MAHATMA GANDHI INSTITUTE OF TECHNOLOGY (Autonomous)

B.Tech in Mechanical Engineering

Scheme of Instruction and Examination

(Choice Based Credit System)

Applicable from the Academic Year 2022-23

I SEMESTER

S.No	Course Code	Course Title	Instruction Hours Per Week			Examination Max. Marks		Examination Duration of SEE in Hours	Credits
			L	T	P/D	CIE	SEE		
1.	MA101BS	Matrices and Calculus	3	1	0	40	60	3	4
2.	PH101BS	Applied Physics	3	1	0	40	60	3	4
3.	CS102ES	C Programming and Data Structures	3	0	0	40	60	3	3
4.	EN101HS	English for Skill Enhancement	2	0	0	40	60	3	2
5.	PH151BS	Applied Physics Laboratory	0	0	3	40	60	3	1.5
6.	CS152ES	C Programming and Data Structures Laboratory	0	0	2	40	60	3	1
7.	EN151HS	English Language and Communication Skills Laboratory	0	0	2	40	60	3	1
8.	MT151PC	Elements of Mechanical Engineering	0	0	2	50	-	-	1
9.	ME151ES	Engineering Workshop	0	1	3	40	60	3	2.5
10.	-	Induction Programme	-	-	-	-	-	-	-
Total Hours/Marks/Credits			**11**	**3**	**12**	**370**	**480**	**-**	**20**

II SEMESTER

S.No	Course Code	Course Title	Instruction Hours Per Week			Examination Max. Marks		Examination Duration of SEE in Hours	Credits
			L	T	P/D	CIE	SEE		
1.	MA201BS	Ordinary Differential Equations and Vector Calculus	3	1	0	40	60	3	4
2.	CH201BS	Engineering Chemistry	3	1	0	40	60	3	4
3.	ME201ES	Engineering Graphics	1	0	4	40	60	3	3
4.	ME202ES	Engineering Mechanics	3	0	0	40	60	3	3
5.	MM201ES	Engineering Materials	2	0	0	40	60	3	2
6.	CH251BS	Engineering Chemistry Laboratory	0	0	2	40	60	3	1
7.	CS251ES	Python Programming Laboratory	0	1	2	40	60	3	2
8.	MM251ES	Fuels & Lubricants Laboratory	0	0	2	40	60	3	1
9.	MC201BS	Environmental Science	3	0	0	40	60	3	0
Total Hours/Marks/Credits			**15**	**3**	**10**	**360**	**540**	**-**	**20**

L: Lecture T: Tutorial D: Drawing P: Practical CIE - Continuous Internal Evaluation SEE - Semester End Examination

B.Tech. in Mechanical Engineering
Scheme of Instruction and Examination
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III Semester

S.No	Course Code	Course Title	Instruction Hours Per Week			Examination Max. Marks		Duration of SEE in Hours	Credits
			L	T	P/D	CIE	SEE		
1	MM331ES	Material Science and Metallurgy	3	0	0	40	60	3	3
2	ME301PC	Mechanics of Solids	3	0	0	40	60	3	3
3	ME302PC	Production Technology	3	0	0	40	60	3	3
4	ME303PC	Thermodynamics	3	1	0	40	60	3	4
5	ME304PC	Fluid Mechanics and Hydraulic Machines	3	0	0	40	60	3	3
6	MC301HS	Constitution of India	3	0	0	40	60	3	0
7	MM361ES	Metallurgy & Mechanics of Solids Lab.	0	0	2	40	60	3	1
8	ME351PC	Production Technology Lab.	0	0	2	40	60	3	1
9	ME352PC	Fluid Mechanics and Hydraulic Machines Lab.	0	0	2	40	60	3	1
10	ME353PC	Machine Drawing Practice	0	0	2	40	60	3	1
Total Hours/Marks/Credits			**18**	**1**	**8**	**400**	**600**		**20**

IV Semester

S.No	Course Code	Course Title	Instruction Hours Per Week			Examination Max. Marks		Duration of SEE in Hours	Credits
			L	T	P/D	CIE	SEE		
1	MA403BS	Probability, Statistics & Complex Variables	3	1	0	40	60	3	4
2	EE431ES	Basic Electrical and Electronics Engineering	3	0	0	40	60	3	3
3	ME401PC	Kinematics of Machinery	3	0	0	40	60	3	3
4	ME402PC	Thermal Engineering - I	3	0	0	40	60	3	3
5	ME403PC	Instrumentation and Control Systems	3	0	0	40	60	3	3
6	EE461ES	Basic Electrical and Electronics Engineering Lab.	0	0	2	40	60	3	1
7	ME451PC	Instrumentation and Control Systems Lab.	0	0	2	40	60	3	1
8	ME452PC	Real-Time Research Project/Field-based Project	0	0	4	50			2
9	MC451HS	Gender Sensitization Lab.	0	0	2	50	50	3	0
Total hours/Marks/Credits			**15**	**1**	**10**	**380**	**470**		**20**

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

L	T	P	C
3	1	0	4

B.Tech. in Mechanical Engineering
I Semester Syllabus

MA101BS: MATRICES AND CALCULUS

(Common to all Branches)

Course Objectives

- Types of matrices and their properties, concept of a rank of the matrix and applying this concept to know the consistency and solving the system of linear equations
- Concept of eigen values and eigen vectors and to reduce the quadratic form to canonical form.
- Geometrical approach to the mean value theorems and their application to the mathematical
- problems, evaluation of improper integrals using Beta and Gamma functions.
- Partial differentiation, concept of total derivative, finding maxima and minima of function of two and three
  variables.
- Evaluation of multiple integrals and their applications.

Course Outcomes

- Write the matrix representation of a set of linear equations and to analyse the solution of thesystem of equations.
- Find the Eigen values and Eigen vectors, reduce the quadratic form to canonical form using orthogonal transformations.
- Solve the applications on the mean value theorems, evaluate the improper integrals using Beta and Gamma functions.
- Find the extreme values of functions of two variables with and without constraints.
- Evaluate the multiple integrals and apply the concept to find areas, volumes.

UNIT-I: Matrices

Rank of a matrix by Echelon form and Normal form, Inverse of Non-singular matrices by Gauss- Jordan method, System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations, LU Decomposition method, Gauss elimination method and Gauss Seidel Iteration Method.

UNIT-II: Eigen values and Eigen vectors

Linear Transformation and Orthogonal Transformation: Eigen values, Eigen vectors, properties of Symmetric, Skew Symmetric, Orthogonal, Unitary, Hermitian and Skew Hermitian matrices with reference to Eigen values and Eigen vectors Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton Theorem, Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation.

UNIT-III: Calculus

Mean value theorems: Rolle's theorem, Lagrange's Mean value theorem with their Geometrical Interpretation and applications, Cauchy's Mean value Theorem, Taylor's Series. Definition of Improper Integral: Beta and Gamma functions and their applications.

UNIT-IV: Multivariable Calculus (Partial Differentiation and applications)

Definitions of Limit and continuity, Partial Differentiation: Euler's Theorem, Total derivative, Jacobian, Functional dependence and independence. Applications: Maxima and minima of functions of two variables and three variables using method of Lagrange multipliers.

UNIT-V: Multivariable Calculus (Integration)

Evaluation of Double Integrals (Cartesian and polar coordinates), change of order of integration (only Cartesian form), Evaluation of Triple Integrals: Change of variables (Cartesian to polar) for double and (Cartesian to Spherical and Cylindrical polar coordinates) triple integrals.

Applications: Areas (by double integrals) and volumes (by double integrals and triple integrals).

Suggested Readings:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications,5th Editon, 2016.

Reference Books:

1. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition, Pearson, Reprint, 2002.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
4. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and Company Limited, New Delhi.

L	T	P	C
3	1	0	4

B.Tech. in Mechanical Engineering
I Semester Syllabus
PH101BS: APPLIED PHYSICS

Course Objectives: The objectives of this course for the student are to:

- Understand the basic principles of quantum physics.
- Understand the underlying mechanism involved in construction and working principles of various semiconductor devices.
- Study the fundamental concepts related to the dielectric and magnetic materials.
- Identify the importance of nanoscale, quantum confinement and various fabrication techniques.
- Study the characteristics of lasers and optical fibres.

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

- Understand physical world from fundamental point of view by the concepts of Quantum mechanics and visualize the difference between conductor, semiconductor and an insulator by classification of solids.
- Identify the role of semiconductor devices in science and engineering Applications.
- Explore the fundamental properties of dielectric and magnetic materials for their applications.
- Appreciate the features and applications of Nanomaterials.
- Understand various aspects of Lasers and Optical fiber and their applications in diverse fields.

UNIT - I: QUANTUM PHYSICS

Blackbody radiation – Planck's radiation law - Wein's law, Rayleigh-Jean's law - Photoelectric effect – de Broglie's Hypothesis, Davisson and Germer's experiment – Heisenberg uncertainty principle with an illustration - Non-existence of electrons in nucleus - Time independent Schrodinger wave equation - Born interpretation of the wave function - Particle in one dimensional potential box.

UNIT - II: SEMICONDUCTORS AND DEVICES

Intrinsic and extrinsic semiconductors – Hall effect - Direct and indirect band gap semiconductors - Construction, principle of operation and characteristics of P-N Junction diode, Zener diode and Bipolar Junction Transistor (BJT) – LED, PIN diode, Avalanche Photo Diode (APD) and Solar cells: structure, materials, working principle and characteristics.

UNIT - III: DIELECTRIC AND MAGNETIC MATERIALS

Dielectric Materials: Types of polarizations – Electronic & Ionic polarizabilities - Internal field in Dielectrics and Clausius-Mossotti Relation – Ferroelectric - Piezoelectric and Pyroelectric materials – Applications: liquid crystal displays (LCD) and crystal oscillators.

Magnetic Materials: Origin of magnetic moment - Classification of Magnetic materials - Weiss theory of ferromagnetism – Hysteresis curve – Soft and Hard magnetic materials – Applications: Bubble memory devices, magnetic field sensors.

UNIT - IV: NANOTECHNOLOGY

Nanoscale – Properties of Nanomaterials - Surface to volume ratio - Quantum confinement – Top-down fabrication: ball milling - Bottom-up fabrication: sol-gel, Physical Vapor Deposition (PVD) and Chemical Vapor Deposition (CVD) - Characterization techniques: XRD, SEM & TEM - Applications of nanomaterials.

UNIT - V: LASERS AND FIBER OPTICS

Lasers: Characteristics - Spontaneous and Stimulated emissions – Einstein coefficients - Population Inversion - Pumping mechanisms - Ruby laser, Nd:YAG laser, He-Ne laser, CO_2 laser, Semiconductor laser - Applications of lasers.

Fiber Optics: Introduction to optical fibers - Advantages of optical Fibers over conventional communications – Principle of light transmission through optical fiber - Structure of optical fiber - Acceptance angle and Numerical aperture - Classification of optical fibers: Step index and Graded index fibers – Attenuation mechanism in optical fibers – Block diagram of optical fiber communication system - applications.

TEXT BOOKS:

1. M. N. Avadhanulu, P.G. Kshirsagar & T. V. S. Arun Murthy "A Text book of Engineering Physics"- S. Chand Publications, 11th Edition 2019.
2. Engineering Physics by Shatendra Sharma and Jyotsna Sharma, Pearson Publication,2019
3. Semiconductor Physics and Devices- Basic Principle – Donald A, Neamen, Mc Graw Hill, 4th Edition,2021.
4. B.K. Pandey and S. Chaturvedi, Engineering Physics, Cengage Learning, 2nd Edition,2022.
5. Essentials of Nanoscience & Nanotechnology by Narasimha Reddy Katta, Typical Creatives NANO DIGEST, 1st Edition, 2021.

REFERENCE BOOKS:

1. Quantum Physics, H.C. Verma, TBS Publication, 2nd Edition 2012.
2. Fundamentals of Physics – Halliday, Resnick and Walker, John Wiley &Sons,11th Edition, 2018.
3. Introduction to Solid State Physics, Charles Kittel, Wiley Eastern, 2019.
4. Elementary Solid State Physics, S.L. Gupta and V. Kumar, Pragathi Prakashan, 2019.
5. A.K. Bhandhopadhya – Nano Materials, New Age International, 1st Edition, 2007.

L	T	P	C
3	0	0	3

B.Tech. in Mechanical Engineering

I Semester Syllabus

CS102ES: C PROGRAMMING AND DATA STRUCTURES

(Common to Civil ,ECE,EEE, Mechanical, Mechatronics and MMT)

Course Objectives: Introduce the importance of programming, C language constructs, programdevelopment, data structures, searching and sorting.

Course Outcomes:

1. Understand the various steps in Program development.
2. Explore the basic concepts in C Programming Language.
3. Develop modular and readable C Programs
4. Understand the basic concepts such as Abstract Data Types, Linear and Non-Linear Datastructures.
5. Apply data structures such as stacks, queues in problem solving
6. To understand and analyze various searching and sorting algorithms.

UNIT – I

Introduction to Computers – Computer Systems, Computing Environments, Computer Languages,Creating and running programs, Software Development
Introduction to C Language – Background, Simple C programs, Identifiers, Basic data types,Variables, Constants, Input / Output
Structure of a C Program – Operators, Bit-wise operators, Expressions, Precedence andAssociatively, Expression Evaluation, Type conversions, Statements.

UNIT – II

Statements – if and switch statements, Repetition statements – while, for, do-while statements, Loopexamples, other statements related to looping – break, continue, go to, Recursion.
Designing Structured Programs- Functions, basics, user defined functions, inter functioncommunication, standard functions.
Arrays – Concepts, using arrays in C, inter function communication, array applications, two –dimensional arrays, multidimensional arrays.

UNIT – III

Pointers – Introduction, Pointers for inter function communication, pointers to pointers, compatibility, **Pointer Applications** – Passing an array to a function, Memory allocation functions, array of pointers **Strings** – Concepts, C Strings, String Input / Output functions, arrays of strings, string manipulationfunctions, string / data conversion.

UNIT – IV

Derived types – The Typedef, enumerated types, Structures – Declaration, definition and initialization of structures, accessing structures, operations on structures, complex structures. Unions – Referencing unions, initializers, unions and structures.

Input and Output – Text vs Binary streams, standard library functions for files, converting file types, File programs – copy, merge files.

UNIT – V

Sorting- selection sort, bubble sort, insertion sort,

Searching-linear and binary search methods.

Data Structures – Introduction to Data Structures, abstract data types, Linear list – singly linked list implementation, insertion, deletion and searching operations on linear list, Stacks-Operations, array and linked representations of stacks, stack applications, Queues-operations, array and linked representations.

