

K.L.N. COLLEGE OF ENGINEERING

Pottapalayam-630612, Sivagangai District

(An Autonomous Institution, Affiliated to Anna University, Chennai)



Estd: 1994

FIRST & SECOND YEAR CURRICULA AND SYLLABI

REGULATIONS 2020

For Under Graduate Program

B.E. – MECHANICAL ENGINEERING

CHOICE BASED CREDIT SYSTEM

(For the students admitted from the academic year 2020-2021 onwards)



K.L.N. COLLEGE OF ENGINEERING, POTTAPALAYAM

(An Autonomous Institution, Affiliated to Anna University, Chennai)



VISION OF THE INSTITUTION

To become a Centre of Excellence in Technical Education and Research in producing Competent and Ethical professionals to the society.

MISSION OF THE INSTITUTION

To impart Value and Need based curriculum to the students with enriched skill development in the field of Engineering, Technology, Management and Entrepreneurship and to nurture their character with social concern and to pursue their career in the areas of Research and Industry.

VISION OF THE DEPARTMENT

To become a centre of excellence for Education and Research in Mechanical Engineering.

MISSION OF THE DEPARTMENT

- Attaining academic excellence through effective teaching learning process and state of the art infrastructure.
- Providing research culture through academic and applied research.
- Inculcating social consciousness and ethical values through co-curricular and extra-curricular activities.



K.L.N. COLLEGE OF ENGINEERING, POTTAPALAYAM

(An Autonomous Institution, Affiliated to Anna University, Chennai)



PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

- PEO 1** Graduates will have successful career in Mechanical Engineering and service industries.
- PEO 2** Graduates will contribute towards technological development through academic research and industrial practices.
- PEO 3** Graduates will practice their profession with good communication, leadership, ethics and social responsibility.
- PEO 4** Graduates will adapt to evolving technologies through life-long learning.

PROGRAM SPECIFIC OUTCOMES (PSOs)

- PSO 1** Derive technical knowledge and skills in the design, develop, analyze and manufacture of mechanical systems with sustainable energy, by the use of modern tools and techniques and applying research based knowledge.
- PSO 2** Acquire technical competency to face continuous technological changes in the field of mechanical engineering and provide creative, innovative and sustainable solutions to complex engineering problems.
- PSO 3** Attain academic and professional skills for successful career and to serve the society needs in local and global environment.



K.L.N. COLLEGE OF ENGINEERING, POTTAPALAYAM

(An Autonomous Institution, Affiliated to Anna University, Chennai)



PO1: Engineering knowledge

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

PO2: 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.

PO3: 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.

PO4: 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.

PO5: 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.

PO6: 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.

PO7: 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.

PO8: Ethics

Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work

Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: 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.

PO11: 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.

PO12: 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.



K.L.N. COLLEGE OF ENGINEERING, POTTAPALAYAM
(An Autonomous Institution, Affiliated to Anna University, Chennai)



REGULATIONS 2020
For Under Graduate Program
B.E. – MECHANICAL ENGINEERING
CHOICE BASED CREDIT SYSTEM

CATEGORY OF COURSES

- i. **Humanities and Social Sciences (HS) Courses** include Technical English, Environmental Science and Engineering, Engineering Ethics and human values, Communication Skills and Management courses.
- ii. **Basic Sciences (BS) Courses** include Mathematics, Physics, and Chemistry.
- iii. **Engineering Sciences (ES) Courses** include Engineering Practices, Engineering Graphics, Basics of Electrical / Electronics / Mechanical / Computer Engineering / Instrumentation etc.
- iv. **Professional Core (PC) Courses** include the core courses relevant to the chosen programme of study.
- v. **Professional Elective (PE) Courses** include the elective courses relevant to the chosen programme of study.
- vi. **Open Elective (OE) Courses** include courses from other departments which a student can choose from the list specified in the curriculum of the students B.E. / B.Tech. Programmes.
- vii. **Employability Enhancement Courses (EEC)** include Project Work and/or Internship, Seminar, Professional Practices, Case Study and Industrial/Practical Training.
- viii. **Mandatory (MC) Courses** include Personality and Character development and the courses recommended by the regulatory bodies such as AICTE, UGC, etc

KLNCE UG MECH R2020

SEMESTER I

(Common to all B.E/B.Tech Programmes)

S. No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1	20HS101	English for Technical Communication	HS	3	3	0	0	3
2	20BS101	Fundamentals of Engineering Mathematics	BS	4	3	1	0	4
3	20BS102	Engineering Physics	BS	3	3	0	0	3
4	20BS103	Engineering Chemistry	BS	3	3	0	0	3
5	20GE101	Problem Solving using Python Programming	ES	3	3	0	0	3
PRACTICAL								
6	20BS1L1	Basic Science Laboratory	BS	3	0	0	3	1.5
7	20GE1L1	Python Programming Laboratory	ES	4	0	0	4	2
8	20GE1L2	Industrial Practices Workshop	ES	3	0	0	3	1.5
TOTAL				26	15	1	10	21

SEMESTER II

S. No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1	20HS201	Advanced Technical Communication (Common to all B.E./B.Tech programmes)	HS	3	3	0	0	3
2	20BS201	Laplace Transform and Advanced Calculus (Common to all B.E./B.Tech programmes)	BS	4	3	1	0	4
3	20BS202	Applied Physics	BS*	3	3	0	0	3
4	20GE201	Engineering Graphics (Common to all B.E./B.Tech programmes)	ES	4	2	0	2	3
5	20GE202	Engineering Mechanics	ES*	4	3	1	0	4
6	20GE203	Basic Electrical, Electronics and Instrumentation Engineering	ES*	3	3	0	0	3
PRACTICAL								
7	20HS2L1	Communication Skills Laboratory (Common to B.E CSE, B.Tech IT , B.E MECH, B.E AUE & B.Tech AIDS programmes)	HS	2	0	0	2	1
8	20GE2L1	Electrical, Electronics and Instrumentation Laboratory	ES*	4	0	0	4	2
TOTAL				27	17	2	8	23

* Common to B.E Mech & B.E Au.Engg programmes

SEMESTER III

S. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	20BS301	Transforms and Partial Differential Equations (Common to Mech,EEE & AUE programmes)	BS	4	3	1	0	4
2.	20ME301	Strength of Materials	ES*	3	3	0	0	3
3.	20ME302	Fluid Mechanics and Machinery	ES*	3	3	0	0	3
4.	20ME303	Manufacturing Processes	PC	3	3	0	0	3
5.	20ME304	Engineering Thermodynamics	PC	4	3	1	0	4
6.	20HS301	Universal Human Values (Common to all B.E./B.Tech programmes)	HS	3	2	1	0	3
PRACTICALS								
7.	20ME3L1	Strength of Materials Laboratory	ES*	3	0	0	3	1.5
8.	20ME3L2	Fluid Mechanics and Machinery Laboratory	ES*	3	0	0	3	1.5
TOTAL				26	17	3	6	23

SEMESTER IV

S. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	20BS401	Statistics and Numerical Methods	BS*	4	3	1	0	4
2.	20ME401	Kinematics of Machines	PC	4	3	1	0	4
3.	20ME402	Manufacturing Technology	PC	3	3	0	0	3
4.	20ME403	Thermal Engineering	PC	4	3	1	0	4
5.	20HS401	Environmental Science and Engineering (Common to all B.E./B.Tech programmes)	HS	2	2	0	0	2
THEORY CUM PRACTICAL								
6.	20ME404	Metrology and Measurement Practices	PC	5	3	0	2	4
PRACTICALS								
7.	20ME4L1	Manufacturing Technology Laboratory	PC*	3	0	0	3	1.5
8.	20ME4L2	Thermal Engineering Laboratory	PC	3	0	0	3	1.5
TOTAL				28	17	3	8	24

* Common to B.E Mech & B.E Au.Engg programmes

20HS101	ENGLISH FOR TECHNICAL COMMUNICATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- This course is designed for entry level Engineering and Technology curriculum enabling the students to learn, acquire and apply for their learning and career.
- The course is aimed at providing effective skills for promoting communication skills through English.
- Students will benefit in conversing with the peers, faculty and fellow professionals.
- The outcome of this course contains refined level of English proficiency by acquiring all four skills, listening, speaking, reading and writing to prepare them for global readiness.

PRE-REQUISITE: NIL

UNIT - I FOCUSING LANGUAGE DEVELOPMENT 9

Listening: Listening to TV News, Guest Lecturers, Note – taking. **Speaking:** Pronunciation Common Vocabulary – Technical Vocabulary – Answering Peer Questions – Conversation with Teacher. **Reading:** News magazines, Reading for unfamiliar words, Variety of News Items

Writing: Word formation – Auxiliary verbs – Modal Verbs – Sentence Types – Affirmative, Negative, Interrogative, Concord – Dialogue Writing, Letter to Principal / Director – Instructions using Auxiliary

UNIT - II GRAMMAR AND TECHNICAL READING 9

Listening: Listening to Peer Conversations – Brief Speeches – Listening for Specific Information – Recap of Speeches. **Speaking:** Wh Questions, Day today conversations, Telephonic enquiries official/formal enquiries. **Reading:** Technical Essays – Identifying Sentence Types – Classifying the verb patterns. **Writing:** Tenses – Simple Present, Present Progressive, Present Perfect, Present Perfect Continuous – Voice – Active & Passive – Précis Writing – Essay Writing

UNIT - III GRAMMAR AND LANGUAGE DEVELOPMENT 9

Listening: TV interviews, Commentaries, Digital Videos for World Information. **Speaking:** Telephonic Conversation – Classroom Activities – Conversing Information. **Reading:** Coherence, Development of Thoughts. **Writing:** Tenses – Simple Past, Past Progressive, Past Perfect, Past perfect continuous – Impersonal Passive-Narrating the past events, Letter to friend/father about Industrial Visit/Functions held – Narrating the past experience using Impersonal Passive voice

UNIT - IV READING AND LANGUAGE DEVELOPMENT 9

Listening: Listening to Dialects of English – British & American Regional. **Speaking:** Role Plays, Extempore, Responding to specific questions. **Reading:** Comprehensive passages, Reading for specific points. **Writing:** Tenses – Simple Future, Future progressive, Future Perfect, Future Perfect continuous – Definition – Phrases of Reason – Cause & Effect, Recommendations, Argumentative Essays, Letter to the Editor on Social Issues – Analytical Essays on Social hazards using Cause and Effect.

UNIT - V EXTENDED WRITING

9

Listening: Listening to Technical Seminar speeches – Listening to achievers, eminent personalities – Dialects – Australian – African – Asian. **Speaking:** Welcome address, Compeering, Vote of Thanks, Peer debates. **Reading:** Texts on self-confidence, motivation, success path. **Writing:** Contracted forms, Conditionals, Articles, Preposition, Tense – ‘going to’ - Error Spotting, Sequence Words – Rearranging – Writing a Book Review – Summary writing – Rearranging Sentences using Sequence Words, Note Making

TOTAL: 45 PERIODS

OUTCOMES:

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

- Listen, Comprehend and Correspond with others at various contexts
- Speak legibly and fluently under various life-time situations by applying proper communication modules.
- Read and understand a variety of writings and technical text by analyzing the meaning and language.
- Apply clear and legible writing skills in error free style in coherent manner
- Remember and use various communicative skills in precise and efficient way on technological contexts
- Form situational conversations and technical writing styles for interpersonal and effective communication

TEXT BOOKS:

1. Board of Editors. “Using English A Course book for Undergraduate Engineers and Technologists”. Orient Black Swan Limited, Hyderabad: 2015
2. Richards, C. Jack. “Interchange Students’ Book-2” New Delhi: CUP, 2015.

REFERENCES:

1. Murphy, Raymond “English Grammar in Use with Answers: Reference and Practice for Intermediate Students”, Cambridge: CUP, 2004
2. Thomson, A.J. and Martinet, A.V. “A Practical English Grammar”, OUP, New Delhi: 1986
Anne Laws, “Writing Skills”, Orient Black Swan, Hyderabad, 2011
3. Board of Editor, “English for Technical Communication”, Great Mind Publication, Chennai : 2018

20BS101	FUNDAMENTALS OF ENGINEERING MATHEMATICS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To relate various methods of Matrix Algebra to handle practical problems arising in the field of engineering.
- The main aim of this course is to achieve conceptual understanding and to retain the best traditions of Calculus.
- The syllabus is designed to provide the basic tools of Calculus of Single and Multivariable, mainly for the purpose of modeling the engineering problems mathematically and obtaining solutions.

