PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

I. The program aims to develop a proficient engineer in Mechatronics multidisciplinary field to serve the various local and global technological needs.

II. To develop the engineers to synergistically practice the multidisciplinary engineering systems integration particularly in mechanical, electrical, electronic, control, manufacturing and software to serve the various technological needs of Industry and Society.

III. The programme shall create engineers continuously to uplift the knowledge, skill, attitude, self-learning, teamwork, constantly able to value the ethics and environmental eco systems.

PROGRAM OUTCOMES (POs)

PO GRADUATE ATTRIBUTE

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

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

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

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

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

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

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

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

(i) Multi-disciplinary Engineering: Analyse the real world needs and design the mechatronics system using the knowledge on multi domain engineering elements and integrated software tools.

(ii) Enhancement and up gradation: Analyse conventional functions and process of various engineering elements and propose automation solution for enhanced performance of conventional systems.

(iii) System integration, Automated Solution and connectivity: Familiarization on sensing, interfacing, controlling, actuating, communicating and analysing the data through various subsystems.

PEO’s – PO’s & PSO’s MAPPING:

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

#### SEMESTER I

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$ Skill Based Course

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

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

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

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

* NCC Credit Course level 3 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA
<table>
<thead>
<tr>
<th>S. NO.</th>
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<th>COURSE TITLE</th>
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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

**SEMIESTER VIII/VII**

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<tr>
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<th>COURSE TITLE</th>
<th>CATEGORY</th>
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<th>TOTAL CONTACT PERIODS</th>
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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: 165
## ELECTIVE – MANAGEMENT COURSES

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<th>SL. NO.</th>
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## MANDATORY COURSES I

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## MANDATORY COURSES II

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<td>Well Being with Traditional Practices (Yoga, Ayurveda and Siddha)</td>
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<td>Political and Economic Thought for a Humane Society</td>
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<td>4.</td>
<td>MX3088</td>
<td>State, Nation Building and Politics in India</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.

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: APPLIED ROBOTICS

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
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<tbody>
<tr>
<td>1.</td>
<td>CRA331</td>
<td>Robots and Systems in Smart Manufacturing</td>
<td>PEC</td>
<td>3 0 0</td>
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<td>2.</td>
<td>CRA332</td>
<td>Drone Technologies</td>
<td>PEC</td>
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<td>3.</td>
<td>CRA333</td>
<td>Microrobotics</td>
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<td>4.</td>
<td>CRA334</td>
<td>Agricultural Robotics and Automation</td>
<td>PEC</td>
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<td>6.</td>
<td>CRA336</td>
<td>Robot Operating Systems</td>
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<td>7.</td>
<td>CRA337</td>
<td>Medical Robotics</td>
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<td>8.</td>
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<td>Humanoid Robotics</td>
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VERTICAL 2: DESIGN AND MANUFACTURING

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<td>1.</td>
<td>CRA339</td>
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<td>2.</td>
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<td>3.</td>
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<td>4.</td>
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<td>Computer Integrated Manufacturing</td>
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### VERTICAL 3: SMART MOBILITY SYSTEMS

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### VERTICAL 4: INTELLIGENCE SYSTEMS

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<td>3.</td>
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### VERTICAL 6: AVIONICS AND DRONE TECHNOLOGY

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<td>Guidance and Control</td>
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<td>Design of UAV systems</td>
<td>PEC</td>
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### VERTICAL 7: LOGISTICS AND SUPPLY CHAIN MANAGEMENT

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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. Mechatronics Engineering

<table>
<thead>
<tr>
<th>S.No</th>
<th>Subject Area</th>
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ENROLLMENT FOR B.E. / B. TECH. (HONOURS) / MINOR DEGREE (OPTIONAL)

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

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

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

Complete details are available in clause 4.10 of Regulations 2021.

VERTICALS FOR MINOR DEGREE
(In addition to all the verticals of other programmes)

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

**VERTICAL 1: FINTECH AND BLOCKCHAIN**

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**VERTICAL 2: ENTREPRENEURSHIP**

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### VERTICAL 4: BUSINESS DATA ANALYTICS

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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 dont's, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing. Discussions would be conducted in small groups of about 20 students with a faculty
mentor each. It would be effective that the faculty mentor assigned is also the faculty advisor for the student for the full duration of the UG programme.

(iv) Literary Activity

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

(v) Proficiency Modules

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

(vi) Lectures by Eminent People

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

(vii) Visits to Local Area

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the 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 grammatical 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 II  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 III  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 IV  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 V  CLASSIFICATION AND RECOMMENDATIONS  
Reading – Newspaper articles; Journal reports –and Non Verbal Communication (tables, pie charts etc.). Writing – Note-making / Note-taking (*Study skills to be taught, not tested); Writing recommendations; Transferring information from non verbal ( chart, graph etc, to verbal mode) Grammar – Articles; Pronouns - Possessive & Relative pronouns. Vocabulary - Collocations; Fixed / Semi fixed expressions.
UNIT V  EXPRESSION
Reading – Reading editorials; and Opinion Blogs; Writing – Essay Writing (Descriptive or narrative). Grammar – Future Tenses, Punctuation; Negation (Statements & Questions); and Simple, Compound & Complex Sentences. Vocabulary - Cause & Effect Expressions – Content vs Function words.