TEXT BOOKS:

1. C Programming & Data Structures, B.A.Forouzan and R.F. Gilberg, Third Edition, CengageLearning.
2. Problem Solving and Program Design in C, J.R. Hanly and E.B. Koffman, Fifth Edition,Pearson Education.
3. The C Programming Language, B.W. Kernighan and Dennis M.Ritchie, PHI/PearsonEducation

REFERENCE BOOKS:

1. C & Data structures – P. Padmanabham, 3rd Edition, B.S. Publications.
2. C Programming with problem solving, J.A. Jones & K. Harrow, Dreamtech Press
3 Programming in C – Stephen G. Kochan, III Edition, Pearson Education.
4. C for Engineers and Scientists, H. Cheng, McGraw-Hill International Edition
5. Data Structures using C – A. M. Tanenbaum, Y. Langsam, and M.J. Augenstein, PearsonEducation / PHI
6. C Programming & Data Structures, E. Balagurusamy, TMH.
7. C Programming & Data Structures, P. Dey, M Ghosh R Thereja, Oxford University Press
8. C & Data structures – E V Prasad and N B Venkateswarlu, S. Chand & Co.

L	T	P	C
2	0	0	2

B.Tech. in Mechanical Engineering
B. Tech. I Semester
EN101HS: English for Skill Enhancement
(Common to CE, ME, MCT, MME & ECE)

Course Objectives: This course will enable the students to:

- Improve the language proficiency in English with an emphasis on Vocabulary and improve their functional grammar.
- Enhance their Reading and Writing skills.
- Develop study skills and communication skills in various professional situations.
- Train in effective reading techniques for better comprehension of texts of various domains.
- Equip them to study Engineering subjects more effectively and critically using the theoretical and practical components of the syllabus.

Course Outcomes: Students will be able to:

- Choose appropriate vocabulary and sentence structures for their oral and written Communication.
- Demonstrate their understanding of the rules of functional grammar.
- Develop comprehension skills from the known and unknown passages.
- Take an active part in drafting paragraphs, letters, essays, abstracts, précis and reports in various contexts.
- Acquire basic proficiency in reading and writing modules of English.

UNIT – I

Chapter entitled '**Toasted English' by R. K. Narayan** from **"English: Language, Context and Culture"** published by Orient BlackSwan, Hyderabad.

Vocabulary: The Concept of Word Formation -The Use of Prefixes and Suffixes - Acquaintance with Prefixes and Suffixes from Foreign Languages to form Derivatives - Synonyms and Antonyms

Grammar: Identifying Common Errors in Writing with Reference to Articles and Prepositions.

Reading: Reading and Its Importance- Techniques for Effective Reading.

Writing: Sentence Structures -Use of Phrases and Clauses in Sentences- Importance of Proper Punctuation- Techniques for Writing precisely – Paragraph Writing – Types, Structures and Features of a Paragraph - Creating Coherence-Organizing Principles of Paragraphs in Documents.

UNIT – II

Chapter entitled **'Appro JRD' by Sudha Murthy** from **"English: Language, Context and Culture" published** by Orient BlackSwan, Hyderabad.

Vocabulary: Words Often Misspelt - Homophones, Homonyms and Homographs

Grammar: Identifying Common Errors in Writing with Reference to Noun-pronoun Agreement and Subject-verb Agreement.

Reading: Sub-Skills of Reading – Skimming and Scanning – Exercises for Practice
Writing: Nature and Style of Writing- Defining /Describing People, Objects, Places and Events – Classifying- Providing Examples or Evidence.

UNIT – III

Chapter entitled **'Lessons from Online Learning' by F. Haider Alvi, Deborah Hurst et al** from **"English: Language, Context and Culture"** published by Orient BlackSwan, Hyderabad.
Vocabulary: Words Often Confused - Words from Foreign Languages and their Use in English.
Grammar: Identifying Common Errors in Writing with Reference to Misplaced Modifiers and Tenses.
Reading: Sub-Skills of Reading – Intensive Reading and Extensive Reading – Exercises for Practice – Barriers to Effective Reading.

Writing: Format of a Formal Letter-Writing Formal Letters E.g.., Letter of Complaint, Letter of Requisition, Email Etiquette, Job Application with CV/Resume.

UNIT – IV

Chapter entitled **'Art and Literature' by Abdul Kalam** from **"English: Language, Context and Culture"** published by Orient BlackSwan, Hyderabad.

Vocabulary: Standard Abbreviations in English – Idioms and Phrases
Grammar: Redundancies and Clichés in Oral and Written Communication.
Reading: Effective Steps to Reading - Survey, Question, Read, Recite and Review (SQ3R Method) - Exercises for Practice
Writing: Writing Practices- Essay Writing-Writing Introduction and Conclusion -Précis Writing.

UNIT – V

Chapter entitled **'Go, Kiss the World' by Subroto Bagchi** from **"English: Language, Context and Culture"** published by Orient BlackSwan, Hyderabad.
Vocabulary: Technical Vocabulary and their Usage
Grammar: Common Errors in English (Covering all the other aspects of grammar which were not covered in the previous units)
Reading: Reading Comprehension-Exercises for Practice
Writing: Technical Reports- Introduction – Characteristics of a Report – Categories of Reports Formats- Structure of Reports (Manuscript Format) -Types of Reports - Writing a Report.

Note: Listening and Speaking Skills which are given under Unit-6 in AICTE Model Curriculum are covered in the syllabus of ELCS Lab Course.

- **Note: 1**. As the syllabus of English given in AICTE Model Curriculum-2018 for B.Tech First Year is **Open-ended**, besides following the prescribed textbook, it is required to prepare teaching/learning materials **by the teachers collectively** in the form of handouts based on the needs of the students in their respective colleges for effective teaching/learning in the class.

- **Note**: **2**. Based on the recommendations of NEP2020, teachers are requested to be flexible to adopt Blended Learning in dealing with the course contents .They are advised to teach 40 percent of each topic from the syllabus in blended mode.

TEXTBOOK:

1. "English: Language, Context and Culture" by Orient BlackSwan Pvt. Ltd, Hyderabad. 2022. Print.

REFERENCE BOOKS:

1. Liss and Davis (2010) Effective Academic Writing, Oxford University Press.
2. Richards, Jack C. (2022) Interchange Series. Introduction, 1, 2, 3. Cambridge University Press
3. Wood, F.T. (2007). Remedial English Grammar. Macmillan.
4. Chaudhuri, Santanu Sinha. (2018). Learn English: A Fun Book of Functional Language, Grammar and Vocabulary. (2nd ed.,). Sage Publications India Pvt. Ltd.
5. Wiley (2019). Technical Communication. Wiley India Pvt. Ltd, Rupa Publications.
6. Vishwamohan, Aysha. (2013). English for Technical Communication for Engineering Students. Mc Graw-Hill Education India Pvt. Ltd.
7. Swan, Michael. (2016). Practical English Usage. Oxford University Press. Fourth Edition
8. Green, David (2015). Contemporary English Grammar Structure And Composition, Trinity Press (Imprint of Laxmi Publication Pvt Ltd)

L	T	P	C
0	0	3	1.5

B.Tech. in Mechanical Engineering

I Semester Syllabus

PH151BS: APPLIED PHYSICS LABORATORY
(Common to all branches)

Course Objectives: The objectives of this course for the student to

- Capable of handling instruments related to the Hall effect and photoelectric effect experiments and their measurements.
- Understand the characteristics of various devices such as PN junction diode, Zener diode, LED, solar cell, lasers and optical fiber and measurement of energy gap and resistivity of semiconductor materials.
- Able to measure the time constant of RC circuits.
- Study the variation of magnetic field along the axis of current carrying coil.
- Understanding the method of least squares fitting.

Course Outcomes: The students will be able to:

- Know the determination of the Planck's constant using Photo electric effect and identify the material whether it is n-type or p-type by Hall experiment.
- Appreciate quantum physics in semiconductor devices and optoelectronics.
- Gain the knowledge of applications of RC circuits.
- Understand the effect of magnetic field in different current carrying coils.
- Carried out data analysis.

LIST OF EXPERIMENTS:

1. Determination of work function and Planck's constant using photoelectric effect.
2. Determination of Hall co-efficient and carrier concentration of a given semiconductor.
3. Characteristics of series and parallel LCR circuits.
4. V-I characteristics of a p-n junction diode and Zener diode
5. V-I and P-I characteristics of light emitting diode (LED)
6. V-I Characteristics of solar cell
7. Determination of Energy gap of a semiconductor.
8. Determination of Acceptance Angle and Numerical Aperture of an optical fiber.
9. V-I characteristics of Laser diode.
10. Understanding the method of least squares – torsional pendulum as an example.
11. Determination of time constant using RC circuits
12. Determination of magnetic field of induction using Steewart-Gee's apparatus

Note: *Any 8 experiments are to be performed.*

REFERENCE BOOK:

1. S. Balasubramanian, M.N. Srinivasan "A Text book of Practical Physics"- S Chand Publishers, 2017.

L	T	P	C
0	0	2	1

B.Tech. in Mechanical Engineering
I Semester Syllabus
CS152ES : C PROGRAMMING AND DATA STRUCTURES LABORATORY
(Common to Civil ,ECE,EEE, Mechanical, Mechatronics and MMT)

Course Objectives: Introduce the importance of programming, C language constructs, programdevelopment, data structures, searching and sorting.

Course Outcomes:

- Develop modular and readable C Programs
- Solve problems using strings, functions
- Handle data in files
- Implement stacks, queues using arrays, linked lists.
- To understand and analyze various searching and sorting algorithms

List of Experiments:

1. Write a C program to find the sum of individual digits of a positive integer.
2. Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Writea C program to generate the first n terms of the sequence.
3. Write a C program to generate all the prime numbers between 1 and n, where n is a valuesupplied by the user.
4. Write a C program to find the roots of a quadratic equation.
5. Write a C program to find the factorial of a given integer.
6. Write a C program to find the GCD (greatest common divisor) of two given integers.
7. Write a C program to solve Towers of Hanoi problem.
8. Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +,-,*, /, % and useSwitch Statement)
9. Write a C program to find both the largest and smallest number in a list of integers.
10. Write a C program that uses functions to perform the following:
    i) Addition of Two Matrices
    ii) Multiplication of Two Matrices
11. Write a C program that uses functions to perform the following operations:
    i) To insert a sub-string in to a given main string from a given position.
    ii) To delete n Characters from a given position in a given string.
12. Write a C program to determine if the given string is a palindrome or not
13. Write a C program that displays the position or index in the string S where the string T begins,or – 1 if S doesn't contain T.
14. Write a C program to count the lines, words and characters in a given text.
15. Write a C program to generate Pascal's triangle.
16. Write a C program to construct a pyramid of numbers.

17. Write a C program that uses functions to perform the following operations:
    i) Reading a complex number
    ii) Writing a complex number
    iii) Addition of two complex numbers
    iv) Multiplication of two complex numbers
    (Note: represent complex number using a structure.)
18.
    i. Write a C program which copies one file to another.
    ii. Write a C program to reverse the first n characters in a file.(Note: The file name and n are specified on the command line.)
19.
    i. Write a C program to display the contents of a file.
    ii. Write a C program to merge two files into a third file (i.e., the contents of the first filefollowed by those of the second are put in the third file)
20. Write a C program that uses functions to perform the following operations on singly linkedlist.:
    i) Creation ii) Insertion iii) Deletion iv) Traversal
21. Write C programs that implement stack (its operations) using
    i) Arrays ii) Pointers
22. Write C programs that implement Queue (its operations) using
    i) Arrays ii) Pointers
23. Write a C program that implements the following sorting methods to sort a given list ofintegers in ascending order
    i) Bubble sort ii) Selection sort iii)Insertion sort
24. Write C programs that use both recursive and non recursive functions to perform the followingsearching operations for a Key value in a given list of integers:
    i) Linear search ii) Binary search

TEXT BOOKS:

1. C Programming & Data Structures, B.A. Forouzan and R. F. Gilberg, Third Edition, CengageLearning.
2. Let us C, Yeswanth Kanitkar
3. C Programming, Balaguruswamy.

L	T	P	C
0	0	2	1

B.Tech. in Mechanical Engineering
B. Tech. I Semester
EN151HS: English Language and Communication Skills Laboratory
(Common to CE, ME, MCT, MME & ECE)

The **English Language and Communication Skills (ELCS) Lab** focuses on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations both in formal and informal contexts.

Course Objectives:

This course aims:

- To facilitate computer-assisted multi-media instruction enabling individualized and independent language learning
- To sensitize the students to the nuances of English speech sounds, word accent, intonation and rhythm
- To bring about a consistent accent and intelligibility in students' pronunciation of English by providing an opportunity for practice in speaking
- To improve the fluency of students in spoken English and neutralize mother tongue interference
- To train students to use language appropriately for public speaking, group discussions
- and interviews.

Course Outcomes: Students will be able to:

- Understand the nuances of English language through audio- visual experience and group Activities.
- Demonstrate their understanding of exact pronunciation of speech sounds.
- Acquire fluency in their language and neutralize their accent for intelligibility without Mother Tongue Interference (MTI).
- Speak with clarity and confidence which in turn enhances their employability skills.
- Develops their ability in presenting, arguing, summarizing and leading various communicative activities.

Syllabus: English Language and Communication Skills Lab (ELCS) shall have two parts:
a. Computer Assisted Language Learning (CALL) Lab

b. Interactive Communication Skills (ICS) Lab

Listening Skills:
Objectives
1. To enable students develop their listening skills so that they may appreciate the role in the LSRW skills approach to language and improve their pronunciation
2. To equip students with necessary training in listening, so that they can comprehend the speech of people of different backgrounds and regions

Students should be given practice in listening to the sounds of the language, to be able to recognize them and find the distinction between different sounds, to be able to mark stress and recognize and use the right intonation in sentences.

- Listening for general content
- Listening to fill up information
- Intensive listening
- Listening for specific information

Speaking Skills:

Objectives

1. To involve students in speaking activities in various contexts
2. To enable students express themselves fluently and appropriately in social and professional

Contexts

- Oral practice
- Describing objects/situations/people
- Role play – Individual/Group activities
- Just A Minute (JAM) Sessions

The following course content is prescribed for the **English Language and Communication Skills Lab**.

Exercise – I

CALL Lab:

Understand: Listening Skill- Its importance – Purpose- Process- Types- Barriers- Effective Listening.
Practice: Introduction to Speech Sounds – Vowels and Consonants – Minimal Pairs-
Consonant Clusters- Past Tense Marker and Plural Marker- Testing Exercises

ICS Lab:

Understand: Spoken vs. Written language- Formal and Informal English.
Practice: Ice-Breaking Activity and JAM Session- Situational Dialogues – Greetings – Taking Leave – Introducing Oneself and Others.

Exercise – II

CALL Lab:

Understand: Structure of Syllables – Word Stress– Weak Forms and Strong Forms – Stress pattern in sentences – Intonation.
Practice: Basic Rules of Word Accent - Stress Shift - Weak Forms and Strong Forms- Stress pattern in sentences – Intonation - Testing Exercises

ICS Lab:

Understand: Features of Good Conversation – Strategies for Effective Communication.
Practice: Situational Dialogues – Role Play- Expressions in Various Situations –Making Requests and Seeking Permissions - Telephone Etiquette.

