a pump
d) Laying pipe connection to the delivery side of a pump.
e) Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

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

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

PART II  ELECTRICAL ENGINEERING PRACTICES  15
a) Introduction to switches, fuses, indicators and lamps - Basic switch board wiring with lamp, fan and three pin socket
b) Staircase wiring
c) Fluorescent Lamp wiring with introduction to CFL and LED types.
d) Energy meter wiring and related calculations/ calibration
e) Study of Iron Box wiring and assembly
f) Study of Fan Regulator (Resistor type and Electronic type using Diac/Triac/quadrac)
g) Study of emergency lamp wiring/Water heater
GROUP – B (MECHANICAL AND ELECTRONICS)

PART III MECHANICAL ENGINEERING PRACTICES

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

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

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

SHEET METAL WORK:
   a) Making of a square tray.

FOUNDRY WORK:
   a) Demonstrating basic foundry operations.

PART IV ELECTRONIC ENGINEERING PRACTICES

SOLDERING WORK:
   a) Soldering simple electronic circuits and checking continuity.

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

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

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

TOTAL : 60 PERIODS
COURSE OBJECTIVES:
To provide practice on:
- Estimation and quantification of biomolecules.
- Separation of macromolecules.
- Use Compound microscope
- Practice on chemical examinations, Histopathological examinations etc

LIST OF EXPERIMENTS:
1. Preparation of solutions: 1) percentage solutions, 2) molar solutions, 3) normal solutions
2. Standardization of pH meter, preparation of buffers, emulsions.
3. Spectroscopy: Determination of absorption maxima ($\lambda_{max}$) of a given solution
4. General tests for carbohydrates, proteins and lipids.
5. Identification of Blood Collection Tubes and Phlebotomy equipment
6. Preparation of serum and plasma from blood
7. Estimation of Haemoglobin and blood glucose
8. Estimation of creatinine, urea and Uric acid
9. Separation of proteins by SDS electrophoresis (Demo) and amino acids by thin layer chromatography (Demo).
10. Urine physical and chemical examination (protein, reducing substances, ketones, bilirubin and blood)
11. Basic staining – Hematoxylin and eosin staining.
12. Special stains – cresyl fast Blue (CFV)- Trichrome – oil red O – PAS
13. Types of Staining : Simple stain, Gram stain
14. Study of parts of compound microscope
15. Study of Histopathological slides of benign and malignant tumours.

TOTAL: 60 PERIODS

COURSE OUTCOMES:
Upon completion of the course, students will be able to:
- Understand the Biochemistry laboratory functional components
- Have a sound knowledge of qualitative test of different biomolecules.
- Understand the basics knowledge of Biochemical parameter and their interpretation in Blood sample.
- Have a sound knowledge of separation technology of proteins and amino acids.
- Student can perform practical experiments on staining Processes.

TEXT BOOK:

LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS:
Requirement for a batch of 30 students
Colorimeter 2 Nos
Spectrophotometer 1 No.
pH meter 1 No
Weighing balance 1 No
Refrigerator 1 No
SDS gel electrophoresis 1 No
TLC, ready TLC plates 1 No
Wintrobe’s tube 2 Nos.
Centrifuge Normal 1 No
Microslides 2 packets
Lancet 5 boxes
Microscope 1 No
Neubaur’s Chamber 2 Nos.
Heparinized Syringe 1 box
Haemoglobinometer 1 No
Capillary tubes 1 box

GE3272 COMMUNICATION LABORATORY

OBJECTIVES
- To identify varied group discussion skills and apply them to take part in effective discussions in a professional context.
- To be able to communicate effectively through writing.

UNIT I 12
Speaking: Role Play Exercises Based on Workplace Contexts, - talking about competition- discussing progress toward goals- talking about experiences- talking about events in life- discussing past events- Writing: writing emails (formal & semi-formal).

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

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

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

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

TOTAL: 60 PERIODS
LEARNING OUTCOMES

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

Assessment Pattern

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

MA3351 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS  L  T  P  C
3  1  0  4

COURSE OBJECTIVES

- To introduce the basic concepts of PDE for solving standard partial differential equations.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 9 + 3
Formation of partial differential equations – Solutions of standard types of first order partial differential equations - First order partial differential equations reducible to standard types- Lagrange’s linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT II FOURIER SERIES 9 + 3
Dirichlet’s conditions – General Fourier series – Odd and even functions – Half range sine series and cosine series – Root mean square value – Parseval’s identity – Harmonic analysis.

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9 + 3
Classification of PDE – Method of separation of variables - Fourier series solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (Cartesian coordinates only).

