ANNA UNIVERSITY, CHENNAI
NON-AUTONOMOUS COLLEGES AFFILIATED TO ANNA UNIVERSITY
REGULATIONS 2021
CHOICE BASED CREDIT SYSTEM

B.E. INDUSTRIAL ENGINEERING

PROGRAM EDUCATIONAL COURSE OBJECTIVES (PEOs)

<table>
<thead>
<tr>
<th>IV.</th>
<th>To provide the students a solid foundation in mathematical, scientific and engineering knowledge required to comprehend, analyze, design and develop innovative solutions for realtime problems.</th>
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<tbody>
<tr>
<td>III.</td>
<td>To impart the students a spirit of team work, effective communication and a commitment to professional ethics.</td>
</tr>
<tr>
<td>II.</td>
<td>To imbibe the students with a desire for lifelong learning and successful career with professional excellence.</td>
</tr>
<tr>
<td>I.</td>
<td>To create and maintain an ambience for Industry – Institute Collaborations.</td>
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PROGRAM COURSE OUTCOMES (POs)

<table>
<thead>
<tr>
<th>PO#</th>
<th>Graduate Attribute</th>
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<tbody>
<tr>
<td>1</td>
<td><strong>Engineering knowledge:</strong> Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.</td>
</tr>
<tr>
<td>2</td>
<td><strong>Problem analysis:</strong> Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.</td>
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<tr>
<td>3</td>
<td><strong>Design/development of solutions:</strong> 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.</td>
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<td>4</td>
<td><strong>Conduct investigations of complex problems:</strong> 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.</td>
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<td>5</td>
<td><strong>Modern tool usage:</strong> Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.</td>
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</table>
**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.

**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.

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

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

**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.

**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.

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

**PROGRAM SPECIFIC COURSE OUTCOMES (PSOs)**

On successful completion of the Industrial Engineering Degree programme, the Graduates shall exhibit the following:

1. Apply the knowledge gained in Industrial Engineering for design and development of systems.

2. Apply the knowledge acquired to investigate research-oriented problems in Industrial engineering with due consideration for sustainability and social impacts.

3. Use the engineering analysis and data management tools for effective management of multidisciplinary projects.

**PEO’s – PO’s & PSO’s MAPPING:**

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ANNA UNIVERSITY, CHENNAI
NON-AUTONOMOUS COLLEGES AFFILIATED TO ANNA UNIVERSITY
B. E. INDUSTRIAL ENGINEERING
REGULATIONS 2021
CHOICE BASED CREDIT SYSTEM
CURRICULUM FOR SEMESTERS I TO VI AND SYLLABI FOR SEMESTERS I TO IV

**SEMESTER I**

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**TOTAL**

* 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
## SEMESTER III

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² Skill Based Course

## SEMESTER IV

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

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

### SEMESTER VI

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*Open Elective – I shall be chosen from the emerging technologies.

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

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

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

**Open Elective – II shall be chosen from the emerging technologies.

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

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

### SEMESTER VIII / VII*

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

TOTAL CREDITS: 164
# MANDATORY COURSES I

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<td>MX3085</td>
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# ELECTIVE - MANAGEMENT COURSES

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**PROFESSIONAL ELECTIVE COURSES: VERTICALS**

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<th>Vertical 1</th>
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<th>Vertical 3</th>
<th>Vertical 4</th>
<th>Vertical 5</th>
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<tbody>
<tr>
<td>Enterprise Resource Planning</td>
<td>Operations Scheduling</td>
<td>Reliability Engineering</td>
<td>Software Quality Management</td>
<td>Smart mobility and Intelligent Vehicles</td>
<td>Ergonomics in Design</td>
<td>Environment Sustainability and Impact Assessment</td>
<td>Design Thinking and Innovation</td>
<td>Safety Engineering and Management</td>
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<td>Logistics Management</td>
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<td>Multivariate Data Analysis</td>
<td>Business Data Analytics</td>
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<td>Nontraditional Manufacturing</td>
<td>Industry 4.0</td>
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Registration of Professional Elective Courses from Verticals:

Professional Elective Courses will be registered in Semesters V and VI. These courses are listed in groups called verticals that represent a particular area of specialisation / diversified group. Students are permitted to choose all the Professional Electives from a particular vertical or from different verticals. Further, only one Professional Elective course shall be chosen in a semester horizontally (row-wise). However, two courses are permitted from the same row, provided one course is enrolled in Semester V and another in semester VI. The registration of courses for B.E./B.Tech (Honours) or Minor degree shall be done from Semester V to VIII. The procedure for registration of courses explained above shall be followed for the courses of B.E./B.Tech (Honours) or Minor degree also. For more details on B.E./B.Tech (Honours) or Minor degree refer to the Regulations 2021, Clause 4.10.

Total number of courses per vertical may change as 6 or 7 or 8. If there is shortage of courses in a vertical then necessary courses may be chosen from another vertical of the same programme.
## PROFESSIONAL ELECTIVE COURSES: VERTICALS

### VERTICAL 1: OPERATIONS AND SUPPLY CHAIN MANAGEMENT

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### VERTICAL 2: MANUFACTURING SYSTEMS

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### Vertical 5: Robotics and Automation

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### Vertical 6: Product and Process Development

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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.)

OPEN ELECTIVE I AND II
(EMERGING TECHNOLOGIES)

To be offered other than Faculty of Information and Communication Engineering

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## SUMMARY

### B.E. INDUSTRIAL ENGINEERING

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**Total** 162
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.

<table>
<thead>
<tr>
<th>Vertical I</th>
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<th>Vertical III</th>
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<td>Fintech and Block Chain</td>
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<td>Team Building &amp; Leadership Management</td>
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<td>Datamining For Business Intelligence</td>
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**VERTICALS FOR MINOR DEGREE (In addition to the all the verticals of other programmes)**
(Choice of courses for Minor degree is to be made from any one vertical of other programmes or from anyone of the following verticals)

### VERTICAL 1: FINTECH AND BLOCK CHAIN

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### VERTICAL 2: ENTREPRENEURSHIP

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# VERTICAL 4: BUSINESS DATA ANALYTICS

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VERTICAL 5: ENVIRONMENT AND SUSTAINABILITY

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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 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, take 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
mentoring 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 under privileged.

