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

SEMESTER I

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

SEMESTER II

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	HS3251	Professional English - II	HSMC	3	1	0	4	4
2.	MA3251	Statistics and Numerical Methods	BSC	3	1	0	4	4
3.	PH3203	Physics for Geoinformatics Engineering	BSC	3	0	0	3	3
4.	BE3252	Basic Electrical, Electronics and Instrumentation Engineering	ESC	3	0	0	3	3
5.	GI3201	Geoinformatics Systems	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.	BE3272	Basic Electrical, Electronics and Instrumentation Engineering Laboratory	ESC	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.

1

IP3151   **INDUCTION PROGRAMME**

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

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

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

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

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

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

   (i) Physical Activity

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

   (ii) Creative Arts

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

   (iii) Universal Human Values

This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's and dont's, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing.
Discussions would be conducted in small groups of about 20 students with a faculty
mentor each. It would be effective that the faculty mentor assigned is also the faculty advisor for the student for the full duration of the UG programme.

   (iv) Literary Activity

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

2

(v) Proficiency Modules

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

(vi) Lectures by Eminent People

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

(vii) Visits to Local Area

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

(viii)   Familiarization to Dept./Branch & Innovations

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

(ix) Department Specific Activities

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

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

References:
Guide to Induction program from AICTE

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

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

INTRODUCTION TO EFFECTIVE COMMUNICATION   **1**
What is effective communication? (There are many interesting activities for this.)
Why is communication critical for excellence during study, research and work?
What are the seven C's of effective communication?
What are key language skills?
What is effective listening? What does it involve?
What is effective speaking?
What does it mean to be an excellent reader? What should you be able to do?

3

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).

4

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

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

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

UNIT I   MATRICES   9+3
Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley - Hamilton theorem – Diagonalization of matrices by orthogonal transformation – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms – Applications : Stretching of an elastic membrane.

UNIT II   DIFFERENTIAL CALCULUS   9+3
Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules (sum, product, quotient, chain rules)   - Implicit differentiation - Logarithmic differentiation - Applications : Maxima and Minima of functions of one variable.

UNIT III   FUNCTIONS OF SEVERAL VARIABLES   9+3

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

UNIT IV   INTEGRAL CALCULUS   9+3

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

UNIT V   MULTIPLE INTEGRALS   9+3

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

TOTAL : 60 PERIODS

OUTCOMES :

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

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

TEXT BOOKS :

1. Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.
3. James Stewart, "Calculus : Early Transcendentals", Cengage Learning, 8th Edition, New Delhi, 2015. [For Units II & IV - Sections 1.1, 2.2, 2.3, 2.5, 2.7 (Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1 (Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].

REFERENCES :

1. Anton. H, Bivens. I and Davis. S, " Calculus ", Wiley, 10th Edition, 2016
2. Bali. N., Goyal. M. and Watkins. C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
3. Jain. R.K.   and   Iyengar. S.R.K., "Advanced   Engineering Mathematics", Narosa Publications, New Delhi,   5th Edition, 2016.
4. Narayanan. S. and Manicavachagom Pillai. T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2009.
5. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
6. Srimantha Pal and Bhunia. S.C, " Engineering Mathematics " Oxford University Press, 2015.
7. Thomas. G. B., Hass. J, and Weir. M.D, " Thomas Calculus ", 14th Edition, Pearson India, 2018.

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

OBJECTIVES:

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

UNIT I   MECHANICS   9

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

UNIT II   ELECTROMAGNETIC WAVES   9

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

UNIT III   OSCILLATIONS, OPTICS AND LASERS   9

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

UNIT IV   BASIC QUANTUM MECHANICS   9

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

UNIT V   APPLIED QUANTUM MECHANICS   9

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

TOTAL : 45 PERIODS

OUTCOMES:

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

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

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

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

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

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

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

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

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

UNIT V   ENERGY SOURCES AND STORAGE DEVICES   9
Stability of nucleus: mass defect (problems), binding energy;Nuclear energy: light water nuclear power plant, breeder reactor. **Solar energy conversion:** Principle, working and applications of solar cells**; Recent developments in solar cell materials. Wind energy; Geothermal energy;Batteries:** Types of batteries, Primary battery - dry cell, Secondary battery - lead acid battery and lithium-ion-battery; **Electric vehicles-working principles;Fuel cells:** H_2-O_2 fuel cell, microbial fuel cell; **Supercapacitors:** Storage principle, types and examples.

                                                                TOTAL: 45 PERIODS

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

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

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

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

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

UNIT I   COMPUTATIONAL THINKING AND PROBLEM SOLVING   9
Fundamentals of Computing – Identification of Computational Problems -Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

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

UNIT III   CONTROL FLOW, FUNCTIONS, STRINGS   9

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

UNIT IV   LISTS, TUPLES, DICTIONARIES   9

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

UNIT V   FILES, MODULES, PACKAGES   9

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

TOTAL : 45 PERIODS

OUTCOMES:
Upon completion of the course, students will be able to
CO1: Develop algorithmic solutions to simple computational problems.
CO2: Develop and execute simple Python programs.
CO3: Write simple Python programs using conditionals and looping for solving problems.
CO4: Decompose a Python program into functions.
CO5: Represent compound data using Python lists, tuples, dictionaries etc.
CO6: Read and write data from/to files in Python programs.

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

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

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

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

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

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

TOTAL: 60 PERIODS

OUTCOMES:
On completion of the course, students will be able to:
CO1: Develop algorithmic solutions to simple computational problems
CO2: Develop and execute simple Python programs.
CO3: Implement programs in Python using conditionals and loops for solving problems..
CO4: Deploy functions to decompose a Python program.
CO5: Process compound data using Python data structures.
CO6: Utilize Python packages in developing software applications.

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

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

11

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

PHYSICS LABORATORY : (Any Seven Experiments)

OBJECTIVES:
- To learn the proper use of various kinds of physics laboratory equipment.
- To learn how data can be collected, presented and interpreted in a clear and concise manner.
- To learn problem solving skills related to physics principles and interpretation of experimental data.
- To determine error in experimental measurements and techniques used to minimize such error.
- To make the student as an active participant in each part of all lab exercises.

1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of regular and irregular objects.
2. Simple harmonic oscillations of cantilever.
3. Non-uniform bending - Determination of Young's modulus
4. Uniform bending – Determination of Young's modulus
5. Laser- Determination of the wave length of the laser using grating
6. Air wedge - Determination of thickness of a thin sheet/wire
7. a) Optical fibre -Determination of Numerical Aperture and acceptance angle
   b) Compact disc- Determination of width of the groove using laser.
8. Acoustic grating- Determination of velocity of ultrasonic waves in liquids.
9. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids
10. Post office box -Determination of Band gap of a semiconductor.
11. Photoelectric effect
12. Michelson Interferometer.
13. Melde's string experiment
14. Experiment with lattice dynamics kit.

TOTAL: 30 PERIODS

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

CHEMISTRY LABORATORY: (Any seven experiments to be conducted)

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

1. Preparation of Na_2CO_3 as a primary standard and estimation of acidity of a water sample using the primary standard
2. Determination of types and amount of alkalinity in water sample.
   - Split the first experiment into two

12

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

TOTAL : 30 PERIODS

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

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

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

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

UNIT I   **MAKING COMPARISONS**   **12**
Listening – Evaluative Listening: Advertisements, Product Descriptions, -Audio / video; Listening and filling a Graphic Organiser (Choosing a product or service by comparison)
Speaking – Marketing a product, Persuasive Speech Techniques.
Reading - Reading advertisements, user manuals, brochures;
Writing – Professional emails, Email etiquette - Compare and Contrast Essay; Grammar – Mixed Tenses, Prepositional phrases
Vocabulary – Contextual meaning of words

UNIT II   EXPRESSING CAUSAL RELATIONS IN SPEAKING AND WRITING   12

Listening - Listening to longer technical talks and completing– gap filling exercises. Listening technical information from podcasts – Listening to process/event descriptions to identify cause & effects - Speaking – Describing and discussing the reasons of accidents or disasters based on news reports.
Reading - Reading longer technical texts– Cause and Effect Essays, and Letters / emails of complaint,
Writing - Writing responses to complaints.
 Grammar - Active Passive Voice transformations, Infinitive and Gerunds Vocabulary – Word Formation (Noun-Verb-Adj-Adv), Adverbs.

UNIT III   PROBLEM SOLVING   12

Listening – Listening to / Watching movie scenes/ documentaries depicting a technical problem and suggesting solutions.
Speaking – Group Discussion(based on case studies), - techniques and Strategies,
Reading - Case Studies, excerpts from literary texts, news reports etc.,
Writing – Letter to the Editor, Checklists, Problem solution essay / Argumentative Essay
Grammar – 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

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, NewDelhi.
3. Learning to Communicate – Dr. V. Chellammal. Allied Publishers, New Delhi, 2003
4. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.
5. Developing Communication Skills by Krishna Mohan, Meera Bannerji- Macmillan India Ltd. 1990, Delhi.

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

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

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

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

UNIT III   SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS   9+3
Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method- Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Eigenvalues of a matrix by Power method and Jacobi's method for symmetric matrices.

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

UNIT V   NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS   9+3
Single step methods: Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first order differential equations - Multi step methods: Milne's and Adams - Bash forth predictor corrector methods for solving first order differential equations.

TOTAL: 60 PERIODS

OUTCOMES:
Upon successful completion of the course, students will be able to:
- Apply the concept of testing of hypothesis for small and large samples in real life problems.
- Apply the basic concepts of classifications of design of experiments in the field of agriculture.
- Appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.
- Understandthe 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.

PH3203 **PHYSICS FOR GEO - INFORMATICS ENGINEERING** **L T P C**
3 0 0 3

OBJECTIVES:
- To understand the fundamentals of electromagnetic radiation, measurement of radiation and physical laws.
- To introduce the concepts of atmosphere and scattering principles. To understand the interaction of EMR with atmosphere and to introduce the concept of imaging and non-imaging sensors for atmospheric probing.
- To gain knowledge about basic optical principles in remote sensing and to introduce the concept of photography and its development.
- To understand the basics of gravitation and the physics behind it, and to introduce satellites and its effectiveness in earth monitoring.
- To understand the different types of electro-optic sensors and its detection mechanism

UNIT I   **ELECTROMAGNETIC RADIATION**   **9**
Electromagnetic Spectrum - radiation quantities - spectral quantities - relationship between luminous and radiant quantities - hemispherical reflectance, transmittance and absorbance, measurement of electromagnetic radiation - responsivity - normalization, radiating structures - thermal emission - fluorescent emission - Radiation principles - Planck's law, Wien's Displacement Law, Stefan's Boltzmann law, Kirchoff's law.

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UNIT II   INTERACTION OF EMR WITH ATMOSPHERE AND EARTH'S SURFACE   9
Introduction to atmosphere, atmospheric composition, atmospheric scattering, Raleigh scattering, Mie scattering, non-selective scattering -atmospheric absorption - atmospheric windows, refraction - interaction of EMR earth's surface - reflection - transmission - spectral signature - Reflectance characteristics of Earth's cover type: Vegetation, water, soil - Interaction of microwave with atmosphere and Earth's surface – Radar - Radar operating principle - radar equation - Side Looking Airborne Radar - Definitions: Incidence angle, look angle, depression angle, Azimuth angle – Spatial resolution in radar - Synthetic Aperture radar.

UNIT III   OPTICS FOR REMOTE SENSING   9
Lenses, mirrors, prisms - Defects of lens - chromatic aberration - longitudinal chromatic aberration - achromatism of lenses - achromatism for two lenses in contact - separated by a distance - spherical aberration - minimization of Spherical aberration - coma astigmatism - Radiative Transfer Functions, Lamella Pack, Volume scattering - Principles of photography: black and white photography - sensitivity - speed - characteristic curve - developing and printing - basic colour photography - construction of colour films - film type - types of filter - and its uses.