Exercise - III

CALL Lab:

Understand: Errors in Pronunciation-Neutralising Mother Tongue Interference (MTI).
Practice: Common Indian Variants in Pronunciation – Differences between British and American Pronunciation -Testing Exercises

ICS Lab:

Understand: Descriptions- Narrations- Giving Directions and Guidelines – Blog Writing
Practice: Giving Instructions – Seeking Clarifications – Asking for and Giving Directions – Thanking and Responding – Agreeing and Disagreeing – Seeking and Giving Advice – Making Suggestions.

Exercise – IV
CALL Lab:
Understand: Listening for General Details.
Practice: Listening Comprehension Tests - Testing Exercises
ICS Lab:
Understand: Public Speaking – Exposure to Structured Talks - Non-verbal Communication- Presentation Skills.
Practice: Making a Short Speech – Extempore- Making a Presentation.

Exercise – V
CALL Lab:
Understand: Listening for Specific Details.
Practice: Listening Comprehension Tests -Testing Exercises
ICS Lab:
Understand: Group Discussion – Introduction to Interview Skills
Practice: Group Discussion – Mock Interviews

Minimum Requirement of infrastructural facilities for ELCS Lab:

1. Computer Assisted Language Learning (CALL) Lab:
The Computer Assisted Language Learning Lab has to accommodate 40 students with 40 systems, with one Master Console, LAN facility and English language learning software for self- study by students.

System Requirement (Hardware component):
Computer network with LAN facility (minimum 40 systems with multimedia) with the following specifications:

i) Computers with Suitable Configuration

ii) High Fidelity Headphones

2. Interactive Communication Skills (ICS) Lab:
The Interactive Communication Skills Lab: A Spacious room with movable chairs and audiovisual aids with a Public Address System, a T. V. or LCD, a digital stereo –audio & video system and camcorder etc.
Source of Material (Master Copy):

- Exercises in Spoken English. Part 1, 2, 3. CIEFL and Oxford University Press

Note: Teachers are requested to make use of the master copy and get it tailor-made to suit the contents of the syllabus.

Suggested Software:

- Cambridge Advanced Learners' English Dictionary with CD.
- Grammar Made Easy by Darling Kindersley.
- Punctuation Made Easy by Darling Kindersley.
- Oxford Advanced Learner's Compass, 10th Edition.
- English in Mind (Series 1-4), Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge.
- English Pronunciation in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
- English Vocabulary in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
- TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS).
- Digital All
- Orell Digital Language Lab (Licensed Version)

REFERENCE BOOKS:

1. Kumar, Rajesh (2022). English Language Communication Skills – Lab Manual cum Workbook. Cengage Learning India Pvt. Ltd.
2. Shobha, KN & Rayen, J. Lourdes. (2019). Communicative English – A workbook. Cambridge University Press
3. Kumar, Sanjay & Lata, Pushp. (2019). Communication Skills: A Workbook. Oxford University Press
4. Board of Editors. (2016). ELCS Lab Manual: A Workbook for CALL and ICS Lab Activities. Orient Black Swan Pvt. Ltd.
5. Mishra, Veerendra et al. (2020). English Language Skills: A Practical Approach. Cambridge University Press.
6. Central Institute of English (2005). Exercises in Spoken English Vol. 1, 2 & 3, Oxford India, Hyderabad

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B.Tech. in Mechanical Engineering

I Semester Syllabus

ME151PC: ELEMENTS OF MECHANICAL ENGINEERING

Course Objectives: The objectives of this course are to

- Make the student to experimentally measure the common geometric properties like length, diameter, flatness, curvature, volume and moment of inertia etc.
- Give a practical knowledge to evaluate the friction between surfaces and also to evaluate thenatural frequency of the system.
- Correlate between theory and experimental results, directly observe the proof of principlesand theories through practical knowledge
- Introduce students to the basic concepts of manufacturing through the demonstration of various processes.
- Understand the commonly used mechanical components like gear box, working of boilers and IC engine etc.

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

- Understand the operation, usage and applications of different measuring instrumentsand tools.
- Examine the different characteristics of instruments like accuracy, precision etc
- Prepare simple composite components and joining different materials using solderingprocess.
- Identify tools & learn practically the process of turning, milling, grinding on mild steelpieces.
- Understand the basic components of IC engine, Gear box and boiler

List of Experiments to be performed:

1. Measurement of length, height, diameter by Vernier calipers.
2. To measure diameter of a given wire and sphere, thickness of a given sheet and volume of an irregular lamina using micrometer screw gauge.
3. Determination of flatness of the surface plate using straight edge and sprit level.
4. Determination of time period and natural frequency of simple pendulum.
5. Determination of time period and natural frequency of compound pendulum
6. Study of CNC Lathe & Milling Machines
7. Study of electronic circuit components of Resistor, Inductor, Capacitor, Diode and Transistors etc.,
8. Study of basic operations of lathe, milling, drilling, grinding machine operations.
9. Assembly /disassembly of Engines
10. Study of transmission system –gear box
11. Metal joining process–soldering of metal alloys to any PCB board
12. Study of various modes of heat transfer

Note: Perform any 10 out of the 12 Exercises.

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B.Tech. in Mechanical Engineering
I Semester Syllabus
ME151ES: ENGINEERING WORKSHOP

Pre-requisites: Practical skill

Course Objectives: At the end of this course students are expected to

- Study of different hand operated power tools, uses and their demonstration.
- Gain a good basic working knowledge required for the production of various engineering products.
- Provide hands on experience about use of different engineering materials, tools, equipment and processes those are common in the engineering field.
- Study commonly used Engineering trades like carpentry, fitting, tin smithy, foundry, house wiring, plumbing & black smithy and practical exposure to these trades.
- Study of various machining operations.

Course Outcomes: At the end of the course, the student will be able to

- Practice on various workshop trades including plumbing, fitting, carpentry, foundry, house wiring, tin smithy, black smithy and welding by using different tools.
- Identify and apply suitable tools for different trades of Engineering processes including drilling, material removing, measuring and chiseling.
- Apply basic electrical engineering knowledge for house wiring practice.
- Implement the knowledge of basic workshop processes under safety norms.
- Understand different metal joining techniques using arc welding process.

1. TRADES FOR EXERCISES:

At least two exercises from each trade:

I. Carpentry – (Bridle Joint, Half - Lap Joint, Mortise & Tenon Joint)
II. Fitting – (L- fit, V-Fit & Dovetail Fit)
III. Tin-Smithy – (Square Tin, Rectangular scoop & Rectangular tray)
IV. Foundry – (Preparation of Green Sand Mould using Single Piece and Split Pattern)
V. Welding Practice – (Arc Welding- Lap Joint, Butt Joint & T Joint)
VI. House-wiring – (Parallel & Series, Two-way Switch and Tube Light)
VII. Black Smithy – (Oval shape, S – Hook & Fan Hook)

2. TRADES FOR DEMONSTRATION & EXPOSURE:

Plumbing, Machine Shop, Metal Cutting (Water Plasma), Power tools used in construction and Wood Working operations.

Text Books:
1. Workshop Practice /B. L. Juneja / Cengage
2. Workshop Manual / K. Venugopal / Anuradha.

Reference Books:
1. Work shop Manual - P. Kannaiah/ K. L. Narayana/ SciTech
2. Workshop Manual / Venkat Reddy/ BSP

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3	1	0	4

B.Tech. in Mechanical Engineering
II Semester Syllabus
MA201BS: Ordinary Differential Equations and Vector Calculus
(Common to all Branches)

Course Objectives

- Methods of solving the differential equations of first order.
- Methods of solving the differential equations of higher order.
- Concept, properties of Laplace transforms, solving ordinary differential equations using Laplace transforms techniques.
- The physical quantities involved in engineering field related to vector valued functions.
- The basic properties of vector valued functions and their applications to line, surface andvolume integrals.

Course Outcomes

- Identify whether the given differential equation of first order is exact or not.
- Solve higher differential equation and apply the concept of differential equation to real worldproblems.
- Use the Laplace transforms techniques for solving ordinary differential equations.
- To analyse the physical quantities involved in engineering field related to vector valued functions.
- Evaluate the line, surface and volume integrals and converting them from one to another.

UNIT-I: First Order Ordinary Differential Equations

Exact differential equations, Equations reducible to exact differential equations, linear and Bernoulli's equations, Orthogonal Trajectories (only in Cartesian Coordinates). Applications: Newton's law of cooling, Law of natural growth and decay.

UNIT-II: Ordinary Differential Equations of Higher Order

Second order linear differential equations with constant coefficients: Non-Homogeneous terms of the type e^{ax}, sin ax, cos ax, polynomials in x, $e^{ax}V(x)$ and $x\,V(x)$, method of variation of parameters, Equations reducible to linear ordinary differential equations with constant coefficients: Legendre's equation, Cauchy-Euler equation. Applications: Electric Circuits.

UNIT-III: Laplace transforms

Laplace Transforms: Laplace Transform of standard functions, First shifting theorem, Second shifting theorem, Unit step function, Dirac delta function, Laplace transforms of functions when they are multiplied and divided by 't', Laplace transforms of derivatives and integrals of function, Evaluation of integrals by Laplace transforms, Laplace transform of periodic functions, Inverse Laplace transform by different methods, Convolution theorem (without proof). Applications: solving Initial value problems by Laplace Transform method.

UNIT-IV: Vector Differentiation

Vector point functions and scalar point functions, Gradient, Divergence and Curl, Directional derivatives, Tangent plane and normal line, Vector Identities, Scalar potential functions, Solenoidal and Irrotational vectors.

UNIT-V: Vector Integration

Line, Surface and Volume Integrals, Theorems of Green, Gauss and Stokes (without proofs) and their applications.

Suggested Readings:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications,5th Edition, 2016.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint,2002.
3. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and CompanyLimited, New Delhi.
4. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications,Reprint, 2008.

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B.Tech. in Mechanical Engineering
II Semester Syllabus
CH201BS: Engineering Chemistry
(Common to all branches)

Course Objectives:

To bring adaptability to the concepts of chemistry and to acquire the required skills to become a perfect engineer:

- To understand water quality for industrial and domestic usage, softening methods and related problems.
- To acquire the knowledge of Battery technology, corrosion and corrosion controlling techniques which are essential for the Engineers and applications in industries.
- To understand the preparation, properties and applications of polymeric materials.
- To get exposed to qualitative and quantitative parameters of fuels and to develop understanding of the combustion process.
- To understand the application of smart materials, lubricants, refractories and cement.

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Course Outcomes:

After completing the course , the student will be able to acquire:

- Knowledge on the disadvantages of hard water for domestic and industrial purposes. The techniques of softening of hard water and treatment of potable water.
- Knowledge on storage of electrical energy in batteries, construction of batteries and fuel cells. Mechanism of corrosion of metals and alloys and corrosion control methods.
- Knowledge on the Preparation, properties and application of polymeric materials.
- Knowledge about the fuels, techniques of analysis for quality parameters of fuels, their combustion process and applications.
- Knowledge pertaining to the applications of smart materials, lubricants, refractories and cement.

UNIT - I: Water and its treatment

Introduction to hardness of water – Expression of hardness, Units and related numerical problems. Potable water and its specifications - Steps involved in the treatment of potable water - Disinfection of potable water by chlorination and breakpoint chlorination.

Boiler troubles: Sludge, Scale, Boiler corrosion and Caustic embrittlement. Internal treatment of Boiler feed water - Calgon conditioning - Phosphate conditioning - Colloidal conditioning. External treatment methods - Softening of water by ion- exchange processes. Desalination of water – Reverse osmosis.

UNIT – II Battery Chemistry & Corrosion

Introduction - Classification of batteries - primary, secondary and reserve batteries with examples. Basic requirements for commercial batteries. Construction, working and applications of Zn-air and Lithium ion battery, Applications of Li-ion battery. Fuel Cells - Differences between batteryand a fuel cell, Construction and applications of Methanol Oxygen fuel cell and Solid oxide fuel cell. Solar cells - Introduction and applications of Solar cells.

Corrosion: Causes and effects of corrosion – Theories of chemical and electrochemical corrosion – mechanism of electrochemical corrosion. Types of corrosion: Galvanic, Water-line and Pitting corrosion. Factors affecting rate of corrosion. Corrosion control methods: Cathodic protection – Sacrificial anode and impressed current methods. Application of Metallic coatings - Electroplating

UNIT - III: Polymeric materials

Definition – Classification of polymers with examples – Types of polymerization – Addition and condensation polymerization with examples.

Plastics: Definition and characteristics - Thermoplastic and thermosetting plastics, Preparation, Properties and Engineering applications of PVC, Teflon and Bakelite.

Fibers: Preparation, Properties and Engineering applications of Nylon 6:6, and Terylene

Elastomers: Characteristics – Preparation – Properties and Applications of Buna-S, Butyl and Thiokol rubber.

Conducting polymers: Characteristics and Classification with examples - Mechanism of conduction in trans-polyacetylene and Applications of conducting polymers.

Biodegradable polymers: Concept and advantages - Polylactic acid and Polyvinyl alcohol and their applications.

UNIT - IV: Energy Sources

Introduction, Calorific value of fuel – HCV, LCV- Dulong's formula. Classification - solid fuels: Coal – Analysis of coal – Proximate and ultimate analysis and their significance. Liquid fuels – Petroleum and its refining, Cracking types – Moving bed catalytic cracking. Knocking – Octane and Cetane rating. Synthetic petrol - Fischer-Tropsch's process. Gaseous fuels – Composition and uses of Natural gas, LPG and CNG. Biodiesel – Transesterification, advantages.

UNIT - V: Engineering Materials

Smart materials and their engineering applications

Shape memory materials - Poly L- Lactic acid. Thermoresponse materials - Polyacryl amides, Poly vinyl amides

Lubricants: Classification of lubricants with examples - Characteristics of a good lubricant. Properties of lubricants: Viscosity, Cloud point,Pour point, Flash point and Fire point.

Refractories: Definition, Classification, Characteristics of a good refractory. Application of refractories.

Cement: Portland cement - its composition, Setting and hardening

TEXT BOOKS:

1. Engineering Chemistry by P.C. Jain and M. Jain, Dhanpatrai Publishing Company, 2010
2. Engineering Chemistry by Rama Devi, Venkata Ramana Reddy and Rath, Cengage learning,2016
3. A textbook of Engineering Chemistry by M. Thirumala Chary, E. Laxminarayana and K. Shashikala, Pearson Publications, 2021.
4. Textbook of Engineering Chemistry by Jaya Shree Anireddy, Wiley Publications.

REFERENCE BOOKS:

1. Engineering Chemistry by Shikha Agarwal, Cambridge University Press, Delhi (2015)
2. Engineering Chemistry by Shashi Chawla, Dhanpatrai and Company (P) Ltd. Delhi (2011)

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1	0	4	3

B.Tech. in Mechanical Engineering
II Semester Syllabus
ME201ES: ENGINEERING GRAPHICS

Course Objectives:

- Recognize the standards of engineering graphics, learn to generate Geometric Constructions, Conic Sections and construct Engineering Scales.
- Understand the procedure to develop Orthographic projections of points, lines and planes.
- Learn the procedure to develop projection of solids and objects.
- Understand the procedure to generate the Sections and developments of Solids.
- Learn the procedure to develop Isometric projections, convert Orthographic views to Isometric views and vice versa using Graphics Instruments and AutoCAD.