TOTAL : 45 PERIODS

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

TEXT BOOKS:
1. English for Engineers & Technologists Orient Blackswan Private Ltd. Department of English, Anna University, (2020 edition)
   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

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

TOTAL: 60 PERIODS

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

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

REFERENCES:
PH3151 ENGINEERING PHYSICS

L T P C
3 0 0 3

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


UNIT II ELECTROMAGNETIC WAVES

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

UNIT III OSCILLATIONS, OPTICS AND LASERS


UNIT IV BASIC QUANTUM MECHANICS

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

UNIT V
APPLIED QUANTUM MECHANICS

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

TOTAL : 45 PERIODS

COURSE OUTCOMES

After completion of this course, the students should be able to

- Understand the importance of mechanics.
- Express their knowledge in electromagnetic waves.
- Demonstrate a strong foundational knowledge in oscillations, optics and lasers.
- Understand the importance of quantum physics.
- Comprehend and apply quantum mechanical principles towards the formation of energy bands.

TEXT BOOKS:

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

REFERENCES:


CY3151
ENGINEERING CHEMISTRY

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


UNIT V  ENERGY SOURCES AND STORAGE DEVICES

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

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

UNIT V  FILES, MODULES, PACKAGES  9
Files and 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/
அதி I  மருத்துவத்தின் இந்திய அலகு

அதி II  பண்படுத்துப் பண்புறத்தின் அறக்கொட்பொடு

அதி III  காமுடையின் விளக்கம்

அதி IV  மேம்பரின் விளக்கம்

அதி V  இதில் இருதொல்கொப்பியம்

TEXT-CUM-REFERENCE BOOKS
1.  செந்தின் வாணவதானம் - மார்க்கவிய பலகோமாகம் - ச.ட.கி. பிள்ளையார் (தமிழில்: செந்தின் வாணவதானம் - மார்க்கவிய பலகோமாகம் - ச.ட.கி. பிள்ளையார்).
2.  இலக்கியம் இந்தியா - சுற்றுலா விளக்கம் (செந்தின் வாணவதானம்).
3.  செந்தின் - மார்க்கவிய பலகோமாகம் (செந்தின் வாணவதானம்).
4.  கொரைய விளக்கம் (செந்தின் வாணவதானம்).
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

TOTAL : 15 PERIODS
Institute of Tamil Studies.

7. Historical Heritage of the Tamils (Dr. S. V. Subatamanian, Dr. K. D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).

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

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

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

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


GE3152 HERITAGE OF TAMILS

UNIT I LANGUAGE AND LITERATURE

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

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

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

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

TOTAL : 15 PERIODS

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

GE3171 PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY L T P C
0 0 4 2

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

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

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)
2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).
3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)
4. Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building – operations of list & tuples)
5. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)
6. Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
7. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
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/
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. Melde’s string experiment
14. Experiment with lattice dynamics kit.

TOTAL: 30 PERIODS

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

CHEMISTRY LABORATORY: (Any seven experiments to be conducted)

COURSE OBJECTIVES:
- To inculcate experimental skills to test basic understanding of water quality parameters, such as, acidity, alkalinity, hardness, DO, chloride and copper.
- To induce the students to familiarize with electroanalytical techniques such as, pHometry, potentiometry and conductometry in the determination of impurities in aqueous solutions.
- To demonstrate the analysis of metals and alloys.
- To demonstrate the synthesis of nanoparticles.
1. Preparation of Na₂CO₃ as a primary standard and estimation of acidity of a water sample using the primary standard
2. Determination of types and amount of alkalinity in 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 (TiO₂/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 L T P C
0 0 2 1

OBJECTIVES :
- To improve the communicative competence of learners
- To help learners use language effectively in academic /work contexts
- To develop various listening strategies to comprehend various types of audio materials like lectures, discussions, videos etc.
- To build on students' English language skills by engaging them in listening, speaking and grammar learning activities that are relevant to authentic contexts.
- To use language efficiently in expressing their opinions via various media.
UNIT I  INTRODUCTION TO FUNDAMENTALS OF  COMMUNICATION  6
Listening for general information-specific details- conversation: Introduction to classmates - Audio / video (formal & informal); Telephone conversation; Listening to voicemail & messages; Listening and filling a form. Speaking - making telephone calls-Self Introduction; Introducing a friend; - politeness strategies- making polite requests, making polite offers, replying to polite requests and offers- understanding basic instructions( filling out a bank application for example).

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

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

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

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

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.

TOTAL : 30 PERIODS
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.

OUTCOMES:

At the end of the course, learners will be able

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

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

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

MA3251 STATISTICS AND NUMERICAL METHODS

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

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

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

UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9+3

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


TOTAL: 60 PERIODS

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

TEXT BOOKS:

REFERENCES:

PH3259  APPLIED MATERIALS SCIENCE

COURSE OBJECTIVES:
- To make the students to understand the basics of crystallography and its importance in studying materials properties.
- To inculcate the knowledge of phase relationships for the understanding of material 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
UNIT I CRYSTALLOGRAPHY

UNIT II PHASE DIAGRAMS

UNIT III ELECTRICAL AND MAGNETIC PROPERTIES OF MATERIALS

UNIT IV SEMICONDUCTORS AND TRANSPORT PHYSICS

UNIT V OPTICAL PROPERTIES OF MATERIALS

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.
- Understand the properties of materials through the study of phase relationships.
- 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.

