

ANNA UNIVERSITY, CHENNAI 600 025
NON - AUTONOMOUS COLLEGES AFFILIATED TO ANNA UNIVERSITY
REGULATIONS 2021
B. E. MEDICAL ELECTRONICS
CHOICE BASED CREDIT SYSTEM
I AND II SEMESTERS CURRICULA AND SYLLABI

I. PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

- I. Preparation:** Acquire the knowledge that prepares them for professional careers / higher studies in the field of Medical Electronics.
- II. Core competence:** Apply the core concepts of Medical Electronics, its underlying sciences, and relevant technologies in their chosen profession.
- III. Multidisciplinary:** An ability to use their multidisciplinary background to foster communication across professional and disciplinary boundaries with the highest professional and ethical standards.
- IV. Professional Environment:** Possess a high standard of personal and professional integrity, human values in multicultural and multidisciplinary environments to progress into positions of increasing leadership responsibilities.
- V. Learning Environment:** The ability to recognize the limits of their knowledge and initiate self-directed learning opportunities to be able to continue to identify and create the opportunities for themselves in the field of Medical Electronics.

II. PROGRAM SPECIFIC OUTCOMES (PSOs)

1. **Living and Nonliving Interaction:** Solve the problems associated with the interaction between the living and non-living materials and system.
2. **Investigation on physiological system:** Make measurements on and interpret data from living systems.
3. **Design and Development:** Design the Prototype for healthcare solutions to exhibit quality control, Medical ethics and standards.

PROGRESS THROUGH KNOWLEDGE

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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.	BM3251	Biosciences for Medical Engineering	PCC	3	0	0	3	3
4.	BE3251	Basic Electrical and Electronics Engineering	ESC	3	0	0	3	3
5.	BM3252	Medical Physics	PCC	3	0	0	3	3
6.	GE3251	Engineering Graphics	ESC	2	0	4	6	4
7.		NCC Credit Course Level 1*	-	2	0	0	2	2*
PRACTICALS								
8.	GE3271	Engineering Practices Laboratory	ESC	0	0	4	4	2
9.	BM3271	Biosciences Laboratory	PCC	0	0	4	4	2
TOTAL				17	2	12	31	25

*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 a broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he/she would understand and fulfill his/her responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed.”

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

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

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

(i) Physical Activity

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

(ii) Creative Arts

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

(iii) Universal Human Values

This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, make decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's and don'ts, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing.

Discussions would be conducted in small groups of about 20 students with a faculty

mentor each. It would be effective that the faculty mentor assigned is also the faculty advisor for the student for the full duration of the UG programme.

(iv) Literary Activity

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

(v) Proficiency Modules

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

(vi) Lectures by Eminent People

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

(vii) Visits to Local Area

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

(viii) Familiarization to Dept./Branch & Innovations

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

(ix) Department Specific Activities

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

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

References:

Guide to Induction program from AICTE

COURSE 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 podcasts, anecdotes / stories / event narration; documentaries and interviews with celebrities.

Speaking - Narrating personal experiences / events; Interviewing a celebrity; Reporting / and summarizing 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 products.

Speaking – Picture description; giving instruction to use the product; Presenting a product; and Summarizing 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 & Role play.

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**COURSE 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.
3. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Jovani, Department of English, Anna University.

REFERENCES:

1. Technical Communication – Principles And Practices By Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi.

2. A Course Book on Technical English By Lakshmi Narayanan, 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, R S 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

COURSE OBJECTIVES:

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

UNIT I MATRICES**9 + 3**

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

COURSE OUTCOMES:

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

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

TEXT BOOKS:

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****COURSE OBJECTIVES:**

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

UNIT I MECHANICS**9**

Multi-particle dynamics: Center of mass (CM) – CM of continuous bodies – motion of the CM – kinetic energy of the 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, CO₂ 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**COURSE OUTCOMES:**

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

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

TEXT BOOKS:

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.

COURSE OBJECTIVES:

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

UNIT I WATER AND ITS TREATMENT 9

Water: Sources and impurities, Water quality parameters: Definition and significance of-color, odour, turbidity, pH, hardness, alkalinity, TDS, COD and BOD, fluoride 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 demineralization 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. CO₂ emission and carbon footprint.

UNIT V ENERGY SOURCES AND STORAGE DEVICES 9

Stability of nucleus: mass defect (problems), binding energy; Nuclear energy: light water nuclear power plant, breeder reactor. Solar energy conversion: Principle, working and applications of solar

cells; Recent developments in solar cell materials. Wind energy; Geothermal energy; Batteries: Types of batteries, Primary battery - dry cell, Secondary battery - lead acid battery and lithium-ion-battery; Electric vehicles - working principles; Fuel cells: H₂-O₂ fuel cell, microbial fuel cell; Supercapacitors: Storage principle, types and examples.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

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

TEXT BOOKS:

1. P. C. Jain and Monica Jain, "Engineering Chemistry", 17th Edition, Dhanpat Rai 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. Shikha Agarwal, "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

COURSE OBJECTIVES:

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

UNIT I COMPUTATIONAL THINKING AND PROBLEM SOLVING 9

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

TOTAL : 45 PERIODS**COURSE OUTCOMES:**

Upon completion of the course, students will be able to

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

TEXT BOOKS:

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

COURSE OBJECTIVES:

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

EXPERIMENTS:

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

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

COURSE OUTCOMES:

On completion of the course, students will be able to:

- CO1: Develop algorithmic solutions to simple computational problems
- CO2: Develop and execute simple Python programs.
- CO3: Implement programs in Python using conditionals and loops for solving problems..
- CO4: Deploy functions to decompose a Python program.
- CO5: Process compound data using Python data structures.
- CO6: Utilize Python packages in developing software applications.

TEXT BOOKS:

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)**COURSE OBJECTIVES:**

- To learn the proper use of various kinds of physics laboratory equipment.
 - To learn how data can be collected, presented and interpreted in a clear and concise manner.
 - To learn problem solving skills related to physics principles and interpretation of experimental data.
 - To determine error in experimental measurements and techniques used to minimize such error.
 - To make the student an active participant in each part of all lab exercises.
1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of regular and irregular objects.
 2. Simple harmonic oscillations of cantilever.
 3. Non-uniform bending - Determination of Young's modulus
 4. Uniform bending – Determination of Young's modulus

5. Laser- Determination of the wavelength of the laser using grating
6. Air wedge - Determination of thickness of a thin sheet/wire
7. a) Optical fibre -Determination of Numerical Aperture and acceptance angle
b) Compact disc- Determination of width of the groove using laser.
8. Acoustic grating- Determination of velocity of ultrasonic waves in liquids.
9. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids
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

COURSE OUTCOMES:

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

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

CHEMISTRY LABORATORY: (Any seven experiments to be conducted)

COURSE OBJECTIVES:

- To inculcate experimental skills to test basic understanding of water quality parameters, such as, acidity, alkalinity, hardness, DO, chloride and copper.
 - To induce the students to familiarize with electroanalytical techniques such as, pH metry, potentiometry and conductometry in the determination of impurities in aqueous solutions.
 - To demonstrate the analysis of metals and alloys.
 - To demonstrate the synthesis of nanoparticles
1. Preparation of Na_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 a water sample.
- Split the first experiment into two
 3. Determination of total, temporary & permanent hardness of water by EDTA method.
 4. Determination of DO content of water sample by Winkler's method.
 5. Determination of chloride content of water sample by Argentometric method.
 6. Estimation of copper content of the given solution by Iodometry.
 7. Estimation of TDS of a water sample by gravimetry.
 8. Determination of strength of given hydrochloric acid using pH meter.
 9. Determination of strength of acids in a mixture of acids using conductivity meter.
 10. Conductometric titration of barium chloride against sodium sulphate (precipitation titration)
 11. Estimation of iron content of the given solution using potentiometer.
 12. Estimation of sodium /potassium present in water using a flame photometer.
 13. Preparation of nanoparticles ($\text{TiO}_2/\text{ZnO}/\text{CuO}$) by Sol-Gel method.
 14. Estimation of Nickel in steel
 15. Proximate analysis of Coal

COURSE OUTCOMES :

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

TEXT BOOKS :

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**COURSE 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 – Error correction; 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 – Precis 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

COURSE OUTCOMES:

At the end of the course, learners will be able

- To compare and contrast products and ideas in technical texts.
- To identify cause and effects in events, industrial processes through technical texts
- To analyze 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. 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, New Delhi.
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. Krishna Mohan, Meera Banerji, “Developing Communication Skills”, Trinity Press, 2017.

MA3251

STATISTICS AND NUMERICAL METHODS

L T P C

3 1 0 4

COURSE OBJECTIVES:

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

UNIT I TESTING OF HYPOTHESIS**9 + 3**

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

UNIT II DESIGN OF EXPERIMENTS**9 + 3**

One way and two way classifications - Completely randomized design – Randomized block design – Latin square design - 2^2 factorial design.

UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS**9 + 3**

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 derivatives 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**COURSE OUTCOMES:**

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

- Apply the concept of testing of hypothesis for small and large samples in real life problems.
- Apply the basic concepts of classifications of design of experiments in the field of agriculture.
- Appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.

- Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
- Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

TEXT BOOKS:

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.