UNIT IV FOURIER TRANSFORMS 9 + 3

UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS 9 + 3

TOTAL: 60 PERIODS
**COURSE OUTCOMES**

Upon successful completion of the course, students should be able to:

CO1: Understand how to solve the given standard partial differential equations.

CO2: Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.

CO3: Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.

CO4: Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.

CO5: Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

**TEXT BOOKS:**


**REFERENCES:**


**CO’s- PO’s & PSO’s MAPPING**

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**BM3353  FUNDAMENTALS OF ELECTRONIC DEVICES AND CIRCUITS**

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**COURSE OBJECTIVES:**

The objective of this unit is to make the student learn and understand

- Introduce the concept of diodes, Bipolar Junction Transistors and FET.
- Study the various model parameters of Transistors
- Learn the concept of special semiconductor devices, Power & Display devices
• Impart the knowledge of various configurations, characteristics, applications.
• To have knowledge of display and power devices.

UNIT I  SEMICONDUCTOR DIODE  9
PN junction diode, Current equations, Energy Band diagram, Diffusion and drift current densities, forward and reverse bias characteristics, Transition and Diffusion Capacitances, Switching Characteristics, Breakdown in PN Junction Diodes.

UNIT II  BIPOLAR JUNCTION TRANSISTORS  9

UNIT III  FIELD EFFECT TRANSISTORS  9
MOSFETs – Drain and Transfer characteristics.-Current equations-Pinch off voltage and its significance- Threshold voltage -Channel length modulation, small signal Characteristics, D- MOSFET, E-MOSFET- Characteristics – Comparison of MOSFET with BJT.

UNIT IV  SPECIAL SEMICONDUCTOR DEVICES  9
Metal-Semiconductor Junction - MESFET, FINFET, PINFET, CNTFET, DUAL GATE MOSFET, Point Contact Diode, p-i-n Diode, Avalanche Photodiode, Schottky barrier diode- Zener diode-Varactor diode –Tunnel diode- Gallium Arsenide device, LASER diode, LDR.

UNIT V  POWER DEVICES AND DISPLAY DEVICES  9
UJT, Thyristor - SCR, Diac, Triac, Power BJT- Power MOSFET- DMOS-VMOS. LED, LCD, Opto Coupler, Solar cell, CCD.

COURSE OUTCOMES:
At the end of the course, the student should be able to:

CO1: Analyze the characteristics of semiconductor diodes.
CO2: Analyze and solve problems of Transistor circuits using model parameters.
CO3: Identify and characterize diodes and various types of transistors.
CO4: Analyze the characteristics of special semiconductor devices.
CO5: Analyze the characteristics of Power and Display devices.

TOTAL:45 PERIODS

TEXT BOOK

REFERENCES
BM3301 SENSORS AND MEASUREMENTS

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand the purpose of measurement, the methods of measurements, errors associated with measurements.
- To know the principle of transduction, classifications and the characteristics of different transducers.
- To learn the different bridges for measurement.
- To know the different display and recording devices.
- To understand various type of biosensors.

UNIT I FUNDAMENTALS OF MEASUREMENTS


UNIT II DISPLACEMENT, PRESSURE, TEMPERATURE SENSORS

Strain Gauge: Gauge factor, sensing elements, configuration, and unbounded strain gage. Capacitive transducer - various arrangements, Inductive transducer, LVDT, Passive types: RTD materials & range, relative resistance vs. temperature characteristics, thermistor characteristics, Active type: Thermocouple - characteristics.

UNIT III PHOTOELECTRIC AND PIEZOELECTRIC SENSORS

Phototube, scintillation counter, photo multiplier tube (PMT), photovoltaic, photo conductive cells, photo diodes, phototransistor, comparison of photoelectric transducers. Optical displacement sensors and optical encoders. Piezoelectric active transducer- Equivalent circuit and its characteristics.

UNIT IV SIGNAL CONDITIONING CIRCUITS AND METERS

Functions of signal conditioning circuits, Preamplifiers, Concepts of passive filters, Impedance matching circuits, AC and DC Bridges - wheat stone bridge, Kelvin, Maxwell, Hay, Schering, Q-meter, PMMC, MI and dynamometer type instruments - DC potentiometer- Digital voltmeter – Multi meter.