PRE-REQUISITE: NIL

UNIT - I MATRICES 12

Introduction to Matrices-Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton Theorem – Diagonalization of matrices – Reduction of a Quadratic form to Canonical form by Orthogonal transformation – Nature of Quadratic forms.

UNIT - II DIFFERENTIAL CALCULUS 12

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules - Differentiation of Polynomials, Exponential, Trigonometric, Hyperbolic, Logarithmic and Implicit functions- Maxima and Minima of functions of single variable.

UNIT – III FUNCTIONS OF SEVERAL VARIABLES 12

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 – Maxima and Minima of functions of two variables – Lagrange’s method of undetermined multipliers.

UNIT – IV INTEGRAL CALCULUS 12

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.

UNIT – V ORDINARY DIFFERENTIAL EQUATIONS 12

Higher order linear differential equations with constant coefficients - Method of variation of parameters – Homogenous equation of Euler’s and Legendre’s type – System of simultaneous linear differential equations with constant coefficients.

TOTAL: 60 PERIODS

OUTCOMES:

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

- Find the Eigen values and Eigen vectors to diagonalize a matrix, reduce quadratic form to canonical form.
- Apply the concept of limits, continuity and rules of differentiation to differentiate some standard functions and apply the techniques of differentiation to differentiate various types of functions.
- Understand the concepts of Concavity and Convexity by finding the Critical points, point of Inflection and to find Maxima and Minima functions of Single variable.
- Find the derivatives of functions of two variables and apply them to calculate the maxima and minima.
- Evaluate integrals using techniques of integration, such as substitution, partial fractions and integration by parts.
- Apply various techniques to solve higher order differential equations with constant and variable coefficients.

TEXT BOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2017.
2. T. Veerarajan., "Engineering Mathematics", The Tata Mc Graw Hill Publication-New Delhi, First Edition, 2018

REFERENCES:

1. James Stewart, "Calculus, Early Transcendental", Cengage Learning, 7th Edition, New Delhi, 2015. [For units II & III].
2. Kreyszig Erwin, "Advanced Engineering Mathematics", John Wiley and Sons, 9th Edition, New Delhi, 2006.
3. Wiley, "Calculus- International Student version", 10th Edition, Wiley India Pvt. Ltd, New Delhi 2017.
4. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 5th Edition, 2016.
5. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.), New Delhi, 9th Edition, 2014.

20BS102**ENGINEERING PHYSICS**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To inculcate the fundamental knowledge in properties of matter and crystal physics.
- To enrich the knowledge on Laser, fiber optics and ultrasonics and their applications relevant to various streams of Engineering and Technology.
- To introduce quantum physics and its applications.

PRE-REQUISITE: NIL**UNIT - I PROPERTIES OF MATTER 9**

Elasticity – Hooke's Law – Stress-strain diagram and its uses – Three modulus of elasticity (qualitative) – Poisson's ratio – factors affecting elastic modulus and tensile strength – twisting couple – torsional pendulum: theory and experiment – bending of beams – bending moment – cantilever: theory and experiment – uniform and non-uniform bending: theory and experiment – I -shaped girders.

UNIT - II LASER AND FIBER OPTICS 9

Lasers: Interaction of radiation with atomic energy states – Einstein's A and B coefficients derivation – Population inversion – resonant cavity, optical amplification (qualitative) – solid state lasers – Nd:YAG laser, Semiconductor lasers: homojunction and heterojunction – Fiber optics: principle, numerical aperture and acceptance angle – types of optical fibers (material, refractive index, mode) – losses associated with optical fibers – fiber optic sensors: pressure and displacement sensor.

UNIT - III ULTRASONICS 9

Ultrasonics – classification (qualitative) – properties – generation – magnetostriction and piezoelectric methods – detection of ultrasound – cavitations – velocity measurement – acoustic grating – Industrial applications (Drilling, Welding, Soldering and Cleaning) – SONAR – NDT – Pulse Echo system through Transmission and Reflection modes – A, B and C scan displays - Medical application – sonogram.

UNIT - IV QUANTUM PHYSICS 9

Black body radiation – Planck's theory (derivation) – Compton effect: theory and experimental verification – wave particle duality – wave function and its physical significance – Schrödinger's wave equation – time independent and time dependent equations – particle in a one-dimensional rigid box – tunneling (qualitative) – scanning tunneling microscope.

UNIT - V CRYSTAL PHYSICS 9

Crystalline and amorphous materials – unit cell, crystal systems, Bravais lattices, lattice planes - Miller indices – Inter planar spacing in cubic lattice – coordination number and packing factor for SC, BCC, FCC, HCP structures – growth of single crystals: solution and melt growth techniques – Mechanisms of plastic deformation, slip and twinning.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Demonstrate the properties of elasticity and measure the different moduli of elasticity.
- Examine the characteristics of laser and optical fiber
- Apply the concepts of ultrasonics in engineering
- Explain black body radiation, properties of matter waves and Schrodinger equation
- Classify the Bravais lattices and different types of crystal structures
- Gain information on growth of crystals and deformations

TEXT BOOKS:

1. R. K. Gaur and S. L. Gupta, "Engineering Physics", Dhanpat Rai Publications, 2012.
2. B. K. Pandey and S. Chaturvedi, "Engineering Physics", Cengage Learning India, 2018.
3. V.Rajendran, "Engineering Physics", Tata McGraw Hill Education Private Limited, 2011.

REFERENCES:

1. D.Halliday, R. Resnick and J. Walker, "Principles of Physics", Wiley publisher, 10th Edition, 2015.
2. R.A.Serway and J.W. Jewett, "Physics for Scientists and Engineers", Cengage Learning, 2014.
3. P.A.Tipler and G. Mosca, "Physics for Scientists and Engineers with Modern Physics", W.H.Freeman, 2007.
4. D.K.Bhattacharya and T. Poonam, "Engineering Physics", Oxford University Press, 2017.

20BS103	ENGINEERING CHEMISTRY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To make the students, familiar with boiler feed water requirements, related problems and water treatment techniques.
- To learn the principle of electrochemical cell, types of corrosion and its control.
- To develop an understanding of the basic concepts of phase rule and its applications to one and two component systems and appreciate the purpose and significance of alloys.
- To be familiar with different types of fuel and their characteristics and also functioning of energy storage devices.
- To understand the techniques of spectra and chromatography for analytical purpose.

PRE-REQUISITE: NIL

UNIT - I WATER AND ITS TREATMENT 9

Characteristics of water; Hard water, Soft water, difference; Hardness – types of hardness, expression of hardness, units, removal of hardness (boiling, soda lime process), estimation of hardness of water by EDTA method (problems); Boiler feed water – requirements – disadvantages of using hard water in boilers (scale and sludge, priming and foaming, caustic embrittlement, boiler corrosion); Treatment of boiler feed water – internal treatment (carbonate, phosphate, and calgon conditioning) external treatment – ion exchange process, zeolite process; Purification of water - reverse osmosis, electro dialysis, Application of nanomaterials in water purification.

UNIT - II ELECTROCHEMISTRY AND CORROSION 9

Electrochemical cell - redox reaction, electrode potential- origin of electrode potential- oxidation potential- reduction potential, - electrochemical series and its significance - Nernst equation (derivation and problems). Corrosion- causes- factors, electrochemical corrosion (galvanic, differential aeration), corrosion control - material selection and design aspects - electrochemical protection – sacrificial anode method and impressed current cathodic method – corrosion inhibitors. Metallic coating – Electroplating – Factors - Electroplating of Copper and Electroless plating of Nickel.

UNIT - III PHASE RULE AND ALLOYS 9

Phase rule - introduction, definition of terms with examples; One component system - water system; Reduced phase rule - two component system, classification, lead-silver system; Alloys – introduction, definition, properties of alloys, significance of alloying; Functions and effects of alloying elements; Heat treatment of steel - annealing, hardening, tempering, carburizing, nitriding; Ferrous alloys- nichrome and stainless steel (18/8); Non-ferrous alloys – brass and bronze.

UNIT - IV FUELS AND BATTERIES 9

Fuels – classification, characteristics; Petrol – characteristics, knocking, octane number; Diesel – characteristics, cetane number; Natural gas (CNG), LPG, Power alcohol, Biodiesel, Gasohol; Combustion of fuels – calorific value, GCV and NCV (Problems), calculation of theoretical air for combustion (Problems), Ignition temperature, explosive range, flue gas analysis (Orsat apparatus);

Batteries – primary and secondary batteries, lead-acid battery, lithium ion battery, Fuel cell (hydrogen oxygen fuel cell).

UNIT - V ANALYTICAL TECHNIQUES**9**

Spectroscopic techniques – UV-visible(Principle and Instrumentation – Block Diagram only and applications), IR(Principle and Instrumentation – Block Diagram only and applications), ¹H NMR ((Principle and Instrumentation – Block Diagram only) – Chromatography – HPLC - Flame photometry – Estimation of sodium by Flame photometry.

TOTAL: 45 PERIODS**OUTCOMES:****AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

- Identify the problems of hardness of water in boilers and to treat water by various methods.
- Construct electrochemical cell and apply Nernst equation for an electrochemical cell and identify various methods to control corrosion.
- Analyse the phase diagram of one component and two component system and describe the various methods of heat treatment of steel.
- Categorise the various types of fuels by their characteristics and analyse the flue gas by Orsat's method.
- Illustrate the working of lead acid battery, lithium ion battery and fuel cell.
- Describe the instrumentation and working of UV, IR, ¹HNMR, HPLC, and flame photometry.

TEXT BOOKS:

1. P.C. Jain and Monika Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company (P) LTD, New Delhi, 2017
2. S.S Dara and S.S Umare, "A Text Book of Engineering Chemistry", S.Chand & Company Limited, 20th Edition, 2018.

REFERENCES:

1. Shashi Chawla, "A Textbook of Engineering Chemistry", Dhanpat Rai & CO. (PVT) LTD, New Delhi, 2012.
2. B.R. Puri, L.R. Sharma, M.S. Pathania, Vishal, "Principles of Physical Chemistry", Vishal Publishing Co., Punjab, 47th Edition, 2017.
3. G Palanna, "Engineering Chemistry", McGraw Hill Education (India) PVT, LTD, Chennai, 2017.
4. Dr. Sunita Rattan, "A Textbook of Engineering Chemistry", S.K.Kataria & Sons, New Delhi, 2012

20GE101	PROBLEM SOLVING USING PYTHON PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To know the basics of Computers and algorithmic problem solving
- To understand Python programs with conditional and looping constructs.
- To define Python functions and strings.
- To use Python data structures – lists, tuples, sets and dictionaries.
- To do input/output with files in Python.

PRE-REQUISITE: NIL

UNIT - I COMPUTER FUNDAMENTALS AND PROBLEM SOLVING 9

Introduction to Computer System – Block Diagram of Computer, Types of Memory, I/O Devices, Application Programs, System Programs – Loader, linker, assembler, compiler, interpreter, Programming process – source code to executable code, Problem Solving Strategies – Problem analysis, Algorithms, Flow Charts, Pseudo Code. Illustrative problems: odd or even number, Leap year, Biggest of three numbers, square root of a number, Sum of n numbers, Armstrong number, Palindrome, Fibonacci Series, Prime number, Bubble Sort and Linear Search.

UNIT - II DATA, EXPRESSIONS, CONTROL FLOW STATEMENTS 9

Python interpreter and interactive mode, values and types – int, float, boolean, string, and list, variables, expressions, statements, tuple assignment, operators and precedence of operators, comments, Control Flow Statements – Conditionals – conditional (if), alternative (if-else), chained conditional (if-elif-else), Iteration – state, while, for, break, continue, pass, Illustrative programs – exchange the values with and without using temporary variables, circulate the values of n variables, distance between two points.

UNIT - III FUNCTIONS, STRINGS 9

Functions – function definition and use, flow of execution, parameters and arguments, function composition, Fruitful functions – return values, parameters, local and global scope, recursion, Strings – string slices, immutability, string functions and methods, string module, Illustrative programs – square root, GCD, exponentiation, Factorial of a number, linear search, binary search.

UNIT - IV LISTS, TUPLES, SETS, DICTIONARIES 9

Lists – list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters, Lists as arrays, Tuples – tuple assignment, tuple as return value, Sets - Creating a set, Modifying a set, Removing elements from a set, Set operations- Set Union, Set intersection, Set difference, Set membership test, Iterating through a set, Set methods, Built-in functions with set, Frozenset - Dictionaries – operations and methods, Advanced list processing –List comprehension, Illustrative programs – selection sort, insertion sort, Matrix addition and subtraction, sum an array of numbers.