BM3251

BIOSCIENCES FOR MEDICAL ENGINEERING

**L T P C
3 0 0 3**

COURSE OBJECTIVES:

The student should be:

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

UNIT I FUNDAMENTALS TO BIOCHEMISTRY

9

Introduction to Biochemistry, water as a biological solvent, weak acid and bases, pH, buffers, Handerson - Hasselbalch equation, physiological buffers in living systems, Energy in living organism. Properties of water and their applications in biological systems. Introduction to Biomolecules, Biological membrane, Clinical application of Electrolytes and radioisotopes.

UNIT II CARBOHYDRATES, LIPIDS, PROTEIN

9

Classification of carbohydrates - mono, di, oligo and polysaccharides. Structure, physical and chemical properties of carbohydrates - Classification of lipids- simple, compound, and derived lipids. Nomenclature of fatty acid - Structure and properties of proteins, structural organization of proteins, classification and properties of amino acids. Nucleic acid: Structural aspects –

Components of DNA and RNA, Nucleosides & Nucleotides (introduction, structure & bonding), Double helical structure of DNA (Watson-Crick model), various forms of DNA.

UNIT III CELL DEGENERATION, REPAIR AND NEOPLASIA 9

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

UNIT IV FLUID AND HEMODYNAMIC DERANGEMENTS 9

Edema, Hyperemia/Ischemia, normal hemostasis, thrombosis, disseminated intravascular coagulation, embolism, infarction, shock, Chronic venous congestion. Hematological disorders- Bleeding disorders, Leukaemias, Lymphomas Haemorrhage.

UNIT V FUNDAMENTALS OF MICROBIOLOGY AND IMMUNOPATHOLOGY 9

Structure of Bacteria and Virus - Morphological features and structural organization of bacteria and virus - List of common bacterial, fungal and viral diseases of human beings.- Basics of Microscopes : Light microscope, Electron microscope (TEM & SEM). - Natural and artificial immunity, types of Hypersensitivity, antibody and cell mediated tissue injury, Immunological techniques: immune diffusion, immuno electrophoresis, RIA and ELISA, monoclonal antibodies.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- Explain the fundamentals of biochemistry
- Analyze structural and functional aspects of living organisms.
- Explain the function of microscope
- Describe methods involved in treating the pathological diseases.

TEXT BOOKS:

1. RAFI MD "Text book of biochemistry for Medical Student" Fourth Edition, Universities Press, Orient Blackswan Private Limited - New Delhi 2021.
- Ramzi S Cotran, Vinay Kumar & Stanley L Robbins, "Pathologic Basis of Diseases", 10th edition: South Asia Edition Elsevier India, 2020. (Units III & IV).
2. Ananthanarayanan & Panicker, "Microbiology" Orientblackswan, 2017 10th edition. (Units III,IV and V).

REFERENCES:

1. Keith Wilson & John Walker, "Practical Biochemistry - Principles & Techniques", Oxford University Press, 2009.
2. Underwood JCE: General and Systematic Pathology Churchill Livingstone, 3rd edition, 2000.
3. Dubey RC and Maheswari DK. "A Text Book of Microbiology" Chand & Company Ltd, 2007
4. Prescott, Harley and Klein, "Microbiology", 10th edition, McGraw Hill, 2017

COURSE OBJECTIVES:

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

UNIT I ELECTRICAL CIRCUITS**9**

DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws –Independent and Dependent Sources – Simple problems- Nodal Analysis, Mesh analysis with Independent sources only (Steady state)

Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor – Steady state analysis of RLC circuits (Simple problems only)

UNIT II ELECTRICAL MACHINES**9**

Construction and Working principle- DC Separately and Self excited Generators, EMF equation, Types and Applications. Working Principle of DC motors, Torque Equation, Types and Applications. Construction, Working principle and Applications of Transformer, Three phase Alternator, Synchronous motor and Three Phase Induction Motor.

UNIT III ANALOG ELECTRONICS**9**

Resistor, Inductor and Capacitor in Electronic Circuits- Semiconductor Materials: Silicon & Germanium – PN Junction Diodes, Zener Diode –Characteristics Applications – Bipolar Junction Transistor-Biasing, JFET, SCR, MOSFET, IGBT – Types, I-V Characteristics and Applications, Rectifier and Inverters

UNIT IV DIGITAL ELECTRONICS**9**

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

UNIT V MEASUREMENTS AND INSTRUMENTATION**9**

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

TOTAL: 45 PERIODS**COURSE OUTCOMES :**

After completing this course, the students will be able to

- CO1:** Compute the electric circuit parameters for simple problems
- CO2:** Explain the working principle and applications of electrical machines
- CO3:** Analyze the characteristics of analog electronic devices
- CO4:** Explain the basic concepts of digital electronics
- CO5:** Explain the operating principles of measuring instruments

TEXT BOOKS:

1. Kothari DP and I.J Nagrath, "Basic Electrical and Electronics Engineering", Second Edition, McGraw Hill Education, 2020
2. S.K.Bhattacharya "Basic Electrical and Electronics Engineering", Pearson Education, Second Edition, 2017.
3. Sedha R.S., "A textbook book of Applied Electronics", S. Chand & Co., 2008
4. James A .Svoboda, Richard C. Dorf, "Dorf's Introduction to Electric Circuits", Wiley, 2018.
5. A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2015.

REFERENCES:

1. Kothari DP and I.J Nagrath, "Basic Electrical Engineering", Fourth Edition, McGraw Hill Education, 2019.
2. Thomas L. Floyd, 'Digital Fundamentals', 11th Edition, Pearson Education, 2017.
3. Albert Malvino, David Bates, 'Electronic Principles, McGraw Hill Education; 7th edition, 2017.
4. Mahmood Nahvi and Joseph A. Edminister, "Electric Circuits", Schaum' Outline Series, McGraw Hill, 2002.
5. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010

BM3252**MEDICAL PHYSICS****L T P C****3 0 0 3****COURSE OBJECTIVE:**

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

UNIT I LOW ENERGY ELECTROMAGNETIC SPECTRUM AND ITS MEDICAL APPLICATION**9**

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

UNIT II PRINCIPLES OF RADIOACTIVE NUCLIDES**9**

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

UNIT III INTERACTION OF RADIATION WITH MATTER LIPIDS**9**

Interaction of charged particles with matter –Specific ionization, Linear energy transfer range, Bremsstrahlung, Annihilation, Interaction of X and Gamma radiation with matter- Photoelectric effect,

Compton Scattering , Pair production, Attenuation of Gamma Radiation, Interaction of neutron with matter and their clinical significance

UNIT IV RADIATION DOSE AND ITS EFFECTS 9

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

UNIT V PRINCIPLES AND APPLICATIONS OF SOUND IN MEDICINE 9

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

TOTAL : 45 PERIODS

Course Outcomes:

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

- Interpret the properties of electromagnetic radiations and its effect on human.
- Apply the principles and understand the production of radioactive nuclides.
- Explain the interaction of radiation with matter.
- Identify and Analyse the radiation quantities and its effects
- Demonstrate the knowledge on the properties of sound and its application in medicine.

TEXT BOOKS:

1. B.H. Brown, R.H. Smallwood, D.C. Barber, P.V. Lawford, D.R. Hose, —Medical Physics and Biomedical Engineeringll, Institute of physics publishing, Bristol and Philadelphia, 1999.
2. Gopal B. Saha —Physics and Radiobiology of Nuclear Medicinell Fourth edition Springer, 2006.

REFERENCES:

1. W.J. Meredith and J.B. Massey “Fundamental Physics of Radiology” Varghese Publishing house, Third Edition, 2013.
2. Steve Webb, The Physics of Medical Imaging, Taylor & Francis, Newyork, Second Edition, 2012.
3. R.S. Khandpur, “Handbook of Biomedical Instrumentation”, Tata McGraw-Hill, New Delhi, 2003.

e-RESOURCES:

1. <http://www.nptel.ac.in/courses/115102017/> , “Nuclear science and Engineering”, Dr. Santanu Gosh, Department of Physics, IIT, Delhi.
2. <http://www.uthgsbsmedphys.org/GS02-0093/> ,” Introduction to Medical Physics”, Dr George Starkschall, The University of Texas at Houston.

GE3251

ENGINEERING GRAPHICS

L T P C
2 0 4 4

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

- Drawing engineering curves.
- Drawing freehand sketch of simple objects.
- Drawing orthographic projection of solids and section of solids.
- Drawing development of solids
- Drawing isometric and perspective projections of simple solids.

CONCEPTS AND CONVENTIONS (Not for Examination)

Importance of graphics in engineering applications — Use of drafting instruments — BIS conventions and specifications — Size, layout and folding of drawing sheets — Lettering and dimensioning.

UNIT I PLANE CURVES 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

COURSE OUTCOMES:

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

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

TEXT BOOKS:

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

PROGRESS THROUGH KNOWLEDGE

NX3251

**NCC Credit Course Level 1*
(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

NX3252

**NCC Credit Course Level 1*
(NAVAL WING)**

NCC Credit Course Level - I

L T P C
2 0 0 2

NCC GENERAL

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

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

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

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

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

NX3253

**NCC Credit Course Level 1*
(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

COURSE OBJECTIVES:

The main learning objective of this course is to provide hands on training to the students in:

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

GROUP – A (CIVIL & ELECTRICAL)**PART I****CIVIL ENGINEERING PRACTICES****15****PLUMBING WORK:**

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

COURSE OUTCOMES:

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

- Draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household wood work.
- Wire various electrical joints in common household electrical wire work.
- Weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipments; Make a tray out of metal sheet using sheet metal work.
- Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.