UNIT V RECORDING DEVICES AND ADVANCED SENSORS

CRO – block diagram, CRT – vertical & horizontal deflection system, DSO, LCD monitor, PMMC writing systems, servo recorders, photographic recorder, magnetic tape recorder, Inkjet recorder, thermal recorder. Biosensors: transduction mechanism in a biosensor and Classification - Electronic
COURSE OUTCOMES:
On successful completion of this course, the student will be able to
CO1: Measure various electrical parameters with accuracy, precision, resolution.
CO2: Select appropriate passive or active transducers for measurement of physical phenomenon.
CO3: Select appropriate light sensors for measurement of physical phenomenon
CO4: Use AC and DC bridges for relevant parameter measurement.
CO5: Employ multimeter, CRO and different types of recorders for appropriate measurement.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

CO’s- PO’s & PSO’s MAPPING

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BM3352 ELECTRIC CIRCUIT ANALYSIS

COURSE OBJECTIVES:
- To introduce the basic concepts of DC and AC circuits behavior
- To study the transient and steady state response of the circuits subjected to step and sinusoidal excitations.
- To introduce different methods of circuit analysis using Network theorems, duality and topology

UNIT I BASIC CIRCUITS ANALYSIS
UNIT II NETWORK THEOREM AND DUALITY

UNIT III SINUSOIDAL STEADY STATE ANALYSIS

UNIT IV TRANSIENTS AND RESONANCE IN RLC CIRCUITS

UNIT V COUPLED CIRCUITS AND TOPOLOGY
Magnetically Coupled Circuits, mutual Inductance, the Linear Transformer, the Ideal Transformer, An introduction to Network Topology, Trees and General Nodal analysis, Links and Loop analysis.

COURSE OUTCOMES:
On successful completion of this course, the student will be able to
CO1: Comprehend and design ac/dc circuits.
CO2: Apply circuit theorems in real time.
CO3: Evaluate ac/dc circuits.
CO4: Analyse the electrical circuits
CO5: Develop and understand ac/dc circuits.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

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BM3351          ANATOMY AND HUMAN PHYSIOLOGY          L T P C
                                  3 0 2 4

COURSE OBJECTIVE
• To integrate the individual functions of all the cells and tissues and organs into functional whole, the human body.
• Function is dependent on a structure, the curriculum lays stress on functional anatomy of the organs.
• Emphasizes on the cardiovascular, respiratory, urinary and nervous system and their interrelatedness.
• Stimulate the students to understand the basic functioning of every system and the resultant unified organization.

UNIT I       BASIC ELEMENTS OF HUMAN BODY      9

UNIT II      SKELETAL AND MUSCULAR SYSTEM      9

UNIT III     CARDIOVASCULAR AND RESPIRATORY SYSTEM      9

UNIT IV      DIGESTIVE AND EXCRETORY SYSTEMS       9
Structure and functions of gastrointestinal system - secretory functions of the alimentary tract - digestion and absorption in the gastrointestinal tract - structure of nephron - mechanism of urine formation - skin and sweat gland - temperature regulation.

UNIT V       NERVOUS AND SENSORY SYSTEM        9

TOTAL : 45 PERIODS

LIST OF EXPERIMENTS
1. Collection of Blood Samples
2. Identification of Blood groups (Forward and Reverse)
3. Bleeding and Clotting time
4. Estimation of Hemoglobin
5. Total RBC and WBC Count
6. Differential count of Blood cells
7. Estimation of ESR, PCV, MCH, MCV, MCHC
8. Hearing test – Tuning fork
9. Visual Activity – Snellen’s Chart and Jaeger’s Chart

TOTAL: 30 PERIODS

LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS:

Requirement for a batch of 30 students
Microscope 2 Nos
Centrifuge Normal 1 No
Wintrobe’s tube 2 Nos.
PCV tube 2 Nos
Neubaur’s Chamber 2 Nos.
Heparinized Syringe 1box
Haemoglobinometer 1 No
Blood grouping kit 1 No
Capillary tubes 1 box
Ophthalmoscope 1 No
Tuning fork (256Hz to 512Hz) 5 Nos.
Microslides 2 packets
Lancet 5 boxes

TOTAL: 75 PERIODS

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

CO1 Identify and explain basic elements of human body
CO2 Explain the functions of skeletal and muscular system
CO3 Describe the structure, function of cardiovascular system and respiratory system
CO4 Discuss the structure of digestive and excretory system.
CO5 Describe the physiological process of Nervous and sensory system

TEXT BOOKS:

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CS3391 OBJECT ORIENTED PROGRAMMING

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3 0 0 3

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

UNIT I INTRODUCTION TO OOP AND JAVA

UNIT II INHERITANCE, PACKAGES AND INTERFACES

UNIT III EXCEPTION HANDLING AND MULTITHREADING

UNIT IV I/O, GENERICS, STRING HANDLING

UNIT V JAVAFX EVENT HANDLING, CONTROLS AND COMPONENTS
COURSE OUTCOMES:
On completion of this course, the students will be able to
CO1: Apply the concepts of classes and objects to solve simple problems
CO2: Develop programs using inheritance, packages and interfaces
CO3: Make use of exception handling mechanisms and multithreaded model to solve real world problems
CO4: Build Java applications with I/O packages, string classes, Collections and generics concepts
CO5: Integrate the concepts of event handling and JavaFX components and controls for developing GUI based applications