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

REFERENCE BOOKS:

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

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**COURSE OBJECTIVES:**

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

**UNIT - I MATRICES**

9 + 3


**UNIT - II DIFFERENTIAL CALCULUS**

9 + 3


**UNIT - III FUNCTIONS OF SEVERAL VARIABLES**

9 + 3


**UNIT - IV INTEGRAL CALCULUS**

9 + 3

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

**UNIT - V MULTIPLE INTEGRALS**

9 + 3


**COURSE OUTCOMES:**

At the end of the course the students will be able to

- Use the matrix algebra methods for solving practical problems.

**TOTAL: 60 PERIODS**
- Apply differential calculus tools in solving various application problems.
- Able to use differential calculus ideas on several variable functions.
- Apply different methods of integration in solving practical problems.
- Apply multiple integral ideas in solving areas, volumes and other practical problems.

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

**REFERENCES:**

PH3151 ENGINEERING PHYSICS L T P C
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**COURSE OBJECTIVES**
- To make the students effectively to 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 be successfully understand the importance of quantum physics.
- To motivate the students towards the applications of quantum mechanics.

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

UNIT III  OSCILLATIONS, OPTICS AND LASERS  9

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

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

TOTAL : 45 PERIODS

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

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

CY3151 ENGINEERING CHEMISTRY
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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

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

UNIT III PHASE RULE AND COMPOSITES
Phase rule: Introduction, definition of terms with examples. One component system - water
system; Reduced phase rule; Construction of a simple eutectic phase diagram - Thermal analysis; Two component system: lead-silver system - Pattinson process.
Composites: Introduction: Definition & Need for composites; Constitution: Matrix materials (Polymer matrix, metal matrix and ceramic matrix) and Reinforcement (fiber, particulates, flakes and whiskers). Properties and applications of: Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites. Hybrid composites - definition and examples.

UNIT IV FUELS AND COMBUSTION
9
Fuels: Introduction: Classification of fuels; Coal and coke: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). Petroleum and Diesel: Manufacture of synthetic petrol (Bergius process), Knocking - octane number, diesel oil - cetane number; Power alcohol and biodiesel.
Combustion of fuels: Introduction: Calorific value - higher and lower calorific values, Theoretical calculation of calorific value; Ignition temperature: spontaneous ignition temperature, Explosive range; Flue gas analysis - ORSAT Method. CO₂ emission and carbon footprint.

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

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

TEXT BOOKS:

REFERENCES:

GE3151 PROBLEM SOLVING AND PYTHON PROGRAMMING L T P C
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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

UNIT II DATA TYPES, EXPRESSIONS, STATEMENTS
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
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
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
Files and exception: 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 looping 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/
இந்திய பிறப்பகுதிகளில் எங்ககொல அறக்கொட்பொடு இலக்கியத்தில் 3 அலகு விமளயொட்டுகள், விமளொழில் வீமண குமரிமுமனயில் மற்றும் நடுகல் அலகு ஆகிமயொரின் வளர்சியில் தென மொர்கள் மொர்கள் கருத்துக்களுடன்.

அலுவல் 2 பார்வை சிவபெருமையை பதிவு தேர்வு சிவபெருமைகள் வந்த – இருப்பதுகள்:
3

அலுவல் 3 தங்குப்புக் கூற்றுகள் மேற்பட்ட இரு விளக்கப்பொருள்கள்:
3
சித்தாத்திப்புத்தியார், பாணாக்கர், சோழபொழியார், தமிழ்ப்பெண்கள், தமிழ்ப்பெண்கள் கதக்கும், தமிழ் புலியொட்டுகள், தமிழ் புலியொட்டுகள், புலியொட்டுகளின் விளக்கப்பொருள்களை.

அலுவல் 4 குரங்கறிகளின் விளக்கம் கையூரிச்சுடா:
3
குரங்கறிகளின் காட்சியங்களுக்குட்பட்டது, நூற்றுக்கண குரங்கறிகளின் காட்சியங்களுக்குட்பட்டது, குரங்கறிகளின் காட்சியங்களுக்குட்பட்டது, குரங்கறிகளின் காட்சியங்களுக்குட்பட்டது, குரங்கறிகளின் காட்சியங்களுக்குட்பட்டது, குரங்கறிகளின் காட்சியங்களுக்குட்பட்டது, குரங்கறிகளின் காட்சியங்களுக்குட்பட்டது

அலுவல் 5 தங்கு வாழ்வு செய்து வந்த இயற்கை செய்திகள் குரங்கறிகளின் பெண்கள் பார்வைப் புரோக்கிகள்:
3
தங்கு வாழ்வு விளக்கப்பொருளின் குரங்கறிகளின் பார்வை - தங்கு வாழ்வு செய்து வந்த இயற்கை செய்திகள் தலைக்குட்பட்டது, தலைக்குட்பட்டது, தலைக்குட்பட்டது, தலைக்குட்பட்டது, தலைக்குட்பட்டது, தலைக்குட்பட்டது, தலைக்குட்பட்டது

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS
1. குரங்கறிகளின் பார்வைப் புரோக்கிகள் – தங்கு வாழ்வு செய்து வந்த இயற்கை செய்திகள் தலைக்குட்பட்டது, தலைக்குட்பட்டது, தலைக்குட்பட்டது, தலைக்குட்பட்டது, தலைக்குட்பட்டது, தலைக்குட்பட்டது (தமிழ் புரோக்கிகள்).
2. குரங்கறிகளின் பார்வைப் புரோக்கிகள் – தங்கு வாழ்வு செய்து வந்த இயற்கை செய்திகள் (தமிழ் புரோக்கிகள்).
3. தங்கு – வாழ்வு விளக்கப்பொருளின் காட்சியங்களுக்குட்பட்டது, தங்கு – வாழ்வு விளக்கப்பொருளின் காட்சியங்களுக்குட்பட்டது (தமிழ் புரோக்கிகள்).
4. தபொருமந – ஆற்றங்கமர நொகரிகம். (ததொல்லியல் துமற் தவளியீடு)
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 Bookand Educational Services Corporation, Tamil Nadu)