BM3271

BIOSCIENCES LABORATORY

L T P C
0 0 4 2**COURSE OBJECTIVES:****To provide practice on:**

- Estimation and quantification of biomolecules.
- Separation of macromolecules.
- Use Compound microscope
- Practice on chemical examinations, Histopathological examinations etc

LIST OF EXPERIMENTS:

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

TOTAL: 60 PERIODS**COURSE OUTCOMES:****Upon completion of the course, students will be able to:**

- Understand the Biochemistry laboratory functional components
- Have a sound knowledge of qualitative test of different biomolecules.
- Understand the basics knowledge of Biochemical parameter and their interpretation in Blood sample.
- Have a sound knowledge of separation technology of proteins and amino acids.
- Student can perform practical experiments on staining Processes.

TEXT BOOK :

1. Ramnik Sood, Textbook of Medical Laboratory Technology, 6th Edition, Jaypee Brothers Medical Publishers, 2009

LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS:**Requirement for a batch of 30 students**

Colorimeter 2 Nos

Spectrophotometer 1 No.

pH meter 1 No

Weighing balance 1 No

Refrigerator 1 No
SDS gel electrophoresis 1 No
TLC, ready TLC plates 1 No
Wintrobe's tube 2 Nos.
Centrifuge Normal 1 No
Microslides 2 packets
Lancet 5 boxes
Microscope 1 No
Neubaur's Chamber 2 Nos.
Heparinized Syringe 1box
Haemoglobinometer 1 No
Capillary tubes 1 box





ANNA UNIVERSITY, CHENNAI 600 025
NON- AUTONOMOUS AFFILIATED COLLEGES
REGULATIONS 2021
CHOICE BASED CREDIT SYSTEM
B. E. MEDICAL ELECTRONICS

I. PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

- I. Preparation:** Acquire the knowledge that prepares them for professional careers / higher studies in the field of Medical Electronics.
- II. Core competence:** Apply the core concepts of Medical Electronics, its underlying sciences, and relevant technologies in their chosen profession.
- III. Multidisciplinary:** An ability to use their multidisciplinary background to foster communication across professional and disciplinary boundaries with the highest professional and ethical standards.
- IV. Professional Environment:** Possess a high standard of personal and professional integrity, human values in multicultural and multidisciplinary environments to progress into positions of increasing leadership responsibilities.
- V. Learning Environment:** The ability to recognize the limits of their knowledge and initiate self-directed learning opportunities to be able to continue to identify and create the opportunities for themselves in the field of Medical Electronics.

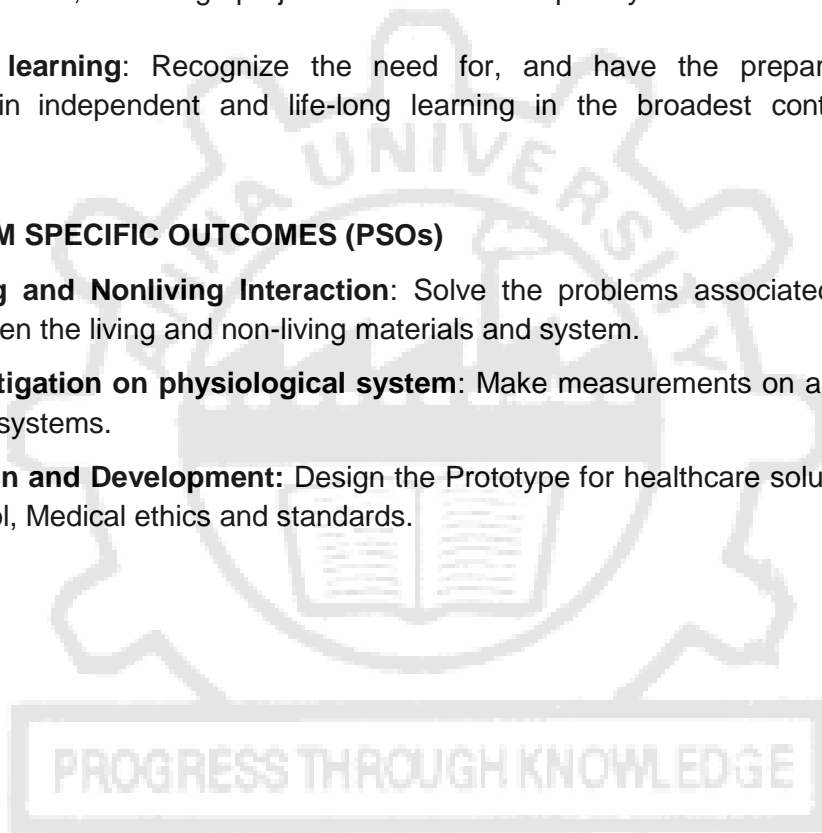
II. PROGRAM OUTCOMES (POs)

- 1 Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- 2 Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- 3 Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- 4 Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- 5 Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- 6 The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

- 7 **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- 8 **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- 9 **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- 10 **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- 11 **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- 12 **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

III. PROGRAM SPECIFIC OUTCOMES (PSOs)

1. **Living and Nonliving Interaction:** Solve the problems associated with the interaction between the living and non-living materials and system.
2. **Investigation on physiological system:** Make measurements on and interpret data from living systems.
3. **Design and Development:** Design the Prototype for healthcare solutions to exhibit quality control, Medical ethics and standards.



ANNA UNIVERSITY, CHENNAI 600 025
NON- AUTONOMOUS AFFILIATED COLLEGES
REGULATIONS 2021

B. E. MEDICAL ELECTRONICS
CHOICE BASED CREDIT SYSTEM

CURRICULA 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			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
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								
8.	GE3171	Problem Solving and Python Programming Laboratory	ESC	0	0	4	4	2
9.	BS3171	Physics and Chemistry Laboratory	BSC	0	0	4	4	2
10.	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			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
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.	BM3251	Biosciences for Medical Engineering	PCC	3	0	0	3	3
4.	BE3251	Basic Electrical and Electronics Engineering	ESC	3	0	0	3	3
5.	BM3252	Medical Physics	PCC	3	0	0	3	3
6.	GE3251	Engineering Graphics	ESC	2	0	4	6	4
7.	GE3252	தமிழர் மரபு /Heritage of Tamils	HSMC	1	0	0	1	1
8.		NCC Credit Course Level 1#	-	2	0	0	2	2*
PRACTICALS								
9.	GE3271	Engineering Practices Laboratory	ESC	0	0	4	4	2
10.	BM3271	Biosciences Laboratory	PCC	0	0	4	4	2
11.	GE3272	Communication Laboratory / Foreign Language §	EEC	0	0	4	4	2
TOTAL				17	1	16	34	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.

§ Skill Based Course

SEMESTER III

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	MA3351	Transforms and Partial Differential Equations	BSC	3	1	0	4	4
2.	EC3354	Signals and Systems	PCC	3	1	0	4	4
3.	BM3352	Electric Circuit Analysis	ESC	3	0	0	3	3
4.	BM3353	Fundamentals of Electronic Devices and Circuits	ESC	3	0	0	3	3
5.	BM3351	Anatomy and Human Physiology	PCC	3	0	2	5	4
6.	CS3391	Object Oriented Programming	ESC	3	0	0	3	3
PRACTICALS								
7.	BM3361	Fundamentals of Electronic Devices and Circuits Laboratory	ESC	0	0	3	3	1.5
8.	CS3381	Object Oriented programming Laboratory	PCC	0	0	3	3	1.5
9.	GE3361	Professional Development [§]	EEC	0	0	2	2	1
TOTAL				18	2	10	30	25

[§] Skill Based Course

SEMESTER IV

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	MA3355	Random Processes and Linear Algebra	BSC	3	1	0	4	4
2.	MD3401	Analog and Digital Electronics	ESC	3	0	0	3	3
3.	BM3451	Bio Control Systems	PCC	3	0	0	3	3
4.	MD3402	Biomedical sensors and Instrumentation	PCC	3	0	0	3	3
5.	EC3491	Digital Signal Processing	PCC	3	0	2	5	4
6.	GE3451	Environmental Sciences and Sustainability	BSC	2	0	0	2	2
7.		NCC Credit Course Level 2 [#]		3	0	0	3	3 [#]
PRACTICALS								
8.	MD3411	Analog and Digital Electronics Laboratory	PCC	0	0	4	4	2
9.	MD3412	Biomedical Sensors and Instrumentation Laboratory	PCC	0	0	3	3	1.5
TOTAL				17	1	9	27	22.5

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

SEMESTER V

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	BM3551	Embedded systems and IOMT	PCC	3	0	0	3	3
2.	BM3591	Diagnostic and Therapeutic Equipment	PCC	3	0	0	3	3
3.		Professional Elective I	PEC	-	-	-	-	3
4.		Professional Elective II	PEC	-	-	-	-	3
5.		Professional Elective III	PEC	-	-	-	-	3
6.		Mandatory Course--I ^{&}	MC	3	0	0	3	0
PRACTICALS								
7.	BM3561	Diagnostic and Therapeutic Equipment Laboratory	PCC	0	0	4	4	2
8.	BM3562	Embedded systems and IOMT Laboratory	PCC	0	0	3	3	1.5
TOTAL				-	-	-	-	18.5

