

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

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	IP3151	Induction Programme	-	-	-	-	-	0
<b>THEORY</b>								
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
<b>PRACTICALS</b>								
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
<b>TOTAL</b>				<b>15</b>	<b>2</b>	<b>8</b>	<b>25</b>	<b>21</b>

**SEMESTER – II**

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

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

## IP3151

## INDUCTION PROGRAMME

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

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

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

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

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

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

### (i) Physical Activity

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

### (ii) Creative Arts

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

### (iii) Universal Human Values

This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's and 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 under privileged.

(viii) Familiarization to Dept./Branch & Innovations

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

(ix) Department Specific Activities

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

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

References:

Guide to Induction program from AICTE

**OBJECTIVES :**

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

**INTRODUCTION TO EFFECTIVE COMMUNICATION****1**

What is effective communication? ( There are many interesting activities for this.)

Why is communication critical for excellence during study, research and work?

What are the seven C's of effective communication?

What are key language skills?

What is effective listening? What does it involve?

What is effective speaking?

What does it mean to be an excellent reader? What should you be able to do?

What is effective writing?

How does one develop language and communication skills?

What does the course focus on? How are communication and language skills going to be enhanced during this course? What do you as a learner need to do to enhance your English language and communication skills to get the best out of this course?

**UNIT I INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION****11**

Listening –for general information-specific details- conversation: Introduction to classmates - Audio / video (formal & informal); Telephone conversation; Listening to voicemail & messages; Listening and filling a form

Speaking - Self Introduction; Introducing a friend; Conversation - politeness strategies; Telephone conversation; Leave a voicemail; Leave a message with another person; asking for information to fill details in a form.

Reading - Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails.

Writing - Writing emails / letters introducing oneself

Grammar - Present Tense ( simple and progressive); Question types: Wh/ Yes or No/ and Tags

Vocabulary - Synonyms; One word substitution; Abbreviations & Acronyms (as used in technical contexts).

**UNIT II NARRATION AND SUMMATION****12**

Listening - Listening to podcast, anecdotes / stories / event narration; documentaries and interviews with celebrities.

Speaking - Narrating personal experiences / events; Interviewing a celebrity; Reporting / and summarising of documentaries / podcasts/ interviews.

Reading - Reading biographies, travelogues, newspaper reports, Excerpts from literature, and travel & technical blogs.

Writing - Guided writing-- Paragraph writing Short Report on an event (field trip etc.)

Grammar –Past tense (simple); Subject-Verb Agreement; and Prepositions

Vocabulary - Word forms (prefixes& suffixes); Synonyms and Antonyms. Phrasal verbs.

### **UNIT III DESCRIPTION OF A PROCESS / PRODUCT**

**12**

Listening - Listen to a product and process descriptions; a classroom lecture; and advertisements about a products.

Speaking – Picture description; Giving instruction to use the product; Presenting a product; and Summarising a lecture.

Reading – Reading advertisements, gadget reviews; user manuals.

Writing - Writing definitions; instructions; and Product /Process description.

Grammar - Imperatives; Adjectives; Degrees of comparison; Present & Past Perfect Tenses.

Vocabulary - Compound Nouns, Homonyms; and Homophones, discourse markers(connectives & sequence words)

### **UNIT IV CLASSIFICATION AND RECOMMENDATIONS**

**12**

Listening – Listening to TED Talks; Scientific lectures; and educational videos.

Speaking – Small Talk; Mini presentations and making recommendations.

Reading – Newspaper articles; Journal reports –and Non Verbal Communication ( tables, pie charts etc., )

Writing – Note-making / Note-taking (\*Study skills to be taught, not tested); ; Writing recommendations; Transferring information from non verbal ( chart , graph etc, to verbal mode)

Grammar – Articles; Pronouns - Possessive & Relative pronouns.

Vocabulary - Collocations; Fixed / Semi fixed expressions.

### **UNIT V EXPRESSION**

**12**

Listening – Listening to debates/ discussions; different viewpoints on an issue; and panel discussions.

Speaking –group discussions, Debates, and Expressing opinions through Simulations & Roleplay.