TOTAL: 45 PERIODS
TEXT BOOKS:

REFERENCES:

BE3253  BASIC ELECTRICAL, ELECTRONICS ENGINEERING AND MEASUREMENTS

L T P C
3 0 0 3

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

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

UNIT II  ELECTRICAL MACHINES

UNIT III  ANALOG ELECTRONICS
UNIT IV  LINEAR INTEGRATED CIRCUITS  9
Ideal OP-AMP characteristics, Basic applications of op-amp – Inverting and Non-inverting Amplifiers, summer, differentiator and integrator-S/H circuit–D/A converter (R- 2R ladder), A/D converters- Flash type ADC using OP-AMPS . Functional block, characteristics of 555 timer– Astable multi-vibrator mode.

UNIT V  MEASUREMENTS AND INSTRUMENTATION  9

TOTAL: 45 PERIODS

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

TEXT BOOKS
3.  S.K. Bhattacharya, Basic Electrical Engineering, Pearson Education, 2019

REFERENCES

GE3251  ENGINEERING GRAPHICS  L T P C
2 0 4 4

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
  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 size.
4. The examination will be conducted in appropriate sessions on the same day.

GE3252

தமிழ் மதொழில்நுட்பம்

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TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS
2. தொன்சித் தொலைபூர் – வரலைச்சியும் குறிப்பிட்டு. (சோழகு: புரட்சியில்).
3. கிளர்ச்சியும் - கைமுத்த இயற்பியலம் தமிழகக் கைத்துச் சட்டகம் (சோழகு: மக்கள் குறிப்பிட்டு).
4. போருக்குறியக் கல்வணிகம். (சோழகு: மக்கள் குறிப்பிட்டு).
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)
UNIT I  WEAVING AND CERAMIC TECHNOLOGY  3
Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

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

UNIT III  MANUFACTURING TECHNOLOGY  3

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

UNIT V  SCIENTIFIC TAMIL & TAMIL COMPUTING  3

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS
1. தமிழக வரலொறு – மக்களும் பண பொடும் – மக்.மக்.பிள்மள (தவளியீடு: தொல்லியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முமனவர் சுந்தரம் (விகடன் பிரசுரம்).
3. கீழடி – மவமகநதிக்கமரில் தொன்ககே கொலநகரிகம் (தொல்லியல் துமற்தவளியீடு).
4. பாராதவத்து – அருணாசலம் தங்கிகம். (தொல்லியல் துமற்தவளியீடு)
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10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
NCC Credit Course Level 1*
NX3251
(ARMY WING) NCC Credit Course Level - I

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NATIONAL INTEGRATION AND AWARENESS

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TOTAL: 30 PERIODS

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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 commonhousehold wood work.
2. Wiring various electrical joints in common household electrical wire work.
3. Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipments; Making a tray out of metal sheet using sheet metal work.
4. Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.

GROUP – A (CIVIL & ELECTRICAL)

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

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

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

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

GROUP – B (MECHANICAL AND ELECTRONICS)

PART III MECHANICAL ENGINEERING PRACTICES

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

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

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

SHEET METAL WORK:
a) Making of a square tray

FOUNDRY WORK:
a) Demonstrating basic foundry operations.

PART IV ELECTRONIC ENGINEERING PRACTICES

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

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

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

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.
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:

ELECTRICAL
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

ELECTRONICS
6. Experiment on Transistor based application circuits (Inverting and non-inverting amplifier or switching circuits)
   (Or)
   Experiments on Operational Amplifier based Inverting and non-inverting amplifier.
7. Experiments on ADC.
8. Experiments on 555 timer

MEASUREMENTS
9. Study on function of DSO.
10. Measurement of Amplitude, Frequency, Time, Phase Measurement using 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
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
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
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
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
Speaking: describing things relatively-describing clothing-discussing safety issues (making recommendations) talking about electrical devices-describing controlling actions-Writing: job application (Cover letter + Curriculum vitae)-writing recommendations.

TOTAL: 60 PERIODS

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

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

MA3351 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

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

UNIT I PARTIAL DIFFERENTIAL EQUATIONS
Formation of partial differential equations-Solutions of standard types of first order partial differential equations - First order partial differential equations reducible to standard types-Lagrange’s linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.
UNIT II    FOURIER SERIES  9+3
Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series and cosine series – Root mean square value – Parseval’s identity – Harmonic analysis.

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

UNIT IV    FOURIER TRANSFORMS  9+3

UNIT V    Z - TRANSFORMS AND DIFFERENCE EQUATIONS  9+3

TOTAL: 60 PERIODS

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

- Understand how to solve the given standard partial differential equations.
- Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
- Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.
- Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.
- Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

TEXT BOOKS:

REFERENCES:
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

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

TOTAL : 45 PERIODS
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Low (1); Medium (2); High (3)

MF3391 MECHANICS OF MATERIALS

COURSE OBJECTIVES:
The main learning objective of this course is to prepare students for:
- Applying the principle concepts behind stress, strain and deformation of solids for various engineering applications.
- Analyzing the transverse loading on beams and stresses in beam for various engineering applications.
- Analyzing the torsion principles on shafts and springs for various engineering applications.
- Analyzing the deflection of beams for various engineering applications.
- Analyzing the thin and thick shells and principal stresses in beam for various engineering applications.

