ANNA UNIVERSITY, CHENNAI
NON-AUTONOMOUS COLLEGES AFFILIATED TO ANNA UNIVERSITY
REGULATIONS 2021
CHOICE BASED CREDIT SYSTEM
B. E. ELECTRONICS AND INSTRUMENTATION ENGINEERING
CURRICULA AND SYLLABI FOR SEMESTER I & II
SEMESTER – I

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	IP3151	Induction Programme	-	-	-	-	-	0
THEORY								
2.	HS3151	Professional English - I	HSMC	3	1	0	4	4
3.	MA3151	Matrices and Calculus	BSC	3	1	0	4	4
4.	PH3151	Engineering Physics	BSC	3	0	0	3	3
5.	CY3151	Engineering Chemistry	BSC	3	0	0	3	3
6.	GE3151	Problem Solving and Python Programming	ESC	3	0	0	3	3
PRACTICALS								
7.	GE3171	Problem Solving and Python Programming Laboratory	ESC	0	0	4	4	2
8.	BS3171	Physics and Chemistry Laboratory	BSC	0	0	4	4	2
			TOTAL	15	2	8	25	21

SEMESTER – II

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	HS3251	Professional English - II	HSMC	3	1	0	4	4
2.	MA3251	Statistics and Numerical Methods	BSC	3	1	0	4	4
3.	PH3255	Physics for Instrumentation Engineering	BSC	3	0	0	3	3
4.	BE3255	Basic Civil and Mechanical Engineering	ESC	3	0	0	3	3
5.	GE3251	Engineering Graphics	ESC	2	0	4	6	4
6.	EE3251	Electric Circuit Analysis	PCC	3	1	0	4	4
7.		NCC Credit Course Level1*	-	2	0	0	2	2
PRACTICALS								
8.	GE3271	Engineering Practices Laboratory	ESC	0	0	4	4	2
9.	EE3271	Electric Circuits Laboratory	PCC	0	0	4	4	2
			TOTAL	17	3	12	32	26

*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.

IP3151   **INDUCTION PROGRAMME**

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

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

"Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond. The graduating student must have knowledge and skills in the area of his/her study. However, he/she must also have 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

HS3151   **PROFESSIONAL ENGLISH - I**   **L T P C**
                                                                             3 1 0 4

OBJECTIVES :
- To improve the communicative competence of learners
- To help learners use language effectively in academic /work contexts
- To build on students' English language skills by engaging them in listening, speaking and grammar learning activities that are relevant to authentic contexts.
- To develop learners' ability to read and write complex texts, summaries, articles, blogs, definitions, essays and user manuals.
- To use language efficiently in expressing their opinions via various media.

INTRODUCTION TO EFFECTIVE COMMUNICATION   1

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

UNIT I   INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION   11

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 - Self Introduction; Introducing a friend; Conversation - politeness strategies; Telephone conversation; Leave a voicemail; Leave a message with another person; asking for information to fill details in a form.
Reading - Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails.
Writing - Writing emails / letters introducing oneself
Grammar - Present Tense (simple and progressive); Question types: Wh/ Yes or No/ and Tags
Vocabulary - Synonyms; One word substitution; Abbreviations & Acronyms (as used in technical contexts).

UNIT II   NARRATION AND SUMMATION   12

Listening - Listening to podcast, anecdotes / stories / event narration; documentaries and interviews with celebrities.
Speaking - Narrating personal experiences / events; Interviewing a celebrity; Reporting / and summarising of documentaries / podcasts/ interviews.
Reading - Reading biographies, travelogues, newspaper reports, Excerpts from literature, and travel & technical blogs.
Writing - Guided writing-- Paragraph writing Short Report on an event (field trip etc.)
Grammar –Past tense (simple); Subject-Verb Agreement; and Prepositions
Vocabulary - Word forms (prefixes& suffixes); Synonyms and Antonyms. Phrasal verbs.

UNIT III   DESCRIPTION OF A PROCESS / PRODUCT   12
Listening - Listen to a product and process descriptions; a classroom lecture;and advertisements about a products.
Speaking – Picture description; Giving instruction to use the product; Presenting a product; and Summarising a lecture.
Reading – Reading advertisements, gadget reviews; user manuals.
Writing - Writing definitions; instructions; and Product /Process description.
Grammar - Imperatives; Adjectives; Degrees of comparison; Present & Past Perfect Tenses.
Vocabulary - Compound Nouns, Homonyms; and Homophones, discourse markers(connectives & sequence words)

UNIT IV   CLASSIFICATION   AND RECOMMENDATIONS   12
Listening – Listening to TED Talks; Scientific lectures; and educational videos.
Speaking – Small Talk; Mini presentations and making 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   12
Listening – Listening to debates/ discussions; different viewpoints on an issue; and panel discussions.
Speaking –group discussions, Debates, and Expressing opinions through Simulations & Roleplay.
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 : 60 PERIODS

OUTCOMES :
At the end of the course, learners will be able
- To listen and comprehend complex academic texts
- To read and infer the denotative and connotative meanings of technical texts
- To write definitions, descriptions, narrations and essays on various topics
- To speak fluently and accurately in formal and informal communicative contexts
- To express their opinions effectively in both oral and written medium of communication

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

REFERENCES:
1. Technical Communication – Principles And Practices, Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi.
2. A Course Book On Technical English By Lakshminarayanan, Scitech Publications (India) Pvt. Ltd.
3. English For Technical Communication (With CD) By Aysha Viswamohan, Mcgraw Hill Education, ISBN : 0070264244.
4. Effective Communication Skill, Kulbhusan Kumar, RS Salaria, Khanna Publishing House.
5. Learning to Communicate – Dr. V. Chellammal, Allied Publishing House, New Delhi,2003.

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

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**

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley - Hamilton theorem – Diagonalization of matrices by orthogonal transformation – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms – Applications : Stretching of an elastic membrane.

UNIT II　DIFFERENTIAL CALCULUS　　　　　　　　　　　　　　**9 + 3**

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

UNIT III　FUNCTIONS OF SEVERAL VARIABLES　　　　　　　　**9 + 3**

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Applications : Maxima and minima of functions of two variables and Lagrange's method of undetermined multipliers.

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**

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals – Applications : Moments and centres of mass, moment of inertia.

　　　　　　　　　　　　　　　　　　　　　　　　　　TOTAL : 60 PERIODS

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 :

1. Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.

2. Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition , 2018.

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 :

1. Anton. H, Bivens. I and Davis. S, " Calculus ", Wiley, 10th Edition, 2016

2. Bali. N., Goyal. M. and Watkins. C., " Advanced Engineering Mathematics ", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.

3. Jain . R.K. and Iyengar. S.R.K., " Advanced Engineering Mathematics ",Narosa Publications, New Delhi, 5th Edition, 2016.

4. Narayanan. S. and Manicavachagom Pillai. T. K., " Calculus " Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2009.

5. Ramana. B.V., " Higher Engineering Mathematics ", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.

6. Srimantha Pal and Bhunia. S.C, " Engineering Mathematics " Oxford University Press, 2015.

7. Thomas. G. B., Hass. J, and Weir. M.D, " Thomas Calculus ", 14th Edition, Pearson India, 2018.

PH3151   **ENGINEERING PHYSICS**   **L T P C**
                                                                            3 0 0 3
OBJECTIVES:
- To make the students effectively to achieve an understanding of mechanics.
- To enable the students to gain knowledge of electromagnetic waves and its applications.
- To introduce the basics of oscillations, optics and lasers.
- Equipping the students to be successfully understand the importance of quantum physics.
- To motivate the students towards the applications of quantum mechanics.

UNIT I   MECHANICS   9
Multiparticle dynamics: Center of mass (CM) – CM of continuous bodies – motion of the CM – kinetic energy of system of particles. Rotation of rigid bodies: Rotational kinematics – rotational kinetic energy and moment of inertia - theorems of M .I –moment of inertia of continuous bodies – M.I of a diatomic molecule - torque – rotational dynamics of rigid bodies – conservation of angular momentum – rotational energy state of a rigid diatomic molecule - gyroscope - torsional pendulum – double pendulum –Introduction to nonlinear oscillations.

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

UNIT III   OSCILLATIONS, OPTICS AND LASERS   9
Simple harmonic motion - resonance –analogy between electrical and mechanical oscillating systems - waves on a string - standing waves - traveling waves - Energy transfer of a wave - sound waves - Doppler effect. Reflection and refraction of light waves - total internal reflection - interference – Michelson interferometer –Theory of air wedge and experiment. Theory of laser - characteristics - Spontaneous and stimulated emission - Einstein's coefficients - population inversion - Nd-YAG laser, CO_2 laser, semiconductor laser –Basic applications of lasers in industry.

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

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

TOTAL : 45 PERIODS

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:
1. D.Kleppner and R.Kolenkow. An Introduction to Mechanics. McGraw Hill Education (Indian Edition), 2017.
2. E.M.Purcell and D.J.Morin, Electricity and Magnetism, Cambridge Univ.Press, 2013.
3. Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, Concepts of Modern Physics, McGraw-Hill (Indian Edition), 2017.

REFERENCES:
1. R.Wolfson. Essential University Physics. Volume 1 & 2. Pearson Education (Indian Edition), 2009.
2. Paul A. Tipler, Physic – Volume 1 & 2, CBS, (Indian Edition), 2004.
3. K.Thyagarajan and A.Ghatak. Lasers: Fundamentals and Applications, Laxmi Publications, (Indian Edition), 2019.
4. D.Halliday, R.Resnick and J.Walker. Principles of Physics, Wiley (Indian Edition), 2015.
5. N.Garcia, A.Damask and S.Schwarz. Physics for Computer Science Students. Springer-Verlag, 2012.

CY3151   **ENGINEERING CHEMISTRY**   **L T P C**
                                                                                       3 0 0 3

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

UNIT I   WATER AND ITS TREATMENT   9
Water: Sources and impurities, **Water quality parameters:** Definition and significance of-colour, odour, turbidity, pH, hardness, alkalinity, TDS, COD and BOD, flouride and arsenic. **Municipal water treatment:** primary treatment and disinfection (UV, Ozonation, break-point chlorination)**. Desalination of brackish water**: Reverse Osmosis. **Boiler troubles:** Scale and sludge, Boiler corrosion, Caustic embrittlement, Priming &foaming. **Treatment of boiler feed water**: Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) and External treatment – Ion exchange demineralisation and zeolite process.

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

UNIT III   PHASE RULE AND COMPOSITES   9
Phase rule: Introduction, definition of terms with examples. One component system - water system; Reduced phase rule; Construction of a simple eutectic phase diagram - Thermal analysis; Two component system: lead-silver system - Pattinson process.
Composites: Introduction: Definition & Need for composites; **Constitution**: Matrix materials (Polymer matrix, metal matrix and ceramic matrix) and Reinforcement (fiber, particulates, flakes and whiskers). **Properties and applications of**: Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites. **Hybrid composites** - definition and examples.

UNIT IV   FUELS AND COMBUSTION   9
Fuels: Introduction: Classification of fuels; **Coal and coke**: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). **Petroleum and Diesel:** Manufacture of synthetic petrol (Bergius process), Knocking - octane number, diesel oil - cetane number; **Power alcohol and biodiesel.**
Combustion of fuels: Introduction: Calorific value - higher and lower calorific values, Theoretical calculation of calorific value; **Ignition temperature**: spontaneous ignition temperature, Explosive range; **Flue gas analysis** - ORSAT Method. **CO_2 emission and carbon foot print.**

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

battery; **Electric vehicles-working principles; Fuel cells:** H_2-O_2 fuel cell, microbial fuel cell; **Supercapacitors:** Storage principle, types and examples.

TOTAL: 45 PERIODS

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:
1. P. C. Jain and Monica Jain, "Engineering Chemistry", 17th Edition, DhanpatRai Publishing Company (P) Ltd, New Delhi, 2018.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008.
3. S.S. Dara, "A text book of Engineering Chemistry", S. Chand Publishing, 12th Edition, 2018.

REFERENCES:
1. B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, "Text book of nanoscience and nanotechnology", Universities Press-IIM Series in Metallurgy and Materials Science, 2018.
2. O.G. Palanna, "Engineering Chemistry" McGraw Hill Education (India) Private Limited, 2nd Edition, 2017.
3. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
4. ShikhaAgarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, Second Edition, 2019.
5. O.V. Roussak and H.D. Gesser, Applied Chemistry-A Text Book for Engineers and Technologists, Springer Science Business Media, New York, 2nd Edition, 2013.

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

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

UNIT I   COMPUTATIONAL THINKING AND PROBLEM SOLVING   9
Fundamentals of Computing – Identification of Computational Problems -Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms

(iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

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

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

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

UNIT V   FILES, MODULES, PACKAGES   9
Files and 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

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:
1. Allen B. Downey, "Think Python : How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
2. Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and programming", 1st Edition, BCS Learning & Development Limited, 2017.

REFERENCES:
1. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.
2. G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.
3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data", Third Edition, MIT Press , 2021.

4. Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019.
5. https://www.python.org/
6. Martin C. Brown, "Python: The Complete Reference", 4th Edition, Mc-Graw Hill, 2018.

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

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

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

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

TOTAL: 60 PERIODS

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:

1. Allen B. Downey, "Think Python : How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
2. Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017.

REFERENCES:

1. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.
2. G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.
3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data", Third Edition, MIT Press , 2021
4. Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019.
5. https://www.python.org/
6. Martin C. Brown, "Python: The Complete Reference", 4th Edition, Mc-Graw Hill, 2018.

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

PHYSICS LABORATORY : (Any Seven Experiments)

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

10. Post office box -Determination of Band gap of a semiconductor.
11. Photoelectric effect
12. Michelson Interferometer.
13. Melde's string experiment
14. Experiment with lattice dynamics kit.

TOTAL: 30 PERIODS

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)

OBJECTIVES:

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

1. Preparation of Na_2CO_3 as a primary standard and estimation of acidity of a water sample using the primary standard
2. Determination of types and amount of alkalinity in water sample.
   - Split the first experiment into two
3. Determination of total, temporary & permanent hardness of water by EDTA method.
4. Determination of DO content of water sample by Winkler's method.
5. Determination of chloride content of water sample by Argentometric method.
6. Estimation of copper content of the given solution by Iodometry.
7. Estimation of TDS of a water sample by gravimetry.
8. Determination of strength of given hydrochloric acid using pH meter.
9. Determination of strength of acids in a mixture of acids using conductivity meter.
10. Conductometric titration of barium chloride against sodium sulphate (precipitation titration)
11. Estimation of iron content of the given solution using potentiometer.
12. Estimation of sodium /potassium present in water using flame photometer.
13. Preparation of nanoparticles (TiO_2/ZnO/CuO) by Sol-Gel method.
14. Estimation of Nickel in steel
15. Proximate analysis of Coal

TOTAL : 30 PERIODS

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

TEXT BOOKS :
1. J. Mendham, R. C. Denney, J.D. Barnes, M. Thomas and B. Sivasankar, Vogel's Textbook of Quantitative Chemical Analysis (2009).

HS3251	PROFESSIONAL ENGLISH - II	L T P C
		3 1 0 4

OBJECTIVES :
- To engage learners in meaningful language activities to improve their LSRW skills
- To enhance learners' awareness of general rules of writing for specific audiences
- 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   12

Listening – Evaluative Listening: Advertisements, Product Descriptions, -Audio / video; Listening and filling a Graphic Organiser (Choosing a product or service by comparison)
Speaking – Marketing a product, Persuasive Speech Techniques.
Reading - Reading advertisements, user manuals, brochures;
Writing – Professional emails, Email etiquette - Compare and Contrast Essay; Grammar – Mixed Tenses, Prepositional phrases
Vocabulary – Contextual meaning of words

UNIT II   EXPRESSING CAUSAL RELATIONS IN SPEAKING AND WRITING   12

Listening - Listening to longer technical talks and completing– gap filling exercises. Listening technical information from podcasts – Listening to process/event descriptions to identify cause & effects -
Speaking – Describing and discussing the reasons of accidents or disasters based on news reports.
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 Vocabulary – Word Formation (Noun-Verb-Adj-Adv), Adverbs.

