BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

(UGC-AUTONOMOUS)

B.Tech. – R21 COURSE STRUCTURE

(Applicable from the batch admitted during 2021-22 and onwards)

Department of Mechanical Engineering

I-Year I–Semester						
S. No.	**Subject Code**	**Subject**	**Hours Per Week**			**Credits**
			L	**T**	**P**	
1	21MA101BS	Linear Algebra and Calculus	3	1	0	4
2	21PH103BS	Engineering Physics	3	1	-	4
3	21CS101ES	Programming for Problem Solving	3	1	-	4
4	21ME103ES	Engineering Graphics	1	-	4	4
5	21PH104BS	Engineering Physics Lab	-	-	3	1.5
6	21CS102ES	Programming for Problem Solving Lab	-	-	3	1.5
TOTAL			**10**	**3**	**10**	**19**
Mandatory Course (Non-Credit)						
7	21MC101ES	Environmental Science	-	-	2	-

I-Year II–Semester						
S. No.	**Subject Code**	**Subject**	**Hours Per Week**			**Credits**
			L	**T**	**P**	
1	21MA202BS	Advanced Calculus	3	1	-	4
2	21CH201BS	Chemistry	3	1	-	4
3	21ME201ES	Engineering Mechanics	3	1	-	4
4	21ME202ES	Engineering Workshop	1	-	3	2.5
5	21EN201HS	English	2	-	-	2
6	21CH202BS	Engineering Chemistry Lab	-	-	3	1.5
7	21EN202HS	English Language and Communication Skills Lab	-	-	2	1
TOTAL			**12**	**3**	**8**	**19**

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II-Year I–Semester						
S. No.	**Subject Code**	**Subject**	**Hours Per Week**			**Credits**
			L	**T**	**P**	
1	21ME304PC	Materials Engineering	3	0	-	3
2	21EE303ES	Basic Electrical & Electronics Engineering	3	-	-	3
3	21ME305PC	Basic Thermodynamics	3	-	-	3
4	21ME307PC	Manufacturing Processes	3	-	-	3
5	21ME309PC	Kinematics of Machinery	3	-	-	3
6	21ME306PC	Fuels and Lubricants lab	-	-	3	1.5
7	21ME308PC	Manufacturing Processes Lab	-	-	3	1.5
8	21EE304ES	Basic Electrical & Electronics Engineering lab	-	-	3	1.5
9	21HS301	Social Innovation in Practice	-	-	3	1.5
TOTAL			**15**	**01**	**12**	**21**
Mandatory Course (Non-Credit)						
10	21MC302	Gender Sensitization Lab	-	-	2	-

II-Year II–Semester						
S. No.	**Subject Code**	**Subject**	**Hours Per Week**			**Credits**
			L	**T**	**P**	
1	21MA403BS	Numerical and Statistical Methods	3	-	-	4
2	21ME410PC	Solid Mechanics	3	-	-	3
3	21ME412PC	Fluid Mechanics & Hydraulic Machinery	3	-	-	3
4	21ME414PC	Dynamics of Machinery	3	-	-	3
5	21ME416PC	Applied Thermodynamics – I	3	-	-	3
6	21ME411PC	Solid Mechanics and Materials Engineering Lab	-	-	3	1.5
7	21ME413PC	Fluid Mechanics & Hydraulic Machinery Lab	-	-	3	1.5
8	21ME415PC	Kinematics & Dynamics Lab	-	-	3	1.5
9	21MA408PC	Aptitude and critical thinking skills Lab	-	-	3	1.5
TOTAL			**15**	**-**	**12**	**21**
Mandatory Course (Non-Credit)						
10	21MC403	Constitution of India	2	-	-	-

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III-Year I–Semester						
S. No.	**Subject Code**	**Subject**	**Hours Per Week**			**Credits**
			L	**T**	**P**	
1	21ME517PC	Instrumentation & Control systems	3	-	-	3
2	21ME519PC	Machine Tools & Metrology	3	-	-	3
3	21ME523PC	Design of Machine Elements-I	3	-	-	3
4	21ME521PC	Applied Thermodynamics – II	3	-	-	3
5		**Professional Elective-I**	3	-	-	3
6	21ME518PC	Instrumentation & Control systems Lab	-	-	2	1
7	21EN503HS	Advanced English Communication Skills Lab	-	-	3	1.5
8	21ME522PC	Thermal Engineering Lab	-	-	3	1.5
9	21ME520PC	Machine Tools & Metrology Lab	-	-	2	1
10	21ME552PR	Summer Internship – I	-	-	-	1
		TOTAL	**15**	**-**	**10**	**21**
Mandatory Course (Non-Credit)						
11	21MC504	Intellectual Property Rights	3	-	-	-
12	21MC506	Cyber Security	3	-	-	-

III-Year II–Semester						
S. No.	**Subject Code**	**Subject**	**Hours Per Week**			**Credits**
			L	**T**	**P**	
1	21ME627PC	Heat Transfer	3	-	-	3
2	21ME629PC	CAD/CAM	3	-	-	3
3	21ME626PC	Design of Machine Elements-II	3	-	-	3
4		**Professional Elective-II**	3	-	-	3
5		**Open Elective-I**	3	-	-	3
6	21ME628PC	Heat Transfer Lab	-	-	3	1.5
7	21ME630PC	Computer Aided Engineering Lab	-	-	3	1.5
8	21ME631PC	Computer Aided Manufacturing Lab	-	-	3	1.5
9	21ME624PC	Mechanical Drawing Lab using CAD	-	-	3	1.5
		TOTAL	**15**	**-**	**12**	**21**
Mandatory Course (Non-Credit)						
10	*21MC605	Environmental Science	3	-	-	-
11	21MC607	Artificial Intelligence	3	-	-	-

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IV-Year I–Semester						
S. No.	**Subject Code**	**Subject**	**Hours Per Week**			**Credits**
			L	**T**	**P**	
1	21SM701MS	Business Economics &Financial Analysis	3	-	-	3
2	21ME732PC	Finite Element Methods	3	-	-	3
3		**Professional Elective-III**	3	-	-	3
4		**Professional Elective-IV**	3	-	-	3
5		**Open Elective-II**	3	-	-	3
6	21ME733PC	3D Printing Lab	-	-	2	1
7	21ME753PR	Summer Internship – II	-	-	-	1
8	21ME754PR	Project Stage – I	-	-	8	4
		TOTAL	**15**	**-**	**10**	**21**

IV-Year II–Semester						
S. No.	**Subject Code**	**Subject**	**Hours Per Week**			**Credits**
			L	**T**	**P**	
1		**Professional Elective-V**	3	-	-	3
2		**Professional Elective-VI**	3	-	-	3
3		**Open Elective-III**	3	-	-	3
4	21ME855PR	Project Stage -II	-	-	16	8
		TOTAL	**9**	**-**	**16**	**17**

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List of Subjects

SI.No.	Name of the Subject
1	Engineering Mechanics
2	Engineering Workshop
3	Engineering Graphics
4	Materials Engineering
5	Basic Thermodynamics
6	Fuels and Lubricants lab
7	Manufacturing Processes
8	Manufacturing Processes Lab
9	Kinematics of Machinery
10	Solid Mechanics
11	Solid Mechanics and Materials Engineering Lab
12	Fluid Mechanics & Hydraulic Machinery
13	Fluid Mechanics & Hydraulic Machinery Lab
14	Dynamics of Machinery
15	Kinematics & Dynamics Lab
16	Applied Thermodynamics – I
17	Instrumentation & Control systems
18	Instrumentation & Control systems Lab
19	Machine Tools & Metrology
20	Machine Tools & Metrology Lab
21	Applied Thermodynamics – II
22	Thermal Engineering Lab
23	Design of Machine Elements-I
24	Mechanical Drawing Lab using CAD
25	Summer Internship – I
26	Design of Machine Elements-II
27	Heat Transfer
28	Heat Transfer Lab
29	CAD/CAM
30	Computer Aided Engineering Lab
31	Computer Aided Manufacturing Lab
32	Finite Element Methods
33	3D Printing Lab
52	Summer Internship – I
53	Summer Internship – II
54	Project Stage– I
55	Project Stage– II

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List of Professional Electives

Subject code	Professional Elective	Subject name
21ME534PE	**Professional Elective-I**	Automobile Engineering
21ME535PE		Industrial Engineering
21ME536PE		Automation in Manufacturing
21ME637PE	**Professional Elective-II**	Refrigeration and Air conditioning
21ME638PE		Unconventional machining processes
21ME639PE		Internal Combustion and Gas Turbines
21ME740PE	**Professional Elective-III**	Artificial Intelligence and Robotics
21ME741PE		Production Planning & Control
21ME742PE		Fluid Power System
21ME743PE	**Professional Elective-IV**	Plant Layout & Material Handling
21ME744PE		Design of Transmission Systems
21ME745PE		Additive Manufacturing and Prototyping
21ME846PE	**Professional Elective-V**	Power Plant Engineering
21ME847PE		Product Life Cycle Management
21ME848PE		Tribology
21ME849PE	**Professional Elective-VI**	Computational Fluid Dynamics
21ME850PE		Composite Materials
21ME851PE		Mechanical Vibration

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

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21MA101BS: LINEAR ALGEBRA AND CALCULUS

B.Tech. I Year I Sem.

L	T	P	C
3	1	0	4

Course Objectives: To learn

- 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 eigenvectors and to reduce the quadratic form to canonical form
- Concept of Sequence.
- Concept of nature of the series.
- Geometrical approach to the mean value theorems and their application to the mathematical problems
- Evaluation of surface areas and volumes of revolutions of curves.
- 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.

Course Outcomes: After learning the contents of this paper the student must be able to

- Write the matrix representation of a set of linear equations and to analyse the solution of the system of equations
- Find the Eigen values and Eigen vectors
- Reduce the quadratic form to canonical form using orthogonal transformations.
- Analyse the nature of sequence and series.
- 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/ without constraints.

UNIT-I: Matrices

Matrices: Types of Matrices, Symmetric; Hermitian; Skew-symmetric; Skew-Hermitian; orthogonal matrices; Unitary 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. Gauss elimination method; Gauss Seidel Iteration Method.

UNIT-II: Eigen values and Eigen vectors

Linear Transformation and Orthogonal Transformation: Eigen values and Eigenvectors and their properties: 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: Sequences & Series

Sequence: Definition of a Sequence, limit; Convergent, Divergent and Oscillatory sequences.

Series: Convergent, Divergent and Oscillatory Series; Series of positive terms; Comparison test, p-test, D-Alembert‘s ratio test; Raabe‘s test; Cauchy‘s Integral test; Cauchy‘s root test; logarithmic test. Alternating series: Leibnitz test; Alternating Convergent series: Absolute and Conditionally Convergence.

UNIT-IV: 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.

Applications of definite integrals to evaluate surface areas and volumes of revolutions of curves (Only in Cartesian coordinates), Definition of Improper Integral: Beta and Gamma functions and their applications.

UNIT-V: Multivariable calculus (Partial Differentiation and applications)

Definitions of Limit and continuity.

Partial Differentiation; Euler‘s Theorem; Total derivative; Jacobian; Functional dependence & independence, Maxima and minima of functions of two variables and three variables using method of Lagrange multipliers.

TEXTBOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition,Pearson, Reprint, 2002.

REFERENCES:

1. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
2. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11thReprint, 2010.

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

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21PH103BS: ENGINEERING PHYSICS

B.Tech. I Year I Sem.

L	T	P	C
3	1	0	4

Course Objectives:

- The course aims at making students to understand the basic concepts of Principles of Physics in a broader sense with a view to lay foundation for the various engineering courses.
- Students will be able to demonstrate competency and understanding of the concepts found in Mechanics, Harmonic Oscillations, Waves in one dimension, wave Optics, Lasers, Fiber Optics and a broad base of knowledge in physics.
- The main purpose of this course is to equip engineering undergraduates with an understanding of the scientific method, so that they may use the training beneficially in their higher pursuits.
- Today the need is to stress principles rather than specific procedures, to select areas of contemporary interest rather than of past interest, and to condition the student to the atmosphere of change he will encounter during his carrier.

Course outcomes: Upon graduation, the graduates will have:

- The knowledge of Physics relevant to engineering is critical for converting ideas into technology.
- An understanding of Physics also helps engineers understand the working and limitations of existing devices and techniques, which eventually leads to new innovations and improvements.
- In the present course, the students can gain knowledge on the mechanism of physical bodies upon the action of forces on them, the generation, transmission and the detection of the waves, Optical Phenomena like Interference, diffraction, the principles of lasers and Fibre Optics.
- Various chapters establish a strong foundation on the different kinds of characters of several materials and pave a way for them to use in at various technical and engineering applications.

UNIT-I: Introduction to Mechanics

Transformation of scalars and vectors under Rotation transformation, Forces in Nature, Newton‘s laws and its completeness in describing particle motion, Form invariance of Newton‘s second law, Solving Newton‘s equations of motion in polar coordinates, Problems including constraints and friction, Extension to cylindrical and spherical coordinates.

UNIT-II: Harmonic Oscillations

Mechanical and electrical simple harmonic oscillators, Complex number notation and phasor representation of simple harmonic motion, Damped harmonic oscillator: heavy, critical and light damping, Energy decay in a damped harmonic oscillator, Quality factor, Mechanical and electrical oscillators, Mechanical and electrical impedance, Steady state motion of forced damped harmonic oscillator, Power observed by oscillator.

UNIT-III: Waves in one dimension

Transverse wave on a string , The wave equation on a string , Harmonic waves, Reflection and transmission of waves at a boundary, Impedance matching , Standing waves and their Eigen frequencies , Longitudinal waves and the wave equations for them, Acoustic waves and speed of sound, Standing sound waves.

UNIT-IV: Wave Optics

Huygen‘s principle, Superposition of waves and interference of light by wave front splitting and amplitude splitting, Young‘s double slit experiment, Newton‘s rings, Michelson‘s interferometer, Mach- Zehnder interferometer, Frunhofer diffraction from a single slit and circular aperture, Diffraction grating- resolving power.

UNIT-V: Lasers and Fibre Optics

Lasers: Introduction to interaction of radiation with matter, Coherence, Principle and working of Laser, Population inversion, Pumping, Types of Lasers: Ruby laser, Carbon dioxide (CO_2) laser, He-Ne laser, Applications of laser. Fibre Optics: Introduction, Optical fibre as a dielectric wave guide, Total internal reflection, Acceptance angle, Acceptance cone and Numerical aperture, Step and Graded index fibres, Losses associated with optical fibres, Applications of optical fibres.

TEXT BOOKS:

1. Engineering Mechanics, 2nd ed.- MK Harbola, Cengage Learning
2. I. G. Main, ―Vibrations and waves in physics‘, 3rd Edn, Cambridge University Press, 2018.
3. Ajoy Ghatak, ―Optics‖, McGraw Hill Education, 2012

REFERENCES:

1. H. J. Pain, ―The physics of vibrations and waves‖, Wiley, 2006
2. O. Svelto, ―Principles of Lasers‖
3. ―Introduction to Mechanics‖, M.K.Verma, Universities Press

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

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21CS101ES: PROGRAMMING FOR PROBLEM SOLVING

B.Tech. I Year I- Sem.

L	T	P	C
3	1	0	4

Course Objectives:

- To learn the fundamentals of computers.
- To understand the various steps in program development.
- To learn the syntax and semantics of C programming language.
- To learn the usage of structured programming approach in solving problems.

Course Outcomes: The student will learn

- To write algorithms and to draw flowcharts for solving problems.
- To convert the algorithms/flowcharts to C programs.
- To code and test a given logic in C programming language.
- To decompose a problem into functions and to develop modular reusable code.
- To use arrays, pointers, strings and structures to write C programs.
- Searching and sorting problems.