Course Outcomes:

- Apply the fundamental principles of Engineering Graphics to create engineering drawings of various geometric constructions, conic sections and engineering scales adhering to BIS Standards.
- Generate Orthographic projections; Front View, top view and side views of points and lines.
- Draw the Orthographic projections of planes and solids
- Understand the Sections of solids and developments of surfaces.
- Develop Isometric projection convert Orthographic views to Isometric views and vice versa for practical engineering problems using AutoCAD.

UNIT – I

Introduction to Engineering Graphics: Principles of Engineering Graphics and their Significance, Scales – Plain & Diagonal, Conic Sections-ellipse, parabola, hyperbola and Rectangular Hyperbola – General method only. Cycloid, Epicycloid and Hypocycloid. Introduction to Auto CAD software – Commands.

UNIT- II

Orthographic Projections: Principles of Orthographic Projections – Conventions – Projections of Points and Lines, Projections of Plane regular geometric figures.

UNIT – III

Projections of Regular Solids inclined to one plane, Sections and Sectional views of Right Regular Solids –Prism, Cylinder, Pyramid, and Cone

UNIT – IV

Development of Surfaces of Right Regular Solids – Prism, Cylinder, Pyramid and Cone. Intersection of solids – cylinder vs cylinder.

UNIT – V

Isometric Projections: Principles of Isometric Projection – Isometric Scale – Isometric Views – Conventions – Isometric Projection of solids. Conversion of Isometric Views to Orthographic Views and Vice-versa – Conventions.

Free hands Sketches of 2D, creation of 2D sketches. conversion of Isometric views to orthographic views using Auto CAD.

TEXT BOOKS:

1. Engineering Drawing N.D. Bhatt / Charotar
2. Engineering Drawing, Basant Agrawal and C M Agrawal, Third Edition McGraw Hill
3. Engineering Drawing and graphics Using AutoCAD Third Edition, T. Jeyapoovan, Vikas: S.Chand and company Ltd.

REFERENCE BOOKS:

1. Engineering Graphics and Design, WILEY, Edition 2020
2. Engineering Drawing, M. B. Shah, B.C. Rane / Pearson.
3. Engineering Drawing, N. S. Parthasarathy and Vela Murali, Oxford
4. Computer Aided Engineering Drawing – K Balaveera Reddy et al – CBS Publishers

Note: - Internal and External examinations are conducted in conventional mode.

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3	0	0	3

B.Tech. in Mechanical Engineering
II Semester Syllabus
ME202ES: ENGINEERING MECHANICS

Course Objectives: The objectives of this course are to

- Explain the resolution of forces, compute the resultant of system of forces and solve problems using equations of equilibrium.
- Perform analysis of forces acting on bodies lying on rough surfaces.
- Locate the centroid and compute the area moment of inertia of standard and composite sections
- Locate centre of gravity and compute the mass moment of inertia of standard and composite bodies.
- Explain kinematics and kinetics of particles, curvilinear motion and rotation of rigid bodies.

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

- Determine resultant of forces acting on a body and analyze equilibrium of a body subjected to system of forces.
- Solve problem of bodies subjected to friction.
- Find the location of centroid and calculate area moment of inertia of a given section.
- Find the centre of gravity and calculate the mass moment of inertia of given body.
- Solve problems using kinematic equations and also solve problems using principles of kinetics such as work-energy principle, Impulse-momentum principle

UNIT-I

Introduction to Engineering Mechanics - Basic concepts, System of Forces, Moment of Forces and its Application; Resultant of Force System, Free body diagrams, Equilibrium of System of Forces, Equations of Equilibrium of Coplanar Concurrent Force System; Spatial Systems - Components in Space, Resultant; Static Indeterminacy.

UNIT-II

Friction: Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, Wedge Friction, Screw jack;

UNIT-III

Centroid of Lines and Areas from first principles; Centroid of composite sections;
Centre of Gravity of simple bodies and composite bodies; Theorems of Pappus.

UNIT-IV

Moment of Inertia – Definition; Theorems of moment of inertia; Area Moment of inertia of plane sections from first principles, Area Moment of inertia of composite sections;
Mass Moment of Inertia - Transfer Formula, Mass moment of inertia of simple bodies and composite bodies.

UNIT-V

Kinematics - Rectilinear motion; Plane curvilinear motion;

Kinetics - D'Alembert's principle - its applications in translation and motion of connected bodies; Work Energy principle - its application in motion of connected bodies; Impulse-momentum principle.

TEXT BOOKS:

1. K.Vijay Kumar Reddy and J.Suresh Kumar, Singer's Engineering Mechanics – Statics and Dynamics, BS Publications, 2011.
2. Irving H. Shames and G. Krishna Mohan Rao, Engineering Mechanics, Pearson Education, 2005.

REFERENCE BOOKS:

1. Timoshenko S.P and Young D.H., Engineering Mechanics, McGraw Hill International Edition, 1983.
2. Beer F.P & Johnston E.R Jr. Vector, Mechanics for Engineers, Tata McGraw Hill, 2004.
3. Hibbeler R.C & Ashok Gupta, Engineering Mechanics, Pearson Education, 2010.
4. Tayal A.K., Engineering Mechanics – Statics & Dynamics, Umesh Publications, 2011.
5. Basudeb Bhattacharyya, Engineering Mechanics, Oxford University Press, 2008.
6. Nelson A, Engineering Mechanics - Statics and Dynamics, McGraw Hill Education, 2017.

L	T	P	C
2	0	0	2

B.Tech. in Mechanical Engineering
II Semester Syllabus
MM201ES: ENGINEERING MATERIALS
(Common to Mechanical & MCT)

Course Objectives:

The objectives of this course are to
- Provide basic understanding of engineering materials, their structure, classification and usage.
- Introduce the testing methods for various material properties and ASTM standards used in testing.
- Understand the various materials used in mechanical engineering like metals, ceramics, polymers, composite materials and other new materials.

Course Outcomes:

At the end of the course, students will be able to**:**
- Classify the various materials that will be essential for the mechanical engineering applications.
- Express the mechanical properties of metals and their testing procedures.
- Understand the application of materials and their processing
- Understand the requirement and need for the development of the new materials.

UNIT-I: Introduction

Classification of Engineering Materials, Ashby chart, Mechanical Properties and their testing equipment/procedures, ASTM standards for testing, Stress–Strain Behavior of various materials, Sources of Material Data.

UNIT –II: Metallic Materials

Metals and Alloys, Classification, Ferrous alloys: Classification, composition, properties and applications of steels and cast irons; Nonferrous Alloys: Classification, composition, properties and applications of Non-ferrous alloys with a basic approach on alloys of Aluminum, Titanium, Zinc, Copper, Nickel, and Cobalt.

UNIT – III: Ceramics and Polymers

Ceramics: Crystal Structure Classification, Properties and Applications of ceramic materials, Ceramic fabrication techniques. Polymers: Chemistry, Characteristics, Applications and classification of polymers, Thermoplastic and Thermosetting Polymers, Processing of Polymers, Elastomers.

UNIT –IV: Composite Materials

Composites: Conceptual study and classification, merits, demerits and applications, Types of reinforcements, Types of matrices, Manufacturing methods: Hand and spray lay - up, injection molding, resin injection, filament winding, pultrusion, centrifugal casting.

UNIT – V: Advanced Materials

Materials for nanotechnology: Nanomaterials for semiconductor applications (Zinc oxide nano materials, titanium dioxide nanoparticles), Metallic nanomaterials (Silver, gold, iron and copper nanoparticles), ceramic nanomaterials and their applications, bio materials and other recently developed materials.

Suggested Readings:

1. George Murray, Charles V. White, Wolfgang Weise, “Introduction to Engineering Materials”, CRC Press, 2007.
2. William. D. Callister, David G. Rethwisch, “Materials Science and Engineering: An Introduction”, John Wiley & Sons, 2018.

Reference Books:

1. Myer Kutz, “Mechanical Engineers’ Handbook”, John Wiley & Sons, 2015.
2. M.A. Shah, K.A.Shah, Nano technology, the science of Small, WILEY, Second Edition, 2019.
3. E. Paul De Garmo, J.T. Black, R.A. Kohler. Materials and Processes in Manufacturing, John Wiley and Sons, Inc., NY, 11 the Edition, 2012.
4. R.J. Crawford, plastics engineering, Pergamon Presss, 2013.
5. Donald R Askland and Pradeep P Phule “Essentials of Materials Science and Engineering”, by Pradeep P. Fulay (Author), Donald R. Askeland, 2013.
6. K. K. Chawala, Cermic Matrix composite Materials, Kluwer Academic Publishers, 2002.

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B.Tech. in Mechanical Engineering
II Semester Syllabus
CH251BS : Engineering Chemistry Lab
(Common to all branches)

Course Objectives:

The course consists of experiments related to the principles of chemistry required for an Engineering student and the student will learn the following:

- Estimation of hardness of water to check its suitability for industrial and drinking purpose and estimation procedures through volumetric analysis.
- Estimation procedures using conductometry and potentiometry.
- Preparation of polymers such as Bakelite and Polystyrene in the laboratory.
- Understand the lubricant properties such as saponification value and viscosity of oils.
- Understand the corrosion of metals in a corrosive medium.

Course Outcomes:

After completing the course, the student will gain practical knowledge on:

- Determination of parameters like hardness of water and estimations through volumetric analysis.
- Performance of experiments of conductometry and potentiometry and estimation procedures using them.
- Preparation of polymers like Bakelite and Polystyrene.
- Performing experiments related to estimation of saponification value and viscosity of lubricating oils.
- Performing experiments to know rate of corrosion of mild steel in various conditions.

List of Experiments:

I. **Volumetric Analysis:** Estimation of hardness of water by EDTA - Complexometry method.
II. **Volumetric Analysis:** Estimation of Fe^{+2} by Dichrometry.
III. **Conductometry:** Estimation of the concentration of an acid by Conductometry.
IV. **Potentiometry:** Estimation of the amount of Fe^{+2} by Potentiometry.
V. **Potentiometry:** Determination of an acid concentration using Potentiometer.
VI. Preparations:
1. Preparation of Bakelite.
2. Preparation Polystyrene

VII. Lubricants:

1. Estimation of acid value of given lubricating oil.
2. Estimation of viscosity of lubricating oil using Ostwald's Viscometer.

VIII. **Corrosion:** Determination of rate of corrosion of mild steel in the presence and absence of inhibitor
IX. Virtual lab experiments
a. Construction of Fuel cell and its working.
b. Smart materials for Biomedical applications
c. Batteries for Electrical vehicles.
d. Functioning of Solar cell and its applications.

REFERENCE BOOKS:

1. Lab manual for Engineering chemistry by B. Ramadevi and P. Aparna - S Chand Publications,New Delhi (2022)
2. Vogel's text book of practical organic chemistry - 5th edition
3. Inorganic Quantitative analysis by A.I. Vogel - ELBS Publications.
4. College Practical Chemistry by V.K. Ahluwalia - Narosa Publications Ltd., New Delhi (2007).

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B.Tech. in Mechanical Engineering
II Semester Syllabus

CS251ES: PYTHON PROGRAMMING LABORATORY

(Common to All Branches)

Course Objectives:

- To install and run the Python interpreter
- To learn control structures.
- To Understand Lists, Dictionaries in python
- To Handle Strings and Files in Python

Course Outcomes: After completion of the course, the student should be able to

- Develop the application specific codes using python.
- Understand Strings, Lists, Tuples and Dictionaries in Python
- Verify programs using modular approach, file I/O, Python standard library
- Implement Digital Systems using Python

Note: The lab experiments will be like the following experiment examples

Week -1:

1. i) Use a web browser to go to the Python website http://python.org. This page contains informationabout Python and links to Python-related pages, and it gives you the ability to search the Python documentation.
   ii) Start the Python interpreter and type help() to start the online help utility.
2. Start a Python interpreter and use it as a Calculator.3.
   i) Write a program to calculate compound interest when principal, rate and number of periods are given.
   ii) Given coordinates (x1, y1), (x2, y2) find the distance between two points
4. Read name, address, email and phone number of a person through keyboard and print the details.

Week - 2:

1. Print the below triangle using for loop.5
   4 4
   3 3 3
   2 2 2 2
   1 1 1 1 1
2. Write a program to check whether the given input is digit or lowercase character or uppercase character or a special character (use 'if-else-if' ladder)
3. Python Program to Print the Fibonacci sequence using while loop
4. Python program to print all prime numbers in a given interval (use break)

Week - 3:

1. i) Write a program to convert a list and tuple into arrays.
   ii) Write a program to find common values between two arrays.
2. Write a function called gcd that takes parameters a and b and returns their greatest common divisor.
3. Write a function called palindrome that takes a string argument and returnsTrue if it is a palindromeand False otherwise. Remember that you can use the built-in function len to check the length of a string.

Week - 4:

1. Write a function called is_sorted that takes a list as a parameter and returns True if the list is sortedin ascending order and False otherwise.
2. Write a function called has_duplicates that takes a list and returns True if there is any element that appears more than once. It should not modify the original list.

   i). Write a function called remove_duplicates that takes a list and returns a new list with only the unique elements from the original. Hint: they don't have to be in the same order.

   ii). The wordlist I provided, words.txt, doesn't contain single letter words. So you might want to add"I", "a", and the empty string.

   iii). Write a python code to read dictionary values from the user. Construct a function to invert its content. i.e., keys should be values and values should be keys.
3. i) Add a comma between the characters. If the given word is 'Apple', it should become 'A,p,p,l,e'
   ii) Remove the given word in all the places in a string?
   iii) Write a function that takes a sentence as an input parameter and replaces the first letter of everyword with the corresponding upper case letter and the rest of the letters in the word by corresponding letters in lower case without using a built-in function?
4. Writes a recursive function that generates all binary strings of n-bit length

Week - 5:

1. i) Write a python program that defines a matrix and prints
   ii) Write a python program to perform addition of two square matrices
   iii) Write a python program to perform multiplication of two square matrices
2. How do you make a module? Give an example of construction of a module using different geometrical shapes and operations on them as its functions.
3. Use the structure of exception handling all general purpose exceptions.

Week-6:

1. a. Write a function called draw_rectangle that takes a Canvas and a Rectangle as arguments anddraws a representation of the Rectangle on the Canvas.
   b. Add an attribute named color to your Rectangle objects and modify draw_rectangle so that ituses the color attribute as the fill color.
   c. Write a function called draw_point that takes a Canvas and a Point as arguments and draws a representation of the Point on the Canvas.
   d. Define a new class called Circle with appropriate attributes and instantiate a few Circle objects.Write a function called draw_circle that draws circles on the canvas.
2. Write a Python program to demonstrate the usage of Method Resolution Order (MRO) in multiple levels of Inheritances.
3. Write a python code to read a phone number and email-id from the user and validate it for correctness.