UNIT III   PROBLEM SOLVING   12

Listening – Listening to / Watching movie scenes/ documentaries depicting a technical problem and suggesting solutions.
Speaking – Group Discussion(based on case studies), - techniques and Strategies,
Reading - Case Studies, excerpts from literary texts, news reports etc.,

Writing – Letter to the Editor, Checklists, Problem solution essay / Argumentative Essay
Grammar –– Errorcorrection; If conditional sentences
Vocabulary - Compound Words, Sentence Completion.

UNIT IV   REPORTING OF EVENTS AND RESEARCH   12
Listening – Listening Comprehension based on news reports – and documentaries – Precise writing, Summarising, Speaking –Interviewing, Presenting an oral report, Mini presentations on select topics; Reading –Newspaper articles; Writing – Recommendations, Transcoding, Accident Report, Survey Report Grammar – Reported Speech, Modals Vocabulary – Conjunctions- use of prepositions

UNIT V   THE ABILITY TO PUT IDEAS OR INFORMATION COGENTLY   12
Listening – Listening to TED Talks, Presentations, Formal job interviews, (analysis of the interview performance);
Speaking – Participating in a Role play, (interview/telephone interview), virtual interviews, Making presentations with visual aids;
 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 Vocabulary – Idioms.
                                                                                TOTAL : 60 PERIODS
OUTCOMES:
At the end of the course, learners will be able
- To compare and contrast products and ideas intechnical 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 :
1. English for Engineers & Technologists   (2020 edition) Orient Blackswan Private Ltd. Department of English, Anna University.
2. English for Science & Technology Cambridge University Press 2021.
   Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

REFERENCES:
1. Raman. Meenakshi, Sharma. Sangeeta (2019). Professional English. Oxford university press. New Delhi.
2. Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, NewDelhi.
3. Learning to Communicate – Dr. V. Chellammal. Allied Publishers, New Delhi, 2003
4. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.
5. Developing Communication Skills by Krishna Mohan, Meera Bannerji- Macmillan India Ltd. 1990, Delhi.

MA3251	STATISTICS AND NUMERICAL METHODS	L T P C
		3 1 0 4

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
Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method- Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Eigenvalues of a matrix by Power method and Jacobi's method for symmetric matrices.

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
Single step methods: Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first order differential equations - Multi step methods: Milne's and Adams - Bash forth predictor corrector methods for solving first order differential equations.

TOTAL: 60 PERIODS

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:
1. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.
2. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.

REFERENCES:
1. Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
3. Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 7th Edition, 2007.
4. Gupta S.C. and Kapoor V. K., " Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12th Edition, 2020.
5. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outlines on Probability and Statistics ", Tata McGraw Hill Edition, 4th Edition, 2012.
6. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", 9th Edition, Pearson Education, Asia, 2010.

PH3255	**PHYSICS FOR INSTRUMENTATION ENGINEERING**	**L**	**T**	**P**	**C**
	(Common to E & I and I & C)	**3**	**0**	**0**	**3**

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

UNIT I   ELECTRICITY AND MAGNETISM   9
Coulomb's law, electric field intensity, electric flux density, Gauss' law, divergence, electric field and potential due to point, line, plane, and spherical charge distributions, effect of the dielectric medium, capacitance of simple configurations, Biot-Savart's law, Ampere's law, curl, Faraday's law, Lorentz force, Inductance, Magneto motive force, reluctance, magnetic circuits, self and mutual inductance of simple configurations.

UNIT II   ELECTRICAL AND MAGNETIC PROPERTIES OF MATERIALS   9
Classical free electron theory - Expression for electrical conductivity – Thermal conductivity, expression - Quantum free electron theory :Tunneling – degenerate states – Fermi- Dirac statistics – Density of energy states – Electron in periodic potential – Energy bands in solids – tight binding approximation - Electron effective mass – concept of hole. Magnetic materials: Dia, para and ferromagnetic effects – paramagnetism in the conduction electrons in metals – exchange interaction and ferromagnetism – quantum interference devices – GMR devices.

UNIT III   SEMICONDUCTORS AND TRANSPORT PHYSICS   9
Intrinsic Semiconductors – Energy band diagram – direct and indirect band gap   semiconductors – Carrier concentration in intrinsic semiconductors – extrinsic   semiconductors - Carrier concentration in N-type & P-type semiconductors – Variation of carrier concentration with temperature – Carrier transport in Semiconductors: Drift, mobility and diffusion – Hall effect and devices – Ohmic contacts – Schottky diode.

UNIT IV   OPTICAL PROPERTIES OF MATERIALS   9
Classification of optical materials – Optical processes in semiconductors: optical absorption and emission, charge injection and recombination, optical absorption, loss and gain. Optical processes in quantum wells – Optoelectronic devices: light detectors and solar cells – light emitting diode – laser diode - optical processes in organic semiconductor devices –excitonic state – Electro-optics and nonlinear optics: Modulators and switching devices – plasmonics.

UNIT V   NANODEVICES AND QUANTUM COMPUTING   9
Introduction - quantum confinement – quantum structures: quantum wells, wires and dots –– band gap of nanomaterials. Tunneling – Single electron phenomena: Coulomb blockade - resonant-tunneling diode – single electron transistor – quantum cellular automata - Quantum system for information processing - quantum states – classical bits – quantum bits or qubits –CNOT gate - multiple qubits – Bloch sphere – quantum gates – advantage of quantum computing over classical computing.

TOTAL: 45 PERIODS

OUTCOMES :
At the end of the course, the students should be able to
- know basics of electricity and magnetism and the influence of vectors in EMT.
- gain knowledge on the electrical and magnetic properties of materials and their applications
- understand clearly of semiconductor physics and functioning of semiconductor devices
- understand the optical properties of materials and working principles of various optical devices
- appreciate the importance of nanotechnology and nanodevices.

TEXT BOOKS :
1. S.O. Kasap. Principles of Electronic Materials and Devices, McGraw Hill Education (Indian Edition), 2020.
2. R.F.Pierret. Semiconductor Device Fundamentals. Pearson (Indian Edition), 2006.
3. G.W.Hanson. Fundamentals of Nanoelectronics. Pearson Education (Indian Edition), 2009.

REFERENCES :
1. Matthew N. O. Sadiku, Principles of Electromagnetics, Oxford Univ. Press 2015.
2. Jasprit Singh, Semiconductor Optoelectronics: Physics and Technology,   McGraw-Hill Education (Indian Edition), 2019.
3. Charles Kittel, Introduction to Solid State Physics, Wiley India Edition, 2019.
4. Mark Fox, Optical Properties of Solids, Oxford Univ.Press, 2001.
5. Parag K. Lala, Quantum Computing: A Beginner's Introduction, McGraw-Hill Education (Indian Edition), 2020.

BE3255   **BASIC CIVIL AND MECHANICAL ENGINEERING**   **L T P C**
                                                                   3 0 0 3

OBJECTIVES:

- To provide the students an illustration of the significance of the Civil and Mechanical Engineering Profession in satisfying the societal needs.
- To help students acquire knowledge in the basics of surveying and the materials used for construction.
- To provide an insight to the essentials of components of a building and the infrastructure facilities.
- To explain the component of power plant units and detailed explanation to IC engines their working principles.
- To explain the Refrigeration & Air-conditioning system.

UNIT I   PART A: OVERVIEW OF CIVIL ENGINEERING   5

Civil Engineering contributions to the welfare of Society - Specialized sub disciplines in Civil Engineering – Structural, Construction, Geotechnical, Environmental, Transportation and Water Resources Engineering – National building code – terminologists: Plinth area, Carpet area, Floor area, Buildup area, Floor space index - Types of buildings: Residential buildings, Industrial buildings.

UNIT I   PART B: OVERVIEW OF MECHANICAL ENGINEERING   4

Overview of Mechanical Engineering - Mechanical Engineering Contributions to the welfare of Society –Specialized sub disciplines in Mechanical Engineering – Manufacturing, Automation, Automobile and Energy Engineering - Interdisciplinary concepts in Mechanical Engineering.

UNIT II   SURVEYING AND CIVIL ENGINEERING MATERIALS   9

Surveying: Objects – Classification – Principles – Measurements of Distances and angles – Leveling – Determination of areas– Contours.
Civil Engineering Materials: Bricks – Stones – Sand – Cement – Concrete – Steel - Timber - Modern Materials, Thermal and Acoustic Insulating Materials, Decorative Panels, Water Proofing Materials. Modern uses of Gypsum, Pre-fabricated Building component (brief discussion only)

UNIT III   BUILDING COMPONENTS AND INFRASTRUCTURE   9

Building plans – Setting out of a Building - Foundations: Types of foundations - Bearing capacity and settlement – Brick masonry – Stone Masonry – Beams – Columns – Lintels – Roofing – Flooring – Plastering.
Types of Bridges and Dams – Water Supply Network - Rain Water Harvesting – Solid Waste Management - Introduction to Highways and Railways - Introduction to Green Buildings.

UNIT IV   INTERNAL COMBUSTION ENGINES AND POWER PLANTS   9

Classification of Power Plants- Working principle of steam, Gas, Diesel, Hydro -electric and Nuclear Power plants- Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines. Working principle of Boilers-Turbines, Reciprocating Pumps (single acting and double acting) and Centrifugal Pumps, Concept of hybrid engines. Industrial safety practices and protective devices

UNIT V   REFRIGERATION AND AIR CONDITIONING SYSTEM   9

Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system–Layout of typical domestic refrigerator–Window and Split type room Air conditioner. Properties of air - water mixture, concepts of psychometric and its process.

TOTAL: 45 PERIODS

OUTCOMES:
CO1: Understanding profession of Civil and Mechanical engineering.
CO2: Summarise the planning of building, infrastructure and working of Machineries.
CO3: Apply the knowledge gained in respective discipline
CO4: Illustrate the ideas of Civil and Mechanical Engineering applications.
CO5: Appraise the material, Structures, machines and energy.

TEXT BOOKS:
1. G Shanmugam, M S Palanichamy, Basic Civil and Mechanical Engineering, McGraw Hill Education; First edition, 2018

REFERENCES:
1. Palanikumar, K. Basic Mechanical Engineering, ARS Publications, 2018.
2. Ramamrutham S., "Basic Civil Engineering", Dhanpat Rai Publishing Co.(P) Ltd, 2013.
3. Seetharaman S., "Basic Civil Engineering", Anuradha Agencies, 2005.
4. Shantha Kumar SRJ., "Basic Mechanical Engineering", Hi-tech Publications, Mayiladuthurai, 2000.

GE3251	ENGINEERING GRAPHICS	L T P C
		2 0 4 4

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 AND FREEHAND SKETCHING   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   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

OUTCOMES:

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

- Use BIS conventions and specifications for engineering drawing.
- Construct the conic curves, involutes and cycloid.
- Solve practical problems involving projection of lines.
- Draw the orthographic, isometric and perspective projections of simple solids.
- Draw the development of simple solids.

TEXT BOOK:

1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 53rd Edition, 2019.
2. Natrajan K.V., "A Text Book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2018.
3. Parthasarathy, N. S. and Vela Murali, "Engineering Drawing", Oxford University Press, 2015

REFERENCES:

1. Basant Agarwal and Agarwal C.M., "Engineering Drawing", McGraw Hill, 2nd Edition, 2019.
2. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Publications, Bangalore, 27th Edition,2017.
3. Luzzader, Warren.J. and Duff,John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
4. Parthasarathy N. S. and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
5. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson Education India, 2nd Edition, 2009.
6. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.

Publication of Bureau of Indian Standards:

1. IS 10711 — 2001: Technical products Documentation — Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) — 2001: Technical products Documentation — Lettering.
3. IS 10714 (Part 20) — 2001 & SP 46 — 2003: Lines for technical drawings.
4. IS 11669 — 1986 & SP 46 —2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) — 2001: Technical drawings — Projection Methods.

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

EE3251	ELECTRIC CIRCUIT ANALYSIS	L	T	P	C
		3	1	0	4

OBJECTIVES:
- To introduce electric circuits and its analysis
- To provide key concepts to analyze and understand electrical circuits
- To impart knowledge on solving circuit equations using network theorems
- To educate on obtaining the transient response of circuits.
- To introduce the phenomenon of resonance in coupled circuits.
- To introduce Phasor diagrams and analysis of single &three phase circuits

UNIT I   BASIC CIRCUITS ANALYSIS   9+3
Fundamentals concepts of R, L and C elements-Energy Sources- Ohm's Law -Kirchhoff 's Laws – DC Circuits – Resistors in series and parallel circuits - A.C Circuits – Average and RMS Value – Complex Impedance – Phasor diagram - Real and Reactive Power, Power Factor, Energy -Mesh current and node voltage methods of analysis D.C and A.C Circuits.

UNIT II   NETWORK REDUCTION AND THEOREMS FOR DC AND AC CIRCUITS   9+3
Network reduction: voltage and current division, source transformation – star delta conversion. Theorems – Superposition, Thevenin's and Norton's Theorem – Maximum power transfer theorem – Reciprocity Theorem – Millman's theorem- Tellegen's Theorem-Statement, application to DC and AC Circuits.

UNIT III   TRANSIENT RESPONSE ANALYSIS   9+3
Introduction – Laplace transforms and inverse Laplace transforms- standard test signals -Transient response of RL, RC and RLC circuits using Laplace transform for Source free, Step input and Sinusoidal input.

UNIT IV   RESONANCE AND COUPLED CIRCUITS   9+3
Series and parallel resonance –frequency response – Quality factor and Bandwidth – Self and mutual inductance – Coefficient of coupling – Dot rule-Analysis of coupled circuits– Single Tuned circuits..

UNIT V   THREE PHASE CIRCUITS   9+3
Analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced and unbalanced – phasor diagram of voltages and currents – power measurement in three phase circuits– Power Factor Calculations.

TOTAL: 60 PERIODS

OUTCOMES:
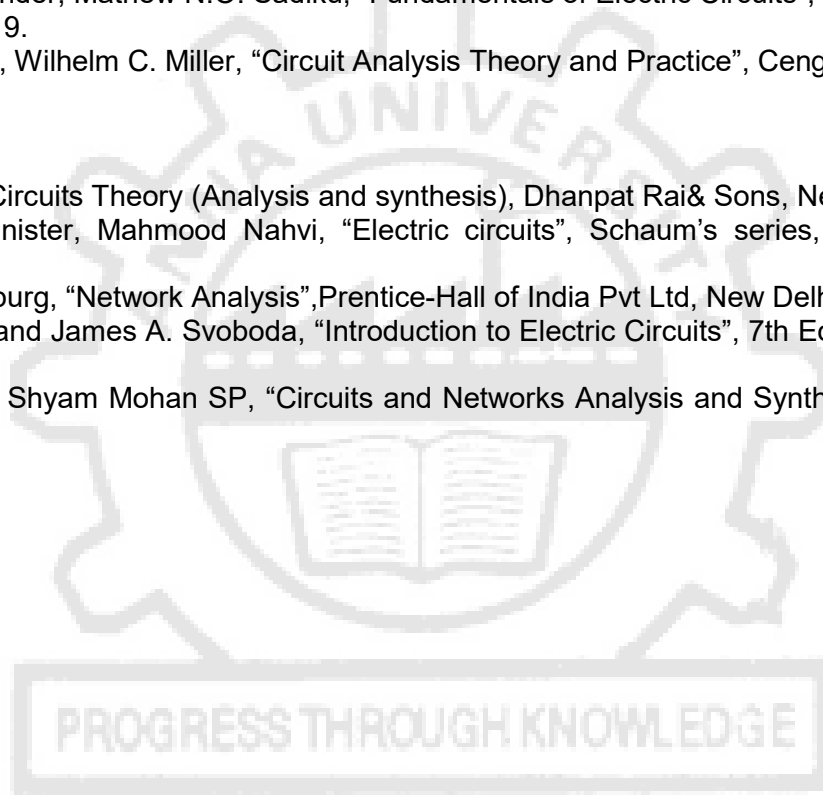
After completing this course, the students will be able to:

CO1: Explain circuit's behavior using circuit laws.