UNIT I STRESS AND STRAIN
9
Introduction, Hooke's law, Calculation of stresses in straight, Stepped and tapered sections, Composite sections, Stresses due to temperature change, Shear stress and strain, Lateral strain and Poisson's ratio, Generalized Hooke's law, Bulk modulus, Relationship between elastic constants.
UNIT II  ANALYSIS OF STRESS AND STRAIN  9
Plane stress, Stresses on inclined planes, Principal stresses and maximum shear stress, Principal angles, Shear stresses on principal planes, Maximum shear stress, Mohr circle for plane stress conditions.


UNIT III  SHEAR FORCES AND BENDING MOMENTS  9
Type of beams, Loads and reactions, Relationship between loads, shear forces and bending moments, Shear force and bending moments of cantilever beams, Pin support and roller supported beams subjected to concentrated loads and uniformly distributed constant / varying loads.

Stress in Beams: Pure bending, Curvature of a beam, Longitudinal strains in beams, Normal stresses in Beams with rectangular, circular, ‘I’ and ‘T’ cross sections, Flexure Formula, Bending Stresses, Deflection of beams (Curvature).

UNIT IV  TORSION  9
Circular solid and hallow shafts, Torsional moment of resistance, Power transmission of straight and stepped shafts, Twist in shaft sections, Thin tubular sections, thin walled sections

Columns: Buckling and stability, Critical load, Columns with pinned ends, Columns with other support conditions, Effective length of columns, Secant formula for columns.

UNIT V  STRAIN ENERGY  9
Castiglioni’s theorem I and II, Load deformation diagram, Strain energy due to normal stresses, Shear stresses, Modulus of resilience, Strain energy due to bending and torsion.

Theories of Failure: Maximum Principal stress theory, Maximum shear stress theory.

TOTAL: 45 PERIODS

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

- Apply the principle concepts behind stress, strain and deformation of solids for various engineering applications.
- Analyze the transverse loading on beams and stresses in beam for various engineering applications.
- Analyze the torsion principles on shafts and springs for various engineering applications.
- Analyze the deflection of beams for various engineering applications.
- Understanding the concept of theories of failure

TEXT BOOKS:  

REFERENCES:  

MR3351 FLUID MECHANICS AND THERMAL SYSTEMS L T P C
4 0 0 4

COURSE OBJECTIVES:
1. To knowledge in Fluid Properties and Statics
2. To understand the concept of fluid kinematics and Dynamics.
3. To learn about the flows in fluid, Viscous flows and flow through pipes
4. To understand the basics laws of thermodynamics
5. To understand the second law of thermodynamics and entropy

UNIT I FLUID PROPERTIES AND FLUID STATICS 12
Fluid Definition and Classification – Properties of fluids: Density, Specific Weight, Specific Volume, Specific Gravity, Viscosity, Compressibility, Bulk Modulus, Capillary and Surface Tension – Fluid statics: Concept of fluid static pressure – Pascal's law – Absolute and Gauge pressures – Manometers: Types and Pressure measurement – Concept of Buoyancy and Floatation.

UNIT II FLUID KINEMATICS AND FLUID DYNAMICS 12
Fluid Kinematics: Types of fluid flow – Continuity equation in two and three dimensions – Velocity and Acceleration of fluid particle – Velocity potential function and Stream function. Fluid dynamics: Euler's equation along a streamline – Bernoulli's equation and applications – Venturi meter, Orifice meter and Pitot tube.

UNIT III VISCOUS FLOW, FLOW THROUGH PIPES AND DIMENSIONAL ANALYSIS 12

UNIT IV BASICS OF THERMODYNAMICS AND FIRST LAW OF THERMODYNAMICS 12

UNIT V SECOND LAW OF THERMODYNAMICS AND ENTROPY 12

TOTAL: 60 PERIODS
COURSE OUTCOMES:
At the end of the course, the student able to:

CO1: Recognize the fluid properties, fluid statics and laws of thermodynamics
CO2: Interpret the problems related to kinematics and dynamics of fluids and thermal systems
CO3: Review the energy losses in flow through pipes and steady flow equation in thermal systems.
CO4: Analyse the fluid flow and thermal process
CO5: Solve the problems related to fluid and thermal systems.

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1 – Slight, 2 – Moderate, 3 – Substantial

TEXT BOOK:

REFERENCES:

MR3391 DIGITAL ELECTRONICS AND MICROPROCESSOR L T P C 3 0 0 3

COURSE OBJECTIVES:
1. To present the Digital fundamentals, Boolean algebra and its applications in digital systems
2. To familiarize with the design of various combinatorial digital circuits using logic gates
3. To introduce the analysis and design procedures for synchronous and asynchronous sequential circuits
4. To explain the various semiconductor memories and related technology
5. To introduce the electronic circuits involved in the making of logic gate

UNIT I DIGITAL FUNDAMENTALS
Number Systems – Decimal, Binary, Octal, Hexadecimal, 1’s and 2’s complements, Codes – Binary, BCD, Excess 3, Gray, Alphanumeric codes, Boolean theorems, Logic gates, Universal gates, Sum of products and product of sums, Minterms and Maxterms, Karnaugh map Minimization and Quine-McCluskey method of minimization.
UNIT II  COMBINATIONAL & SYNCHRONOUS SEQUENTIAL CIRCUITS  9

UNIT III  ASYNCHRONOUS SEQUENTIAL CIRCUITS AND MEMORY DEVICES  9

UNIT IV  8085 PROCESSOR  9

UNIT V  PROGRAMMING PROCESSOR  9
Instruction - format and addressing modes – Assembly language format – Data transfer, data manipulation& control instructions – Programming: Loop structure with counting & Indexing – Look up table - Subroutine instructions – stack -8255 architecture and operating modes