UNIT IV   GRAVITATION AND SATELLITES   9
Newton's law of gravitation - Gravitational field and potential - Determination of gravity, variation of acceleration due to gravity of the earth with depth and with altitude - Variation of acceleration due to gravity due to rotation of the earth – Refraction. Diffraction - Fresnel theory, Circular diffraction, Polarisation double refraction - Escape velocity - Kepler's law of planetary motion - Doppler effect – Satellites andits functions - Types of satellites –Indian satellites and their functions – contribution in earth observation, communication, navigation, weather, military and scientific purpose.

UNIT V   ELECTRO - OPTIC SENSORS   9
Photomultipliers, photo resistors, photodiodes, nonselective detectors - Optical receivers, PIN and APD, optical preamplifiers, Detectors: Basic detector mechanisms, noise in detectors. Thermal and photo emissive detectors, Photoconductive and photovoltaic detectors, performance limits, Photographic, - Sensitivity, time and frequency response - hybrid photo detectors - Imaging detectors - eye and vision, photographic film. Camera tubes, solid-state arrays, video, Detector electronics, detector interfacing - Different CCD cameras.Orbital Mechanics, Concept of orbits-propulsion, aero dynamics, navigation guidance and control.

TOTAL: 45 PERIODS

OUTCOMES:
- The students will gain knowledge about electromagnetic radiation and its principles.
- The students will be able to understand the physics of atmosphere and the use of imaging and non-imaging sensor in atmospheric probing.
- The students will gain knowledge about remote sensing and photography.
- The students will be encouraged to learn the development of satellite technology in geo-informatics.
- The students will gain knowledge about different electro optic sensors.

TEXT BOOKS:
1. T.M.Lillesand, R.W.Kiefer and J.W.Chipman. Remote Sensing and Image Interpretation. Wiley, 2011.
2. Manual of Remote Sensing. American Society of Photogrammetry, 2016.
3. M.Anij Reddy. Textbook of Remote Sensing and Geographical Information systems. BS Publications, 2012.

REFERENCES:
1. D.G.Andrews. An Introduction to Atmospheric Physics. Cambridge University Press, 2010.
2. Murry L. Salby, Physics of the Atmosphere and Climate, Cambridge Univ. Press, 2012.
3. F.G.Smith,T.A.King and D.Wilkins. Optics and Photonics: An Introduction. Wiley-Blackwell , 2007.
4. Hengnian Li, Geostationary Satellites Collocation, Springer, 2014.
5. Silvano Donati, Electro-optical Instrumentation: Sensing and measuring with Lasers, Prentice Hall, 2004.

BE3252 BASIC ELECTRICAL, ELECTRONICS AND INSTRUMENTATION   L T P C
ENGINEERING   3 0 0 3

OBJECTIVES :
- To introduce the basics of electric circuits and analysis
- To impart knowledge in domestic wiring
- To impart knowledge in the basics of working principles and application of electrical machines
- To introduce analog devices and their characteristics
- To introduce the functional elements and working of sensors and transducers.

UNIT I   ELECTRICAL CIRCUITS   9
DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws – 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), Three phase supply – star and delta connection – power in three-phase systems

UNIT II   MAGNETIC CIRCUITS AND ELECTRICAL INSTALLATIONS   9
Magnetic circuits-definitions-MMF, flux, reluctance, magnetic field intensity, flux density, fringing, self and mutual inductances-simple problems.
Domestic wiring , types of wires and cables, earthing ,protective devices- switch fuse unit- Miniature circuit breaker-moulded case circuit breaker- earth leakage circuit breaker, safety precautions and First Aid

UNIT III   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, harmonics

UNIT V   SENSORS AND TRANSDUCERS   9
Sensors, solenoids, pneumatic controls with electrical actuator, mechatronics, types of valves and its applications, electro-pneumatic systems, proximity sensors, limit switches, piezoelectric, hall effect, photo sensors,Strain gauge, LVDT, differential pressure transducer,optical and digital transducers, Smart sensors, Thermal Imagers.

TOTAL: 45 PERIODS

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

CO1:   Compute the electric circuit parameters for simple problems
CO2:   Explain the concepts of domestics wiring and protective devices
CO3:   Explain the working principle and applications of electrical machines
CO4:   Analyze the characteristics of analog electronic devices
CO5:   Explain the types and operating principles of sensors and transducers

TEXT BOOKS:
1. D P Kothari and I.J Nagarath, "Basic Electrical and Electronics Engineering", McGraw Hill Education (India) Private Limited, Second Edition, 2020
2. A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2015.
3. S.K. Bhattacharya, Basic Electrical Engineering, Pearson Education, 2019
4. James A Svoboda, Richard C. Dorf, Dorf's Introduction to Electric Circuits, Wiley,2018

REFERENCES:
1. John Bird, "Electrical Circuit theory and technology", Routledge; 2017.
2. Thomas L. Floyd, 'Electronic Devices', 10th Edition, Pearson Education, 2018.
3. Albert Malvino, David Bates, '**Electronic Principles**, McGraw Hill Education; 7th edition, 2017
4. Muhammad H.Rashid, "Spice for Circuits and electronics", 4th Edition.,Cengage India,2019.
5. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010

GI3201	GEOINFORMATICS SYSTEMS	L T P C
		3 0 0 3

OBJECTIVES:
- To introduce the information concepts and systems used in Geoinformatics
- To familiarize the role of Internet and Networks in Geoinformatics.
- To familiarize web data services and geoinformation

UNIT I   COMPUTER SYSTEMS   9
Computers - types - components - CPU - memory - Input devices-Output devices - Operating Systems: Windows, Linux–fundamentals - software - system software, application software - file operations.

UNIT II   DATA ACQUISITION   9
Acquisition and storage of Numeric data- Textual data - image data - Audio data - Animation and Video data - Data formats - fundamentals of image and video compression - introduction to geospatial data- remote sensing sensors, data organization

UNIT III   NETWORKS AND COMMUNICATION   9
Fundamental computer network concepts - Network layers - TCP/IP model - LAN, WAN, WLAN, intranet, Internet - Applications - Essentials of internet - Ethernet - Network Routing - Switching - Data transportation through Network - protocols - Cell phone working fundamentals - Cell phone frequencies & channels - Digital cell phone components - Cell phone network technologies / architecture.

UNIT IV   WEB DATA AND SERVICES   9
Browser fundamentals - Client - Server - Architecture - web site essentials - Web development - Platforms - Tools - Languages - HTML PHP - client side scripting - javascript - database - Postgresql - MySQL - Web server - Application Server - Data server - Data services - Big data - cloud storage

UNIT V   GEOINFORMATION   9
Information System - GIS - GPS - Information retrieval system - Geo-database - interactive applications - Multimedia applications - Earth resource platform - Google maps and Google earth - LBS - Introduction to Integration of Geo-database and Social networking applications

TOTAL : 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
- Understand Computer systems and data formats
- Understand basics of Geoinformation
- Understand the role of network systems that handles Geoinformation.
- Understand data and technologies related to Geoinformation .

TEXT BOOKS:
1. Robin Nixon, "Learning PHP, MySQL, JavaScript, CSS & HTML5" Third Edition, O'Reilly, 2014.
2. James F. Kurose, "Computer Networking: A Top-Down Approach" Sixth Edition, Pearson, 2012.

REFERENCES:
1. Gottapu Sasibhushana Rao, "Mobile Cellular Communication", Pearson, 2012.
2. Peter Norton, "Introduction to Computers" Sixth edition, Tata McGraw – Hill, 2008.
3. R. Kelly Rainer, Casey G. Cegielski, Brad Prince, "Introduction to Information Systems", Fifth Edition, Wiley Publication, 2014.

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)

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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 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

NCC Credit Course Level 1*

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

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

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

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

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

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

TOTAL: 30 PERIODS

NCC Credit Course Level 1*

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

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

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

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

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

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

TOTAL : 30 PERIODS

NCC Credit Course Level 1*

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

NCC GENERAL   6

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

NATIONAL INTEGRATION AND AWARENESS   4

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

PERSONALITY DEVELOPMENT   7

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

LEADERSHIP   5

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

SOCIAL SERVICE AND COMMUNITY DEVELOPMENT   8

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

TOTAL : 30 PERIODS

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

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

1. Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planing; making joints in wood materials used in 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

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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.

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BE3272   **BASIC ELECTRICAL, ELECTRONICS AND INSTRUMENTATION**
                ENGINEERING LABORATORY   **L T P C**
                                                   0 0 4 2

OBJECTIVES:

- To train the students in conducting load tests electrical machines
- To gain practical experience in experimentally obtaining the characteristics of electronic devices and rectifiers
- To train the students to measure three phase power and displacement

List of Experiments

1. Verification of ohms and Kirchhoff's Laws.
2. Three Phase Power Measurement
3. Load test on DC Shunt Motor.
4. Load test on Self Excited DC Generator
5. Load test on Single phase Transformer
6. Load Test on Induction Motor
7. Characteristics of PN and Zener Diodes
8. Characteristics of BJT, SCR and MOSFET
9. Design and analysis of Half wave and Full Wave rectifiers
10. Measurement of displacement of LVDT

                                          TOTAL: 60 PERIODS

OUTCOMES:

After completing this course, the students will be able to

CO1: Use experimental methods to verify the Ohm's law and Kirchhoff's Law
and to measure three phase power
CO2: Analyze experimentally the load characteristics of electrical machines
CO3: Analyze the characteristics of basic electronic devices
CO4: Use LVDT to measure displacement
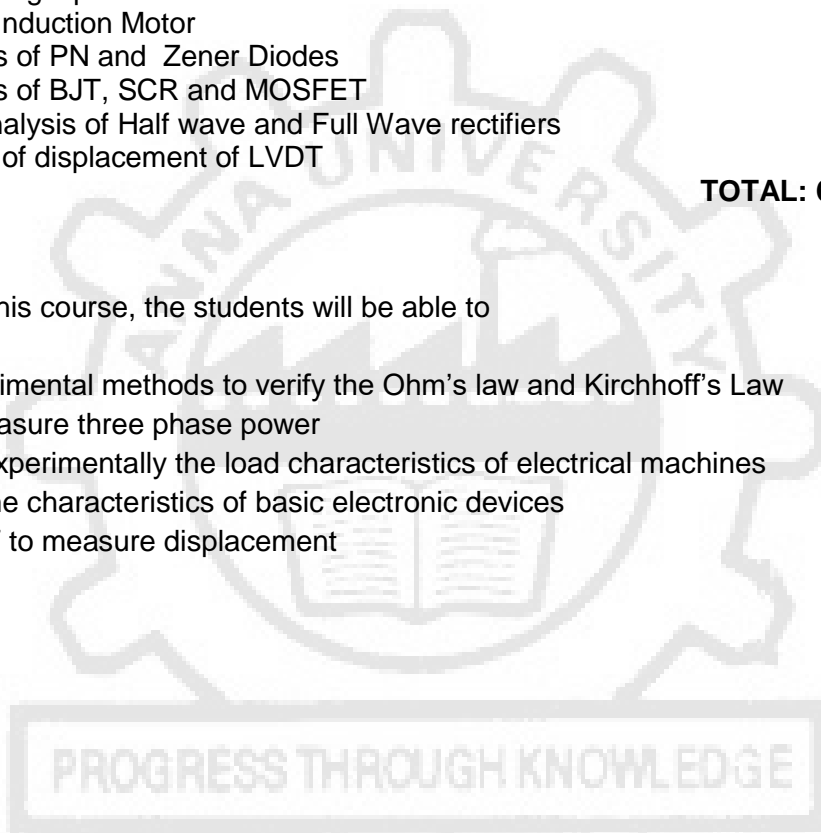
ANNA UNIVERSITY, CHENNAI
NON AUTONOMOUS AFFILIATED COLLEGES
REGULATIONS – 2021

| B.E. GEOINFORMATICS ENGINEERING |

CHOICE BASED CREDIT SYSTEM

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

I.   To prepare the students for successful careers in Geospatial Industries and Information Technology that meet the needs of India and other Countries.
II.   To develop the professional ability among the students to collect various Geospatial relates from various platform, data, analysis and synthesis that create user oriented real world applications.
III. To provide an opportunity for students to work as part of teams on multidisciplinary projects.
IV.   To provide students with a sound foundation in the mathematical, scientific and engineering fundamentals necessary to formulate, solve and analyze engineering and multidisciplinary problems and to prepare them for graduate studies.
V.   To promote students awareness of the life-long learning and to introduce them to professional ethics and codes of professional practice.