GE3152 HERITAGE OF TAMILS L
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UNIT I LANGUAGE AND LITERATURE
3

UNIT II HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE
3
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
3
Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

35
UNIT IV  THINAI CONCEPT OF TAMILS

3

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

UNIT V  CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE

3

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

TOTAL : 15

PERIODS

TEXT-CUM-REFERENCE BOOKS

1. தமிழகவரலொறு – மக்களும் பணைத்தி மக்களும் – தொல்பொன்றி (தமிழைப்பொிண்: தமிழகவரலொறு புனைத்தி மபத்யாக மக்களும் பணைத்தி மக்களும்).
2. வையுத்தில் தமிழ் – முழுநாளின் முழுநாளின். (தமிழைப் பொன்றி).
3. முழுநாள் – தொல்பொன்றி பணைத்தி மக்களும் மக்களும் பணைத்தி (தமிழைப்பொிண் தொல்பொன்றி).
4. சிறைக்கல் – அறிவியல் பிளமை பிளமை. (தமிழைப்பொிண் தொல்பொன்றி).
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).
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11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)

GE3171  PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY  L T P C
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36
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)
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
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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 as 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 wave length 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. Mende’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, pHmetry, 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 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.
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 BOOK:

GE3172 ENGLISH LABORATORY

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

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

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

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

UNIT IV CLASSIFICATION AND RECOMMENDATIONS
6
Listening – Listening to TED Talks; Listening to lectures - and educational videos. Speaking – Small Talk; discussing and making plans-talking about tasks-talking about progress- talking about positions and directions of movement-talking about travel preparations- talking about transportation-
UNIT V  EXPRESSION  6
Listening – Listening to debates/ discussions; different viewpoints on an issue; and panel discussions. Speaking – making predictions- talking about a given topic-giving opinions- understanding a website-describing processes

TOTAL : 30 PERIODS

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

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

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  6
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  6
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  6
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
6

UNIT V THE ABILITY TO PUT IDEAS OR INFORMATION COGENTLY
6
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.
COURSE OBJECTIVES:

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

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

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

UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS
9+3

UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION
9+3
Lagrange’s and Newton’s divided difference interpolations – Newton’s forward and backward difference interpolation – Approximation of derivateis 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:

PH3251 MATERIALS SCIENCE L T P C
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0 3

COURSE OBJECTIVES:
• To make the students to understand the basics of crystallography and its importance in studying materials properties.
• To understand the electrical properties of materials including free electron theory, applications of quantum mechanics and magnetic materials.
• To instil knowledge on physics of semiconductors, determination of charge carriers and device applications
• To establish a sound grasp of knowledge on different optical properties of materials, optical displays and applications
• To inculcate an idea of significance of nano structures, quantum confinement and ensuing nano device applications.

UNIT I CRYSTALLOGRAPHY

Crystal structures: BCC, FCC and HCP – directions and planes - linear and planar densities – crystal imperfections- edge and screw dislocations – grain and twin boundaries - Burgers
vector and elastic strain energy - Slip systems, plastic deformation of materials - Polymorphism – phase changes – nucleation and growth – homogeneous and heterogeneous nucleation.

UNIT II  ELECTRICAL AND MAGNETIC PROPERTIES OF MATERIALS  
9

UNIT III  SEMICONDUCTORS AND TRANSPORT PHYSICS  
9

UNIT IV  OPTICAL PROPERTIES OF MATERIALS  
9

UNIT V  NANOELECTRONIC DEVICES  
9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of the course, the students should be able to
- know basics of crystallography and its importance for varied materials properties
- gain knowledge on the electrical and magnetic properties of materials and their applications
- understand clearly of semiconductor physics and functioning of semiconductor devices
- understand the optical properties of materials and working principles of various optical devices
- appreciate the importance of functional nanoelectronic devices.

TEXT BOOKS:

REFERENCES:

BE3251 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING L T P C
3 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
Junction Transistor-Biasing, JFET, SCR, MOSFET, IGBT – Types, I-V Characteristics and Applications, Rectifier and Inverters

UNIT IV DIGITAL ELECTRONICS

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

UNIT V MEASUREMENTS AND INSTRUMENTATION


TOTAL: 45 PERIODS

COURSE OUTCOMES:
After completing this course, the students will be able to
1. Compute the electric circuit parameters for simple problems
2. Explain the working principle and applications of electrical machines
3. Analyze the characteristics of analog electronic devices
4. Explain the basic concepts of digital electronics
5. Explain the operating principles of measuring instruments

TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Drawing engineering curves.
2. Drawing freehand sketch of simple objects.
3. Drawing orthographic projection of solids and section of solids.
4. Drawing development of solids
5. 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

COURSE 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
4. The examination will be conducted in appropriate sessions on the same day.
வடிவமைச்சவு கிணறுகள் – கிணறுகள் மத்தியில் கிணறுகள் மற்றும் மின்னக்கண்டது மலரை மணியும் மற்றும் மலரை மனையுடன் – மலரை கிணறிகள் பார்வையும் அறியும் – அறியை உறுதியும்.

அறிக்காண்டு: அறிவியல் தமிழ் மற்றும் கைித்தமிழ்:
3
அறிவியல் தமிழில் சொல்லிக்குறுக்கு முறையில் - தமிழ் மாணவர்கள் பபைப்பிற்று தொடர்வு - தமிழ் முடிவு பார்வையும் மற்றும் தமிழ் வளம் வளம் - தமிழ் வளம் வளம் - தமிழ் நூல்கள் தமிழ் அறிவியல் - கவனிக்கும் விளமை.