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES:

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BM3361 FUNDAMENTALS OF ELECTRONIC DEVICES AND CIRCUITS LABORATORY
L T P C
0 0 3 1.5

COURSE OBJECTIVE:
• To supplement the theory courses Semiconductor Devices and Basic Electrical Engineering.
• To assist the students in obtaining a better understanding of the operation of electronic circuits and devices.
• To provide experience in analyzing network theorems.

LIST OF EXPERIMENTS
1. Characteristics of PN and zener diode.
2. Characteristics of CE, CB configurations.
3. Half wave and Full wave rectifier with capacitor filter.
5. Study of characteristics of photo diodes.
6. Study of characteristics of SCR.
7. Verification of KVL and KCL.
8. Verification of Thevenin’s and Norton’s Theorems.
9. Verification of superposition Theorem.
10. Verification of Maximum power transfer and reciprocity theorems.

LIST OF EQUIPMENTS: (30 STUDENTS PER BATCH)
1. DSO (50MHz)
2. DC Digital Ammeter
3. DC Digital Voltmeter
4. Function Generator (3MHz)
5. Analog IC Tester
6. Digital IC Tester
7. Digital IC Trainer Kit
8. Dual Regulated Power supply (0-30) V/2A
9. Multiple Regulated Power supply (+5) V/2A, (015)V/2A
10. Single Regulated Power supply (0-30) V/2A
11. Decade Inductance Box (6Dial)
12. Variable Resistance Box (6Dial)
13. Decade Capacitance Box (6Dial)
14. Analog Ammeter (0-1) mA
15. Analog Voltmeter
16. Digital Multimeter

TOTAL : 45 PERIODS

COURSE OUTCOMES:
Upon completion of the course, students will be able to:
1. Experiment and determine the VI characteristics of given PN junction diode, Zener diode, Photo diode and Silicon Controlled Rectifier.
2. Experiment and determine the Input & output characteristics of BJT
3. Experiment and test half wave and full wave rectifier circuit using PN Junction diode and obtain the ripple factor, rectifier efficiency and experiment and test voltage regulation characteristics using Zener diode voltage regulator circuit.
4. Experiment and test the given electric circuit using Kirchhoff’s laws and obtain the mesh current & node voltage and obtain the load current for the given circuit using Superposition, Thevenin’s, and Norton’s and Reciprocity theorems.
5. Construct and test RLC series and parallel circuits to compute the resonant frequency and bandwidth by plotting the frequency response.

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COURSE OBJECTIVES:
- To introduce the relevance of this course to the existing technology through demonstrations, simulations with a futuristic vision along with socio-economic impact and issues.
- To study the characteristics of sensors, signal conditioning circuits and display devices.

LIST OF EXPERIMENTS:
1. Calibration of voltmeter and ammeter using shunt type Potentiometer
2. Characteristics of thermistor
3. Characteristics of thermocouple
4. Characteristics of LDR
5. Characteristics of Photo Diode
6. Characteristics of Photo transistor
7. Characteristics of RTD
8. Characteristics of LVDT
9. Measurement of unknown Resistance using Kelvin Double Bridge and Wheatstone bridge
10. Measurement of unknown Capacitance using Schering Bridge
11. Measurement of unknown Inductance using Maxwell’s & Hay’s Bridge
12. Characteristics of Hall effect transducer
13. Characteristics of strain gauge
14. Study of Electronic nose
15. Demonstration of CRO & DSO
16. Characteristics of Piezoelectric Transducer

LAB REQUIREMENTS FOR 30 STUDENTS:
1. Thermocouple-- 15 Nos
2. RTD-- 15 Nos
3. Strain Gauge (bonded and unbounded type)-15each
4. Photo transister, photo diode—15 Nos each
5. Resistors-Range between 1-0.0001 ohm – 30 Nos/each
6. CRO-10
7. DSO-5
8. LVDT – 5
9. Hall effect transducer - 15 Nos
10. Piezoelectric Transducer- 15 Nos

TOTAL:45 PERIODS

COURSE OUTCOMES:
On successful completion of this course, the student will be able to
- CO1: design and understand characteristics and calibration of various transducers.
- CO2: design and develop bridge circuits to find unknown variables.
- CO3: select proper transducer for various applications.
- CO4: understand various read out and display devices.
- CO5: design a measurement system for various applications.
CS3381 OBJECT ORIENTED PROGRAMMING LABORATORY L T P C
0 0 3 1.5