UNIT - 1: Introduction to Programming

Introduction to components of a computer system: disks, primary and secondary memory, processor, operating system, compilers, creating, compiling and executing a program etc., Number systems Introduction to Algorithms: steps to solve logical and numerical problems. Representation of Algorithm, Flowchart/Pseudo code with examples, Program design and structured programming Introduction to C Programming Language: variables (with data types and space requirements), Syntax and Logical Errors in compilation, object and executable code , Operators, expressions and precedence, Expression evaluation, Storage classes (auto, extern, static and register), type conversion, The main method and command line arguments

Bitwise operations: Bitwise AND, OR, XOR and NOT operators

Conditional Branching and Loops: Writing and evaluation of conditionals and consequent branching with if, if-else, switch-case, ternary operator, goto, Iteration with for, while, do-while loops

I/O: Simple input and output with scanf and printf, formatted I/O, Introduction to stdin, stdout and stderr. Command line arguments

UNIT - II: Arrays, Strings, Structures and Pointers:

Arrays: one and two dimensional arrays, creating, accessing and manipulating elements of arrays Strings: Introduction to strings, handling strings as array of characters, basic string functions available in C (strlen, strcat, strcpy, strstr etc.), arrays of strings

Structures: Defining structures, initializing structures, unions, Array of structures

Pointers: Idea of pointers, Defining pointers, Pointers to Arrays and Structures, Use of Pointers in self-referential structures, usage of self referential structures in linked list (no implementation) Enumeration data type

UNIT - III: Preprocessor and File handling in C:

Preprocessor: Commonly used Preprocessor commands like include, define, undef, if, ifdef, ifndef Files: Text and Binary files, Creating and Reading and writing text and binary files, Appending data to existing files, Writing and reading structures using binary files, Random access using fseek, ftell and rewind functions.

UNIT - IV: Function and Dynamic Memory Allocation:

Functions: Designing structured programs, Declaring a function, Signature of a function, Parameters and return type of a function, passing parameters to functions, call by value, Passing arrays to functions, passing pointers to functions, idea of call by reference, Some C standard functions and libraries

Recursion: Simple programs, such as Finding Factorial, Fibonacci series etc., Limitations of Recursive functions

Dynamic memory allocation: Allocating and freeing memory, Allocating memory for arrays of different data types

Unit - V: Introduction to Algorithms:

Algorithms for finding roots of a quadratic equations, finding minimum and maximum numbers of a given set, finding if a number is prime number, etc.

Basic searching in an array of elements (linear and binary search techniques),

Basic algorithms to sort array of elements (Bubble, Insertion and Selection sort algorithms), Basic concept of order of complexity through the example programs

TEXT BOOKS:

1. Byron Gottfried, Schaum‘s Outline of Programming with C, McGraw-Hill

2. B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, Cengage Learning, (3rd Edition)

REFERENCE BOOKS:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice
2. Hall of India
3. R.G. Dromey, How to solve it by Computer, Pearson (16th Impression)
4. Programming in C, Stephen G. Kochan, Fourth Edition, Pearson Education.
5. Herbert Schildt, C: The Complete Reference, Mc Graw Hill, 4th Edition

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21ME103ES: ENGINEERING GRAPHICS

B.Tech. I Year I Sem.

L	T	P	C
1	0	4	4

Pre-requisites: Nil

Course objectives:

- To provide basic concepts in engineering drawing.
- To impart knowledge about standard principles of orthographic projection of objects.
- To draw sectional views and pictorial views of solids.

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

- Preparing working drawings to communicate the ideas and information.
- Read, understand and interpret engineering drawings.

UNIT – I

Introduction to Engineering Drawing: Principles of Engineering Graphics and their Significance, Conic Sections including the Rectangular Hyperbola – General method only. Cycloid, Epicycloid and Hypocycloid, Scales – Plain & Diagonal.

UNIT- II

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

UNIT – III

Projections of Regular Solids – Auxiliary Views - Sections or Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views – Sections of Sphere

UNIT – IV

Development of Surfaces of Right Regular Solids – Prism, Cylinder, Pyramid and Cone,
Intersection of Solids: Intersection of – Prism vs Prism- Cylinder Vs Cylinder

UNIT – V

Isometric Projections: Principles of Isometric Projection – Isometric Scale – Isometric Views – Conventions – Isometric Views of Lines, Plane Figures, Simple and Compound Solids – Isometric Projection of objects having non- isometric lines. Isometric Projection of Spherical Parts. Conversion of Isometric Views to Orthographic Views and Vice-versa –Conventions

Introduction to CAD: (For Internal Evaluation Weightage only):

Introduction to CAD Software Package Commands.- Free Hand Sketches of 2D- Creation of 2D Sketches by CAD Package

TEXTBOOKS:

1. Engineering Drawing N.D. Bhatt / Charotar
2. Engineering Drawing / N. S. Parthasarathy and Vela Murali/ Oxford

REFERENCE BOOKS:

1. Engineering Drawing / Basant Agrawal and McAgrawal/ McGraw Hill
2. Engineering Drawing/ M. B. Shah, B.C. Rane / Pearson.
3. Computer Aided Engineering Drawing – K Balaveera Reddy et al – CBS Publishers

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21PH104BS: ENGINEERING PHYSICS LAB

B.Tech. I Year I Sem.

L	T	P	C
0	0	3	1.5

List of Experiments:

1. Melde‘s experiment:
   To determine the frequency of a vibrating bar or turning fork using Melde‘s arrangement.

2. Torsional pendulum:
   To determine the rigidity modulus of the material of the given wire using torsional pendulum.

3. Newton‘s rings:
   To determine the radius of curvature of the lens by forming Newton‘s rings.

4. Diffraction grating:
   To determine the number of lines per inch of the grating.

5. Dispersive power:
   To determine the dispersive power of prism by using spectrometer.

6. Coupled Oscillator:
   To determine the spring constant by single coupled oscillator.

7. LCR Circuit:
   To determine quality factor and resonant frequency of LCR circuit.

8. LASER:
   To study the characteristics of LASER sources.

9. Optical fibre:
   To determine the bending losses of Optical fibres.

10. Optical fibre:
    To determine the Numerical aperture of a given fibre.

Note: Any 8 experiments are to be performed

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21CS102ES: PROGRAMMING FOR PROBLEM SOLVING LAB

B.Tech. I Year I-Sem.

L	T	P	C
0	0	3	1.5

Course Objectives: The students will learn the following:

- To work with an IDE to create, edit, compile, run and debug programs
- To analyze the various steps in program development.
- To develop programs to solve basic problems by understanding basic concepts in C like operators, control statements etc.
- To develop modular, reusable and readable C Programs using the concepts like functions, arrays etc.
- To Write programs using the Dynamic Memory Allocation concept.
- To create, read from and write to text and binary files

Course Outcomes: The candidate is expected to be able to:

- formulate the algorithms for simple problems
- translate given algorithms to a working and correct program
- correct syntax errors as reported by the compilers
- identify and correct logical errors encountered during execution
- represent and manipulate data with arrays, strings and structures
- use pointers of different types
- create, read and write to and from simple text and binary files
- modularize the code with functions so that they can be reused

Practice sessions:

a. Write a simple program that prints the results of all the operators available in C (including pre/ post increment , bitwise and/or/not , etc.). Read required operand values from standard input.

b. Write a simple program that converts one given data type to another using auto conversion and casting. Take the values form standard input.

Simple numeric problems:

a. Write a program for fiend the max and min from the three numbers.

b. Write the program for the simple, compound interest.

c. Write program that declares Class awarded for a given percentage of marks, where mark <40%= Failed, 40% to <60% = Second class, 60% to <70%=First class, >= 70% = Distinction. Read percentage from standard input.

d. Write a program that prints a multiplication table for a given number and the number of rows in the table. For example, for a number 5 and rows = 3, the output should be:

e. 5 x 1 = 5

f. 5 x 2 = 10

g. 5 x 3 = 15

h. Write a program that shows the binary equivalent of a given positive number between 0 to 255.

Expression Evaluation:

a. A building has 10 floors with a floor height of 3 meters each. A ball is dropped from the top of the building. Find the time taken by the ball to reach each floor. (Use the formula s = ut+(1/2)at^2 where u and a are the initial velocity in m/sec (= 0) and acceleration in m/sec^2 (= 9.8 m/s^2)).

b. 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 use Switch Statement)

c. Write a program that finds if a given number is a prime number

d. Write a C program to find the sum of individual digits of a positive integer and test given number is palindrome.

e. A 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. Write a C program to generate the first n terms of the sequence.

f. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.

g. Write a C program to find the roots of a Quadratic equation.

h. Write a C program to calculate the following, where x is a fractional value. i. 1-x/2 +x^2/4-x^3/6

j. Write a C program to read in two numbers, x and n, and then compute the sum of this geometric progression: 1+x+x^2+x^3+ .....+x^n. For example: if n is 3 and x is 5, then the program computes 1+5+25+125.

Arrays and Pointers and Functions:

a. Write a C program to find the minimum, maximum and average in an array of integers.

b. Write a functions to compute mean, variance, Standard Deviation, sorting of n elements in single dimension array.

c. Write a C program that uses functions to perform the following:

d. Addition of Two Matrices

e. ii. Multiplication of Two Matrices

f. iii. Transpose of a matrix with memory dynamically allocated for the new matrix as row and column counts may not be same.

g. Write C programs that use both recursive and non-recursive functions

h. To find the factorial of a given integer.

i. ii. To find the GCD (greatest common divisor) of two given integers.

j. iii. To find x^n

k. Write a program for reading elements using pointer into array and display the values using array.

l. Write a program for display values reverse order from array using pointer.

m. Write a program through pointer variable to sum of n elements from array.

Files:

a. Write a C program to display the contents of a file to standard output device.

b. Write a C program which copies one file to another, replacing all lowercase characters with their uppercase equivalents.

c. Write a C program to count the number of times a character occurs in a text file. The file name and the character are supplied as command line arguments.

d. Write a C program that does the following:
It should first create a binary file and store 10 integers, where the file name and 10 values are given in the command line. (hint: convert the strings using atoi function)
Now the program asks for an index and a value from the user and the value at that index should be changed to the new value in the file. (hint: use fseek function)
The program should then read all 10 values and print them back.

e. Write a C program to merge two files into a third file (i.e., the contents of the firs t file followed by those of the second are put in the third file).

Strings:

a. Write a C program to convert a Roman numeral ranging from I to L to its decimal equivalent.

b. Write a C program that converts a number ranging from 1 to 50 to Roman equivalent

c. Write a C program that uses functions to perform the following operations:

d. To insert a sub-string in to a given main string from a given position.

e. ii. To delete n Characters from a given position in a given string.

f. Write a C program to determine if the given string is a palindrome or not (Spelled same in both directions with or without a meaning like madam, civic, noon, abcba, etc.)

g. Write a C program that displays the position of a character ch in the string S or – 1 if S doesn_t contain ch.

h. Write a C program to count the lines, words and characters in a given text.

Miscellaneous:

a. Write a menu driven C program that allows a user to enter n numbers and then choose between finding the smallest, largest, sum, or average. The menu and all the choices are to be functions. Use a switch statement to determine what action to take. Display an error message if an invalid choice is entered.

b. Write a C program to construct a pyramid of numbers as follows:

```
1          *          1          1          *
1 2        * *        2 3        2 2        * *
1 2 3      * * *      4 5 6      3 3 3      * * *
                                 4 4 4 4    * * *
```

Sorting and Searching:

a. Write a C program that uses non recursive function to search for a Key value in a given
b. list of integers using linear search method.
c. Write a C program that uses non recursive function to search for a Key value in a given
d. sorted list of integers using binary search method.
e. Write a C program that implements the Bubble sort method to sort a given list of
f. integers in ascending order.
g. Write a C program that sorts the given array of integers using selection sort in descending order
h. Write a C program that sorts the given array of integers using insertion sort in ascending order
i. Write a C program that sorts a given array of names

Suggested Reference Books for solving the problems:

i. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
ii. B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, Cengage Learning, (3rd Edition)
iii. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice
iv. Hall of India
v. R.G. Dromey, How to solve it by Computer, Pearson (16th Impression)
vi. Programming in C, Stephen G. Kochan, Fourth Edition, Pearson Education.
vii. Herbert Schildt, C: The Complete Reference, Mc Graw Hill, 4th Edition

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE (UGC-AUTONOMOUS)

*21MC101ES: ENVIRONMENTAL SCIENCE

B.Tech. I Year I Sem.

L	T	P	C
3	0	0	0

Course Objectives:

- Understanding the importance of ecological balance for sustainable development.
- Understanding the impacts of developmental activities and mitigation measures.
- Understanding the environmental policies and regulations

Course Outcomes:

- Based on this course, the Engineering graduate will understand /evaluate / develop technologies on the basis of ecological principles and environmental regulations which in turn helps in sustainable development

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 using mineral resources, **Land resources:** Forest resources, **Energy resources:** growing energy needs, renewable and non renewable energy sources, use of alternate energy source, case studies.

UNIT-III

Biodiversity And Biotic Resources: Introduction, Definition, genetic, species and ecosystem diversity. Value 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. **Water pollution:** Sources and types of pollution, drinking water quality standards. **Soil Pollution:** Sources and types, Impacts of modern agriculture, degradation of soil. **Noise Pollution:** Sources and Health hazards, standards, **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: C**limate 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, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Overview on Impacts of air, water, biological and Socio-economical aspects. Strategies for risk assessment, Concepts of Environmental Management Plan (EMP). **Towards Sustainable Future:** Concept of Sustainable Development Goals, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Human health, Environmental Ethics, Concept of Green Building, Ecological Foot Print, 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, BS Publications.

Introduction to Environmental Science by Y. Anjaneyulu, BS.Publications.

B.TECH. ME **R21 Regulations**

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

(UGC-AUTONOMOUS)

21MA202BS: ADVANCED CALCULUS

Common for All Branches

B.Tech. I Year II Sem.

L	T	P	C
3	1	0	4

Course Objectives: To learn

- Methods of solving the differential equations of first and higher order.
- Evaluation of multiple integrals and their applications
- 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 and volume integrals

Course Outcomes: After learning the contents of this paper the student must be able to

- 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 world problems
- Evaluate the multiple integrals and apply the concept to find areas, volumes, centre of mass and Gravity for cubes, sphere and rectangular parallelopiped
- Evaluate the line, surface and volume integrals and converting them from one to another

UNIT-I: First Order ODE

Exact, linear and Bernoulli's equations; Applications : Newton's law of cooling, Law of natural growth and decay; Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

UNIT-II: Ordinary Differential Equations of Higher Order

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

UNIT-III: 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) for triple integrals.

Applications: Areas (by double integrals) and volumes (by double integrals and triple integrals), Centre of mass and Gravity (constant and variable densities) by double and triple integrals (applications involving cubes, sphere and rectangular parallelopiped).

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.

TEXT BOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006
3. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition,Pearson, Reprint, 2002.

REFERENCES:

1. Paras Ram, Engineering Mathematics, 2nd Edition, CBS Publishes
2. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.

B.TECH. ME **R21 Regulations**

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

(UGC-AUTONOMOUS)

21CH201BS: CHEMISTRY

B.Tech. I Year II Sem.