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 – Math and Rand, Illustrative programs – word count, copy file, merge two files.

TOTAL: 45 PERIODS**OUTCOMES:****AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

- Explain Components of a Computer System, types of programming languages, types of software with examples and purpose.
- Perform problem analysis, use algorithms and prepare flow charts, pseudo code for solving simple problems.
- Use Conditional, iteration constructs of python programming and apply to solve simple problems.
- Use Functions, recursive function, String functions in python programming and apply to perform linear and binary search.
- Explain the various operations for manipulating Tuples, Dictionaries and Use List to perform simple and sorting operations.
- Explain file handling operations, exception handling, modules and packages and illustrate programs for word count, file copy, merge operations and exception handling.

TEXT BOOKS:

1. E. Balagurusamy, “Problem solving and Python Programming”, First edition, McGraw Hill Education (India) Private Limited, 2017.
2. Allen B. Downey, “Think Python: How to Think Like a Computer Scientist”, 2nd edition, Updated for Python 3, Shroff/O’Reilly Publishers, 2016 (<http://greenteapress.com/wp/think-python/>)

REFERENCES:

1. Yashavant Kanetkar, Aditya Kanetkar, “Let Us Python”, 2nd Edition, BPB Publications, 2020.
2. John V Guttag, “Introduction to Computation and Programming Using Python: With Application to Understanding Data”, 2nd Edition, PHI Publisher, 2017.
3. Robert Sedgewick, Kevin Wayne, Robert Dondero, “Introduction to Programming in Python: An Inter-disciplinary Approach”, Pearson India Education Services Pvt. Ltd., 2016.
4. Timothy A. Budd, “Exploring Python”, Mc-Graw Hill Education (India) Private Ltd., 2015.
5. Paul Gries, Jennifer Campbell and Jason Montojo, “Practical Programming: An Introduction to Computer Science using Python 3.6”, 3rd edition, Shroff/O’ Reilly Publishers, 2018.
6. Dr. A. Kannan, Dr. L. Sai Ramesh, “Problem Solving and Python Programming”, Updated Edition, United Global Publishers Pvt. Ltd., April 2018.

20BS1L1 BASIC SCIENCE LABORATORY

L T P C
0 0 3 1.5

PHYSICS LABORATORY

OBJECTIVES:

- To introduce different experiments to test basic understanding of physics concepts applied in Optics, properties of matter and liquids.

PRE-REQUISITE: NIL

LIST OF EXPERIMENTS

(Any five to be carried out & one demonstration experiment)

- Determination of Rigidity modulus – Torsional Pendulum.
- Determination of Young’s modulus – Non Uniform Bending.
- a. Determination of wavelength and particle size using diode laser.
b. Determination of acceptance angle in an optical fiber.
- Determination of velocity of sound and compressibility of liquid using ultrasonic interferometer.
- Determination of band gap of a semiconductor diode.
- Determination of thickness of a thin wire – Air wedge method.
- Determination of dispersive power of a prism – Spectrometer*
- Determination of wavelength of mercury spectrum – Spectrometer grating
*Demonstration experiment

OUTCOMES:

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

- Evaluate moment of inertia of a disc and rigidity modulus for thin wire using Torsional pendulum
- Appraise Young’s modulus of material of the given beam by Non-Uniform bending method
- Measure the wavelength of laser light , Particle size and basic parameter of optical fiber using Semiconductor diode LASER
- Estimate velocity of ultrasound and compressibility of liquid
- Estimate the wavelength of the prominent spectral lines
- Utilize experiment kits for useful applications

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Torsional pendulum set	6
2	Travelling microscope & accessories	6
3	Laser kit	6
4	Ultrasonic interferometer	6
5	Semiconductor band gap kit	6
6	Air wedge set up	6
7	Spectrometer & prism	6
8	Spectrometer & Grating	6

CHEMISTRY LABORATORY

OBJECTIVES:

- To make the students to acquire practical skill in the determination of water quality parameters through volumetric analysis.
- To have hands on experience in using instruments like pH meter, conductivity meter, potentiometer.
- To acquaint the students with the determination of molecular weight of polymer by viscometer.

PRE-REQUISITE: NIL

Any Five experiments to be given

1. Determination of total, temporary & permanent hardness of water by EDTA method.
2. Determination of alkalinity in water sample.
3. Determination of dissolved oxygen content of water sample by Winkler's method.
4. Determination of strength of given hydrochloric acid using pH meter.
5. Estimation of iron content of the given solution using potentiometer.
6. Conductometric titration of a strong acid Vs a strong base.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
9. Corrosion Experiment – Weight Loss Method.
10. Estimation of sodium present in water using flame photometer.

TOTAL(Physics & Chemistry): 45 PERIODS

OUTCOMES:

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

- Estimate the Chemical quality parameter of a water sample.
- Estimate the strength of acid by conductometric and pH metric titration..
- Estimate the strength of oxidisable material present in given sample by potentiometry.
- Determine the molecular weight of polymer by Ostwald viscometer.
- Demonstrate the rate of corrosion by weight loss method.

REFERENCE:

1. Vogel's "Text book of quantitative chemical analysis" (8th edition, 2014)

LIST OF APPARATUS AND EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Burette	30
2	Pipette	30
3	Beaker (100ml)	30
4	Conical Flask (250ml)	30
5	Conductivity meter	10
6	Potentiometer	10
7	pH meter	10
8	Viscometer	10
9	Flame Photometer	1
10	Electronic Balance	1

20GE1L1	PYTHON PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To write, test, and debug simple Python programs using conditional statements.
- To implement Python programs using loops.
- To use functions for structuring Python programs.
- To implement Python programs using lists.
- To write Python programs for implementing file operations.

PRE-REQUISITE: NIL

LIST OF PROGRAMS

1. Biggest of three numbers, odd or even number, Leap year.
2. GCD, Armstrong Number, Palindrome, Fibonacci Series, Prime number
3. Find the square root and exponentiation of a number with and without built-in functions
4. Linear search and Binary search using Recursion.
5. Find the maximum of a list of numbers
6. Selection sort, Insertion sort
7. First n prime numbers
8. Transpose of a Matrix
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Merge two files

PLATFORM NEEDED: Python 3 interpreter for Windows/Linux

TOTAL: 60 PERIODS

OUTCOMES:

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

- Develop simple Python programs using conditional and iterative constructs.
- Develop simple Python programs using built-in functions and user-defined functions.
- Develop a Python program using recursion to implement linear and binary search.
- Develop a Python program using list to implement selection and insertion sort.
- Develop Python programs to implement matrix operations.
- Develop a Python program to implement file handling.

20GE1L2	INDUSTRIAL PRACTICES WORKSHOP	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To provide exposure to the students with Hands on Experience on various Basic Industrial Practices in Civil, Mechanical, Electrical and Electronics Engineering.

PRE-REQUISITE: NIL**GROUP A (CIVIL & MECHANICAL)
LIST OF EXPERIMENTS****I CIVIL ENGINEERING PRACTICE****UNIT - I CARPENTRY PRACTICE**

1. Study of carpentry tools.
2. Preparation of Cross lap joint
3. Preparation of Dovetail joint
4. Preparation of T joint

UNIT - II PLUMBING PRACTICE

1. Study of plumbing tools, pipeline joints, its location and functions: valves, taps, couplings, unions, reducers and elbows in household fittings.
2. Exercise on Preparation of plumbing line sketches for water supply and sewage works.
3. Exercise on providing of basic water line connection for a residential house using plumbing components.
4. Exercise on providing Water line pipe connections for household utilities like water heater, wash basin etc.,

II MECHANICAL ENGINEERING PRACTICE**UNIT - III SHEET METAL PRACTICE**

1. Study of sheet metal forming tools.
2. Preparation of a Model of rectangular tray.
3. Preparation of a Model of Conical Funnel.

UNIT - IV MACHINING PRACTICE

1. Study of machining tools.
2. Exercise on Simple turning, Facing, Chamfering
3. Exercise on Taper turning.
4. Exercise on Drilling and Tapping.

UNIT - V METAL JOINING PROCESS

1. Study of welding tools.
2. Exercise to join two metal plates by single butt joint using arc welding.
3. Exercise to join two metal plates by T Fillet joint using arc welding.
4. Exercise to join two metal plates by lap joint using arc welding.

DEMONSTRATION

1. Gas welding process.
2. Refrigeration and Air conditioning process.

**GROUP B (ELECTRICAL & ELECTRONICS)
LIST OF EXPERIMENTS**

I ELECTRICAL ENGINEERING PRACTICE

1. Residential house wiring using switches, fuse, indicator, Fluorescent lamp and Energy Meter.
2. Measurement of Power consumption for CFL, Fluorescent Lamp, LED Lamp and Incandescent lamp.
3. Stair case wiring
4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of an electrical equipment.

II ELECTRONICS ENGINEERING PRACTICE

1. Study of Electronic components – Resistor colour coding, Capacitor, Inductor- Measurement using LCR meter, Transistor & Diode – Terminal identification using Multimeter.
2. Study of logic gates AND, OR, EX-OR and NOT.
3. Measurement of AC signal parameter (peak-peak, rms value, period & frequency) using CRO and AFO.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

TOTAL: 45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS		
CIVIL		
S. No	Component Name	No. of Components
1	Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, coupling, unions, elbows, plugs and other fittings	15 sets
2	Carpentry Vice (fitted to work bench)	15 nos
3	Standard wood working tools	15 sets
4	Models of industrial trusses, door joints, furniture joints	5 each
5	Power Tools a. Rotary Hammer b. Demolition Hammer c. Circular Saw	2 nos 2 nos 2 nos

	d. Planer e. Hand Drilling Machine f. Jigsaw	2 nos 2 nos 2 nos
MECHANICAL		
1	Arc welding transformer with cables and holders	5 nos
2	Welding booth with exhaust facility	5 nos
3	Welding accessories like welding shield, chipping hammer, wire brush, etc.	5 sets
4	Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.	2 nos
5	Centre Lathe	2 nos
6	Power Tool: Angle Grinder	2 nos
7	Study purpose items: Refrigerator and Air Conditioner	One each
ELECTRICAL		
1	Assorted electrical components for house wiring	10 sets
2	Electrical measuring instruments	10 sets
3	Study purpose items: Iron box, fan and regulator, emergency lamp	1 each
4	Megger (250V/500V)	1 no.
5	Power Tools a. Range Finder b. Digital Live-wire detector	2 nos 2 nos
ELECTRONICS		
1	Soldering guns	10 nos
2	Assorted electronic components for making circuits	50 nos
3	Small PCBs	10 nos
4	Multimeters	10 nos
5	Regulated of power supply, CRO	1 no. each

OUTCOMES:

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

- Prepare different carpentry joints.
- Prepare pipe connections with different joints for domestic applications.
- Make the models using sheet metal works.
- Carry out the basic machining operations.
- Prepare joints using welding equipment's.
- Demonstrate on gas welding, refrigeration and air conditioning processes.
- Carry out basic home electrical works and appliances.
- Measure the electrical quantities.
- Elaborate on the components, gates, soldering practices.

20HS201	ADVANCED TECHNICAL COMMUNICATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- This course is designed for Engineering and Technology curriculum enabling the students to learn, acquire and apply updated elements of English communication.
- The course is aimed at providing effective skills for procuring communication skills for business and advanced technology.
- Students will benefit by learning the four skills – Listening, Speaking, Reading and Writing – to meet the global requirements for their career and higher studies.

PRE-REQUISITE: NIL

UNIT - I TECHNICAL WRITING 9

Listening: Listening to audio-visuals on personal Interviews, Speeches from Company CEOs, TV Debates. **Speaking:** Wishing, Greeting, Enquiring Hobbies. **Reading:** Editorials, Letter to the Editor Columns, Technical Papers. **Writing:** Analytical writings, Emphasis Techniques, Letter Writing – Business Correspondence, Abstract Writing, Common Errors, Footnotes, Compound words, Preparation of Agenda

UNIT - II BUSINESS ENGLISH AND LANGUAGE DEVELOPMENT 9

Listening: Listening to Audio-Visual documentary, TV Programs of Celebrities Forum. **Speaking:** Self-Expression, Introducing the fellow students, Talking about celebrities, leaders

Reading: Company Correspondence, Business Correspondence, Technical Text for Vocabulary

Writing: Bibliography, Sentence Completion, Cloze exercises, Verbal Analogy, Letter – Business enquiry orders, payments, Minutes Preparation.