COURSE OBJECTIVES

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

LIST OF EXPERIMENTS

1. Solve problems by using sequential search, binary search, and quadratic sorting algorithms (selection, insertion)
2. Develop stack and queue data structures using classes and objects.
3. Develop a java application with an Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club funds. Generate pay slips for the employees with their gross and net salary.
4. Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named printArea(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method printArea() that prints the area of the given shape.
5. Solve the above problem using an interface.
6. Implement exception handling and creation of user defined exceptions.
7. Write a java program that implements a multi-threaded application that has three threads. First thread generates a random integer every 1 second and if the value is even, the second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of the cube of the number.
8. Write a program to perform file operations.
9. Develop applications to demonstrate the features of generics classes.
10. Develop applications using JavaFX controls, layouts and menus.
11. Develop a mini project for any application using Java concepts.

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

TOTAL: 45 PERIODS
COURSE OUTCOMES:
On completion of this course, the students will be able to
CO1: Design and develop Java programs using object oriented programming concepts
CO2: Develop simple applications using package, exceptions, multithreading, and generics concepts
CO3: Create GUIs and event driven programming applications for real world problems

CO’s- PO’s & PSO’s MAPPING

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GE3361 PROFESSIONAL DEVELOPMENT
L T P C
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OBJECTIVES:
To be proficient in important Microsoft Office tools: MS WORD, EXCEL, POWERPOINT.
- To be proficient in using MS WORD to create quality technical documents, by using standard templates, widely acceptable styles and formats, variety of features to enhance the presentability and overall utility value of content.
- To be proficient in using MS EXCEL for all data manipulation tasks including the common statistical, logical, mathematical etc., operations, conversion, analytics, search and explore, visualize, interlink, and utilizing many more critical features offered.
- To be able to create and share quality presentations by using the features of MS PowerPoint, including: organization of content, presentability, aesthetics, using media elements and enhance the overall quality of presentations.

MS WORD: 10 Hours
Create and format a document
Working with tables
Working with Bullets and Lists
Working with styles, shapes, smart art, charts
Inserting objects, charts and importing objects from other office tools
Creating and Using document templates
Inserting equations, symbols and special characters
Working with Table of contents and References, citations
Insert and review comments
Create bookmarks, hyperlinks, endnotes footnote
Viewing document in different modes
Working with document protection and security
Inspect document for accessibility

**MS EXCEL:** 10 Hours

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

**MS POWERPOINT:** 10 Hours

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

**TOTAL: 30 PERIODS**

**OUTCOMES:**

On successful completion the students will be able to

- Use MS Word to create quality documents, by structuring and organizing content for their day to day technical and academic requirements
- Use MS EXCEL to perform data operations and analytics, record, retrieve data as per requirements and visualize data for ease of understanding
• Use MS PowerPoint to create high quality academic presentations by including common tables, charts, graphs, interlinking other elements, and using media objects.

MA3355 RANDOM PROCESSES AND LINEAR ALGEBRA L T P C 3 1 0 4

COURSE OBJECTIVES:
• To introduce the basic notions of vector spaces which will then be used to solve related problems.
• To understand the concepts of vector space, linear transformations, inner product spaces and orthogonalization.
• To provide necessary basic concepts in probability and random processes for applications such as random signals, linear systems in communication engineering.
• To provide necessary basics in probability that are relevant in applications such as random signals, linear systems in communication engineering.
• To understand the basic concepts of probability, one and two dimensional random variables and to introduce some standard distributions applicable to engineering which can describe real life phenomenon.

UNIT - I: PROBABILITY AND RANDOM VARIABLES 9 + 3
Axioms of probability – Conditional probability – Baye’s theorem - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions - Functions of a random variable.

UNIT - II: TWO-DIMENSIONAL RANDOM VARIABLES 9 + 3
Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT – III: RANDOM PROCESSES 9 + 3
Classification – Stationary process – Markov process - Poisson process - Discrete parameter Markov chain – Chapman Kolmogorov equations (Statement only) - Limiting distributions .

UNIT - IV: VECTOR SPACES 9 + 3
Vector spaces – Subspaces – Linear combinations and linear system of equations – Linear independence and linear dependence – Bases and dimensions.

UNIT - V: LINEAR TRANSFORMATION AND INNER PRODUCT SPACES 9 + 3

COURSE OUTCOMES:
Upon successful completion of the course, students will be able to:
CO1: Explain the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts.
CO2: Demonstrate accurate and efficient use of advanced algebraic techniques.
CO3: Apply the concept of random processes in engineering disciplines.