CO2: Apply mesh analysis/ nodal analysis / network theorems to determine behavior of the given DC and AC circuit

CO3: Compute the transient response of first order and second order systems to step and sinusoidal input

CO4: Compute power, line/ phase voltage and currents of the given three phase circuit

CO5: Explain the frequency response of series and parallel RLC circuits

CO6: Explain the behavior of magnetically coupled circuits.

TEXT BOOKS:

1. William H. HaytJr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", McGraw Hill publishers, 9thedition, New Delhi, 2020.
2. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", Second Edition, McGraw Hill, 2019.
3. Allan H. Robbins, Wilhelm C. Miller, "Circuit Analysis Theory and Practice", Cengage Learning India, 2013.

REFERENCES

1. Chakrabarti A, "Circuits Theory (Analysis and synthesis), Dhanpat Rai& Sons, New Delhi, 2020.
2. Joseph A. Edminister, Mahmood Nahvi, "Electric circuits", Schaum's series, McGraw-Hill, First Edition, 2019.
4. M E Van Valkenburg, "Network Analysis",Prentice-Hall of India Pvt Ltd, New Delhi, 2015.
5. Richard C. Dorf and James A. Svoboda, "Introduction to Electric Circuits", 7th Edition, John Wiley & Sons, Inc. 2018.
6. Sudhakar A and Shyam Mohan SP, "Circuits and Networks Analysis and Synthesis", McGraw Hill, 2015.

NCC Credit Course Level 1*

NX3251	(ARMY WING) NCC Credit Course Level - I	L	T	P	C
		2	0	0	2

NCC GENERAL — 6

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

NATIONAL INTEGRATION AND AWARENESS — 4

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

PERSONALITY DEVELOPMENT — 7

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

LEADERSHIP — 5

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

SOCIAL SERVICE AND COMMUNITY DEVELOPMENT — 8

SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth	3
SS 4	Protection of Children and Women Safety	1
SS 5	Road / Rail Travel Safety	1
SS 6	New Initiatives	2
SS 7	Cyber and Mobile Security Awareness	1

TOTAL : 30 PERIODS

NCC Credit Course Level 1*

	(NAVAL WING) NCC Credit Course Level - I	**L**	**T**	**P**	**C**
NX3252		**2**	**0**	**0**	**2**

NCC GENERAL — 6

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

NATIONAL INTEGRATION AND AWARENESS — 4

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

PERSONALITY DEVELOPMENT — 7

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

LEADERSHIP — 5

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

SOCIAL SERVICE AND COMMUNITY DEVELOPMENT — 8

SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth	3
SS 4	Protection of Children and Women Safety	1
SS 5	Road / Rail Travel Safety	1
SS 6	New Initiatives	2
SS 7	Cyber and Mobile Security Awareness	1

TOTAL : 30 PERIODS

NCC Credit Course Level 1*

NX3253	**(AIR FORCE WING) NCC Credit Course Level - I**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**2**

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

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

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

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

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

TOTAL : 30 PERIODS

GE3271   **ENGINEERING PRACTICES LABORATORY**   **L T P C**
                                                                  0 0 4 2

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

GROUP – A (CIVIL & ELECTRICAL)

PART I   CIVIL ENGINEERING PRACTICES   15

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

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

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

PART II   ELECTRICAL ENGINEERING PRACTICES   15

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

GROUP – B (MECHANICAL AND ELECTRONICS)

PART III   MECHANICAL ENGINEERING PRACTICES   15

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   15

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

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.

EE3271   **ELECTRIC CIRCUITS LABORATORY**   L T P C
                                                             0 0 4 2
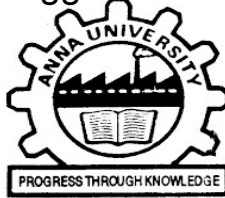
OBJECTIVES:
- To simulate various electric circuits using Pspice/ Matlab/e-Sim / Scilab
- To gain practical experience on electric circuits and verification of theorems

LIST OF EXPERIMENTS

Familiarization of various electrical components, sources and measuring instruments

1. Simulation and experimental verification of series and parallel electrical circuit using fundamental laws.
2. Simulation and experimental verification of electrical circuit problems using Thevenin's theorem.
3. Simulation and experimental verification of electrical circuit problems using Norton's theorem.
4. Simulation and experimental verification of electrical circuit problems using Superposition theorem.
5. Simulation and experimental verification of Maximum Power transfer theorem.
6. Simulation and Experimental validation of R-C,R-L and RLC electric circuit transients
7. Simulation and Experimental validation of frequency response of RLC electric circuit.
8. Design and implementation of series and parallel resonance circuit.
9. Simulation and experimental verification of three phase balanced and unbalanced star, delta networks circuit (Power and Power factor calculations).

                                                             TOTAL: 60 PERIODS

OUTCOMES:

- Use simulation and experimental methods to verify the fundamental electrical laws for the given DC/AC circuit (Ex 1)
- Use simulation and experimental methods to verify the various electrical theorems (Superposition, Thevenin , Norton and maximum power transfer) for the given DC/AC circuit (Ex 2-5)
- Analyze transient behavior of the given RL/RC/RLC circuit using simulation and experimental methods (Ex 6)
- Analyze frequency response of the given series and parallel RLC circuit using simulation and experimentation methods (Ex 7-8)
- Analyze the performance of the given three-phase circuit using simulation and experimental methods (Ex 9)

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

B.E. ELECTRONICS AND INSTRUMENTATION ENGINEERING

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Bachelor of Electronics and Instrumentation Engineering curriculum is designed to prepare the graduates to acquire knowledge, skills and attitudes in order to:

- Succeed in their professional career and develop innovative products
- Intrigue in the life- long learning to get flourished with the upcoming state of art technologies.
- Demonstrate leadership capability and social responsibility.

PROGRAMME OUTCOMES (POs):

The graduates will have the ability to

1. Apply the Mathematical knowledge and the basics of Science and Engineering to solve the problems pertaining to Electronics and Instrumentation Engineering.
2. Identify and formulate Instrumentation Engineering problems from research literature and be able to analyze the problem using first principles of Mathematics and Engineering Sciences.
3. Come out with solutions for the complex problems and to design system components or process that fulfill the particular needs taking into account public health and safety and the social, cultural and environmental issues.
4. Draw well-founded conclusions applying the knowledge acquired from research and research methods including design of experiments, analysis and interpretation of data and synthesis of information and to arrive at significant conclusion.
5. Form, select and apply relevant techniques, resources and Engineering and IT tools for Engineering activities like electronic prototyping, modeling and control of systems/processes and also being conscious of the limitations.
6. Understand the role and responsibility of the Professional Instrumentation Engineer and to assess societal, health, safety issues based on the reasoning received from the contextual knowledge.
7. Be aware of the impact of professional Engineering solutions in societal and environmental contexts and exhibit the knowledge and the need for sustainable Development.
8. Apply the principles of Professional Ethics to adhere to the norms of the engineering practice and to discharge ethical responsibilities.
9. Function actively and efficiently as an individual or a member/leader of different teams and multidisciplinary projects.
10. Communicate efficiently the engineering facts with a wide range of engineering community and others, to understand and prepare reports and design documents; to make effective presentations and to frame and follow instructions.
11. Demonstrate the knowledge and understanding of Engineering and Management principles and to apply these to one's own work as a member / leader in a team to manage Electronics / Instrumentation / Control and Automation projects.
12. Recognize the need for self and life-long learning, keeping pace with technological challenges in the broadest sense.

PROGRAM SPECIFIC OUTCOMES (PSOs)

After completion of Electronics and Instrumentation Engineering program, students will gain core competency skills in domains such as Electronics, Instrumentation and Process Control

1. Apply the knowledge gained in Electronics and Instrumentation to design and select appropriate signal conditioning circuit and measuring instruments for diversified applications.
2. Understand and analyses control problem for the interdisciplinary applications and provide suitable state of art solutions.
3. Apply the Skill to Calibrate, select and install instruments for industrial applications.

PEO's – PO's& PSO's MAPPING:

PEO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	1	1	1	1	2	2	2	1	1	1	1	3	1	2
2	2	2	2	2	2								3	2	1
3	1	1	1	2	2									2	2
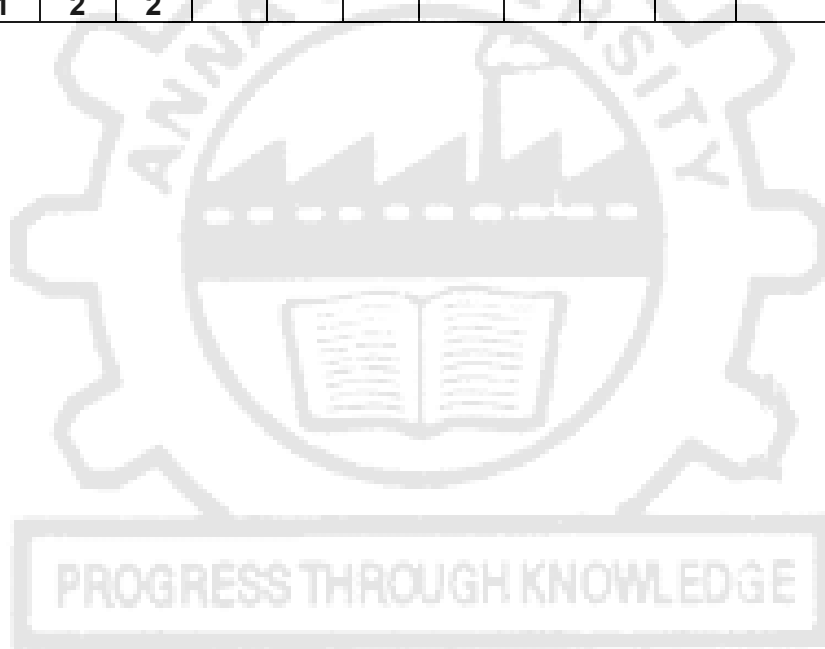
ANNA UNIVERSITY, CHENNAI
NON-AUTONOMOUS AFFILIATED COLLEGES
REGULATIONS 2021
CHOICE BASED CREDIT SYSTEM
B. E. ELECTRONICS AND INSTRUMENTATION ENGINEERING
CURRICULUM FOR SEMESTERS I TO VIII AND SYLLABI FOR SEMESTERS III AND IV
SEMESTER – I

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK L	T	P	TOTAL CONTACT PERIODS	CREDITS
1.	IP3151	Induction Programme	-	-	-	-	-	0
THEORY								
2.	HS3151	Professional English - I	HSMC	3	0	0	3	3
3.	MA3151	Matrices and Calculus	BSC	3	1	0	4	4
4.	PH3151	Engineering Physics	BSC	3	0	0	3	3
5.	CY3151	Engineering Chemistry	BSC	3	0	0	3	3
6.	GE3151	Problem Solving and Python Programming	ESC	3	0	0	3	3
7.	GE3152	அறிவியல் தமிழ் / Scientific Thoughts in Tamil	HSMC	1	0	0	1	1
PRACTICALS								
7.	GE3171	Problem Solving and Python Programming Laboratory	ESC	0	0	4	4	2
8.	BS3171	Physics and Chemistry Laboratory	BSC	0	0	4	4	2
9.	GE3172	English Laboratory $^\$$	EEC	0	0	2	2	1
			TOTAL	**16**	**1**	**10**	**27**	**22**

$ Skill Based Course

SEMESTER – II

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK L	T	P	TOTAL CONTACT PERIODS	CREDITS
THEORY								
1.	HS3251	Professional English - II	HSMC	2	0	0	2	2
2.	MA3251	Statistics and Numerical Methods	BSC	3	1	0	4	4
3.	PH3255	Physics for Instrumentation Engineering	BSC	3	0	0	3	3
4.	BE3255	Basic Civil and Mechanical Engineering	ESC	3	0	0	3	3
5.	GE3251	Engineering Graphics	ESC	2	0	4	6	4
6.	EE3251	Electric Circuit Analysis	PCC	3	1	0	4	4
7.		NCC Credit Course Level1$^\#$	-	2	0	0	2	2$^\#$
	GE3252	தமிழர் மரபு Heritage of Tamils	HSMC	1	0	0	1	1
PRACTICALS								
8.	GE3271	Engineering Practices Laboratory	ESC	0	0	4	4	2
9.	EE3271	Electric Circuits Laboratory	PCC	0	0	4	4	2
	GE3272	Communication Laboratory / Foreign Language$^\$$	EEC	0	0	4	4	2
			TOTAL	**17**	**2**	**16**	**35**	**27**

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

$ Skill Based Course

SEMESTER III

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	MA3353	Transforms and Differential Equations	BSC	3	1	0	4	4
2.	EI3351	Analog Electronics	PCC	3	0	0	3	3
3.	EI3352	Digital System Design and Applications	PCC	2	1	0	3	3
4.	EI3353	Transducers Engineering	PCC	3	0	0	3	3
5.	EI3354	Linear Integrated Circuits and Applications	PCC	3	0	0	3	3
6.	CS3354	Data Structures and OOPS	PCC	3	0	0	3	3
PRACTICALS								
7.	EI3361	Semiconductor Devices and Circuits Laboratory	PCC	0	0	3	3	1.5
8.	CS3363	Data Structures and OOPS Laboratory	PCC	0	0	3	3	1.5
9.	GE3361	Professional Development$	EEC	0	0	2	2	1
			TOTAL	**17**	**2**	**8**	**27**	**23**

$ Skill Based Course

SEMESTER IV

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	EI3451	Industrial Instrumentation	PCC	3	0	0	3	3
2.	IC3451	Automatic Control Systems	PCC	3	1	0	4	4
3.	GE3451	Environmental Sciences and Sustainability	BSC	2	0	0	2	2
4.	EI3401	Embedded Systems	PCC	3	0	2	5	4
5.	OCS352	IoT Concepts and Applications##	PCC	2	0	2	4	3
6.	IC3452	Electrical Machines and Drives	PCC	2	0	2	4	3
7.		NCC Credit Course Level 2#		3	0	0	3	3#
PRACTICALS								
8.	EI3461	Digital and Linear Integrated Circuits Laboratory	PCC	0	0	3	3	1.5
9.	EI3462	Sensors and Signal Conditioning Circuits Laboratory	PCC	0	0	3	3	1.5
			TOTAL	**15**	**1**	**12**	**28**	**22**

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

Students shall not permitted to select this course under Open Elective I & II

SEMESTER V

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	EI3551	Process Control	PCC	3	0	0	3	3
2.	EI3501	Signal and Image Processing	PCC	3	0	0	3	3
3.		Professional Elective I	PEC	3	0	0	3	3
4.		Professional Elective II	PEC	3	0	0	3	3
5.		Professional Elective III	PEC	3	0	0	3	3
6.		Professional Elective IV	PEC	3	0	0	3	3
7.		Mandatory Course-I$^{\&}$	MC	3	0	0	3	0
PRACTICALS								
8.	EI3561	Process Control and Instrumentation Laboratory	PCC	0	0	4	4	2
			TOTAL	**21**	**0**	**4**	**25**	**20**

$^{\&}$ **Mandatory Course-I is a Non-credit Course (Student shall select one course from the list given under MC-I)**

SEMESTER VI

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	EI3651	Industrial Automation Systems	PCC	3	0	0	3	3
2.	EI3652	Introduction to Industrial Processes, Measurement and Control	PCC	3	0	0	3	3
3.		Open Elective – I*	OEC	3	0	0	3	3
4.		Professional Elective V	PEC	3	0	0	3	3
5.		Professional Elective VI	PEC	3	0	0	3	3
6.		Professional Elective VII	PEC	3	0	0	3	3
7.		Professional Elective VIII	PEC	3	0	0	3	3
8.		Mandatory Course-II$^{\&}$	MC	3	0	0	3	0
9.		NCC Credit Course Level$^{\#}$		3	0	0	3	3$^{\#}$
PRACTICALS								
10.	EI3661	Industrial Automation Systems Laboratory	PCC	0	0	4	4	2
			TOTAL	**24**	**0**	**4**	**28**	**23**

* 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

SEMESTER VII/VIII*

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	EI3751	Industrial Data Communication	PCC	3	0	0	3	3
2.	EI3752	Applied Machine Learning	PCC	3	0	0	3	3
3.	GE3791	Human values and Ethics	HSMC	2	0	0	2	2
4.		Elective – Management#	HSMC	3	0	0	3	3
5.		Open Elective – II**	OEC	3	0	0	3	3
6.		Open Elective – III**	OEC	3	0	0	3	3
7.		Open Elective – IV**	OEC	3	0	0	3	3
PRACTICALS								
			TOTAL	20	0	0	20	20

*If students undergo internship in Semester VII, then the courses offered during semester VII will be offered during semester VIII.
#Elective - Management shall be chosen from the Elective Management Courses
**Open Elective II, III and IV (shall be chosen from the list of open electives offered by other Programmes).