Reading – Reading editorials; and Opinion Blogs;

Writing – Essay Writing (Descriptive or narrative).

Grammar – Future Tenses, Punctuation; Negation (Statements & Questions); and Simple, Compound & Complex Sentences.

Vocabulary - Cause & Effect Expressions – Content vs Function words.

**TOTAL : 60 PERIODS**

### **OUTCOMES :**

At the end of the course, learners will be able

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

### **TEXT BOOKS :**

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

### **REFERENCES:**

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

**OBJECTIVES :**

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

**UNIT I MATRICES****9 + 3**

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

**UNIT II DIFFERENTIAL CALCULUS****9 + 3**

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

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

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

**UNIT IV INTEGRAL CALCULUS****9 + 3**

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

**UNIT V MULTIPLE INTEGRALS****9 + 3**

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

**TOTAL : 60 PERIODS****OUTCOMES :**

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

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

**TEXT BOOKS :**

1. Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10<sup>th</sup> Edition, New Delhi, 2016.
2. Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44<sup>th</sup> Edition , 2018.
3. James Stewart, " Calculus : Early Transcendentals ", Cengage Learning, 8<sup>th</sup> 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, 10<sup>th</sup> Edition, 2016
2. Bali. N., Goyal. M. and Watkins. C., " Advanced Engineering Mathematics ", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.), New Delhi, 7<sup>th</sup> Edition, 2009.
3. Jain . R.K. and Iyengar. S.R.K., " Advanced Engineering Mathematics ", Narosa Publications, New Delhi, 5<sup>th</sup> 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 ", 14<sup>th</sup> Edition, Pearson India, 2018.

**PH3151****ENGINEERING PHYSICS****L T P C  
3 0 0 3****OBJECTIVES:**

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

**UNIT I MECHANICS****9**

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

**UNIT II ELECTROMAGNETIC WAVES****9**

The Maxwell's equations - wave equation; Plane electromagnetic waves in vacuum, Conditions on the wave field - properties of electromagnetic waves: speed, amplitude, phase, orientation and waves in

matter - polarization - Producing electromagnetic waves - Energy and momentum in EM waves: Intensity, waves from localized sources, momentum and radiation pressure - Cell-phone reception. Reflection and transmission of electromagnetic waves from a non-conducting medium-vacuum interface for normal incidence.

**UNIT III OSCILLATIONS, OPTICS AND LASERS 9**

Simple harmonic motion - resonance –analogy between electrical and mechanical oscillating systems - waves on a string - standing waves - traveling waves - Energy transfer of a wave - sound waves - Doppler effect. Reflection and refraction of light waves - total internal reflection - interference – Michelson interferometer –Theory of air wedge and experiment. Theory of laser - characteristics - Spontaneous and stimulated emission - Einstein's coefficients - population inversion - Nd-YAG laser, CO<sub>2</sub> laser, semiconductor laser –Basic applications of lasers in industry.

**UNIT IV BASIC QUANTUM MECHANICS 9**

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

**UNIT V APPLIED QUANTUM MECHANICS 9**

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

**TOTAL : 45 PERIODS**

**OUTCOMES:**

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

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

**TEXT BOOKS:**

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

**REFERENCES:**

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



**OBJECTIVES:**

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

**UNIT I WATER AND ITS TREATMENT****9**

**Water:** Sources and impurities, **Water quality parameters:** Definition and significance of-colour, odour, turbidity, pH, hardness, alkalinity, TDS, COD and BOD, 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 demineralisation and zeolite process.

**UNIT II NANOCHEMISTRY****9**

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

**UNIT III PHASE RULE AND COMPOSITES****9**

**Phase rule:** Introduction, definition of terms with examples. One component system - water system; Reduced phase rule; Construction of a simple eutectic phase diagram - Thermal analysis; Two component system: lead-silver system - Pattinson process.