UNIT - III VISUAL BASED LANGUAGE DEVELOPMENT 9

Listening: Visuals on Group Discussion-Understanding the nuances of GD – Approach – Content – Methodology. **Speaking:** Discussing main points on burning issues, Social issues – Expressing ideas and suggestions. **Reading:** Etiquettes of Non-Verbal Communication. **Writing:** List of common expressions for specified situations – Sentence linkers – Formal Expressions – Suggestions – Reported Speech - Letter to the Editor on Common Issues – Writing the Points in Indirect Form – Check Lists – Numerical Expression.

UNIT - IV EMPLOYABILITY CORRESPONDENCE 9

Listening: Listening to Visuals of Technical Paper presentation – Technical and HR interviews

Speaking: Peer-to-Peer Interview – Mock Interview – Telephone Conversations. **Reading:** Comparative Analyses – Instructions on Public Spots – Time Management concepts – Email Correspondence. **Writing:** Compare and Contrast – Cause and Effect – Purpose and Function – Job Application Letter – Drafting Resume / CV, – Inferring the graphical / Pictorial representations – Bar chart – Pie chart, Instruction – common and technical instructions for a process or a component.

UNIT - V TECHNICAL REPORT WRITING**9**

Listening: Key note speeches – Annual Reports of institutions / companies. **Speaking:** Answering to the Mock Panel Interview – Sharing of interview experiences – presenting a Technical Paper. **Reading:** Annual Reports – Company Reports – Newspaper reports – Comprehension passages. **Writing:** Homophones – Abbreviations and Acronyms – SI Units – Report Writing with recommendations – Inferring the Graph – Flow Chart – Tables – Technical Papers.

TOTAL: 45 PERIODS**OUTCOMES:****AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

- Listen, Understand and create technical correspondence at advanced level
- Respond or answer to the contextual questions, interview questions, form instructions, draft reports
- Speak and analyze social issues, come out with effective ideas for discussion, understand the passages for meaning and vocabulary
- Assess error free technical writings, create legible and coherent technical papers, derive ideas of the given texts in a precise form
- Remember the updated elements of communication skills, nuances of non-verbal communication, business communication
- Create technical instructions, process instructions, self-appraisals, Resumes, reports on various situations

TEXT BOOKS:

1. Board of editors. "Fluency in English A Course book for Engineering and Technology". Orient Blackswan, Hyderabad: 2016
2. Raman, Meenakshi and Sharma, Sangeetha "Technical Communication Principles and Practice". Oxford University Press: New Delhi, 2014.

REFERENCES:

1. Booth-L. Diana, "Project Work", Oxford University Press, Oxford: 2014
2. Grussendorf, Marion, "English for Presentations", Oxford University Press, Oxford: 2007
3. Means, L. Thomas and Elaine Langlois, "English & Communication For Colleges. Cengage Learning", USA: 2007
4. Board of Editor, "Advanced Technical Communication", Great Mind Publication, Chennai : 2019

OUTCOMES:

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

- Understand the properties of Laplace transforms and to find the Laplace transform of some standard functions.
- Apply Laplace transform and inverse transform to solve the initial value problems.
- Solve the multiple integrals and apply the concept to find areas, volumes.
- Evaluation of line, surface and volume integrals using Green's, Gauss and Stokes theorems.
- Determine Analytic functions, Bilinear Transformations and apply the concept of conformal mapping to find the images of given curves.
- Evaluation of Contour Integrals using Cauchy's Integral and Residue theorems.

TEXT BOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2017.
2. T. Veerarajan., "Engineering Mathematics I", The Tata Mc Graw Hill Publication-New Delhi, First Edition 2018.

REFERENCES:

1. Kreyszig Erwin, "Advanced Engineering Mathematics", John Wiley and Sons, 9th Edition, New Delhi, 2006.
2. James Stewart, "Calculus, Early Transcendental", Cengage Learning, 7th Edition, New Delhi, 2015.
3. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics II", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.), New Delhi, 9th Edition, 2014.
4. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics II", Narosa Publications, New Delhi, 5th Edition, 2016.
5. Sastry, S.S. "Engineering Mathematics", Vol.I & II, PHI Learning Pvt. Ltd, 4th Edition, New Delhi, 2014.

20BS202

APPLIED PHYSICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the phase diagrams and their usage.
- To establish testing methodologies of materials science.
- To inculcate the knowledge on new Engineering materials for Mechanical and Automobile Engineering applications.

PRE-REQUISITE: NIL

UNIT - I PHASE DIAGRAMS 9

Solid solutions - Hume Rothery's rules – the phase rule - single component system - one-component system of iron - binary phase diagrams - isomorphous systems - the tie-line rule - the lever rule - application to isomorphous system - eutectic phase diagram - peritectic phase diagram - other invariant reactions – free energy composition curves for binary systems - microstructural change during cooling.

UNIT - II FERROUS ALLOYS 9

The iron-carbon equilibrium diagram – phases, invariant reactions – microstructure of slowly cooled steels – eutectoid steel, hypo and hypereutectoid steels – effect of alloying elements on the Fe-C system – diffusion in solids – Fick's law – phase transformations – T-T-T diagram for eutectoid steel – pearlitic and martensitic transformations – tempering of martensite steels – stainless steels – cast irons.

UNIT - III NON DESTRUCTIVE TESTING METHODS 9

Non-destructive testing – objectives of NDT – types of defects – cracking, spalling, staining, honeycombing, dusting and blistering – methods of NDT – Liquid penetration method – radiographic testing –magnetic particle inspection-thermography testing– Eddy current testing.

UNIT - IV MAGNETIC AND DIELECTRIC MATERIALS 9

Magnetic materials: Origin of magnetic moment – Bohr magneton- comparison of Dia, para and ferro magnetism- domain theory – types of energy- hysteresis- soft and hard magnetic materials- antiferromagnetic materials-ferrites and its applications. Dielectric materials: Electrical susceptibility – dielectric constant- electronic, ionic, orientational and space charge polarization- Langevin-Debye equation - internal field - clausius- mosotti relation (derivation)- dielectric loss – dielectric breakdown- ferroelectricity and application.

UNIT - V ADVANCED ENGINEERING MATERIALS 9

Composites: Classifications, role of matrix and reinforcement processing of fiber – reinforced plastics – Polymers: types of polymers- properties and engineering applications-metallic glasses: production and types –melt spinning process – applications – shape memory alloys: phases, shape memory effect, pseudo elastic effect, NiTi alloy, applications – Nanomaterials: preparation (bottom up and top down approaches), properties and applications – Biomaterials and its applications.

OUTCOMES:

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

- Explain various phase diagrams.
- Demonstrate the microstructure and phase transformations of ferrous alloys
- Identify the defects by Non destructive testing.
- Describe magnetic properties of materials
- Explain dielectric properties of materials and their applications
- Acquire knowledge on composites, metallic glasses, SMA and nanomaterials

TEXT BOOKS:

1. V.Raghavan, "Materials science and Engineering (a first course)", PHI learning private limited, Delhi, 6th Edition, 2017
2. S. O. Pillai, "Solid State Physics", New Age International publisher, 8th Edition, 2018
3. Charles Kittel, "Introduction to Solid State Physics", John Wiley & sons, 8th Edition, 2015

REFERENCES:

1. B. K. Pandey and S.Chaturvedi, "Engineering Physics", Cengage learning India Pvt Ltd, 2013
2. D. K. Bhattacharya and Poonam tendon, "Engineering Physics", Oxford University Press, New Delhi, First Edition, 2017
3. Dr. V. Jeyakumar, "Engineering Metallurgy", Lakshmi Publications, 2017

20GE201**ENGINEERING GRAPHICS**

L	T	P	C
2	0	2	3

OBJECTIVES:

- To develop graphic skills for communication of concepts, ideas and design of Engineering products.
- To expose national standards related to technical drawings.

PRE-REQUISITE: NIL**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 PROJECTION OF POINTS AND LINES 6+6

Orthographic projection – Principles - Principal planes - Projection of points in all quadrants - 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.

UNIT - II PROJECTION OF PLANE SURFACES 6+6

Projection of planes (Polygonal and Circular surfaces) inclined to both the principal planes by rotating object method.

UNIT - III PROJECTION OF SOLIDS 6+6

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one of the principal planes by rotating object method.

UNIT - IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 6+6

Sectioning of simple solids in vertical position when the cutting plane is inclined to 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, cylinder and cone.

UNIT - V ISOMETRIC PROJECTION AND FREEHAND SKETCHING 6+6

Principles of Isometric Projection – Isometric scale – Isometric projections of simple solids - truncated Prisms and Pyramids.

Visualization concepts and Free Hand sketching : Principles – Representation of Three Dimensional objects – Layout of views - Freehand sketching of multiple views from pictorial views of objects

TOTAL: 60 PERIODS

OUTCOMES:

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

- Familiarize with the fundamentals and standards of Engineering graphics.
- Draw the orthographic projections of points, lines and planes.
- Draw the projections of simple solids like prisms, pyramids, cylinder and cone.
- Draw the projections of sectional views of solids and develop its lateral surfaces.
- Draw the isometric projection of simple objects, truncated prism and pyramids.
- Draw the free hand sketching of simple objects.

TEXT BOOKS:

1. Natarajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 30th Edition, 2017.
2. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 15th Edition, 2018.

REFERENCES:

1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 53rd Edition, 2019.
2. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson Education, 3rd Edition, 2012.

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: Technical drawings - General principles of presentation.
4. IS 11669 – 1986: General principles of dimensioning on technical drawings.
5. SP 46 (2003): Engineering Drawing Practice for Colleges.
6. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

SPECIAL POINTS APPLICABLE TO 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.

20GE202	ENGINEERING MECHANICS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To develop capacity to predict the effect of force and motion in the course of carrying out the design functions of Engineering.
- To apply the techniques to find out centroid and mass moment of inertia of plane surfaces.
- To enhance skills to carry out kinematic and kinetic analyses for system of particles.

PRE-REQUISITE: NIL

UNIT - I BASICS AND STATICS OF PARTICLES 12

Introduction - Units and Dimensions - Laws of Mechanics - Vectorial representation of forces – Resolution and Composition of forces -Equilibrium of a particle –Forces in space – Equilibrium of a particle in space –Equivalent systems of forces –Principle of transmissibility –Single equivalent force.

UNIT - II EQUILIBRIUM OF RIGID BODIES 12

Free body diagram –Types of supports and their reactions –Moments and Couples –Moment of a force about a point and about an axis, Vectorial representation of moments and couples –Scalar components of a moment-Varignon’s theorem –Equilibrium of Rigid bodies in two dimensions.

UNIT - III PROPERTIES OF SURFACES AND SOLIDS 12

First moment of area and the Centroid of sections- Rectangle, circle, triangle from integration- T section , I section, Angle section, Hollow section by using standard formula- Pappus and Guldinus theorems - moment of inertia of plane areas -Parallel and perpendicular axis theorem -radius of gyration.

UNIT - IV DYNAMICS OF PARTICLES 12

Displacements -Velocity and acceleration, their relationship –Rectilinear and Curvilinear motion –Newton’s law –Work Energy Equation of particles –Impulse and Momentum.

UNIT - V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS 12

Frictional force -Laws of friction -Simple contact friction –Rolling resistance –Belt friction – Translation and Rotation of Rigid Bodies –Velocity and acceleration –General Plane motion.

TOTAL: 60 PERIODS

OUTCOMES:

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

- Illustrate the vectorial and scalar representation of forces and moments.
- Solve problems in engineering systems using the concept of static equilibrium
- Draw free body diagram and apply equilibrium principles for two dimensional rigid bodies.

- Determine the centroid and moment of inertia of plane lamina.
- Apply fundamental principles to solve problems in dynamics of particles.
- Summarize the basic principles of friction and general plane motion.

TEXT BOOKS:

1. Vela Murali, "Engineering Mechanics", Oxford University Press, 2010
2. Beer FP, Mazurek DF, Sanghi S, Eisenberg ER, Johnson ER and Cornwell PJ, "Vector Mechanics for Engineers: Statics and Dynamics", Tata McGraw Hill Education Private Limited, 10th Edition, 2012.

REFERENCES:

1. Hibbeler RC, "Engineering Mechanics: Statics & Dynamics", Pearson India Education Services Private Limited, 13th Edition, 2012.
2. Palanichamy M.S and Nagan S, "Engineering Mechanics – Statics and Dynamics", Tata McGraw Hill, 3rd Edition, 2004
3. Meriam J.L and Kraig L.G, 'Engineering Mechanics-Statics and Dynamics', John Wiley & sons, Newyork, 2008
4. Irving H Shames, "Engineering Mechanics – Statics and Dynamics", Pearson Education Asia Private Limited, 4thEdition, 2003.
5. Murugaperumal P, "Engineering Mechanics – Sri Krishna Hitech Publishing Company Private Limited., 2013.