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

SEMESTER VI

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	CS3491	Artificial Intelligence and Machine Learning	PCC	3	0	2	5	4
2.	BM3651	Fundamentals of Healthcare Analytics	PCC	3	0	0	3	3
3.	BM3652	Medical Image Processing	PCC	3	0	2	5	4
4.		Open Elective – I*	OEC	3	0	0	3	3
5.		Professional Elective V	PEC	-	-	-	-	3
6.		Professional Elective VI	PEC	-	-	-	-	3
7.		Professional Elective VII	PEC	-	-	-	-	3
8.		Mandatory Course-II ^{&}	MC	3	0	0	3	0
9.		NCC Credit Course Level 3 [#]		3	0	0	3	3 [#]
TOTAL				-	-	-	-	23

*Open Elective – I Shall be chosen from the list of open electives offered by other Programmes

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

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

SEMESTER VII / VIII*

S. NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	GE3791	Human Values and Ethics	HSMC	2	0	0	2	2
2.		Management – Elective [#]	HSMC	3	0	0	3	3
3.		Open Elective – II**	OEC	3	0	0	3	3
4.		Open Elective – III**	OEC	3	0	0	3	3
5.		Open Elective – IV**	OEC	3	0	0	3	3
PRACTICALS								
6.	MD3711	Hospital Training	EEC	0	0	0	0	2
TOTAL				14	0	0	14	16

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

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

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

SEMESTER VIII /VII*

S. NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
PRACTICALS								
1.	MD3811	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: 163

MANAGEMENT – ELECTIVE

S. NO	COURSE CODE	COURSE TITLE	CATEGORY	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

MANDATORY COURSES I

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	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	CATEGORY	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



PROGRESS THROUGH KNOWLEDGE

PROFESSIONAL ELECTIVE COURSES: VERTICALS

Vertical I Bio Engineering	Vertical II Medical Device Innovation and Development	Vertical III Management (Healthcare)	Vertical IV Mechanics	Vertical V Signal and Image Processing	Verticals VI Communication	Verticals VII Advanced Healthcare Devices
Biomaterials	Foundation Skills in integrated product Development	Clinical Engineering	Biomechanics	Bio signal Processing	Communication Systems	Bio MEMS
Artificial Organs and Implants	Medical Device Design	Hospital Planning and management	Rehabilitation engineering	Computer Vision	Wearable devices	Critical Care Equipment
Biomedical Optics and Photonics	Patient safety, Standards and Ethics	Medical waste Management	Physiological modelling	Speech and audio signal Processing	Body Area Networks	Human Assist Devices
Neural Engineering	Medical Device Regulations	Economics management and for Engineers	Assistive Technology	Medical Systems Imaging	Virtual reality and Augmented Reality in Healthcare	Advancements in Healthcare Technology
Principles of Tissue Engineering	Medical Innovation and Entrepreneurship	Bio Statistics	Ergonomics	Brain Computer Interface and Applications	Telehealth Technology	Robotics in Medicine
Genetic Engineering	Rapid Prototyping	Forensic Science in healthcare	Haptics	Biometrics	Medical Informatics	Therapeutic Equipment

Registration of Professional Elective Courses from Verticals:

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

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

PROFESSIONAL ELECTIVE COURSES: VERTICALS**VERTICAL 1: BIO ENGINEERING**

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CBM337	Biomaterials	PEC	3	0	0	3	3
2.	CBM332	Artificial Organs and Implants	PEC	3	0	0	3	3
3.	CBM339	Biomedical Optics and Photonics	PEC	2	0	2	4	3
4.	CBM359	Neural Engineering	PEC	3	0	0	3	3
5.	CBM362	Principles of Tissue Engineering	PEC	3	0	0	3	3
6.	CBM349	Genetic Engineering	PEC	3	0	0	3	3

VERTICAL 2: MEDICAL DEVICE INNOVATION AND DEVELOPMENT

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CBM348	Foundation Skills in integrated product Development	PEC	3	0	0	3	3
2.	CBM353	Medical Device Design	PEC	3	0	0	3	3
3.	CBM360	Patient safety, Standards and Ethics	PEC	3	0	0	3	3
4.	CBM357	Medical Device Regulations	PEC	3	0	0	3	3
5.	CBM357	Medical Innovation and Entrepreneurship	PEC	3	0	0	3	3
6.	CBM363	Rapid Prototyping	PEC	3	0	0	3	3

VERTICAL 3: MANAGEMENT (HEALTHCARE)

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CBM343	Clinical Engineering	PEC	3	0	0	3	3
2.	CBM351	Hospital Planning and management	PEC	3	0	0	3	3
3.	CBM358	Medical waste Management	PEC	3	0	0	3	3
4.	CBM345	Economics management and for Engineers	PEC	3	0	0	3	3
5.	CBM336	Bio Statistics	PEC	2	0	2	4	3
6.	CBM347	Forensic Science in Healthcare	PEC	3	0	0	3	3

VERTICAL 4: MECHANICS

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CBM338	Biomechanics	PEC	2	0	2	4	3
2.	CBM364	Rehabilitation engineering	PEC	3	0	0	3	3
3.	CBM361	Physiological modelling	PEC	3	0	0	3	3
4.	CBM333	Assistive Technology	PEC	3	0	0	3	3
5.	CBM346	Ergonomics	PEC	3	0	0	3	3
6.	CBM350	Haptics	PEC	3	0	0	3	3

VERTICAL 5: SIGNAL AND IMAGE PROCESSING

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CBM335	Bio signal Processing	PEC	3	0	0	3	3
2.	CBM371	Computer Vision	PEC	2	0	2	4	3
3.	CBM366	Speech and audio signal Processing	PEC	3	0	0	3	3
4.	CBM355	Medical Imaging Systems	PEC	3	0	0	3	3
5.	CBM342	Brain Computer Interface and Applications	PEC	3	0	0	3	3
6.	CBM340	Biometrics	PEC	3	0	0	3	3

VERTICAL 6: COMMUNICATION

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	EC3491	Communication Systems	PEC	3	0	0	3	3
2.	CBM370	Wearable devices	PEC	3	0	0	3	3
3.	CBM341	Body Area Networks	PEC	3	0	0	3	3
4.	CBM369	Virtual reality and Augmented Reality in Healthcare	PEC	3	0	0	3	3
5.	CBM367	Telehealth Technology	PEC	2	0	2	4	3
6.	CBM356	Medical Informatics	PEC	3	0	0	3	3

VERTICAL 7: ADVANCED HEALTHCARE DEVICES

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CBM334	Bio MEMS	PEC	3	0	0	3	3
2.	CBM344	Critical Care Equipment	PEC	3	0	0	3	3
3.	CBM352	Human Assist Devices	PEC	3	0	0	3	3
4.	CBM331	Advancements in Healthcare Technology	PEC	2	0	2	4	3
5.	CBM365	Robotics in Medicine	PEC	3	0	0	3	3
6.	CBM368	Therapeutic Equipment	PEC	3	0	0	3	3

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 ELECTIVES – I

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	OAS351	Space Science	OEC	3	0	0	3	3
2.	OIE351	Introduction to Industrial Engineering	OEC	3	0	0	3	3
3.	OBT351	Climate Change and its Impact	OEC	3	0	0	3	3
4.	OCE351	Environment and Social Impact Assessment	OEC	3	0	0	3	3
5.	OEE351	Renewable Energy System	OEC	3	0	0	3	3
6.	OEI351	Introduction to Industrial Instrumentation and Control	OEC	3	0	0	3	3
7.	OMA351	Graph Theory	OEC	3	0	0	3	3
8.	OCS355	Deep Learning	OEC	3	0	0	3	3
9.	OCS356	Digital Marketing	OEC	3	0	0	3	3

OPEN ELECTIVES – II

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	OIE352	Resource Management Techniques	OEC	3	0	0	3	3
2.	OMG351	Fintech Regulations	OEC	3	0	0	3	3
3.	OFD351	Holistic Nutrition	OEC	3	0	0	3	3
4.	OCE352	ICT in Agriculture	OEC	3	0	0	3	3
5.	OEI352	Introduction to Control Engineering	OEC	3	0	0	3	3
6.	OPY351	Pharmaceutical Nanotechnology	OEC	3	0	0	3	3
7.	OAE351	Aviation Management	OEC	3	0	0	3	3
8.	OCS357	Dev-ops	OEC	3	0	0	3	3
9.	OCS358	Robotics Process Automation	OEC	3	0	0	3	3

OPEN ELECTIVES – III

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 engineering	OEC	3	0	0	3	3
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.	OEI353	Introduction to PLC Programming	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.	OMA352	Operations Research	OEC	3	0	0	3	3
37.	OMA353	Algebra and Number Theory	OEC	3	0	0	3	3
38.	OMA354	Linear Algebra	OEC	3	0	0	3	3
39.	OCE353	Lean Concepts, Tools And Practices	OEC	3	0	0	3	3

OPEN ELECTIVES – IV

S. 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 Robotics	OEC	3	0	0	3	3
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.	OEI354	Introduction to Industrial Automation Systems	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.	OCE354	Basics of Integrated Water Resources Management	OEC	3	0	0	3	3

SUMMARY

Name of the Programme: B.E. Medical Electronics										
S.No	Subject Area	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII/VIII	VIII/VII	
1	HSMC	4	3					5		12
2	BSC	12	4	4	6					26
3	ESC	5	9	10.5	3					27.5
4	PCC		8	9.5	13.5	9.5	11			51.5
5	PEC					9	9			18
6	OEC						3	9		12
7	EEC	1	2	1				2	10	16
8	Non-Credit (Mandatory)					√	√			
Total		22	26	25	22.5	18.5	23	16	10	163

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

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

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

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

Complete details are available in clause 4.10 of Regulations 2021.