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

**UNIT IV FUELS AND COMBUSTION****9**

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

**Combustion of fuels: Introduction:** Calorific value - higher and lower calorific values, Theoretical calculation of calorific value; **Ignition temperature:** spontaneous ignition temperature, Explosive range; **Flue gas analysis** - ORSAT Method. **CO<sub>2</sub> emission and carbon foot print.**

**UNIT V ENERGY SOURCES AND STORAGE DEVICES****9**

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

battery; **Electric vehicles-working principles; Fuel cells:** H<sub>2</sub>-O<sub>2</sub> fuel cell, microbial fuel cell;  
**Supercapacitors:** Storage principle, types and examples.

**TOTAL: 45 PERIODS**

### OUTCOMES:

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

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

### TEXT BOOKS:

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

**PROGRESS THROUGH KNOWLEDGE**  
**PROBLEM SOLVING AND PYTHON PROGRAMMING**

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

### OBJECTIVES:

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

### UNIT I COMPUTATIONAL THINKING AND PROBLEM SOLVING

**9**

Fundamentals of Computing – Identification of Computational Problems -Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

**UNIT II DATA TYPES, EXPRESSIONS, STATEMENTS 9**

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

**UNIT III CONTROL FLOW, FUNCTIONS, STRINGS 9**

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

**UNIT IV LISTS, TUPLES, DICTIONARIES 9**

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

**UNIT V FILES, MODULES, PACKAGES 9**

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

**TOTAL : 45 PERIODS**

**OUTCOMES:**

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

CO1: Develop algorithmic solutions to simple computational problems.

CO2: Develop and execute simple Python programs.

CO3: Write simple Python programs using conditionals and looping for solving problems.

CO4: Decompose a Python program into functions.

CO5: Represent compound data using Python lists, tuples, dictionaries etc.

CO6: Read and write data from/to files in Python programs.

**TEXT BOOKS:**

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

**REFERENCES:**

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

**OBJECTIVES:**

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

**EXPERIMENTS:**

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

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

**TOTAL: 60 PERIODS****OUTCOMES:**

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

CO1: Develop algorithmic solutions to simple computational problems

CO2: Develop and execute simple Python programs.

CO3: Implement programs in Python using conditionals and loops for solving problems..

CO4: Deploy functions to decompose a Python program.

CO5: Process compound data using Python data structures.

CO6: Utilize Python packages in developing software applications.

**TEXT BOOKS:**

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

**REFERENCES:**

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

**BS3171****PHYSICS AND CHEMISTRY LABORATORY****L T P C  
0 0 4 2****PHYSICS LABORATORY : (Any Seven Experiments)****OBJECTIVES:**

- To learn the proper use of various kinds of physics laboratory equipment.
  - To learn how data can be collected, presented and interpreted in a clear and concise manner.
  - To learn problem solving skills related to physics principles and interpretation of experimental data.
  - To determine error in experimental measurements and techniques used to minimize such error.
  - To make the student as an active participant in each part of all lab exercises.
1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of regular and irregular objects.
  2. Simple harmonic oscillations of cantilever.
  3. Non-uniform bending - Determination of Young's modulus
  4. Uniform bending – Determination of Young's modulus
  5. Laser- Determination of the wave length of the laser using grating
  6. Air wedge - Determination of thickness of a thin sheet/wire
  7. a) Optical fibre -Determination of Numerical Aperture and acceptance angle  
b) Compact disc- Determination of width of the groove using laser.
  8. Acoustic grating- Determination of velocity of ultrasonic waves in liquids.
  9. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids

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

**TOTAL: 30 PERIODS**

**OUTCOMES:**

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

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

**CHEMISTRY LABORATORY: (Any seven experiments to be conducted)**

**OBJECTIVES:**

- To inculcate experimental skills to test basic understanding of water quality parameters, such as, acidity, alkalinity, hardness, DO, chloride and copper.
  - To induce the students to familiarize with electroanalytical techniques such as, pH metry, potentiometry and conductometry in the determination of impurities in aqueous solutions.
  - To demonstrate the analysis of metals and alloys.
  - To demonstrate the synthesis of nanoparticles
1. Preparation of  $\text{Na}_2\text{CO}_3$  as a primary standard and estimation of acidity of a water sample using the primary standard
  2. Determination of types and amount of alkalinity in water sample.
    - Split the first experiment into two
  3. Determination of total, temporary & permanent hardness of water by EDTA method.
  4. Determination of DO content of water sample by Winkler's method.
  5. Determination of chloride content of water sample by Argentometric method.
  6. Estimation of copper content of the given solution by Iodometry.
  7. Estimation of TDS of a water sample by gravimetry.
  8. Determination of strength of given hydrochloric acid using pH meter.
  9. Determination of strength of acids in a mixture of acids using conductivity meter.
  10. Conductometric titration of barium chloride against sodium sulphate (precipitation titration)
  11. Estimation of iron content of the given solution using potentiometer.
  12. Estimation of sodium /potassium present in water using 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

**TOTAL : 30 PERIODS**

**OUTCOMES :**

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

**TEXT BOOKS :**

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

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

- To engage learners in meaningful language activities to improve their LSRW skills
- To enhance learners' awareness of general rules of writing for specific audiences
- To help learners understand the purpose, audience, contexts of different types of writing
- To develop analytical thinking skills for problem solving in communicative contexts
- To demonstrate an understanding of job applications and interviews for internship and placements

**UNIT I MAKING COMPARISONS****12**

Listening – Evaluative Listening: Advertisements, Product Descriptions, -Audio / video; Listening and filling a Graphic Organiser (Choosing a product or service by comparison)

Speaking – Marketing a product, Persuasive Speech Techniques.

Reading - Reading advertisements, user manuals, brochures;

Writing – Professional emails, Email etiquette - Compare and Contrast Essay; Grammar – Mixed Tenses, Prepositional phrases

Vocabulary – Contextual meaning of words

**UNIT II EXPRESSING CAUSAL RELATIONS IN SPEAKING AND WRITING****12**

Listening - Listening to longer technical talks and completing– gap filling exercises. Listening technical information from podcasts – Listening to process/event descriptions to identify cause & effects -

Speaking – Describing and discussing the reasons of accidents or disasters based on news reports.

Reading - Reading longer technical texts– Cause and Effect Essays, and Letters / emails of complaint,

Writing - Writing responses to complaints.

Grammar - Active Passive Voice transformations, Infinitive and Gerunds Vocabulary – Word Formation (Noun-Verb-Adj-Adv), Adverbs.

**UNIT III PROBLEM SOLVING****12**

Listening – Listening to / Watching movie scenes/ documentaries depicting a technical problem and suggesting solutions.

Speaking – Group Discussion(based on case studies), - techniques and Strategies,

Reading - Case Studies, excerpts from literary texts, news reports etc.,

Writing – Letter to the Editor, Checklists, Problem solution essay / Argumentative Essay

Grammar – Errorcorrection; If conditional sentences

Vocabulary - Compound Words, Sentence Completion.

**UNIT IV REPORTING OF EVENTS AND RESEARCH****12**

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

**UNIT V THE ABILITY TO PUT IDEAS OR INFORMATION COGENTLY****12**

Listening – Listening to TED Talks, Presentations, Formal job interviews, (analysis of the interview performance);  
Speaking – Participating in a Role play, (interview/telephone interview), virtual interviews, Making presentations with visual aids;  
Reading – Company profiles, Statement of Purpose, (SOP), an excerpt of interview with professionals; Writing – Job / Internship application – Cover letter & Resume; Grammar – Numerical adjectives, Relative Clauses Vocabulary – Idioms.

**TOTAL : 60 PERIODS****OUTCOMES:**

At the end of the course, learners will be able

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

**TEXT BOOKS :**

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

**REFERENCES:**

1. Raman. Meenakshi, Sharma. Sangeeta (2019). Professional English. Oxford university press. New Delhi.
2. Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, 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. Developing Communication Skills by Krishna Mohan, Meera Bannerji- Macmillan India Ltd. 1990, Delhi.

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

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



- To introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

#### **UNIT I TESTING OF HYPOTHESIS**

**9 + 3**

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

#### **UNIT II DESIGN OF EXPERIMENTS**

**9 + 3**

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

#### **UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS**

**9 + 3**

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

#### **UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION**

**9 + 3**

Lagrange's and Newton's divided difference interpolations – Newton's forward and backward difference interpolation – Approximation of 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**

#### **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, 10<sup>th</sup> 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, 8<sup>th</sup> Edition, 2015.