20GE203	BASIC ELECTRICAL, ELECTRONICS AND INSTRUMENTATION ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the concept of electric circuit laws and theorems.
- To analyze the single phase and three phase circuits.
- To study about the working principles of Electrical Machines, electronic devices, circuits and various measuring instruments.

PRE-REQUISITE: NIL

UNIT - I DC NETWORKS 9

Basic Concepts-Atomic structure-Electric charge-Electric Current-Circuit components - Resistance-Capacitance -Inductance-potential and potential difference-Ohm's Law-work-power and Energy-DC Network Terminologies-Series and parallel circuits-Voltage and current divider rules-Kirchhoff's Laws-Maxwell's mesh current method-Nodal Analysis.

UNIT - II AC FUNDAMENTALS 9

Introduction to AC circuits –Generation of AC power-advantages– waveforms and RMS value –average value-form factor and peak factor-power and power factor, single phase and three-phase balanced circuits.

UNIT - III ELECTRICAL MACHINES 9

Construction , principles of operation, characteristics and applications of ; DC machines-Transformers (single and three phase) -Synchronous machines -three phase and single phase induction motors.(Qualitative Treatment Only)

UNIT - IV ELECTRONIC DEVICES & CIRCUITS 9

Types of Materials – conductor, semiconductor and insulators-comparison-Silicon & Germanium- N type and P type materials – PN Junction –Forward and Reverse Bias – Semiconductor Diodes –Bipolar Junction Transistor – Characteristics - Introduction to operational Amplifier –Inverting Amplifier –Non Inverting Amplifier.

UNIT - V MEASUREMENTS & INSTRUMENTATION 9

Classification of instruments - Types of indicating Instruments –moving coil and moving iron instruments-dynamometer type wattmeter and induction type energy meter- three-phase power measurements -Introduction to transducers - Classification of Transducers-selection of transducers- Resistive, Inductive, Capacitive.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Solve the simple and complex electric circuits using various methodologies.
- Discuss about the concepts of single and three phase circuits.
- Explain the Construction and working principles of electrical machines.
- Summarize the characteristics of electrical machines and choose drives for precise applications.
- Describe the various electronic materials, devices and circuits.
- Select appropriate instruments for electrical measurement for a specific application.

TEXT BOOKS:

1. S.K Bhattacharya, "Basic Electrical and Electronics Engineering", Pearson, second Edition 2017.
2. D P Kothari and I.J Nagrath, "Basic Electrical and Electronics Engineering", McGraw Hill Education(India) Private Limited, Third Reprint, 2017

REFERENCES:

1. Thereja .B.L., "Fundamentals of Electrical Engineering and Electronics", S. Chand & Co. Ltd., 2017
2. N K De, Dipu Sarkar, "Basic Electrical Engineering", Universities Press (India)Private Limited 2016
3. Del Toro, "Electrical Engineering Fundamentals", Pearson Education, New Delhi, 2015
4. Rajendra Prasad, "Fundamentals of Electrical Engineering", Prentice Hall of India, 2014
5. John Bird, "Electrical Circuit Theory and Technology", Elsevier, First Indian Edition, 2013
6. Allan S Moris, "Measurement and Instrumentation Principles", Elseveir, First Indian Edition, 2011
7. A.E.Fitzgerald, David E Higginbotham and Arvin Gabel, "Basic Electrical Engineering", McGraw Hill Education (India) Private Limited, 2009

20HS2L1	COMMUNICATION SKILLS LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- This course is framed for imparting practical approach in learning and enhancing communication skill to develop in students.
- Students will be able to identify appropriate expressions in speaking and writing.
- They will also be able to understand the style and perfection of language in reading and listening various contexts of engineering and technology.
- The course will benefit to the students to gain confidence for every day communication, aptitude test and interviews.

PRE-REQUISITE: NIL

UNIT - I LISTENING 6

Listen and takes notes of Lecture, Listen and Write appropriate word, Talks on Engineering and Technology, Developing effective listening skills, barriers to effective listening

UNIT - II SPEAKING 6

Self-Introduction, Role play of Celebrities, Sharing memorable incidents

UNIT - III READING 6

Reading Online Blogs, Reading Advertisement in Online, Newspaper archives reading

UNIT - IV WRITING 6

Process Description, Narrating experiences, Creating Email blogs, Review Writing – Books, Movies, and Journals

UNIT - V SUMMARIZED ACTIVITIES 6

Reading – cloze exercises, Identifying redundant words, Jargon words, Foreign words, Technical terms. **Writing** – Error free sentences, Sequential paragraphs, Essay writing on various levels – basic, middle, and advanced. **Speaking** – Face to face conversation on specific topics, interviewing celebrities, getting acquaintance with new people, sharing information with persons from abroad.

TOTAL: 30 PERIODS

OUTCOMES:

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

- Express ideas and concepts on par global communication
- Involve inter-personal communication with flair and error-free verbatim
- Face interviews confidently and respond in proper language ability
- Participate in group discussion and share innovative ideas in technical environments
- Adapt multi-national exposure on employment
- Master all-round competency in delivering apt communication for employability

TEXT BOOKS:

1. E. Suresh Kumar et al. "Communication for Professional Success". Orient Blackswan: Hyderabad, 2015

REFERENCES:

1. Butterfield, Jeff "Soft Skills of Everyone". Cengage Learning: New Delhi, 2015
2. "Interact English Lab Manual for Undergraduate Students", Orient BlackSwan: Hyderabad, 2016.
3. Raman, Meenakshi and Sangeetha Sharma. "Professional Communication". Oxford University Press: Oxford, 2014.
4. S. Hariharanetal. "Soft Skills". MJP Publishers: Chennai, 2010

20GE2L1**ELECTRICAL, ELECTRONICS AND
INSTRUMENTATION LABORATORY**

L	T	P	C
0	0	4	2

OBJECTIVES:

- To train the students in performing various tests on electrical drives, electronic devices, measuring instruments sensors and circuits.

PRE-REQUISITE: NIL**LIST OF EXPERIMENTS:**

1. Load test on separately excited DC shunt generator
2. Load test on Single phase Transformer
3. Load test on single phase Induction motor
4. Load test on DC shunt motor.
5. Measurement of three phase power
6. Verification of Circuit Laws
7. Transistor based application circuits
8. Study of CRO.
9. Characteristics of LVDT
10. Calibration of Rotameter
11. Measurement of temperature by using RTD
12. Measurement of temperature by using Thermistor

TOTAL: 60 PERIODS**OUTCOMES:****AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

- Practiced to solve the electrical circuits.
- Ability to determine the speed characteristic of different electrical machines.
- Select the electrical drives for particular application.
- Capability to design simple circuits involving transistors.
- Explain the working principles of display devices.
- Skillful to use measuring Instruments.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	Qty.
1	D. C. Motor Generator Set	2
2	D.C. Shunt Motor	2
3	Single Phase Transformer	2
4	Single Phase Induction Motor	2
5	Ammeter A.C and D.C	20
6	Voltmeters A.C and D.C	20
7.	Watt meters LPF and UPF	4
8.	Resistors & Breadboards	-
9.	Cathode Ray Oscilloscopes	4
10.	Dual Regulated power supplies	6
11.	A.C. Signal Generators	4
12.	Transistors (BJT, JFET)	-

20BS301	TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS	L	T	P	C
		3	1	0	4

OBJECTIVES

- To make the student familiar with the topics such as Fourier Transforms, Z-Transforms and Fourier series.
- To learn the formation of partial differential equations and the solution of first order and higher order partial differential equations.
- To apply Fourier series to solve one dimensional wave, one and two dimensional heat equations which occur frequently in various branches of engineering disciplines.

PRE-REQUISITE: NIL

UNIT - I PARTIAL DIFFERENTIAL EQUATIONS 12

Formation of partial differential equations – Singular integrals - Solutions of standard types of first order partial differential equations - Lagrange’s linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT – II FOURIER SERIES 12

Dirichlet’s conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier series – Parseval’s identity – Harmonic analysis.

UNIT - III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12

Classification of PDE – Method of separation of variables - Fourier Series Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction.

UNIT – IV FOURIER TRANSFORMS 12

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

UNIT - V Z -TRANSFORMS AND DIFFERENCE EQUATIONS 12

Z-transforms - Elementary properties – Inverse Z-transform (using partial fraction and residues) – Initial and final value theorems - Convolution theorem - Formation of difference equations – Solution of difference equations using Z - transform.

TOTAL : 60 PERIODS

OUTCOMES:

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

- Solve the given standard type of first order partial differential equations.
- Solve linear partial differential equation of second and higher order with constant coefficients.
- Solve differential equations using Fourier series analysis.
- Analyze the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equation problems.
- Compute the Fourier transforms of various functions.
- Apply Z-transforms techniques for discrete time systems.

TEXT BOOKS:

1. Grewal .B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2017.
2. Bali.N.P. and Manish Goyal, "A Textbook of Engineering Mathematics", Laxmi Publications Pvt. Ltd, 9th Edition, 2014.

REFERENCES:

1. Erwin Kreyszig, "Advanced Engineering Mathematics ", John Wiley, India, 8th Edition, 2016.
2. James.G., "Advanced Modern Engineering Mathematics", Pearson Education, 3rd Edition, 2007.
3. Andrews.L.C., L.C and Shivamoggi .B, "Integral Transforms for Engineers", SPIE Press, 1999.
4. Narayanan.S., Manicavachagom Pillay.T.K. and Ramanaiah.G, "Advanced Mathematics for Engineering Students", S.Viswanathan Publishers Pvt. Ltd, Chennai, Vol. II 2003 & Vol.III 2002.
5. Ramana.B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.

UNIT - V DEFLECTION OF BEAMS, COLUMNS

9

Computation of slopes and deflections in beams - Double Integration method, Macaulay's method. Maxwell's reciprocal theorems.

COLUMNS – Long and short columns, Euler's formula for crippling load with different end conditions, eccentric loading, Rankine formulae.

TOTAL : 45 PERIODS**OUTCOMES:****AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

- Explain the fundamental concepts of stress and strain
- Determine the deformation of bars while applying loads
- Compute stresses due to internal pressure in cylinders and spherical shells
- Apply basic equation of simple torsion in designing of shafts and helical springs
- Construct Shear force diagram, Bending moment diagram for different beam configurations with combination of transverse loading
- Calculate the deflection in beams by various methods and crippling load of columns under various conditions.

TEXT BOOKS:

1. Beer F. P. and Johnson R, "Mechanics of Materials", McGraw-Hill Book Co, 8th Edition, 2019.
2. Bansal R.K, "A Textbook of Strength of Materials", Laxmi Publications Pvt. Ltd., New Delhi, 6th Edition, 2019.
3. Khurmi R.S, Khurmi N, "Strength of Materials", S.Chand, New Delhi, 2015.

REFERENCES:

1. Popov E.P, "Engineering Mechanics of Solids", Prentice-Hall of India, New Delhi, 2nd Edition, 2015.
2. S. S. Bhavikatti, Strength of Materials, Vikas Publishing House-Pvt. Ltd., 4th Edition. 2013.
3. Rajput, R K, "Strength of Materials", S.Chand & Co, New Delhi, 2015
4. Singh D.K, "Mechanics of Solids" Pearson Education, 2008.
5. R. C. Hibbeler, Mechanics of Materials, Prentice Hall, Pearson Education., 2005

20ME302**FLUID MECHANICS AND MACHINERY**

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand the properties of fluids and flow characteristics.
- To gain knowledge about the applications of the conservation laws to flow through pipes.
- To study about dimensional analysis and model analysis
- To understand the working principle and performance of hydraulic turbines.
- To understand the working principle and performance of hydraulic pumps.

PREREQUISITE:

Course Code: 20BS101

Course Name: Fundamentals of Engineering Mathematics

UNIT - I FLUID PROPERTIES AND FLOW CHARACTERISTICS 9

Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, surface tension and capillarity. Flow measurement, Flow characteristics, Types of fluid flow, concept of control volume, application of continuity equation, energy equation and momentum equation.

UNIT – II FLOW THROUGH CIRCULAR CONDUITS 9

Laminar flow through circular conduits and circular annuli, Hagen Poiseuille's Equation, Darcy Weisbach equation, major and minor losses, Hydraulic and energy gradient, Moody diagram. Commercial pipes - Flow through pipes in series and parallel. Boundary layer concepts, types of boundary layer thickness.