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

Vertical I Fintech and Block Chain	Vertical II Entrepreneurship	Vertical III Public Administration	Vertical IV Business Data Analytics	Vertical V Environmental and Sustainability
Financial Management	Foundations of Entrepreneurship	Principles of Public Administration	Statistics for Management	Sustainable infrastructure Development
Fundamentals of Investment	Team Building & Leadership Management for Business	Constitution of India	Datamining for Business Intelligence	Sustainable Agriculture and Environmental Management
Banking, Financial Services and Insurance	Creativity & 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 Entrepreneurs	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

PROGRESS THROUGH KNOWLEDGE

(choice of courses for Minor degree is to be made from any one vertical of other programmes or from anyone of the following verticals)

VERTICAL 1: FINTECH AND BLOCK CHAIN

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	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 2: ENTREPRENEURSHIP

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CMG337	Foundations of Entrepreneurship	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 3: PUBLIC ADMINISTRATION

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	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

VERTICAL 4: BUSINESS DATA ANALYTICS

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	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

PROGRESS THROUGH KNOWLEDGE

VERTICAL 5: ENVIRONMENTAL AND SUSTAINABILITY

S. 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



COURSE OBJECTIVES

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

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 9 + 3

Formation of partial differential equations – Solutions of standard types of first order partial differential equations - First order partial differential equations reducible to standard types- Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT II FOURIER SERIES 9 + 3

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series and cosine series – Root mean square value – Parseval's identity – Harmonic analysis.

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9 + 3

Classification of PDE – Method of separation of variables - Fourier series solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (Cartesian coordinates only).

UNIT IV FOURIER TRANSFORMS 9 + 3

Statement of Fourier integral theorem– Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

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**

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

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

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

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

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

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

TEXT BOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", 44th Edition, 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", 4th Edition, Pearson Education, New Delhi, 2016.
4. Narayanan. S., Manicavachagom Pillay.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.

EC3354

SIGNALS AND SYSTEMS

L T P C

3 1 0 4

COURSE OBJECTIVES :

- To understand the basic properties of signal & systems
- To know the methods of characterization of LTI systems in time domain
- To analyze continuous time signals and system in the Fourier and Laplace domain
- To analyze discrete time signals and system in the Fourier and Z transform domain

UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS

6+6

Standard signals- Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids_Classification of signals – Continuous time (CT) and Discrete Time (DT) signals, Periodic & Aperiodic signals, Deterministic & Random signals, Energy & Power signals - Classification of systems- CT systems and DT systems- – Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non-causal, Stable & Unstable.

UNIT II ANALYSIS OF CONTINUOUS TIME SIGNALS

6+6

Fourier series for periodic signals - Fourier Transform – properties- Laplace Transforms and Properties

UNIT III LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS

6+6

Impulse response - convolution integrals- Differential Equation- Fourier and Laplace transforms in Analysis of CT systems - Systems connected in series / parallel.

UNIT IV ANALYSIS OF DISCRETE TIME SIGNALS**6+6**

Baseband signal Sampling–Fourier Transform of discrete time signals (DTFT)– Properties of DTFT - Z Transform & Properties

UNIT V LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS**6+6**

Impulse response–Difference equations–Convolution sum- Discrete Fourier Transform and Z Transform Analysis of Recursive & Non-Recursive systems-DT systems connected in series and parallel.

TOTAL: 30+30 PERIODS**COURSE OUTCOMES:****At the end of the course, the student will be able to:**

CO1:determine if a given system is linear/causal/stable

CO2: determine the frequency components present in a deterministic signal

CO3:characterize continuous LTI systems in the time domain and frequency domain

CO4:characterize continuous LTI systems in the time domain and frequency domain

CO5:compute the output of an LTI system in the time and frequency domains

TEXT BOOKS:

1. Oppenheim, Willsky and Hamid, “Signals and Systems”, 2nd Edition, Pearson Education, New Delhi, 2015.(Units I - V)
2. Simon Haykin, Barry Van Veen, “Signals and Systems”, 2nd Edition, Wiley, 2002

REFERENCES :

1. B. P. Lathi, “Principles of Linear Systems and Signals”, 2nd Edition, Oxford, 2009.
2. M. J. Roberts, “Signals and Systems Analysis using Transform methods and MATLAB”, McGraw- Hill Education, 2018.
3. John Alan Stuller, “An Introduction to Signals and Systems”, Thomson, 2007.

BM3352**ELECTRIC CIRCUIT ANALYSIS****L T P C
3 0 0 3****COURSE OBJECTIVES:**

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

UNIT I BASIC CIRCUITS ANALYSIS**9**

Basic Components of electric Circuits, Charge, current, Voltage and Power, Voltage and Current Sources, Ohms Law, Kirchoff’s Laws, Mesh current and node voltage method of analysis for D.C and A.C. circuits. The single Node – Pair Circuit, series and Parallel Connected Independent Sources, Resistors in Series and Parallel, voltage and current division, Nodal analysis, Mesh analysis.

UNIT II NETWORK THEOREM AND DUALITY**9**

Useful Circuit Analysis techniques - Linearity and superposition, Thevenin and Norton Equivalent Circuits, Maximum Power Transfer, application of Network theorems. Network reduction: voltage and current division, source transformation, Delta-Wye Conversion. Duals, Dual circuits.

UNIT III SINUSOIDAL STEADY STATE ANALYSIS 9

Sinusoidal Steady – State analysis , Characteristics of Sinusoids, The Complex Forcing Function, The Phasor, Phasor relationship for R, L, and C, impedance and Admittance, Nodal and Mesh Analysis, Phasor Diagrams, AC Circuit Power Analysis, Instantaneous Power, Average Power, apparent Power and Power Factor, Complex Power.

UNIT IV TRANSIENTS AND RESONANCE IN RLC CIRCUITS 9

Basic RL and RC Circuits, The Source- Free RL Circuit, The Source-Free RC Circuit, The Unit-Step Function, Driven RL Circuits, Driven RC Circuits, RLC Circuits, Frequency Response, Parallel Resonance, Series Resonance, Quality Factor.

UNIT V COUPLED CIRCUITS AND TOPOLOGY 9

Magnetically Coupled Circuits, mutual Inductance, the Linear Transformer, the Ideal Transformer, An introduction to Network Topology, Trees and General Nodal analysis, Links and Loop analysis.

COURSE OUTCOMES:

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

- CO1: Comprehend and design ac/dc circuits.
- CO2 : Apply circuit theorems in real time.
- CO3 : Evaluate ac/dc circuits.
- CO4 : Analyse electrical circuits
- CO5 : Develop and understand ac/dc circuits.

TOTAL:45 PERIODS**TEXT BOOKS**

1. Hayt Jack Kemmerly, Steven Durbin, "Engineering Circuit Analysis", Mc Graw Hill education, 9th Edition, 2018.
2. Joseph Edminister and Mahmood Nahvi, "Electric Circuits", Schaum's Outline Series, Tata McGraw Hill Publishing Company, New Delhi, Fifth Edition Reprint 2016.

REFERENCES

1. Robert.L. Boylestead, "Introductory Circuit Analysis", Pearson Education India, 12th Edition, 2014.
2. John O Mally, Schaum's Outlines "Basic Circuit Analysis", The Mc Graw Hill companies, 2nd Edition, 2011.
3. Charles.K.Alexander, Mathew N.O.Sadiku, "Fundamentals of Electric Circuits", McGraw Hill, 5th Edition, 2012.
4. Allan H.Robbins, Wilhelm C.Miller, "Circuit Analysis Theory and Practice", Cengage Learning, Fifth Edition, 1st Indian Reprint 2013.

BM3353 FUNDAMENTALS OF ELECTRONICS DEVICES AND CIRCUITS L T P C
3 0 0 3

COURSE OBJECTIVES:

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

- Introduce the concept of diodes, Bipolar Junction Transistors and FET.
- Study the various model parameters of Transistors
- Learn the concept of special semiconductor devices, Power & Display devices

- Impart the knowledge of various configurations, characteristics, applications.
- To have knowledge of display and power devices.

UNIT I SEMICONDUCTOR DIODE 9

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

UNIT II BIPOLAR JUNCTION TRANSISTORS 9

NPN -PNP -Operations-Early effect-Current equations – Input and Output characteristics of CE, CB, CC - Hybrid - π model - h-parameter model, Ebers Moll Model- Gummel Poon- model, Multi Emitter Transistor.

UNIT III FIELD EFFECT TRANSISTORS 9

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

UNIT IV SPECIAL SEMICONDUCTOR DEVICES 9

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

UNIT V POWER DEVICES AND DISPLAY DEVICES 9

UJT, Thyristor - SCR, Diac, Triac, Power BJT- Power MOSFET- DMOS-VMOS. LED, LCD, Opto Coupler, Solar cell, CCD.