TOTAL: 60 PERIODS
CO4: Understand the fundamental concepts of probability with a thorough knowledge of standard distributions that can describe certain real-life phenomenon.
CO5: Understand the basic concepts of one and two dimensional random variables and apply them to model engineering problems.

TEXT BOOKS:

REFERENCE BOOKS:

BM3491 BIOMEDICAL INSTRUMENTATION

COURSE OBJECTIVES:
- To understand the origin of various biological signals and electrode configurations specific to bio-potential measurements.
- To understand the characteristics of Bio signals.
- To understand the design of bioamplifiers.
- To explain the different techniques used for measurement of non-electrical bio-parameters.
- To explain the biochemical measurement techniques as applicable for diagnosis and treatment.

UNIT I ELECTRODE CONFIGURATIONS

UNIT II BIOSIGNAL CHARACTERISTICS
Bio signals characteristics – ECG-frequency and amplitude ranges – Einthoven’s triangle, standard 12 lead system. EEG - EEG – 10-20 electrode system, unipolar, bipolar and average mode. EMG–unipolar and bipolar mode. EMG - Electrode configuration -unipolar and bipolar mode.
UNIT III BIOAMPLIFIERS  

UNIT IV MEASUREMENT OF BIO SIGNALS  

UNIT V BIOCHEMICAL MEASUREMENTS  

COURSE OUTCOMES:
On successful completion of this course, the student will be able to
CO1 : Illustrate the origin of various biological signals and their characteristics.
CO2: Gain knowledge on characteristics of bio signals.
CO3: Gain knowledge on various amplifiers involved in monitoring and transmission of biosignals.
CO4: Explain the different measurement techniques for non-electrical bio-parameters
CO5: Explain the biochemical measurement techniques as applicable for diagnosis and further treatment.

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCE BOOKS

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COURSE OBJECTIVES:

- To study the circuit configuration and introduce practical applications of linear integrated circuits.
- To introduce the concept of application of ADC and DAC in real time systems and Phase Locked Loop with applications.
- To introduce the design of various combinational digital circuits using logic gates
- To bring out the analysis and design procedures for synchronous and asynchronous sequential circuits

UNIT I

INTRODUCTION TO OPERATIONAL AMPLIFIER AND ITS APPLICATIONS

Operational amplifier – ideal characteristics, Performance Parameters, Linear and Nonlinear Circuits and their analysis - voltage follower, Inverting amplifier, Non-inverting Amplifiers, Differentiator, Integrator, Voltage to Current converter, Instrumentation amplifier, Low pass, High pass filter and band pass filters, Comparator, Multivibrator and Schmitt trigger, Triangular wave generator.

UNIT II

DIGITAL TO ANALOG AND ANALOG TO DIGITAL CONVERTERS AND PLL

Analog switches, High speed sample and hold circuit and IC’s, Types of D/A converter - Weighted resistor, R-2R ladder DAC, D/A Accuracy and Resolution. A/D converter - Flash, Dual slope, Successive approximation, A/D Accuracy and Resolution. Voltage controlled oscillator, Voltage to Frequency converters. PLL-Closed loop analysis of PLL, Frequency multiplication/ division, FSK demodulator.

UNIT III

THE BASIC GATES AND COMBINATIONAL LOGIC CIRCUITS

Number Systems – Decimal, Binary, Octal, Hexadecimal, 1’s and 2’s complements, Codes – Binary, BCD, 84-2-1, 2421, Excess 3, Biquinary, Gray, Alphanumeric codes, Boolean theorems, Logic gates, Universal gates, Sum of products and product of sums, Minterms and Maxterms, Karnaugh map and Tabulation methods. Logic families- TTL, MOS, CMOS, BiCMOS - Comparison of Logic families.

UNIT IV

COMBINATIONAL LOGIC CIRCUITS


UNIT V

SEQUENTIAL LOGIC CIRCUITS

Flip flops – SR, JK, T, D, Master/Slave FF, Triggering of FF, Analysis and design of clocked sequential circuits – state minimization, state assignment, circuit implementation. Counters, Ripple Counters, Ring Counters. Types of Registers, Serial In - Serial Out, Serial In - Parallel out, Parallel In - Parallel Out, Universal Shift Register.

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

CO1: design new analog linear circuits and develop linear IC based Systems.

CO2: Apply the concept of ADC and DAC in real time systems and Phase Locked Loop with applications.

CO3: Use Boolean algebra and apply it to digital systems.