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

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

PROGRAMME SPECIFIC OUTCOMES (PSOs)

Graduates of B.E. Geoinformatics students will be able to

PSO1 Knowledge of Geoinformatics discipline
Demonstrate in-depth knowledge of Geoinformatics engineering discipline with an ability to evaluate, analyze and synthesize existing and new knowledge.

PSO2 Critical analysis of Geoinformatics Engineering problems and innovations
Critically analyze complex Geoinformatics problems and apply independent judgment for synthesizing information and make innovative advances in a theoretical, practical policy context.

PSO3 Conceptualization and evaluation of engineering solutions to Geoinformatics engineering issues
Conceptualize and solve Geoinformatics engineering problems, evaluate potential solutions and arrive at technically feasible, economically viable and environmentally sound solutions with due consideration of health, safety and socio cultural factors
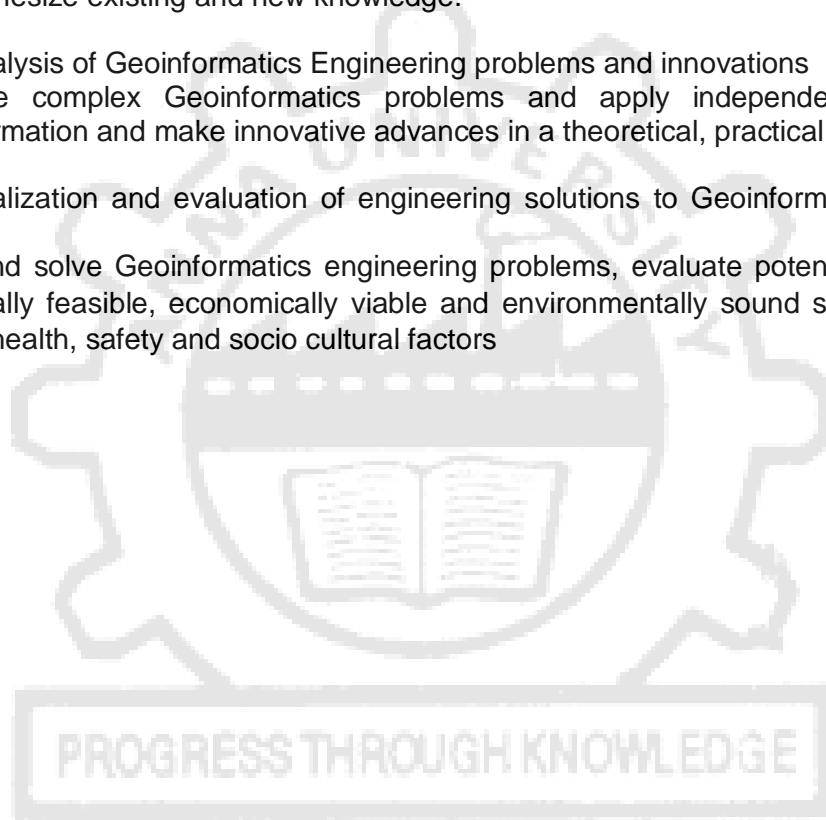
ANNA UNIVERSITY, CHENNAI
NON-AUTONOMOUS AFFILIATED COLLEGES
B.E. GEOINFORMATICS ENGINEERING
REGULATIONS – 2021
CHOICE BASED CREDIT SYSTEM
CURRICULUM FOR SEMESTERS I TO VIII AND SYLLABI FOR SEMESTERS III AND IV
SEMESTER I

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			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.	PH3203	Physics for Geoinformatics Engineering	BSC	3	0	0	3	3
4.	BE3252	Basic Electrical, Electronics and Instrumentation Engineering	ESC	3	0	0	3	3
5.	GI3201	Geoinformatics Systems	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#
8.	GE3252	தமிழர் மரபு / Heritage of Tamils	HSMC	1	0	0	1	1
PRACTICALS								
9.	GE3271	Engineering Practices Laboratory	ESC	0	0	4	4	2
10.	BE3272	Basic Electrical, Electronics and Instrumentation Engineering Laboratory	ESC	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	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	MA3302	Transforms and Statistics	BSC	3	1	0	4	4
2.	GI3301	Spatial Database Management system	PCC	3	0	0	3	3
3.	GI3302	Surveying	PCC	3	0	0	3	3
4.	GI3303	Remote Sensing	PCC	3	0	0	3	3
5.	GI3304	Geodesy	PCC	3	0	0	3	3
6.	GI3391	Photogrammetry	PCC	3	0	0	3	3
PRACTICALS								
8.	GI3311	Surveying Laboratory I	PCC	0	0	4	4	2
9.	GI3312	Remote Sensing and Photogrammetry Laboratory	PCC	0	0	2	2	1
10.	GE3361	Professional Development $	EEC	0	0	2	2	1
			TOTAL	**18**	**1**	**8**	**27**	**23**

$ **Skill Based Course**

SEMESTER IV

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	GI3401	Sensors and Data products	PCC	3	0	0	3	3
2.	GI3402	Digital Image Processing	PCC	3	0	0	3	3
3.	GI3403	Microwave Remote Sensing	PCC	3	0	0	3	3
4.	GI3491	Cartography and GIS	PCC	3	0	0	3	3
5.	GI3492	Total Station and GPS Surveying	PCC	3	0	0	3	3
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.	GI3411	Total Station and GPS Surveying Laboratory	PCC	0	0	4	4	2
9.	GI3412	Cartography and GIS Laboratory	PCC	0	0	2	2	1
10.	GI3413	Digital Image Processing Laboratory	PCC	0	0	4	4	2
			TOTAL	**17**	**0**	**10**	**27**	**22**

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

SEMESTER V

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	GI3501	Spatial Analysis and Applications	PCC	3	0	0	3	3
2.	GI3502	Mapping toolboxes for Geomatics	PCC	3	0	0	3	3
3.		Professional Elective I	PEC	3	0	0	3	3
4.		Professional Elective II	PEC	3	0	0	3	3
5.		Professional Elective III	PEC	3	0	0	3	3
6.		Professional Elective IV	PEC	3	0	0	3	3
7.		Mandatory course-I**&**	MC	3	0	0	3	0
PRACTICALS								
9.	GI3511	Mapping toolboxes Laboratory	PCC	0	0	2	2	1
			TOTAL	**21**	**0**	**6**	**27**	**19**

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

SEMESTER VI

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	GI3601	Geospatial analysis with R programming	PCC	2	0	2	4	3
2.	GI3691	Airborne and Terrestrial Laser Mapping	PCC	3	0	0	3	3
3.		Open elective-I*	OEC	3	0	0	3	3
4.		Professional Elective V	PEC	3	0	0	3	3
5.		Professional Elective VI	PEC	3	0	0	3	3
6.		Professional Elective VII	PEC	3	0	0	3	3
7.		Mandatory course-II**&**	MC	3	0	0	3	0
		NCC Credit course level 3**#**	-	3	0	0	3	3**#**
PRACTICALS								
8.	GI3611	Spatial Analysis and Applications Laboratory	PCC	0	0	4	4	2
9.	GI3612	Survey Camp (2 Weeks)	EEC	-	-	-	-	1
			TOTAL	**20**	**0**	**6**	**26**	**21**

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

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

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

SEMESTER VII/VIII*

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	GI3701	Spatial data adjustment	PCC	3	0	0	3	3
2.	GI3702	Web GIS	PCC	3	0	0	3	3
3.	GE3791	Human Values and Ethics	HSMC	2	0	0	2	2
4.	GE3752	Total Quality Management	HSMC	3	0	0	3	3
5.		Open Elective II**	OEC	3	0	0	3	3
6.		Open Elective III***	OEC	3	0	0	3	3
7.		Open Elective IV***	OEC	3	0	0	3	3
PRACTICALS								
8.	GI3711	Customization laboratory	PCC	0	0	2	2	1
			TOTAL	**20**	**0**	**2**	**22**	**21**

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

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

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

SEMESTER VIII/VII*

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
PRACTICALS								
1.	GI3811	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 NO. OF CREDITS: 164

MANDATORY COURSES I

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

MANDATORY COURSES II

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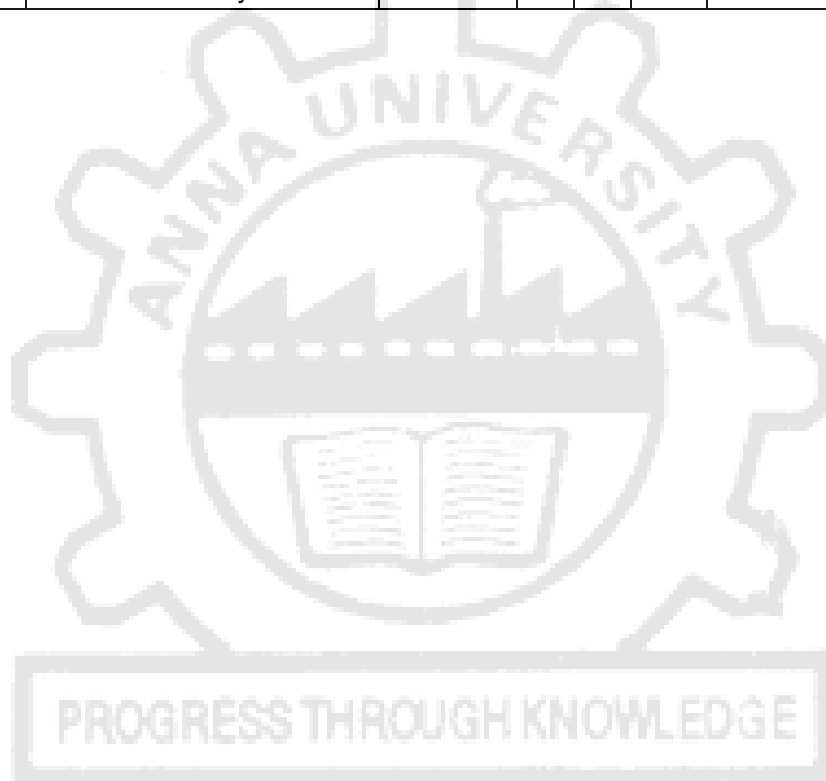
PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL I (Surveying & Mapping)	VERTICAL II (Geospatial Data Analytics)	VERTICAL III (Image Processing and Analysis)	VERTICAL IV (Geo Spatial Applications)	VERTICAL V (Geodesy)
Terrestrial and Close Range Photogrammetry	GIS Customization and Scripting	Soft Computing Techniques	Environmental Geoinformatics	Advanced Geodesy
GPS Surveying	Open Source GIS	Thermal, Hyperspectral and Planetary Remote Sensing	Geomatics for Urban Infrastructure	Satellite Geodesy
Terrestrial and Bathymetric Laser Scanning	Location Based GIS	Polarimetry and Interferometry	Geomatics for Hydrology and Water Resources	Physical Geodesy
Unmanned Aerial Vehicle (UAV) for Large Scale MAPPING	Enterprise GIS	AI / DL for image Processing	Satellite Meteorology	Geodetic Interferometry
Sub surface Survey Methods	GIS based Utility and Asset Management	Pattern Recognition (Satellite, Aerial, UAV)	Geomatics for Disaster and Risk Mitigation	Environmental Geodesy
Cadastral Surveying	Geo Computing	Raster Data Modelling	Geomatics for Agriculture and Forestry	Geodetic Control Survey and Adjustment
Advanced Surveying Techniques	Geo Spatial Modeling & Simulation	SDG and Geomatics	Geomatics for ocean and Coastal Applications	Geodetic Astronomy

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 specialization. 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.