TOTAL: 45 PERIODS

COURSE OUTCOMES
At the end of the course, the student able to:
CO1: State the fundamental operating concepts behind digital logic circuits and microprocessors.
CO 2: Recognize the use of various digital logic circuitsand sub units in microprocessors.
CO 3: Sketch the digital logic circuits and the architectures of microprocessors
CO 4: Design the DLC and Microprocessor for the standard applications.
CO 5: Create the circuits using DLC and Microprocessor for given applications

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1 – Slight, 2 – Moderate, 3 – Substantial

TEXT BOOKS:

REFERENCES:
MR3392    ELECTRICAL DRIVES AND ACTUATORS    L T P C
                        3 0 0 3

COURSE OBJECTIVES:
1. To familiarize a relay and power semiconductor devices
2. To get a knowledge on drive characteristics
3. To obtain the knowledge on DC motors and drives.
4. To obtain the knowledge on AC motors and drives.
5. To obtain the knowledge on Stepper and Servo motor.

UNIT I    RELAY AND POWER SEMI-CONDUCTOR DEVICES    9
Study of Switching Devices – Relay and Types, Switching characteristics -BJT, SCR, TRIAC, GTO, MOSFET, IGBT and IGCT:- SCR, MOSFET and IGBT - Triggering and commutation circuit - Introduction to Driver and snubber circuits

UNIT II    DRIVE CHARACTERISTICS    9

UNIT III    DC MOTORS AND DRIVES    9
DC Servomotor - Types of PMDC & BLDC motors - principle of operation- emf and torque equations - characteristics and control – Drives- H bridge - Single and Three Phases – 4 quadrant operation – Applications

UNIT IV    AC MOTORS AND DRIVES    9

UNIT V    STEPPER AND SERVO MOTOR    9

COURSE OUTCOMES
At the end of the course, the student able to:
1. Recognize the principles and working of relays, drives and motors.
2. Explain the working and characteristics of various drives and motors.
3. Apply the solid state switching circuits to operate various types of Motors and Drivers
4. Interpret the performance of Motors and Drives.
5. Suggest the Motors and Drivers for given applications.

TOTAL: 45 PERIODS

Mapping of COs with POs and PSOs

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TEXT BOOKS:

REFERENCES:

MR3361 ELECTRICAL DRIVES AND ACTUATORS LABORATORY

COURSE OBJECTIVES:
1. To impart knowledge on Performance of the fundamental control practices associated with AC and DC machines (starting, reversing, braking, plugging, etc.) using power electronics To impart industry oriented learning
2. To evaluate the use of computer-based analysis tools to review the major classes of machines and their physical basis for operation

LIST OF EXPERIMENTS:
1. Load test on DC Motor
2. Load test on 3 Phase Induction Motor
3. Load test on 3 Phase Synchronous Motor.
4. Rheostat based Speed control of motors (AC and DC)
5. Switching circuits of MOSFET, IGBT, SCR and TRAIC.
6. Gate pulsation generation using PWM signals.
7. Speed control of DC motor using Power Electronic Drive.
8. Position and direction control DC servomotor using Power Electronic Drive.
12. VFD control of single phase and three-phase induction motor using Power Electronic Drive.
13. AC servomotor position, direction and speed control using Power Electronic Drive.
(Any 10 experiments)

TOTAL: 60 PERIODS
COURSE OUTCOMES:
At the end of the course, the student able to:
CO1: Practice the basic working of AC, DC motor, stepper motor, servo motor and synchronous motor using power electronic drive.
CO2: Demonstrate the control of AC, DC motor, stepper motor, servo motor and synchronous motor using power electronic drive.
CO3: Analyze the performance of AC, DC motor, stepper motor, servo motor and synchronous motor using power electronic drive.

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List of Equipment's:
1. DC Motor with load – 1. N.o.
2. 3 Phase Induction Motor with load – 1. N.o.
3. 3 Phase Synchronous Motor with load – 1. N.o.
4. Rheostat based Speed control of motors (AC and DC) with load – 1. N.o.
5. MOSFET, IGBT, SCR and TRAIC – 1. N.o.
6. DC motor with speed control Drive. – 1. N.o.
7. DC servomotor with Power Electronic Drive (Position, Direction and speed). – 1. N.o.
11. VFD with single phase and three-phase induction motor. – 1. N.o.

MR3311 DESIGN AND MODELLING LABORATORY L T P C 0 0 4 2

COURSE OBJECTIVES:
1. To prepare assembly drawings both manually and using standard CAD packages.
2. To familiarize the commands and procedure for 2D drawing and 3D models in computer oriented Modelling environment.
3. To assemble the parts and generate the motion simulation of 3D models.

LIST OF EXPERIMENTS
2D and 3D Modelling of Components
1. Bearing and Couplings.
2. Ball Screw and Gears
3. Sheet Metal Components
4. Jigs, Fixtures and Die Assemblies.
Modelling and Simulation of Mechanism
5. 4 Bar Chain
6. Slider Crank
7. Quick Return and Elliptical Trammel.
8. Screw jack.

Assembly and Simulation of Parts
9. Basic Serial Robots
10. Simple Machines

TOTAL: 60 PERIODS

COURSE OUTCOMES:
At the end of the course, the student able to:
CO1: Create 2D drawing and 3D models for part design and model developments.
CO2: Integrate the parts and capable to simulate motion functionality of the model virtually.
CO3: Analyze the Design, assembly and visualize the motion of machines and robots.