L	T	P	C
3	1	0	4

Course Objectives:

- To bring adaptability to the concepts of chemistry and to acquire the required skills to become a perfect engineer.
- To impart the basic knowledge of atomic, molecular and electronic modifications which makes the student to understand the technology based on them.
- To acquire the knowledge of electrochemistry, corrosion and water treatment which are essential for the Engineers and in industry.
- To acquire the skills pertaining to spectroscopy and to apply them for medical and other fields.
- To impart the knowledge of stereochemistry and synthetic aspects useful for understanding reaction pathways

Course Outcomes: The basic concepts included in this course will help the student to gain:

- The knowledge of atomic, molecular and electronic changes, band theory related to conductivity.
- The required principles and concepts of electrochemistry, corrosion and in understanding the problem of water and its treatments.
- The required skills to get clear concepts on basic spectroscopy and application to medical and other fields.
- The knowledge of configurational and conformational analysis of molecules and reaction mechanisms.

UNIT - I:

Molecular structure and Theories of Bonding: Atomic and Molecular orbitals. Linear Combination of Atomic Orbitals (LCAO), molecular orbitals of diatomic molecules, molecular orbital energy level diagrams of N_2, O_2 and F_2 molecules. π molecular orbitals of butadiene andbenzene.

Crystal Field Theory (CFT): Salient Features of CFT – Crystal Field Splitting of transition metal ion d- orbitals in Tetrahedral, Octahedral and square planar geometries. Band structure of solids and effect of doping on conductance.

UNIT - II:

Water and its treatment: Introduction – hardness of water – Causes of hardness - Types of hardness: temporary and permanent – expression and units of hardness – Estimation of hardness of water by complexometric method. Potable water and its specifications. Steps involved in treatment of water – Disinfection of water by chlorination and ozonization. Boiler feed water and its treatment – Calgon conditioning, Phosphate conditioning and Colloidal conditioning. External treatment of water – Ion exchange process. Desalination of water – Reverse osmosis. Numerical problems.

UNIT - III:

Electrochemistry and corrosion: Electro chemical cells – electrode potential, standard electrode potential, types of electrodes – calomel, Quinhydrone and glass electrode. Nernst equation Determination of pH of a solution by using quinhydrone and glass electrode. Electrochemical series and its applications. Numerical problems. Potentiometric titrations. Batteries – Primary (Lithium cell) and secondary batteries (Lead – acid storage battery and Lithium ion battery).

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 cathodic methods. Surface coatings – metallic coatings – methods of application. Electroless plating of Nickel.

UNIT - IV:

Stereochemistry, Reaction Mechanism and synthesis of drug molecules: Introduction to representation of 3-dimensional structures, Structural and stereoisomers, configurations, symmetry and chirality. Enantiomers, diastereomers, optical activity and Absolute configuration. Conformation alanalysis of n- butane.

Substitution reactions: Nucleophilic substitution reactions: Mechanism of S_N1, S_N2 reactions. Electrophilic and nucleophilic addition reactions: Addition of HBr to propene. Markownikoff and anti Markownikoff's additions.

Grignard additions on carbonyl compounds. Elimination reactions: Dehydro halogenation of alkylhalides. Saytzeff rule. Oxidation reactions: Oxidation of alcohols using $KMnO_4$ and chromic acid.
Reduction reactions: reduction of carbonyl compounds using $LiAlH_4$ & $NaBH_4$. Hydroboration of olefins. Structure, synthesis and pharmaceutical applications of Paracetamol and Aspirin.

UNIT - V:

Spectroscopic techniques and applications: Principles of spectroscopy, selection rules and applications of electronic spectroscopy. vibrational and rotational spectroscopy. Basic concepts of Nuclear magnetic resonance Spectroscopy, chemical shift. Introduction to Magnetic resonance imaging.

TEXT BOOKS:

1. Physical Chemistry, by P.W. Atkins
2. Engineering Chemistry by P.C.Jain & M.Jain; Dhanpat Rai Publishing Company (P) Ltd., New Delhi.
3. Fundamentals of Molecular Spectroscopy, by C.N. Banwell
4. Organic Chemistry: Structure and Function by K.P.C. Volhardt and N.E.Schore, 5^{th} Edition.
5. University Chemistry, by B.M. Mahan, Pearson IV Edition.
6. Engineering Chemistry (NPTEL Web-book), by B.L. Tembe, Kamaluddin and M.S. Krishnan

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

(UGC-AUTONOMOUS)

21ME201ES: ENGINEERING MECHANICS

B.Tech. I Year II Sem.

L	T	P	C
3	1	0	4

Course Objectives: The objectives of this course are to

- Explain the resolution of a system of forces, compute their resultant and solve problems using equations of equilibrium
- Perform analysis of bodies lying on rough surfaces.
- Locate the centroid of a body and compute the area moment of inertia and mass moment of inertia of standard and composite sections
- Explain kinetics and kinematics of particles, projectiles, curvilinear motion, centroidal motion and plane motion of rigid bodies.
- Explain the concepts of work-energy method and its applications to translation, rotation and plane motion and the concept of vibrations

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

- Determine resultant of forces acting on a body and analyse equilibrium of a body subjected to a system of forces.
- Solve problem of bodies subjected to friction.
- Find the location of centroid and calculate moment of inertia of a given section.
- Understand the kinetics and kinematics of a body undergoing rectilinear, curvilinear, rotatory motion and rigid body motion.
- Solve problems using work energy equations for translation, fixed axis rotation and plane motion and solve problems of vibration.

UNIT-I:

Introduction to Engineering Mechanics - Force Systems :Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant-Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy

UNIT-II:

Friction: Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack;

Centroid and Centre of Gravity -Centroid of Lines, Areas and Volumes from first principle, centroid of composite sections; Centre of Gravity and its implications. – Theorem of Pappus

UNIT-III:

Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Product of Inertia, Parallel Axis Theorem, Perpendicular Axis Theorem Mass Moment of Inertia : Moment of Inertia of Masses - Transfer Formula for Mass Moments of Inertia– Mass moment of inertia of composite bodies.

UNIT-IV:

Review of particle dynamics- Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton‘s 2nd law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique).

UNIT-V:

Kinetics of Rigid Bodies -Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D‘Alembert‘s principle and its applications in plane motion and connected bodies; Work Energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation

TEXT BOOKS:

1. Shames and Rao (2006) , Engineering Mechanics, Pearson Education
2. Reddy Vijay Kumar K. and J. Suresh Kumar (2010), Singer's Engineering Mechanics – Statics & Dynamics

REFERENCE BOOKS:

1. Timoshenko S.P and Young D.H., –Engineering Mechanics‖, McGraw Hill International Edition, 1983.
2. Andrew Pytel, Jaan Kiusalaas, –Engineering Mechanics‖, Cengage Learning, 2014.
3. Beer F.P & Johnston E.R Jr. Vector, –Mechanics for Engineers‖, TMH, 2004.
4. Hibbeler R.C & Ashok Gupta, –Engineering Mechanics‖, Pearson Education, 2010.
5. Tayal A.K., –Engineering Mechanics – Statics & Dynamics‖, Umesh Publications, 2011.
6. Basudeb Bhattacharyya, –Engineering Mechanics‖, Oxford University Press, 2008.
7. Meriam. J. L., –Engineering Mechanics‖, Volume-II Dynamics, John Wiley & Sons, 2008.

B.TECH. ME **R21 Regulations**

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

(UGC-AUTONOMOUS)

21ME202ES: ENGINEERING WORKSHOP

B.Tech. I Year II Sem.

L	T	P	C
1	0	3	2.5

Pre-requisites: Practical skill

Course Objectives:

- To Study of different hand operated power tools, uses and their demonstration.
- To gain a good basic working knowledge required for the production of various engineering products.
- To provide hands on experience about use of different engineering materials, tools, equipments and processes those are common in the engineering field.
- To develop a right attitude, team working, precision and safety at work place.
- It explains the construction, function, use and application of different working tools, equipment and machines.
- To study commonly used carpentry joints.
- To have practical exposure to various welding and joining processes.
- Identify and use marking out tools, hand tools, measuring equipment and to work to prescribed tolerances.

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

- Study and practice on machine tools and their operations
- Practice on manufacturing of components using workshop trades including pluming, fitting, carpentry, foundry, house wiring and welding.
- Identify and apply suitable tools for different trades of Engineering processes including drilling, material removing, measuring, chiseling.
- Apply basic electrical engineering knowledge for house wiring practice.

1. TRADES FOR EXERCISES:

At least two exercises from each trade:

I. Carpentry – (T-Lap Joint, Dovetail Joint, Mortise & Tenon Joint)
II. Fitting – (V-Fit, Dovetail Fit & Semi-circular fit)
III. Tin-Smithy – (Square Tin, Rectangular Tray & Conical Funnel)
IV. Foundry – (Preparation of Green Sand Mould using Single Piece and Split Pattern)
V. Welding Practice – (Arc Welding & Gas Welding)
VI. House-wiring – (Parallel & Series, Two-way Switch and Tube Light)
VII. Black Smithy – (Round to Square, Fan Hook and S-Hook)

2. TRADES FOR DEMONSTRATION & EXPOSURE:

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

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

B.TECH. ME **R21 Regulations**

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

(UGC-AUTONOMOUS)

21EN201HS: ENGLISH

B.Tech. I Year II Sem.

L	T	P	C
2	0	0	2

INTRODUCTION

In view of the growing importance of English as a tool for global communication and the consequent emphasis on training students to acquire language skills, the syllabus of English has been designed to develop linguistic, communicative and critical thinking competencies of Engineering students.

In English classes, the focus should be on the skills development in the areas of vocabulary, grammar, reading and writing. For this, the teachers should use the prescribed text for detailed study. The students should be encouraged to read the texts leading to reading comprehension and different passages may be given for practice in the class. The time should be utilized for working out the exercises given after each excerpt, and also for supplementing the exercises with authentic materials of a similar kind, for example, newspaper articles, advertisements, promotional material etc. *The focus in this syllabus is on skill development, fostering ideas and practice of language skills in various contextsand cultures.*

Learning Objectives: The course will help to

- Improve the language proficiency of students in English with an emphasis on Vocabulary, Grammar, Reading and Writing skills.
- Equip students to study academic subjects more effectively and critically using the theoreticaland practical components of English syllabus.
- Develop study skills and communication skills in formal and informal situations.

Course Outcomes: Students should be able to

- Use English Language effectively in spoken and written forms.
- Comprehend the given texts and respond appropriately.
- Communicate confidently in various contexts and different cultures.
- Acquire basic proficiency in English including reading and listening comprehension, writingand speaking skills.

SYLLABUSUNIT – I

'The Raman Effect' from the prescribed textbook 'English for Engineers' published byCambridge University Press.

Vocabulary Building: The Concept of Word Formation --The Use of Prefixes and Suffixes. **Grammar:** Identifying Common Errors in Writing with Reference to Articles and Prepositions.**Reading:** Reading and Its Importance- Techniques for Effective Reading.

Basic Writing Skills: 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

'Ancient Architecture in India' from the prescribed textbook 'English for Engineers' publishedby Cambridge University Press.

Vocabulary: Synonyms and Antonyms.

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

Reading: Improving Comprehension Skills – Techniques for Good Comprehension

Writing: Format of a Formal Letter-**Writing Formal Letters** E.g.., Letter of Complaint, Letter ofRequisition, Job Application with Resume.

UNIT –III

'Blue Jeans' from the prescribed textbook 'English for Engineers' published by CambridgeUniversity Press.

Vocabulary: Acquaintance with Prefixes and Suffixes from Foreign Languages in English to form Derivatives-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- Skimming and Scanning

Writing: Nature and Style of Sensible Writing- **Defining- Describing** Objects, Places and Events – **Classifying**- Providing Examples or Evidence

UNIT –IV

'What Should You Be Eating' from the prescribed textbook 'English for Engineers' published byCambridge University Press.

Vocabulary: Standard Abbreviations in English

Grammar: Redundancies and Clichés in Oral and Written Communication.

Reading: Comprehension- Intensive Reading and Extensive Reading

Writing: Writing Practices--Writing Introduction and Conclusion - Essay Writing-Précis Writing.

UNIT –V

'How a Chinese Billionaire Built Her Fortune' from the prescribed textbook 'English forEngineers' published by Cambridge University Press.

Vocabulary: Technical Vocabulary and their usage

Grammar: Common Errors in English

Reading: Reading Comprehension-Exercises for Practice

Writing: **Technical Reports**- Introduction – Characteristics of a Report – Categories ofReports Formats- Structure of Reports (Manuscript Format) -Types of Reports - Writing aReport.

TEXTBOOK:

1. **Sudarshana, N.P. and Savitha, C. (2018). English for Engineers. Cambridge University Press.**

REFERENCE BOOKS:

1. Swan, M. (2016). Practical English Usage. Oxford University Press.
2. Kumar, S and Lata, P. (2018). Communication Skills. Oxford University Press.
3. Wood, F.T. (2007). Remedial English Grammar. Macmillan.
4. Zinsser, William. (2001). On Writing Well. Harper Resource Book.
5. Hamp-Lyons, L. (2006). Study Writing. Cambridge University Press.
6. Exercises in Spoken English. Parts I –III. CIEFL, Hyderabad. Oxford University Press.

B.TECH. ME **R21 Regulations**

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

(UGC-AUTONOMOUS)

21CH202BS: ENGINEERING CHEMISTRY LAB

B.Tech. I Year II Sem.

L	T	P	C
0	0	3	1.5

Course Objectives: The course consists of experiments related to the principles of chemistry required for engineering student. The student will learn:

- Estimation of hardness and chloride content in water to check its suitability for drinking purpose.
- To determine the rate constant of reactions from concentrations as an function of time.
- The measurement of physical properties like adsorption and viscosity.
- To synthesize the drug molecules and check the purity of organic molecules by thin layer chromatographic (TLC) technique.

Course Outcomes: The experiments will make the student gain skills on:

- Determination of parameters like hardness and chloride content in water.
- Estimation of rate constant of a reaction from concentration – time relationships.
- Determination of physical properties like adsorption and viscosity.
- Calculation of R_f values of some organic molecules by TLCtechnique.

List of Experiments:

1. Determination of total hardness of water by complexometric method using EDTA
2. Determination of chloride content of water by Argentometry
3. Estimation of an HCl by Conductometric titrations
4. Estimation of Acetic acid by Conductometric titrations
5. Estimation of HCl by Potentiometric titrations
6. Estimation of Fe^{2+} by Potentiometry using $KMnO_4$
7. Determination of rate constant of acid catalysed hydrolysis of methyl acetate
8. Synthesis of Aspirin and Paracetamol
9. Thin layer chromatography calculation of R_f values. eg ortho and para nitro phenols
10. Determination of acid value of coconut oil
11. Verification of freundlich adsorption isotherm-adsorption of acetic acid on charcoal
12. Determination of viscosity of castor oil and ground nut oil by using Ostwald‘s viscometer.
13. Determination of partition coefficient of acetic acid between n-butanol and water.
14. Determination of surface tension of a give liquid using stalagmometer.

REFERENCE BOOKS:

1. Senior practical physical chemistry, B.D. Khosla, A. Gulati and V. Garg (R. Chand & Co., Delhi)
2. An introduction to practical chemistry, K.K. Sharma and D. S. Sharma (Vikas publishing, N. Delhi)
3. Vogel‘s text book of practical organic chemistry 5^{th} edition
4. Text book on Experiments and calculations in Engineering chemistry – S.S. Dara

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

(UGC-AUTONOMOUS)

21EN202HS: ENGLISH LANGUAGE AND COMMUNICATION SKILLS LAB

B.Tech. I Year II Sem. **L T P C**

0 0 2 1

The **Language 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:

- To facilitate computer-assisted multi-media instruction enabling individualized and independent language learning
- To sensitize 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 their mother tongue influence
- To train students to use language appropriately for public speaking and interviews

Learning Outcomes: Students will be able to attain

- Better understanding of nuances of English language through audio- visual experience and group activities
- Neutralization of accent for intelligibility
- Speaking skills with clarity and confidence which in turn enhances their employability skills

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

- **The following course content is prescribed for the English Language and Communication Skills Lab based on Unit-6 of AICTE Model Curriculum 2018 for B.Tech First English. As the syllabus is very limited, 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 and timesaving in the Lab)**

Exercise – I

CALL Lab:

Understand: Listening Skill- Its importance – Purpose- Process- Types- Barriers of Listening.