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS
1. தமிழக வரலைச் - மக்களும் பணையும் – மத.செ. புதுநாடா (இயற்கைப்புத்: தமிழக பாணிக் மற்றும் கல்விப்புத் பாணிக் குறுவி).
2. கல்வியும் தமிழ் – வேல்வியும் தொடர் குறுவி. (திலக புதுநாடா).
3. இறைவு – தமிழக கல்வியும் பால்வாக் தொடர் குறுவி (திலக புதுநாடா தொடர் இயற்கைப்பு)
4. பழைய விளக்கு – மற்றும் பால்வாக் தொடர் குறுவி (திலக புதுநாடா தொடர் இயற்கைப்பு)
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 Bookand Educational Services Corporation, Tamil Nadu)

GE3252 TAMILS AND TECHNOLOGY L
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1001

51
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. தமிழகவரலொறு – மக்களும் பண்பொடும் – மக.மக. பிளமள (தவளியீடு: தமிழ்நொடுபொடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முமனவர் இல.சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – மவமகநதிக்கமரயில் எங்ககொலநகர் நொகரிகம் (ததொல்லியல் துமறதவளியீடு).
4. பார்ஸ்கோப் – கீழக்கநசிறு தசகாரிகம். (தகாலியீடு குறுத் தொலியீடு).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in
6. Social Life of the Tamils - The Classical Period (Dr. S. Singaravelu) (Published by: International Institute of Tamil Studies).
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11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

NCC CREDIT COURSE LEVEL 1*
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### NCC GENERAL
- **NCC 1**: Aims, Objectives & Organization of NCC
- **NCC 2**: Incentives
- **NCC 3**: Duties of NCC Cadet
- **NCC 4**: NCC Camps: Types & Conduct

### NATIONAL INTEGRATION AND AWARENESS
- **NI 1**: National Integration: Importance & Necessity
- **NI 2**: Factors Affecting National Integration
- **NI 3**: Unity in Diversity & Role of NCC in Nation Building
- **NI 4**: Threats to National Security

### PERSONALITY DEVELOPMENT
- **PD 1**: Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving
- **PD 2**: Communication Skills
- **PD 3**: Group Discussion: Stress & Emotions

### LEADERSHIP
- **L 1**: Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code
- **L 2**: Case Studies: Shivaji, Jhasi Ki Rani

### SOCIAL SERVICE AND COMMUNITY DEVELOPMENT
- **SS 1**: Basics, Rural Development Programmes, NGOs, Contribution of Youth
- **SS 4**: Protection of Children and Women Safety
- **SS 5**: Road / Rail Travel Safety
- **SS 6**: New Initiatives
- **SS 7**: Cyber and Mobile Security Awareness

**TOTAL: 30 PERIODS**
NCC CREDIT COURSE LEVEL 1*
NX3252
(NAVAL WING) NCC CREDIT COURSE LEVEL - I

NCC GENERAL 6
NCC 1 Aims, Objectives & Organization of NCC 1
NCC 2 Incentives 2
NCC 3 Duties of NCC Cadet 1
NCC 4 NCC Camps: Types & Conduct 2

NATIONAL INTEGRATION AND AWARENESS 4
NI 1 National Integration: Importance & Necessity 1
NI 2 Factors Affecting National Integration 1
NI 3 Unity in Diversity & Role of NCC in Nation Building 1
NI 4 Threats to National Security 1

PERSONALITY DEVELOPMENT 7
PD 1 Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving 2
PD 2 Communication Skills 3
PD 3 Group Discussion: Stress & Emotions 2

LEADERSHIP 5
L 1 Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code 3
L 2 Case Studies: Shivaji, Jhasi Ki Rani 2

SOCIAL SERVICE AND COMMUNITY DEVELOPMENT 8
SS 1 Basics, Rural Development Programmes, NGOs, Contribution of Youth 3
SS 4 Protection of Children and Women Safety 1
SS 5 Road / Rail Travel Safety 1
SS 6 New Initiatives 2
SS 7 Cyber and Mobile Security Awareness 1
# NCC CREDIT COURSE LEVEL 1

**NX3253 (AIR FORCE WING) NCC CREDIT COURSE LEVEL – 1**

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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

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

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

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

PART II

ELECTRICAL ENGINEERING PRACTICES

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

GROUP – B (MECHANICAL AND ELECTRONICS)  

PART III  
MECHANICAL ENGINEERING PRACTICES  

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

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

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

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  

TOTAL = 60 PERIODS  

COURSE OUTCOMES:  
Upon completion of this course, the students will be able to:  
1. 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.
2. Wire various electrical joints in common household electrical wire work.
3. 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.
4. Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.

BE3271 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY

COURSE OBJECTIVES:
- To train the students in conducting load tests on electrical machines
- To gain practical experience in characterizing electronic devices
- To train the students to use DSO for measurements.

LIST OF EXPERIMENTS
1. Verification of ohms and Kirchhoff’s Laws.
2. Load test on DC Shunt Motor.
3. Load test on Self Excited DC Generator
4. Load test on Single phase Transformer
5. Load Test on Induction Motor
6. Characteristics of PN and Zener Diodes
7. Characteristics of BJT, SCR and MOSFET
8. Half wave and Full Wave rectifiers
9. Study of Logic Gates
10. Implementation of Binary Adder and Subtractor
11. Study of DSO

TOTAL: 60

PERIODS

COURSE OUTCOMES:
After completing this course, the students will be able to
1. Use experimental methods to verify the Ohm’s and Kirchhoff’s Laws.
2. Analyze experimentally the load characteristics of electrical machines
3. Analyze the characteristics of basic electronic devices
4. Use DSO to measure the various parameters
OBJECTIVES
- To identify varied group discussion skills and apply them to take part in effective discussions in a professional context.
- To be able to communicate effectively through writing.

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

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

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

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

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

TOTAL: 60 PERIODS

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

Assessment Pattern
- One online / app based assessment to test speaking and writing skills
- Proficiency certification is given on successful completion of speaking and writing.
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 and diagonalization.
- To apply the concept of inner product spaces in orthogonalization.
- To provide necessary basics in probability and random processes 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 VECTOR SPACES 9+3
Vector spaces – Subspaces – Linear combinations and linear system of equations – Linear independence and linear dependence – Bases and dimensions.

UNIT IV LINEAR TRANSFORMATION AND DIAGONALIZATION 9+3
Linear transformation - Null spaces and ranges - Dimension theorem - Matrix representation of a linear transformations - Eigenvalues and eigenvectors –Diagonalization.

UNIT V INNER PRODUCT SPACES 9+3
Inner product, norms - Gram Schmidt orthogonalization process - Adjoint of linear operations - Least square approximation.