COURSE OUTCOMES:

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

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

TOTAL:45 PERIODS

TEXT BOOK

1. Millman and Halkias, "Electronic Devices and Circuits", 4th Edition, McGraw Hill, 2015.
2. Mohammad Rashid, "Electronic Devices and Circuits", Cengage Learning Pvt. Ltd, 2015.
3. Salivahanan. S, Suresh Kumar. N, "Electronic Devices and circuits", 4th Edition, McGraw Hill, 2016.

REFERENCES

1. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory" Pearson Prentice Hall, 11th Edition, 2014.
2. Bhattacharya and Sharma, "Solid State Electronic Devices", 2nd Edition, Oxford University Press, 2014.
3. R.S.Sedha, "A Textbook of Electronic Devices and Circuits", 2nd Edition, S.Chand Publications, 2008.
4. David A. Bell, "Electronic Devices and Circuits", 5th Edition, Oxford University Press, 2008.

BM3351

ANATOMY AND HUMAN PHYSIOLOGY

L T P C

3 0 2 4

COURSE OBJECTIVE

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

UNIT 1 BASIC ELEMENTS OF HUMAN BODY 9

Cell – Cell Structure and organelles - Functions of each component in the cell. Cell membrane – transport across membrane - Action potential (Nernst, Goldman equation), Homeostasis. Tissue: Types, functions.

UNIT 2 SKELETAL AND MUSCULAR SYSTEM 9

Skeletal: Types of Bone and function – Physiology of Bone formation – Division of Skeleton -Types of joints and function – Types of cartilage and function. –Types of muscles – Structure and Properties of Skeletal Muscle- Changes during muscle contraction- Neuromuscular junction.

UNIT 3 CARDIOVASCULAR AND RESPIRATORY SYSTEM 9

Cardiovascular System: Structure – Conduction System of heart – Cardiac Cycle – Cardiac output. Blood: Composition – Functions - Haemostasis – Blood groups and typing. Blood Vessels – Structure and types - Blood pressure - Respiratory system: Parts of respiratory system – Respiratory physiology – Lung volumes and capacities – Gaseous exchange.

UNIT 4 DIGESTIVE AND EXCRETORY SYSTEMS 9

Structure and functions of gastrointestinal system - secretory functions of the alimentary tract - digestion and absorption in the gastrointestinal tract - structure of nephron - mechanism of urine formation - skin and sweat gland - temperature regulation.

UNIT 5 NERVOUS AND SENSORY SYSTEM 9

Structure and function of nervous tissue – Brain and spinal cord – Functions of CNS – Nerve conduction and synapse – Reflex action– Somatic and Autonomic Nervous system. Physiology of Vision, Hearing, Integumentary, Olfactory systems. Taste buds.

TOTAL : 45 PERIODS**LIST OF EXPERIMENTS**

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

TOTAL: 30 PERIODS**LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS:****Requirement for a batch of 30 students**

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

TOTAL:75 PERIODS**COURSE OUTCOMES:**

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

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

TEXT BOOKS:

- Elaine.N. Marieb, "Essential of Human Anatomy and Physiology", Ninth Edition, Pearson Education, New Delhi, 2018.
- Gopal B. Saha "Physics and Radiobiology of Nuclear Medicine" Third edition Springer, 2006. (Unit 2,3,4)

REFERENCES:

- Guyton & Hall, "Text book of Medical Physiology", 13th Edition, Saunders, 2015.
- Ranganathan T S, "Text book of Human Anatomy", S.Chand& Co. Ltd., New Delhi, 2012.
- SaradaSubramanyam, K MadhavanKutty, Singh H D, "Textbook of Human Physiology", S. Chand and Company Ltd, New Delhi, 2012.

CS3391**OBJECT ORIENTED PROGRAMMING****L T P C****3 0 0 3****COURSE OBJECTIVES:**

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

UNIT I INTRODUCTION TO OOP AND JAVA 9

Overview of OOP – Object oriented programming paradigms – Features of Object Oriented Programming – Java Buzzwords – Overview of Java – Data Types, Variables and Arrays – Operators – Control Statements – Programming Structures in Java – Defining classes in Java – Constructors-Methods -Access specifiers - Static members- JavaDoc comments

UNIT II INHERITANCE, PACKAGES AND INTERFACES 9

Overloading Methods – Objects as Parameters – Returning Objects –Static, Nested and Inner Classes. Inheritance: Basics– Types of Inheritance -Super keyword -Method Overriding – Dynamic Method Dispatch –Abstract Classes – final with Inheritance. Packages and Interfaces: Packages – Packages and Member Access –Importing Packages – Interfaces.

UNIT III EXCEPTION HANDLING AND MULTITHREADING 9

Exception Handling basics – Multiple catch Clauses – Nested try Statements – Java’s Built-in Exceptions – User defined Exception. Multithreaded Programming: Java Thread Model–Creating a Thread and Multiple Threads – Priorities – Synchronization – Inter Thread Communication- Suspending –Resuming, and Stopping Threads –Multithreading. Wrappers – Auto boxing.

UNIT IV I/O, GENERICS, STRING HANDLING 9

I/O Basics – Reading and Writing Console I/O – Reading and Writing Files. Generics: Generic Programming – Generic classes – Generic Methods – Bounded Types – Restrictions and Limitations. Strings: Basic String class, methods and String Buffer Class.

UNIT V JAVA FX EVENT HANDLING, CONTROLS AND COMPONENTS 9

JAVAFX Events and Controls: Event Basics – Handling Key and Mouse Events. Controls: Checkbox, ToggleButton – RadioButtons – ListView – ComboBox – ChoiceBox – Text Controls – ScrollPane. Layouts – FlowPane – HBox and VBox – BorderPane – StackPane – GridPane. Menus – Basics – Menu – Menu bars – MenuItem.

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1:Apply the concepts of classes and objects to solve simple problems

CO2:Develop programs using inheritance, packages and interfaces

CO3:Make use of exception handling mechanisms and multithreaded model to solve real world problems

CO4:Build Java applications with I/O packages, string classes, Collections and generics concepts

CO5:Integrate the concepts of event handling and JavaFX components and controls for developing GUI based applications

TOTAL:45 PERIODS

TEXT BOOKS:

1. Herbert Schildt, “Java: The Complete Reference”, 11th Edition, McGraw Hill Education, New Delhi, 2019
2. Herbert Schildt, “Introducing JavaFX 8 Programming”, 1st Edition, McGraw Hill Education, New Delhi, 2015

REFERENCES:

1. Cay S. Horstmann, “Core Java Fundamentals”, Volume 1, 11th Edition, Prentice Hall, 2018.

BM3361 FUNDAMENTALS OF ELECTRONIC DEVICES AND CIRCUITS LABORATORY

L T P C
0 0 3 1.5

COURSE OBJECTIVE:

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

LIST OF EXPERIMENTS

1. Characteristics of PN and zener diode.
2. Characteristics of CE, CB configurations.
3. Half wave and Full wave rectifier with capacitor filter.
4. Voltage regulation using zener diode.
5. Study of characteristics of photo diodes
6. Study of characteristics of SCR
7. Verification of KVL and KCL
8. Verification of Thevenin's and Norton's Theorems.
9. Verification of superposition Theorem.
10. Verification of Maximum power transfer and reciprocity theorems.
11. Frequency response of RLC series and parallel resonance circuits.

LIST OF EQUIPMENTS:(30 STUDENTS PER BATCH)

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

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1:Experiment and determine the VI characteristics of given PN junction diode, Zener diode, Photo diode and Silicon Controlled Rectifier.

CO2:Experiment and determine the Input & output characteristics of BJT

CO3: Experiment and test half wave and full wave rectifier circuit using PN Junction diode and obtain the ripple factor, rectifier efficiency and experiment and test voltage regulation characteristics using Zener diode voltage regulator circuit.

CO4: Experiment and test the given electric circuit using Kirchhoff's laws and obtain the mesh current & node voltage and obtain the load current for the given circuit using Superposition, Thevenin's, and Norton's and Reciprocity theorems.

CO5: Construct and test RLC series and parallel circuits to compute the resonant frequency and bandwidth by plotting the frequency response.

CS3381

OBJECT ORIENTED PROGRAMMING LABORATORY

L T P C

0 0 3 1.5

COURSE OBJECTIVES:

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

LIST OF EXPERIMENTS:

1. Solve problems by using sequential search, binary search, and quadratic sorting algorithms (selection, insertion)
2. Develop stack and queue data structures using classes and objects.
3. Develop a java application with an Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club funds. Generate pay slips for the employees with their gross and net salary.
4. Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named printArea(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method printArea() that prints the area of the given shape.
5. Solve the above problem using an interface.
6. Implement exception handling and creation of user defined exceptions.
7. Write a java program that implements a multi-threaded application that has three threads. First thread generates a random integer every 1 second and if the value is even, the second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of the cube of the number.
8. Write a program to perform file operations.
9. Develop applications to demonstrate the features of generics classes.
10. Develop applications using JavaFX controls, layouts and menus.
11. Develop a mini project for any application using Java concepts.

Lab Requirements: for a batch of 30 students

Operating Systems: Linux / Windows

Front End Tools: Eclipse IDE / Netbeans IDE

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1 : Design and develop java programs using object oriented programming concepts

CO2 : Develop simple applications using object oriented concepts such as package, exceptions

CO3: Implement multithreading, and generics concepts

CO4 : Create GUIs and event driven programming applications for real world problems

CO5: Implement and deploy web applications using Java

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

COURSE OBJECTIVES :

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

UNIT - I: PROBABILITY AND RANDOM VARIABLES 9 + 3

Axioms of probability – Conditional probability – Baye’s theorem - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions - Functions of a random variable.