Practice: Introduction to Phonetics – Speech Sounds – Vowels and Consonants.

ICS Lab:

Understand: Communication at Work Place- Spoken vs. Written language.

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 and Rhythm– Weak Forms and Strong Forms in Context.

Practice: Basic Rules of Word Accent - Stress Shift - Weak Forms and Strong Forms in Context.

ICS Lab:

Understand: Features of Good Conversation – Non-verbal Communication.

Practice: Situational Dialogues – Role-Play- Expressions in Various Situations –Making Requests and Seeking Permissions - Telephone Etiquette.

Exercise - III

CALL Lab:

Understand: Intonation-Errors in Pronunciation-the Influence of Mother Tongue (MTI).

Practice: Common Indian Variants in Pronunciation – Differences in British and American Pronunciation.

ICS Lab:

Understand: How to make Formal Presentations.

Practice: Formal Presentations.

Exercise – IV

CALL Lab:

Understand: Listening for General Details.

Practice: Listening Comprehension Tests.

ICS Lab:

Understand: Public Speaking – Exposure to Structured Talks.

Practice: Making a Short Speech – Extempore.

Exercise – V

CALL Lab:

Understand: Listening for Specific Details.

Practice: Listening Comprehension Tests.

ICS Lab:

Understand: Interview Skills. *Practice:*

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 audio-visual aids with a Public-Address System, a LCD and a projector etc.

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

(UGC-AUTONOMOUS)

21ME304PC: MATERIALS ENGINEERING

B.Tech. II Year I Sem. **LT/P/D C**

3 0/0/0 3

COURSE OBJECTIVES:

The students will be able to

1. Understand the crystal structure and bond formation between grains and crystals.
2. Development of microstructure using phase diagrams and lever rule applicable in calculating the liquid and solid percentage.
3. Apply heat treatment process to different materials to get required properties.
4. Gain knowledge about cooling curves and its properties.
5. Know about alloying of steel and its structural properties with applications.

COURSE OUTCOMES:

At the end of the course students develop ability to

1. Identify the crystal structure and bond formation between grains and crystals.
2. Compose new materials using phase diagrams and iron carbide diagram.
3. Select the heat treatment process to get required properties from different materials.
4. Summarize the cooling curves and its properties.
5. Contrast the selection of heat treatment process for different materials

UNIT – I

Crystal Structure: Unit cells, Metallic crystal structures, Ceramics. Imperfection in solids: Point, line, interfacial and volume defects; dislocation strengthening mechanisms and slip systems, critically resolved shear stress. **Lattices, Basic idea of symmetry, Bravis Lattice**

UNIT – II

Alloys, substitutional and interstitial solid solutions- Phase diagrams: Interpretation of binary phase diagrams and microstructure development; eutectic, peritectic, peritectoid and monotectic reactions. Iron Iron-carbide phase diagram and microstrctural aspects of ledeburite, austenite, ferrite and cementite, cast iron

UNIT –III

Heat treatment of Steel: Annealing, Normalising, Hardening, Tempering and Spheroidising, Isothermal transformation diagrams for Fe-C alloys and microstructures development. **TIT Diagrams, surface hardening methods, age hardening treatments**

UNIT – IV

Continuous cooling curves and interpretation of final microstructures and properties- austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, vacuum and plasma hardening

UNIT – V

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. **Ceramics, polymers and composites; crystalline ceramics, glasses, cermets, Structure, properties and applications**

TEXT BOOKS:

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, WileyIndia.

REFERENCE BOOKS:

1. Kenneth G. Budinski and Michael K. Budinski, –Engineering Materials‖, Prentice Hall of IndiaPrivate Limited, 4th Indian Reprint, 2002.
2. U. C. Jindal, –Engineering Materials and Metallurgy‖, Pearson, 2011.

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

(UGC-AUTONOMOUS)

21EE303ES: BASIC ELECTRICAL &ELECTRONICS ENGINEERING

B.Tech. II Year I Sem.

L	T/P/D	C
3	0/0/0	3

Course Objectives:

Students will be able to

1. The basic concepts of electrical circuits which is the foundation for network theory
2. To understand about single phase AC circuits.
3. To understand functioning of different types of DC machines and transformers.
4. To understand the various operations of transistors and special purpose diodes
5. To learn basic concepts of diodes, Rectifiers and filters.

Course Outcomes:

At the end of the course students develop ability to

1. Analyze circuit theorems, mesh and nodal analysis, series and parallel networks, Electrical power
2. Gain knowledge on AC circuits, reactance, Impedance, Susceptance and Admittance and Power Factor
3. Learn the working principle of DC motors, Transformers
4. Study the characteristics of PN Junction diode and zener diode
5. Learn the basic of Amplifiers and Rectifiers.

UNIT-I:

Electrical Circuits: Circuits concept, R-L-C Parameters, Voltage and Currentsources, Source Transformation, V–I relationship for Passive elements, Kirchoff‘s Laws,Network reduction techniques – series, parallel, series parallel, star-delta & star-delta transformations, Nodal Analysis, Mesh analysis with DC excitations. Network Theorems -Thevenin‘s, Norton‘s, Maximum Power Transfer, Superposition, Reciprocity Theoremswith DC excitation Calculaion of Power (VI)

UNIT-II:

Single Phase AC Circuits - R.M.S. and Average values, Form Factor, steady state analysis of series, Parallel
and Series parallel Combinations of R, L and C with Sinusoidal excitation concept of reactance, Impedance,
Susceptance and Admittance –Concept of Power Factor.

UNIT-III:

Transformers and DC Machines::D.C.Machines: Constructional features, Methods of Excitation,E.M.F. Equation and Applications, Torque development in D.C motor Characteristics of DC motors, losses,Efficiency, Speed control of DC Shunt motors Role of Transformers in the fields of engineering,Transformer principle, Ideal and Practical Transformers Equivalent circuit, Regulation and Efficiency.

UNIT-IV:

P-N Junction Diode - Diode equation, V-I characteristic, Temperature dependence, Bipolar JunctionTransistor (BJT) - Construction, Principle of Operation, CB,CE and CC configurations, Zener Diode, Zenerdiode characteristics, Use of Zener diode as simple regulator.

UNIT-V:

Operational amplifier basics, op amp inverting and Non Inverting amplifier, Rectifiers and Filters - The P-Njunction as a rectifier - A Half Wave Rectifier, Bridge Rectifier, Filters –Inductor Filters, Capacitor Filters.

Text Books:

1. Circuit Theory Analysis and Synthesis by A Chakrabarti, Dhanpatrai& co.
2. Basic Electrical Engineering, P Ramana, M. Suryakalavathi, G. T. Chandra Sekhar,1st Edition, S.Chand Technical Publications, 2018
3. Electronic Devices and Circuits, S. Salivahanan and N Suresh Kumar, 3rd Edition TMH, Revised 2019

References:

1. Network Analysis by M.E Van Valkenburg, Pearson Publications 3rd Edition
2. Principles of electrical machines by V K Mehta, S Chand Publications
3. Electronics devices and circuits by I J NagrathPHI Publications

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

(UGC-AUTONOMOUS)

21ME305PC: BASIC THERMODYNAMICS

B.Tech. II Year I Sem.	**L**	**T/P/D**	**C**
	3	**0/0/0**	**3**

Pre-requisite: Engineering Chemistry and Physics

Course Objective:

Students will be able to

1. Discuss the laws of thermodynamics.
2. Identify different types of laws.
3. Interpret various properties, phase changes, and illustrate gas laws
4. Explain specific heat and temperature related to thermodynamics
5. Illustrate different type of power cycles and Refrigeration cycles.

Course Outcomes:

At the end of the course students develop ability to

1. Apply concepts in designing various thermal equipment
2. Distinguish Different Laws
3. Design T-S& H-S diagrams and Identify the usage og gas laws
4. Inspect types of heat and temperatures
5. Compare different types of cycles

Tables/Codes: Steam Tables and Mollier Chart, Refrigeration

TablesUNIT – 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 – Elementary Treatment of the Third Law of Thermodynamics

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 andFree Expansion Processes – Flow processes

UNIT - IV

Deviations from perfect Gas Model – Vader Waals Equation of State – Compressibility charts – variable specific Heats – Gas Tables 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. And Molecular Internal Energy, Enthalpy, sp. Heats and Entropy of Mixture of perfect Gases and Vapour, 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 – AdiabaticSaturation, Carrier‘s Equation – Psychrometric chart.

UNIT - V

Power Cycles: Otto, Diesel, Dual Combustion cycles, Sterling Cycle, Atkinson Cycle, Ericsson Cycle, Lenoir Cycle – Description and representation on P–V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis – comparison of Cycles.

Refrigeration Cycles:

Brayton and Rankine cycles – Performance Evaluation – combined cycles, Bell-Coleman cycle, Vapourcompression cycle-performance Evaluation.

TEXT BOOKS:

1. Engineering Thermodynamics / PK Nag / Mc Graw Hill
2. Thermodynamics for Engineers / Kenneth A. Kroos ; Merle C. Potter/ Cengage

REFERENCE BOOKS:

1. Engineering Thermodynamics / Chattopadhyay/ Oxford
2. Engineering Thermodynamics / Rogers / Pearson

TEXT BOOKS:

1. Chandra A M, ‒Plane Surveying and Higher Surveying‖, New age International Pvt. Ltd.,Publishers, New Delhi.
2. Duggal S K, ‒Surveying (Vol – 1 & 2), Tata McGraw Hill Publishing Co. Ltd. New Delhi.

REFERENCE BOOKS:

1. Arthur R Benton and Philip J Taety, Elements of Plane Surveying, McGraw Hill.
2. Surveying and levelling by R. Subramanian, Oxford university press, New Delhi
3. Arora K R ‒Surveying Vol 1, 2 & 3), Standard Book House, Delhi.
4. Surveying (Vol – 1, 2 & 3), by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain - LaxmiPublications (P) ltd., New Delhi.

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

(UGC-AUTONOMOUS)

21ME307PC: MANUFACTURING PROCESSES

B.Tech. II Year I Sem.	**L**	**T/P/D**	**C**
	3	**0/0/0**	**3**

Course Objectives:

Students will be able to

1. Illustrate the process-level dependence of casting and moulding.
2. Expose the students to a variety of manufacturing processes including their suitability andcapabilities of welding and cost calculations.
3. Understand the important effects that manufacturing processes may have on the materialproperties and welding defects.
4. Rephrase the thermal and mechanical technical aspects, and rolling methods
5. Provide a various exposure on working processes on metals and forging operations.

Course Outcomes:

At the end of the course students develop ability to

1. Outline the idea for selecting materials for patterns allowances of patterns used in casting
2. Examine the arc, gas, solid state and resistance welding processes.
3. Comparing soldering and brazing ,welding defects.
4. Adapt new metal forming processes using hot and cold working.
5. Identify the extrusion process ,its characteristics and hammering.

UNIT – I

Casting: Steps involved in making a casting – Advantage 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 – Types of gates, Design of gating systems – Riser – Function, types of Riser and Riser design. Casting processes – Types – Sand moulding, Centrifugal casting, die- casting, Investmentcasting, shell moulding; Solidification of casting – Solidification of pure metal, Directional Solidification.

UNIT – II

Welding: Classification – Types of welds and welded joints, Weld Symbols, 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

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

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. Forcesin 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.

Non destructive testing: various non destructive testing methods like liquid dye penetrate magnetic particle testing, ultrasonic testing and radiography.

UNIT – V

Extrusion of Metals: Basic extrusion process and its characteristics. Hot extrusion and cold extrusion

- Forward extrusion and backward extrusion – Impact extrusion – Extruding equipment – Tubeextrusion, 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-hydraulicForming, Electro-magnetic forming and rubber pad Forming.

TEXT BOOKS:

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

REFERENCE BOOKS:

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

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

(UGC-AUTONOMOUS)

21ME309PC: KINEMATICS OF MACHINERY

B.Tech. II Year I Sem. **L T/P/D C**

3 0/ 0 / 0 3

Prerequisites: Basic principles of Mechanics

Course Objectives:

Students will be able to

1 Comprehend the fundamentals of kinematics. And to understand the concept of machines, mechanisms and related terminologies.
2 Formulate the concept of synthesis and analysis of different mechanisms.
3 Distinguish a mechanism for displacement, velocity and acceleration, analyze Steering gear mechanisms and working of hooks joint.
4 Develop skills for designing and analyzing linkages, cams
5 Understand the working principles of drives.

Course Outcomes:

At the end of the course students develop ability to

1. Build up various mechanical elements for kinematics of machines
2. Utilize analytical, mathematical and graphical aspects of kinematics of Machines for effective design.
3. Evaluate computer software to study the motion of a mechanism.
4. Design basic cam systems
5. Solve problems on gears and gear trains, examine friction in machine elements

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 in line 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 of slider crank chain for displacement- velocity and acceleration of slider – 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 3 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 velocityratio 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 pathof contact of Pinion & Gear and Pinion & Rack Arrangements– Introduction to Helical – Bevel and wormgearing

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.

TEXT BOOKS:

1. Theory of Machines and Mechanisms/JOSEPH E. SHIGLEY/ Oxford
2. Theory of Machines / S. S. Rattan / Mc Graw Hill Publishers.

REFERENCE BOOKS:

1. Theory of Machines / Sadhu Singh / Pearson.
2. Theory of Machines / Thomas Bevan/CBS.

B.TECH. ME **R21 Regulations**

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

(UGC-AUTONOMOUS)

21ME306PC: FUELS AND LUBRICANTS LAB

B.Tech. II Year I Sem. **L T/P/D C**

3 0/0/0 1.5

Prerequisites: Chemistry

Course Outcomes:

at the end of the course students develop ability to

6. Illustrate the viscosity of liquid lubricants.
7. Determine the calorific values of solid and gaseous fuels.
8. Analyse the flash and fire points of liquid fuels.
9. Observe the carbon residue for fuels
10. Compare the depth penetration for different lubricants.

List of Experiments:

1. Determination of Flash and Fire points of Liquid fuels/Lubricants using: Abels Apparatus
2. Determination of Flash and Fire points of Liquid fuels/Lubricants using: Pensky Martens Apparatus
3. Carbon residue test: Liquid fuels.
4. Determination of Viscosity of Liquid lubricants and Fuels using: Saybolt Viscometer
5. Determination of Viscosity of Liquid lubricants and Fuels using: Redwood Viscometer
6. Determination of Viscosity of Liquid lubricants and Fuels using: Engler Viscometer
7. Determination of Calorific value: of Gaseous fuels using: Junkers Gas Calorimeter.
8. Determination of Calorific value: Solid/Liquid/ fuels using: Bomb Calorimeter.
9. Drop point and Penetration Apparatus for Grease.
10. ASTM Distillation Test Apparatus.
11. Cloud and Pour point Apparatus.

B.TECH. ME **R21 Regulations**

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

(UGC-AUTONOMOUS)

21ME308PC: MANUFACTURING PROCESSES LAB

B.Tech. II Year I Sem.