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PROFESSIONAL ELECTIVE COURSES : VERTICALS

VERTICAL I: SURVEYING & MAPPING

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	GI3001	Terrestrial and Close Range Photogrammetry	PEC	3	0	0	3	3
2.	GI3002	GPS Surveying	PEC	3	0	0	3	3
3.	GI3003	Terrestrial and Bathymetric Laser Scanning	PEC	3	0	0	3	3
4.	GI3004	Unmanned Aerial Vehicle (UAV) for Large Scale Mapping	PEC	3	0	0	3	3
5.	GI3005	Sub Surface Survey Methods	PEC	3	0	0	3	3
6.	GI3006	Cadastral Surveying	PEC	3	0	0	3	3
7.	GI3007	Advanced surveying Techniques (Mining, Hydrology, Route, Astronomy)	PEC	3	0	0	3	3

VERTICAL II: GEOSPATIAL DATA ANALYTICS

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	GI3008	GIS Customization and Scripting	PEC	3	0	0	3	3
2.	GI3009	Open Source GIS	PEC	3	0	0	3	3
3.	GI3010	Location Based GIS	PEC	3	0	0	3	3
4.	GI3011	Enterprise GIS (API, rest soap SOA, SAS, OGC, Web services)	PEC	3	0	0	3	3
5.	GI3012	GIS based Utility and Asset Management	PEC	3	0	0	3	3
6.	GI3013	Geo Computing	PEC	3	0	0	3	3
7.	GI3014	Geo Spatial Modeling and Simulation	PEC	3	0	0	3	3

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VERTICAL III: IMAGE PROCESSING AND ANALYSIS

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	GI3015	Soft Computing Techniques	PEC	3	0	0	3	3
2.	GI3016	Thermal Hyperspectral & Planetary Remote Sensing	PEC	3	0	0	3	3
3.	GI3017	Polarimetry and Interferometry	PEC	3	0	0	3	3
4.	GI3018	AI / DL for image Processing	PEC	3	0	0	3	3
5.	GI3019	Pattern Recognition (Satellite, Aerial, UAV)	PEC	3	0	0	3	3
6.	GI3020	Raster Data Modelling	PEC	3	0	0	3	3
7.	GI3021	SDG and Geomatics	PEC	3	0	0	3	3

VERTICAL IV: GEO SPATIAL APPLICATIONS

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	GI3022	Environmental Geoinformatics	PEC	3	0	0	3	3
2.	GI3023	Geomatics for Urban Infrastructure	PEC	3	0	0	3	3
3.	GI3024	Geomatics for Hydrology and Water Resources	PEC	3	0	0	3	3
4.	GI3025	Satellite Meteorology	PEC	3	0	0	3	3
5.	GI3026	Geomatics for Disaster and Risk Mitigation	PEC	3	0	0	3	3
6.	GI3027	Geomatics for Agriculture and Forest	PEC	3	0	0	3	3
7.	GI3028	Geomatics for Ocean and Coastal Applications	PEC	3	0	0	3	3

VERTICAL V: GEODESY

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	GI3029	Advanced Geodesy	PEC	3	0	0	3	3
2.	GI3030	Satellite Geodesy	PEC	3	0	0	3	3
3.	GI3031	Physical Geodesy	PEC	3	0	0	3	3
4.	GI3032	Geodetic Interferometry	PEC	3	0	0	3	3
5.	GI3033	Environmental Geodesy	PEC	3	0	0	3	3
6.	GI3034	Geodetic Control Survey and Adjustment	PEC	3	0	0	3	3
7.	GI3035	Geodetic Astronomy	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 ELECTIVE I AND II
(EMERGING TECHNOLOGIES)
To be offered other than Faculty of Information and Communication Engineering

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	OCS351	Artificial Intelligence and Machine Learning Fundamentals	OEC	2	0	2	4	3
2.	OCS352	IoT Concepts and Applications	OEC	2	0	2	4	3
3.	OCS353	Data Science Fundamentals	OEC	2	0	2	4	3
4.	OCS354	Augmented and Virtual Reality	OEC	2	0	2	4	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

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SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	TOTAL CONTACT PERIODS	CREDITS
17.	OCE353	Lean Concepts, Tools And Practices	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.	OBM351	Foundation Skills in integrated product Development	OEC	3	0	0	3	3
37.	OBM352	Assistive Technology	OEC	3	0	0	3	3
38.	OMA352	Operations Research	OEC	3	0	0	3	3
39.	OMA353	Algebra and Number Theory	OEC	3	0	0	3	3
40.	OMA354	Linear Algebra	OEC	3	0	0	3	3

OPEN ELECTIVES – IV

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	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

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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.	OCE354	Basics of Integrated Water Resources Management	OEC	3	0	0	3	3
31.	OAI352	Agriculture Entrepreneurship Development	OEC	3	0	0	3	3

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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.	OBM353	Wearable devices	OEC	3	0	0	3	3
51.	OBM354	Medical Informatics	OEC	3	0	0	3	3

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SUMMARY

S.No.	SUBJECT AREA	CREDITS AS PER SEMESTER								CREDITS TOTAL
		I	II	III	IV	V	VI	VII/VIII	VIII/VII	
1.	HSMC	4	3					5		12
2.	BSC	12	7	4	2					25
3.	ESC	5	11							16
4.	PCC		3	18	20	7	8	7		63
5.	PEC					12	9			21
6.	OEC						3	9		12
7.	EEC	1	2	1			1		10	15
	Total	22	26	23	22	19	21	21	10	164
8.	Mandatory Course (Non Credit)					✓	✓			

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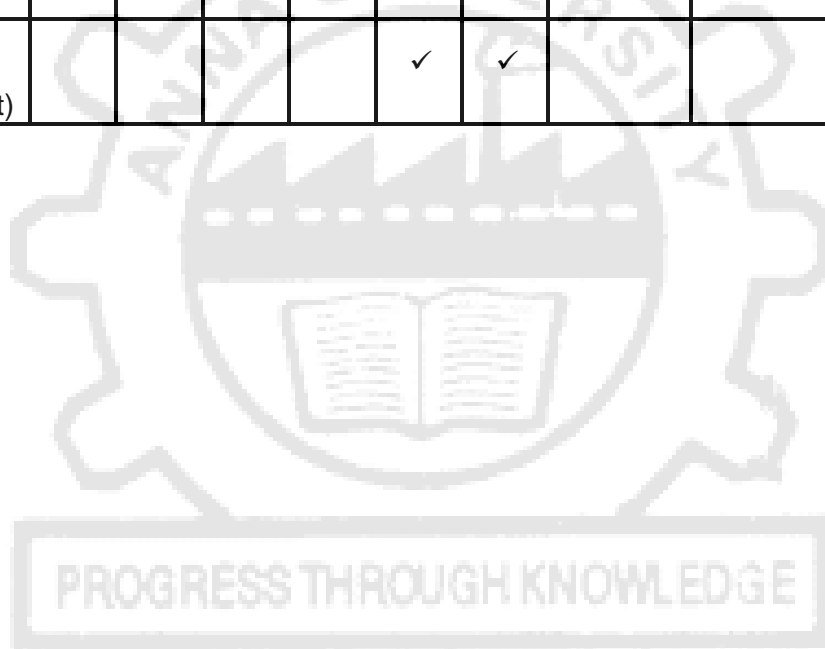
ENROLLMENT FOR B.E. / B. TECH. (HONOURS) / MINOR DEGREE (OPTIONAL)

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

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

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

Complete details are available in clause 4.10 of Regulations 2021.

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

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

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

VERTICAL 1: FINTECH AND BLOCK CHAIN

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

VERTICAL 2: ENTREPRENEURSHIP

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	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 and Leadership Management for Business	PEC	3	0	0	3	3
3.	CMG339	Creativity and 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 Entrepreneurship	PEC	3	0	0	3	3
6.	CMG342	Financing New Business Ventures	PEC	3	0	0	3	3

VERTICAL 3: PUBLIC ADMINISTRATION

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

VERTICAL 4: BUSINESS DATA ANALYTICS

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

VERTICAL 5: ENVIRONMENT AND SUSTAINABILITY

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

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MA3302   **TRANSFORMS AND STATISTICS**   **L T P C**
                                                                               3 1 0 4

UNIT I   FOURIER SERIES   **9 + 3**
Dirichlet's conditions – General Fourier series – Odd and even functions – Half-range Sine and cosine series – Root mean square value - Parseval's identity – Harmonic Analysis.

UNIT II   FOURIER TRANSFORM   **9 + 3**
Fourier integral theorem – Fourier transform pair - Sine and cosine transforms – Properties – Transform of elementary functions – Convolution theorem – Parseval's identity.

UNIT III   RANDOM VARIABLES   **9 + 3**
Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions - Functions of a random variable.

UNIT IV   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 V   ESTIMATION THEORY   **9 + 3**
Unbiased estimators - Efficiency - Consistency - Sufficiency - Robustness - Method of moments - Method of maximum Likelihood - Interval estimation of Means - Differences between means, variations and ratio of two variances.

                                                                               TOTAL: 60 PERIODS

COURSE OUTCOMES:

• On completion of the course, the student is expected to

CO 1   Apply Fourier series techniques used in wide variety of situations in which the functions used are not periodic and to solve boundary value problems.
CO 2   Apply the Fourier transform techniques to solve boundary value problems.
CO 3   To understand and apply the concept of Probability and random variables in Statistics which is central to many geometric applications.
CO 4   To apply the basic concepts of two dimensional random variables.
CO 5   To understand the knowledge of applying the concept of estimation theory which plays an important role in real life problems.

TEXTBOOKS:
1. Grewal. B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.
2. John E. Freund's "Mathematical Statistics with Applications", 8th Edition, Pearson Education, New Delhi, 2017.
3. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, New Delhi, 4th Edition, 3rd Reprint, 2008.

REFERENCES:
1. James. G., "Advanced Modern Engineering Mathematics ", 4th Edition, Pearson Education, New Delhi, 2016.
2. Kreyszig. E, "Advanced Engineering Mathematics", John Wiley & Sons, 10th Edition, New Delhi, 2014.
3. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Thomson Brooks/Cole, International Student Edition, New Delhi, 8th Edition, 2012.
4. Ross. S.M., "Introduction to Probability and Statistics for Engineers and Scientists", Elsevier, New Delhi, 5th Edition, 2014.
5. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill, New Delhi, 2004.

GI3301 **SPATIAL DATABASE MANAGEMENT SYSTEM** **L T P C**
3 0 0 3

OBJECTIVES:

- Introduce the students to the concepts of DBMS, Spatial Database Management System (SDBMS), Spatial Database design, basic application program development and user interfaces.

UNIT I **INTRODUCTION** **9**

Data — Information - File system Vs DBMS — Database Management Systems — Database architectures, users and administrators — Classification of Database Management Systems – Spatial Data - Points, Lines, Polygons – definition of SDBMS – user classes of SDBMS – Multilayer architecture of SDBMS – GIS and SDBMS.