TOTAL: 60 PERIODS

COURSE OUTCOMES:
Upon successful completion of the course, students should 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: Demonstrate their mastery by solving non-trivial problems related to the concepts and by proving simple theorems about the statements proven by the text.
- 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
COURSE OBJECTIVES:
1. To introduce the students about properties of the fluids, behaviour of fluids under static conditions.
2. To impart basic knowledge of the dynamics of fluids and boundary layer concept.
3. To expose to the applications of the conservation laws to a) flow measurements b) flow through pipes (both laminar and turbulent) and c) forces on pipe bends.
4. To exposure to the significance of boundary layer theory and its thicknesses.
5. To expose the students to basic principles of working of hydraulic machineries and to design Pelton wheel, Francis and Kaplan turbine, centrifugal and reciprocating pumps.

UNIT I FLUID PROPERTIES AND FLOW CHARACTERISTICS
10+3
Properties of fluids – Fluid statics - Pressure Measurements - Buoyancy and floatation - Flow characteristics - Eulerian and Lagrangian approach - Concept of control volume and system - Reynold’s transportation theorem - Continuity equation, energy equation and momentum equation - Applications.

UNIT II FLOW THROUGH PIPES AND BOUNDARY LAYER
9+3
Reynold’s Experiment - Laminar flow through circular conduits - Darcy Weisbach equation - friction factor - Moody diagram - Major and minor losses - Hydraulic and energy gradient lines - Pipes in series and parallel - Boundary layer concepts - Types of boundary layer thickness.

UNIT III DIMENSIONAL ANALYSIS AND MODEL STUDIES
8+3
Fundamental dimensions - Dimensional homogeneity - Rayleigh’s method and Buckingham Pi theorem - Dimensionless parameters - Similitude and model studies - Distorted and undistorted models.

UNIT IV TURBINES
9+3

UNIT V PUMPS
9+3
Classification of pumps - Centrifugal pumps - Working principle - Heads and efficiencies – Velocity triangles - Work done by the impeller - Performance curves - Reciprocating pump working principle - Indicator diagram and it's variations - Work saved by fitting air vessels - Rotary pumps.

TOTAL: 60

OUTCOMES:
On completion of the course, the student is expected to be able to
1. Understand the properties and behaviour in static conditions. Also, to understand the conservation laws applicable to fluids and its application through fluid kinematics and dynamics
2. Estimate losses in pipelines for both laminar and turbulent conditions and analysis of pipes connected in series and parallel. Also, to understand the concept of boundary layer and its thickness on the flat solid surface.
3. Formulate the relationship among the parameters involved in the given fluid phenomenon and to predict the performances of prototype by model studies
4. Explain the working principles of various turbines and design the various types of turbines.
5. Explain the working principles of centrifugal, reciprocating and rotary pumps and design the centrifugal and reciprocating pumps

**TEXT BOOKS:**

**REFERENCES:**

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Low (1): Medium (2) : High (3)

CE3491 STRENGTH OF MATERIALS

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**COURSE OBJECTIVES:**
- To understand the concepts of stress, strain, principal stresses and principal planes.
- To study the concept of shearing force and bending moment due to external loads in determinate beams and their effect on stresses.
- To determine stresses and deformation in circular shafts and helical spring due to torsion.
- To compute slopes and deflections in determinate beams by various methods.
- To study the stresses and deformations induced in thin and thick shells.

**UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS**
Rigid bodies and deformable solids – Tension, Compression and Shear Stresses - Deformation of simple and compound bars – Thermal stresses – Elastic constants - Volumetric strains – Stresses on inclined planes – Principal stresses and principal planes – Mohr’s circle of stress.

UNIT II TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM
9

UNIT III TORSION
9
Theory of Torsion – Stresses and Deformations in Solid and Hollow Circular Shafts – Combined bending moment and torsion of shafts - Power transmitted to shaft – Shaft in series and parallel – Closed and Open Coiled helical springs – springs in series and parallel.

UNIT IV DEFLECTION OF BEAMS
9

UNIT V THIN CYLINDERS, SPHERES AND THICK CYLINDERS
9
Stresses in thin cylindrical shell due to internal pressure - circumferential and longitudinal stresses - Deformation in thin cylinders – Spherical shells subjected to internal pressure – Deformation in spherical shells – Thick cylinders - Lame’s theory.

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course the students would be able to
1. Understand the concepts of stress and strain in simple and compound bars, the importance of principal stresses and principal planes.
2. Understand the load transferring mechanism in beams and stress distribution due to shearing force and bending moment.
3. Apply basic equation of torsion in designing of shafts and helical springs.
4. Calculate slope and deflection in beams using different methods.
5. Analyze thin and thick shells for applied pressures.

TEXT BOOKS:
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Low (1) ;       Medium (2) ;       High (3)

IE3351 WORK SYSTEM DESIGN
L T P 3 0 3

COURSE OBJECTIVES:
- Explain the concepts of workstudy productivity and productivity measurement approaches.
- Plan and record and analyse selected tasks using different flow charts.
- Use method study to improve a task. Apply principles of motion economy to improve performance.
- Plan and conduct a time study to improve the efficiency of the system.
- Appraise the standard times to assess the office work condition.

UNIT I PRODUCTIVITY
Work Study and Productivity - Total time for a job or operation, total work content and in effective time, – Production and Productivity-Productivity and standard of living, Factors affecting Productivity, Productivity measurement Models. – procedure of work study

UNIT II METHODS ENGINEERING

UNIT III WORK MEASUREMENT
Purpose of work measurement – Techniques of work measurement – Time study – Equipment - selecting and timing the job - performance rating – allowances – Standard time – setting time standard for work with machines-learning effect

UNIT IV  APPLIED WORK MEASUREMENT  9
Work sampling and Structured estimating – Group sampling Technique – predetermined time standards (PTS), types - use of time standard - Methods Time Measurement (MTM)- MOST technique - Wage incentive plans.

UNIT V  WORK DESIGN FOR OFFICE WORK  9
Method Study in office- Organization and methods (O&M) - Work measurement of office work- Work Analysis techniques applied to support staff- Form design and control.