**UNIT IV OPTICAL PROPERTIES OF MATERIALS****9**

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

**UNIT V NANODEVICES AND QUANTUM COMPUTING****9**

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

**TOTAL: 45 PERIODS****OUTCOMES :**

At the end of the course, the students should be able to

- know basics of electricity and magnetism and the influence of vectors in EMT.
- gain knowledge on the electrical and magnetic properties of materials and their applications
- understand clearly of semiconductor physics and functioning of semiconductor devices
- understand the optical properties of materials and working principles of various optical devices
- appreciate the importance of nanotechnology and nanodevices.

**TEXT BOOKS :**

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

**REFERENCES :**

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

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

- To provide the students an illustration of the significance of the Civil and Mechanical Engineering Profession in satisfying the societal needs.
- To help students acquire knowledge in the basics of surveying and the materials used for construction.
- To provide an insight to the essentials of components of a building and the infrastructure facilities.

- To explain the component of power plant units and detailed explanation to IC engines their working principles.
- To explain the Refrigeration & Air-conditioning system.

**UNIT I PART A: OVERVIEW OF CIVIL ENGINEERING 5**

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

**UNIT I PART B: OVERVIEW OF MECHANICAL ENGINEERING 4**

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

**UNIT II SURVEYING AND CIVIL ENGINEERING MATERIALS 9**

**Surveying:** Objects – Classification – Principles – Measurements of Distances and angles – Leveling – Determination of areas– Contours.

Civil Engineering Materials: Bricks – Stones – Sand – Cement – Concrete – Steel - Timber - Modern Materials, Thermal and Acoustic Insulating Materials, Decorative Panels, Water Proofing Materials. Modern uses of Gypsum, Pre-fabricated Building component (brief discussion only)

**UNIT III BUILDING COMPONENTS AND INFRASTRUCTURE 9**

Building plans – Setting out of a Building - Foundations: Types of foundations - Bearing capacity and settlement – Brick masonry – Stone Masonry – Beams – Columns – Lintels – Roofing – Flooring – Plastering.

Types of Bridges and Dams – Water Supply Network - Rain Water Harvesting – Solid Waste Management - Introduction to Highways and Railways - Introduction to Green Buildings.

**UNIT IV INTERNAL COMBUSTION ENGINES AND POWER PLANTS 9**

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

**UNIT V REFRIGERATION AND AIR CONDITIONING SYSTEM 9**

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

**TOTAL: 45 PERIODS**

**OUTCOMES:**

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

**TEXT BOOKS:**

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

## REFERENCES:

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

GE3251

ENGINEERING GRAPHICS

L T P C  
2 0 4 4

## OBJECTIVES:

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

1. Drawing engineering curves.
2. Drawing freehand sketch of simple objects.
3. Drawing orthographic projection of solids and section of solids.
4. Drawing development of solids
5. Drawing isometric and perspective projections of simple solids.

## CONCEPTS AND CONVENTIONS (Not for Examination)

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

### UNIT I PLANE CURVES AND FREEHAND SKETCHING

6+12

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

### UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE

6+12

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

### UNIT III PROJECTION OF SOLIDS

6+12

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes and parallel to the other by rotating object method. Visualization concepts and Free Hand sketching: Visualization principles —Representation of Three Dimensional objects — Layout of views- Freehand sketching of multiple views from pictorial views of objects.

Practicing three dimensional modeling of simple objects by CAD Software(Not for examination)

### UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES

6 +12

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other — obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids — Prisms, pyramids cylinders and cones.