SEMESTER VIII/VII*

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
PRACTICALS								
1.	EI3811	Project Work / Internship	EEC	0	0	20	20	10
			TOTAL	0	0	20	20	10

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

TOTAL CREDITS RANGE :167

MANDATORY COURSES I

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	MX3081	Introduction to Women and Gender Studies	MC	3	0	0	3	0
2.	MX3082	Elements of Literature	MC	3	0	0	3	0
3.	MX3083	Film Appreciation	MC	3	0	0	3	0
4.	MX3084	Disaster Management	MC	3	0	0	3	0

MANDATORY COURSES II

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	MX3085	Well Being with Traditional Practices (Yoga, Ayurveda and Siddha)	MC	3	0	0	3	0
2.	MX3086	History of Science and Technology in India	MC	3	0	0	3	0
3.	MX3087	Political and Economic Thought for a Humane Society	MC	3	0	0	3	0
4.	MX3088	State, Nation Building and Politics in India	MC	3	0	0	3	0
5.	MX3089	Industrial Safety	MC	3	0	0	3	0

ELECTIVE -MANAGEMENT COURSES

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	GE3751	Principles of Management	HSMC	3	0	0	3	3
2.	GE3752	Total Quality Management	HSMC	3	0	0	3	3
3.	GE3753	Engineering Economics and Financial Accounting	HSMC	3	0	0	3	3
4.	GE3754	Human Resource Management	HSMC	3	0	0	3	3
5.	GE3755	Knowledge Management	HSMC	3	0	0	3	3
6.	GE3792	Industrial Management	HSMC	3	0	0	3	3

PROFESSIONAL ELECTIVE COURSES : VERTICALS

Professional Elective	Vertical I	Vertical II	Vertical III	VerticalIV	VerticalV	VerticalVI	VerticalVII
	Automation	Internet of Things	Advanced Control	Applied Instrumentation	Health Care Instrumentation	Semi conductor / Communication	Computer
1.	PLC Programming	Industry IoT	Process Modeling and Simulation	Fiber Optics Instrumentation	Biomedical Instrumentation	Digital VLSI	Data Science
2.	Robotics and Automation	Sensor for IoT Application	Computer Control of Processes	Analytical Instrumentation	Bio Signal Processing	Semiconductor Manufacturing	Virtual/ Augmented Reality
3.	Industry 4.0	IoT for Industry Automation	System Identification	Electric Vehicle Technology	Digital Image Processing	Automotive Electronics	Computer Architecture
4.	Intelligent Automation	Data Analytics for IoT	Non Linear Control	Thermal Power Plant Instrumentation	Medical Imaging	Green Electronics	Computer Vision
5.	Smart Manufacturing	IoT for Smart Agriculture	Adaptive Control	Instrumentation in Petrochemical Industry	Medical Robotics	Real Time Embedded Systems	Cloud and Edge computing
6.	Cyber Security	IoT Security	Model Based Control	Safety Instrumented Systems	Brain Control and Application	Solar PV Fundamental and Applications	Block Chain Technology
7.	Building Automation	IoT for Smart Cities	Optimal Control	Renewable Systems	Diagnosis and Therapeutic Equipment	Communication Systems	Deep and Reinforcement Learning
8.	Smart Farming	IoT and Edge computing	Machine Monitoring System	Automotive Instrumentation and Control	Physiological Control Systems	Wireless Sensor Networks	Java Programming

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. Students are permitted to choose all the Professional Electives from a particular vertical or from different verticals. Further, only one Professional Elective course shall be chosen in a semester horizontally (row-wise). However, two courses are permitted from the same row, provided one course is enrolled in Semester V and another in semester VI.

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

PROFESSIONAL ELECTIVE COURSES : VERTICALS

VERTICAL I: AUTOMATION

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CEI331	PLC Programming	PEC	3	0	0	3	3
2.	CEI332	Robotics and Automation	PEC	3	0	0	3	3
3.	CEI333	Industry 4.0	PEC	3	0	0	3	3
4.	CEI334	Intelligent Automation	PEC	3	0	0	3	3
5.	CEI335	Smart Manufacturing	PEC	3	0	0	3	3
6.	CEI336	Cyber Security	PEC	3	0	0	3	3
7.	CEI337	Building Automation	PEC	3	0	0	3	3
8.	CEI338	Smart Farming	PEC	3	0	0	3	3

VERTICAL II: INTERNET OF THINGS

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CEI339	Industry IoT	PEC	3	0	0	3	3
2.	CEI340	Sensor for IoT Application	PEC	3	0	0	3	3
3.	CEI341	IoT for Industry Automation	PEC	3	0	0	3	3
4.	CEI342	Data Analytics for IoT	PEC	3	0	0	3	3
5.	CEI343	IoT for Smart Agriculture	PEC	3	0	0	3	3
6.	CEI344	IoT Security	PEC	3	0	0	3	3
7.	CEI345	IoT for Smart Cities	PEC	3	0	0	3	3
8.	CEI346	IoT and Edge computing	PEC	3	0	0	3	3

VERTICAL III: ADVANCED CONTROL

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CIC331	Process Modeling and Simulation	PEC	3	0	0	3	3
2.	CIC332	Computer Control of Processes	PEC	3	0	0	3	3
3.	CIC333	System identification	PEC	3	0	0	3	3
4.	CIC334	Non linearControl	PEC	3	0	0	3	3
5.	CIC335	Adaptive Control	PEC	3	0	0	3	3
6.	CIC336	Model Based Control	PEC	3	0	0	3	3
7.	CIC337	Optimal Control	PEC	3	0	0	3	3
8.	CIC338	Machine Monitoring System	PEC	3	0	0	3	3

VERTICAL IV :APPLIED INSTRUMENTATION

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CIC339	Fiber optics instrumentation	PEC	3	0	0	3	3
2.	CIC340	Analytical Instrumentation	PEC	3	0	0	3	3
3.	CIC341	Electric Vehicle technology	PEC	3	0	0	3	3
4.	CIC342	Thermal Power Plant Instrumentation	PEC	3	0	0	3	3
5.	CIC343	Instrumentation in Petrochemical Industry	PEC	3	0	0	3	3
6.	CIC344	Safety Instrumented Systems	PEC	3	0	0	3	3
7.	CIC345	Renewable Systems	PEC	3	0	0	3	3
8.	CIC346	Automotive Instrumentation and Control	PEC	3	0	0	3	3

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VERTICAL V : HEALTH CARE INSTRUMENTATION

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	BM3491	Biomedical Instrumentation	PEC	3	0	0	3	3
2.	CBM335	Bio Signal Processing	PEC	3	0	0	3	3
3.	CBM372	Digital Image Processing	PEC	3	0	0	3	3
4.	CBM373	Medical Imaging	PEC	3	0	0	3	3
5.	CBM374	Medical Robotics	PEC	3	0	0	3	3
6.	CBM375	Brain Control and Application	PEC	3	0	0	3	3
7.	BM3591	Diagnosis and Therapeutic Instrumentation	PEC	3	0	0	3	3
8.	CBM376	Physiological Control Systems	PEC	3	0	0	3	3

VERTICAL VI: SEMI CONDUCTOR /COMMUNICATION

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CEC373	Digital VLSI	PEC	3	0	0	3	3
2.	CEC374	Semiconductor Manufacturing	PEC	3	0	0	3	3
3.	CEC375	Automotive Electronics	PEC	3	0	0	3	3
4.	CEC376	Green Electronics	PEC	3	0	0	3	3
5.	CEC377	Real Time Embedded Systems	PEC	3	0	0	3	3
6.	CEC378	Solar PV Fundamentals and Applications	PEC	3	0	0	3	3
7.	EC3491	Communication Systems	PEC	3	0	0	3	3
8.	CEC379	Wireless Sensor Network	PEC	3	0	0	3	3

VERTICAL VII :COMPUTER

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CCS377	Data Science	PEC	3	0	0	3	3
2.	CCS378	Virtual/ Augmented Reality	PEC	3	0	0	3	3
3.	CCS379	Computer Architecture	PEC	3	0	0	3	3
4.	CCS338	Computer Vision	PEC	2	0	2	4	3
5.	CCS380	Cloud and Edge computing	PEC	3	0	0	3	3
6.	CCS381	Block Chain Technology	PEC	3	0	0	3	3
7.	CCS382	Deep and Reinforcement Learning	PEC	3	0	0	3	3
8.	CCS383	Java Programming	PEC	3	0	0	3	3

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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
(EMERGING TECHNOLOGIES)
To be offered other than Faculty of Information and Communication Engineering

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	OCS351	Artificial Intelligence and Machine Learning Fundamentals	OEC	2	0	2	4	3
2.	OCS353	Data Science Fundamentals	OEC	2	0	2	4	3
3.	OCS354	Augmented and Virtual Reality	OEC	2	0	2	4	3

OPEN ELECTIVES – II

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	OHS351	English for Competitive Examinations	OEC	3	0	0	3	3
2.	OMG352	NGOs and Sustainable Development	OEC	3	0	0	3	3
3.	OMG353	Democracy and Good Governance	OEC	3	0	0	3	3
4.	OME353	Renewable Energy Technologies	OEC	3	0	0	3	3
5.	OME354	Applied Design Thinking	OEC	2	0	2	4	3
6.	OMF351	Reverse Engineering	OEC	3	0	0	3	3
7.	OMF353	Sustainable Manufacturing	OEC	3	0	0	3	3
8.	OAU351	Electric and Hybrid Vehicle	OEC	3	0	0	3	3
9.	OAS352	Space Engineering	OEC	3	0	0	3	3
10.	OIM351	Industrial Management	OEC	3	0	0	3	3
11.	OIE354	Quality Engineering	OEC	3	0	0	3	3
12.	OSF351	Fire Safety Engineering	OEC	3	0	0	3	3
13.	OML351	Introduction to non-destructive testing	OEC	3	0	0	3	3
14.	OMR351	Mechatronics	OEC	3	0	0	3	3
15.	ORA351	Foundation of Robotics	OEC	3	0	0	3	3
16.	OAE352	Fundamentals of Aeronautical	OEC	3	0	0	3	3

		engineering					
17.	OGI351	Remote Sensing Concepts	OEC	3	0	0	3	3
18.	OAI351	Urban Agriculture	OEC	3	0	0	3	3
19.	OEN351	Drinking Water Supply and Treatment	OEC	3	0	0	3	3
20.	OEE352	Electric Vehicle Technology	OEC	3	0	0	3	3
21.	OCE353	Lean Concepts, Tools And Practices	OEC	3	0	0	3	3
22.	OCH351	Nano Technology	OEC	3	0	0	3	3
23.	OCH352	Functional Materials	OEC	3	0	0	3	3
24.	OBT352	Biomedical Instrumentation	OEC	3	0	0	3	3
25.	OFD352	Traditional Indian Foods	OEC	3	0	0	3	3
26.	OFD353	Introduction to food processing	OEC	3	0	0	3	3
27.	OPY352	IPR for Pharma Industry	OEC	3	0	0	3	3
28.	OTT351	Basics of Textile Finishing	OEC	3	0	0	3	3
29.	OTT352	Industrial Engineering for Garment Industry	OEC	3	0	0	3	3
30.	OTT353	Basics of Textile Manufacture	OEC	3	0	0	3	3
31.	OPE351	Introduction to Petroleum Refining and Petrochemicals	OEC	3	0	0	3	3
32.	OPE352	Energy Conservation and Management	OEC	3	0	0	3	3
33.	OPT351	Basics of Plastics Processing	OEC	3	0	0	3	3
34.	OEC351	Signals and Systems	OEC	3	0	0	3	3
35.	OEC352	Fundamentals of Electronic Devices and Circuits	OEC	3	0	0	3	3
36.	OBM351	Foundation Skills in integrated product Development	OEC	3	0	0	3	3
37.	OBM352	Assistive Technology	OEC	3	0	0	3	3
38.	OMA352	Operations Research	OEC	3	0	0	3	3
39.	OMA353	Algebra and Number Theory	OEC	3	0	0	3	3
40.	OMA354	Linear Algebra	OEC	3	0	0	3	3

OPEN ELECTIVES – III & OPEN ELECTIVES – IV

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	OHS352	Project Report Writing	OEC	3	0	0	3	3
2.	OMA355	Advanced Numerical Methods	OEC	3	0	0	3	3
3.	OMA356	Random Processes	OEC	3	0	0	3	3
4.	OMA357	Queuing and Reliability Modelling	OEC	3	0	0	3	3
5.	OMG354	Production and Operations Management for Entrepreneurs	OEC	3	0	0	3	3
6.	OMG355	Multivariate Data Analysis	OEC	3	0	0	3	3
7.	OME352	Additive Manufacturing	OEC	3	0	0	3	3
8.	OME353	New Product Development	OEC	3	0	0	3	3
9.	OME355	Industrial Design & Rapid Prototyping Techniques	OEC	2	0	2	4	3
10.	OMF352	Micro and Precision Engineering	OEC	3	0	0	3	3
11.	OMF354	Cost Management of Engineering Projects	OEC	3	0	0	3	3
12.	OAU352	Batteries and Management system	OEC	3	0	0	3	3
13.	OAU353	Sensors and Actuators	OEC	3	0	0	3	3
14.	OAS353	Space Vehicles	OEC	3	0	0	3	3
15.	OIM352	Management Science	OEC	3	0	0	3	3
16.	OIM353	Production Planning and Control	OEC	3	0	0	3	3
17.	OIE353	Operations Management	OEC	3	0	0	3	3
18.	OSF352	Industrial Hygiene	OEC	3	0	0	3	3
19.	OSF353	Chemical Process Safety	OEC	3	0	0	3	3
20.	OML352	Electrical, Electronic and Magnetic materials	OEC	3	0	0	3	3
21.	OML353	Nanomaterials and applications	OEC	3	0	0	3	3
22.	OMR352	Hydraulics and Pneumatics	OEC	3	0	0	3	3
23.	OMR353	Sensors	OEC	3	0	0	3	3
24.	ORA352	Foundation of Automation	OEC	3	0	0	3	3
25.	ORA353	Concepts in Mobile	OEC	3	0	0	3	3