COURSE OUTCOMES:

CO1: Ability to understand the concepts of work study productivity and productivity measurement approaches.
CO2: Ability to record and analyze selected tasks using different flow charts.
CO3: Ability to apply method study to improve a task. Apply principles of motion economy to improve performance.
CO4: Ability to conduct a time study to improve the efficiency of the system.
CO5: Ability to estimate the standard times to assess the office work condition.

TEXT BOOKS:

CO’s- PO’s & PSO’s MAPPING

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ME3393  MANUFACTURING PROCESSES  3 0 0 3

COURSE OBJECTIVES:

1. To illustrate the working principles of various metal casting processes.
2. To learn and apply the working principles of various metal joining processes.
3. To analyse the working principles of bulk deformation of metals.
4. To learn the working principles of sheet metal forming process.
5. To study and practice the working principles of plastics molding.

UNIT – I METAL CASTING PROCESSES

UNIT II METAL JOINING PROCESSES

UNIT III BULK DEFORMATION PROCESSES

UNIT IV SHEET METAL PROCESSES

UNIT V MANUFACTURE OF PLASTIC COMPONENTS

OUTCOMES: At the end of the course the students would be able to
1. Explain the principle of different metal casting processes.
2. Describe the various metal joining processes.
3. Illustrate the different bulk deformation processes.
4. Apply the various sheet metal forming process.
5. Apply suitable molding technique for manufacturing of plastics components.

TEXT BOOKS:

REFERENCES:
ME3351 ENGINEERING MECHANICS

COURSE OBJECTIVES:
1. To Learn the use scalar and vector analytical techniques for analyzing forces in statically determinate structures.
2. To introduce the equilibrium of rigid bodies, vector methods and free body diagram.
3. To study and understand the distributed forces, surface, loading on beam and intensity.
4. To learn the principles of friction, forces and to determine the apply the concepts of frictional forces at the contact surfaces of various engineering systems.
5. To develop basic dynamics concepts – force, momentum, work and energy.

UNIT I STATICS OF PARTICLES

UNIT II EQUILIBRIUM OF RIGID BODIES

UNIT III DISTRIBUTED FORCES
Centroids of lines and areas – symmetrical and unsymmetrical shapes, Determination of Centroids by Integration, Theorems of Pappus-Guldinus, Distributed Loads on Beams, Centre of Gravity of a Three-Dimensional Body, Centroid of a Volume, Composite Bodies, Determination of Centroids of Volumes by Integration. Moments of Inertia of Areas and Mass - Determination of the Moment of Inertia of an Area by Integration, Polar Moment of Inertia, Radius of Gyration of an Area, Parallel-Axis Theorem, Moments of Inertia of Composite Areas, Moments of Inertia of a Mass - Moments of Inertia of Thin Plates, Determination of the Moment of Inertia of a Three-Dimensional Body by Integration.
UNIT IV  FRICTION
The Laws of Dry Friction, Coefficients of Friction, Angles of Friction, Wedge friction, Wheel Friction, Rolling Resistance, Ladder friction.

UNIT V  DYNAMICS OF PARTICLES

TOTAL : 45 PERIODS

OUTCOMES:
At the end of the course the students would be able to
1. Illustrate the vector and scalar representation of forces and moments
2. Analyse the rigid body in equilibrium
3. Evaluate the properties of distributed forces
4. Determine the friction and the effects by the laws of friction
5. Calculate dynamic forces exerted in rigid body

TEXT BOOKS:

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Low (1) ;    Medium (2) ;    High (3)
COURSE OBJECTIVE:
1. To study the mechanical properties of metals, wood and spring by testing in laboratory.
2. To verify the principles studied in fluid mechanics and machinery theory by performing experiments in laboratory.

UNIT – I STRENGTH OF MATERIALS 30

LIST OF EXPERIMENTS
1. Tension test on mild steel rod
2. Torsion test on mild steel rod
3. Hardness test on metal (Rockwell and Brinell Hardness)
4. Compression test on helical spring
5. Deflection test on carriage spring

UNIT – II FLUID MECHANICS AND MACHINES LABORATORY 30

LIST OF EXPERIMENTS
1. (a) Determination of coefficient of discharge of a venturimeter
   (b) Determination of friction factor for flow through pipes
2. (a) Determination of metacentric height
   (b) Determination of forces due to impact of jet on a fixed plate
3. Characteristics of centrifugal pumps
4. Characteristics of reciprocating pump
5. Characteristics of Pelton wheel turbine

TOTAL: 60 PERIODS

OUTCOMES: On completion of the course, the student is expected to be able to
1. Determine the tensile, torsion and hardness properties of metals by testing
2. Determine the stiffness properties of helical and carriage spring
3. Apply the conservation laws to determine the coefficient of discharge of a venturimeter and finding the friction factor of given pipe
4. Apply the fluid static and momentum principles to determine the metacentric height and forces due to impact of jet
5. Determine the performance characteristics of turbine, rotodynamic pump and positive displacement pump.
COURSE OBJECTIVES:
1. To Selecting appropriate tools, equipment’s and machines to complete a given job.
2. To Performing various welding process using GMAW and fabricating gears using gear making machines.
3. To Performing various machining process such as rolling, drawing, turning, shaping, drilling, milling and analyzing the defects in the cast and machined components.

LIST OF EXPERIMENTS
1. Fabricating simple structural shapes using Gas Metal Arc Welding machine.
2. Preparing green sand moulds with cast patterns.
3. Taper Turning and Eccentric Turning on circular parts using lathe machine.
4. Knurling, external and internal thread cutting on circular parts using lathe machine.
5. Shaping – Square and Hexagonal Heads on circular parts using shaper machine.
8. Cutting spur and helical gear using milling machine.
13. Cutting force calculation using dynamometer in milling machine

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

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<tr>
<td>3.</td>
<td>Horizontal Milling Machine</td>
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<td>5.</td>
<td>Surface Grinding Machine</td>
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<tr>
<td>8.</td>
<td>Lathe Tool Dynamometer</td>
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<td>12.</td>
<td>Arc welding transformer with cables and holders</td>
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<tr>
<td>13.</td>
<td>Oxygen and Acetylene gas cylinders, blow pipe and other welding outfit</td>
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TOTAL: 60 PERIODS
OUTCOMES:
At the end of the course the students would be able to
1. Demonstrate the safety precautions exercised in the mechanical workshop and join two metals using GMAW.
2. The students able to make the work piece as per given shape and size using machining process such as rolling, drawing, turning, shaping, drilling and milling.
3. The students become make the gears using gear making machines and analyze the defects in the cast and machined components.