CO4: Design various combinational digital circuits using logic gates.

CO5: Bring out the analysis and design procedures for synchronous and asynchronous sequential circuits.

65
TEXT BOOKS

REFERENCES

CO’s- PO’s & PSO’s MAPPING

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BM3451 BIO CONTROL SYSTEMS L T P C 3 0 0 3

COURSE OBJECTIVES
The objective of this course is to enable the student to
- Understand the concept behind feedback and continuum in various systems and subsystems and the need for mathematical modeling of various systems.
- Analyze the systems in time and frequency domains
- Understand the concept of stability of various systems.
- Apply mathematical modeling principles in understanding the various fundamental biological systems.

UNIT I INTRODUCTION 9
Open and Closed loop Systems, Mathematical Modeling of systems, Block diagram and signal flow graph representation of systems - reduction of block diagram and signal flow graph, Introduction to Physiological control systems- Illustration, Linear models of physiological systems, Difference between engineering and physiological control systems.

UNIT II TIME RESPONSE ANALYSIS 9
Step and impulse responses of first order and second order systems - time domain specifications of first and second order systems - steady state error constants.

UNIT III STABILITY ANALYSIS 9
UNIT IV  FREQUENCY RESPONSE ANALYSIS

UNIT V  BIOLOGICAL CONTROL SYSTEM ANALYSIS

TOTAL : 45 PERIODS

COURSE OUTCOMES
Upon successful completion of the course, students will be able to
CO1: Interpret the need for mathematical modeling of various systems, representation of systems in block diagrams and signal flow graphs and are introduced to biological control systems
CO2: Determine the time response of various systems
CO3: discuss the concept of system stability
CO4: Examine the frequency response characteristics of various systems using different charts
CO5: Appraise the concept of modeling basic physiological systems

TEXT BOOKS

REFERENCES:

ONLINE RESOURCES
1. https://nptel.ac.in/courses/108/101/108101037/
2. https://nptel.ac.in/content/storage2/courses/112104158/lecture14.pdf
3. https://nptel.ac.in/content/storage2/courses/112104158/lecture16.pdf
4. https://nptel.ac.in/content/storage2/courses/112104158/lecture17.pdf

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COURSE OBJECTIVES:
- To understand about the continuous time and discrete time signals and systems.
- To learn the analysis of LTI systems using Laplace and Z transform.
- To represent the signal in frequency domain using FFT.
- To gain knowledge about the design of IIR and FIR filters.

UNIT I  FUNDAMENTALS OF SIGNALS AND SYSTEMS
Classification of systems: Continuous, discrete, linear, causal, stability, dynamic, recursive, time variance; classification of signals: continuous and discrete, energy and power; mathematical representation of signals; spectral density; sampling techniques, quantization, quantization error, Nyquist rate, aliasing effect.

UNIT II  ANALYSIS OF LTI SYSTEMS

UNIT III  DISCRETE FOURIER TRANSFORM
DFT and its properties, magnitude and phase representation-Linear Convolution- Correlation-Circular Convolution, Overlap-add and overlap-save methods. FFT - Decimation in Time Algorithm, Decimation in Frequency Algorithm. Use of FFT in Linear Filtering.

UNIT IV  INFINITE IMPULSE RESPONSE FILTERS
Analog filters – Butterworth filters, Chebyshev Type I filters (upto 3rd order), Analog Transformation of prototype LPF to BPF /BSF/ HPF. Transformation of analog filters into equivalent digital filters using Impulse invariant method and Bilinear Z transform method - Realization structures for IIR filters – direct, cascade and parallel forms.

UNIT V  FINITE IMPULSE RESPONSE FILTERS AND MULTIRATE SIGNAL PROCESSING

COURSE OUTCOMES:
CO1: To classify the continuous time and discrete time signals and systems.
CO2: To analyze the signals in both continuous time and discrete time
CO3: To apply DFT for the analysis of digital signals & systems
CO4: To design IIR filter to process real world signals.
CO5: To design FIR filter to process real world signals.

TOTAL: 45 PERIODS

PRACTICALS:
1. Construction of signals with different Frequencies.
2. Analyse the stability of a CT System with various inputs.
3. Analyse the stability of a DT System with various inputs.
4. Reconstruct a signal from samples and study the effect of Aliasing.
5. Spectrum Analysis using FFT
7. Finite word length effect.
9. DSP Processor Implementation. (Linear and Convolution, FFT implementation, IIR and FIR filters implementation)

**Equipment required for 30 students**
1. Computers with MATLAB / Equivalent software- 15 Numbers
2. TMS320C5416 Processors – 5 Numbers

**PERIODS:30**
**TOTAL:75 PERIODS**

**TEXT BOOKS**

**REFERENCES**

**CO’s- PO’s & PSO’s MAPPING**

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**GE3451** **ENVIRONMENTAL SCIENCES AND SUSTAINABILITY**

**UNIT I** **ENVIRONMENT AND BIODIVERSITY**

**UNIT II** **ENVIRONMENTAL POLLUTION**
Management system (OHASMS). Environmental protection, Environmental protection acts.