UNIT II **SPATIAL CONCEPTS AND DATA MODELS** **9**

Field based model – object based model – spatial data types – operations on spatial objects - Entity Relationship Model (ER Model) – Relational Model – Constraints and Normal forms of Relational Model - mapping ER model to Relational model – ER model with spatial concepts – Object-oriented data modeling with Unified Modeling Language(UML).

UNIT III **QUERY LANGUAGE** **9**

SQL — Data Definition — Data Manipulation - Basic structure of SQL — Set operations — Aggregate Functions – Simple queries – spatial Vs non spatial - Nested sub queries – Complex queries – Views – Trigger - OGIS standard for extending SQL - example spatial SQL queries – Object relational SQL.

UNIT IV **SPATIAL STORAGE AND INDEXING** **9**

Disk geometry — Buffer manager – Field-Record — File — File Structure — Clustering – Basic concepts of file organizations, indexing – Spatial Indexing – Grid files – R Tree – Concurrency support – Spatial Join index – Database recovery techniques – Database Security.

UNIT V **SPATIAL DATABASE SYSTEMS AND APPLICATION DESIGN AND DEVELOPMENTS** **9**

Exploring Spatial Geometry – Organizing spatial data - spatial data relationships and functionalities of any one commercial and one FOS SDBMS each – Application program and user Interfaces.

TOTAL:45 PERIODS

COURSE OUTCOMES:

•On completion of the course, the student is expected to
CO1 Understand the concepts, classification, architectures of DBMS, SDBMS
CO2 Provide the information on Field Based, Object Based, ER, Relational and UML models.
CO3 Enable the SQL, Extended SQL for handling Spatial and Non-Spatial Queries.
CO4 Show the methods of Storing, Indexing, Database Recovery and Data Security concepts
CO5 Give the Design and Development Environment of Spatial Data

TEXTBOOKS:

1. Shashi Shekhar, Sanjay Chawla,"Spatial Databases a Tour" Prentice Hall, 1st edition, 2003.
2. Philippe Rigaux, Michel Scholl, Agnès Voisard "Spatial Databases" Morgan Kaufmann,2001

REFERENCES:

1. Abraham Silberschatz, Henry F. Korthand S. Sudharshan,"Database System Concepts", 7th edition, McGraw Hill, 2020.
2. Ravi Kothuri, Albert Godfrind, Euro Beinat "Pro Oracle Spatial for Oracle Database 11g", Apress, 2019.
3. Regina, Leo Hsu "Post GIS in Action", Oreilly&AssociatesInc., third edition (2021).
4. Vijay Gandhi; James Kang; Shashi Shekhar, "Spatial Databases." Minnesota univ minneapolis dept of electrical and computer engineering, 2007
5. Albert K. W. Yeung & G. Brent Hall ," Spatial Data and Spatial Database Systems", 2007

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GI3302   **SURVEYING**   **L T P C**
                                                                                3 0 0 3

OBJECTIVES:
- To introduce the rudiments of surveying and its principles to Geoinformatics Engineers.
- To learn the various methods of surveying to solve the real-world problems.
- To introduce the concepts of control surveying
- To introduce the basics of cadastral Surveying

UNIT I   FUNDAMENTALS OF CONVENTIONAL SURVEYING   9
Definition – Classifications – Basic principles – Equipment and accessories for ranging and chaining – Methods of ranging – well conditioned triangles – Chain traversing – Compass – Basic principles – Types – Bearing – System and conversions – Sources of errors and Local attraction - Magnetic declination – Dip – compass traversing – Plane table and its accessories – Merits and demerits - Radiation – Intersection – Resection – Plane table traversing.

UNIT II   LEVELLING   9
Level line – Horizontal line – Datum – Benchmarks – Levels and Staves - Temporary and Permanent adjustments – Methods of leveling – Fly leveling – Check leveling – Procedure in leveling – Booking – Reduction – Curvature and refraction – Reciprocal leveling – Precise leveling – Contouring – Methods of interpolating Contours – Characteristics and uses of Contours – Areas enclosed by straight lines – Irregular figures – Volumes – Earth work calculations.

UNIT III   THEODOLITE SURVEYING   9
Theodolite – Types – Horizontal and Vertical angle measurements - Temporary and Permanent adjustments – Trigonometric Levelling - Heights and distances – Single Plane method – Double Plane method – Geodetic observation - Tacheometric surveying – Stadia Tacheometry – Subtense method –Tangential Tacheometry.

UNIT IV   CONTROL SURVEYING AND ADJUSTMENT   9
Horizontal and Vertical control – Methods – Triangulation – Base line – Instruments and accessories – Corrections – Satellite station – Traversing – Coordinate computation – Gale's table – Omitted measurement – Trilateration – Concepts of measurements and errors – weight of an observation – law of weight – adjustment methods – angles, lengths and levelling network – simple problems

UNIT V   CADASTRAL SURVEYING   9
History of cadastral survey – Land Records - FMB Sketch -Tax – Real Property- Legal Cadastral – Graphical and Numerical Cadastre - Legal Characteristics of Records - Torrens System. Cadastral map reproduction – Map projection for cadastral maps - Automated Cadastral map – Land Information System.

                                                             TOTAL:45 PERIODS

COURSE OUTCOMES:
• On completion of the course, the student is expected to
CO 1   Understand the rudiments of various surveying and its principles.
CO 2   Gain knowledge in computation of levels of terrain and ground features
CO 3   Understand the concepts of Theodolite Surveying for complex surveying operations
CO 4   Understand the procedure for establishing horizontal and vertical control
CO 5   Gain knowledge on cadastral survey
TEXTBOOKS:
1. T. P. Kanetkarand S. V. Kulkarni, Surveying and Levelling, Parts 1 &2, Pune Vidyarthi Griha Prakashan, Pune, 2010, 24th edition.
2. Dr. B. C. Punmia, Ashok K. Jain and Arun K Jain, Surveying Vol. I & II, Lakshmi Publications Pvt Ltd, New Delhi, Sixteenth Edition, 2016.

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REFERENCES:
1. R. Subramanian, Surveying and Levelling, Oxford University Press, Second Edition, 2012.
2. James M. Anderson and Edward M. Mikhail, Surveying, Theory and Practice, Seventh Edition, McGraw Hill 2001.
3. Bannister and S. Raymond, Surveying, Seventh Edition, Longman 2004.
4. S. K. Roy, Fundamentals of Surveying, Second Edition, Prenticeˆ Hall of India 2004.
5. K. R. Arora, Surveying Vol I & II, Standard Book house, 2019
6. C. Venkatramaiah, Textbook of Surveying, Universities Press, Second Edition, 2011.

GI3303	REMOTE SENSING	L T P C
		3 0 0 3

OBJECTIVES:
- To introduce the concepts of remote sensing processes and its components.
- To expose the various remote sensing platforms and sensors and to introduce the elements of data interpretation

UNIT I   REMOTE SENSING AND ELECTROMAGNETIC RADIATION   9
Definition — components of RS — History of Remote Sensing — Merits and demerits of Data Collation between conventional and remote sensing methods – Electromagnetic Spectrum – Radiation principles - Wave theory, Planck's law, Wien's Displacement Law, Stefan's Boltzmann law, Kirchhoff's law – Radiation sources: active & passive – Radiation Quantities.

UNIT II   EMR INTERACTION WITH ATMOSPHERE AND EARTH MATERIAL   9
Standard atmospheric profile – main atmospheric regions and its characteristics – interaction of radiation with atmosphere – Scattering, absorption and refraction – Atmospheric windows – Energy balance equation — Specular and diffuse reflectors — Spectral reflectance&emittance— Spectroradiometer – Spectral Signature concepts – Typical spectral reflectance curves for vegetation, soil and water – solid surface scattering in microwave region.

UNIT III   ORBITS AND PLATFORMS   9
Motions of planets and satellites – Newton's law of gravitation – Gravitational field and potential - Escape velocity - Kepler's law of planetary motion - Orbit elements and types — Orbital perturbations and maneuvers – Types of remote sensing platforms - Ground based, Air borne platforms and Space borne platforms – Classification of satellites – Sun synchronous and Geosynchronous satellites — Lagrange Orbit.

UNIT IV   SENSING TECHNIQUES   9
Classification of Remote Sensors – Resolution concept: spatial, spectral, radiometric and temporal resolutions - Scanners - Along and across track scanners – Optical-infrared sensors – Thermal sensors – Microwave sensors – Calibration of sensors – High Resolution Sensors - LIDAR, UAV – Orbital and sensor characteristics of live Indian earth observation satellites.

UNIT V   DATA PRODUCTS AND INTERPRETATION   9
Photographic and Digital products – Types, levels and open-source satellite data products – selection and procurement of data – Visual interpretation: basic elements and interpretation keys - Digital interpretation – Concepts of Image rectification, Image enhancement and Image classification.

TOTAL:45 PERIODS

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COURSE OUTCOMES:

•On completion of the course, the student is expected to

CO 1 Understand the concepts and laws related to remote sensing

CO 2 Understand the interaction of electromagnetic radiation with atmosphere and Earth material

CO 3 Acquire knowledge about satellite orbits and different types of satellites.

CO 4 Understand the different types of remote sensors.

CO 5 Gain knowledge about the concepts of interpretation of satellite imagery.

TEXTBOOKS:

1. Thomas M. Lillesand, Ralph W. Kieferand Jonathan W. Chipman, Remote Sensing and Image interpretation, John Wiley and Sons, Inc., New York, 2015.

2. George Joseph and C Jeganathan, Fundamentals of Remote Sensing, Third Edition Universities Press (India) Private limited, Hyderabad, 2018.

REFERENCES:

1. Stanley A Morain; Amelia M Budge; Michael S Renslow. Manual of Remote Sensing. Vol. I, American Society for Photogrammetry and Remote Sensing, Virginia, USA,2019, 4th edition

2. Verbyla, David, Satellite Remote Sensing of Natural Resources. CRC Press,2022 first edition.

3. Paul Curran P. J. Principles of Remote Sensing Longman, RLBS, 1996.

4. Introduction to Physics and Techniques of Remote Sensing, Charles Elachi and Jacob Van Zyl, 2021 Edition3, Wiley Publication.

5. Basudeb Bhatta, Remote Sensing and GIS, Oxford University Press, 2020 third edition.

GI3304   **GEODESY**   **L T P C**
3 0 0 3

OBJECTIVES:

• To understand the geometry of the earth, Gravity, and its relationship with nature.

UNIT I   FUNDAMENTALS   9
Definitions - Classifications, Problem of Geodesy and purpose of Geodesy Historical development and Organization of Geodesy. Reference Surfaces and their relationship. Applications, Engineering, Lunar, Planetary and interferometric Synthetic aperture radar Geodesy – Local and International Spheroid.

UNIT II   GEOMETRIC GEODESY   9
Geometry of ellipsoid, fundamental mathematical relationship of ellipsoid, Geodetic, Geocentric and Reduced latitudes and their relationship. Ellipsoidal Co-ordinates in terms of Reduced, Geodetic and geocentric latitude. Radius of curvature in the meridian & prime vertical and their relationship. Mean Radius of curvature in any azimuth, Length of the meridian arcs and arcs of parallel and Area of trapezium on the ellipsoid. Curves on the ellipsoid, properties of Geodesic.

UNIT III   CO-ORDINATE SYSTEMS   9
Natural or Astronomical Co-ordinate System, Geodetic or Geographical co-ordinate System, Rectangular or Cartesian Co-ordinate System and relationship between them. Curvilinear Co-ordinate System. Deflection of Vertical, Spherical excess. Astro-Geodetic method of determining the reference Spheroid.