Practicing three dimensional modeling of simple objects by CAD Software(Not for examination)

## UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS

6+12

Principles of isometric projection — isometric scale — Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

Practicing three dimensional modeling of isometric projection of simple objects by CAD Software(Not for examination)

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

### OUTCOMES:

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

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

### TEXT BOOK:

1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 53<sup>rd</sup> 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, 2<sup>nd</sup> Edition, 2019.
2. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Publications, Bangalore, 27<sup>th</sup> 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, 2<sup>nd</sup> 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

**OBJECTIVES:**

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

**UNIT I BASIC CIRCUITS ANALYSIS****9+3**

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

**UNIT II NETWORK REDUCTION AND THEOREMS FOR DC AND AC CIRCUITS****9+3**

Network reduction: voltage and current division, source transformation – star delta conversion. Theorems – Superposition, Thevenin's and Norton's Theorem – Maximum power transfer theorem – Reciprocity Theorem – Millman's theorem- Tellegen's Theorem-Statement, application to DC and AC Circuits.

**UNIT III TRANSIENT RESPONSE ANALYSIS****9+3**

Introduction – Laplace transforms and inverse Laplace transforms- standard test signals -Transient response of RL, RC and RLC circuits using Laplace transform for Source free, Step input and Sinusoidal input.

**UNIT IV RESONANCE AND COUPLED CIRCUITS****9+3**

Series and parallel resonance –frequency response – Quality factor and Bandwidth – Self and mutual inductance – Coefficient of coupling – Dot rule-Analysis of coupled circuits– Single Tuned circuits..

**UNIT V THREE PHASE CIRCUITS****9+3**

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

**TOTAL: 60 PERIODS****OUTCOMES:**

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

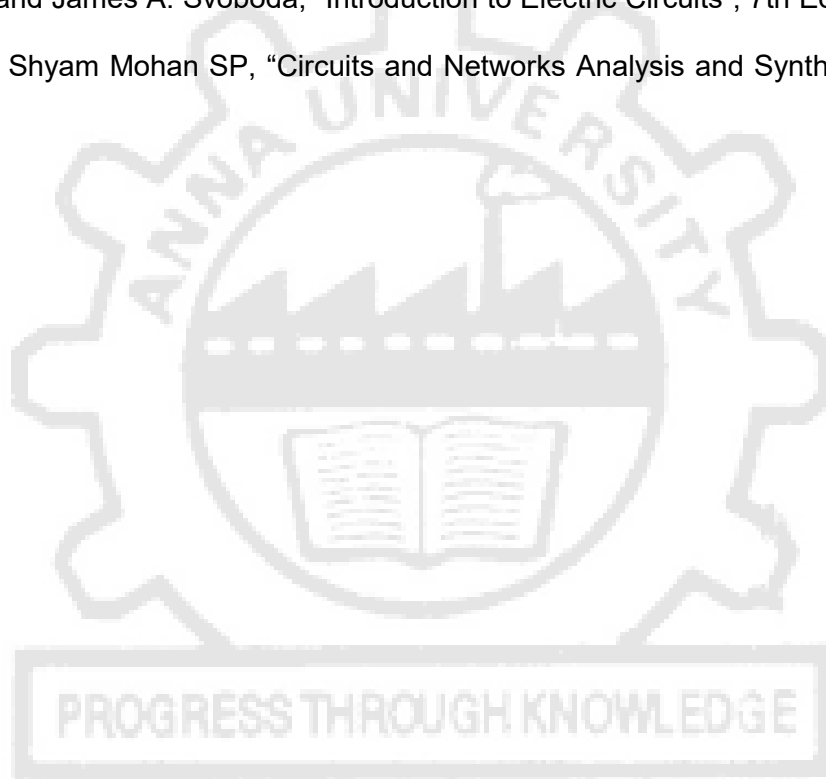
- CO1: Explain circuit's behavior using circuit laws.
- CO2: Apply mesh analysis/ nodal analysis / network theorems to determine behavior of the given DC and AC circuit
- CO3: Compute the transient response of first order and second order systems to step and sinusoidal input
- CO4: Compute power, line/ phase voltage and currents of the given three phase circuit
- CO5: Explain the frequency response of series and parallel RLC circuits
- CO6: Explain the behavior of magnetically coupled circuits.