L	T/P/D	C
0	0/3/0	1.5

Pre-requisites: Production Technology

Course Outcomes:

At the end of the course students develop ability to

1. Examine the properties of moulding sands and pattern making.
2. Fabricate joints using gas welding and arc welding.
3. Evaluate the quality of welded joints.
4. Design of press working tools and performs moulding studies on plastics.
5. Identify the appropriate method for welding application

Minimum of 12 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 BOOK:

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

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

(UGC-AUTONOMOUS)

21EE304ES: BASIC ELECTRICAL &ELECTRONICS ENGINEERING LAB

B.Tech. II Year I Sem.	**L**	**T/ P/D**	**C**
	0	**0 /3/0**	**1.5**

Course Objectives:

Students will be able to

1. Introduce the concepts of electrical circuits and its components
2. Understand magnetic circuits, DC circuits and AC single phase & three phase circuits
3. Study and understand the different types of DC/AC machines and Transformers.
4. Import the knowledge of various electrical installations.
5. Introduce the concepts of diodes & transistors, and

Course Outcomes:

At the end of the course students develop ability to

1. Analyze and solve electrical circuits using network laws and theorems.
2. Understand and analyze basic Electric and Magnetic circuits
3. Study the working principles of Electrical Machines
4. Introduce components of Low Voltage Electrical Installations
5. Identify and characterize diodes and various types of transistors.

List of experiments/demonstrations:

PART A: ELECTRICAL

1. Verification of KVL and KCL
2. (i) Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single-Phase Transformer
(ii) Verification of Relationship between Voltages and Currents (Star-Delta, Delta-Delta, Deltastar,
Star-Star) in a Three Phase Transformer
3. Measurement of Active and Reactive Power in a balanced Three-phase circuit
4. Performance Characteristics of a Separately Excited 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
(i) Multi-meters (ii) Function Generator (iii) Regulated Power Supplies (iv) CRO.
2. PN Junction diode characteristics
3. Zener diode characteristics and Zener as voltage Regulator
4. Input & Output characteristics of Transistor in CB / CE configuration
5. Full Wave Rectifier with & without filters
6. Input and Output characteristics of FET in CS configuration

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. Millman‘s Electronic Devices and Circuits – J. Millman and C. C. Halkias, SatyabrataJit, TMH,2/e, 1998.
3. Engineering circuit analysis- by William Hayt and Jack E. Kemmerly, McGraw Hill Company, 6thedition.
4. Linear circuit analysis (time domain phasor and Laplace transform approaches) - 2nd edition byRaymond A. De Carlo and Pen-Min-Lin, Oxford University Press-2004.
5. Network Theory by N. C. Jagan& C. Lakshminarayana, B.S. Publications.
6. Network Theory by Sudhakar, Shyam Mohan Palli, TMH.
7. L. S. Bobrow, ―Fundamentals of Electrical Engineering‖, Oxford University Press, 2011.
8. E. Hughes, ―Electrical and Electronics Technology‖, Pearson, 2010.
9. V. D. Toro, ―Electrical Engineering Fundamentals‖, Prentice Hall India, 1989

B.TECH. ME **R21 Regulations**

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

(UGC-AUTONOMOUS)

21HS301: SOCIAL INNOVATION IN PRACTICE

B.Tech. II Year I Sem.

L	T/P/D	C
0	0/3/0	1.5

COURSE OBJECTIVES:

Students will be able to

1. Understand social innovation concepts and approaches.
2. Understand the community problems, social and economical change.
3. Identify new and unaddressed social needs.
4. Analysis of social innovation disclosures in different sectors.
5. Design innovative solutions with Social impact through application of new models of leadership, collective intelligence and creativity techniques.

UNIT-I:INTRODUCTION TO SOCIAL INNOVATION

Core definitions, core elements and common features of social innovation, a topology of social innovations, history of social innovation, social and economic change, Swachh Bharat, Unnat Bharat Abhiyan, National Service Scheme (NSS).

UNIT-II:INTERACTION AND ENGAGEMENT WITH SOCIETY

Engage with community, interact with them to understand the community problems, Understanding social and economical change individuals, organizations and movements.

UNIT-III:PROCESS OF SOCIAL INNOVATION

Understanding the pain/need, description and problem definition, social and economic constraints for affordable and appropriate technology.

UNIT-IV:SOCIAL INNOVATION ACROSS FOUR SECTORS IN INDIA AND GLOBAL SCENARIO

The four sectors the non-profit sector, public sector, the private sector, the informal sector, links between and cross sectors

UNIT-V:SOCIAL INNOVATION CASE STUDIES

Designing and implementing social innovations, report writing and documentation, presentation of the case studies with a focus on impact and vision on society**.**

TEXT BOOKS:

1. The Power of Social Innovation: How Civic Entrepreneurs Ignite Community Networks for Good 1st Edition by Stephen Goldsmith, Michael R. Bloomberg, Gigi Georges, Tim Glynn Burke.

2. The Open Book of Social Innovation: Ways to Design, Develop and Grow Social Innovation Paperback March, 2010 by Robin Murray, Julia Caulier-Grice, Geoff Mulgan.

REFERENCE BOOKS:

1. Social innovator series: ways to design, develop and grow social innovation, the open book of social innovation by robin murray julie caulier-grice geoff mulgan.
2. The International Handbook on Social Innovation: Collective Action, Social Learning and

Transdisciplinary Research Paperback by Frank Moulaert , Diana MacCallum. Guide to Social Innovation by Johannes HAHN and Laszlo ANDOR.

B.TECH. ME **R21 Regulations**

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

(UGC-AUTONOMOUS)

21MC302: GENDER SENSITIZATION LAB

B.Tech. II Year I Sem.	**L**	**T/P/D**	**C**
	0	**0/2/0**	**0**

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.

Objectives of the Course:

Students will be able to

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

Learning Outcomes:

At the end of the course students develop ability to

1. Students will have developed a better understanding of important issues related to gender in contemporary India.
2. 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.
3. Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.
4. Students will acquire insight into the gendered division of labour and its relation to politics and economics.
5. Men and women students and professionals will be better equipped to work and live together as equals.

6. Students will develop a sense of appreciation of women in all walks of life.
7. 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.

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. GrowingupMale.FirstlessonsinCaste.

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 OutIs 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‖.

- ESSENTIAL READING: The Textbook, ‒*Towards a World of Equals: A Bilingual Textbook 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%

B.TECH. ME **R21 Regulations**

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

(UGC-AUTONOMOUS)

21MA403BS: NUMERICAL AND STATISTICAL METHODS

B.Tech. II Year II Sem.	**L**	**T/P/D**	**C**
	3	**1/0/0**	**4**

Course Outcomes:

At the end of the course students develop ability to

1. Estimate the value for the given data using interpolation and Find the root of a given equation.
2. Identify the numerical solutions for a given ODE‘s
3. evaluate Correlation, regression , fitting of curves using method of least squares
4. study the Large sampling theory
5. determine the Small sampling theory

UNIT – I

Numerical Methods – I: Solution of polynomial and transcendental equations – Bisection method, Iteration Method, Newton- Raphson method and Regula-Falsi method. Finite differences- forward differences- backward differences-central differences-symbolic relations and separation of symbols; Interpolation using Newton‘s forward and backward difference formulae. Central difference interpolation: Gauss‘s forward and backward formulae; Lagrange‘s method of interpolation

UNIT - II

Numerical Methods – II: Numerical integration: Trapezoidal rule and Simpson‘s 1/3rd and 3/8 rules. Ordinary differential equations: Taylor‘s series; Picard‘s method; Euler and modified Euler‘s methods; Runge-Kutta method of fourth order

UNIT - III

Applied Statistics: Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves; Correlation and regression – Rank correlation.

UNIT - IV

Testing of Hypothesis-I: Test of significance: Basic of testing of Hypothesis. Null and alternate Hypothesis, types of errors, level of significance, critical region. Large sample test for single proportion, difference of proportions, single mean, difference of two means

UNIT - V

Testing of Hypothesis-II: Small samples: Test for single mean, difference of means, test for ratio of variances for small samples and chi-square distribution.

TEXT BOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.
3. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc-Graw Hill,2004.

UNIT - V

Torsion of Circular Shafts: Theory of pure torsion – Derivation of Torsion equations: T/J = q/r =

B.TECH. ME **R21 Regulations**

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

(UGC-AUTONOMOUS)

21ME410PC: SOLID MECHANICS

B.Tech. II Year II Sem.	**L**	**T/P/D**	**C**
	3	**0/0/0**	**3**

Course Objectives:

Students will be able to

1. Explain various stresses and system of stresses
2. Draw the Shear force & bending moment diagrams for various types of beams and explain point of contraflexure.
3. Calculate the bending and shear stresses
4. Apply principal stress and shear stress
5. Design of shafts according to theory of failures.

Course Outcomes:

At the end of the course students develop ability to

1. Calculate stresses and strains of solid bodies subjected to various types of loading.
2. Analysis of simple structures
3. Evaluate Shear stress distribution across various beams
4. Analyze various theories of failures
5. Identify theories of failures in the designing of shafts.

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, impact and shock loadings. **2-D Stress system, stress at a point on a plane & Problems.**

UNIT – II

Shear Force and Bending Moment: Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beamssubjected to point loads, u.d.l., uniformly varying loads and combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam. . **Applications of moments**

UNIT – III

Flexural Stresses: Theory of simple bending – Assumptions – Derivation of bending equation: M/I = f/y = E/R Neutral axis – Determination bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections – Design of simple beam sections.

Shear Stresses: Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T angle sections **Deflection of beams using double integration method, computation of slopes & deflection in beams**

UNIT - IV

Principal Stresses and Strains: Introduction – Stresses on an inclined section of a bar under axial loading – compound stresses – Normal and tangential stresses on an inclined plane for biaxial stresses-Two perpendicular normal stresses accompanied by a state of simple shear – Mohr‘s circle of stresses-Principal stresses and strains – Analytical and graphical solutions.

Theories of Failure: Introduction – Various theories of failure - Maximum Principal Stress Theory,Maximum Principal Strain Theory, Strain Energy and Shear Strain Energy Theory (Von

UNIT - V

Torsion of Circular Shafts: Theory of pure torsion – Derivation of Torsion equations: T/J = q/r = Mises Theory).

Nθ/L-Assumptions made in the theory of pure torsion – Torsional moment of resistance – Polar section modulus – Power transmitted by shafts – Combined bending and torsion and end thrust – Design of shafts according to theories of failure.

Thin Cylinders: Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and Volumetric strains – changes in dia, and volume of thin cylinders– Thin spherical shells.

Columns and Struts-Failure of Columns, Euler's Formulas, Rankin-Gordon's Formula and Johnson's Empirical Formula for Axially Loaded Columns and their Applications.

TEXT BOOKS:

1. Strength of materials – R.S. Kurmi and Gupta.
2. Solid Mechanics, by Popov
3. Strength of Materials – Ryder. G.H.; Macmillan Long Man Pub.
4. Strength of Materials – W.A. Nash, TMH

REFERENCE BOOKS:

1. Strength of Materials -By Jindal, Umesh Publications.
2. Analysis of structures by Vazirani and Ratwani.
3. Mechanics of Structures Vol –I by H. J. Shah and S. B. Junnarkar, Charotar Publishing House Pvt. Ltd.
4. Strength of Materials by D.S Prakash Rao, Universities Press Pvt. Ltd.
5. Strength of Materials by S. S. Rattan, Tata McGraw Hill Education Pvt. Ltd.
6. Fundamentals of Solid Mechanics by M. L. Gambhir, PHI Learning Pvt. Ltd
7. Strength of Materials by R.K Rajput, S. Chand & Company Ltd.

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

(UGC-AUTONOMOUS)

21ME412PC: FLUID MECHANICS & HYDRALIC MACHINERY

B.Tech. II Year II Sem.	**L**	**T/P/D**	**C**
	3	**0/0/0**	**3**

Course Outcomes:

At the end of the course students develop ability to

1. explain the effect of fluid properties on a flow system.
2. Interpret type of fluid flow patterns and describe continuity equation
3. Estimate the concept of boundary layer theory and flow separation
4. Analyze an appropriate turbine with reference to given situation in power plants.
5. 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 surfacetension - vapour pressure and their influence on fluid motion- atmospheric, gauge and vacuum pressures – measurement of pressure- Piezometer, U-tube and differential manometers.

Compressibility, capillarity, Pascal's law, Newtonian & non-Newtonian fluids. Hydrostatic pressure on plane & curved surfaces centre of pressure, buoyancy.

UNIT - II

Fluid kinematics: Stream line, path line and 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 stream line, 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: Reynold's experiment- Darcy Weisbach equation- Minor losses in pipes- pipes in series and pipes in parallel- total energy line-hydraulic gradient line. Measurement of flow: Pitot tube,venturi meter, and orifice meter, Flow nozzle

UNIT - IV

Basics of turbo machinery: Hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at 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, hydraulicdesign –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.

Hydraulic Systems: Function, Construction and Operation of Hydraulic Accumulator, Hydraulic Intensifier, Hydraulic Crane, Hydraulic Lift and Hydraulic Press, Fluid Coupling and Torque Converter, Hydraulic Ram, Problems

TEXT BOOKS:

1. Hydraulics, Fluid mechanics and Hydraulic Machinery - MODI and SETH.
2. Fluid Mechanics and Hydraulic Machines by Rajput.

REFERENCES:

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

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

(UGC-AUTONOMOUS)

21ME414PC: DNAMICS OF MACHINERY

B.Tech. II Year II Sem.	**L**	**T/P/D**	**C**
	3	**0/0/0**	**3**

Pre-requisite: Kinematics of Machinery

Course Objectives:

Students will be able to

1. Understand the fundamental knowledge of dynamics of machines
2. Develop understanding of vibrations and its significance on engineering design.
3. Explain the working of important machine elements like clutches, brakes, flywheels, governors
4. Outline the balancing of rotating & reciprocating parts
5. Summarize the linear, longitudinal, & tensional vibrations

Course Outcome:

At the end of the course students develop ability to

1. Analyze stabilization of sea vehicles, aircrafts and automobile vehicles
2. Evaluate the dynamic force analysis of slider crank mechanism and design of flywheel.
3. Determine frictional torque and power in bearings, clutches, brakes, dynamometers and governors.
4. Summarise the concept of balancing of rotating and reciprocating masses.
5. Describe the Free vibrations of single degree freedom systems.

UNIT – I

Precession: Gyroscopes – effect of precession – motion on the stability of moving vehicles such as motorcycle – motorcar – aeroplanes and ships.

Static and Dynamic Force Analysis: Static force analysis of planar mechanisms – Analytical Method – Dynamic Force Analysis – D'Alembert's principle, Dynamic Analysis of 4-link mechanism, Slider Crank Mechanism.

UNIT – II

Turning Moment Diagram and Flywheels: Engine Force Analysis – Piston Effort, Crank Effort, etc., Inertia Force in Reciprocating Engine – Graphical Method - Turning moment diagram –fluctuation of energy – flywheels and their design - Inertia of connecting rod-inertia force in reciprocating engines – crank effort and torque diagrams.-.

UNIT – III

Friction: pivots and collars – uniform pressure, uniform wear – friction circle and friction axis: lubricated surfaces – boundary friction – film lubrication. Clutches – Types – Single plate, multi-plate and cone clutches. **Brakes and Dynamometers:** Types of brakes: Simple block brake, band and block brake- internal expanding shoe brake-effect of braking of a vehicle. Dynamometers – absorption and transmission types. General description and methods of operation.

UNIT – IV

Governors: Types of governors - Watt, Porter and Proell governors. Spring loaded governors – Hartnell and Hartung with auxiliary springs. Sensitiveness, isochronisms and hunting – stability – effortand power of the governors.