UNIT IV   PHYSICAL GEODESY   9
Basics - INGN -the significance of gravity measurements, Gravity field of earth, Concept of equipotential, Geo potential and Sphero potential Surface - Normal gravity and its computations, Methods of measuring Absolute and Relative gravity- Gravimeters - Reduction of gravity measurements, terrain and Isostasy corrections. Gravity networks. Gravity anomaly and Gravity disturbance - Fundamental equation of Physical Geodesy. Gravimetric determination of Geoid and Deflection of Vertical - Gravimetric satellite.

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UNIT V   GEODETIC ASTRONOMY   9
Celestial Sphere – Astronomical triangle – celestial coordinates systems and its relationship with Cartesian Co-ordinates and Transformation between them - Special star positions, Major 44 constellations - time systems (sidereal, Universal, atomic and standard) rising and setting of Stars with respect to Declination, hour angle and Azimuth, Culmination, Prime Vertical Crossing and Elongation.

TOTAL:45 PERIODS

COURSE OUTCOMES:
•On completion of the course, the student is expected to
CO 1   Learn about the fundamentals of Geodesy
CO 2   Understand the concepts of geoid, ellipsoid and their interrelationship
CO 3   Know about the various types of coordinate systems and relationship between them
CO 4   Learn about the methods for measurement of gravity and gravity network
CO 5   Understand the concepts of geodetic astronomy

TEXTBOOKS:
1.   Wolfgang Torge, Geodesy, Walter De Gruyter Inc., Berlin, 2015 2ⁿᵈ edition.
2.   Guy Bomford‖Geodesy‖ Nabu Press, 2015, ISBN 1172029091.

REFERENCES:
1.   PetrVanicek and Edward J. Krakiwsky, Geodesy: The concepts, North-Holland Publications Co., Amsterdam, 2014 2ⁿᵈ edition.
2.   Tom Herring, Geodesy Elsevier,2009, ISBN: 0444534601
3.   Schwarze, V.S. Geodesy: The challenge of the 3rd millennium, Springer verlag, and 2003.
4.   James R.Smith, Introduction to Geodesy, John wiley & Sons Inc. 1997

GI3391	**PHOTOGRAMMETRY**	**L T P C**
		3 0 0 3

OBJECTIVES:
●   To introduce basics and concepts of optics, aerial photography acquisition and mapping from aerial photographs.

UNIT I   PRINCIPLES AND PROPERTIES OF PHOTOGRAPHY   9
History - Definition, Applications – Types of Photographs, Classification – Photographic overlaps –Camera: metric vs. non-metric, Digital Aerial cameras – Multiple frame and Line cameras – Linear array scanner – Flight Planning – Crab & Drift– Computation of flight plan - Photogrammetry project Planning.

UNIT II   GEOMETRIC PROPERTIES OF AERIAL PHOTOGRAPHS   9
Photo coordinate measurement – Vertical photographs -geometry, scale, Coordinate system, Relief displacement – Stereoscopes – Stereoscopic parallax – parallax equations -Geometry, Scale, Coordinate system – Relief displacement –- Photo Interpretation.

UNIT III   STEREOPLOTTERS & ORIENTATION   9
Projection system, Viewing, Measuring and Tracing system Stereo plotters–Classification: Analog, semi analytical, Analytical and Digital systems –   Interior orientation - Relative orientation – Absolute orientation - Collinearity condition and Coplanarity condition - Orientation: Two-dimensional coordinate transformations –Three-dimensional conformal coordinate transformation

UNIT IV   AEROTRIANGULATION, TERRAIN MODELING, ORTHOPHOTO   9
Neat model – Strip and blocks of photographs – Aerotriangulation: strip adjustment, independent model triangulation, Bundle block Adjustment and GPS Aerotriangulation (INS and GNSS integration) - feature collection – DTM generation and Contour mapping – ortho rectification - mono plotting – stereo plotting

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UNIT V   DIGITAL PHOTOGRAMMETRY   9

Photogrammetric Scanner – Digital Photogrammetry WorkStation – Work Station Basic system function – Storage System – Stereoscopic Viewing and Measuring System – Image properties - Image matching: template matching, feature based matching - DEM and DSM - Satellite photogrammetry principles

TOTAL:45 PERIODS

COURSE OUTCOMES:

•On completion of the course, the student is expected to

CO1 Understand and appreciate the importance of photography as means of mapping, functional and physical elements of photography.

CO2 Understand the need of the photogrammetric mapping and the relevance of accuracy standards and means to achieve them for precise large-scale maps with scientific methods.

CO3 Evaluate the standards of map based on the state-of-the-art tool and techniques and assess the production standards for photogrammetric map making.

CO4 Acquire knowledge on the current development, issues methods and solutions in map making and evaluate methods of production.

CO5 Analyze critically and evaluate methods by applying the knowledge gained and to be a part of innovation and integration of mapping technology.

TEXTBOOKS:

1. Paul. R Wolf., Bon A. De Witt, Elements of Photogrammetry with Application in GIS McGraw Hill International Book Co., 4th Edition, 2014.
2. E. M. Mikhail, J. S. Bethel, J. C. McGlone, Introduction to Modern Photogrammetry, Wiley Publisher, 2001.

REFERENCES:

1. Gollfried Konecny, Geoinformation: Remote Sensing, Photogrammetry and Geographical Information Systems, CRC Press, 2nd Edition, 2014.

2. Karl Kraus, Photogrammetry: Geometry from Images and Laser Scans, Walter de Gruyter GmbH & Co.2nd Edition, 2007.

3. Manual of Photogrammetry – American society of Photogrammetry & amp; R. S by Albert. D, 1980.

4. Digital Photogrammetry – A practical course by Wilfried Linder, 3rd edition, Springer, 2009.

5. Digital Photogrammetry by – Y. Egels& amp; Michel Kasser, Taylor & amp; Francis group, 2003.

GI3311	**SURVEYING LABORATORY I**	**L T P C**
		0 0 4 2

OBJECTIVES:

• To familiarize with the various surveying instruments and methods.

EXCERCISES:

1. Chain traversing
2. Compass traversing
3. Centre line marking of a building
4. Planimetric Mapping of an Area using Plane Table Surveying (Radiation, Intersection)
5. Map updation using Plane Table Surveying through Resection (Graphical Method)
6. Plane table surveying – Two point problem
7. Fly and Check Levelling using dumpy level / tilting level
8. Determination of horizontal and vertical angles using theodolite
9. Determination of tacheometric constants using horizontal and inclined line of sight
10. Single plane method using theodolite
11. Double plane method using theodolite

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12. Determination of RL of a point on sloping terrain using tacheometric surveying
13. Preparation of Planimetric Map using stadia tacheometry

TOTAL: 60 PERIODS

COURSE OUTCOMES:

• On completion of the course, the student is expected to
CO 1   Gain knowledge on the usage of basic surveying instruments like chain/tape, compass, plane table and leveling instruments
CO 2   Use levelling instrument for surveying operations
CO 3   Use theodolite for various surveying operations
CO 4   Carry out the necessary surveys for social infrastructures
CO 5   Prepare the planimetric maps

REFERENCES:

1. T. P. Kanetkar and S. V. Kulkarni, Surveying and Levelling, Parts 1 & 2, Pune Vidyarthi Griha Prakashan, Pune, 24th Reprint, 2010.
2. Dr. B. C. Punmia, Ashok K. Jain and Arun K Jain, Surveying Vol. I & II, Lakshmi Publications Pvt Ltd, New Delhi, 17th Edition, 2016.
3. James M. Anderson and Edward M. Mikhail, Surveying, Theory and Practice, Seventh Edition, McGraw Hill 2001
4. Bannister and S. Raymond, Surveying, Seventh Edition, Longman 2004 a. David Clark, Plane and Geodetic Surveying for Engineers, Volume I, Constable and Company Ltd, London, CBS, 6th Edition, 2004.
5. David Clark and James Clendinning, Plane and Geodetic Surveying for Engineers, Volume II, Constable and Company Ltd, London, CBS, 6th Edition, 2004.
6. S. K. Roy, Fundamentals of Surveying, Second Edition, Prentice 'Hall of India 2004
7. K. R. Arora, Surveying Vol. I & II, Standard Book house, 2019.

GI3312   REMOTE SENSING AND PHOTOGRAMMETRY LABORATORY   L T P C
**   0 0 2 1**

OBJECTIVES:

• To facilitate the students with hands on experience on visual interpretation of satellite data products and conventional and digital interpretation of aerial photographs.

REMOTE SENSING EXERCISES

1. Preparation of Base Map from Survey of India Topo sheets
2. Introduction to various satellite data products and image interpretation keys
3. Preparation of Land use/land cover map using Satellite Data / Aerial Photograph.
4. Spectral measurements using spectroradiometer and processing for
   a. Water & Soil
   b. Vegetation
   c. Various surfaces and land cover

PHOTOGRAMMETRY EXERCISES

1. Testing stereovision with Stereogram card
2. Mirror stereoscope- base line, orientation of aerial photographs and Photo Interpretation
3. To find the height of point using Parallax bar
4. Scale of vertical photographs
5. Aerial Triangulation using digital photogrammetry
6. Bundle Block adjustment
7. Generation and editing of DTM and Contour
8. Orthophoto generation and Mosaic
9. Preparation of Planimetric map

TOTAL: 30 PERIODS

26

The following instruments and software are required

Sl. No.	Instrument	Numbers
1.	Light Table	10
2.	Computer	10
3.	Spectroradiometer	1
4.	Pocket Mirror Stereoscope	10
5.	Mirror Stereoscope	10
6.	Parallax bar	10
7.	Digital Photogrammetry Software (Free software also available) (licenses)	5
8.	Anaglyphic Glass	20
9.	CAD software (Free software also available) (licenses)	5

COURSE OUTCOMES:

•On completion of the course, the student is expected to
CO 1 Identify different features from satellite images
CO 2 Interpret images to prepare thematic maps
CO 3 Determine geometrical elements of aerial photograph
CO 4 Analyze the aerial Photograph
CO 5 To generate Digital Elevation Model and Ortho photo from Stereo models

TEXTBOOKS:

1. Thomas M. Lillesand, Ralph W. Kieferand Jonathan W. Chipman, Remote Sensing and Image interpretation, John Wiley and Sons, Inc., New York, 2015.
2. Paul. R Wolf., Bon A. De Witt, Elements of Photogrammetry with Application in GIS McGraw Hill International Book Co., 4thEdition, 2014.

REFERENCES:

1. Verbyla, David, Satellite Remote Sensing of Natural Resources. CRC Press,2022 first edition.
2. Paul Curran P. J. Principles of Remote Sensing Longman, RLBS, 1996.
3. Introduction to Physics and Techniques of Remote Sensing, Charles Elachi and Jacob Van Zyl, 2021 Edition3, Wiley Publication
4. Gollfried Konecny, Geoinformation: Remote Sensing, Photogrammetry and Geographical Information Systems, CRC Press, 2nd Edition, 2014.
5. Karl Kraus, Photogrammetry: Geometry from Images and Laser Scans, WalterdeGruyter GmbH & Co.2nd Edition, 2007.

GI3401	SENSORS AND DATA PRODUCTS	L T P C
		3 0 0 3

OBJECTIVES:

• To familiarize the students with principle and operation of available sensing system, access protocols and its applicability.

UNIT I   OPTICAL AND IR SENSORS   9
Land observation satellites, IRS series, LANDSAT series, SPOT series, High resolution satellites, character and applications, CARTOSAT series, IKONOS Series, QUICKBIRD series, Weather/Meteorological satellites, INSAT series – data formats

UNIT II   MICROWAVE AND THERMAL SENSORS   9
Use of Microwave data - SeaWiFS, OCR, CZCs studies -chlorophyll production index -sea surface temperature (SST) sensors -NIMBUS, RADARSAT, CASI - MESSR, OCTS ATSR -Sensors - OCEANSAT ATSR on ERS TOPEX/Poseidon satellite data – NASA earth data, ESA, NCEL, GLOVIS, NEO, USGSEE - GOOGLE EARTH- SARAL.