UNIT III  RENEWABLE SOURCES OF ENERGY  6
Energy management and conservation, New Energy Sources: Need of new sources. Different types new energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy.

UNIT IV  SUSTAINABILITY AND MANAGEMENT  6
Development , GDP ,Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols-Sustainable Development Goals-targets, indicators and intervention areas Climate change- Global, Regional and local environmental issues and possible solutions-case studies. Concept of Carbon Credit, Carbon Footprint. Environmental management in industry-A case study.

UNIT V  SUSTAINABILITY PRACTICES  6

TOTAL: 30 PERIODS

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

REFERENCES:
COURSE OBJECTIVES:
The student should be made to
- To study and design Bio amplifiers.
- To provide hands on training on Measurement of physiological parameters.

LIST OF EXPERIMENTS:
1. Design of pre amplifiers to acquire bio signals along with impedance matching circuit using suitable IC’s
2. Design of ECG Amplifiers with appropriate filter to remove power line and other artifacts.
3. Design of EMG amplifier
4. Design a suitable circuit to detect QRS complex and measure heart rate
5. Design of frontal EEG amplifier
6. Design of EOG amplifier to detect eye blink
7. Design a right leg driven ECG amplifier.
8. Design and study the characteristics of optical Isolation amplifier
9. Design a Multiplexer and Demultiplexer for any two biosignals.
13. Measurement and recording of peripheral blood flow
14. Design a PCB layout for any bio amplifier using suitable software tool.

List of Equipment:(30 Students per Batch)
1. pH meter and conductivity meter: 1 No.
2. Photo transducer for pulse measurement: 1 No.
3. Sphygmomanometer and Stethoscope: 1 No.
5. Multiparameter (ECG, EMG, EEG) Simulator: 2 No.
6. Function generator, DSO, Regulated Power supplies, Bread boards – 8 each
7. IC LM 324, AD 620, INA series (126,128 etc.), 555 Timer: 20 each
8. Opto Isolator IC: MCT2E – 1 No.
9. Software tool for PCB design: 1

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On successful completion of this course, the student will be able to
CO1: Design the amplifier for Bio signal measurements
CO2: Measure heart rate and heart sounds.
CO3: Record and analyze pulse rate and respiration rate
CO4: Measure blood pressure and blood flow
CO5: Design isolation amplifier

CO’s PO’s & PSO’s MAPPING

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BM3412 ANALOG AND DIGITAL INTEGRATED CIRCUITS LABORATORY

COURSE OBJECTIVES:
The student should be made to
- To design digital logic and circuits
- To learn the function of different ICs
- To understand the applications of operation amplifier.
- To learn the working of multivibrators
- To design circuits for generating waveforms using ICs.

LIST OF EXPERIMENTS:
1. Inverting, non-inverting amplifier and comparator
2. Integrator and Differentiator
3. Design and analysis of active filters using opamp
4. Schmitt trigger using operational amplifier
5. Instrumentation amplifier using operational amplifier
6. RC and LC oscillators
7. Multivibrators using IC555 Timer
8. Study of logic gates, Half adder and Full adder
9. Encoder and BCD to 7 segment decoder
10. Multiplexer and demultiplexer using digital ICs
11. Universal shift register using flip flops
12. Design of mod-N counter
13. Simulation and analysis of circuits using software

LIST OF EQUIPMENT:(30 Students per Batch)
1. CRO/DSO (30MHz) – 15 Nos.
2. Signal Generator /Function Generators (3 MHz) – 15 Nos
3. Dual Regulated Power Supplies (0 – 30V) – 15 Nos.
5. Transistor/FET (BJT-NPN-PNP and NMOS/PMOS) – 50 Nos
7. SPICE Circuit Simulation Software: (any public domain or commercial software)

TOTAL: 45 PERIODS
COURSE OUTCOMES:
On successful completion of this course, the student will be able to
CO1: Design Combinational Circuits using logic gates
CO2: Design and implement arithmetic circuits for different applications using opamp
CO3: Design Sequential Circuits using logic gates
CO4: Design waveform generators and analyse their characteristics
CO5: Simulate and analyse circuits using ICs

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

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