Mapping of COs with POs and PSOs

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List of Equipment:
Equipment
1. Computers – 30 no's
2. CAD Modelling packages – open source/ licensed – 30 users

GE3361

OBJECTIVES:
To be proficient in important Microsoft Office tools: MS WORD, EXCEL,
POWERPOINT:
- To be proficient in using MS WORD to create quality technical documents, by using standard templates, widely acceptable styles and formats, variety of features to enhance the presentability and overall utility value of content.
- To be proficient in using MS EXCEL for all data manipulation tasks including the common statistical, logical, mathematical etc., operations, conversion, analytics, search and explore, visualize, interlink, and utilizing many more critical features offered
- To be able to create and share quality presentations by using the features of MS PowerPoint, including: organization of content, presentability, aesthetics, using media elements and enhance the overall quality of presentations.
MS WORD: 10 Hours
Create and format a document
Working with tables
Working with Bullets and Lists
Working with styles, shapes, smart art, charts
Inserting objects, charts and importing objects from other office tools
Creating and Using document templates
Inserting equations, symbols and special characters
Working with Table of contents and References, citations
Insert and review comments
Create bookmarks, hyperlinks, endnotes footnote
Viewing document in different modes
Working with document protection and security
Inspect document for accessibility

MS EXCEL: 10 Hours
Create worksheets, insert and format data
Work with different types of data: text, currency, date, numeric etc.
Split, validate, consolidate, Convert data
Sort and filter data
Perform calculations and use functions: (Statistical, Logical, Mathematical, date, Time etc.)
Work with Lookup and reference formulae
Create and Work with different types of charts
Use pivot tables to summarize and analyse data
Perform data analysis using own formulae and functions
Combine data from multiple worksheets using own formulae and built-in functions to generate results
Export data and sheets to other file formats
Working with macros
Protecting data and Securing the workbook

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

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:
1. To study the concepts and basic mechanics of metal cutting and the factors affecting machinability.
2. To learn working of basic and advanced turning machines.
3. To teach the basics of machine tools with reciprocating and rotating motions and abrasive finishing processes.
4. To study the basic concepts of CNC of machine tools and constructional features of CNC.
5. To learn the basics of CNC programming concepts to develop the part programme for Machine centre and turning centre.

UNIT I MECHANICS OF METAL CUTTING
Mechanics of chip formation, forces in machining, Types of chip, cutting tools – single point cutting tool nomenclature, orthogonal and oblique metal cutting, thermal aspects, cutting tool materials, tool wear, tool life, surface finish, cutting fluids and Machinability.

UNIT II TURNING MACHINES
Centre lathe, constructional features, specification, operations – taper turning methods, thread cutting methods, special attachments, surface roughness in turning, machining time and power estimation. Special lathes - Capstan and turret lathes- tool layout – automatic lathes: semi-automatic – single spindle: Swiss type, automatic screw type – multi spindle

UNIT III RECIPROCATING MACHINE TOOLS

UNIT IV CNC MACHINES
Computer Numerical Control (CNC) machine tools, constructional details, special features – Drives, Recirculating ball screws, tool changers; CNC Control systems – Open/closed, point-to-point/continuous - Turning and machining centres – Work holding methods in Turning and machining centres, Coolant systems, Safety features.

UNIT V PROGRAMMING OF CNC MACHINE TOOLS
Coordinates, axis and motion, Absolute vs Incremental, Interpolators, Polar coordinates, Program planning, G and M codes, Manual part programming for CNC machining centers and Turning centers – Fixed cycles, Loops and subroutines, Setting up a CNC machine for machining.

TOTAL : 45 PERIODS

OUTCOMES:
At the end of the course the students would be able to
1. Apply the mechanism of metal removal process and to identify the factors involved in improving machinability.
2. Describe the constructional and operational features of centre lathe and other special purpose lathes.
3. Describe the constructional and operational features of reciprocating machine tools.
4. Apply the constructional features and working principles of CNC machine tools.
5. Demonstrate the Program CNC machine tools through planning, writing codes and setting up CNC machine tools to manufacture a given component.
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Low (1) ; Medium (2) ; High (3)
COURSE OBJECTIVES:
1. To understand the basic components and layout of linkages in the assembly of a system/machine and also learn about the mechanisms.
2. To understand the basic concepts of toothed gearing and kinematics of gear trains and the effects of friction in motion transmission and in machine components.
3. To learn about the concepts in friction.
4. To understand the principles in force analysis.
5. To learn about the basic concept of static and dynamic balancing and vibration.

UNIT I KINEMATIC OF MACHINES
12

UNIT II GEAR S AND GEAR TRAINS
12

UNIT III FRICTION
12
Sliding and Rolling Friction angle – friction in threads – Friction Drives – Belt and rope drives.