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UNIT III   HYPERSPECTRAL SENSORS   9
Scanner types and characterization - specifications of various sensors Spectrographic imagers-hyperspectral sensors, Design tradeoffs. Data formats and systems, AVIRIS, CASI, NASA Terra Moderate Resolution Imaging Spectrometer (MODIS), Hyperion - VEDAS

UNIT IV   GEO PORTALS   9
Open sources satellite imagery - USGS Earth Explorer - NASA Earth data Search - NOAA Data Access Viewer - Bhuvan Indian Geo-Platform of ISRO – Google Earth Engine - Copernicus Open Access Hub – up scaling and downscaling – sample data download and appraisal

UNIT V   APPLICATION AREAS   9
Data download – climatic data- oceanic data – coastal data – land data – rainfall data; applications – rainfall vs NDVI, PPI- LST vs land use – wind vector and oceans current; mini project

TOTAL: 45 PERIODS

COURSE OUTCOMES:
•On completion of the course, the student is expected to
CO 1 Gain knowledge on the current and historic satellite missions and sensors national and international importance and their relevance in the resource application
CO 2   Gain information on the various types of primary and derived satellite data for earth resource management and their specifications
CO 3   Acquire the knowledge about open geoportals that offer satellite data and related resource data and their applicability
CO 4 Acquire knowledge on the methods to download satellite data or how to procure them from the authorized geoportals
CO 5 Analyze critically and evaluate the quality, standards of satellite data and to use them for various applications.

TEXTBOOKS:
1. Introduction to Satellite Remote Sensing (Atmosphere, Ocean, Land and Cryosphere Applications), Bill Emery, Adriano Camps, First edition, 2017.
2. Landsat Data Continuity Mission(L1) Data format Control Book – USGS
3. Eni G.Njoku ,"Surface waves and Fluxes: Chapter-Satellite Remote Sensing of Sea Surface Temperature",1990,Volume 8,ISBN: 978-94-010-6769-0.

REFERENCES:
1. Fundamentals of Satellite Remote Sensing: An Environmental Approach, Emilio Chuvieco, Third Edition, 2020.
2. Hyperspectral Remote Sensing: Principles and Applications, Marcus Borengasser, First Edition, 2007.
3. Advances in Environmental Remote sensing: QihaoWeng, 1st Edition. 2017.

GI3402	DIGITAL IMAGE PROCESSING	L T P C
		3 0 0 3

OBJECTIVES:
•   To make the undergraduate Engineering Students understand the concepts, principles, processing of Satellite data in order to extract useful information from them.

UNIT I   FUNDAMENTALS OF IMAGE PROCESSING   9
Definition - Image Representation - Steps in DIP— Components – Elements of Visual Perception – Image Formation - Image Sampling and Quantization- Image acquisition, storage and retrieval —Relationships between pixels - Color image fundamentals - RGB, HSI models- data products – satellite data formats – Digital Image Processing Systems – Hardware and software design consideration.

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UNIT II   PREPROCESSING   9

Image Characteristics – Histograms – Scattergrams –Initial statistics – Univariate and multivariate statistics-Initial image display- Ideal display, types, Sensor models - spatial, spectral, radiometric, temporal - IFOV, GIFOV& GSI - geometry and Radiometry – Sources of Image degradation and Correction procedures - Atmospheric, Radiometric, Geometric Corrections- Image Geometry Restoration-Interpolation methods and resampling techniques.

UNIT III   IMAGE ENHANCEMENT   9

Image characteristics- point, local and regional operation – contrast, spatial feature and multi-image manipulation techniques – level slicing, contrast stretching, spatial filtering, edge detections - Fourier transform-FFT, DFT - Band ratio - Principal Component Analysis (PCA) – Scale-space transform- multi-image fusion.

UNIT IV   IMAGE CLASSIFICATION   9

Pattern recognition concepts – Bayes approach – spectral Signature and training sets – Separability test – Supervised Classification – stages – Minimum distance to mean, Parallelepiped, MLC – Unsupervised classifiers – ISODATA, K-means-Support Vector Machine – sub-pixel classifier– Error matrix -Accuracy assessment – accuracy metrics: Kappa statistics, ERGAS, RMS.

UNIT V   ADVANCED CLASSIFIERS   9

Texture based classification -Segmentation (Spatial, Spectral)-regions Fuzzy set classification – Object based classifiers – Deep Learning - Artificial Neural nets: Hebbian leaning - Adaline, Madaline, BPN – hybrid classifiers – Neuro - Fuzzy models- Expert system – Knowledge based systems,

TOTAL:45 PERIODS

COURSE OUTCOMES:
- On completion of the course, the student is expected to

CO 1 To understand various components and characteristics of image processing systems

CO 2 To familiarize the concepts of image geometry and radiometry corrections

CO 3 To acquire knowledge about different types of image enhancement techniques used for satellite image processing

CO 4 To gain knowledge about Image classification and accuracy assessment of various classifiers

CO 5 To acquaint with various advanced classification techniques available for feature extraction

TEXTBOOKS:
1. John,R.Jensen, Introductory Digital Image Processing, Prentice Hall, NewJersey, 2021 Fourth edition.
2. Robert,A.Schowengergt, Techniques for Image Processing and classification in Remote Sensing,1983.

REFERENCES:
1. Robert, G. Reeves,-Manual of Remote Sensing Vol.I &II- American Society of Photogrammetry ,Falls ,Church, USA,1983.
2. John.A Richards, Remote sensing digital Image Analysis – An Introduction Springer-Verlag, Fifth Edition, 2014.
3. Digital Image Processing by Rafael C. Gonzalez, Richard Eugene Woods - Pearson/Prentice Hall,Fourth edition, 2022.
4. Fundamentals of Digital Image Processing by Annadurai Pearson Education (2007)

GI3403   **MICROWAVE REMOTE SENSING**   **L T P C**
                                                                             3 0 0 3

OBJECTIVES:

- To impart the knowledge on Microwave Remote Sensing and its applications.

UNIT I   FUNDAMENTALS AND ACTIVE SYSTEM   9
Introduction–Radar frequency bands – SLAR - Antenna System – SLAR Imaging Geometry – RADAR equation – Resolution concepts: Range and Azimuth resolution – Synthetic Aperture Radar - Geometric Distortions – Multilook averaging and speckle correction.

UNIT II   RADAR INETERACTION WITH EARTH FEATURES   9
System parameters - target parameters: roughness scales and criteria, dielectric constant and penetration depth – Surface backscattering models: Clapp, Facet, Bragg resonance models and Hard targets – Volume backscattering – RADAR Image signatures.

UNIT III   IMAGING AND NON IMAGING SENSING   9
SAR Interferometry-Basics- Differential SAR Interferometry-applications polarimetry- Introduction - Polarization Ellipse - Polarization types –- Synthesis and signatures – Polarimetric parameters- Information extraction – Polarimetric Image Interpretation and applications. Altimetry - Principle – Frequency bands – Location Systems- missions, Scatterometry- Scatterometer types and calibration - missions

UNIT IV   SAR APPLICATIONS   9
Airborne, Space borne – different platforms and sensors- History- ENVISAT, ASAR, ALOS / PALSAR- RADARSAT , RISAT, GRACE and Sentinel 3 missions - SAR Data products and selection procedure - Applications in Agriculture- Forestry - Geology –Hydrology – snow cover mapping-snow depth estimation – Landuse/landcover mapping – Ocean related studies.

UNIT V   PASSIVE SYSTEM   9
Radiometry- Passive microwave sensing components - Blackbody radiation and Grey body radiation – Emissivity, Radiometers – Components - Brightness temperature - Antenna temperature - Power-temperature correspondence, passive microwave interaction with atmospheric constituents - Emission characteristics of various earth features – Data products and Applications - Passive missions-DMSP, TRMM, Aqua missions, AMSR-E, AMSU.

                                                                TOTAL: 45 PERIODS

COURSE OUTCOMES:

- On completion of the course, the student is expected to
CO 1 Understand the fundamentals of microwave remote sensing system such as SLAR, RAR and SAR
CO 2 Learn the interaction mechanism of Radar with target features
CO 3 Understand the principles and applications of Imaging and Non-Imaging observation
CO 4 Learn the about the satellite sensing system and applicability of SAR
CO 5 Understand the concepts of passive microwave systems and applications

TEXTBOOKS:

1. Ulaby, F.T., Moore, R.K, Fung, A.K, "Microwave Remote Sensing; active and passive, Vol. 1,2 and 3, Addison - Wesley publication company, 2001.
2. John R.Jensen,"Remote Sensing of the Environment: An Earth Resource Perspective",Pearson Education India, 2013.
3. John A.Richards,"Remote Sensing with Imaging RADAR", Springer,2009.

REFERENCES:
1. Prashant Srivastava, Dillep Gupta, Tanvir Islam, Dawei Han,Rajendra Prasad,"RADAR Remote Sensing Application and Challenges", Elsevier,2022.
2. Pranab Kumar Karmakar Microwave Propagation And Remote Sensing Atmospheric Influences With Models And Applications, Taylor & Francis,CRC Press, 2020
3. Alessandro Ferretti ,"Satellite InSAR data: Reservoir monitoring from Space", EAGE Publications, 2014.
4. Jhon R.Schott, Fundamentals of Polarimetric Remote Sensing , SPIE press, 2010
5. Woodhouse Iain. H, "Introduction to Microwave Remote Sensing" Taylor & Francis, 2006.

GI3491	CARTOGRAPHY AND GIS	L T P C
		3 0 0 3

OBJECTIVES:
* To introduce concepts of Cartography and GIS
* To expose the process of map making and production
* To introduce GIS data structures, data input and data presentation

UNIT I   ELEMENTS OF CARTOGRAPHY   9

Definition of Cartography – Maps – Functions – Uses and Types of Maps – Map Scales and Contents – Map Projections – Shape, Distance, Area and Direction Properties – Perspective and mathematical Projections – Indian Maps and Projections – Map Co-ordinate System – UTM and UPS References.

UNIT II   MAP DESIGN AND PRODUCTION   9

Elements of a Map – Map Layout Principles – Map Design Fundamentals – Symbols and Conventional Signs – Graded and Ungraded Symbols – Color Theory – Colours and Patterns in Symbolization – Map Lettering – Map Production – Map Printing – Colours and Visualization – Map Reproduction – Map Generalization – Geometric Transformations – Bilinear and Affine Transformations.

UNIT III   FUNDAMENTALS OF GIS   9

Introduction to GIS – Definitions – History of GIS – Components of a GIS – Hardware, Software, Data, People, Methods – Introduction to data quality – Types of data – Spatial, Attribute data – types of attributes – scales/levels of measurements – spatial data models – Raster Data Structures – Raster Data Compression – Vector Data Structures – Raster Vs Vector Models – TIN and GRID data models.

UNIT IV   DATA INPUT AND TOPOLOGY   9

Scanner – Raster Data Input – Raster Data File Formats – Georeferencing– Vector Data Input – Digitizer– Datum Projection and Reprojection – Coordinate Transformation – Topology - Adjacency, Connectivity and containment – Topological Consistency – Non topological file formats – Attribute Data Linking – Linking External Databases – GPS Data Integration – Raster to Vector and Vector to Raster Conversion.