Week- 7

1. Write a Python code to merge two given file contents into a third file.
2. Write a Python code to open a given file and construct a function to check for given words present init and display on found.
3. Write a Python code to Read text from a text file, find the word with most number of occurrences.

4. Write a function that reads a file *file1* and displays the number of words, number of vowels, blank spaces, lower case letters and uppercase letters.

Week - 8:

1. Import numpy, Plotpy and Scipy and explore their functionalities.
2. a) Install NumPy package with pip and explore it.
3. Write a program to implement Digital Logic Gates – AND, OR, NOT, EX-OR
4. Write a program to implement Half Adder, Full Adder, and Parallel Adder
5. Write a GUI program to create a window wizard having two text labels, two text fields and two buttonsas Submit and Reset.

TEXT BOOKS:

1. Supercharged Python: Take your code to the next level, Overland
2. Learning Python, Mark Lutz, O'reilly

REFERENCE BOOKS:

1. Python Programming: A Modern Approach, Vamsi Kurama, Pearson
2. Python Programming A Modular Approach with Graphics, Database, Mobile, and Web Applications, Sheetal Taneja, Naveen Kumar, Pearson
3. Programming with Python, A User's Book, Michael Dawson, Cengage Learning, India Edition
4. Think Python, Allen Downey, Green Tea Press
5. Core Python Programming, W. Chun, Pearson
6. Introduction to Python, Kenneth A. Lambert, Cengage

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B.Tech. in Mechanical Engineering
II Semester Syllabus
MM251ES: Fuels and Lubricants Laboratory
(Common to Mechanical & MCT)

Course Objective:

- To Understand the fuels and lubricants properties.

Course Outcomes:

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

- Find the kinematic viscosity of lubricants and its variation with temperature
- Determine the flash point, fire point, cloud point and pour point of liquid fuels
- Determine the calorific value of solid, liquid, and gaseous fuels
- Determination of the dropping point of lubricating grease
- Determination of distillation characteristics of petroleum products

List of Experiments:

1. Determination of Flash point of liquid fuels using Abel's Flash point Apparatus
2. Determination of Flash and Fire points of liquid fuels using Pensky Marten's Apparatus.
3. Carbon residue test: Liquid fuels.
4. Determination of Kinematic and Absolute viscosity of liquid lubricants using Saybolt/Universal viscometer.
5. Determination of Kinematic and Absolute viscosity of liquid lubricants using Redwood-I viscometer.
6. Determination of Kinematic and Absolute viscosity of liquid lubricants using Redwood-II viscometer.
7. Determination of Kinematic and Absolute viscosity of liquid lubricants using Engler viscometer.
8. Determination of Calorific value of Gaseous fuels using Junkers Gas Calorimeter.
9. Determination of Calorific value of Solid/Liquid fuels using Bomb Calorimeter.
10. Determination of grease penetration number by using grease penetration apparatus.
11. ASTM Distillation test Apparatus.
12. Cloud and Pour points apparatus.

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B.Tech. in Mechanical Engineering
II Semester Syllabus
MC201BS: Environmental Science
(Common to all branches**)**

Course Objectives:

- To understand the importance of ecosystem and ecological balance.
- To understand the natural resources and their conservation.
- To understand the importance of biodiversity and its values.
- To gain knowledge about environmental pollution, effects and controlling measures. To study about global environmental problems and global issues.
- To understand the environmental policies, regulations and sustainable development.

Course Outcomes:

After completing the course, the student will be able to:

- Get the information about ecosystem and their usage and conservation.
- Learn different types of natural resources and take up the measures to protect the resources.
- Get the information about biodiversity and their usage and conservation.
- Get the information about the types of pollution, understand their effects and controlling measures. Gain the knowledge about current global environmental issues and initiations to be taken to protect the environment.
- Gain the knowledge about environmental acts, EIA, sustainable development and follow the rules and regulations.

UNIT – I

Ecosystems: Definition, scope, and importance of ecosystem. Classification, structure, and function of an ecosystem, food chains, food webs, and ecological pyramids. Flow of energy, biogeochemical cycles, bioaccumulation, biomagnification, ecosystem value, services and carrying capacity. Field visits.

UNIT – II

Natural Resources: Classification of resources: Living and non-living resources. **Water resources:** Use and over utilization of surface and ground water, floods and droughts. Dams: Benefits and problems. **Mineral resources:** Use and exploitation, environmental effects of extracting and usingmineral resources. **Land resources** and **Forest resources**. **Energy resources:** Growing energy needs, renewable and non-renewable energy resources, use of alternate energy resources. Case studies.

UNIT – III

Biodiversity and Biotic Resources: Introduction, definition, genetic, species and ecosystem diversity. Values of biodiversity: Consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, hot spots of biodiversity. Field visit. Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts. Conservation of biodiversity: In - Situ and Ex -situ conservation. National biodiversity act.

UNIT – IV

Environmental Pollution and Control Technologies: Environmental pollution: Classification of pollution. **Air pollution:** Primary and secondary pollutants, automobile and industrial pollution. Ambient air quality standards. **Soil pollution:** Sources and types, impacts of modern agriculture, degradation of soil. **Solid waste:** Municipal solid waste management, composition and characteristics of e-waste and its management.

Pollution control technologies: Wastewater treatment methods: Primary, secondary and tertiary. Overview of air pollution control technologies, concepts of bioremediation.

Global Environmental issues and Global efforts: Climate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions /Protocols: Earth summit, Kyoto protocol and Montréal protocol. NAPCC-GoI Initiatives.

UNIT – V

Environmental Policy, Legislation & EIA: Environmental Protection Act, legal aspects Air Act- 1981, Water Act, biomedical waste management and handling rules, hazardous waste management and handling rules.

EIA: EIA structure, methods of baseline data acquisition. Concepts of environmental management plan (EMP).

Towards Sustainable Future: Concept of sustainable development goals, population and its explosion. Crazy consumerism, Environmental education, Human health, Environmental ethics. Concept of green building, Principles of green chemistry, Ecological footprint, Life cycle assessment (LCA), Low carbon life style.

TEXT BOOKS:

1 Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
2 Environmental Studies by R. Rajagopalan, Oxford University Press.

REFERENCE BOOKS:

1. Environmental Science: Towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela. 2008, PHI Learning Pvt. Ltd.
3. Environmental Science by Daniel B. Botkin & Edward A. Keller, Wiley INDIA edition.
4. Environmental Studies by Anubha Kaushik, 4th Edition, New Age International publishers.
5. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BSPublications.
6. Introduction to Environmental Science by Y. Anjaneyulu, BS Publications.

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B.Tech. in Mechanical Engineering
III Semester Syllabus
MM331ES: Material Science and Metallurgy
(Common to ME & MCT)

Course Objectives

The objectives of the course is to make the student

- This course provides the fundamental knowledge of science behind metals.
- This course introduces the concept of structure property relations, which lays the basis for studies in fields such as solid-state physics, mechanical behavior of materials, phase diagram and heat treatment.
- To develop an understanding of the atomistic and defect structures, and how they result in the microstructure and influence the properties of metals.
- To develop an understanding of the processes occurring in metals during heating that influences the microstructure and properties.
- To develop an understanding of the effects of alloying of metals upon the microstructure and properties.

Course Outcomes

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

- Analyze the Structure of materials at different levels, basic concepts of crystalline materials like unit cell, FCC, BCC, HCP, APF and Coordination Number etc.
- Understand the concept of phase, phase diagram and understand the basic terminologies associated with metallurgy. Construction and identification of iron –Iron carbide phase diagrams and invariant reactions.
- Understand the objectives of heat treatment and suggest the heat treatment process for various applications. Introduce the concept of Hardenability.
- Understand the construction and Significance of Time Temperature Transformation and ContinuousCooling Transformation diagrams. Understand the various Surface hardening mechanisms.
- Understand the significance and microstructure of alloy steels, cast irons and non-ferrous (aluminum,copper and Titanium) alloys.

Unit-I: Crystal Structure

Crystal Structure: Unit cells, Metallic crystal structures, SC, FCC, BCC and HCP, Atomic Packing Factor, coordination number, Ceramics. Imperfection in solids: Point, line, interfacial and volume defects; Edge and screw dislocations, strengthening mechanisms and slip systems, critically resolved shear stress.

Unit-II: Phase Diagrams

Alloys, substitutional and interstitial solid solutions: Hume-Rothery rules, Phase rule, Phase diagrams: Interpretationof binary phase diagrams and microstructure development; eutectic, eutectoid, peritectic, peritectoid and monotectic reactions. Iron-Iron carbide phase diagram and microstructural aspects of ledeburite, austenite, ferrite and cementite.

Unit-III: Heat Treatment of Steel

Objectives of Heat treatment: Annealing, Normalising, Hardening, Tempering and Spheroidising, Isothermal transformation diagrams for Fe-C alloys and microstructures development, Bainite, Pearlite, Martensite. TTT diagrams for eutectoid, hypoeutectoid and hypereutectoid steels, Continuous cooling curves and interpretation of final microstructures and properties-austempering, martempering.

Unit-IV: Surface Hardening Treatments

Surface Hardening Treatments, Case Hardening, Carburizing, Nitriding, Cyaniding, Carbo-Nitriding, Flame and Induction Hardening, Vacuum and Plasma Hardening.

Unit-V: Ferrous and Nonferrous Alloys

Alloying of steel, properties of stainless steel and tool steels, maraging steels, cast irons; grey, white, malleable and spheroidal cast irons, copper and copper alloys (Brass, bronze and cupro-nickel), Aluminium and Al-Cu-Mg alloys, Titanium alloys.

Suggested Readings:

1. V. Raghavan, "Material Science and Engineering', Prentice Hall of India Private Limited, 1999.
2. W. D. Callister, 2006, "Materials Science and Engineering-An Introduction", 6th Edition, Wiley India.

Reference Books:

1. S.H. Armer, Introduction to Physical Metallurgy, Mc. Graw Hill.
2. R.E. Reed Hill, Physical Metallurgical Principles, EWP Publishers.

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B.Tech. in Mechanical Engineering
III Semester Syllabus
ME301PC: Mechanics of Solids

Course Objectives

The objectives of the course is to make the student

- Understand basic concepts of stress, strain and their relations based on elasticity.
- Concepts of material behavior due to different types of loading.
- Calculate stresses and deformation of a bar due to loading under various conditions.
- Draw Shear Force and Bending Moment diagrams of a beam and find the maximum moment/shear and theirlocations.
- Compute normal and shear stresses.

Course Outcomes

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

- Apply knowledge of materials and structural elements for the analysis of simple structures;
- Analyze the behavior of the solid bodies subjected to various types of loading.
- Design the structural members subjected to bending and shear loads.
- Analyze and interpret materials testing data relating to behavior of structures.
- Undertake problem identification, formulation, and solution using a range of analytical methods.

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Unit – I

Simple Stresses & Strains: Elasticity and plasticity; Types of stresses & strains; Hooke's law; Stress-strain diagram for mild steel; Working stress; Factor of safety; Lateral strain, Poisson's ratio & volumetric strain; Elastic moduli & the relationship between them; Bars of varying section; Composite bars; Temperature stresses; Strain energy; Resilience; Gradual, sudden and impact loadings.

Unit – II

Shear Force and Bending Moment: Definition of beam; Types of beams; Concept of Shear Force (SF) and Bending Moment (BM); SF and BM diagrams for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed loads, uniformly varying loads and combination of these loads; Point of contra flexure; Relation between SF, BM and rate of loading at a section of a beam.

Unit - III

Flexural Stresses: Theory of simple bending; Assumptions; Derivation of bending equation: $M/I = f/y = E/R$; Neutral axis; Determination of bending stresses – section modulus of rectangular and circular sections, I-section and T-sections.

Unit-IV

Shear Stresses: Derivation of shear stress equation – Shear stress distribution across various beams sections like rectangular, triangular, I-section and T-sections.

Principal Stresses and Strains: Introduction; Stresses on an inclined section of a bar under axial loading; Normal and tangential stresses on an inclined plane for biaxial stresses; Principal stresses and strains - analytical approach.

Unit – V

Torsion of Circular Shafts: Theory of pure torsion; Assumptions; Derivation of Torsion equation: $T/J = \tau/r = G\theta/L$; Torsional moment of resistance – Polar section modulus.

Thin Cylinders: Thin cylindrical shells; Derivation of formula for longitudinal and circumferential stresses; Hoop, longitudinal and volumetric strains – changes in diameter and volume of thin cylinders; Thinspherical shells

Suggested Readings:

1. S. Ramamrutham and R.Narayanan, Strength of materials, Dhanpatrai Publishing Company.
2. Sadhu Singh, Strength of Materials, Khanna Publishers

Reference Books:

1. Popov, Solid Mechanics.
2. Ryder. G.H.Strength of Materials; Macmillan Long Man Publication.
3. Jindal, Strength of Materials, Umesh Publications.
4. D.S Prakash Rao, Strength of Materials Universities Press Pvt. Ltd.
5. S. S. Rattan, Strength of Materials Tata McGraw Hill Education Pvt. Ltd.
6. M. L. Gambhir, Fundamentals of Solid Mechanics PHI Learning Pvt. Ltd

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B.Tech. in Mechanical Engineering
III Semester Syllabus
ME302PC: Production Technology

Course Objectives

The objectives of the course is to make the student
- Identify the necessity and define with examples the concept of "manufacturing".
- List the main classifications of the manufacturing processes with examples.
- Understand the casting processes, patterns, principles of Gating system risers, methods of melting of metalsand alloys.
- Understand the welding processes: Gas Arc TIG & MIG, Thermit and plasma arc and other welding Processes.
- Know about rolling, extrusion, forging and various metal forming operations.

Course Outcomes

At the end of this course students should be able to
- An ability to understand the technical aspects of Moulding, Melting and casting.
- Exposure to various welding processes and their significance.
- Gain knowledge about soldering, Brazing, HAZ and testing of welds.
- An ability to analyze plane rolling and sheet metal forming processes.
- An ability to understand Extrusion and various forging and high energy rate forming principles and operations.

Unit – I: Casting Process

Steps involved in making a casting – Advantages of casting and its applications; Patterns -Pattern making, Types, Materials used for patterns, pattern allowances; Properties of moulding sands. Methods of Melting - Crucible melting and cupola operation – Defects in castings; Principles of Gating– Requirements of Gating system – Types of gates – Riser – Functions and types of Risers, Casting processes – Types – Sand moulding, Centrifugal casting, die- casting, Investment casting, shell moulding; Solidification of casting – Solidification of pure metal, Directional Solidification.

Unit – II: Welding processes - 1

Classification – Types of welds and welded joints; Welding Positions - Gas welding - Types, oxy-fuel gas cutting – standard time and cost calculations. Arc welding, forge welding, submerged arc welding, Resistance welding, Thermit welding.

Unit – III: Welding Processes - 2

Inert Gas Welding _ TIG Welding, MIG welding, Friction welding, Friction Stir Welding, induction welding, explosive welding, Laser Welding; Soldering and Brazing; Heat affected zone in welding. Welding defects – causes and remedies; destructive and non- destructive testing of welds.