UNIT - II : TWO - DIMENSIONAL RANDOM VARIABLES 9 + 3

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT – III : RANDOM PROCESSES 9 + 3

Classification – Stationary process – Markov process - Poisson process - Discrete parameter Markov chain – Chapman Kolmogorov equations (Statement only) - Limiting distributions .

UNIT - IV : VECTOR SPACES 9 + 3

Vector spaces – Subspaces – Linear combinations and linear system of equations – Linear independence and linear dependence – Bases and dimensions.

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

Linear transformation - Null spaces and ranges - Dimension theorem - Matrix representation of a linear transformations - Inner product - Norms - Gram Schmidt orthogonalization process - Adjoint of linear operations - Least square approximation.

TOTAL : 60 PERIODS

COURSE OUTCOMES :

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

CO1: Explain the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts.

CO2: Demonstrate accurate and efficient use of advanced algebraic techniques.

CO3:Apply the concept of random processes in engineering disciplines.

CO4:Understand the fundamental concepts of probability with a thorough knowledge of standard distributions that can describe certain real-life phenomenon.

CO5:Understand the basic concepts of one and two dimensional random variables and apply them to model engineering problems.

TEXT BOOKS :

1. Gross, D., Shortle, J.F, Thompson, J.M and Harris. C.M., "Fundamentals of Queueing Theory", Wiley Student 4th Edition, 2014.
2. Ibe, O.C., "Fundamentals of Applied Probability and Random Processes", Elsevier,1st Indian Reprint, 2007.
3. Friedberg. A.H., Insel. A.J. and Spence. L., "Linear Algebra", Prentice Hall of India, New Delhi, 4th Edition, 2004.

REFERENCE :

1. Hsu, "Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes", Tata McGraw Hill Edition, New Delhi, 2004.
2. Trivedi, K.S., "Probability and Statistics with Reliability, Queueing and Computer Science Applications", 2nd Edition, John Wiley and Sons, 2002.
3. Yates, R.D. and Goodman. D. J., "Probability and Stochastic Processes", 2nd Edition, Wiley India Pvt. Ltd., Bangalore, 2012.
4. Kolman. B. Hill. D.R., "Introductory Linear Algebra", Pearson Education, New Delhi, First Reprint, 2009.
5. Kumaresan. S., "Linear Algebra – A Geometric Approach", Prentice – Hall of India, New Delhi, Reprint, 2010.
6. Strang. G., "Linear Algebra and its applications", Thomson (Brooks/Cole), New Delhi, 2005.

MD3401

ANALOG AND DIGITAL ELECTRONICS

**L T P C
3 0 0 3**

COURSE OBJECTIVES:

- To understand the basic building blocks of linear integrated circuits
- To learn the linear and non-linear applications of operational amplifiers
- To know the theory of timer, regulator, ADC and DAC
- To present the digital fundamentals and combinational circuits
- To familiarize the sequential and programmable circuits

UNIT I BASICS OF OPERATIONAL AMPLIFIERS

9

Functional Block Diagram – Symbol- Characteristics of an ideal operational amplifier- Circuit schematic of $\mu A 741$ - Open loop gain-CMRR -Input bias and Offset currents- Input and Output offset voltages- Offset compensation techniques, Frequency response characteristics: Stability – Limitations-Transfer characteristics, Need for single power supply op-amp, Slew rate operational amplifiers.

UNIT II LINEAR AND NON-LINEAR APPLICATIONS

9

Inverting and Non-inverting amplifier - Differential amplifier-Instrumentation amplifier- Integrator and Differentiator- Active filters: Filter design-Low pass filter -High pass filter-Comparator- Zero crossing detector, Clipper and Clamper, Square and Triangular waveform generators.

UNIT III TIMER REGULATOR A/D AND D/A 9

Timer: Monostable and Astable operation, Voltage controlled oscillator, Phase locked loops: Principle of operation - Characteristics - Lock-in range and Capture range –Applications, IC Voltage regulators: Fixed and adjustable three terminal regulators- Digital to Analog converters: Binary weighed resistor type - R-2R Ladder type, Analog to Digital converters: Counter type- Successive approximation-Single slope-Dual slope.

UNIT IV DIGITAL NUMBER SYSTEM AND COMBINATIONAL CIRCUITS 9

Introduction to digital Circuits, Representation of number system: Binary – Octal- Decimal - Hexadecimal-1's and 2's complement - Computer codes : Binary codes-Error detecting and correcting codes, Gray code - Logic Gates: Operation-Truth table, Boolean algebra: Basic postulates - fundamental theorems-Binary adder- Binary subtractor- Decoders- Encoders- Multiplexers- De-multiplexers.

UNIT V SEQUENTIAL AND PROGRAMMABLE CIRCUITS 9

Latches: SR- D latches ,Flip flops: –SR-D-JK- T - Master slave configuration , Mealy/Moore models of finite state machines : Concept of state - State diagram - State table , Applications- Shift register – Up/down counter - Random Access Memory(RAM)- Read Only Memory(ROM) ,Programmable Logic Array(PLA) , Programmable Array Logic(PAL).

COURSE OUTCOMES:

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

- CO1:** Design linear and non-linear applications of op-amps
- CO2:** Design timer, regulator, DAC, ADC using op-amps
- CO3:** The analysis and design combinational and sequential circuits
- CO4:** Analysis and design programmable memory applications.

TOTAL:45 PERIODS**TEXT BOOK**

1. D.Roy Choudhry, Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd., New Delhi, 2018
2. David J Comer, "Digital Logic and State Machine Design", Oxford University Press, New Delhi, 2017.
3. B.Venkataramani & M-Bhaskar- "Digital Signal Processor Architecture-

REFERENCES

1. Ramakant A, Gayakwad, "OP-AMP and Linear ICs", Prentice Hall of India, New Delhi, 2017.
2. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", Mc Graw Hill India, New Delhi, 2017.
3. Thomas L.Floyd , "Digital Fundamentals", Pearson Education, England, 2021.

BM3451**BIO CONTROL SYSTEMS****LT P C
3 0 0 3****COURSE OBJECTIVES**

The objective of this course is to enable the student to

- Understand the concept behind feedback and continuum in various systems and subsystems and the need for mathematical modeling of various systems.
- Analyze the systems in time and frequency domains
- Understand the concept of stability of various systems.

- Apply mathematical modeling principles in understanding the various fundamental biological systems.

UNIT I INTRODUCTION 9

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

UNIT II TIME RESPONSE ANALYSIS 9

Step and impulse responses of first order and second order systems - time domain specifications of first and second order systems - steady state error constants.

UNIT III STABILITY ANALYSIS 9

Definition of stability, Routh- Hurwitz criteria of stability, Root locus technique - construction of root locus and study of stability.

UNIT IV FREQUENCY RESPONSE ANALYSIS 9

Frequency domain specifications - Polar plots - Bode plots - Nyquist plot - Nyquist stability criterion, closed loop stability - Constant M and N circles - Nichol's chart.

UNIT V BIOLOGICAL CONTROL SYSTEM ANALYSIS 9

Simple models of muscle stretch reflex action - steady state analysis of muscle stretch reflex action, transient response analysis of neuromuscular reflex model action, frequency response of circulatory control model, Stability analysis of Pupillary light reflex.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Interpret the need for mathematical modeling of various systems, representation of systems in block diagrams and signal flow graphs and are introduced to biological control systems

CO2: Determine the time response of various systems

CO3: discuss the concept of system stability

CO4: Examine the frequency response characteristics of various systems using different charts

CO5: Appraise the concept of modeling basic physiological systems

TEXT BOOKS

1. I.J. Nagarath and M. Gopal, Control Systems Engineering, New Age International Publishers, 1st September, 2018.
2. Michael C K Khoo, Physiological Control Systems, IEEE Press, Prentice Hall India, 2005.

REFERENCES:

1. Salivahanan S. Rengaraj R. and Venkatakrishnan G. R., Control Systems Engineering, Pearson Education India, 2015.
2. Benjamin C. Kuo, Automatic Control Systems, Prentice Hall of India, 1995.
3. Ogata, Katsuhiko and Yanjuan Yang, Modern control engineering, Vol 4, Prentice-Hall, 2002.

CO3: Use AC and DC bridges for relevant parameter measurement

CO4: Employ multimeter, CRO, and recorders for appropriate measurements

TOTAL:45 PERIODS

TEXT BOOK

1. A.K.Sawhney , "Electrical & Electronics Measurement and Instrumentation", Dhanpat Rai & Co, New Delhi, 2017.
2. John G. Webster, "Medical Instrumentation Application and Design", Wiley India Pvt Ltd, New Delhi, 2020.

REFERENCES

1. Leslie Cromwell, "Biomedical Instrumentation and Measurement", Prentice Hall of India, New Delhi, 2015.
2. Albert D.Helfrick, William D. Cooper , "Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, New Delhi, 2016.
3. KhandpurR.S , "Handbook of Biomedical Instrumentation", Tata McGraw-Hill, New Delhi, 2014.
4. BanshiDhar Gupta, Anand Mohan Shrivastav and SruthiPrasood Usha , "Optical Sensors for Biomedical Diagnostics and Environmental Monitoring", CRC Press, New York, 2018.