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		Robotics						
26.	OMV351	Marine Propulsion	OEC	3	0	0	3	3
27.	OMV352	Marine Merchant Vehicles	OEC	3	0	0	3	3
28.	OMV353	Elements of Marine Engineering	OEC	3	0	0	3	3
29.	OAE353	Drone Technologies	OEC	3	0	0	3	3
30.	OGI352	Geographical Information System	OEC	3	0	0	3	3
31.	OAI352	Agriculture Entrepreneurship Development	OEC	3	0	0	3	3
32.	OEN352	Biodiversity Conservation	OEC	3	0	0	3	3
33.	OEE353	Introduction to control systems	OEC	3	0	0	3	3
34.	OCE354	Basics of Integrated Water Resources Management	OEC	3	0	0	3	3
35.	OCH353	Energy Technology	OEC	3	0	0	3	3
36.	OCH354	Surface Science	OEC	3	0	0	3	3
37.	OBT353	Environment and Agriculture	OEC	3	0	0	3	3
38.	OFD354	Fundamentals of Food Engineering	OEC	3	0	0	3	3
39.	OFD355	Food safety and Quality Regulations	OEC	3	0	0	3	3
40.	OPY353	Nutraceuticals	OEC	3	0	0	3	3
41.	OTT354	Basics of Dyeing and Printing	OEC	3	0	0	3	3
42.	OTT355	Fibre Science	OEC	3	0	0	3	3
43.	OTT356	Garment Manufacturing Technology	OEC	3	0	0	3	3
44.	OPE353	Industrial safety	OEC	3	0	0	3	3
45.	OPE354	Unit Operations in Petro Chemical Industries	OEC	3	0	0	3	3
46.	OPT352	Plastic Materials for Engineers	OEC	3	0	0	3	3
47.	OPT353	Properties and Testing of Plastics	OEC	3	0	0	3	3
48.	OEC353	VLSI Design	OEC	3	0	0	3	3
49.	OEC354	Industrial IoT and Industry 4.0	OEC	2	0	2	4	3
50.	OBM353	Wearable devices	OEC	3	0	0	3	3
51.	OBM354	Medical Informatics	OEC	3	0	0	3	3

Summary

No.	Subject Area	Credits per Semester								Credits Total
		I	II	III	IV	V	VI	VII/VIII	VIII/VII	
1.	HSMC	4	3					5		12
2.	BSC	12	7	4	2					25
3.	ESC	5	9							14
4.	PCC		6	18	20	8	8	6		66
5.	PEC					12	12			24
6.	OEC						3	9		12
7.	EEC	1	2	1					10	14
	TOTAL	**22**	**27**	**23**	**22**	**20**	**23**	**20**	**10**	**167**
8.	**Mandatory Course (Non credit)**					✓	✓			

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) 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 degree programmes)

Vertical I	Vertical II	Vertical III	Vertical IV	Vertical V
Fintech and Block Chain	**Entrepreneurship**	**Public Administration**	**Business Data Analytics**	**Environment and Sustainability**
Financial Management	Foundations of Entrepreneurship	Principles of Public Administration	Statistics for Management	Sustainable infrastructure Development
Fundamentals of Investment	Team Building and Leadership Management for Business	Constitution of India	Datamining for Business Intelligence	Sustainable Agriculture and Environmental Management
Banking, Financial Services and Insurance	Creativity and Innovation in Entrepreneurship	Public Personnel Administration	Human Resource Analytics	Sustainable Bio Materials
Introduction to Blockchain and its Applications	Principles of Marketing Management for Business	Administrative Theories	Marketing and Social Media Web Analytics	Materials for Energy Sustainability
Fintech Personal Finance and Payments	Human Resource Management for Entrepreneurship	Indian Administrative System	Operation and Supply Chain Analytics	Green Technology
Introduction to Fintech	Financing New Business Ventures	Public Policy Administration	Financial Analytics	Environmental Quality Monitoring and Analysis
-	-	-	-	Integrated Energy Planning for Sustainable Development
-	-	-	-	Energy Efficiency for Sustainable Development

VERTICALS FOR MINOR DEGREE

(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 I : FINTECH AND BLOCK CHAIN

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CMG331	Financial Management	PEC	3	0	0	3	3
2.	CMG332	Fundamentals of Investment	PEC	3	0	0	3	3
3.	CMG333	Banking, Financial Services and Insurance	PEC	3	0	0	3	3
4.	CMG334	Introduction to Blockchain and its Applications	PEC	3	0	0	3	3
5.	CMG335	Fintech Personal Finance and Payments	PEC	3	0	0	3	3
6.	CMG336	Introduction to Fintech	PEC	3	0	0	3	3

VERTICAL II : ENTREPRENEURSHIP

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CMG337	Foundations of Entrepreneruship	PEC	3	0	0	3	3
2.	CMG338	Team Building & Leadership Management for Business	PEC	3	0	0	3	3
3.	CMG339	Creativity & Innovation in Entrepreneurship	PEC	3	0	0	3	3
4.	CMG340	Principles of Marketing Management For Business	PEC	3	0	0	3	3
5.	CMG341	Human Resource Management for Entrepreneurs	PEC	3	0	0	3	3
6.	CMG342	Financing New Business Ventures	PEC	3	0	0	3	3

VERTICAL III: PUBLIC ADMINISTRATION

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CMG343	Principles of Public Administration	PEC	3	0	0	3	3
2.	CMG344	Constitution of India	PEC	3	0	0	3	3
3.	CMG345	Public Personnel Administration	PEC	3	0	0	3	3
4.	CMG346	Administrative Theories	PEC	3	0	0	3	3
5.	CMG347	Indian Administrative System	PEC	3	0	0	3	3
6.	CMG348	Public Policy Administration	PEC	3	0	0	3	3

VERTICALIV :BUSINESS DATA ANALYTICS

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CMG349	Statistics For Management	PEC	3	0	0	3	3
2.	CMG350	Datamining For Business Intelligence	PEC	3	0	0	3	3
3.	CMG351	Human Resource Analytics	PEC	3	0	0	3	3
4.	CMG352	Marketing And Social Media Web Analytics	PEC	3	0	0	3	3
5.	CMG353	Operation And Supply Chain Analytics	PEC	3	0	0	3	3
6.	CMG354	Financial Analytics	PEC	3	0	0	3	3

VERTICALV :ENVIRONMENT AND SUSTAINABILITY

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CES331	Sustainable infrastructure Development	PEC	3	0	0	3	3
2.	CES332	Sustainable Agriculture and Environmental Management	PEC	3	0	0	3	3
3.	CES333	Sustainable Bio Materials	PEC	3	0	0	3	3
4.	CES334	Materials for Energy Sustainability	PEC	3	0	0	3	3
5.	CES335	Green Technology	PEC	3	0	0	3	3
6.	CES336	Environmental Quality Monitoring and Analysis	PEC	3	0	0	3	3
7.	CES337	Integrated Energy Planning for Sustainable Development	PEC	3	0	0	3	3
8.	CES338	Energy Efficiency for Sustainable Development	PEC	3	0	0	3	3

MA3353 **TRANSFORMS AND DIFFERENTIAL EQUATIONS** **L T P C**
(FOR III - SEMESTER EIE AND ICE) **3 1 0 4**

COURSE OBJECTIVES:

- To acquaint the students with Differential Equations which are significantly used in engineering problems.
- 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 make the students appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.
- 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 ORDINARY DIFFERENTIAL EQUATIONS **9 +3**
Higher order linear differential equations with constant coefficients - Method of variation of parameters – Homogenous equation of Euler's and Legendre's type – System of simultaneous linear first order differential equations with constant coefficients - Method of undetermined coefficients.

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

UNIT III FOURIER SERIES **9 +3**
Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series and cosine series – Root mean square values - Parseval's identity –Harmonic analysis.

UNIT IV LAPLACE TRANSFORMS **9 +3**
Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems -Transforms of derivatives and integrals – Initial and final value theorems – Inverse transforms – Convolution theorem – Transform of periodic functions – Application to solution of linear second order ordinary differential equations with constant coefficients.

UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS **9 +3**
Z-transforms - Elementary properties – Convergence of Z-transforms - Initial and final value theorems - Inverse Z-transform using partial fraction and convolution theorem - Formation of difference equations – Solution of difference equations using Z - transforms.

TOTAL : 60 PERIODS

COURSE OUTCOMES:
Students able to
CO1 To acquaint the students with Differential Equations which are significantly used in engineering problems.
CO2 Understand how to solve the given standard partial differential equations
CO3 Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.

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CO4 Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.

CO5 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.

CO6 Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

TEXT BOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", 44thEdition, Khanna Publishers, New Delhi, 2018.
2. Kreyszig E, "Advanced Engineering Mathematics ", 10th Edition, John Wiley, New Delhi, India, 2016.

REFERENCES:

1. Andrews. L.C and Shivamoggi. B, "Integral Transforms for Engineers" SPIE Press, 1999.
2. Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 10th Edition, Laxmi Publications Pvt. Ltd, 2015.
3. James. G., "Advanced Modern Engineering Mathematics", 4thEdition, Pearson Education, New Delhi, 2016.
4. Narayanan. S., ManicavachagomPillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students", Vol. II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai, 1998.
5. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2018.
6. Wylie. R.C. and Barrett . L.C., "Advanced Engineering Mathematics" Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.
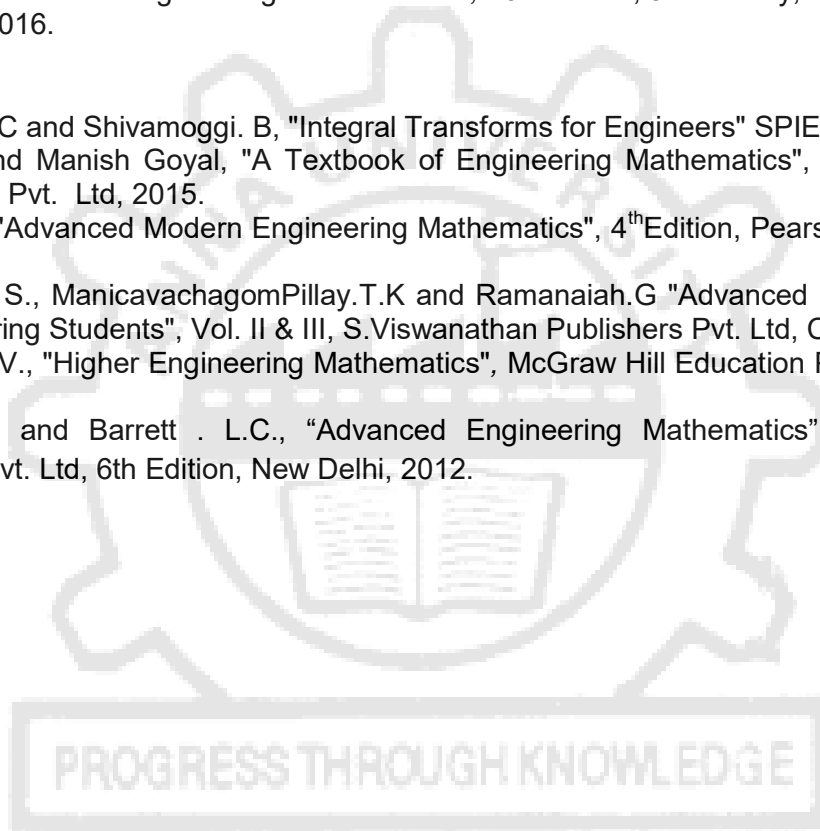
EI3351   **ANALOG ELECTRONICS**   L   T   P   C

                                                              3   0   0   3

COURSE OBJECTIVES:

- To understand the structure, operation and applications of electronic devices.
- To familiarize biasing of BJT & JFET devices.
- To explore the frequency response of amplifiers in various configurations.
- To learn the function of power amplifiers and negative feedback amplifiers.
- To design RC and LC tuned oscillators for a given frequency.

UNIT I   PN JUNCTION DEVICES(8+1 SKILL)   9
PN junction diode – structure, operation and V-I characteristics, Transition and Diffusion capacitances – Rectifiers – Half Wave and Full Wave Rectifier with capacitor filter. Zener diode – reverse characteristics – Zener as voltage regulator, Display devices – LED, Laser diode, Photo diode.

UNIT II   BJT AND SMALL SIGNAL AMPLIFIERS(8+1 SKILL)   9
BJT - structure, operation of NPN and PNP transistor, Input and output characteristics of CE, CB and CC configurations. DC Load Line and operating point, Need for biasing – Bias stabilization -Fixed and Voltage divider biasing. Single stage BJT amplifiers – AC analysis of CE and CC amplifier with Voltage divider bias using h-parameters - Gain and frequency response.

UNIT III   FIELD EFFECT TRANSISTORS AND THYRISTORS(8+1 SKILL)   9
JFET, MOSFET - structure, operation and characteristics, JFET Biasing - self and voltage divider biasing. FET small signal model - Analysis of CS,CG and Source follower. Thyristor - SCR operation and characteristics, UJT - operation and characteristics.

UNIT IV DIFFERENTIALAMPLIFIERSANDLARGESIGNALAMPLIFIERS(8+1 SKILL)   9
Cascade amplifier, BJT Differential amplifier – DC and AC analysis of common mode gain, differential mode gain and CMRR - Single tuned amplifier - construction, operation and frequency response. Power amplifiers – class A, class B and class C (Qualitative analysis only).

UNIT V   FEEDBACK AMPLIFIERS AND OSCILLATORS(8+1 SKILL)   9
Feedback concepts, feedback topologies - voltage / current, series / shunt feedback - Transfer gain with feedback - effect of negative feedback on R_i and R_o – Condition for oscillations, RC phase shift, Wien bridge, Hartley, Colpitts and Crystal oscillators.

                                                          TOTAL 45 PERIODS
**SKILL DEVELOPMENT ACTIVITIES (Group Seminar/Mini   5
Project/Assignment/Content Preparation / Quiz/ Surprise Test / Solving GATE
questions/ etc)**
1. Interpretation of Data Sheet of transistors and diodes with respect to their Static and Dynamic Characteristics.
2. Familiarization of any one relevant software tool (MATLAB/ SCILAB/ LABVIEW/ Proteus/ Equivalent open source software)
3. Design and verification of simple signal conditioning circuit thro simulation.
4. Realization of signal conditioning circuit in hardware
5. Introduction to other advanced logic circuits not covered in the above syllabus

COURSE OUTCOMES:

CO1   Explain the operation and characteristics of PN junction diode, Zener diode, LED and Laser diode. (L2)

CO2   Formulate the expression for voltage gain, current gain, input resistance and output resistance of a BJT CE and CC amplifier using h-parameter model. (L5)

CO3   Formulate the expression for voltage gain, input resistance and output resistance of FET amplifier under CS,CG and Source follower. (L5)

CO4   Explain the operation of cascade amplifier, differential amplifier, single tuned amplifier and power amplifiers. (L2)

CO5   Analyze the operation of negative feedback amplifiers and to design RC and LC tuned Oscillators for a given frequency range. (L4)

TEXT BOOKS:

1. Sedra and smith, "Microelectronic circuits", 8th ed., Oxford University Press 2020.
2. S.Salivahanan, N.SureshKumar, "Electronic Devicesand Circuits", McGraw Hill Education (India)Private Limited,4th Edition, 2017.
3. David A. Bell, "Electronic Devices and Circuits", Oxford University press higher education, 5th Edition,2008.

REFERENCES:

1. Thomas L.Floyd, "Electronic devices" Conventional current version, Pearson prentice hall,10th Edition,2017.
2. RobertBoylestadandLouisNashelsky.,"ElectronDeviceandCircuitTheory"PrenticeHallPrivateLimited,11th edition, 2017.
3. Jacob Millman, Christos C Halkias, SatyabrataJit, 'Electronic Devices and circuits',McGraw Hill education, 4th edition, 2015.
4. BalbirKumar,Shail.B.Jain,"Electronicdevicesandcircuits"PHIlearningprivatelimited,2nd Edition2014.
5. SedhaR.S, "ATextBookofAppliedElectronics", S.Chand&companyLtd.,Revisededition, 2013.

List of Open Source Software/ Learning website:

1. https://nptel.ac.in/courses/117101105.
2. https://www.google.com/url?sa=t&source=web&rct=j&url=https://picture.iczhiku.com/resource/eetop/WhkgDOyuhiJsYvMv.pdf&ved=2ahUKEwiLzOTqhuj4AhX_-TgGHefXBp0QFnoECAgQAQ&usg=AOvVaw0RFLaVzmh0NUI_3W3zqwzU
3. https://nptel.ac.in/courses/117106030
4. https://nptel.ac.in/courses/117102012
5. https://nptel.ac.in/courses/117106093
6. https://www.google.com/url?sa=t&source=web&rct=j&url=http://in.ncu.edu.tw/ncume_ee/harvardes154/lect_20_stability.pdf&ved=2ahUKEwjjnISXiOj4AhWqSWwGHRGkDxMQFnoECAMQAQ&usg=AOvVaw3YU37qK9qkYUf-ptaeD4D0

25

EI3352	**DIGITAL SYSTEM DESIGN AND APPLICATIONS**	**L**	**T**	**P**	**C**
		2	**1**	**0**	**3**

COURSE OBJECTIVES:

- To study various number systems and basic theorems of Boolean algebra and gate level minimization and implementation.
- To outline the formal procedures for the analysis and design of combinational circuits
- To analyze and design synchronous sequential circuits.
- To introduce the concept of asynchronous sequential circuits, PLCs and Logic Families.
- To introduce digital simulation techniques for development of application oriented logic circuit.