UNIT - III DIMENSIONAL ANALYSIS 9

Need for dimensional analysis, methods of dimensional analysis. Similitude –types of similitude. Dimensionless parameters, application of dimensionless parameters. Model analysis.

UNIT – IV TURBINES 9

Classification of turbines, heads and efficiencies, velocity triangles. Axial, radial and mixed flow turbines. Pelton wheel, Francis turbine and Kaplan turbines- working principles, workdone by water on the runner, draft tube. Specific speed, unit quantities, performance curves for turbines, governing of turbines. Concepts of Water Hammer.

UNIT - V PUMPS 9

Impact of jets, Euler's equation. Theory of rotodynamic machines, various efficiencies, velocity components at entry and exit of the rotor, velocity triangles. Centrifugal pumps– working principle, workdone by the impeller, performance curves. Reciprocating pump– working principle. Rotary pumps –classification, working principle. Submergible pumps.

OUTCOMES:

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

- Determine the effect of fluid properties on a flow system
- Apply the kinematic concepts and dynamic concepts which relates to the conservation principles of mass and energy
- Compute loses in pipes, bends and fittings using conservation laws.
- Use dimensional analysis to design physical or numerical experiments and to apply dynamic similarity
- Analyze the performance of hydraulic turbines.
- Analyze the performance of pumps

TEXT BOOKS:

1. R.K. Bansal, "A Text Book of Fluid Mechanics and Hydraulic Machines", 10th Edition, Laxmi Publications Pvt. Ltd., 2018.
2. Modi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi, 21st Edition, 2017.
3. Kumar K. L., "Engineering Fluid Mechanics", Eurasia Publishing House Pvt. Ltd., New Delhi, 2016

REFERENCES:

1. Frank White, "Fluid Mechanics", 8th Edition, McGraw Hill Education (India) Pvt. Ltd, 2017.
2. Streeter, V. L. and Wylie E. B., "Fluid Mechanics", 9th Edition, McGraw Hill Publishing Co. 2017.
3. Yunus A Cengel and John A Cimbala, Fluid Mechanics-Fundamentals & Applications, 4th Edition, Tata McGraw Hill, 2017.
4. Fox and MacDonald, Introduction to Fluid Mechanics, 9th Edition, Wiley India, 2015
5. S. K. Som, Gautam Biswas, Suman Chakraborty, Introduction to Fluid Mechanics and Fluid Machines, 3rd Edition, Tata McGraw-Hill Education, 2012.

20ME303

MANUFACTURING PROCESSES

L	T	P	C
3	0	0	3

OBJECTIVES

- To provide knowledge on the working, advantages, limitations and applications of metal casting, metal joining, bulk deformation and sheet metal processes.
- To gain knowledge about the defects in various manufacturing processes.
- To provide knowledge about the load and power calculation for various manufacturing processes.
- To understand the working principles of moulding of plastic components.
- To understand the concepts of powder metallurgy and additive manufacturing process.

PREREQUISITE: NIL

UNIT - I METAL CASTING PROCESSES 9

Pattern – Types, Materials, allowances. Molding sand – Types and Properties, Design of patterns, cores, Moulds, Riser and gating design (Qualitative treatment ONLY). Basic steps in sand casting, Cupola and crucible furnace, Procedural Steps and applications of special casting processes (Shell, Investment, Pressure die casting, Centrifugal Casting, CO₂ casting), Defects in Sand casting process

UNIT – II METAL JOINING PROCESSES 9

Welding Equipment – Fusion welding: Oxy-fuel gas Welding, Arc welding, MIG welding, TIG welding, CO₂ Welding, Thermit welding, Plasma arc welding, Laser Beam welding.

Solid State welding: Resistance Welding, friction stir welding, ultra sonic welding, explosion welding. Defects in welding. Testing and Inspection of welding, Brazing and soldering

UNIT - III BULK DEFORMATION PROCESSES 9

Hot working and cold working of metals, Forging processes – Open, impression and closed die forging, Defects in forging. Types of Rolling, Rolling mill, Defects in rolling. Principle of rod, wire and tube drawing. Classification of extrusion processes. Estimation of load and power for forging, rolling, drawing, extrusion operations.

UNIT – IV SHEET METAL AND POWDER METALLURGY PROCESSES 9

Sheet metal forming methods: shearing, bending, deep drawing, stretch forming, spinning processes. High velocity forming: Hydro forming, Explosive forming, magnetic pulse forming, Shot peening. Estimation of load and power for shearing, bending, deep drawing
Introduction to Powder metallurgy process.

UNIT - V PROCESSING OF PLASTICS AND ADDITIVE MANUFACTURING 9

Molding of plastics, working principles. Injection molding, Compression molding, Transfer Molding, Blow molding, Rotational molding, Film blowing, Extrusion, Thermoforming.

KLNCE UG MECH R2020

Additive Manufacturing: Classification – Fusion deposition modeling, Selective Laser Sintering, Stereolithography, Benefits, Applications.

TOTAL : 45 PERIODS

OUTCOMES:

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

- Identify defects and interpret causes for defects in product of metal casting processes.
- Select the suitable metal joining process for a given product or component.
- Determine the power required for bulk deformation process.
- Determine the power required for shearing, bending and deep drawing.
- Explain the steps involved in manufacturing of parts by powder metallurgy.
- Choose a suitable plastic molding process and additive manufacturing process for producing a given part.

TEXT BOOKS:

1. Kalpakjian. S, "Manufacturing Engineering and Technology", Pearson Education India 7th Edition, 2014.
2. Hajra Choudhary S.K. and Hajra Choudhury. A. K., Elements of Workshop Technology, Volume I and II, Media Promoters and Publishers Pvt. Limited, Mumbai, 13th Edition 2010.
3. Pham, D.T. and Dimov, S.S., "Rapid manufacturing", Springer-Verlag, London, 2011.

REFERENCES:

1. Gosh A, Mallik, A.K., Manufacturing Science, East-West Press Pvt Ltd, 2010.
2. Geoffrey Boothroyd, "Fundamentals of Metal Machining and Machine Tools", Mc Graw Hill, 3rd Edition, 2006.
3. Rao. P. N., Manufacturing Technology Foundry, Forming and Welding, 5th Edition, Tata McGraw Hill, 2013.
4. Sharma, P.C., A Textbook of Production Technology (Manufacturing Processes), S.Chand and Co. Ltd., 2007.
5. Roy. A. Lindberg, Processes and materials of manufacture, PHI / Pearson education, 2006.

20ME304	ENGINEERING THERMODYNAMICS	L	T	P	C
		3	1	0	4

(Use of Standard and approved Steam Table, Mollier Chart, Compressibility Chart and Psychrometric Chart permitted)

OBJECTIVES

- To understand the first law of thermodynamics for various systems.
- To understand the second law of thermodynamics and Entropy.
- To understand the properties of pure substance and steam power cycles.
- To understand behavior of real gas.
- To understand Psychrometric properties.

PREREQUISITE:

Course Code: 20BS101

Course Name: Fundamentals of Engineering Mathematics

UNIT - I BASIC CONCEPT AND FIRST LAW 12

Thermodynamic Processes and systems, First law of thermodynamics-applied to closed and open systems. Steady flow energy equation (SFEE), applications of SFEE. Zeroth law of thermodynamics and temperature scales.

UNIT – II SECOND LAW AND ENTROPY 12

Second law of thermodynamics - irreversible processes, Carnot theorem, Clausius Inequality, Entropy, Entropy change for pure substances – T-S diagram, Entropy change applied to closed and open systems. Availability and irreversibility.

UNIT - III PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE 12

Properties of pure substances- Phase Rule, property diagrams (PV, PT, TV, TS & HS). Work transfer with steam-Non-Flow Processes. Vapour power cycles - Rankine cycle, Improvisations of Rankine cycle, Superheating, Reheat cycle, Regenerative cycle

UNIT – IV IDEAL AND REAL GASES, THERMODYNAMIC RELATIONS 12

Thermodynamic relations: Partial derivatives - Maxwell relations - Clapeyron equation, Internal energy, Enthalpy, Entropy, Specific heat- Equations of state for real gases, Reduced properties-Law of corresponding states- Generalized Compressibility Chart

UNIT - V GAS MIXTURES AND PSYCHROMETRY 12

Mixture of non-reacting gases - Dalton's and Amalgam's model - Calculation of C_p , C_v , R , u , h and s changes for gas mixtures. Psychrometry- dry and atmospheric air, Psychrometric properties of moist air specific and relative humidity, dew point temperature - Psychrometric chart.

TOTAL : 60 PERIODS

OUTCOMES:

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

- Apply first law of thermodynamics and determine energy exchange in closed systems and flow process
- Apply second law of thermodynamics to determine the performance limits of thermodynamic cycles
- Determine thermodynamic properties of pure substances
- Calculate efficiency of simple and improved Rankine cycle
- Derive simple thermodynamic relations of ideal gases
- Calculate properties of gas mixtures and moist air using thermodynamic relations and psychrometric chart.

TEXT BOOKS:

1. Nag.P.K., Engineering Thermodynamics, 6th Edition, McGraw Hill Education, 2017.
2. R.K.Rajput, "A Text Book Of Engineering Thermodynamics", 5th Edition, 2017.
3. Cengel. Y and M.Boles, "Thermodynamics - An Engineering Approach", 9th Edition, McGraw Hill, 2019.

REFERENCES:

1. William C. Reynolds, Henry C. Perkins, Engineering thermodynamics, Mc Graw Hill, 2009
2. Michael J. Moran, Howard N. Shapiro, "Fundamentals of Engineering Thermodynamics", 8th Edition, 2003.
3. Sonntag, R.E., Borgnakke, C., and Van Wylen, Fundamentals of Thermodynamics, 7th Edition, Wiley Eastern Ltd, 2009.
4. Prasannakumar, "Thermodynamics", Pearson – Dorling Kindersley (India) Pvt. Ltd., 2013.
5. Single.O.P., Engineering Thermodynamics, Macmillan Publishers India Limited, 2000.

20HS301	UNIVERSAL HUMAN VALUES	L	T	P	C
		2	1	0	3

OBJECTIVES:

- To create an awareness on Engineering Ethics and Human Values.
- To understand social responsibility of an engineer.
- To appreciate ethical dilemma while discharging duties in professional life.

PRE-REQUISITE: NIL

UNIT - I INTRODUCTION TO VALUE EDUCATION 9

Value Education – Definition - Concept and Need for Value Education - The Evolution of Value Education: Natural acceptance, Self exploration - Fundamentals of value education - Happiness and Prosperity as parts of Value Education- fulfilling human aspirations.

Practice sessions: To discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

UNIT - II HARMONY IN THE HUMAN BEING 9

Human being vs Value education – I’ and Body synchronization - Understanding Myself as Co-existence of the Self and the Body - Realization - Self, Body needs - Scanning of Karma - Self and Body - Understanding Sanyam and Health.

Practice sessions: To discuss the role others have played in making material goods available to self. Identifying from one’s own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.

UNIT - III HARMONY IN THE FAMILY, SOCIETY AND NATURE 9

Family as a basic unit of Human Interaction - Values in Relationships - The Basics for Trust and Respect in today’s Crisis: Affection, e-Guidance, Reverence, Glory, Gratitude and Love – Harmony in society : Resolution, Prosperity, Fearlessness and Co-existence as Comprehensive Human Goal - Harmony in Nature: The Four Orders in Nature - The Holistic Perception of Harmony in Existence.

Practice sessions: To discuss on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education. Gratitude as a universal value in relationship. Discuss with scenarios. Elicit examples from students’ lives

UNIT - IV SOCIAL ETHICS 9

The Basics for Ethical Human Conduct - Defects in Ethical Human Conduct - Holistic Alternative and Universal Order - Universal Human Order and Ethical Conduct - Human Rights violation and Social Disparities.

Practice sessions: To discuss human being as cause of imbalance in nature, pollution, depletion of resources and role of technology

UNIT - V PROFESSIONAL ETHICS 9

Value based Life and Profession - Professional Ethics and Right Understanding - Competence in Professional Ethics - Issues in Professional Ethics – The Current Scenario - Vision for Holistic Technologies, Production System and Management Models.