Balancing: Balancing of rotating masses- Primary, Secondary, and higher balancing of reciprocating masses. Analytical and graphical methods. Unbalanced forces and couples. Examination of ‒V‖ and multi cylinder in-line and radial engines for primary and secondary balancing- locomotive balancing – Hammer blow – Swaying couple – variation of tractive effort.

UNIT – V

Vibrations: Free Vibration of mass attached to vertical spring – Transverse loads – vibrations of beams with concentrated and distributed loads. Dunkerly‘s method – Raleigh‘s method. Whirling of shafts – critical speed – torsional vibrations – one, two and three rotor systems. Kinematic Synthesis of Mechanisms– Freudenstien‘s Equation, Function Generation Errors in Synthesis, Two/Three Point Synthesis, Transmission Angles, Least Square Techniques.

TEXT BOOKS:

1. Theory of Machines /S.S.Rattan / Mc Graw Hill.
2. Theory of Machines /Sadhu Singh/ Pearson

REFERENCE BOOKS:

1. Theory of Machines and Mechanisms/Joseph E. Shigley / Oxford
2. Theory of Machines / Rao,J.S & R.V. Duggipati/ New Age

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

(UGC-AUTONOMOUS)

21ME416PC: APPLIED THERMODNAMICS-1

B.Tech. II Year II Sem.	**L**	**T/P/D**	**C**
	3	**0/0/0**	**3**

Pre-requisite: Thermodynamics

Course Objective:

Students will be able to

1. Interpet the working principle of different I.c engines
2. Find the difference between the normal and abnormal combustion and list the causes for abnormal combustion
3. Classify the compressors and outline theperformance
4. Compare different types of compressor
5. Summarize the working of steam turbine powerplant and classify the working cycles

Course Outcomes:

At the end of the course students develop ability to

1. Distinguish different types of I.C engines
2. Explain various causes of Abnormal combustion
3. Construct and build the compressors
4. Develop new types of compressors
5. Design new cycle for power plant.

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.

Modern Developments In Ic Engines: Turbo charging and super charging of I.C.engines, Stratified charge engines (Lean burned SI engine) Multi fuel engines, Wankel engine

UNIT – II

Normal Combustion and abnormal combustion in SI engines – Importance of flame speed and effect ofengine variables – Abnormal combustion, pre-ignition and knocking in SI Engines – Fuel requirementsand 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: Parameters of performance - measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, Brake power – Determination of frictional losses andindicated power – Performance test – Heat balance sheet and chart

Classification of compressors – Fans, blowers and compressors – positive displacement and dynamictypes – reciprocating and rotary types.

Reciprocating Compressors: Principle of operation, work required, Isothermal efficiency volumetric efficiency and effect of clearance volume, staged compression, under cooling, saving of work, minimumwork condition for staged compression

UNIT – IV

Rotary Compressor (Positive displacement type): Roots Blower, vane sealed compressor, Lysholm compressor – mechanical details and principle of working – efficiency considerations.

Dynamic Compressors: 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

Gas Turbines: Simple Gas Turbine Plant – Ideal Cycle – Closed Cycle and Open Cycle for Gast Turbines, Constant Pressure Cycle, Constant Volume Cycle, Efficiency – Work Ratio and Optimum Pressure Ration for Simple Gas Turbine Cycle. Parameters of Performance, Actual Cycle, Regeneration, Intercooling and Reheating – Closed and Semi-Closed Cycle

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Applied Thermodynamics for Engineering Technologists / Eastop / Pearson
2. Fundamentals of Classical Thermodynamics / Vanwylen G.J., Sonntag R.E. / Wiley Eastern
3. Internal Combustion Engines Fundamentals – John B. Heywood – McGraw Hill Ed.

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

(UGC-AUTONOMOUS)

21ME411PC: SOLID MECHANICS & MATERIALS ENGINEERING LAB

B.Tech. II Year II Sem.

L	T/P/D	C
0	0/3/0	1.5

Course Outcomes:

At the end of the course students develop ability to

1. Study the behavior of the solid bodies subjected to various types of loading
2. Evaluate various types of materials and structural elements to the analysis of simple structures
3. Apply the various theories to calculate the stresses generated on the solid bodies under various types of loading
4. Analyze the laboratory data of behavior of materials and can able to select suitable materials for the designing in respective applications.
5. Explain various stresses and strains generated under various loading and can calculate peak loads and suggest suitable loads for various practical applications.

List of Experiments:

1. Direct tension test
2. Bending test on Simple supported beam
3. Bending test on Cantilever beam
4. Torsion test
5. Brinell hardness test/ Rockwell hardness test
6. Test on springs
7. Izod Impact test/ Charpy Impact test
8. Preparation and study of crystal models for simple cubic, body centred cubic, face centred cubic and hexagonal close packed structures.
9. Preparation and study of the Microstructure of pure metals like Iron, Cu and Al.
10. Preparation and study of the Microstructure of Mild steels, low carbon steels, high – C steels.
11. Study of the Microstructures of Cast Irons.
12. Study of the Microstructures of Non-Ferrous alloys.
13. Hardenability of steels by Jominy End Quench Test.

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

(UGC-AUTONOMOUS)

21ME413PC: FLUID MECHANICS AND HYDRAULIC MACHINES LAB

B.Tech. II Year II Sem.

L	T/P/D	C
0	0/3/0	1.5

Course Objectives:

Students will be able to

1. To provide practical knowledge in verification of principles of fluid flow.
2. To understand the concept of fluid measurement, types of flows and dimensional analysis.
3. To impart knowledge in measuring pressure, discharge and velocity of fluid flow
4. To evaluate the performance of hydraulic turbines.
5. To understand the functioning of pumps and characteristic curves of pumps.

Course Outcomes:

At the end of the course students develop ability to

1. Able to explain the effect of fluid properties.
2. Able to determine type of flows.
3. To calculate losses in pipes and to evaluate coefficient of discharge by using flow meters.
4. To analyze performance and characteristics of hydraulic turbines
5. To estimate performance parameters of a given Centrifugal and Reciprocating pump.

List of 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. Determination of loss of head due to sudden contraction in a pipeline.
12. Verification of Bernoulli‘s Theorems.

B.TECH. ME **R21 Regulations**

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

(UGC-AUTONOMOUS)

21ME415PC: KINEMATICS & DNAMATICS LAB

B.Tech. II Year II Sem.	**L**	**T/P/D**	**C**
	0	**0/3/0**	**1.5**

Pre-requisites:

Prerequisites for the graduate-level course are Kinematics, Dynamics, differential equations, motion simulation, displacement, velocity, acceleration, force, torque, power, Newton's motion laws, vibration,Gyroscopic Effect, Cams, Bearings.

Course Outcomes:

At the end of the course students develop ability to

1. Analyze the various types of forces
2. Identify the forces and torques of components in linkages
3. Influence the static and dynamic balance in linkages.
4. Elaborate forward and inverse kinematics of open-loop mechanisms
5. Discreet various functions of mechanical elements

Experiments: (A Minimum of 10 experiments are to be conducted)

1. To determine the state of balance of machines for primary and secondary forces
2. To determine the frequency of torsional vibration of a given rod
3. Determine the effect of varying mass on the centre of sleeve in porter and proell governor
4. Find the motion of the follower if the given profile of the cam
5. The balance masses statically and dynamically for single rotating mass systems
6. Determine the critical speed of a given shaft for different n-conditions
7. For a simple pendulum determine time period and its natural frequency
8. For a compound pendulum determine time period and its natural frequency
9. Determine the effect of gyroscope for different motions
10. Determine time period, amplitude and frequency of undamped free longitudinal vibration ofsingle degree spring mass systems.
11. Determine the pressure distribution of lubricating oil at various load and speed of a Journalbearing.
12. Determine time period, amplitude and frequency of damped free longitudinal vibration of singledegree spring mass systems

B.TECH. ME **R21 Regulations**

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

(UGC-AUTONOMOUS)

21MA408PC: APTITUDE AND CRITICAL THINKING SKILLS LAB

B.Tech. II Year II Sem.	**L**	**T/P/D**	**C**
	3	**0/0/0**	**1.5**

Course Objectives:

Students will be able to

1. To categorize, apply and use thought process to distinguish between concepts of Quantitative methods.
2. To prepare and explain the fundamentals related to various possibilities and probabilities related to quantitative aptitude.
3. To critically evaluate numerous possibilities related to puzzles.

Course Outcomes:

The student will be able to

1. Use their logical thinking and analytical abilities to solve Quantitative aptitude questions from company specific and other competitive tests.
2. Solve questions related to Time and distance and time and work etc. from company specific and other competitive tests.
3. Understand and solve puzzle related questions from specific and other competitive tests

UNIT I

NUMERICAL ABILITY:

Simplification, BODMAS, Fractions, Decimals, Squares, Square Roots, Cubes, Cube Roots, Speed Maths,
LCM & HCF

UNIT II

Numerical computation:

Applications based on Numbers, Chain Rule, Ratio Proportion

Numerical Reasoning:

Problems related to Number series, Analogy of numbers, Classification of numbers, Letter series, Seating arrangements, Directions, blood relations and puzzle test.

UNIT III

Numerical estimation - I

Applications Based on Time and work, Time and Distance

Combinatory:

Counting techniques, Permutations, Combinations and Probability

Numerical estimation – II

Applications based on Percentages, Profit Loss and Discount, Simple interest and Compound Interest Partnerships.

UNIT IV

Data interpretation

Data interpretation related to Averages, Mixtures and allegations, Bar charts, Pie charts, Venn diagrams Application to industry in Geometry and Menstruation

UNIT V

Critical Thinking:

Alphabet Test, Coding-Decoding, Statement and Conclusion, Statement and Arguments, Statement and Assumption, Calendars, Clocks, Cubes and dice, Counting of figures.

Books for practice

Quantitative aptitude by R S Agarwal, S Chand Publications

Verbal and non verbal Reasoning by RS Agarwal from S Chand publications

References

Barron‟s by Sharon Welner Green and IraK Wolf (Galgotia Publications pvt. Ltd.)

Quantitative Aptitude by U Mohan Rao Scitech publications

Quantitative Aptitude by Arun Sharma McGrawhill publications

Quantitative Aptitude by Ananta Asisha Arihant publications

Quantitative Aptitude by Abhijit Guha

Quantitative Aptitude by Pearson publications

Material from „IMS, Career Launcher and Time Institutes for Competitive exams.

Elementary and Higher Algebra by H. S. Hall an S. R. Knight

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

(UGC-AUTONOMOUS)

21MC403: CONSTITUTION OF INDIA

B.Tech. II Year II Sem. L T/P/D C

3 0/0/0 0

The Constitution of India is the supreme law of India. Parliament of India cannot make any law which violates the Fundamental Rights enumerated under the Part III of the Constitution. The Parliament of India has been empowered to amend the Constitution under Article 368, however, it cannot use this power to change the ―basic structure‖ of the constitution, which has been ruled and explained by the Supreme Court of India in its historical judgments. The Constitution of India reflects the idea of ―Constitutionalism‖ – a modern and progressive concept historically developed by the thinkers of ―liberalism‖ – an ideology which has been recognized as one of the most popular political ideology and result of historical struggles against arbitrary use of sovereign power by state. The historic revolutions in France, England, America and particularly European Renaissance and Reformation movement have resulted into progressive legal reforms in the form of ―constitutionalism‖ in many countries. The Constitution of India was made by borrowing models and principles from many countries including United Kingdom and America.

The Constitution of India is not only a legal document but it also reflects social, political and economic perspectives of the Indian Society. It reflects India's legacy of ―diversity‖. It has been said that Indian constitution reflects ideals of its freedom movement; however, few critics have argued that it does not truly incorporate our own ancient legal heritage and cultural values. No law can be ―static‖ and therefore the Constitution of India has also been amended more than one hundred times. These amendments reflect political, social and economic developments since the year 1950. The Indian judiciary and particularly the Supreme Court of India has played an historic role as the guardian of people. It has been protecting not only basic ideals of the Constitution but also strengthened the same through progressive interpretations of the text of the Constitution. The judicial activism of the Supreme Court of India and its historic contributions has been recognized throughout the world and it gradually made it―as one of the strongest court in the world‖.

Course content

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India
3. Salient features and characteristics of the Constitution of India
4. Scheme of the fundamental rights
5. The scheme of the Fundamental Duties and its legal status
6. The Directive Principles of State Policy – Its importance and implementation
7. Federal structure and distribution of legislative and financial powers between the Union and the States
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India
9. Amendment of the Constitutional Powers and Procedure
10. The historical perspectives of the constitutional amendments in India
11. Emergency Provisions: National Emergency, President Rule, Financial Emergency
12. Local Self Government – Constitutional Scheme in India
13. Scheme of the Fundamental Right to Equality
14. Scheme of the Fundamental Right to certain Freedom under Article 19
15. Scope of the Right to Life and Personal Liberty under Article 21

BALAJI INSTITUTE OF TECHNOLOGY&SCIENCE
(UGC-AUTONOMOUS)
21ME517PC: INSTUMENTATION AND CONTROL SYSTEMS

B.Tech. III Year I Sem.	**L**	**T/P/D**	**C**
	3	**0/0/0**	**3**

COURSE OBJECTIVES:

Students will be able to

1. Understanding the basic characteristic of a typical instrument.
2. Identifying errors and their types that would occur in an instrument.
3. The concept of transducer and Various types and their characters.

COURSE OUTCOMES:

At the end of the course, the students will develop ability to

1. To identify various elements and their purpose in typical instruments, to identify various errors that would occur in instruments.
2. Analysis of errors so as to determine correction factors for each instrument.
3. To understand static and dynamic characteristics of instrument and should be able to determine loading response time.
4. For given range of displacement should be able to specify transducer, it accurate and loading time of that transducer.
5. Identifying properties used for evaluating the thermal systems.

UNIT – I

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

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; Changes in Chemical Phase: Fusible Indicators and Liquid crystals. Measurement of Pressure: Different principles used- Classification: Manometers, Dead weight pressure gauge Tester (Piston gauge), Bourdon pressure gauges, Bulk modulus pressure gauges, Bellows, Diaphragm gauges. Low pressure measurement – Thermal conductivity gauges, ionization pressure gauges, McLeod pressure gauge.

UNIT – III

Measurement of Level: Direct methods – Indirect methods – Capacitive, Radioactive, Ultrasonic, Magnetic, Cryogenic Fuel level indicators –Bubbler level indicators. Flow measurement: Rotameter, magnetic, Ultrasonic, Turbine flowmeter, Hot – wire anemometer, Laser Doppler Anemometer (LDA). Measurement of Speed: Mechanical Tachometers, Electrical tachometers, Non- contact type Stroboscope; Measurement of Acceleration and Vibration: Different simple instruments – Principles of Seismic instruments – Vibrometer and accelerometer using this principle- Piezo electric accelerometer.

UNIT – IV

Stress-Strain measurements: Various types of stress and strain measurements –Selection and installation of metallic strain gauges; electrical strain gauge – gauge factor – method of usage ofresistance strain gauge for bending, compressive and tensile strains – Temperature compensation techniques, Use of strain gauges for measuring torque, Strain gauge Rosettes. Measurement of Humidity: Moisture content of gases, Sling Psychrometer, Absorption Psychrometer, Dew point meter. Measurement of Force, Torque and Power- Elastic force meters, load cells, Torsion meters, Dynamometers.