EC3491

DIGITAL SIGNAL PROCESSING

L T P C

3 0 2 4

COURSE OBJECTIVES:

- To learn discrete fourier transform, properties of DFT and its application to linear filtering
- To understand the characteristics of digital filters, design digital IIR and FIR filters and apply these filters to filter undesirable signals in various frequency bands
- To understand the effects of finite precision representation on digital filters
- To understand the fundamental concepts of multi rate signal processing and its applications
- To introduce the concepts of adaptive filters and its application to communication engineering

UNIT I DISCRETE FOURIER TRANSFORM

9

Sampling Theorem, concept of frequency in discrete-time signals, summary of analysis & synthesis equations for FT & DTFT, frequency domain sampling, Discrete Fourier transform (DFT) - deriving DFT from DTFT, properties of DFT - periodicity, symmetry, circular convolution. Linear filtering using DFT. Filtering long data sequences - overlap save and overlap add method. Fast computation of DFT - Radix-2 Decimation-in-time (DIT) Fast Fourier transform (FFT), Decimation-in-frequency (DIF) Fast Fourier transform (FFT). Linear filtering using FFT.

UNIT II INFINITE IMPULSE RESPONSE FILTERS

9

Characteristics of practical frequency selective filters. characteristics of commonly used analog filters - Butterworth filters, Chebyshev filters. Design of IIR filters from analog filters (LPF, HPF, BPF, BRF) - Approximation of derivatives, Impulse invariance method, Bilinear transformation. Frequency transformation in the analog domain. Structure of IIR filter - direct form I, direct form II, Cascade, parallel realizations.

UNIT III FINITE IMPULSE RESPONSE FILTERS

9

Design of FIR filters - symmetric and Anti-symmetric FIR filters - design of linear phase FIR filters using Fourier series method - FIR filter design using windows (Rectangular, Hamming and

Hanning window), Frequency sampling method. FIR filter structures - linear phase structure, direct form realizations

UNIT IV FINITE WORD LENGTH EFFECTS 9

Fixed point and floating point number representation - ADC - quantization - truncation and rounding - quantization noise - input / output quantization - coefficient quantization error - product quantization error - overflow error - limit cycle oscillations due to product quantization and summation - scaling to prevent overflow.

UNIT V DSP APPLICATIONS 9

Multirate signal processing: Decimation, Interpolation, Sampling rate conversion by a rational factor – Adaptive Filters: Introduction, Applications of adaptive filtering to equalization-DSP Architecture-Fixed and Floating point architecture principles

45 PERIODS

PRACTICAL EXERCISES:

30 PERIODS

MATLAB / EQUIVALENT SOFTWARE PACKAGE/ DSP PROCESSOR BASED IMPLEMENTATION

1. Generation of elementary Discrete-Time sequences
2. Linear and Circular convolutions
3. Auto correlation and Cross Correlation
4. Frequency Analysis using DFT
5. Design of FIR filters (LPF/HPF/BPF/BSF) and demonstrates the filtering operation
6. Design of Butterworth and Chebyshev IIR filters (LPF/HPF/BPF/BSF) and demonstrate the filtering operations
7. Study of architecture of Digital Signal Processor
8. Perform MAC operation using various addressing modes
9. Generation of various signals and random noise
10. Design and demonstration of FIR Filter for Low pass, High pass, Band pass and Band stop filtering
11. Design and demonstration of Butter worth and Chebyshev IIR Filters for Low pass, High pass, Band pass and Band stop filtering
12. Implement an Up-sampling and Down-sampling operation in DSP Processor

TOTAL:75 PERIODS

COURSE OUTCOMES:

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

CO1:Apply DFT for the analysis of digital signals and systems

CO2:Design IIR and FIR filters

CO3: Characterize the effects of finite precision representation on digital filters

CO4:Design multirate filters

CO5:Apply adaptive filters appropriately in communication systems

TEXT BOOK

1. John G. Proakis and Dimitris G.Manolakis, Digital Signal Processing – Principles, Algorithms and Applications, Fourth Edition, Pearson Education / Prentice Hall, 2007.
2. A. V. Oppenheim, R.W. Schafer and J.R. Buck, "Discrete-Time Signal Processing", 8th Indian Reprint, Pearson, 2004.

REFERENCES

1. Emmanuel C. Ifeakor & Barrie. W. Jervis, "Digital Signal Processing", Second Edition, Pearson Education / Prentice Hall, 2002.
2. Sanjit K. Mitra, "Digital Signal Processing – A Computer Based Approach", Tata Mc Graw Hill, 2007.
3. Andreas Antoniou, "Digital Signal Processing", Tata Mc Graw Hill, 2006.

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 9

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 . edition 2010.
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, Third Edition, 2015.
5. Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013.

MD3411

ANALOG AND DIGITAL ELECTRONICS LABORATORY

**L T P C
0 0 4 2**

COURSE OBJECTIVES:

- To study the characteristics of inverting, non-inverting, and instrumentation amplifier
- To learn the linear and non-linear applications of operational amplifiers
- To know the combinational circuits
- To understand the function of sequential circuits

LIST OF EXPERIMENTS

1. Design of inverting and non-inverting amplifier
2. Design of Integrator and Differentiator
3. Design of Instrumentation amplifier
4. Design of Active low pass, High pass filter and Band pass filter
5. Design of Astable and Monostable multivibrator using 555 timer.
6. Design of RC Phase shift and Wien bridge oscillators using op-amp.
7. Design of Schmitt Trigger using op-amp.
8. Design of DC power supply using LM317 and LM723.
9. Design and implementation of code converters using logic gates
10. Design and implementation of 4 bit binary Adder/ Subtractor and BCD adder using IC 7483.
11. Design and implementation of multiplexer and Demultiplexer
12. Design and implementation of encoder and decoder using logic gates.
13. Design and implementation of shift registers.
14. Design and implementation of Synchronous and asynchronous counters.

15. Design and implementation of sequence detector.
16. Simulation and analysis of circuits using software (any open access).

COURSE OUTCOMES:

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

- CO1:** Design amplifiers using op-amp
- CO2:** Design filters, and multivibrator
- CO3:** Design and test the performance of combinational circuits
- CO4:** Design and test the performance of sequential circuits.

TOTAL:60 PERIODS

LAB EQUIPMENTS FOR A BATCH OF 30 STUDENTS

1. Digital Trainer Kit - 15 Nos. (with 5 V, Variable and fixed frequency Clock, Bread Board, Four Seven Segment displays, LEDs for output display, Logic 1 and 0 Input switches)
2. Logic ICs - 50Nos each (7400, 7402, 7404, 7408, 7410, 7420, 7432, 7447, 7448, 7474, 7476, 7483, , 7485, 7486, 7490, 7495, 74151, 741 Common Anode and cathode 7-segment displays, LEDs)
3. NE555 – 50 nos
4. LM317 and LM723 – Each 15 Nos
5. Resistors - 50 nos
6. capacitors - 50 nos
7. IC Power supply (5 V fixed) - 15 Nos
8. Bread Boards - 15 Nos
9. IC741- 50nos

MD3412 BIOMEDICAL SENSORS AND INSTRUMENTATION LABORATORY **L T P C**
0 0 3 1.5

COURSE OBJECTIVES:

To impart knowledge on:

- Characteristics of various biomedical sensors.
- Different bridge circuits for the measurement of resistance, capacitance and inductance.
- Recording and analyzing bio signals.
- Comprehension of suitable preamplifiers used for amplifying the bio signals.
- Monitoring and Measurements of physiological parameters.

LIST OF EXPERIMENTS:

1. Characteristics of various Biomedical sensors
 (Pulse sensor, Galvanic skin Response, EMG, Finger Crip Heart rate, Finger print sensor, Glucose sensor, myoware muscle sensor, e-health shield, MQ-3 Alcohol sensor)
2. a) Measurement of Resistance, Inductance and Capacitance using bridge circuits.
 b) Testing and analysis of Non-contact IR thermometer
3. a) Design of preamplifiers to acquire bio-signals along with impedance matching circuit using suitable IC's
 b) Design and study the characteristics of optical Isolation amplifier
4. Acquire and display electrical and biological signals on a computer using the appropriate hardware and software tools.
5. a) Design of EEG, ECG amplifiers and Measurement of heart rate and Blood pressure.

6. Understand the origin of cardiac and muscle biosignals and acquire data using ECG and Electromyogram electrodes.
7. Study of Laboratory diagnostics and testing guidance (Real time RT-PCR kit) for Covid 19.
8. a) Measurement of pH and Conductivity.
b) Measurement of respiration rate.
9. a) Design of Pulse oximeter
b) Pressure Sensors for phonocardiogram (PCG) measurement
10. e-Health Sensor Platform V2.0 using Arduino and Raspberry Pi

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Apply appropriate measurement techniques.	Apply
CO2	Analyze the performance characteristics of various sensors & biomedical equipments and infer their safety aspects.	Analyze
CO3	Evaluate the performance of medical instruments.	Evaluate
CO4	Design portable instruments capable of recording bio signals.	Create

REQUIRED SOFTWARE

- Keysight BenchVue
- MATLAB and Simulink
- LabVIEW
- Tinker CAD
- Google Docs