Practice sessions: To discuss the conduct as an engineer or scientist

OUTCOMES:

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

- Explain the significance of value inputs in a classroom and start applying them in their life and profession.
- Distinguish between Values and Skills to ensure happiness and prosperity.
- Distinguish between Thyself and the Body to ensure competency of an individual.
- Explain the role of a human being in ensuring harmony in society and nature.
- Distinguish between ethical and unethical practices, and apply suitable strategy to actualize a harmonious working environment.
- Develop an awareness of human values to appreciate the rights of others.

TEXT BOOKS:

1. R.R.Gaur, R. Sangal and G.P. Bagaria, "A Foundation Course in Human Values and Professional Ethics", Excel Books, 2nd Revised Edition, New Delhi, Re-print 2019.
2. A.N. Tripathy, "Human Values", New Age International Publishers, New Delhi, 2003.

REFERENCES:

1. E.G.Seebauer and Robert L. Berry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, 2000.
2. M.Govindrajran, S.Natrajan and V.S.Senthil Kumar, "Engineering Ethics (including Human Values)", Eastern Economy Edition, Prentice Hall of India Ltd., 2004.
3. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, New York, 1996.
4. Charles E. Harries, Michael S. Protchard and Michael J. Rabins, "Engineering Ethics - Concepts and Cases", Thomson Learning, 2000.
5. S.K.Chakraborty and Dabangshu Chakraborty, "Human Values and Ethics: Achieving Holistic Excellence", ICFAI University Press, 2006.

20ME3L1	STRENGTH OF MATERIALS LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To understand the fundamental modes of loading of the structures
- To measure loads, displacements and strains.
- To obtain the strength of the material and stiffness properties of structural elements
- To study the mechanical properties of materials when subjected to different types of loading.
- To understand the hardening and tempering process

PREREQUISITE: NIL**LIST OF EXPERIMENTS**

1. Tensile test
2. Double shear test
3. Torsion test
4. Impact test
5. Strain Measurement using Single and Tri axial strain gauges.
6. Hardness test - Brinell Hardness Number
7. Hardness test - Rockwell Hardness Number
8. Deflection test on beams
9. Compression test on helical springs
10. Effect of hardening- Improvement in hardness and impact resistance of steels.
11. Tempering- Improvement Mechanical properties Comparison
 - (i) Unhardened specimen and
 - (ii) Quenched Specimen

TOTAL: 45 PERIODS**OUTCOMES:****AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

- Explain the concept of determining stresses and strains from the member forces.
- Apply the basic concepts and effects of axial loads, shear, and torsion on structural components.
- Determine the young's modulus of beams by means of deflection of beam experiments.
- Calculate the hardness of different materials by means of Brinell and Rockwell hardness experiments.
- Calculate the modulus of rigidity and stiffness of spring by means of open coil and closed coil experiments.
- Calculate the hardness and Physical insight into the behavior materials by means of hardening and tempering experiments.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. No.	Name of The Equipment	Quantity
1	Universal Tensile Testing machine with double shear attachment	1
2	Torsion Testing Machine	1
3	Impact Testing Machine	1
4	Brinell Hardness Testing Machine	1
5	Rockwell Hardness Testing Machine	1
6	Spring Testing Machine for tensile and compressive loads	1
7	Muffle Furnace	1
8	Rosette strain gauge	1
9	Metallurgical Microscope	1
10	Disc Polishing Machine	1

20ME3L2	FLUID MECHANICS AND MACHINERY LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To determine the coefficient of discharge for Orifice meter and Venturimeter.
- To measure rate of flow using rotameter.
- To study the performance characteristics of various hydraulic pumps.
- To conduct performance tests in hydraulic turbines.
- To gain practical knowledge about friction factor.

PREREQUISITE: NIL**LIST OF EXPERIMENTS**

1. Determination of coefficient of discharge for Orifice meter.
2. Determination of coefficient of discharge for Venturimeter
3. Determination of rate of flow using Rotameter and its calibration.
4. Performance characteristics of Centrifugal pump
5. Performance characteristics of Submergible pump.
6. Performance characteristics of Reciprocating pump
7. Performance characteristics of Gear pump.
8. Performance characteristics of Pelton turbine.
9. Performance characteristics of Francis turbine.
10. Performance characteristics of Kaplan turbine.
11. Determination of friction factor for flow through pipes.

TOTAL: 45 PERIODS**OUTCOMES:****AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

- Determine the coefficient of discharge for Orifice meter and Venturimeter
- Determine the rate of flow using Rota meter and calibrate it
- Predict performance characteristics of centrifugal pump and submergible pump.
- Predict performance characteristics of reciprocating pump and gear pump.
- Predict performance characteristics of turbines.
- Determine the friction factor for flow through pipes.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. No.	Name of The Equipment	Quantity
1	Orifice meter	1
2	Venturimeter	1

KLNCE UG MECH R2020

3	Rotameter	1
4	Centrifugal pump	1
5	Submergible pump.	1
6	Reciprocating pump	1
7	Gear pump.	1
8	Pelton turbine.	1
9	Francis turbine.	1
10	Kaplan turbine.	1
11	Pipe friction apparatus	1

20BS401	STATISTICS AND NUMERICAL METHODS	L	T	P	C
		3	1	0	4

OBJECTIVES

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

PREREQUISITE: NIL

UNIT - I TESTING OF HYPOTHESIS 12

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

UNIT – II DESIGN OF EXPERIMENTS 12

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 12

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 - Eigen values of a matrix by Power method and Jacobi’s method for symmetric matrices.

UNIT – IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION 12

Lagrange’s and Newton’s divided difference interpolations – Newton’s forward and backward difference interpolation – Approximation of derivatives using interpolation polynomials – Numerical single and double integrations using Trapezoidal and Simpson’s 1/3 rules.

UNIT - V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 12

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

OUTCOMES:

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

- Apply the concept of testing of hypothesis for large samples in real life problems.
- Apply t-test, chi-square and F distributions for small samples.
- Apply the basic concepts of classifications of design of experiments in the field of agriculture.
- Solve Algebraic and Transcendental equations.
- Solve problems involving numerical differentiation and integration using interpolation methods.
- Apply numerical techniques to solve the partial differential equations with initial and boundary conditions with engineering applications.

TEXT BOOKS:

1. Grewal. B.S. ,“Numerical Methods in Engineering and Science” , Khanna Publishers, New Delhi, 14th Edition, 2016.
2. Veerajan.T., “Probability,Statistics and Random Processes”, Tata McGraw Hill, New Delhi ,2006.

REFERENCES:

1. Johnson.R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
2. Burden.R.L and Faires, J.D, "Numerical Analysis", Cengage Learning, 9th Edition, 2016.
3. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 8th Edition, 2011.
4. Venkatraman.M.K., "Numerical Methods in Science and Engineering", National Publishing Co., Madras, 2000.
5. Subramaniam.N., "Statistics and Numerical Methods", SCM Publication,Reprint 2015.

UNIT - V FRICTION

12

Surface contacts– Sliding and Rolling friction, Friction in drives, Friction in screw threads, Friction in clutches, Friction in brakes-band and Block brakes, Friction in screw jacks, wedge, vehicles.

TOTAL : 60 PERIODS**OUTCOMES:****AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

- Calculate the degrees of freedom in simple kinematics chain
- Determine the velocity and acceleration for simple mechanisms
- Develop the cam profile for various type of followers
- Determine the speed and contact ratio of gear pair and gear trains
- Determine the tooth load and torque in gear trains
- Determine the friction of various machine elements

TEXT BOOKS:

1. Uicker, J.J., Pennock G.R and Shigley, J.E., “Theory of Machines and Mechanisms”, 5th Edition, Oxford University Press, 2017
2. Rattan, S.S, “Theory of Machines”, 5th Edition, Tata McGraw-Hill, 2019.
3. J. K. Gupta & R S Khurmi “Theory of Machines”, 14th Edition, S. Chand Publication, 2008.

REFERENCES:

1. F.B. Sanyal, “Kinematics of Machinery”, MacMillan Publishers Pvt Ltd., Tech-max Educational resources, 2011.
2. Robert Norton., “Kinematics and Dynamics of machinery” 1st Edition., McGraw Hill India., 2009
3. Rao and Duggipati, R.V, “Mechanism and Machine Theory”, New Age International Pvt. Ltd., 2010.
4. Thomas Bevan, “Theory of Machines”, CBS – 3rd Edition, 2010.
5. Amitabha Ghosh, Asok Kumar Mallik, “Theory of Mechanisms and Machines” East West Press, 2020.

20ME402

MANUFACTURING TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand the mechanics of metal cutting, tool materials and tool life.
- To gain knowledge about the working principles of turning, shaping, planning, milling, drilling and grinding machines.
- To calculate the process parameters such as cutting speed, feed, Depth of Cut & machining time.
- To understand the working principle of NC and CNC machine tools.
- To gain knowledge about CNC Programming.

PREREQUISITE: NIL

UNIT - I THEORY OF METAL CUTTING 9

Mechanics of chip formation, Cutting forces in orthogonal and oblique cutting, Merchant circle diagram and measurement of cutting forces, Types of chips, single point cutting tool – nomenclature, cutting tool materials, tool wear, tool life and Taylor’s equation, variables affecting tool life, Thermal effects, cutting fluids and Machinability. Economics of machining

UNIT – II TURNING MACHINES 9

Centre lathe and Capstan and turret lathe: constructional features, specification, lathe accessories, operations, calculation of process parameters (cutting speed, feed, Depth of Cut) & machining time.

Automats: single spindle: swiss type, multi spindle

UNIT - III SPECIAL PURPOSE MACHINE TOOLS 9

Shaping, Planning, Drilling, Milling Machines: Classification, Constructional features (Horizontal Shaper and Planner, Radial & Bench Drilling machines, Column and Knee & Vertical Milling machine), specification, driving mechanisms, operations, calculation of process parameters, (cutting speed, feed, Depth of Cut) & machining time.

Gear cutting: Indexing calculations in milling machine, Gear hobbing, Gear shaping processes.

UNIT – IV GRINDING MACHINES 9

Constructional features (cylindrical, surface, centreless and internal grinding), specification, Operations, Selection of grinding wheel, mounting, glazing & loading, dressing, balancing, calculation of process parameters (cutting speed, feed, Depth of Cut) & machining time, honing, lapping, polishing and buffing.

UNIT - V NC AND CNC MACHINES

9

Numerical Control (NC) and Computer Numerical Control (CNC) machine tools – Construction and working principle - CNC programming – Lathe and Milling.

TOTAL : 45 PERIODS**OUTCOMES:****AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

- Calculate the cutting forces in orthogonal cutting and cutting tool life.
- Develop process sheet for machining operation of a given part in turning machine.
- Calculate the machining time for producing components in shaper, drilling and milling machine.
- Identify and select suitable abrasive process for producing a given product and explain the process in detail.
- Explain the constructional features and working principles of NC/CNC machine tools
- Develop CNC program for the given part.

TEXT BOOKS:

1. Hajra Choudhury, "Elements of Workshop Technology", Vol.II., Media Promoters 2014
2. Rao. P.N "Manufacturing Technology - Metal Cutting and Machine Tools" (Vol. – II), 4th Edition, Tata McGraw-Hill, New Delhi, 2018.
3. Geoffrey Boothroyd, "Fundamentals of Metal Machining and Machine Tools", Mc Graw Hill, 3rd Edition, 2006

REFERENCES:

1. Chapman, W.A.J., Workshop Technology, Vol - II, Oxford & IBH Publishing Co. Ltd., 2007
2. HMT, "Production Technology", Tata McGraw Hill, 28th Reprint, 2008.
3. Philip F. Oswald, and Jairo Munoz, "Manufacturing Process and Systems", John Wiley India Edition, 9th Edition, Reprint 2008.
4. Mikell P.Groover, "Fundamentals of Modern Manufacturing", Wiley India Edition, 3rd Edition, Reprint, 2012.
5. E. Paul DeGarmo, J.T. Black and Ronald A. Kohser, "Degarmo's Materials and Processes in Manufacturing", John Wiley & Sons, 11th Edition 2011.

20ME403	THERMAL ENGINEERING	L	T	P	C
		3	1	0	4

(Use of standard refrigerant property data book, Steam Tables, Mollier diagram and Psychrometric chart permitted)

OBJECTIVES

- To understand thermodynamic concepts to different air standard cycles.
- To understand various IC engine Performance parameters.
- To understand the various Refrigeration systems and Coefficient of performance of Refrigeration systems.
- To understand the importance of Psychrometric process and Air conditioning systems.
- To understand the single stage and multistage air compressors.

PREREQUISITE:

Course Code: 20ME304

Course Name: Engineering Thermodynamics.