UNIT – V

Elements of Control Systems: Introduction, Importance – Classification – Open and closed systemsServomechanisms – Examples with block diagrams – Temperature, speed and position control systems- Transfer functions- First and Second order mechanical systems

TEXT BOOKS:

1. Principles of Industrial Instrumentation & Control Systems, - Alavala, - Cengage Learning
2. Basic Principles – Measurements (Instrumentation) & Control Systems – S. Bhaskar – Anuradha Publications.

REFERENCE BOOKS:

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

BALAJI INSTITUTE OF TECHNOLOGY&SCIENCE
(UGC-AUTONOMOUS)
21ME519PC: MACHINE TOOLS AND METROLOGY

B.Tech. III Year I Sem.	**L**	**T/P/D**	**C**
	3	**0/0/0**	**3**

Pre-requisite: Production Technology

COURSE OBJECTIVES:
Students will be able to
1. Discuss the basics of elementary treatment in machine tools.
2. Comprehend the principle, working and construction of various types of lathes.
3. Evaluate the optimum cutting parameters i.e. feed, cutting speed, depth of cut for particular machining process.
4. Know about the interference concept.
5. Learn limits, fits, tolerances, linear, angular measurements and comparators for the application of mechanical engineering components, parts, assembly, interchangeability, standards of measurement.

COURSE OUTCOMES:
At the end of the course, the students will develop ability to
1. Know the construction and working of various machine tools like lathe, milling machines, drill press, grinding machines, etc.
2. Comprehend principles and economics of metal cutting and able to select the economical machining process.
3. Apply cutting mechanics to metal machining based on cutting force and power consumption.
4. Apply mathematics to calculations of surface texture(or) surface quality, surface roughness, surface finish assessment by using C.L.A., and R.M.S. methods and linear, angular measurements by using various micrometers, bevel protractor, auto collimators etc.
5. Apply the interference concept on various parts to observe different images on surfaces.
6. Analyze machinability of different materials using specific cutting forces and surface finish.
7. Calculate the surface roughness for various work parts by using Talysurf surface roughness, etc.
8. Evaluate design of Jigs and Fixtures.

UNIT – I

Elementary Treatment of Metal Cutting Theory: Element of cutting process – Geometry of single point tool and angles, chip formation and types of chips – built up edge and its effects chip breakers. Mechanics of orthogonal cutting –Merchant's Force diagram, cutting forces – cutting speeds, feed, depth of cut, tool life, coolants, Tool materials.

Engine Lathe: Principle of working, specification of lathe – types of lathe – work holders tool holders – Box tools Taper turning thread turning – for Lathes and attachments. Turret and capstan lathes - Principal features of automatic lathes – classification – Single spindle and multi-spindle automatic lathes

UNIT – II

Shaping Slotting and Planing Machines: Principles of working – Principal parts – specification classification, operations performed. Kinematic scheme of the shaping slotting and planing machines, machining time calculations.

Drilling and Boring Machines – Principles of working, specifications, types, operations performed – tool holding devices – twist drill – Boring machines – Fine boring machines – Jig Boring machine. Deep hole drilling machine.

UNIT – III

Milling Machine: Principles of working – specifications – classifications of milling machines – Principal features

of horizontal, vertical and universal milling machines – machining operations Types geometry of milling cutters – milling cutters – methods of indexing

Grinding machine – Fundamentals – Theory of grinding – classification of grinding machine – cylindrical and surface grinding machine – Tool and cutter grinding machine – special types of grinding machines –selection of a grinding wheel

Principles of design of Jigs and fixtures and uses. Classification of Jigs & Fixtures – Principles of location and clamping – Types of clamping & work holding devices. Typical examples of jigs and fixtures.

UNIT – IV

System of Limits and Fits: Introduction – normal size, tolerance limits, deviations, allowance, fits and their types – unilateral and bilateral tolerance system, hole and shaft basis systems – interchangeability and selective assembly. Indian standard institution system – British standard system, International Standard system

Linear Measurement: Length standard, line and end standard, slip gauges – calibration of the slip gauges. Dial indicator, micrometers.

Measurement of Angles and Tapers: Different methods – Bevel protractor – angle slip gauges – spirit levels – sine bar – Sine plate, rollers and spheres used to determine the tapers.

Limit Gauges: Taylors principle – Design of go and No go gauges, plug, ring, snap, gap, taper, profile and position gauges.

UNIT – V

Optical Measuring Instruments: Tool maker's microscope and its uses – collimators, optical projector – optical flats and their uses, interferometer.

Flat Surface Measurement: Measurement of flat surfaces – instruments used – straight edges – surface plates – optical flat and auto collimator.

Surface Roughness Measurement: Differences between Surface Roughness and surface waviness – Numerical assessment of surface finish – CLA, R.M.S. values – Rz values, Methods of measurement of surface finish – profilograph. Talysurf, ISI symbols for indication of surface finish

TEXT BOOKS:

1. P.C. Sharma, "A text book of manufacturing Technology – II", S. Chand, 2010, ISBN 13: 9788121928465.
2. Serope Kalpakjian and Steven R.Schmid, "Manufacturing Engineering and Technology", Ed.4, Pearson Publications, 2001, ISBN: 0132272717.
3. Anand Bewoor, Vinay A.Kulkarni, "Metrology and Measurement", TMH, 2009 1st Ed., ISBN 9780070140004.

REFERENCE BOOKS:

1. P.N.Rao, "Manufacturing Technology" Vol.2, Metal Cutting and Machine Tools, TMH, 2009, Ed.2, ISBN Number: 0074631802.
2. R.K.Jain, "Production Technology" Khanna Publishers, 2001, ISBN Number: 978-8174090997.
3. Connie Dotson, "Fundamentals of Dimensional Metrology", Thomson, 2003 6th Edition, ISBN-13: 9781133600923.

BALAJI INSTITUTE OF TECHNOLOGY&SCIENCE
(UGC-AUTONOMOUS)
21ME523PC: DESIGN OF MACHINE ELEMENTS-I

B.Tech. III Year I Sem.	**L**	**T/P/D**	**C**
	3	**0/0/0**	**3**

Pre-requisite: Engineering Mechanics, Mechanics of Solids.

COURSE OBJECTIVES:
Students will be able to

4. Identify the references that provide tabulated physical and mechanical data that are useful for mechanical design engineers.
5. Recall the material and its properties for the optimum design of a component.
6. Summarise the design principles of various machine members and able to apply the principles in designing new parts as per its functional requirements.
7. Apply the knowledge of the theories of failures.
8. Analyse the theories of failures in defining the failure criteria of the definite machine parts.

COURSE OUTCOMES:
At the end of the course, the students will develop ability to

6. Select a particular machine element and make use of standards parts and dimensions using design data book.
7. Summarize the various theories of failures in different applications.
8. Design the riveted joints for a particular application.
9. Develop a welded joint for different load applications.
10. Compute the various stresses in bolted joints.
11. Calculate the different dimensions of keys, cotters and knuckle joints.
12. Estimate the strength and rigidity of solid and hallow shafts.
13. Recommend suitable shaft coupling.

UNIT – I
Introduction: Definition, Types of design, General considerations in the design – Design procedure – Selection of Material for design and manufacturing.

Stresses in Machine Members: Simple stresses – Combined stresses - stress strain relation – Various theories of failure – factor of safety – Design for strength and rigidity. The concept of stiffness in tension, bending, torsion and combined situations.

UNIT – II
Strength of Machine Elements: Stress concentration – Theoretical stress Concentration factor – Fatigue stress concentration factor – Design for fluctuating stresses – Endurance limit – Estimation of Endurance strength – Goodman's line – Soderberg's line.

UNIT – III
Design of Fasteners: Riveted joints – definition, types and design - Welded joints - definition, types and design – Bolted joints – Design of bolts with initial stresses – Design of joints under eccentric loading.

UNIT – IV
Keys, Cotters and Knuckle Joints: Design of keys-stresses in keys-cottered joints- spigot and socket, sleeve and cotter, Gib and cotter joints-Knuckle joints.

UNIT – V
Shafts and Shaft Couplings: Shafts: Design of solid and hollow shafts for strength and rigidity – Design of shafts for combine bending and axial loads.

Shaft Coupling: Rigid couplings – Muff, Split muff and Flange couplings. Flexible couplings – Flange coupling (Modified) – One Case Study.

TEXT BOOKS:

3. P. Kannaiah, "Machine Design", Sci-Tech, 4th Ed. 2012, / ISBN-13: 978-81-8371-151-7.

4. Pandya and Shah,"Machine Design Charotar", 18th Ed.,2012, ISBN: 978-93-80358-51-2.

REFERENCE BOOKS:

6. Schaum Series, "Machine deign", Mc. Graw Hill, ISBN-13: 9780070255951.

7. R. S. Kurmi, J. K. Gupta, "Machine design", S. Chand, 14th Ed., ISBN: No.-13: 9788121925372.

8. S. Md. Jalaludeen, "Machine Design", Anuradha Publications, ISBN-13: 9788189638214.

BALAJI INSTITUTE OF TECHNOLOGY&SCIENCE
(UGC-AUTONOMOUS)
21ME521PC: APPLIED THERMODYNAMICS - II

B.Tech. III Year I Sem.	**L**	**T/P/D**	**C**
	3	**0/0/0**	**3**

Pre-requisite:

COURSE OBJECTIVES:
Students will be able to
1. Explain thermodynamic properties of gas mixtures.
2. Discuss Maxwell's relations of gas mixtures.
3. Apply the second law for the analysis of reactive systems.
4. Illustrate various concepts of Statistical Thermodynamics.
6. Apply kinetic theory of gases for the analysis of gas mixtures.

COURSE OUTCOMES:
At the end of the course, the students will develop ability to
9. Memorize the concepts of thermodynamics.
10. Estimate thermodynamic properties of gas mixtures.
11. Identify the models to estimate the properties of real gases.
12. Define adiabatic flame temperature.
13. Discuss Heisenberg's Uncertainty Principle and Schrodinger's Wave Equation.
14. Apply the concepts of statistical Thermodynamics for the analysis of gas mixtures.
15. Analyze reactive and non-reactive gas mixtures using kinetic theory of gases.
16. Explain the transport Processes in Gases.

UNIT-I
Revision of Thermodynamics: First Law of Thermodynamics, Second Law of Thermodynamics, Entropy, Availability
Properties of Gases and Gas Mixtures: Equations of State, changes in internal energy, enthalpy and entropy for an ideal gas, Equations of state for a real gas, Law of Corresponding States, Generalized Compressibility Chart, Reduced coordinates, Other Equations of state, Dalton's Law of Partial Pressures, Internal Energy, Enthalpy and Entropy and Specific Heats of Gas Mixtures, Gibbs Function of a Mixture.

UNIT-II
Thermodynamic Relations: Mathematical Theorems, Maxwell's Relations, T-ds Equations, Difference in Heat Capacities, Ratio of Heat Capacities, Energy Equation, Clausius-Claperyon Equation, Joule-Thomson Coefficient, Evaluation of Thermodynamic Properties from Equation of State, Conditions of Stability, Third Law of Thermodynamics.

UNIT-III
Reactive Mixtures: Degree of Reaction, Reaction Equilibrium, Equilibrium Constant, Law of Mass Action, Thermal Ionization of Monatomic Gas, Gibbs Function Change, Fugacity and Activity, Enthalpy of Formation, Enthalpy of Combustion, Heating Values, Adiabatic Flame Temperature, Second Law Analysis of reactive Systems, Chemical Exergy, Second Law Efficiency.

UNIT-IV
Statistical Thermodynamics: Quantum Hypothesis, Quantum Principle Applied to a System of Particles, Wave-Particle Duality, De Broglie Equation, Heisenberg's Uncertainty Principle, Schrodinger's Wave Equation,

Probability Function, Particle in a Box, Rigid Rotator, Harmonic Oscillator, Phase Space, Maxwell-Boltzmann Statistics, Stirling's Approximation, Bose-Einstein Statistics, Fermi-Dirac Statistics, Partition Function, Entropy and Probability, Monatomic Ideal Gas, Principle of Equi-partition of Energy, Statistics of a photon gas, Electron Gas, Thermodynamic Properties.

UNIT-V

Kinetic Theory of Gases: Molecular Model, Distribution of Molecular Velocities, Molecular Collisions with a Stationary Wall, Maxwell-Boltzmann Velocity Distribution, Average, Root-Mean Square and Most Probable Speeds, Molecules in a Certain Speed Range, Energy Distribution Function, Specific Heat of a Gas, Specific Heat of a Solid.

Transport Processes in Gases: Mean Free Path and Collision Cross-section, Distribution of Free Paths, Transport Properties.

TEXT BOOKS:

1. Cengel, Y.A & Boles, M.A., Thermodynamics-An Engineering Approach, TMH, 2011.
2. Borgnakke, C & Sonntag, R.E., Fundamentals of Thermodynamics, Wiley, 2009.
3. Nag, P.K., Basic and Applied Thermodynamics, TMH, 2009.
4. Smith, J.M. etal, Introduction to Chemical Engineering Thermodynamics, TMH, 2005.
5. Mcquarrie, D.A., and Simon, J.D., Molecular Thermodynamics, Viva Books, 2004.

REFERENCE BOOKS:

1. Thermodynamics/Holman/ Me Graw Hill.
2. Engg. Thermodynamics/PL.Dhar / Elsevier
3. Thermodynamics/Sonnatag& Van Wylen / John Wiley & Sons
4. Thermodynamics for Engineers/Doolittle-Messe / John Wiley & Sons
5. Irreversible thermodynamics/HR De Groff.
6. Thermal Engineering / Soman / PHI
7. Thermal Engineering / Rathore / TMH
8. Engineering Thermodynamics/Chatopadyaya/

BALAJI INSTITUTE OF TECHNOLOGY&SCIENCE
(UGC-AUTONOMOUS)
21ME534PE: AUTOMOBILE ENGINEERING (PE-I)

B.Tech. III Year I Sem.	**L**	**T/P/D**	**C**
	3	**0/0/0**	**3**

COURSE OBJECTIVES:
Students will be able to

1. Understand the fundamentals of automobile theory, necessary background for intelligent diagnosis, maintenance and repair of different type of modern automobiles.
2. Learn the components of automobile in detail, power transmission, engine construction and working, lubrication system.
3. Get the idea of emissions that will be released from the automobile
4. Understand different types of fuel systems, cooling and ignition systems.
5. Gain knowledge of different systems of an automobile like electrical, transmission, suspension and breaking systems.

COURSE OUTCOMES:
At the end of the course, the students will develop ability to

1. Understand working of engine, based upon the principles of 2- stroke, and 4-stroke.
2. Analyze the cooling systems depending upon the cooling requirements for particular automobile.
3. Understand different types of ignition systems used in an automobile.
4. Understand various transmission systems, steering systems and suspension and breaking systems.
5. Identify the different steering gear mechanisms

UNIT – I

Introduction: Components of four wheeler automobile – chassis and body – power unit – power transmission – rear wheel drive, front wheel drive, 4 wheel drive – types of automobile engines, engine construction – engine lubrication, splash and pressure lubrication systems, oil filters, oil pumps – crank case ventilation – engine service, reboring, decarbonisation, Nitriding of crank shaft..

Emission from Automobiles : Pollution standards, National and international – Pollution Control – Techniques – Noise Pollution & control.

UNIT – II

Fuel System: S.I. Engine: Fuel supply systems, Mechanical and electrical fuel pumps – carburetor – types – air filters – petrol injection.C.I. Engines: Requirements of diesel injection systems, types of injection systems, fuel pump, nozzle, Alternative fuels for Automobiles-injection, Classification, Properties, Hybrid vehicles injection timing, testing of fuel, pumps.