UNIT V   DATA QUALITY AND OUTPUT   9

Assessment of Data Quality - Basic Aspects - Completeness, Logical Consistency, Positional Accuracy, Temporal Accuracy, Thematic Accuracy and Lineage – Metadata – GIS Standards – Interoperability – OGC - Spatial Data Infrastructure – Data Output – Map Compilation – Chart / Graphs.

TOTAL:45 PERIODS

COURSE OUTCOMES:

•On completion of the course, the student is expected to

CO 1 Be familiar with appropriate map projection and co-ordinate system for production of Maps and shall able to compile and design maps for their required purpose.

CO 2 Be familiar with co-ordinate and Datum transformations

CO 3 Understand the basic concepts and components of GIS, the techniques used for storage of spatial data and data compression

CO 4 Understand the concepts of spatial data quality and data standard

CO 5 Understand the concept of spatial data inputs

TEXTBOOKS:

1. Arthur H. Robinson et al, "Elements of Cartography", 7th Edition, Wiley, 2002.
2. Kang – Tsung Chang, "Introduction to Geographic Information Systems", McGraw Hill Publishing, Fourth Edition, 2017.
3. Ian Heywood, Sarah Cornelius, Steve Carver, Srinivasa Raju, "An Introduction to Geographical Information Systems, Pearson Education, Fourth Edition, 2011.

REFERENCES:

1. John Campbell, "Introductory Cartography", Wm. C.BrownPublishers,3rd Edition,2004
2. Chor Pang LO, Albert K. W. Yeung, "Concepts and Techniques of Geographic Information Systems", Pearson Education, 2nd Edition, November 2016. ISBN: 9789332581883.

GI3492   **TOTAL STATION AND GPS SURVEYING**   **L T P C**
                                                        3 0 0 3

OBJECTIVES:

•   To understand the working of Total Station and GPS and solve the surveying problems.

UNIT I   **FUNDAMENTALS OF TOTAL STATION AND ELECTROMAGNETIC WAVES**   **9**

Methods of Measuring Distance, Basic Principles of Total Station, Historical Development, Classifications, applications and comparison with conventional surveying - Applications of Electromagnetic waves, Propagation properties, wave propagation at lower and higher frequencies – Refractive index (RI) – factors affecting RI -Computation of group for light and near infrared waves at standard and ambient conditions – Computation of RI for microwaves at ambient condition – Reference refractive index -Real-time application of first velocity correction. Measurement of atmospheric parameters - Mean refractive index – Second velocity correction -Total atmospheric correction - Use of temperature -pressure, transducers.

UNIT II   **ELECTRO-OPTICAL AND MICROWAVE**   **9**

Electro - optical system: Measuring principle, Working principle, Sources of Error, Infrared and Laser Total Station instruments.

Microwave system: Measuring principle, working principle, Sources of Error, Microwave Total Station instruments. Comparison between Electro-optical and Microwave system. Care and maintenance of Total Station instruments.

COGO functions: Area, Inverse / MLM, REM, Resection, offsets and stakeout - Land survey applications.

UNIT III   **SATELLITE SYSTEM**   **9**

Basic concepts of GPS – Historical perspective and development – applications -Geoid and Ellipsoid – satellite orbital motion – Keplerian motion – Kepler's Law – Perturbing forces -Geodetic satellite – Doppler effect – Positioning concept – GNSS and IRNSS – SBAS: GAGAN and WAAS Different segments - space, control and user segments – satellite configuration – GPS signal structure – Orbit determination and representation – Anti Spoofing and Selective Availability -Task of control segment – GPS receivers.

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UNIT IV GPS DATA PROCESSING 9
GPS observables – code and carrier phase observation – linear combination and derived observables – concept of parameter estimation – downloading the data – RINEX Format–Differential data processing – software modules - solutions of cycle slips, ambiguities - Multi path and other observational errors – satellite geometry and accuracy measures – Continuously Operating Reference System (CORS)– long base line processing - use of different processing software's: Open Source, Scientific and Commercial.

UNIT V SURVEYING METHODS AND APPLICATIONS 9
Total Station: Traversing and Trilateration measurement and adjustment –Planimetric map and Contour map and Topography Mapping.
GNSS: Concepts of rapid, static, semi-Kinematic, pure Kinematic and RTK methods. Observation by Radiation, Lee frog and Trilateration measurement and processing -Topography mapping using PPK and RTK methods
Total Station and GNSS applications

TOTAL:45 PERIODS

COURSE OUTCOMES:
•On completion of the course, the student is expected to
CO 1 Learn about the fundamental concept of Total station.
CO 2 Provide knowledge about electromagnetic waves and its usage in Total station and GNSS.
CO 3 Gain Knowledge on basic concepts of GNSS
CO 4 Understand the measuring and working principle of electro optical and Microwave Total station and GPS
CO 5 Gain knowledge about Total station and GNSS data processing and Mapping.

TEXTBOOKS:
1. Rueger, J.M. Electronic Distance Measurement, Springer-Verlag, Berlin, 4th Edition,1996.
2. SatheeshGopi, rasathishkumar, N.madhu, — Advanced Surveying , Total Station GPS and Remote Sensing — Pearson education , 2nd Edition,2017. isbn: 978-81317 00679.
3. Gunter Seeber , Satellite Geodesy, Walter De Gruyter, Berlin, 2nd Edition, 2003

REFERENCES:
1. R.Subramanian, Surveying and Levelling, Oxford University Press, Second Edition, 2012.
2. Laurila, S.H. Electronic Surveying in Practice, John Wiley and Sons Inc, 1983
3. Guocheng Xu, GPS Theory, Algorithms and Applications, Springer - Verlag, Berlin,3rdEdition,2016.
4. Alfred Leick, GPS satellite surveying, John Wiley & Sons Inc., 4th Edition, 2015.

PROGRESS THROUGH KNOWLEDGE

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

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

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

UNIT III   RENEWABLE SOURCES OF ENERGY   6

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

UNIT IV   SUSTAINABILITY AND MANAGEMENT   6

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

UNIT V   SUSTAINABILITY PRACTICES   6

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

TOTAL:30 PERIODS

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

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

GI3411   TOTAL STATION AND GPS SURVEYING LABORATORY   L T P C
                                                                        0 0 4 2

OBJECTIVES:
- To train the students to acquire skill in making precise measurements and obtaining accurate results with Total Station and GPS.

EXCERCISES:
1. Temporary adjustment of Total station and Angle, Distance and Coordinate measurement
2. Establishment of Horizontal control point by Traversing
3. To determine the instrument station coordinate by Resection method (Angles only and Distances only)
4. Application COGO function: Area, MLM / Inverse function, REM and offsets

34

5. Planimetric mapping using Total Station
6. Preparation of Contour map using Total Station
7. Setting out: by Coordinates, by Distance and angle, Points at equal length
8. Navigation and Feature collection using handheld GPS
9. GNSS Planning
10. Accuracy evaluation of baseline with different common observation times
11. Establishment of Ground Control Point using Static / Rapid Static differential GNSS survey by Lee Frog Method
12. Establishment of Ground Control Point using Static / Rapid Static differential GNSS survey by Trilateration method
13. Preparation of Planimetric map using Post Processed Kinematic (PPK) method
14. Network Adjustment of GNSS observation

TOTAL: 60 PERIODS

COURSE OUTCOMES:

•On completion of the course, the student is expected to
CO 1 Gain the basic idea about Total station and GNSS.
CO 2 Acquire knowledge about establishment of horizontal control point using Total station and GNSS.
CO 3 Impart Knowledge in preparation of contour map using Total station and GNSS.
CO 4 Understand the various coordinate geometry function in Total station and GPS
CO 5 Gain knowledge about Total station and GNSS data processing, network adjustment and Mapping.

REFERENCES:

1. Rueger, J.M. Electronic Distance Measurement, Springer-Verlag, Berlin, 4th Edition,1996.
2. Satheesh Gopi, rasathishkumar, N.madhu, ― Advanced Surveying , Total Station GPS and Remote Sensing ― Pearson education , 2nd Edition,2017. isbn: 978-81317 00679.
3. Seeber G, Satellite Geodesy, Walter De Gruyter, Berlin, 2003
4. R.Subramanian, Surveying and Levelling, Oxford University Press, Second Edition, 2012.
5. Laurila, S.H. Electronic Surveying in Practice, John Wiley and Sons Inc, 1983
6. Guocheng Xu, GPS Theory, Algorithms and Applications, Springer - Verlag, Berlin,3rd Edition,2016.
7. Alfred Leick, GPS satellite surveying, John Wiley & Sons Inc., 4th Edition, 2015.

GI3412	**CARTOGRAPHY AND GIS LABORATORY**	L T P C
		0 0 2 1

OBJECTIVES:

• Hands on experience of basics of cartography and GIS.
• Designing the map
• Development of GIS database and populating attribute data

EXCERCISES:

1. Simple conical,cylindrical and planar projection for the reduced earth having 2to4 cm radius – aspect and secant demo.
2. Graded symbolization and isopleth/choropleth map
3. Map compilation and Design
4. Data Input –Onscreen Digitization –Creation of Point, Line and Polygon layers
5. Projection, Reprojection and Coordinate Transformation of Maps
6. Attribute data input and Measurement of Distance, Area
7. Linking External Database and Tabular Data Analysis using SQL commands
8. Generating Graphs,Charts and Diagrams from Tabular data
9. Data Conversion –Vector to Raster and Raster to Vector
10. Map Joining, Edge Matching and Layout Design

TOTAL:30 PERIODS

35

COURSE OUTCOMES:

•On completion of the course, the student is expected to

CO 1   Design and produce thematic maps with suitable projection, symbols and color codes
CO 2   Compile and develop digital maps
CO 3   Create spatial database and non-spatial databases in GIS environment
CO 4   Analyze spatial database and generate reports, maps
CO 5   Represent spatial data in a professional format

REFERENCES:
1.   Arthur,H.Robinson,Elements of Cartography, Seventh Edition, John Wiley and Sons, 2002.
2.   C.P.Lo Albert K.W.Yeung, "Concepts and Techniques of Geographic Information Systems", Pearson Education, Second Edition, 2016.

LIST OF EQUIPMENTS
1.   i7 computer system with minimum 4GBRAM, 500GB HDD-15 Numbers for 30 students
2.   Standard GIS Software-15 user licenses.

GI3413	DIGITAL IMAGE PROCESSING LABORATORY	L T P C
		0 0 4 2

OBJECTIVES:
● To familiarize the undergraduate level students in the regular Image Processing Software.

EXCERCISES:
1.   Image reading and writing
2.   Pre-processing techniques: radiometric correction
3.   Random and Periodic Noise removal
4.   Pre-processing techniques: Ground control and rectification
5.   Enhancements – histogram, filters
6.   Band ratioing and normalization – NDVI, SAVI & NDWI
7.   PCA
8.   Image fusion
9.   Classification –supervised &unsupervised
10. Sub pixel classification
11. Classification using Neural Network and Fuzzy Logic
12. Accuracy assessment – correlation, RMSE & kappa
13. Crop conditioning assessment/ inundation damage assessment/ forest fire/ change dynamic analysis

TOTAL: 60 PERIODS

COURSE OUTCOMES:

•On completion of the course, the student is expected to
CO 1   Enhance satellite imagery through filtering, band ratioing , PCA etc
CO 2   Georeference and project the satellite imagery
CO 3   Classify and assess accuracy of classification.
CO 4   Perform advanced classifier
CO 5   Carry out mini project in any of the application

TEXT BOOK
1.   Richards, Remote sensing digital Image Analysis –An Introduction Springer-Verlag1993.

LIST OF EQUIPMENTS
1.   Number of i7 Computer system   - 15 for 30 students (two students per system).
2.   Standard Satellite image processing software - 15 user licenses.
3.   Satellite data indifferent spatial resolution and corresponding Toposheets.
4.   A1size Scanner and Color plotter.