UNIT - I GAS POWER CYCLES 12

Classification of IC engines, Working of two and four stroke engines, Valve and Port timing diagrams, Comparison of air and fuel standard cycles.

Air Standard Cycles - Otto, Diesel, Dual, Brayton. Cycle Analysis, Performance and Comparison.

UNIT – II INTERNAL COMBUSTION ENGINE: COMBUSTION AND PERFORMANCE 12

Fuels for IC engines, Combustion in SI and CI engines, Knocking and detonation – phenomena and control. Engine exhaust emissions and air pollution, Emissions control technique. Performance parameters and calculations. Morse and Heat Balance tests.

UNIT - III REFRIGERATION SYSTEMS 12

Refrigerants, Vapour compression refrigeration cycle- Super heating, Sub cooling. Performance calculations. Vapour absorption refrigeration system – Ammonia - water, Lithium bromide - water.

UNIT – IV PSYCHROMETRIC PROCESSES AND AIR CONDITIONING SYSTEMS 12

Psychrometric process, Air conditioning system – Working principles and concept of RSHF, GSHF, ESHF, Cooling Load calculations.

UNIT - V RECIPROCATING AIR COMPRESSOR

12

Compressors, Classification of compressors, Performance of reciprocating air compressor, Effect of clearance volume. Multi stage reciprocating air compressor. Optimum intermediate pressure for perfect inter cooling, Compressor mean effective pressure.

TOTAL : 60 PERIODS**OUTCOMES:****AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

- Explain the working of IC engines
- Calculate efficiency of gas power cycles
- Determine the performance Parameters of IC Engines
- Calculate performance of refrigeration cycles
- Determine cooling load using Psychrometric chart
- Determine the performance of Reciprocating Air Compressors

TEXT BOOKS:

1. Rajput. R. K., "Thermal Engineering" S.Chand Publishers, 10th Edition, 2018
2. Kothandaraman.C.P., Domkundwar. S, Domkundwar. A.V., "A course in thermal Engineering", 5th Edition, "Dhanpat Rai & sons , 2016
3. Nag.P.K., Engineering Thermodynamics, 6th Edition, Tata McGraw-Hill, New Delhi 2017.

REFERENCES:

1. Cengel. Y and M.Boles, "Thermodynamics - An Engineering Approach", 7th Edition, Tata McGraw Hill, 2010.
2. Michael J. Moran, Howard N. Shapiro, "Fundamentals of Engineering Thermodynamics", 8th Edition, 2003.
3. Sarkar, B.K, "Thermal Engineering" Tata McGraw-Hill Publishers, 2007
4. Sonntag, R.E., Borgnakke, C., and Van Wylen, Fundamentals of Thermodynamics, 7th Edition, Wiley Eastern Ltd, 2009.
5. Rudramoorthy, R, "Thermal Engineering ",Tata McGraw-Hill, New Delhi,2003

		L	T	P	C
20HS401	ENVIRONMENTAL SCIENCE AND ENGINEERING	2	0	0	2

OBJECTIVES

- To study the scope and significance of environment
- To understand the interrelationship between living organism and environment
- To get a conceptual knowledge on various types of pollution and its effects
- To gain knowledge on various natural resources and its significances
- To provide knowledge on solid wastes ,disposal methods and natural disasters and its management
- To learn social issues such as human welfare, sustainability related to population

PREREQUISITE: NIL

UNIT - I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 6

Environment – definition, importance, public awareness Ecosystem – concept, structure and function– producers, consumers and decomposers - characteristic features, structure and function of the forest ecosystem and grassland ecosystem. Biodiversity– definition, types - genetic, species and ecosystem diversity – values - consumptive use, productive use, social, ethical, aesthetic and option values – hot-spots of biodiversity –threats to biodiversity: habitat loss, poaching of wildlife – endangered and endemic species of India – Assignment on conservation of biodiversity.

UNIT – II ENVIRONMENTAL POLLUTION 6

Definition, causes, effects and control measures of (i) Air pollution (ii) Water pollution (iii) Soil pollution (iv) Marine pollution – role of an individual in prevention of pollution – pollution case studies -Climate change - global warming, acid rain, ozone layer depletion.

UNIT - III NATURAL RESOURCES 6

Forest resources: Uses, over-exploitation, deforestation, case studies Water resources: Surface water and ground water - uses, over-utilization, conflicts over water, Conservation of water - rain water harvesting, dams-benefits and problems. Mineral resources: uses,over exploitation, environmental effects of extracting mineral resources, case studies.

UNIT – IV SOLID WASTE AND DISASTER MANAGEMENT 6

Solid waste management Introduction, types ,effects on human beings and disposal management. Disaster management Introduction, causes, effects and management of flood, cyclone, earthquake, landslide disasters – case studies- roles and responsibilities of Government and community.

UNIT - V HUMAN POPULATION AND SOCIAL ISSUES

6

Population growth, population explosion – family welfare programme –women and child welfare – human rights – value education – sustainable development – resettlement and rehabilitation –waste land reclamation – role of information technology in environment and human health- Debate on women and child welfare.

TOTAL : 30 PERIODS**OUTCOMES:****AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

- Describe the environment, ecosystem and their significances.
- Identify the threats to biodiversity and methods to conserve biodiversity.
- Identify and implement technological and economical solution to environmental pollution.
- Develop the knowledge on various natural resources and effect on environment due to over utilization.
- Record the consequences of natural disasters.
- Outline the social issues such as welfare, sustainability etc., and to relate with population growth.

TEXT BOOKS:

1. Anubha Kaushik and Kaushik C.P., Environmental Science and Engineering, New Age International (P) Ltd, Sixth Edition, 2018.
2. Benny Joseph, Environmental Science and Engineering, Tata McGraw-Hill Publishing Company Ltd, New Delhi, ISBN: 0070601690, 2006.

REFERENCES:

1. Erach Bharucha, "Text book of Environmental Studies", Universities Press (I) PVT LTD, Hyderabad, 2015
2. G. Tyler Miller and Scott E.Spoolman, "Environmental Science", Cengage Learning India PVT, LTD, Delhi, 2014
3. Gilbert M. Masters, "Introduction to Environmental Engineering and Science", 2nd edition, Pearson Education, 2004

a given industry.

- Choose appropriate method and instruments for inspection of various forms.
- Select suitable advanced measuring instruments for special requirement in the industries.
- Choose appropriate method for the measurement of power, flow for a given application.
- Conduct experiments on various dimensional/physical measuring instruments and determine the parameters like diameter, angle, straightness, force, temperature, torque etc.,

TEXT BOOKS:

1. R. K. Jain, "Engineering Metrology", Khanna Publishers, 2015
2. Gupta, I.C., Engineering Metrology, Dhanpat Rai & Sons, 2019.
3. N.V. Raghavendra and L. Krishnamurthy, "Engineering Metrology and Measurements", Oxford University Press, 2017

REFERENCES:

1. J. P. Holman, "Experimental Methods for Engineers", Tata McGraw Hill, 2012
2. Galyer.J.F.W. Shotbolt, C.R., "Metrology for Engineers", ELBS with Casell Ltd., UK, 5th Edition, 1990.
3. Thomas G. Beckwith, Roy D. Marangoni, John H. Lienhard V, "Mechanical Measurements", Pearson Learning Solution, 2011.
4. Ernest O. Doebelin, "Measurement Systems: Application and Design" McGraw Hill Education, 2017
5. Alan S Morris, Reza Langari, "Measurement and Instrumentation", Academic Press, 2012

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. No.	Name of The Equipment	Quantity
1.	Micrometer	5
2.	Vernier Caliper	5
3.	Vernier Height Gauge	2
4.	Vernier depth Gauge	2
5.	Slip Gauge Set	1
6.	Gear Tooth Vernier	1
7.	Sine Bar	1
8.	Floating Carriage Micrometer	1

KLNCE UG MECH R2020

9.	Profile Projector / Tool Makers Microscope	1
10.	Parallel/counter flow heat exchanger apparatus	1
11.	Mechanical / Electrical / Pneumatic Comparator	1
12.	Autocollimator	1
13.	Temperature Measuring Setup	1
14.	Force Measuring Setup	1
15.	Torque Measuring Setup	1
16.	Coordinate measuring machine	1
17.	Surface finish measuring equipment	1
18.	Bore gauge	1
19.	Telescope gauge	1

20ME4L1	MANUFACTURING TECHNOLOGY LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To practice the various operations that can be performed in Lathe.
- To gain practical knowledge about shaper, drilling, milling machines etc.
- To understand the various grinding processes.
- To measure the cutting forces in Turning/ Milling Process.
- To write CNC programs for Machining processes.

PREREQUISITE: NIL**LIST OF EXPERIMENTS**

1. External Thread cutting in lathe
2. Eccentric Turning in lathe
3. Square Head Shaping
4. Spur gear cutting in milling machine
5. Helical gear cutting in milling machine
6. Contour milling in vertical milling machine
7. Angular drilling in Radial drilling machine
8. Gear generation in gear hobbing machine
9. Gear generation in gear shaping machine
10. Surface grinding and Cylindrical grinding
11. Measurement of cutting forces in Milling / Turning Process
12. Simple CNC Programming – Lathe and Milling

TOTAL: 45PERIODS**OUTCOMES:****AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

- Perform various operations in Lathe.
- Perform shaping, drilling and milling operations.
- Generate gear profile using milling, gear hobbing and gear shaping machines.
- Use grinding machine for surface finishing operations on simple parts.
- Calculate cutting forces using cutting tool dynamometer in Turning/ Milling Process.
- Develop CNC programming for the simple components produced in CNC lathe and CNC milling.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. No.	Name of The Equipment	Quantity
1	Centre Lathes	7
2	Shaper	1
3	Radial Drilling Machine	1
4	Horizontal Milling Machine	1
5	Vertical Milling Machine	1
6	Surface Grinding Machine	1
7	Cylindrical Grinding Machine	1
8	Centerless grinding machine	1
9	Gear Hobbing Machine	1
10	Gear Shaping machine	1
11	Lathe Tool Dynamometer	1
12	Milling Tool Dynamometer	1
13	CNC Lathe	1
14	CNC Milling machine	1

20ME4L2**THERMAL ENGINEERING LABORATORY**

L	T	P	C
0	0	3	1.5

OBJECTIVES:

- To understand the construction, working and performance of I.C.Engines.
- To measure viscosity of lubricants
- To measure performance characteristics of refrigerator.
- To determine COP of an air conditioner.
- To gain practical knowledge about the working of air compressor.

PREREQUISITE: NIL**LIST OF EXPERIMENTS**

1. Valve Timing diagrams of four stroke diesel engine and Port Timing diagrams of two stroke petrol engine.
2. Determination of Flash Point and Fire Point of various fuels / lubricants.
3. Determination of viscosity of a lubricant.
4. Determination of p-v diagram of IC engine using Data acquisition system.
5. Performance Test on 4 – stroke Diesel Engine.
6. Heat Balance Test on 4 – stroke Diesel Engine.
7. Retardation Test on a Diesel Engine.
8. Morse Test on Multi-cylinder Petrol Engine.
9. Determination of COP of a refrigeration system.
10. Performance test in a HC Refrigeration System.
11. Determination of COP of an air conditioning system.
12. Performance test on a reciprocating air compressor.

TOTAL: 45 PERIODS**OUTCOMES:****AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

- Conduct tests on I.C Engine – 2 stroke and 4 stroke model and Calculate Valve Timing and Port Timing Values.
- Conduct tests on Flash and Fire Point apparatus and determine the value of Flash and Fire Point of fossil fuels and Lubricants.
- Conduct Performance tests on Diesel and Petrol engine Test rigs and analyze the performance Parameters of different engines.
- Conduct tests on refrigeration test rigs and determine the COP of refrigeration test rigs.
- Conduct tests on air conditioning test rigs and determine the COP of air conditioning test rigs.
- Conduct tests on reciprocating air compressor test rigs and determine the volumetric efficiency of reciprocating air compressor test rigs.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. No.	Name of The Equipment	Quantity
1	I.C Engine – 2 stroke and 4 stroke model.	1
2	Apparatus for Flash and Fire Point.	1
3	Viscometer	1
4	4-stroke Diesel Engine with mechanical loading.	1
5	4-stroke Diesel Engine with hydraulic loading.	1
6	4-stroke Diesel Engine with electrical loading.	1
7	Multi-cylinder Petrol Engine.	1
8	Refrigeration test rig.	1
9	Air-conditioning test rig.	1
10	Reciprocating air compressor.	1
11	Refrigeration test rig with HC as the Refrigerant.	1