UNIT I   BOOLEAN ALGEBRA AND GATE LEVEL MINIMIZATION (8+1 SKILL)   9

Review of number systems, types and conversion, binary codes, error detection and correction codes (Parity and Hamming code). Boolean theorems and properties – Boolean functions - Logic gates – Gate Level Minimization using Karnaugh Map, SOP & POS simplification, Don't Care conditions. Implementations of Logic Functions using gates-NAND–NOR implementations.

UNIT II   COMBINATIONAL LOGIC (8+1 SKILL)   9

Design of adders, subtractors, Multiplexers - Combinational logic design using Multiplexers - Demultiplexers and their use in combinational logic design –2 bitMagnitude comparator, Code Converters - BCD to Binary and Binary to BCD, Encoder, Priority Encoder - Decimal to BCD, Octal to Binary, Decoders- BCD to Decimal and BCD to Seven Segment displaydecoder.

UNIT III   SYNCHRONOUS SEQUENTIAL LOGIC (8+1 SKILL)   9

Sequential logic - SR, JK, JKMS, D and T flip flops – characteristics and excitation table - level triggering and edge triggering - counters - asynchronous and synchronous type - Modulo counters - Shift registers - design of synchronous sequential circuits – Moore and Mealy models- state diagram; state reduction; state assignment.

**UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUITS, MEMORY AND LOGIC   9
FAMILIES (8+1 SKILL)**

Asynchronous sequential logic circuits - Transition and flow table - race conditions, hazards & errors in digital circuits; analysis of asynchronous sequential logic circuits. Memories: PROM, PLA – PAL, CPLD - FPGA. Digital Logic gate realization and characteristics of TTL, ECL, CMOS families.

UNIT V   VHDL (8+1 SKILL)   9

RTL Design – combinational logic – Sequential circuit – Operators – Introduction to Packages – Subprograms – Test bench. (Simulation /Tutorial Examples: adders, counters, flip flops, Multiplexers & De multiplexers).

TOTAL 45 PERIODS

SKILL DEVELOPMENT ACTIVITIES (Group Seminar/Mini Project/Assignment/Content Preparation / Quiz/ Surprise Test / Solving GATE questions/ etc)   5

1. Interpretation of Data Sheet of all logic gates.
2. Familiarization of any one relevant software tool (MATLAB/ SCILAB/ LABVIEW/ Proteus/ Equivalent open source software).
3. Design and verification of simple signal conditioning circuit thro simulation.
4. Realization of signal conditioning circuit in hardware.
5. Introduction to other advanced logic circuits not covered in the above syllabus.

COURSE OUTCOMES:

CO1   Convert various types of codes and number system & gate level implementation of Boolean functions.(L2)

CO2   Apply K –Map for simplification and implementation of combinational logic circuit (L3)

CO3   Design the synchronous Sequential logic circuits namely counters, registers etc, (L5)

CO4   Analyze the asynchronous sequential circuits and explain the operation of memories and digital logic families (L4)

CO5   Design the VHDL coding for combinational logic and Sequential circuits. (L5)

TEXT BOOKS:

1. M. Morris Mano, Michael D. Ciletti, "Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog" Pearson India, 6th Edition, 2018.
2. Comer "Digital Logic & State Machine Design, Oxford,3rd Edition, 2016.

REFERENCES:

1. D.P.Kothari, J.S.Dhillon "Digital Circuits and Design" Pearson Education, 2016
2. Mandal,"DigitalElectronicsPrinciples&Application,McGrawHill,2013.
3. William Keitz, Digital Electronics-A Practical Approach with VHDL, Pearson,2013
4. Raj Kamal "Digital Systems – Principles and Design"Pearson Education India, 2012.
5. JamesW.Bignel,DigitalElectronics,Cengagelearning,5thEdition,2007.

List of Open Source Software/ Learning website:

1. https://nptel.ac.in/courses/117106114
2. https://nptel.ac.in/courses/117106086
3. https://nptel.ac.in/courses/106102181
4. https://archive.nptel.ac.in/courses/108/105/108105132/

EI3353 **TRANSDUCERS ENGINEERING** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To know the methods of measurement, classification of transducers and to analyze error.
- To understand the behavior of transducers under static and dynamic conditions and hence to model the transducer.
- Get exposed to different types of resistive transducers and their application areas.
- To acquire knowledge on capacitive and inductive transducers.
- To gain knowledge on variety of transducers and get introduced to MEMS and Smart transducers.

UNIT I   SCIENCE OF MEASUREMENTS AND CLASSIFICATION OF TRANSDUCERS(8+1 SKIL
9

Units and standards – Static calibration – Classification of errors, Limiting error and probable error – Error analysis – Statistical methods – Odds and uncertainty – Classification of transducers – Selection of transducers.

UNIT II CHARACTERISTICS OF TRANSDUCERS (8+1 SKILL) **9**
Static characteristics: - Accuracy, precision, resolution, sensitivity, linearity, span and range. Dynamic characteristics: Mathematical model of transducer, Zero, I and II order transducers, Response to impulse, step, ramp and sinusoidal inputs.

UNIT III   VARIABLE RESISTANCE TRANSDUCERS (8+1 SKILL) **9**
Principle of operation, construction details, characteristics and applications of potentiometer, strain gauge, resistance thermometer, thermistor, hot-wire anemometer, piezo-resistive sensor and humidity sensor.

UNIT IV VARIABLE INDUCTANCE AND CAPACITANCE TRANSDUCERS (8+1 SKILL) **9**
Inductive transducers: – Principle of operation, construction details, characteristics and applications of LVDT, Induction potentiometer – variable reluctance transducers – Synchros – Microsyn – Principle of operation, construction details. Characteristics of Capacitive transducers – different types & signal conditioning – Applications: - capacitor microphone, capacitive pressure sensor, proximity sensor.

UNIT V   OTHER SENSORS AND TRANSDUCERS (8+1 SKILL) **9**
Piezoelectric transducer – Hall Effect transducer – Magneto elastic sensor – Digital transducers – Fiber optic sensors -Smart Sensors - Film sensor, MEMS & Nano Sensors, LASER sensors - Environmental Monitoring sensors (Water Quality & Air pollution).

TOTAL: 45 PERIODS

SKILL DEVELOPMENT ACTIVITIES (Group Seminar/Mini Project/Assignment/Content Preparation / Quiz/ Surprise Test / Solving GATE questions/ etc) **5**
1. Interpretation of Data Sheet of sensors with respect to their Static and Dynamic Characteristics.
2. Selection of Sensors for applications.
3. Familiarization of any one relevant software tool (MATLAB/ SCILAB/ LABVIEW/ Proteus/ Equivalent open source software).
4. Design and verification of simple signal conditioning circuit thro simulation.

5. Realization of signal conditioning circuit in hardware.
6. Introduction to other advanced sensors not covered in the above syllabus.

COURSE OUTCOMES:

Students able to

CO1   Understand the working principles of various types of transducers (L2).

CO2   Gain knowledge on the application areas of different sensors (L2).

CO3   Select the right sensor/transducer for a given application (L3).

CO4   Determine the static and dynamic characteristics of transducers using software packages (L4)

CO5   Design simple signal conditioning circuits for the R,L and C type of sensors (L3).

CO6   Summarize the advanced sensor technologies and sensors for specific applications.(L2)

TEXT BOOKS:

1. Ernest O Doebelin, "Measurement Systems – Applications and Design", Tata McGraw-Hill, 2019.
2. Patranabis D, "Sensors & Transducers", 2nd Edition, PHI, New Delhi, 2011.
3. R. K. Jain, "Mechanical and Industrial measurements" Khanna Publishers, 2017

REFERENCES:

1. BelaG.Liptak Instrument Engineers' Handbook, Process Measurement and Analysis, 4th Edition, Vol. 1, ISA/CRC Press, 2003.
2. John Turner and Martyn Hill "Instrumentation for Engineers and Scientists", Process Measurement and Analysis, 4[th]Edition, Vol. 1, ISA/CRC Press, 2003.
3. Richard Zurawski "Industrial Communication Technology Handbook", 2[nd]edition, CRC Press, 2017.
4. NeubertH.K.P.Instrument Transducers – An Introduction to their Performance and Design Oxford University Press, Cambridge, 2003.

List of Open Source Software/ Learning website:

1. http://nptel.iitm.ac.in/courses.php
2. http://www.nptelvideos.in/2012/11/industrial-instrumentation.html
3. https://nptel.ac.in/content/storage2/courses/112103174/pdf/ mod2.pdf
4. https://instrumentationtools.com/tag/sensors-and-transducers-nptel- pdf
5. https://www.analog.com
6. https://electronics-tutorials.ws/io/io-
7. https://www.cse.wustl.edu/~lu/cse521s/Slides/wirelesshart.pdf

EI3354   **LINEAR INTEGRATED CIRCUITS AND APPLICATIONS**   L   T   P   C

                                                                        3   0   0   3

COURSE OBJECTIVES:

- To discuss the IC fabrication procedure.
- To learn the characteristics of Op-Amp.
- To design and construct the basic applications of Op–amp.
- To interpret the internal functional blocks and the applications of special ICs.
- To illustrate the operation of application ICs

UNIT I   IC FABRICATION (8+1 SKILL)   **9**
IC classification - fundamentals of monolithic IC technology – basic planar processes - fabrication of typical circuit - Fabrication of diodes, resistance, capacitance and FETs.

UNIT II   CHARACTERISTICS AND APPLICATIONS OF OPAMP (8+1 SKILL)   **9**
Ideal Op-Amp - DC and AC characteristics - Basic applications of Op-Amp – Inverting and Non-inverting Amplifiers, summer, , differentiator and integrator - Op-Amp circuits using Diodes - peak detector, clippers, clampers– comparators – Schmitt trigger- multivibrators - waveform generators – First order and second order Low pass and high pass active filters.

UNIT III   SPECIAL   ICs(8+1 SKILL)   **9**

555 Timer - Functional block, characteristics – IC NE/SE 566 Voltage Controlled Oscillator - IC NE/SE 565 Phase Locked Loop - Analog multiplier and Divider IC AD633.

UNIT IV   APPLICATION ICs(8+1 SKILL)   **9**

IC voltage regulators – LM78XX, LM79XX series voltage regulator - LM317, LM723 Variable voltage regulator – μA78S40 switching regulator - LM 380 power amplifier - ICL 8038 function generator IC- LM 324 Quad op amp.

UNIT V   SIGNAL CONDITIONING CIRCUITS (8+1 SKILL)   **9**
V/I and I/V converters.- differential amplifier Instrumentation amplifier -S/H circuit – DAC and ADC characteristics - D/A converter (R- 2R ladder and weighted resistor types) - A/D converter (Flash and Successive approximation types)- Design of signal conditioning circuit for RTD and strain Gauge.

                                                  TOTAL : 45 PERIODS

SKILL DEVELOPMENT ACTIVITIES (Group Seminar/Mini Project/Assignment/Content Preparation / Quiz/ Surprise Test / Solving GATE questions/ etc)   **5**

1. Interpretation of Data Sheet of ICs.
2. Familiarization of any one relevant software tool (MATLAB/ SCILAB/ LABVIEW/ Proteus/ Equivalent open source software)
3. Design and verification of simple signal conditioning circuit thro simulation.
4. Realization of signal conditioning circuit in hardware.
5. Introduction to other advanced logic circuits not covered in the above syllabus.

COURSE OUTCOMES:

     Explain the IC fabrication process and discuss the fabrication of active and passive
CO1   components. (L2)
CO2   Compute the gain and output voltage of the given Op-Amp circuits. (L3)

CO3   Explain the internal functional blocks and applications of ICs 555, 566, 565, and AD633 . (L2)

CO4   Explain the operation of voltage regulator ICs namely LM78XX, LM79XX, LM317 and LM723. (L2)

CO5   Explain the operation and design of various signal conditioning circuits. (L2)

TEXT BOOKS:

1. D. Roy Choudhury, Shail B. Jain, "Linear Integrated Circuits", 5th Edition, New Age, 2018.
2. Ramakant A. Gayakward, "Op–Amps and Linear Integrated Circuits", 4th Edition, PHI,2015.
3. David A. Bell, 'Operational Amplifiers and Linear ICs, Oxford higher education, 2013.

REFERENCES:

1. Fiore, 'Opamps& Linear Integrated Circuits Concepts & applications', Cengage, 2018.
2. Sergio Franco, 'Design with Operational Amplifiers and Analog Integrated Circuits', McGraw Hill,2016.
3. Jacob Millman, Christos Halkias, Chetan D Parikh, 'Integrated Electronics - Analog and Digital circuits system', McGraw Hill, 2nd edition, 2017.
4. Floyd ,Buchla, 'Fundamentals of Analog Circuits', Pearson, 2013.
5. Robert F.Coughlin, Fredrick F. Driscoll, 'Op-amp and Linear ICs', Pearson, 6th edition, 2012.

List of Open Source Software/ Learning website:

1. https://www.google.com/url?sa=t&source=web&rct=j&url=https://lecturenotes.in/subject/899/linear-integrated-circuits-and-applications-lica&ved=2ahUKEwjr6e2di-j4AhVETmwGHXi7CjEQFnoECA4QAQ&usg=AOvVaw3rhB8gam3anif-itEmwKX.
2. https://www.google.com/url?sa=t&source=web&rct=j&url=https://archive.nptel.ac.in/content/storage2/courses/downloads_new/108108111/W0A1.pdf&ved=2ahUKEwiJssC3i-j4AhWCS2wGHabOD4AQFnoECDYQAQ&usg=AOvVaw3NDeqOP88V7iqJ09j9vf4K
3. https://nptel.ac.in/courses/108108111

31

CS3354	DATA STRUCTURESAND OOPS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce the basics of C programming language.
- To learn the concepts of advanced features of C.
- To understand the concepts of ADTs and linear data structures.
- To know the concepts of non-linear data structure and hashing.
- To familiarize the concepts of sorting and searching techniques.

UNIT I   C PROGRAMMING FUNDAMENTALS (8+1 SKILL)   9
Data Types – Variables – Operations – Expressions and Statements – Conditional Statements – Functions – Recursive Functions – Arrays – Single and Multi-Dimensional Arrays.

UNIT II   C PROGRAMMING - ADVANCED FEATURES (8+1 SKILL)   9
Structures – Union – Enumerated Data Types – Pointers: Pointers to Variables, Arrays and Functions – File Handling – Preprocessor Directives.

UNIT III   LINEAR DATA STRUCTURES (8+1 SKILL)   9
Abstract Data Types (ADTs) – List ADT – Array-Based Implementation – Linked List – Doubly- Linked Lists – Circular Linked List – Stack ADT – Implementation of Stack – Applications – Queue ADT – Priority Queues – Queue Implementation – Applications.

UNIT IV NON-LINEAR DATA STRUCTURES (8+1 SKILL)   9
Trees – Binary Trees – Tree Traversals – Expression Trees – Binary Search Tree – Hashing - Hash Functions – Separate Chaining – Open Addressing – Linear Probing– Quadratic Probing – Double Hashing – Rehashing.

UNIT V   SORTING AND SEARCHING TECHNIQUES (8+1 SKILL)   9
Insertion Sort – Quick Sort – Heap Sort – Merge Sort –Linear Search – Binary Search.