Unit – IV: Metal Working Processes

Hot working, cold working, strain hardening, recovery, recrystallisation and grain growth. Sheet metal Operations: Stamping, Blanking and piercing, Coining, Strip layout, Hot and cold spinning – Bending and deep drawing. Rolling fundamentals – theory of rolling, types of Rolling mills and products. Forces in rolling and power requirements. Drawing and its types – wire drawing and Tube drawing –. Types of presses and press tools. Forces and power requirement in the above operations.

Unit – V: Extrusion, Forging and HERF Processes

Extrusion of Metals: Basic extrusion process and its characteristics. Hot extrusion and cold extrusion- Forward extrusion and backward extrusion – Impact extrusion – Extruding equipment – Tube extrusion, Hydrostatic extrusion. Forces in extrusion

Forging Processes: Forging operations and principles – Tools – Forging methods – Smith forging, Drop Forging – Roll forging – Forging hammers: Rotary forging – forging defects – cold forging, swaging, Forces in forging operations.

High Energy Rate Forming Processes: Limitations, Principles of Explosive Forming, Electro-hydraulic Forming, Electro-magnetic forming and rubber pad Forming.

Suggested Readings:

1. P.N. Rao, Manufacturing Technology, Vol.1 & 2 / Mc Graw Hill
2. Serope Kalpakjian, Steven R. Schmid, Manufacturing Engineering & Technology Pearson

Reference Books:

1. Serope Kalpakjian, Steven R. Schmid, Metal Casting, T.V Ramana Rao / New Age
2. G. Thirupathi Reddy, Production Technology, Scitech
3. J.P. Kaushish, Manufacturing Processes, PHI Publications

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B.Tech. in Mechanical Engineering
III Semester Syllabus
ME303PC: Thermodynamics

Pre-requisite: Engineering Chemistry and Physics Course

Course Objectives

At the end of the course, the students are expected to
- Understand the treatment of classical Thermodynamics
- Apply the First and Second laws of Thermodynamics to engineering applications
- Understand phase change phenomenon in pure substances and to understand various property diagrams
- Understand various properties of moist air and plot them on psychrometric chart
- Represent various cycles on P-v and T-s diagrams

Course Outcomes

After successful completion of course
- Understand and differentiate between different thermodynamic systems and processes.
- Understand and apply the laws of Thermodynamics to different types of systems undergoing variousprocesses and to perform thermodynamic analysis.
- Analyze the problems related to pure substances and to plot the processes on T-s, P-v and h-s diagrams.
- Analyze various properties of moist air for air-conditioning applications
- Understand and analyze the Thermodynamic cycles and evaluate performance parameters.

Tables/Codes: Steam Tables and Mollier Chart, Refrigeration Tables

Unit-I

Introduction: Basic Concepts- System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Exact & Inexact Differentials, Cycle – Reversibility – Quasi – static Process, Irreversible Process, Causes of Irreversibility – Energy in State and in Transition, Types, Displacement & Other forms of Work, Heat, Point and Path functions, Zeroth Law of Thermodynamics – Concept of Temperature – Principles of Thermometry – Reference Points – Const. Volume gas Thermometer – Scales of Temperature, Ideal Gas Scale

Unit-II

PMM I - Joule's Experiments – First law of Thermodynamics – Corollaries – First law applied to a Process – applied to a flow system – Steady Flow Energy Equation. Limitations of the First Law – Thermal Reservoir, Heat Engine, Heat pump , Parameters of performance, Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements and their Equivalence / Corollaries, PMM of Second kind, Carnot's principle, Carnot cycle and its specialties, Thermodynamic scale of Temperature, Clausius Inequality, Entropy, Principle of Entropy Increase – Energy Equation, Availability and Irreversibility – Thermodynamic Potentials, Gibbs and Helmholtz Functions, Maxwell Relations

Unit-III

Pure Substances, p-V-T- surfaces, T-S and h-s diagrams, Mollier Charts, Phase Transformations – Triple point at critical state properties during change of phase, Dryness Fraction – Clausius – Clapeyron Equation Property tables. Mollier charts – Various Thermodynamic processes and energy

Transfer – Steam Calorimetry. Perfect Gas Laws – Equation of State, specific and Universal Gas constants – various Non-flow processes, properties, end states, Heat and Work Transfer, changes in Internal Energy – Throttling and Free Expansion Processes – Flow processes

Unit-IV

Mixtures of perfect Gases – Mole Fraction, Mass friction Gravimetric and volumetric Analysis – Dalton's Law of partial pressure, Avogadro's Laws of additive volumes – Mole fraction, Volume fraction and partial pressure, Equivalent Gas const, vanderwaals equation for real gases. Atmospheric air - Psychrometric Properties – Dry bulb Temperature, Wet Bulb Temperature, Dew point Temperature, Thermodynamic Wet Bulb Temperature, Specific Humidity, Relative Humidity, saturated Air, Vapour pressure, Degree of saturation – Adiabatic Saturation, Carrier's Equation – Psychrometric chart

Unit-V

Power Cycles: Otto, Diesel, Dual Combustion cycles, Ericsson Cycle - Description and representation on P–V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis – comparison of Cycles. Brayton and Rankine cycles – Performance Evaluation. Refrigeration Cycles: Bell-Coleman cycle, Vapour compression cycle-performance Evaluation.

Suggested Readings:

1. P. K Nag, Engineering Thermodynamics –TMH
2. Kenneth A. Kroos, Thermodynamics for Engineers, Merle C. Potter/ Cengage

Reference Books:

1. Yunus. A. Cengel Introduction to Thermodynamics
2. Sonntag, Borgnakke, Van wylen Fundamentals of Thermodynamics
3. Chattopadhyay, Engineering Thermodynamics, Oxford
4. Rogers, Engineering Thermodynamics, Pearson

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B.Tech. in Mechanical Engineering
III Semester Syllabus
ME304PC: Fluid Mechanics and Hydraulic Machines

Course Objectives

The Objectives of the course is to make the student

- To understand the basic principles of fluid mechanics
- To understand kinematic and dynamic flows
- To understand boundary layer concepts and flow through pipes
- To evaluate the performance of hydraulic turbines
- To understand the functioning and characteristic curves of pumps

Course Outcomes

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

- Able to explain the effect of hydro static forces.
- Able to identify type of fluid flow patterns and describe continuity equation.
- To analyze a variety of practical fluid flow and measuring devices and utilize Fluid Mechanics principles in design. Able to demonstrate boundary layer concepts.
- To select and analyze the properties of a turbine with reference to given situation in power plants.
- To estimate performance parameters of a given Centrifugal and Reciprocating pump.

Unit–I

Fluid statics: Dimensions and units: physical properties of fluids-specific gravity, viscosity, and surface tension – vapor pressure and their influence on fluid motion-atmospheric, gauge and vacuum pressures–measurement of pressure-Piezometer-tube and differential manometers.

Hydro static forces on surfaces: Total pressure and center of pressure, vertical plane surface, horizontal plane surface, inclined plane surface and curved surfaces submerged in liquids- Pressure distribution in liquids.

Unit–II

Fluid kinematics: Streamline, path line, streak lines and stream tube, classification of flows-steady& unsteady, uniform & non-uniform, laminar & turbulent, rotational & irrotational flows-equation of continuity for one dimensional flow and three-dimensional flows.

Fluid dynamics: Surface and body forces –Euler's and Bernoulli's equations for flow along a streamline, Measurement of flow applications of Bernoulli's Equation : Pitot tube, venture meter, and orifice meter, Flow nozzle – momentum equation and its application on force on pipe bend.

Unit–III

Boundary Layer Concepts: Definition, thicknesses, characteristics along thin plate, laminar and turbulent boundary layers (No derivation) boundary layer in transition, separation of boundary layer, submerged objects– drag and lift.

Closed conduit flow: Reynolds's experiment- Darcy Weisbach equation- Minor losses and major losses in pipes- pipes in series and pipes in parallel-Total energy line-hydraulic gradient line.

Unit–IV

Basics of turbo machinery: Hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at its tip, velocity diagrams, work done and efficiency, flow over radial vanes.

Hydraulic Turbines: Classification of turbines, Heads and efficiencies, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design –draft tube theory-functions and efficiency.
Performance of hydraulic turbines: Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer.

Unit–V

Centrifugal pumps: Classification, working, work done–barometric head-losses and efficiencies specific speed- performance characteristic curves, NPSH.
Reciprocating pumps: Working, Discharge, slip, indicator diagrams.

Suggested Readings:

1. R.K. Bansal, Fluid Mechanics and Hydraulic Machinery
2. MODI and SETH, Hydraulics, Fluid mechanics and Hydraulic Machinery.
3. Rajput, Fluid Mechanics and Hydraulic Machines.

Reference Books:

1. D.S.Kumar, Fluid Mechanics and Fluid Power Engineering, Kotaria& Sons.
2. D.Rama Durgaiah, Fluid Mechanics and Machinery, New Age International.
3. Banga & Sharma, Hydraulic Machines, Khanna Publishers.

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B.Tech. in Mechanical Engineering
III Semester Syllabus
MC301HS: Constitution of India
(Common to CE, EEE, ME, ECE, MCT & MME)

Course Objectives

- Students will get to know about the history of Indian Constitution
- Students will get to know about President election and his Powers
- Students will get to know about Council of Ministers and their election Procedure and their Powers andResponsibilities
- Students will get know about Judicial System in India
- Students will get know about Panchayat-raj System in India

Course Outcomes

- This enables the Students to know about the Rights of Citizen.
- This enables the Students to know about Fundamental Duties of People.
- This enables the Students to Know the Directive principles of State Policy.
- This enables the Students to know about Functioning of Parliament and its Powers.
- This enables the Students to know about various Constitutional bodies in India.

Course content

1. Meaning of the constitution law, and constitutionalism
2. Historical perspective of the Constitution of India
   - Drafting Committee
3. Salient features and characteristics of the Constitution of India
   - Preamble
   - Salient Features
   - Major Sources of Indian Constitution
4. Scheme of the fundamental rights
   - Article 13 to 32
   - Scheme of the Fundamental Right to Equality
   - Scheme of the Fundamental Right to certain Freedom
   - Scope of the Right to Life and Personal Liberty
5. The scheme of the Fundamental Duties and its legal status
   - List of Fundamental Duties
   - Justifiability of Fundamental Duties
6. The Directive Principles of State Policy – Its importance and implementation
   - Categories - Gandhian, Socialist and Liberal Principles
   - Significance of Directive Principles of State Policy
   - Relation between Fundamental rights and Directive Principles of State Policy
7. Federal structure and distribution of legislative and financial powers between the Union and the States
   - Union List
   - State List
   - Concurrent List
   - Residuary Powers
8. Parliamentary Form of Government in India.
9. The constitutional powers and status of the President of India vs the constitutional powers and status of theCouncil of ministers headed by the Prime Minister

10. Amendment of the Constitution and its Procedure
    - Procedure of Amendment to Constitution of India
    - Important Amendments
11. Emergency Provisions: National Emergency, President Rule, Financial Emergency
12. Local Self Government – Constitutional Scheme in India
    - Urban local Self Government
    - Rural local Self Government
13. Important Constitutional Bodies
    - Election Commission of India
    - Finance Commission of India
    - Union Public Service Commission
    - C-AG

Suggested Readings:

1. Subhash Kashyap, Our Constitution, National Book Trust, 5th Edition,Reprint- 2017.
2. V. N Shukla, The Constitution of India,Law literature Publication, 11th Edition, 2020.

Reference Books:

1. M P Jain, Indian Constitutional Law, Lexis Nexis, 8th Edition, 2018.
2. Samaraditya Pal, Indian Constitution-Origin& Evolution, Lexis Nexis, 1st Edition, 2019

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B.Tech. in Mechanical Engineering
III Semester Syllabus
MM361ES: Metallurgy & Mechanics of Solids Lab
(Common to ME & MCT)

A) Metallurgy Lab

Course Objectives

At the end of this course, students are expected to
- Impart fundamental knowledge of materials properties, their selection and application.
- Explain the role of Metallurgy and Material Science in all manufacturing processes.
- Understand the metallography of ferrous and non-ferrous metals.

Course Outcomes

After successful completion of this course, students should be able to develop following skills
- Study the atomic structure of the materials.
- Analyze the microstructure of the materials.
- Correlate the microstructure to mechanical properties of the materials.

List of Experiments:

1. Preparation and study of crystal structure models for simple cubic, body centred cubic, face centered cubic andhexagonal close packed structures.
2. Preparation and study of microstructure of pure metals like Iron, Cu, and Al.
3. Preparation and study of microstructure of mild steels, low carbon steels and high carbon steels.
4. Study of microstructures of Cast Irons.
5. Study of microstructures of Non-Ferrous alloys.
6. Hardenability of steels by Jominy End Quench Test.

B) Mechanics of Solids:

Course Objectives

- Understand basic concepts of stress, strain and their relations based on elasticity.
- Understand basic concepts of material behavior due to different types of loading.
- Understand how to calculate stresses and deformation of a bar due to an axial loading.

Course Outcomes

- Analyze the behavior of the solid bodies subjected to various types of loading.
- Apply knowledge of materials and structural elements to the analysis of simple structures.
- Analyze and interpret laboratory data relating to behavior of structures and the materials they are made of.

List of Experiments:

1. Tension test
2. Bending test on Simply supported beam
3. Bending test on Cantilever beam
4. Torsion test
5. Hardness test (Brinell & Rockwell)
6. Test on springs
7. Impact test.(Charpy and Izod)

Note: Any 10 experiments from the above are to be conducted taking at least four from each section.

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B.Tech. in Mechanical Engineering
III Semester Syllabus
ME351PC: Production Technology Lab

Course Objectives

The objectives of the course is to make the student
- Understand the manufacturing of simple patterns and making a casting.
- Fabricate welded joints using processes like Arc welding, TIG welding, Plasma welding, Spot welding.
- Study simple, compound and progressive dies and the process to perform blanking and piercing operations.
- Gain knowledge in deep drawing, extrusion bending and other operations using hydraulic press
- Prepare plastic products by using Injection and & Blow moulding equipment

Course Outcomes

At the end of the course, the student will be able to
- Design and manufacture simple patterns, test Sand properties and perform moulding, melting and casting.
- Operate Arc welding, Gas welding, TIG, Water Plasma and Spot welding Equipment for making different joints.
- Use of various dies and perform blanking and piercing operations
- Perform deep drawing and extrusion operations using Hydraulic Press.
- Use injection moulding and blow moulding equipment for processing of plastics.

Minimum of 10 Exercises need to be performed:

I. Metal Casting Lab:
1. Pattern Design and making - for one casting drawing.
2. Sand properties testing - Exercise -for strengths, and permeability – 1
3. Moulding Melting and Casting - 1 Exercise

II. Welding Lab:
1. ARC Welding Lap & Butt Joint - 2 Exercises
2. Spot Welding - 1 Exercise
3. TIG Welding - 1 Exercise
4. Plasma welding and Brazing - 2 Exercises(Water Plasma Device)

III. Mechanical Press Working:
1. Blanking & Piercing operation and study of simple, compound and progressive press tool.
2. Hydraulic Press: Deep drawing and extrusion operation.
3. Bending and other operations

IV. Processing Of Plastics
1. Injection Moulding
2. Blow Moulding

Reference Books:
1. G.H.F. Nayler, Dictionary of Mechanical Engineering –Jaico Publishing House.