UNIT IV FORCE ANALYSIS
12

UNIT V BALANCING AND VIBRATION
12

COURSE OUTCOMES
At the end of the course, the student able to:
CO1: Recognize the basic terminologies of kinematics and dynamics of machines
CO2: Interpret the various concepts of kinematics and dynamics including forces and frictions
CO 3: Show the motions parameters on the various mechanisms, gears and gear trains.
CO 4: Apply the mechanism, gears and gear train for the design of new machines.
CO 5: Analyze the working of various mechanism, gears and gear train.
TEXT BOOKS:

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1 – Slight, 2 – Moderate, 3 – Substantial

MR3491 SENSORS AND INSTRUMENTATION L T P C 3 0 0 3

COURSE OBJECTIVES:
1. To understand the concepts of measurement technology.
2. To learn the various sensors used to measure various physical parameters.
3. To learn the fundamentals of signal conditioning, data acquisition and communication systems used in mechatronics system development
4. To learn about the optical, pressure and temperature sensor
5. To understand the signal conditioning and DAQ systems

UNIT I INTRODUCTION 9

UNIT II MOTION, PROXIMITY AND RANGING SENSORS 9
UNIT III  FORCE, MAGNETIC AND HEADING SENSORS  8
Strain Gage, Load Cell, Magnetic Sensors –types, principle, requirement and advantages:
Magneto resistive – Hall Effect – Current sensor Heading Sensors – Compass, Gyroscope,
Inclinometers.

UNIT IV  OPTICAL, PRESSURE AND TEMPERATURE SENSORS  10
Photo conductive cell, photo voltaic, Photo resistive, LDR – Fiber optic sensors – Pressure –
Diaphragm, Bellows, Piezoelectric – Tactile sensors, Temperature – IC, Thermistor, RTD,
Thermocouple. Acoustic Sensors – flow and level measurement, Radiation Sensors - Smart
Sensors - Film sensor, MEMS & Nano Sensors, LASER sensors.

UNIT V  SIGNAL CONDITIONING AND DAQ SYSTEMS  9
Amplification – Filtering – Sample and Hold circuits – Data Acquisition: Single channel and
multi-channel data acquisition – Data logging - applications - Automobile, Aerospace, Home
appliances, Manufacturing, Environmental monitoring.

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon successful completion of the course, students should be able to:
CO1: Recognize with various calibration techniques and signal types for sensors.
CO2: Describe the working principle and characteristics of force, magnetic, heading,
pressure and temperature, smart and other sensors and transducers.
CO3: Apply the various sensors and transducers in various applications
CO4: Select the appropriate sensor for different applications.
CO5: Acquire the signals from different sensors using Data acquisition systems.

TEXT BOOKS:
Hill, 2009
2. Sawney A K and Puneet Sawney, "A Course in Mechanical Measurements and

REFERENCES
Sons, Canada, 2001
2. Hans Kurt Tönshoff (Editor), Ichiro, “Sensors in Manufacturing" Volume 1, Wiley-VCH
April 2001.
Press, 2015

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1 – Slight, 2 – Moderate, 3 – Substantial
COURSE OBJECTIVES:
1. To familiarize the architecture and fundamental units of microcontroller.
2. To know the microcontroller programming methodology and to acquire the interfacing skills and data exchange methods using various communication protocols.
3. To design the interface circuit and programming of I/O devices, sensors and actuators.
4. To understand ARM processor architecture and its functions to meet out the computational and interface needs of growing mechatronic systems.
5. To acquaint the knowledge of real time embedded operating system for advanced system developments.

UNIT I  INTRODUCTION TO MICROCONTROLLER  6

UNIT II  PROGRAMMING AND COMMUNICATION  6

UNIT III  PERIPHERAL INTERFACING  6
I/O Programming – Interfacing of Memory, Key Board and Displays – Alphanumeric and Graphic, RTC, interfacing of ADC and DAC, Sensors - Relays - Solenoid Valve and Heater - Stepper Motors, DC Motors - PWM Programming – Closed Loop Control Programming of Servomotor – Traffic Light

UNIT IV  ARM PROCESSOR  6

UNIT V  SINGLE BOARD COMPUTERS AND PROGRAMMING  6

EMBEDDED SYSTEMS LAB

LIST OF EXPERIMENTS
1. Assembly Language Programming and Simulation of 8051.
2. Alphanumeric and Graphic LCD Interfacing using 8051 Microcontroller.
3. Input switches and keyboard interfacing of 8051.
4. Sensor Interfacing with ADC to 8051 and DAC & RTC Interfacing with 8051.
5. Timer, Counter and Interrupt Program Application for 8051.
6. Step Motor (Unipolar & Bipolar Motor) and PWM Servo Motor Control to Interfacing with 8051.
7. UART Serial and Parallel Port Programming of 8051.
8. I²C, SPI and CAN Programming of 8051.

TOTAL: 30 PERIODS
9. Interfacing and Programming of Bluetooth and Wi-Fi with 8051
15. IOT application using SBC.

(any 7 experiments) TOTAL:30 PERIODS

COURSE OUTCOMES
Upon successful completion of the course, students should be able to:
CO 1: Know the various functional units of microcontroller, processors and system-on-chip based on the features and specifications.
CO 2: Recognize the role of each functional units in microcontroller, processors and system-on-chip based on the features and specifications.
CO 3: Interface the sensors, actuators and other I/O’s with microcontroller, processors and system on chip based interfacing
CO 4: Design the circuit and write the programming microcontroller, processors and system on chip
CO 5: Develop the applications using Embedded system.