TOTAL   45 PERIODS

SKILL DEVELOPMENT ACTIVITIES (Group Seminar/Mini Project/Assignment/Content Preparation / Quiz/ Surprise Test / Solving GATE questions/ etc)   5

COURSE OUTCOMES:

CO1   Develop C programs for any real world/technical application.
CO2   Apply advanced features of C in solving problems.
CO3   Write functions to implement linear and non–linear data structure operations.
CO4   Suggest and use appropriate linear/non–linear data structure operations for solving a given problem.
CO5   Appropriately use sort and search algorithms for a given application.
CO6   Apply appropriate hash functions that result in a collision free scenario for data storage and retrieval.

TEXT BOOKS:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education, 1997.
2. ReemaThareja, "Programming in C", Second Edition, Oxford University Press, 2016.

REFERENCES:

1. Brian W. Kernighan, Rob Pike, "The Practice of Programming", Pearson Education, 1999.
2. Paul J. Deitel, Harvey Deitel, "C How to Program", Seventh Edition, Pearson Education, 2013.
3. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education,1983.
4. Ellis Horowitz, SartajSahni and Susan Anderson, "Fundamentals of Data Structures", Galgotia, 2008.

List of Open Source Software/ Learning website:

https://www.coursera.org/specializations/data-structures-algorithms

https://nptel.ac.in/courses/112107243

https://nptel.ac.in/courses/112105598

EI3361	SEMICONDUCTOR DEVICES AND CIRCUITS LABORATORY	L T P C 0 0 3 1.5

COURSE OBJECTIVES:

- To understand the behavior of semiconductor devices experimentally.
- To design the amplifiers and oscillators.
- To analyze the rectifier and filters.

LIST OF EXPERIMENTS

1. Characteristics of Semiconductor diode.
2. Characteristics of Zener diode and Zener as series voltage regulator.
3. Single Phase half-wave and full wave rectifiers with capacitive filters.
4. Characteristics of JFET.
5. Characteristics of UJT and generation of saw tooth waveform.
6. Characteristics of a BJT under common emitter and common base configurations.
7. Design and testing of Common Emitter amplifier.
8. Design and testing of Common Source amplifier.
9. Differential amplifier using FET.
10. Design and testing of RC phase shift and LC oscillators.
11. Design and testing of Feedback amplifiers (Any one type)
12. Simulation of rectifier circuits using PSIM/SIMULINK

TOTAL: 45 PERIODS

COURSE OUTCOMES:
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

CO1   Determine the Breakdown voltage, forward and reverse resistance of PN junction diode and Zener diode and calculate the ripple factor of rectifier circuits with filter.

CO2   Calculate the hybrid parameters of BJT under CE and CB configuration

CO3   Obtain the frequency response of CE amplifier and CS amplifier

CO4   Obtain the UJT and JFET parameters from the characteristics and also to calculate the gain of differential amplifier using JFET.

CO5   Design the RC and LC tuned oscillators for a given oscillating frequency.

CO6   Analyze the input and output performance of the given diode based circuit using simulation tools.

| CS3363 | DATA STRUCTURES AND OOPS LABORATORY | L T P C |
| | | 0 0 3 1.5 |

COURSE OBJECTIVES:

- To implement linear and non-linear data structures
- To understand the different operations of search trees
- To implement graph traversal algorithms
- To get familiarized to sorting and searching algorithms

LIST OF EXPERIMENTS

1. Array implementation of Stack and Queue ADTs
2. Array implementation of List ADT
3. Linked list implementation of List, Stack and Queue ADTs
4. Applications of List, Stack and Queue ADTs
5. Implementation of Binary Trees and operations of Binary Trees
6. Implementation of Binary Search Trees
7. Implementation of AVL Trees
8. Implementation of Heaps using Priority Queues.
9. Graph representation and Traversal algorithms
10. Applications of Graphs
11. Implementation of searching and sorting algorithms
12. Hashing – any two collision techniques

TOTAL(40+5*): 45 PERIODS

* SKILL DEVELOPMENT ACTIVITIES (Group Seminar/Mini Project/Assignment/Content Preparation / Quiz/ Surprise Test / Solving GATE questions/ etc)   5

COURSE OUTCOMES:

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

CO1   Write functions to implement linear and non-linear data structure operations

CO2   Suggest appropriate linear / non-linear data structure operations for solving a given problem

CO3   Appropriately use the linear / non-linear data structure operations for a given problem

CO4   Apply appropriate hash functions that result in a collision free scenario for data storage and Retrieval

CO5   Ability to apply Sorting and searching Algorithms for give application

SEMESTER IV

EI3451	INDUSTRIAL INSTRUMENTATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce the measurement techniques of viscosity,humidity and moisture
- To introduce the measurement of temperature and pressure.
- To introduce the flow measurement techniques.
- To introduce the electrical flow measurement techniques.
- To introduce the level measurement techniques and transmitters.

UNIT I MEASUREMENT OF VISCOSITY, HUMIDITY AND MOISTURE   9
Viscosity: Saybolt viscometer - Rotameter type and Torque type viscometers.
Humidity: Dry and wet bulb psychrometers – Resistive and capacitive type hygrometers – Dew cell – Commercial type dew meter. Moisture: Different methods of moisture measurements –Thermal, Conductivity and Capacitive sensors, Microwave, IR and NMR sensors, Application of moisture measurement - Moisture measurement in solids.

UNIT II   TEMPERATURE & PRESSURE MEASUREMENT   9
Definitions and standards –Different types of filled in system thermometers – Bimetallic thermometers – IC sensors – Thermocouples, Signal conditioning for thermocouple, Commercial circuits for cold junction compensation,, Special techniques for measuring high temperature using thermocouple –- Radiation methods of temperature measurement – Total radiation pyrometers – Optical pyrometers – Fiber optic sensor for temperature measurement – Thermograph – Temperature sensor selection, Installation and Calibration, Manometers: Different types, Bourdon tube, Bellows, Diaphragms and Capsules, Pressure gauge selection, installation and calibration using dead weight tester.

UNIT III   FLOW MEASUREMENT   9
Orifice plate: different types of orifice plates – Cd variation – pressure tapping– Venturi tube – Flow nozzle – Dall tube – Pitot tube, Installation and applications of head flowmeters, Positive displacement flow meters, Rotameter –theory, characteristics, installation and applications, Mass flow meter, Calibration of flow meters: – Dynamic weighing method.

UNIT IV ELECTRICAL TYPE FLOW METERS   9
Principle and constructional details of Electromagnetic flow meter – Ultrasonic flow meters – Laser Doppler anemometer – Vortex shedding flow meter – Target flow meter – Guidelines for selection of flow meter – Open channel flow measurement – Solid flow rate measurement.

UNIT V   LEVEL MEASUREMENT AND TRANSMITTER   9
Level measurement: Float gauges - Displacer type, Ultrasonic gauge – Boiler drum level measurement :– Differential pressure method and Hydrastep method - Solid level measurement, Operation of Electronics and Smart transmitters – Principle of operation of flow, level, temperature and pressure transmitters.

TOTAL: 45 PERIODS

SKILL DEVELOPMENT ACTIVITIES (Group Seminar/Mini Project/Assignment/Content Preparation / Quiz/ Surprise Test / Solving GATE questions/ etc)   5

1. Design of signal conditioning circuits for industrial instruments used for measurement of temperature, pressure, flow, level.
2. Calibration of sensor and transmitters along with uncertainty measurement.
3. Configuration of smart transmitters with HART communicator.
4. Selection, installation and commissioning of transducers

COURSE OUTCOMES:

Upon completion of the course, the student should be able to:

CO1   Understand Principles and working of Viscosity, Humidity, Moisture, temperature , pressure, flow and level measuring Instruments.(L2)

CO2   Calibrate temperature, flow , level and Pressure measuring devices .(L3)

CO3   Apply measurement of Viscosity, Humidity, Moisture, temperature , pressure, flow and level in Industrial Applications.(L3)

CO4   Select and install Industrial instruments for various applications   (L4)

CO5   Understand various Electrical type Industrial Instruments (L2)

TEXT BOOKS:

1. Doebelin, E.O. and Manik, D.N., "Measurement systems Application and Design", 6th McGraw-Hill Education Pvt. Ltd,2011.
2. A.K. Sawhney and PuneetSawhney, "Mechanical Measurements and Instrumentation and Control", DhanpatRai& Co. (P) Limited, 2015.

REFERENCES:

1. Liptak, B.G., "Instrumentation Engineers Handbook (Measurement)", CRC Press,2005.
2. Patranabis, D., "Principles of Industrial Instrumentation", 3rd Edition, McGraw-Hill Education,2017.
3. Eckman D.P., "Industrial Instrumentation", Wiley Eastern Limited,1990.
4. Singh,S.K., "Industrial Instrumentation and Control", Tata Mc-Graw-Hill Education Pvt. Ltd., New Delhi,2009.
5. https://swayam.gov.in/ Principles of Industrial Engineering

List of Open Source Software/ Learning website:

1. http://instrumentationtoolbox.com
2. Our instrumentation.com.
3. Home Instrumentation Tools.

IC3451   **AUTOMATIC CONTROL SYSTEMS**   **L T P C**

       3 1 0 4

COURSE OBJECTIVES:

- To introduce the control system components and transfer function model with their graphical representation.
- To understand the analysis of system in time domain along with steady state error.
- To introduce frequency response analysis of systems.
- To accord basic knowledge in design of compensators.
- To introduce the state space models.

UNIT I SYSTEMS COMPONENTS AND THEIR REPRESENTATION (11+1 SKILL)   **12**
Control System: Terminology and Basic Structure- Feed forward and Feedback control theory-Electrical and Mechanical Transfer Function Models-Block diagram Models-Signal flow graphs models-DC and AC servo Systems-Synchro.

UNIT II TIME RESPONSE ANALYSIS (11+1 SKILL)   **12**
Transient response-steady state response-Measure of performance of the standard first order and second order system-Time domain specifications -Effect on an additional zero and an additional pole-Steady state error - Type number-PID control-Effect of PD, PI, PID control systems.

UNIT III FREQUENCY RESPONSE ANDSYSTEM ANALYSIS (11+1 SKILL)   **12**
Closed loop frequency Response-Performance specification in frequency domain - Bode Plot – Polar Plot- Design of compensators using Bode plots - Cascade lead compensation - Cascade lag compensation- Cascade lag-lead compensation.

UNIT IV CONCEPTSOFSTABILITYANALYSIS (11+1 SKILL)   **12**
Concept of Stability-Bounded – Input Bounded – Output Bounded-Routh Hurwitz stability Criterion-Relative Stability-Root locus concept-Guidelines for sketching root locus - Nyquist stability criterion.

UNIT V CONTROL SYSTEM ANALYSIS USING STATE VARIABLE METHOD(11+1SKILL)   **12**
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 -Equivalence between transfer function and state variable representations.

       TOTAL60 PERIODS

SKILL DEVELOPMENT ACTIVITIES (Group Seminar/Mini Project/Assignment/Content Preparation / Quiz/ Surprise Test / Solving GATE questions/ etc)   **5**
1. Explore various controllers presently used in industries.
2. Develop control structures for industrial processes.
3. Implement the controllers for various transfer functions of industrial systems.
4. Using software tools for practical exposures to the controllers used in industries by undergoing training.
5. Realisation of various stability criterion techniques for economical operation of process.

COURSE OUTCOMES:

CO1   To represent and develop systems in different forms using the knowledge gained (L5).

CO2   To analyses the system in time and frequency domain (L4).

CO3   To discuss the effect of PID controller in closed loop systems (L2).

CO4   To construct compensator for the linear systems in frequency domain.(L5)

CO5   To analyses the stability of physical systems(L4).

CO6   To acquire and analyses knowledge in State variable model for MIMO systems(L4)

TEXT BOOKS:

1. Nagarath, I.J. and Gopal, M., "Control Systems Engineering", New Age International Publishers,2017.
2. Benjamin C. Kuo, "Automatic Control Systems", Wiley, 2014

REFERENCES:

1. Katsuhiko Ogata, "Modern Control Engineering", Pearson, 2015.
2. Richard C. Dorf and Bishop, R.H., "Modern Control Systems", Pearson Education,2009.
3. John J.D., Azzo Constantine, H. and HoupisSttuart, N Sheldon, "Linear Control System Analysis and Design with MATLAB", CRC Taylor& Francis Reprint 2009.
4. RamesC.Panda and T. Thyagarajan, "An Introduction to Process Modelling Identification and Control of Engineers", Narosa Publishing House, 2017.
5. M. Gopal, "Control System: Principle and design", McGraw Hill Education, 2012.
6. NPTEL Video Lecture Notes on "Control Engineering "by Prof. S. D. Agashe, IIT Bombay.

List of Open Source Software/ Learning website:

1. https://nptel.ac.in/courses/112107240
2. https://onlinecourses.nptel.ac.in/noc20_me25/preview
3. https://onlinecourses.nptel.ac.in/noc20_ee90/preview
4. https://www.classcentral.com/course/swayam-automatic-control-9850

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

UNIT I   ENVIRONMENT AND BIODIVERSITY   6
Definition, scope and importance of environment – need for public awareness. Eco-system and Energy flow– ecological succession. Types of biodiversity: genetic, species and ecosystem diversity– values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ.

UNIT II   ENVIRONMENTAL POLLUTION   6
Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollutions. Solid, Hazardous and E-Waste management. Case studies on Occupational Health and Safety Management system (OHASMS). Environmental protection, Environmental protection acts .

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

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

UNIT V   SUSTAINABILITY PRACTICES   6
Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transports. Sustainable energy: Non-conventional Sources, Energy Cycles-carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization- Socio-economical and technological change.

TOTAL: 30 PERIODS

TEXT BOOKS:
1. Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers ,2018.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2016.
3. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
4. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.
5. Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning.
6. Environment Impact Assessment Guidelines, Notification of Government of India, 2006.
7. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998.

REFERENCES

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media. 38.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT. LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.
5. Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013.

EI3401   **EMBEDDED SYSTEMS**   **L T P C**
                                                                                         3 0 2 4

COURSE OBJECTIVES:

- To get familiarized with the embedded hardware architecture.
- To acquire knowledge about various embedded software development tools.
- To get an insight over various wired and wireless communication protocols used in
- embedded system design.
- To understand the basics of RTOS.
- To build knowledge on programming and realize the concept of peripheral interface.

UNIT I EMBEDDED HARDWARE ARCHITECTURE   **9**

CISC Architecture:- Introduction to MCS51 Family - 8051 Microcontroller - Architecture - Timers - Interrupts - Serial Data Communication - RISC Architecture:- overview of PIC 16F487x family - PIC16F877A - Architecture - Timers - Interrupts - Serial ports.

UNIT II ARM & EMBEDDED SOFTWARE DEVELOPMENT TOOLS   **9**
Introduction to ARM - LPC4088 Architecture - Software Development Tools: - IDE Tools - ISP Tools - ARM Development Tools.

UNIT III COMMUNICATION INTERFACES   **9**

Wired Communication protocols:- Serial communication interface:- RS232, RS485, I^{2}C SPI and USB - Parallel communication interface - IEE 488 - Wireless communication protocols: - Bluetooth classic, BLE, IEEE 802.15.4, Zigbee, IEEE 802.11 and LoRaWAN.

UNIT IV REAL TIME OPERATING SYSTEM   **9**
Operating System Basics:- The Kernel and its subsystems, Kernel Space and User Space - Types of RTOS - Functions of RTOS - Task, process and Threads, Interrupt handling, Multiprocessing & Multitasking and Task scheduling - Comparative study of various RTOSs.

UNIT V EMBEDDED PROGRAMMING AND PERIPHERAL INTERFACING   **9**
Embedded C and Python Programming for Embedded Applications - Input and output devices Interface, ADC Interface - DAC Interface - PWM Generation - sensor Interface.