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B.Tech. in Mechanical Engineering
III Semester Syllabus
ME352PC: Fluid Mechanics and Hydraulic Machines Lab

Course Objectives

At the end of this course students are expected to:

- Verify the Bernoulli's equation and to calculate pressure heads along pipe flow
- Determine the coefficient of discharge for venturimeter, orifice meter.
- Find out the major losses in flow through pipes.
- Study the characteristic of a centrifugal and reciprocating pump
- Evaluate the coefficient of impact of jet on different kinds of vanes and also to study the performance of hydraulic turbines

Course Outcomes

After successful completion of the course, student will:

- Understand on calibration of venturimeter and orifice meter.
- Understand about different coefficients of discharges for different flow devices
- Obtain the knowledge on design of turbines with the available heads and speeds
- To estimate performance parameters of a given centrifugal and reciprocating pump
- To analyze the losses of a fluid flow in pipes

List of Experiments:
(To conduct any Ten Experiments)

1. Impact of jets on Vanes.
2. Performance Test on Pelton Wheel.
3. Performance Test on Francis Turbine.
4. Performance Test on Kaplan Turbine.
5. Performance Test on Single Stage Centrifugal Pump.
6. Performance Test on Multi Stage Centrifugal Pump.
7. Performance Test on Reciprocating Pump.
8. Calibration of Venturimeter.
9. Calibration of Orifice meter.
10. Determination of friction factor for a given pipe line.
11. Calibration of V- Notch and Rectangular Notch
12. Verification of Bernoulli's Theorem

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B.Tech. in Mechanical Engineering

III Semester Syllabus

ME353PC: Machine Drawing Practice

Course Objectives:

The objectives of the course is to make the students

- Familiarize with the standard conventions for different materials and machine parts in working drawings.
- Make part drawings including sectional views for various machine elements.
- Prepare assembly drawings given the details of part drawings.
- Learn the concept of fluid system and analyzing the applications of fluid systems in power transmission.
- Prepare CAD 2D and 3D part models using AUTOCAD and Solid works

Course Outcomes:

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

- Prepare engineering and working drawings with dimensions and bill of material during design anddevelopment. Developing assembly drawings using part drawings of machine components.
- Use conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs and ribs, Sections
- Learn and draw different types of Drawings – working drawings for machine parts.
- Prepare Title boxes, their size, location and details and methods of dimensioning.
- Understand the types of sections – selection of section planes and drawing of sections and auxiliary sectional views. Parts not usually sectioned.
- Preparation of 2D Drawings and 3D Basic solid models using CAD

Machine Drawing Conventions:

Need for drawing conventions– introduction to BIS conventions, Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs and ribs.

I. Drawing of Machine Elements and simple parts

Selection of Views, additional views for the following machine elements and parts with easy Drawing proportions.

1) Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws and gears.
2) Keys, cotter joints and knuckle joint.
3) Rivetedjointsforplates.
4) Shaft coupling: Universal coupling, Oldham's coupling.
5) Journal, pivot and collar and foot step bearings.

II. Assembly Drawings:

Drawings of assembled views, detailing for the part drawings of the following using conventions and easy drawing proportions.

1) Engine parts – stuffing box, Eccentric, Petrol Engine connecting rod.
2) Machine tool parts: Tool Post, Machine Vice.
3) Other machine parts- Screws jack, Plummer block.
4) Valves: Air Cock, Rams bottom safety valve, blow-off cock valve.

NOTE: First angle projection to be adopted. The student should be able to provide working drawings of actualparts.

TEXTBOOKS:

1. Machine Drawing–Ajeet Singh, TMH Publications
2. Machine Drawing–K.L.Narayana, P.Kannaiah & K.VenkataReddy/NewAge/Publishers
3. MachineDrawing–N.D.Bhatt.
4. EngineeringGraphicswithAutoCAD–JamesD.Bethune–PHI2009Edition.

REFERENCEBOOKS:

1. Machine Drawing–P.S.Gill.
2. Machine Drawing–Luzzader
3. MachineDrawing-Rajput

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Mahatma Gandhi Institute of Technology (A)
B.Tech. IV Semester
MA403BS: Probability, Statistics and Complex Variables
(ME, MCT and MME)

Course Objectives

- The ideas of random variables and various discrete and continuous probability distributions and their properties.
- The concept of theoretical distributions
- The testing of hypothesis and making statistical inferences
- Differentiation of complex valued functions.
- Evaluation of integrals using Cauchy's integral formula and Cauchy's residue theorem. Expansion of complex functions using Taylor's and Laurent's series.

Course Outcomes: After completion of the course the students will be able to:

- Formulate and solve problems involving random variables and probability distributions
- Understand the theoretical distributions
- Apply concept of testing of hypothesis to case studies
- Analyze the complex function with reference to their analyticity
- Evaluating integrals using Cauchy's integral and residue theorems. Taylor's and Laurent's series expansions of complex function

UNIT-I: Random Variables and Probability Distributions

Concept of a Random variables - Discrete and Continuous random variables and their distribution functions – Expectation, Variance and standard deviation of random variables.

UNIT-II: Theoretical Distributions

Binomial, Poisson distributions and their properties, Poisson approximation to the binomial distribution, Uniform distribution, Normal distributions and its properties. Normal approximation to Binomial distribution

UNIT-III: Tests of Hypotheses:

Test of significance- Basics of testing of hypothesis, Null and Alternate hypothesis, types of errors, level of significance, Critical region, Large sample test - single mean, single proportion, difference of means, difference of proportions; Small sample tests- Student's t-distribution, single mean, difference of means.

UNIT-IV: Complex Differentiation

Limit, Continuity and Differentiation of Complex functions, Analyticity, Cauchy-Riemann equations in Cartesian and Polar co-ordinates (without proof), finding harmonic conjugate, Mobius transformation.

UNIT-V: Complex Integration

Line integral, Cauchy's theorem, Cauchy's Integral formula, Zeros of analytic functions, Singularities, Taylor's series, Laurent's series, Residues, Cauchy Residue theorem (All theorems without Proof).

Text Books:

1. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition,2010.
2. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, keying Ye, Probability and statistics for engineers and scientists, 9th Edition, Pearson Publications.

Reference Books:

1. Fundamentals of Mathematical Statistics, Khanna Publications, S.C.Guptha and V.K.Kapoor.
2. Miller and Freund's, Probability and Statistics for Engineers, 8th Edition, Pearson Educations.
3. N.P.Bali and Manish Goyal, A textbook of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
4. J. W. Brown and R.V.Churchill, ComplexVariables and Applications, 7th Edition, Mc-GrawHill,2004.

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MAHATMA GANDHI INSTITUTE OF TECHNOLOGY (Autonomous)
IV Semester Syllabus
EE431ES: BASIC ELECTRICAL AND ELECTRONICS ENGINEERING
(Common for ME and MME)

Prerequisite: **Mathematics, Physics**

Course Objectives:

1. To understand magnetic circuits, DC circuits and AC single phase & three phase circuits
2. To impart the knowledge of various electrical installations
3. To study and understand the different types of DC/AC machines and Transformers.
4. To introduce the concepts of diodes & filters
5. To impart the knowledge of various configurations, characteristics and applications in transistors and field effect transistors.

Course Outcomes:

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

1. To analyze and solve electrical circuits using network laws and theorems.
2. To introduce components of Low Voltage Electrical Installations
3. To study the working principles of Electrical Machines
4. To understand and analyze basic diode and rectifier configurations
5. To identify and characterize various types of transistors.

UNIT-I: ELECTRICAL CIRCUITS

DC Circuits: Electrical circuit elements (Resistor, Inductor & Capacitor), Ohm's Law, voltage and current sources (Independent and Dependent), Kirchhoff's Laws, Mesh Analysis, Nodal Analysis, Delta-Star & Star Delta Conversion
A.C. Circuits: Representation of sinusoidal waveforms, peak value and rms values, phasor representation, Analysis of single-phase ac circuits with phasor diagrams, Three-phase balanced circuits, voltage and current relations in star and delta connections

UNIT-II: ELECTRICAL INSTALLATION

Miniature Circuit Breaker (MCB), Types of Wires and Cables, Earthing, Types of earthing, Batteries, Elementary calculations for energy consumption.

UNIT-III: ELECTRICAL MACHINES

Working principle of Single-phase transformer, equivalent circuit, ideal transformer - phasor diagram of ideal transformer at no load and load, losses in transformers, efficiency & regulation calculation. Construction and working principle of DC generators, Types of DC generators: Separately excited, Self-Excited (Shunt, Series, Compound), EMF equation. Working principle of DC motors, Types of DC motors,
Torque equations Construction and working principle of Three-phase Induction motor, Slip, effect of slip on rotor parameters.

UNIT-IV: ELECTRONIC DEVICES

Diodes: Principle of Operation, Forward bias, Reverse bias, Static Volt-Ampere characteristics, Static and dynamic resistances, Operation of Zener diode, Characteristics of zener diode and applications.

Rectifiers and Filters: P-N junction as a rectifier - Half Wave Rectifier, Full Wave Rectifier, Bridge Rectifier, Filters – Inductor Filters, Capacitor Filters

UNIT-V: TRANSISTORS

Bipolar Junction Transistor (BJT) - Construction, Principle of Operation, Common Emitter, configurations, Input and Output Characteristics.

Field Effect Transistor (FET): Construction, Principle of Operation of JFET, Output Characteristics, Transfer Characteristics

Suggested Readings:

1. M S Sukija, TK Nagasarkar Basic Electrical and Electronics Engineering – Oxford University.
2. D.P. Kothari, I J Nagrath, Basic Electrical and Electronics Engineering - McGraw Hill Education.

Reference Books:

1. R. L. Boylestad and Louis Nashelsky, Electronic Devices and Circuits, PEI/PHI, 9th Ed, 2006.
2. J. Millman and C. C. Halkias, Satyabrata Jit, Millman's Electronic Devices and Circuits, TMH, 2/e, 1998.
3. William Hayt and Jack E. Kemmerly, Engineering circuit analysis, McGraw Hill Company, 6th edition.

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B.Tech. in Mechanical Engineering
IV Semester Syllabus
ME401PC: Kinematics of Machinery (Common to ME & MCT)

Course Objectives

The objectives of the course is to make the student
- To study the relative motion, velocity, and accelerations of the various elements in a mechanism.
- To study the concept of mobility of Linkages, mechanismssuchasfourbar/slidercrank/doubleslidercrank/straightlinemotionmechanismetc.
- To analyze and understand the mechanisms with Lower pairs and Steering gear mechanisms and working of hooks joint.
- Develop the skills for designing and analyzing the mechanisms with higher pair such as Cams, Gears and Gear Trains.

Course Outcomes

At the end of the course, the student will be able to
- Identify different relative motions among various elements in mechanisms.
- Understand the position, velocity and acceleration in kinematics of mechanisms.
- Design the mechanisms with lower pairs and higher pairs.
- Understand the application of gears and gear trains

Unit–I

Mechanisms: Elements or Links – Classification – Rigid Link, flexible and fluid link – Types of kinematics pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs– constrained motion–completely, partially or successfully and incompletely constrained.

Mechanism and Machines – Mobility of Mechanisms: Grubler's criterion, classification of machines – kinematics chain – inversions of mechanism – inversions of quadric cycle chain, single and double slider crank chains, Mechanical Advantage.

Unit–II

Kinematics: Velocity and acceleration – Motion of link in machine – Determination of Velocity and acceleration– Graphical method – Application of relative velocity method.

Plane motion of body: Instantaneous center of rotation-centrodes and axodes–Three centers inline theorem – Graphical determination of instantaneous center, determination of angular velocity of points and links by instantaneous center method.

Kliens construction - Coriolis acceleration - determination of Coriolis component of acceleration **Analysis of Mechanisms:** Analysis ofslidercrankschainfordisplacement-velocityandaccelerationofslider– Acceleration diagram for a given mechanism.

Unit–III

Straight-line motion mechanisms: Exact and approximate copied and generated types–Peaucellier - Hart - Scott Russel – Grasshopper – Watt -Tchebicheff's and Robert Mechanism – Pantographs Steering gears : Conditions for correct steering – Davis Steering gear, Ackerman's steering gear. Hooke's Joint: Single and double Hooke's joint– velocity ratio –application–problems.

Unit–IV

Cams: Definitions of cam and followers – their uses – Types of followers and cams – Terminology –Types of follower motion - Uniform velocity, Simple harmonic motion and uniform acceleration and retardation. Maximum
velocity and maximum acceleration during outward and return strokes in the above three cases.
Analysis of motion of followers: Tangent cam with Roller follower – circular arc cam with straight, concave and convex flanks.

Unit–V

Higher pair: Friction wheels and toothed gears–types–law of gearing, condition for constant velocity ratio for transmission of motion –velocity of sliding. Forms of teeth, cycloidal and involutes profiles–phenomena of interferences – Methods of interference. Condition for minimum number of teeth to avoid interference – expressions for arc of contact and path of contact of Pinion & Gear and Pinion & Rack Arrangements– Introduction to Helical– Bevel and worm gearing

Gear Trains: Introduction – Types – Simple – compound and reverted gear trains – Epicyclic gear train. Methods of finding train value or velocity ratio of Epicyclic gear trains. Selection of gear box –Differential gear for an automobile.

Suggested Readings:

1. JOSEPH E. SHIGLEY, Theory of Machines and Mechanisms, Oxford
2. R S Khurmi & J.K. Gupta.Theory of Machines

Reference Books:

1. S. S. Rattan, Theory of Machines Mc Graw Hill Publishers
2. Sadhu Singh, Theory of Machines, Pearson.
3. Thomas Bevan, Theory of Machines, CBS.

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B.Tech. in Mechanical Engineering
IV Semester Syllabus
ME402PC: Thermal Engineering – I

Course Objectives

The objectives of the course is to make the student

- To apply the laws of thermodynamics to analyze air standard cycles.
- To understand the combustion phenomena in spark ignition and compression ignition engines.
- To evaluate the performance parameters of major components and systems of internal combustion engines.
- To understand the working and the performance of reciprocating and centrifugal compressor.
- To apply the principles of thermodynamics to analyze different types of refrigeration systems and to understand the concepts of Air-refrigeration.

Course Outcomes

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

- Explain basic concepts of actual cycles with analysis and to describe the fundamental concepts of IC engines along with its working principles
- To describe the combustion phenomenon in SI and CI engines.
- To evaluate the performance parameters (Brake power, Friction power, Torque, Efficiencies) of internal combustion engines.
- To analyze working and the performance of (Isothermal efficiency, volumetric efficiency) reciprocating and centrifugal compressor.
- To differentiate between different types of refrigeration systems with respect to application and evaluate the performance parameters of air-refrigeration systems.