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Low (1) ; Medium (2) ; High (3)

GE3361 PROFESSIONAL DEVELOPMENT

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:
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

10 Hours
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

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.

TOTAL: 30 PERIODS
COURSE OBJECTIVES:

- Provide knowledge of optimization techniques and approaches.
- Formulate a real-world problem as a mathematical programming model.
- Enable the students apply mathematical, computational and communication skills needed for the practical utility of Operations Research.
- Knowledge to solve networking problems.
- Knowledge to solve various inventory problems.
- Gain knowledge on solving different waiting line models.

UNIT I  LINEAR PROGRAMMING  9

UNIT II  ADVANCES IN LINEAR PROGRAMMING  9

UNIT III  NETWORK ANALYSIS  9

UNIT IV  INVENTORY MODELS  9
Purchase model with no shortages – Manufacturing model with no shortages - Model with price breaks - Reorder point model - Probabilistic inventory model

UNIT V  QUEUING THEORY  9
Queuing theory terminology – Single server, multi server- limited and unlimited queue capacity- limited and unlimited population –limited and infinite queue length.

COURSE OUTCOMES:

CO1: Learned to translate a real-world problem, given in words, into a mathematical Formulation.
CO2: An understanding of the role of algorithmic thinking in the solution of operations research problems.
CO3: Be able to build and solve Transportation Models and Assignment Models, maximal flow problem, minimum spanning tree and shortest path problem.
CO4: Able to handle issues in various Inventory models.
CO5: The students acquire capability in applying and using of queuing models for day today problem

TOTAL: 45 PERIODS
**CO's- PO's & PSO's MAPPING**

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**TEXT BOOKS:**

**REFERENCES:**

**IE3451 THERMODYNAMICS**

**COURSE OBJECTIVES:**
- To explain the basic concepts of thermodynamics and the first law of thermodynamics.
- To analyze the thermodynamics' second law.
- To assess the qualities of pure materials.
- To obtain a better understanding of mode of heat conduction, convection, and radiation.
- To apply thermodynamic concepts to IC engines, boilers, turbines, refrigeration, and air-conditioning systems.

**UNIT I BASICS CONCEPTS AND FIRST LAW OF THERMODYNAMICS 9+3**
Basic concepts; Continuum and macroscopic approach; thermodynamic systems (closed and open); thermodynamic properties and equilibrium; state of a system, state postulate for simple compressible substances, paths and processes on state diagrams; concepts of heat and work, different modes of work; zeroth law of thermodynamics; concept of temperature. First Law of Thermodynamics; Concept of energy and various forms of energy; internal energy, enthalpy; specific heats; first law applied to elementary processes, closed systems and control volumes, steady and unsteady flow analysis

**UNIT II SECOND LAW OF THERMODYNAMICS 9+3**
Second law of thermodynamics; Limitations of the first law of thermodynamics, concepts of heat engines and heat pumps/refrigerators, Kelvin-Planck and Clausius statements and their equivalence; reversible and irreversible processes; Carnotus theorems; thermodynamic temperature scale; Clausius inequality and concept of entropy; the principle of increase of entropy, T-s diagrams; second law analysis of control volume; availability and irreversibility; third law of thermodynamics.
UNIT III    PROPERTIES OF PURE SUBSTANCE  9+3
Thermodynamic properties of pure substances in solid, liquid and vapour phases; P-v-T behaviour of simple compressible substances, thermodynamic property tables and charts, psychrometric charts ideal and real gases: Vander waals equations - Reduced property - Compressibility chart - Properties of mixture of gases - Dalton's law and Gibbs - Internal energy, Enthalpy and specific heats of gas mixtures.

UNIT IV    BASICS OF HEAT TRANSFER  9+3

UNIT V    APPLICATIONS OF THERMODYNAMIC CYCLES  9+3

TOTAL: 60 PERIODS

COURSE OUTCOMES:
At the end of this course the students shall be able to:
CO1. Apply first law of thermodynamics to engineering applications.
CO2. Differentiate first and second law of thermodynamics.
CO3. Examine the properties of real and ideal gas mixtures using thermodynamic charts.
CO4. Evaluate the heat transfer through conduction, convection and radiation
CO5. Analyze the thermodynamic operations on IC engine, boilers, turbine, refrigerator etc.

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TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVES:
- Explain the knowledge of basic human science and Engineering science.
- Teach skills associated with ergonomic measurement methods and analytical techniques to workplace ergonomic problems.
- Plan and conduct an ergonomic analysis and ergonomic recommendations for modern work environment problems.
- Use the occupational health and safety rules to improve the workplace.
- Teach and apply ergonomic principles to design workplaces for the improvement of human performance.

UNIT I  INTRODUCTION  12
Brief history of human factors Engineering/Ergonomics – Interdisciplinary nature - Human–machine systems - Ergonomics and its areas of application in the work system - Future directions for ergonomics- Biostatic and Biodynamic Mechanics

UNIT II  WORK PLACE DESIGN  12
Problems of body size- Anthropometry measures- Work posture – Design for standing and seated workers - Design of repetitive tasks - Design of manual handling tasks- VDT work stations – Handtool design

UNIT III  PHYSIOLOGICAL ASPECTS OF HUMAN AT WORK  12
Stress and fatigue -Physical work capacity - Physiological factors affecting work capacity – Fitness for work –Working hours and shift work – Quantitative work load analysis – Psychological work Demands.