TOTAL : 45+30 = 75 PERIODS

1.   Implementation of specific tasks using Embedded C/Python programming
2.   Interfacing input devices with 8051/PIC16F877A/LPC4088.
3.   Interfacing output devices with 8051/PIC16F877A/LPC4088.
4.   Implementation of recurring tasks using the timers and interrupts of 8051/PIC microcontroller/ LPC4088.
5.   Interfacing ADC & DAC with 8051 microcontroller.
6.   PWM generation using PIC16F877A/LPC4088..

7. Interfacing RTC with microcontroller.
8. Establishing serial data transmission through UART.
9. Establishing serial data communication using I^{2}C and SPI protocols.
10. Wireless data communication using Zigbee.
11. Multitasking using RTOS.
12. Design and implementation of ON/OFF control strategy.

SKILL DEVELOPMENT ACTIVITIES (Group Seminar/Mini Project/Assignment/Content Preparation / Quiz/ Surprise Test / Solving GATE questions/ etc) **5**
1. Interpretation of Embedded systems architecture.
2. Selection of Micro controller for applications.
3. Familiarization of any one relevant software tool (MATLAB/ SCILAB/ LABVIEW/ Proteus/ Equivalent open source software).
4. Design and verification of embedded systems and RTOS applications in any of the software.
5. Realization of embedded and RTOSin hardware.
6. Introduction to other advanced micro controller not covered in the above syllabus.

COURSE OUTCOMES:
The students will be able to

CO1 Understand the concept of embedded system and its architecturalfeatures (L2).
CO2 Develop embedded software using Embedded C and Python(L5)
CO3 Experimentreal world field devices with microcontrollers(L4).

CO4 Constructreal world signals using suitable data converters for controlapplications(L5).
CO5 Use the power of RTOS for embedded applications(L3).
CO6 Design embedded systems with the right choice of microcontroller and the associated peripherals for a given embedded application(L5).

TEXT BOOKS:
1. Rajkamal, 'Embedded system-Architecture, Programming, Design', TataMcgraw Hill,2011.
2. Peckol, "Embedded System Design", John Wiley,2010.

REFERENCES:
1. Tammy Noergaard, "Embedded Systems Architecture", Elsevier, 2006.
2. Han-Way Huang, "Embedded system Design using C8051", Cengage Learning,2009.
3. Rajib Mall "Real-Time systems Theory and Practice" Pearson Education, 2007.
4. Shibu.k.v, "Introduction to Embedded Systems", TataMcgraw Hill, 2009

List of Open Source Software/ Learning website:
1. https://nptel.ac.in/courses/108105057
2. https://nptel.ac.in/courses/106105193
3. https://nptel.ac.in/courses/106105172
4. https://www.iare.ac.in/sites/default/files/lecture_notes/ESD%20NOTES-A70440.pdf
5. https://www.udemy.com/course/embedded-device-interfacing.

OCS352   **IOT CONCEPTS AND APPLICATIONS**   **L T P C**
                                                                           2 0 2 3

OBJECTIVES:
- To apprise students with basic knowledge of IoT that paves a platform to understand physical and logical design of IOT
- To teach a student how to analyse requirements of various communication models and protocols for cost-effective design of IoT applications on different IoT platforms.
- To introduce the technologies behind Internet of Things(IoT).
- To explain the students how to code for an IoT application using Arduino/Raspberry Pi open platform.
- To apply the concept of Internet of Things in real world scenario.

UNIT I   INTRODUCTION TO INTERNET OF THINGS   5
Evolution of Internet of Things – Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT Models – Simplified IoT Architecture and Core IoT Functional Stack – Fog, Edge and Cloud in IoT

UNIT II   COMPONENTS IN INTERNET OF THINGS   5
Functional Blocks of an IoT Ecosystem – Sensors, Actuators, and Smart Objects – Control Units - Communication modules (Bluetooth, Zigbee,Wifi, GPS, GSM Modules)

UNIT III   PROTOCOLS AND TECHNOLOGIES BEHIND IOT   6
IOT Protocols - IPv6, 6LoWPAN, MQTT, CoAP - RFID, Wireless Sensor Networks, BigData Analytics, Cloud Computing, Embedded Systems.

UNIT IV   OPEN PLATFORMS AND PROGRAMMING   7
IOT deployment for Raspberry Pi /Arduino platform-Architecture –Programming – Interfacing – Accessing GPIO Pins – Sending and Receiving Signals Using GPIO Pins – Connecting to the Cloud.

UNIT V   IOT APPLICATIONS   7
Business models for the internet of things, Smart city, Smart mobility and transport, Industrial IoT, Smart health, Environment monitoring and surveillance – Home Automation – Smart Agriculture

                                                                    30 PERIODS
PRACTICAL EXERCISES: 30 PERIODS
1. Introduction to Arduino platform and programming
2. Interfacing Arduino to Zigbee module
3. Interfacing Arduino to GSM module
4. Interfacing Arduino to Bluetooth Module
5 Introduction to Raspberry PI platform and python programming
6. Interfacing sensors to Raspberry PI
7. Communicate between Arduino and Raspberry PI using any wireless medium
8. Setup a cloud platform to log the data
9. Log Data using Raspberry PI and upload to the cloud platform
10.Design an IOT based system

COURSE OUTCOMES:
CO 1:Explain the concept of IoT.
CO 2:Understand the communication models and various protocols for IoT.
CO 3:Design portable IoT using Arduino/Raspberry Pi /open platform
CO 4:Apply data analytics and use cloud offerings related to IoT.
CO 5:Analyze applications of IoT in real time scenario.

                                                            TOTAL PERIODS:60

TEXTBOOKS
1. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017
2. Samuel Greengard, The Internet of Things, The MIT Press, 2015

REFERENCES
1. Perry Lea, "Internet of things for architects", Packt, 2018
2. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols", Wiley, 2012
3. IOT (Internet of Things) Programming: A Simple and Fast Way of Learning, IOT Kindle Edition.
4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet of Things", Springer, 2011.
5. ArshdeepBahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015
6. https://www.arduino.cc/
   https://www.ibm.com/smarterplanet/us/en/?ca=v_smarterplanet

IC3452	ELECTRICAL MACHINES AND DRIVES	L T P C
		2 0 2 3

COURSE OBJECTIVES:

To impart basic knowledge on different AC& DC Machines.
*   To introduce the concept of special machines to motivate the students to solve complex problems related to machines.
*   To impart knowledge on testing and controlling of different machines.
*   Comprehensive introduction to various power electronic devices, their structure, operating principle and characteristics.
*   Overview on dc and ac drives and their control using power electronic circuits.

UNIT I   DC MACHINES   6
Construction of D.C. Machines – DC Generator: Principle of operation – Characteristics- DC Motor: Principle of operation -Types-Torque equation-Characteristics.

UNIT II   TRANSFORMERS   6
Transformer - Principle - Theory of ideal transformer - EMF equation - Construction details of shell and core type transformers - Tests on transformers.

UNIT III   THREE PHASE INDUCTION MOTOR   6
Three phase Induction motor:- Construction and principle of operation - torque and toque-slip characteristics-Efficiency- Application-starting methods – speed control of induction motor.

UNIT IV   POWER SEMICONDUCTOR DEVICES AND CHARACTERISTICS   6
Operating principle and switching Characteristics: Power diodes, Power BJT, Power MOSFET, IGBT, SCR, TRIAC.

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UNIT V   DRIVES AND CONTROL   6

Static and Dynamic equations of dc and ac machines – Electrical breaking – Rectifier and chopper control of DC drives– Open loop and Closed loop schemes for DC and AC drives(Block diagram approach only)

TOTAL : 30 PERIODS

SKILL DEVELOPMENT ACTIVITIES (Group Seminar/Mini Project/Assignment/Content Preparation / Quiz/ Surprise Test / Solving GATE questions/ etc)   5

1. Differentiate the switching characteristics of the semiconductor devices.
2. Design the SCR circuit with the help of two BJT and explain the switching characteristics for the same.
3. Elaborate the speed control of Induction motor and starting methods for the same.
4. Practically compare the characteristics of 3 φ induction motor and DC machines.
5. Discuss the no load and load test on transformers [Group seminar].

LIST OF EXPERIMENTS FOR MACHINES LAB

1. Open circuit characteristics of D.C. shunt generator.

2. Load characteristics of D.C. shunt generator.

3. Load test on D.C. shunt motor.

4. Speed control of D.C. shunt motor.

5. Open circuit and short circuit tests on single phase transformer (Determination of equivalent circuit parameters).

6. Load test on single phase induction motor.

Minimum of five experiments to be offered from the list. Additional one or two experiments can be framed beyond the list or curriculum

TOTAL : 30 PERIODS

COURSE OUTCOMES:

CO1   Ability to understand the terms associated with electrical machines
CO2   Ability to understand basic concepts and working principle of electrical machines

CO3   Ability to understand the performance characteristics of machines
CO4   Ability to identify suitable machines for carrying out interdisciplinary projects.
CO5   Ability to understand the motor operating principle and characteristics of motor
CO6   Ability to understand the motor operating principle and characteristics of transformer
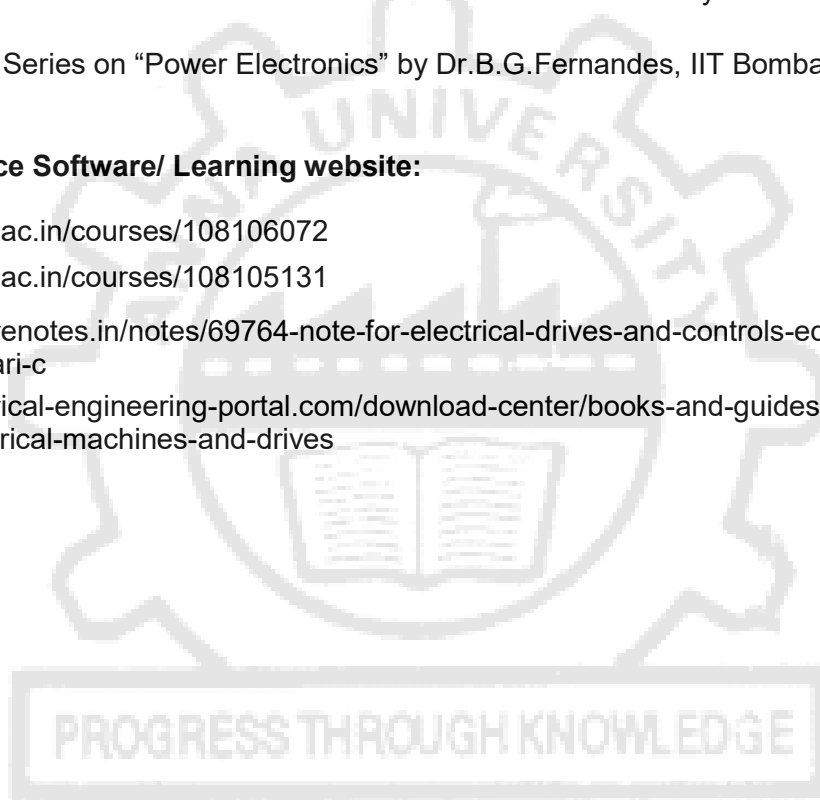
45

TEXT BOOKS:

1. Fitzgerald A.E., Kingsley C., Umans, S. and Umans S.D., "Electric Machinery", McGraw-Hill,Singapore, 2003. 6th Edition.
2. Theraja, B.L., "A Text book of Electrical Technology", Vol.II, S.C Chand and Co., New Delhi, 2007
3. Mohan, Udeland and Robbins., "Power Electronics", John Wiley and Sons, New York, 1995.

REFERENCES:

1. Del Toro, V., "Electrical Engineering Fundamentals", Prentice Hall of India, New Delhi, 1995.
2. Cotton, H., "Advanced Electrical Technology", Sir Isaac Pitman and Sons Ltd., London, 1999.
3. Lecture series on "Electrical Machines I" and "Electrical Machines II" by Dr.KrishnaVasudevan, IIT Madras.
4. NPTEL Lecture Series on "Power Electronics" by Dr.B.G.Fernandes, IIT Bombay.

List of Open Source Software/ Learning website:

1. https://nptel.ac.in/courses/108106072
2. https://nptel.ac.in/courses/108105131
3. https://lecturenotes.in/notes/69764-note-for-electrical-drives-and-controls-edc-by-bhuvaneswari-c
4. https://electrical-engineering-portal.com/download-center/books-and-guides/automation-control/electrical-machines-and-drives

EI3461   **DIGITAL AND LINEAR INTEGRATED CIRCUITS**   **L T P C**
                      LABORATORY   **0 0 3 1.5**

OBJECTIVES:

- To design, test and characterize circuit behavior with digital and analog ICs.
- To design and test various combinational and sequential circuits.
- To introduce the functions of counter, shift register.
- To interpret and realize the basic applications of Op–amp and timer.
- To explain the behavior of special ICs.

LIST OF EXPERIMENTS:

1. Implementation of Boolean Functions, Adder and Subtractor circuits.
2. Implementation of Binary to Gray code converter and vice-versa.
3. Implementation of Encoders, Decoders using logic gates and MSI devices
4. Implementation of multiplexer and de multiplexer using logic gates and MSI devices.
5. Implementation of Shift Registers: SISO, SIPO, PISO, PIPOusing MSI devices.
6. Implementation of Counters: synchronous and Asynchronous types (Each one).
7. Design and testing of inverting , non-inverting amplifier and Adder
8. Design and testing of comparator and Schmitt trigger.
9. Design and testing of Integrator and Differentiator.
10. Design and testing of Astable and Monostable operation using 555 timer.
11. Verification of Variability Voltage Regulator using IC LM317/LM723.
12. Simulation of combinational circuits using VHDL codes
13. Simulation of any one of the Op amp application circuit using PSPICE/SIMULINK

TOTAL: 45 PERIODS

OUTCOMES:

Studentswill be able to:

CO1: Design and implement the given Boolean function using logic gates.

CO2: Design and verify the truth table of combinational logic circuits (code converters, encoders, decoders, multiplexer and demultiplexer).

CO3: Design and implement the Counters and Shift registers.

CO4: Design and testing of Op-Amp circuits and to simulatethe op-amp application circuit using simulation tools.

CO5: Design and testing of astable and monostablecircuits using Timer IC NE/SE 555.

CO6: Design and testing of variable voltage regulator using IC LM317/LM723.

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EI3462   **SENSORS AND SIGNAL CONDITIONING CIRCUITS**   **L T P C**
              LABORATORY   **0 0 3 1.5**

COURSE OBJECTIVES:

- To make the students aware of basic concepts of measurement and operation of different types of transducers.
- To make the students conscious about static and dynamic characteristics of different types of transducer.
- To make the students study on the design of signal conditioning circuit for different transducers.

LIST OF EXPERIMENTS

1. Determination of Static and Dynamic characteristics of Thermocouple (J,K,E) with and without thermo-well.
2. Determination of Static and Dynamic characteristics of RTD and Thermistor.
3. Determination of Characteristics of linear displacement transducers (LVDT and Hall Effect sensor).
4. Determination of Characteristics of angular displacement transducers (Synchros and Capacitive transducer).
5. Determination of Characteristic study of load cell and pressure cell.
6. Sensitivity analysis of strain gauge bridges (quarter, half and full).
7. a. Determination of Static characteristic of flapper-nozzle system
   b. Loading effect on resistive potentiometer.
8. Determination of Characteristic of seismic type accelerometer.
9. Measurement of inductance (Anderson), capacitance (Schering) and resistance (Kelvin double) using bridges.
10. Design of signal conditioning circuits for resistive & capacitive sensors
11. Design of signal conditioning circuits for inductive sensors
12. Design of cold junction compensation for Thermocouples and lead wire compensation schemes for RTD

TOTAL : 45 PERIODS

COURSE OUTCOMES:

CO1   Ability to perform error analysis and uncertainty analysis.

CO2   Ability to evaluate the static and dynamic characteristics of measuring instruments.

CO3   Ability to design and construct measurement systems using different types of resistance, capacitance and inductance transducers.

CO4   Ability to apply special transducers for measurement applications.

CO5   Ability to interface and analyze different signal conditioning units.

CO6   Ability to present the results in oral form as well as in written form as a report and graph.