Unit – I

I.C. Engines: Classification - Working principles of Four & Two stroke engine, SI & CI engines, Valve and Port Timing Diagrams, Air – Standard, air-fuel and actual cycles - Engine systems – Carburetor and Fuel Injection Systems for SI engines, Fuel injection systems for CI engines, Ignition, Cooling and Lubrication system, Fuel properties and Combustion Stoichiometry.

Unit – II

Normal Combustion and abnormal combustion in SI engines – Importance of flame speed and effect of engine variables – Abnormal combustion, pre-ignition and knocking in SI Engines – Fuel requirements and fuel rating, anti-knock additives – combustion chamber – requirements, types of SI engines.

Four stages of combustion in CI engines – Delay period and its importance – Effect of engine variables – Diesel Knock– Need for air movement, suction, compression and combustion induced turbulence in Diesel engine – open and divided combustion chambers and fuel injection– Diesel fuel requirements and fuel rating.

Unit – III

Testing and performance: parameter of performance, Measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, Brake power – determination of frictional losses and indicated power.– performance test-heat balance sheet and chart.

Classification of compressors-fans blowers and compressors-positive displacement and dynamic types – reciprocating and rotary type.
Reciprocating compressors: principle of operation, work required, isothermal efficiency, volumetric efficiency and effect of clearance volume, staged compression under cooling, saving of work, minimum work condition for staged compression.

Unit-IV

Rotary flow compressors: Roots Blower, vane sealed compressor, Lysholm compressor- mechanical details and principle of working – efficiency considerations.
Centrifugal Compressors: Mechanical details and principle of operation – velocity and pressure variation. Energy transfer-impeller blade shape-losses, slip factor, power input factor, pressure coefficient and adiabatic coefficient – velocity diagrams – power.
Axial Flow Compressors: Mechanical details and principle of operation – velocity triangles and energy transfer per stage degree of reaction, work done factor - isentropic efficiency- pressure rise calculations – Polytropic efficiency.

Unit–V

Mechanical refrigeration and types-unit of refrigeration-air refrigeration system, details and principle of operation- applications of air refrigeration, vapor compression refrigeration systems-calculation of COP-effect of superheating and sub cooling, desired properties of refrigerants and common refrigerants-vapor absorption system-mechanical details-working principle. Use of p-h charts for calculations.
Air conditioning: concept of psychrometry: concept of psychrometry- properties of moist air-usage of psychrometric chart-calculation of moist air properties.
Types of air-conditioning systems-requirements –schematic layout of a typical plant.

Suggested Readings:

1. V. Ganesan, I.C. Engines Mc Graw Hill
2. Mahesh M Rathore, Thermal Engineering, Mc Graw Hill

Reference Books:

1. J.B Heywood, I.C. Engines Fundamentals, TMH
2. Taylor, The I.C. Engine in theory and Practice Vol.I, IT Prof. and Vol. II
3. R.K. Rajput, Thermal Engineering, Lakshmi Publication.
4. Engine emission -Springer and Patterson, Plenum Press.

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B.Tech. in Mechanical Engineering

IV Semester Syllabus
ME403PC: Instrumentation and Control Systems

Course Objectives

At the end of this course students are expected to:

- Know the basic principles of Measurements, General measurement system, Static Characteristics, Errors in various measuring instruments and the measurement of Displacement using various transducers.
- Understand the construction, working, advantages, limitations and applications of Instruments used for the measurement of Temperature and Pressure.
- Learn the principles of measurement of Level, Flow, Speed, Vibration and Acceleration.
- Understand the construction, working, advantages, limitations and applications of devices used for the measurement of Stress – strain, Humidity, Force.
- Learn the basic concepts of open & closed loop control systems and Transfer functions of Mechanical systems.

Course Outcomes

After successful completion of the course, student will:

- Be familiar with the basic principles of Measurements, Static Characteristics, Errors in various measuring instruments and the measurement of Displacement through various transducers.
- Be able to demonstrate the use of various measurement systems for the measurement of Temperature and Pressure.
- Possess a reasonable level of competence in the use of different sensors/gauges for the measurement of Level, Flow, Speed, Vibration and Acceleration.
- Be able to demonstrate the use of various sensors and transducers used for the measurement of Stress – Strain, Humidity and Force.
- Be able to apply the knowledge of Open and Closed loop control systems and Transfer functions of Mechanical systems

Unit – I

Definition – Basic principles of measurement – Measurement systems, generalized configuration and Functional description of measuring instruments – examples. Static performance characteristics –Classification of errors. Measurement of Displacement: Theory and construction of various transducers to measure displacement – Using Piezo electric, Inductive, capacitance, resistance, and Photo electric transducers;

Unit – II

Measurement of Temperature: Various Principles of measurement - Classification: Expansion Type: Bimetallic Strip- Liquid in glass Thermometer; Electrical Resistance Type: Thermistor, Thermocouple, RTD; Radiation Pyrometry: Optical Pyrometer; Measurement of Pressure: Dead weight pressure gauge, Bourdon pressure gauges, Bulk modulus pressure gauges, Bellows, Diaphragm gauges. Low pressure measurement –McLeod pressure gauge.

Unit – III

Measurement of Level: Direct methods – Indirect methods – Capacitive, Radioactive, Ultrasonic, Bubbler levelindicators. Flow measurement: Rotameter, magnetic, Ultrasonic, Turbine flowmeter, Hot – wire anemometer.

Measurement of Speed: Mechanical Tachometers, Electrical tachometers, Non- contact typeStroboscope;

Measurement of Acceleration and Vibration: Different simple instruments

Unit – IV

Stress-Strain measurements: Various types of stress and strain measurements –Selection and installation of metallic strain gauges; electrical strain gauge – gauge factor –Use of strain gauges for measuring torque, Strain gauge Rosettes.

Measurement of Humidity: Sling Psychrometer, Absorption Psychrometer, Dew point meter. Measurement of Force - Elastic force meters, load cells

Unit – V

Elements of Control Systems: Introduction, Importance – Classification – Open and closed systems- Difference between open and closed loop systems, systems- Transfer functions- First and Second order mechanicalsystems

Suggested Readings:

1. Dr.D.S.Kumar, Mechanical Measurements and control –
2. Alavala, Principles of Industrial Instrumentation & Control Systems, - - Cengage Learning
3. S. Bhaskar, Basic Principles – Measurements (Instrumentation) & Control Systems –Anuradha Publications.
4. S K Singh, Industrial Instrumentation and control –

Reference Books:

1. E. O. Doebelin, Measurement Systems: Applications & design, TMH
2. B.C. Nakra& K.K. Choudhary, Instrumentation, Measurement & Analysis, TMH
3. Holman, Experimental Methods for Engineers
4. R. K. Jain, Mechanical and Industrial Measurements, Khanna Publishers.
5. Sirohi and Radhakrishna, Mechanical Measurements, New Age International.

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MAHATMA GANDHI INSTITUTE OF TECHNOLOGY (Autonomous)
(Common to ME & MME)
IV Semester Syllabus
EE461ES: BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY

Prerequisite: **Basics of Electrical and Electronics Engineering**

Course Objectives:

1. To study a given network by applying various electrical laws
2. To understand the performance characteristics of DC and AC machines
3. To understand the characteristics of PN junction and Zener Diode
4. To understand the applications of diode as rectifiers
5. To understand the characteristics of BJT and FET

Course Outcomes:

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

1. Analyze network by applying various electrical laws
2. Analyze performance characteristics of DC and AC machines
3. Analyze the characteristics of PN junction and Zener Diode
4. Acquire the knowledge of various rectifier configurations
5. Analyze the characteristics of BJT and FET

LIST OF EXPERIMENTS/ DEMONSTRATIONS:

PART A: ELECTRICAL

1. Verification of KVL and KCL
2. Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single-Phase Transformer
3. Measurement of Active and Reactive Power in a balanced Three-phase circuit
4. Performance Characteristics of a DC Shunt Motor
5. Performance Characteristics of a Three-phase Induction Motor
6. No-Load Characteristics of a Three-phase Alternator

PART B: ELECTRONICS

1. Study and operation of
    a. Multi-meter (ii) Function Generator (iii) Regulated Power Supply (iv) Cathode Ray Oscilloscope.
2. PN Junction diode characteristics
3. Zener diode characteristics and Zener as voltage Regulator
4. Input & Output characteristics of Transistor in CE configuration
5. Full Wave Rectifier with & without filters
6. Input and Output characteristics of FET in CS configuration

Any 5 experiments from PART-A and 5 experiments from PART-B are to be conducted.

TEXT BOOKS:

1. Basic Electrical and electronics Engineering –M S Sukija TK Nagasarkar Oxford University
2. Basic Electrical and electronics Engineering-D P Kothari. I J Nagarath, McGraw Hill Education

Reference Books:

1. Electronic Devices and Circuits – R. L. Boylestead and Louis Nashelsky, PEI/PHI, 9th Ed, 2006.
2. Engineering circuit analysis- by William Hayt and Jack E. Kemmerly, McGraw Hill Company, 6th edition.
3. Network Theory by N. C. Jagan& C. Lakshminarayana, B.S. Publications.
4. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
5. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
6. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989

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B.Tech. in Mechanical Engineering
IV Semester Syllabus
ME451PC: Instrumentation and Control Systems Lab

Course Objectives

At the end of this course, the students are expected to:

- Study the working of Thermocouple, Thermister and Resistance Temperature Detector (RTD) for temperature measurement.
- Study and use of LVDT transducer.
- Study the measurement of vibration using accelerometer.
- Study the working of Optical, Proximity and Tacho Pickups for the measurement of speed.
- Study the measurement and control of Process parameters like Flow, Pressure, Temperature and Level using SCADA

Course Outcomes

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

- Understand the calibration of Thermocouple, Thermister and Resistance Temperature Detector (RTD) for temperature measurement.
- Analyze the calibration of LVDT transducer.
- Understand the calibration of accelerometers for the measurement of vibration amplitude of an engine bed at various loads.
- Apply the calibration using Optical, Proximity and Tacho Pickups used for the measurement of speed of a d.c motor.
- Design a Closed loop circuit for the measurement and control of Process parameters like Flow, Pressure, Temperature and Level using SCADA

List of Experiments:

1. Calibration of Pressure Gauges.
2. Study and calibration of LVDT transducer for displacement measurement.
3. Calibration of strain gauge for load measurement.
4. Calibration of thermocouple for temperature measurement.
5. Calibration of capacitive transducer for angular displacement.
6. Study and calibration of photo and magnetic speed pickups for the measurement of speed.
7. Calibration of resistance temperature detector for temperature measurement.
8. Study and use of a Seismic pickup for the measurement of vibration amplitude of an engine bed at variousloads.
9. Study and calibration of McLeod gauge for low pressure.
10. Measurement and control of Pressure of a process using SCADA system.
11. Measurement and control of level in a tank using capacitive transducer with SCADA.
12. Measurement and control of temperature of a process using resistance temperature detector with SCADA.

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B.Tech. in Mechanical Engineering
IV Semester Syllabus
MC451HS: Gender Sensitization Lab
(An Activity-based Course)
(Common to CE, EEE, ECE, ME, MCT & MME)

Course Objectives

This course aims:

- To develop students' sensibility with regard to issues of gender in contemporary India.
- To provide a critical perspective on the socialization of men and women.
- To introduce students to information about some key biological aspects of genders.
- To expose the students to debates on the politics and economics of work.
- To help students reflect critically on gender violence.
- To expose students to more egalitarian interactions between men and women.

Course Outcomes

- Students will have developed a better understanding of important issues related to gender in contemporary India.
- Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film.
- Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.
- Students will acquire insight into the gendered division of labour and its relation to politics and economics.
- Men and women students and professionals will be better equipped to work and live together as equals.
- Students will develop a sense of appreciation of women in all walks of life.
- Through providing accounts of studies and movements as well as the new laws that provide protection and relief to women, the textbook will empower students to understand and respond to gender violence.

Course Description

This course offers an introduction to Gender Studies, an interdisciplinary field that asks critical questions about the meanings of sex and gender in society. The primary goal of this course is to familiarize students with key issues, questions and debates in Gender Studies, both historical and contemporary. It draws on multiple disciplines – such as literature, history, economics, psychology, sociology, philosophy, political science, anthropology and media studies – to examine cultural assumptions about sex, gender, and sexuality. This course integrates analysis of current events through student presentations, aiming to increase awareness of contemporary and historical experiences of women, and of the multiple ways that sex and gender interact with race, class, caste, nationality and other social identities. This course also seeks to build an understanding and initiate and strengthen programmes combating gender-based violence and discrimination. The course also features several exercises and reflective activities designed to examine the concepts of gender, gender-based violence, sexuality, and rights. It will further explore the impact of gender- based violence on education, health and development.

Unit-I: Understanding Gender

Introduction: Definition of Gender-Basic Gender Concepts and Terminology-Exploring Attitudes towards Gender- Construction of Gender-Socialization: Making Women, Making Men - Preparing for Womanhood. Growing up Male.

Unit-II: Gender Roles and Relations

Two or Many? -Struggles with Discrimination-Gender Roles and Relations-Types of Gender Roles-Gender Roles and Relationships Matrix-Missing Women-Sex Selection and Its Consequences-Declining Sex Ratio. Demographic Consequences-Gender Spectrum: Beyond the Binary

Unit-III: Gender and Labour

Division and Valuation of Labour-Housework: The Invisible Labor- "My Mother doesn't Work." "Share the Load."- Work: Its Politics and Economics -Fact and Fiction. Unrecognized and Unaccounted work. -Gender Development Issues-Gender, Governance and Sustainable Development-Gender and Human Rights-Gender and Mainstreaming

Unit–IV: Gender - Based Violence

The Concept of Violence- Types of Gender-based Violence-Gender-based Violence from a Human Rights Perspective-Sexual Harassment: Say No! -Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: "Chupulu".

Domestic Violence: Speaking Out -Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Thinking about Sexual Violence Blaming the Victim-"I Fought for my Life…."

Unit – V: Gender and Culture

Gender and Film-Gender and Electronic Media-Gender and Advertisement-Gender and Popular Literature- Gender Development Issues-Gender Issues-Gender Sensitive Language-Gender and Popular Literature - Just Relationships: Being Together as Equals Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Rosa Parks-The Brave Heart.

Note: Since it is Interdisciplinary Course, Resource Persons can be drawn from the fields of **English Literature** or Sociology or Political Science or **any other qualified faculty who has expertise in this field from engineering departments.**

- Classes will consist of a combination of activities: dialogue-based lectures, discussions, collaborative learning activities, group work and in-class assignments. Apart from the above prescribed book, Teachers can make use of any authentic materials related to the topics given in the syllabus on "Gender".

Suggested Readings:

- The Textbook, "Towards a World of Equals: A Bilingual Text Book on Gender" written by A. Suneetha, Uma Bhrugubanda, DuggiralaVasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu published by Telugu Akademi, Telangana Government in 2015.

Assessment and Grading:

- Discussion & Classroom Participation: 20%
- Project/Assignment: 30%
- End Term Exam: 50%