TEXT BOOKS:

REFERENCES:

Mapping of COs with POs and PSOs

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1 – Slight, 2 – Moderate, 3 – Substantial
COURSE OBJECTIVES:
1. To introduce the components and their representation of control systems
2. To learn various methods for analyzing the time response, frequency response and stability of the systems.
3. To learn the various approach for the system frequency analysis
4. To understand the concept of stability analysis
5. To know about the state variable methods of control system analysis

UNIT I  SYSTEMS COMPONENTS AND THEIR REPRESENTATION  9
Control System: Terminology and Basic Structure-Feed forward and Feedback control theory-Electrical and Mechanical Transfer Function Models-Block diagram Models-Signal flow graphs

UNIT II  TIME RESPONSE ANALYSIS  9
Transient response-steady state response-Measures of performance of the standard first order and second order system-effect on an additional zero and an additional pole-steady error constant and system-type number-PID control-Analytical design for PD, PI,PID control systems

UNIT III  FREQUENCY RESPONSE AND SYSTEM ANALYSIS  9
Closed loop frequency response-Performance specification in frequency domain-Frequency response of standard second order system- Bode Plot - Polar Plot-Design of compensators using Bode plots- Cascade lead, lag and lag-lead compensation.

UNIT IV  CONCEPTS OF STABILITY ANALYSIS  9

UNIT V  CONTROL SYSTEM ANALYSIS USING STATE VARIABLE METHODS  9
State variable representation-Conversion of state variable models to transfer functions-Conversion of transfer functions to state variable models-Solution of state equations-Concepts of Controllability and Observability

TOTAL: 45 PERIODS

CONTROL SYSTEMS LABORATORY
Experiments
1. Mathematical Modelling and Simulation of a Physical Systems and Simulation and Reduction of Cascade and Parallel, and Closed Loop Sub-System.
2. Simulation and Analysis of First and Second Order System Equations in Time and Frequency Domain.
3. Simulation and Analysis of System using Root-Locus and Bode Plot.
4. Simulation and Implementation of PID Combination for First Order Systems.
5. Simulation and Implementation of PID Combination Second Order Systems.
6. Auto tuning of PID parameters and analysis of PID Control.

TOTAL : 30 PERIODS

COURSE OUTCOMES
Upon successful completion of the course, students should be able to:
CO1: State the various control terminologies and concepts.
CO2: Know the procedures in developing the transfer function, state space models and time and frequency domain analysis methods.
CO3: Apply the procedures on developing the systems in transfer function and state space approach and apply to evaluate the performance of system in time and frequency domain techniques.
CO4: Illustrate the time and frequency response characteristics of system response.
CO5: Analyze the performance of system using various time and frequency domain techniques.

TEXT BOOKS:

REFERENCES:

TOTAL : 45(L) + 30(P) = 75 PERIODS

Mapping of COs with POs and PSOs

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1 – Slight, 2 – Moderate, 3 – Substantial

GE3451 ENVIRONMENTAL SCIENCE AND SUSTAINABILITY

COURSE OBJECTIVES:
1. To study the nature and its impacts on human life.
2. To study the environmental pollution, its types, control methods and protection acts
3. To provide the knowledge of about the energy management and energy resources
4. To study the concepts of Sustainability, global warming and Management
5. To study the Sustainability Practices and socio economical changes

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

OUTCOMES:
At the end of the course the students would be able to
1.Understand the nature and its impacts on human life.
2.The students have the knowledge and awareness of Environmental Pollution.
3.Understanding of the energy sources and scientific concepts/principles behind them
4.Understand the concepts of the Sustainability and Management
5.Understand the Sustainability Practices and socio economical changes

TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVES
1. To learn about various force, pressure and vibration measuring sensors.
2. To learn about various Temperature, light and magnetic field measuring sensors.
3. To learn about various displacement and speed measuring sensors.

LIST OF EXPERIMENTS
SENSORS AND INSTRUMENTATION
1. Determination of Load, Torque and Force using Strain Gauge.
3. Determination of Displacement using LVDT.
4. Determine the Characteristics of Various Temperature Sensors.
5. Determine the Characteristics of Various Light Detectors (Optical Sensors).
7. Determine angular velocity of gyroscope.
8. Vibration measurement using Accelerometer.
9. Direction measurement using Magnetometer.
10. Speed, Position and Direction Measurement Using Encoders.
11. Force measurement using 3 axis force sensor.
13. Data acquisition, visualization and analysis of signals.

TOTAL: 60 PERIODS

COURSE OUTCOMES:
Upon the completion of this course, the students will be able to:
CO1: Demonstrate the various contact and non-contact sensors.
CO2: Analyze and Identify appropriate sensors for given applications.
CO3: Create a sensor system for given requirements.

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1 – Slight, 2 – Moderate, 3 – Substantial

Equipment List
1. Load, Torque and Force using Strain Gauge – 3 Nos
2. Pressure Sensor and Piezoelectric Force Sensor - 1 No’s
3. LVDT setup – 1 No.
4. Temperature Sensors measurement setup with RTD, Thermocouple and Thermistor - 1 No.
5. Measurement setup Optical Sensors LDR, Photo transistor, photo diode – 1 each
7. Gyroscope measurement setup - 1 No.
8. Accelerometer measurement setup - 1 No.
9. Magnetometer measurement setup -1 No.
10. Absolute Encoders and Incremental encoder with DSO/ single board computer- 1 no
11. DAQ with sensor or transducer -1 set
12. 3 axis force sensor – 1 No.
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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<td>Horizontal Milling Machine</td>
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<td>Surface Grinding Machine</td>
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<td>Lathe Tool Dynamometer</td>
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<td>Arc welding transformer with cables and holders</td>
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<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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