UNIT IV  DESIGN OF ENVIRONMENT  12

UNIT V  HUMAN PERFORMANCE  12
Human Information receiving and processing – Information theory and its application – Cognitive systems - Mental Work Load -Signal detection theory ---Design of Displays and controls

COURSE OUTCOMES:
CO1: Ability to apply Knowledge of basic human science and Engineering science.
CO2: Ability to Apply skills associated with ergonomic measurement methods and analytical techniques to workplace ergonomic problems.
CO3: Ability to conduct an ergonomic analysis and ergonomic recommendations for modern work environment problems.
CO4: Ability to implement the occupational health and safety rules to improve the workplace.
CO5: Ability to apply ergonomic principles to design workplaces for the improvement of human performance.
TEXT BOOKS:

REFERENCES:

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

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IE3453 ENGINEERING QUALITY CONTROL

COURSE OBJECTIVES:
- Developing a clear knowledge in the basics of various quality concepts.
- Facilitating the students in understanding the application of control charts and its techniques.
- Developing the special control procedures for service and process oriented industries.
- Analyzing and understanding the process capability study.
- Developing the acceptance sampling procedures for incoming raw material.

UNIT I QUALITY FUNDAMENTALS
Importance of quality- evolution of quality- definitions of quality- dimensions of quality- quality controlquality assurance- areas of quality- quality planning- quality objectives and policies- quality costseconomics of quality- quality loss function- quality Vs productivity- Quality Vs reliability.

UNIT II CONTROL CHARTS FOR VARIABLES
Process variation- preliminary decisions- control limits and their computation- construction and application of X bar, R and S charts- warning and modified control limits- process adjustment for trend - Comparison of process variation with specification limits- O.C. curve for X bar chart.

UNIT III STATISTICAL PROCESS CONTROL
Process stability- process capability study using control charts- capability evaluation- Cp, Cpk and Cpm – capability analysis using histogram and normal probability plot- machine capability study gauge capability study- setting statistical tolerances for components and assemblies- individual measurement charts- X-chart, moving average and moving range chart, multi-vari chart.
UNIT IV  CONTROL CHARTS FOR ATTRIBUTES
Limitations of variable control charts- Control charts for fraction non-conforming- p and np charts, variable sample size, operating characteristic function, run length- Control chart for nonconformities(defects)- c, u, ku charts, demerits control chart- applications.

UNIT V  ACCEPTANCE SAMPLING
Need- economics of sampling- sampling procedure- single and double sampling- O.C. Curves- Average outgoing quality- Average sample number- Average total inspection- Multiple and sequential sampling- Standard sampling plans- Military, Dodge-Roming, IS 2500.

COURSE OUTCOMES:
Students will be able to:
CO1: Control the quality of processes using control charts for variables in manufacturing industries.
CO2: Control the occurrence of defective product and the defects in manufacturing companies.
CO3: Control the occurrence of defects in services.
CO4: Analyzing and understanding the process capability study.
CO5: Developing the acceptance sampling procedures for incoming raw material.

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TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVES:
1. To understand the principles in the formation of mechanisms and their kinematics.
2. To learn the basic concepts of toothed gearing and kinematics of gear trains.
3. To study the effect of friction in different machine elements.
4. To analyze the forces and torque acting on simple mechanical systems.
5. To understand the importance of balancing and vibration.

UNIT I KINEMATIC ANALYSIS IN SIMPLE MECHANISMS AND CAMS 9

UNIT II TOOTHED GEARING AND GEAR TRAINS 9

UNIT III FRICTION ASPECTS IN MACHINE COMPONENTS 9

UNIT IV STATIC AND DYNAMIC FORCE ANALYSIS 9

UNIT V BALANCING OF ROTATING MASSES AND VIBRATION 9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
CO1: Design the linkages and the cam mechanisms for specified output motions.
CO2: Determine the gear parameters of toothed gearing and speeds of gear trains in various applications.
CO3: Evaluate the frictional torque in screw threads, clutches, brakes and belt drives.
CO4: Determine the forces on members of mechanisms during static and dynamic equilibrium conditions.
CO5: Determine the balancing masses on rotating machineries and the natural frequencies of free and forced vibratory systems.

TEXT BOOK
REFERENCES
5. Thomas Bevan, “The Theory of Machines”, Pearson Education Ltd., 2010

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

UNIT I ENVIRONMENT AND BIODIVERSITY

UNIT II ENVIRONMENTAL POLLUTION

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

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

TOTAL: 30 PERIODS

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

REFERENCES :

IE3411    WORK SYSTEM DESIGN LABORATORY   L   T   P   C
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OBJECTIVE:
To understand the theory better and apply in practice, practical training is given in the following areas:
1. Graphic tools for method study
   a)  outline process chart
   b)  Flow Process Chart
   c)  Two handed process Chart
2. Peg board experiment
3. Stop watch time study
4. Performance rating exercise
   a. Walking rating
   b. Card dealing
5. Work sampling
6. MTM practice
7. Video Based Time Study

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Students should be able
CO1: Ability to record and analyze selected tasks using different recording techniques
CO2: Ability to conduct a time study to improve the efficiency of the system.
CO3: Ability to apply MTM to improve the efficiency of the system.
CO4: Ability to conduct the work sampling study to determine the standard time
CO5: Ability to analyze the efficiency of the rating analyst in performance rating exercise

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IE3461 OPTIMIZATION LABORATORY

COURSE OBJECTIVES:
- Give adequate exposure to use different optimization software packages for solving Operations Research problems.
- Practice to solve Linear programming problems.
- Learn problem solving techniques, writing algorithms and procedures.
- Solve optimization problems using ‘C’ programming language.
- Practice C code for simple logic on OR problem.

LABORATORY EXPERIMENTS
Experiment 1: LP Models formulation and solving using softwares
Experiment 2: Formulation of Transportation Problem and solving using software package
Experiment 3: Formulation of Assignment Problems and solving using software package
Experiment 4: Solving Maximal Flow problem
Experiment 5: Solving Minimal Spanning Tree problems
Experiment 6: Solving shortest route problems
Experiment 7: Solving Project Management problems
Experiment 8: Solving Waiting line problems
Experiment 9: Solving Queuing problems
Experiment 10: Solving Inventory problems

TOTAL: 45 PERIODS
**COURSE OUTCOMES:**
CO1: Use computer tools to solve a mathematical model for practical problems.
CO2: Acquired knowledge in using Optimization Software Package.
CO3: Ability to develop C++ programming for solving optimization problem.
CO4: Able to design new simple models, like: CPM, MSPT to improve decision – making develop critical thinking and objective analysis of decision problems.
CO5: Ability to use logical thinking for solving OR problem.

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