**TEXT BOOKS:**

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

**REFERENCES**

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





## NCC Credit Course Level 1\*

NX3251		(ARMY WING) NCC Credit Course Level - I	L	T	P	C
			2	0	0	2
<b>NCC GENERAL</b>						<b>6</b>
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
<b>NATIONAL INTEGRATION AND AWARENESS</b>						<b>4</b>
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
<b>PERSONALITY DEVELOPMENT</b>						<b>7</b>
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
<b>LEADERSHIP</b>						<b>5</b>
L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code					3
L 2	Case Studies: Shivaji, Jhasi Ki Rani					2
<b>SOCIAL SERVICE AND COMMUNITY DEVELOPMENT</b>						<b>8</b>
SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth					3
SS 4	Protection of Children and Women Safety					1
SS 5	Road / Rail Travel Safety					1
SS 6	New Initiatives					2
SS 7	Cyber and Mobile Security Awareness					1

**TOTAL : 30 PERIODS**

## NCC Credit Course Level 1\*

NX3252	(NAVAL WING) NCC Credit Course Level - I	L	T	P	C
		2	0	0	2
<b>NCC GENERAL</b>					<b>6</b>
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
<b>NATIONAL INTEGRATION AND AWARENESS</b>					<b>4</b>
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
<b>PERSONALITY DEVELOPMENT</b>					<b>7</b>
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
<b>LEADERSHIP</b>					<b>5</b>
L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code				3
L 2	Case Studies: Shivaji, Jhasi Ki Rani				2
<b>SOCIAL SERVICE AND COMMUNITY DEVELOPMENT</b>					<b>8</b>
SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth				3
SS 4	Protection of Children and Women Safety				1
SS 5	Road / Rail Travel Safety				1
SS 6	New Initiatives				2
SS 7	Cyber and Mobile Security Awareness				1

**TOTAL : 30 PERIODS**

## NCC Credit Course Level 1\*

NX3253	(AIR FORCE WING) NCC Credit Course Level - I	L	T	P	C
		2	0	0	2
<b>NCC GENERAL</b>					<b>6</b>
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
<b>NATIONAL INTEGRATION AND AWARENESS</b>					<b>4</b>
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
<b>PERSONALITY DEVELOPMENT</b>					<b>7</b>
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
<b>LEADERSHIP</b>					<b>5</b>
L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code				3
L 2	Case Studies: Shivaji, Jhasi Ki Rani				2
<b>SOCIAL SERVICE AND COMMUNITY DEVELOPMENT</b>					<b>8</b>
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
<b>TOTAL : 30 PERIODS</b>					

**OBJECTIVES:**

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

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

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

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

**WOOD WORK:**

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

**Wood Work Study:**

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

**PART II ELECTRICAL ENGINEERING PRACTICES 15**

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

## GROUP – B (MECHANICAL AND ELECTRONICS)

### PART III MECHANICAL ENGINEERING PRACTICES

15

#### WELDING WORK:

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

#### BASIC MACHINING WORK:

- a) (simple)Turning.
- b) (simple)Drilling.
- c) (simple)Tapping.

#### ASSEMBLY WORK:

- a) Assembling a centrifugal pump.
- b) Assembling a household mixer.
- c) Assembling an airconditioner.

#### SHEET METAL WORK:

- a) Making of a square tray

#### FOUNDRY WORK:

- a) Demonstrating basic foundry operations.

### PART IV ELECTRONIC ENGINEERING PRACTICES

15

#### SOLDERING WORK:

- a) Soldering simple electronic circuits and checking continuity.

#### ELECTRONIC ASSEMBLY AND TESTING WORK:

- a) Assembling and testing electronic components on a small PCB.

#### ELECTRONIC EQUIPMENT STUDY:

- a) Study an elements of smart phone..
- b) Assembly and dismantle of LED TV.
- c) Assembly and dismantle of computer/ laptop

**TOTAL : 60 PERIODS**

#### OUTCOMES:

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

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

**OBJECTIVES:**

- To simulate various electric circuits using Pspice/ Matlab/e-Sim / Scilab
- To gain practical experience on electric circuits and verification of theorems

**LIST OF EXPERIMENTS****Familiarization of various electrical components, sources and measuring instruments**

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

**TOTAL: 60 PERIODS****OUTCOMES:**

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