UNIT – III

Cooling System: Cooling Requirements, Air Cooling, Liquid Cooling and Forced Circulation System – Radiators – Types – Cooling Fan - water pump, thermostat, evaporative cooling – pressure sealed cooling – antifreeze solutions.

Ignition System: Function of an ignition system, battery ignition system, constructional features of storage battery, auto transformer, contact breaker points, condenser and spark plug – Magneto coil ignition system, electronic ignition system using contact breaker, electronic ignition using contact triggers – spark advance and retard mechanism.

UNIT – IV

Electrical System: Charging circuit, generator, current – voltage regulator – starting system, bendix drive mechanism solenoid switch, lighting systems, Horn, wiper, fuel gauge – oil pressure gauge, engine temperature indicator etc.

Transmission System: Clutches, principle, types, cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches, fluid fly wheel – Gear boxes, types, sliding mesh, constant mesh, synchro mesh gear boxes, epicyclic gear box, over drive torque converter. Propeller shaft – Hotch – Kiss drive, Torque tube drive universal joint, differential rear axles – types – wheels and tyres.

UNIT – V

Steering System: Steering geometry – camber, castor, king pin rake, combined angle toe in, center point steering. Types of steering mechanism – Ackerman steering mechanism, Davis steering mechanism, steering gears – types, steering linkages. Suspension System: Objects of suspension systems – rigid axle suspension system, torsion bar, shock absorber, Independent suspension system. Braking System: Mechanical brake system, Hydraulic brake system, Master cylinder, wheel cylinder tandem master cylinder Requirement of brake fluid, Pneumatic and vacuum brakes.

TEXT BOOKS:

1. Kripal Singh, "Automobile Engineering", Vol. 1 & Vol. 2, Standard Publishers Distribution 12th Edition, ISBN Numbers: 9788180141713, 9788180141775.
2. K.M Gupta, "Automobile Engineering", Vol. 1 & Vol. 2, Umesh publication, 1st Edition, 2013, ISBN Numbers: 9788188114220.

REFERENCE BOOKS:

1. Heitner, "Automotive Mechanics", 2nd Ed., CBS Publishers & Distributors, ISBN-13: 978-8123908915.
2. P. RamiReddy, "Alternative fuels of Automobiles", Frontline publications.

BALAJI INSTITUTE OF TECHNOLOGY&SCIENCE
(UGC-AUTONOMOUS)
21ME535PE-INDUSTRIAL ENGINEERING (PE-I)

B.Tech. III Year I Sem.	**L**	**T/P/D**	**C**
	3	**0/0/0**	**3**

COURSE OBJECTIVES:
Students will be able to
7. Understand the philosophies of management gurus
8. Understand the various types of organization structures and their features, and Their advantages and disadvantages.
9. Learning various Industrial Engineering Practices like Operations Management techniques, work study, statistical quality control techniques, Job evaluation techniques and network analysis techniques.

COURSE OUTCOMES:
At the end of the course, the students will develop ability to
17. Apply principles of management
18. Design the organization structure
19. Apply techniques for plant location, design plant layout and value analysis
20. Carry out work study to find the best method for doing the work and establish standard time for a given method
21. Apply various quality control techniques and sampling plans

UNIT – I
Introduction to Management: Entrepreneurship and organization – Nature and Importance of Management, Functions of Management, Taylor's Scientific Management Theory, Fayol's Principles of Management, Maslow's Theory of Human Needs, Douglas McGregor's Theory X and Theory Y, Herzberg's Two-Factor Theory of Motivation, Systems Approach to Management, Leadership Styles, Social responsibilities of Management

UNIT – II
Designing Organizational Structures: Departmentalization and Decentralization, Types of Organization structures – Line organization, Line and staff organization, functional organization, Committee organization, matrix organization, Virtual Organization, Cellular Organization, team structure, boundary less organization, inverted pyramid structure, lean and flat organization structure and their merits, demerits and suitability.

UNIT – III
Operations Management: Objectives- product design process- Process selection-Types of production system (Job, batch and Mass Production), Plant location-factors- Urban-Rural sites comparison- Types of Plant Layouts- Design of product layout- Line balancing (RPW method) Value analysis-Definition-types of values- Objectives- Phases of value analysis- Fast diagram

UNIT – IV
Work Study: Introduction — definition — objectives — steps in work study — Method study — definition, objectives — steps of method study. Work Measurement — purpose — types of study — stop watch methods — steps — key rating — allowances — standard time calculations — work sampling.
Statistical Quality Control: variables-attributes, Shewart control charts for variables- chart, R chart, – Attributes- Defective-Defect- Charts for attributes-p-chart -c chart (simple Problems), Acceptance Sampling- Single sampling- Double sampling plans-OC curves.

UNIT – V
Job Evaluation: Methods of job evaluation — simple routing objective systems — classification method factor comparison method, point method, benefits of job evaluation and limitations. **Project Management (PERT/CPM)**: Network Analysis, Programme Evaluation and Review Technique (PERT), Critical Path Method

(CPM), Identifying critical path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing. (simple problems)

TEXT BOOKS:

4. Industrial Engineering and Management/O.P. Khanna/Khanna Publishers
5. Industrial Engineering and Management Science/T.R. Banga and S.C. Sarma/Khanna Publishers.

REFERENCE BOOKS:

4. Motion and Time Study by Ralph M Barnes! John Willey & Sons Work Study by lLO.
5. Human factors in Engineering & Design/Ernest J McCormick /TMH.
6. Production & Operation Management /Paneer Selvam/PHI.
7. Industrial Engineering Management/NVS Raju/Cengage Learning.
8. Industrial Engineering Hand Book/Maynard.
9. Industrial Engineering Management I Ravi Shankar/Galgotia.

BALAJI INSTITUTE OF TECHNOLOGY&SCIENCE
(UGC-AUTONOMOUS)
21ME536PE: AUTOMATION IN MANUFACTURING (PE-I)

B.Tech. III Year I Sem.	**L**	**T/P/D**	**C**
	3	**0/0/0**	**3**

COURSE OUTCOMES:

At the end of the course, the students will develop ability to

1. Formulate different types of automated flow lines, transfer lines.
2. Design material handling systems in production
3. Estimate the various types of automated assembly lines.
4. Recognize the ergonomics of material handling.
5. Apply the principles of ERP, BPE, concurrent engineering, and rapid proto typing

UNIT - I Introduction: Types and strategies of automation, pneumatic and hydraulic components circuits, Automation in machine tools. Mechanical feeding and too changing and machine tool control transfer the automaton.

UNIT - II Automated flow lines: Methods or work part transport transfer Mechanical buffer storage control function, design and fabrication consideration. Analysis of Automated flow lines: General terminology and analysis of transfer lines without and with buffer storage, partial automation, implementation of automated flow lines.

UNIT - III Assembly system and line balancing: Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

UNIT - IV Automated material handling: Types of equipment, functions, analysis and design of material handling systems conveyor systems, automated guided vehicle systems. Automated storage systems, Automated storage and retrieval systems; work in process storage, interfacing handling and storage with manufacturing.

UNIT -V Fundamentals of Industrial controls: Review of control theory, logic controls, sensors and actuators, Data communication and LAN in Manufacturing. Business process Re-engineering: Introduction to BPE logistics, ERP, Software configuration of BPE.

TEXT BOOK: 1. Automation, Production Systems and Computer Integrated Manufacturing: M.P. Groover 3e./PE/PHI, 2009. REFERENCE BOOKS: 1. Computer Aided Manufacturing, Tien-Chien Chang, Richard A. Wysk and Hsu-Pin Wang, Pearson, 2009. 2. Automation by W. Buekinsham.

BALAJI INSTITUTE OF TECHNOLOGY&SCIENCE

(UGC-AUTONOMOUS)

21ME518PC: INSTRUMENTATION AND CONTROL SYSTEMS LAB

B.Tech. III Year I Sem.	**L**	**T/P/D**	**C**
	0	**0/2/0**	**1**

Experiments:

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

BALAJI INSTITUTE OF TECHNOLOGY&SCIENCE

(UGC-AUTONOMOUS)

21EN503HS-ADVANCED COMMUNICATIONS SKILLS LAB

B.Tech. III Year I Sem. **L T/P/D C**

0 0/3/0 1.5

INTRODUCTION: The introduction of the Advanced Communication Skills Lab is considered essential at 3rd year level. At this stage, the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalized context. The proposed course should be a laboratory course to enable students to use 'good' English and perform the following:

- Gathering ideas and information to organize ideas relevantly and coherently.
- Engaging in debates.
- Participating in group discussions.
- Facing interviews.
- Writing project/research reports/technical reports.
- Making oral presentations.
- Writing formal letters.
- Transferring information from non-verbal to verbal texts and vice-versa.
- Taking part in social and professional communication.

Course Objectives: This Lab focuses on using multi-media instruction for language development to meet the following targets:

- To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
- Further, they would be required to communicate their ideas relevantly and coherently in writing.
- To prepare all the students for their placements.

Experiments:

1. Activities on Fundamentals of Inter-personal Communication and Building Vocabulary - Starting a conversation – responding appropriately and relevantly – using the right body language – Role Play in different situations & Discourse Skills- using visuals - Synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, business vocabulary, analogy, idioms and phrases, collocations & usage of vocabulary.

2. Activities on Reading Comprehension –General Vs Local comprehension, reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading& effective googling.

3. Activities on Writing Skills – Structure and presentation of different types of writing – letter writing/Resume writing/ e-correspondence/Technical report writing/ – planning for writing – improving one's writing.

4. Activities on Presentation Skills – Oral presentations (individual and group) through JAM sessions/seminars/PPTs and written presentations through posters/projects/reports/ emails/assignments etc

5. Activities on Group Discussion and Interview Skills – Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation- Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference & video-conference and Mock Interviews.

4. MINIMUM REQUIREMENT: The Advanced English Communication Skills (AECS) Laboratory shall have the following infrastructural facilities to accommodate at least 35 students in the lab:

- Spacious room with appropriate acoustics.
- Round Tables with movable chairs

- Audio-visual aids
- LCD Projector
- Public Address system
- P – IV Processor, Hard Disk – 80 GB, RAM–512 MB Minimum, Speed – 2.8 GHZ
- T. V, a digital stereo & Camcorder
- Headphones of High quality

SUGGESTED SOFTWARE: The software consisting of the prescribed topics elaborated above should be procured and used.

- Oxford Advanced Learner's Compass, 7th Edition
- DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.
- Lingua TOEFL CBT Insider, by Dream tech
- TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)

TEXT BOOKS:

1. Effective Technical Communication by M Asharaf Rizvi. McGraw Hill Education (India) Pvt. Ltd. 2 nd Edition
2. Academic Writing: A Handbook for International Students by Stephen Bailey, Routledge, 5th Edition.

REFERENCE BOOKS:

1. Learn Correct English – A Book of Grammar, Usage and Composition by Shiv K. Kumar and Hemalatha Nagarajan. Pearson 2007
2. Professional Communication by Aruna Koneru, McGraw Hill Education (India) Pvt. Ltd, 2016.
3. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.
4. Technical Communication by Paul V. Anderson. 2007. Cengage Learning pvt. Ltd. New Delhi.
5. English Vocabulary in Use series, Cambridge University Press 2008.
6. Handbook for Technical Communication by David A. McMurrey & Joanne Buckley. 2012. Cengage Learning.
7. Communication Skills by Leena Sen, PHI Learning Pvt Ltd., New Delhi, 2009.
8. Job Hunting by Colm Downes, Cambridge University Press 2008.
9. English for Technical Communication for Engineering Students, Aysha Vishwamohan, Tata Mc Graw-Hill 2009.

BALAJI INSTITUTE OF TECHNOLOGY&SCIENCE

(UGC-AUTONOMOUS)

21ME522PC: THERMAL ENGINEERING LAB

B.Tech. III Year I Sem.	**L**	**T/P/D**	**C**
	0	**0/3/0**	**1.5**

Pre-requisites: Thermodynamics & Thermal Engineering – I

Course Objectives: To understand the working principles of IC Engines, Compressors.

Experiments:

1. I.C. Engines Valve / Port Timing Diagrams
2. I.C. Engines Performance Test for 4 Stroke SI engines
3. I.C. Engines Performance Test for 2 Stroke SI engines
4. I.C. Engines Morse, Retardation, Motoring Tests
5. I.C. Engine Heat Balance – CI/SI Engines
6. I.C. Engines Economical speed Test on a SI engine
7. I.C. Engines effect of A/F Ratio in a SI engine
8. Performance Test on Variable Compression Ratio Engine
9. IC engine Performance Test on a 4S CI Engine at constant speed
10. Volumetric efficiency of Air – Compressor Unit
11. Dis-assembly / Assembly of Engines
12. Study of Boilers

Note: Perform any 10 out of the 12 Exercises

BALAJI INSTITUTE OF TECHNOLOGY&SCIENCE

(UGC-AUTONOMOUS)

21ME520PC: MACHINE TOOLS & METROLOGY LAB

B.Tech. III Year I Sem.

L	T/P/D	C
0	0/2/0	1

Pre-requisites: Theoretical exposure to Metrology and machine tools.

Course Outcomes:

1. To import practical exposure to the metrology equipment & Machine Tools
2. To conduct experiments and understand the working of the same.

Experiments:

1. Step turning on lathe machine
2. Taper turning on lathe machine
3. Thread cutting and knurling on lathe machine (2 exercises)
4. Measurement of cutting forces on lathe
5. Machining of holes using Drilling and boring machines.
6. Gear cutting on the Milling machine
7. Grinding of Tool angles using Cylindrical / Surface Grinding
8. Measurement of lengths, heights, diameters by vernier calipers, micrometers.
9. Measurement of Diameter of bores by internal micrometers and dial bore indicators.
10. Use of gear teeth vernier calipers for checking the chordal addendum and chordal height of the spur gear.
11. Angle and taper measurements by bevel protractor and sine bars.
12. Thread measurement by 2-wire and 3-wire methods.
13. Surface roughness measurement by Tally Surf.
14. Use of mechanical comparator

BALAJI INSTITUTE OF TECHNOLOGY&SCIENCE
(UGC-AUTONOMOUS)
21ME627PC: HEAT TRANSFER

B.Tech. III Year II Sem.	**L**	**T/P/D**	**C**
	3	**0/0/0**	**3**

Pre-requisite: Applied Thermodynamics

COURSE OBJECTIVES:
Students will be able to

10. Discuss the basic differences between modes of heat transfer conduction, convection and radiation.
11. Memorize the basic laws like Fourier's law, Newton's law of cooling and Stefan Boltzmann law & to illustrate the general heat conductive equations & transient heat conduction.
12. Apply the concept of hydrodynamic and thermal boundary layers. Heat transfer in phase change like boiling and condensation. Film wise and drop wise condensation.
13. Compare various types of heat exchangers, heat transfer coefficients & the concepts of log mean temperature difference and NTU methods for heat exchangers.
14. Apply radiation heat transfer, Planks law, Kirchoff law, Stefan Boltzmann law, concept of shape factor, black body and emissivity.

COURSE OUTCOMES:
At the end of the course, the students will develop ability to

1. Illustrate the general heat conduction equation for Cartesian, cylindrical and spherical coordinate system.
2. Apply boundary conditions, to solve general heat conduction equation for 1-D steady state Problems. Evaluate a fin using fin performance parameter.
3. Analyze the transient heat conduction problems.
4. Solve the problems of radiation shield & radiative heat exchange between surfaces. Design the devices like heat exchangers, boilers, condensers, fins etc as per the requirement.
5. Analyze the working of the physical components involving steady, unsteady states like heat exchangers, boilers, condensers, fins, electric iron.

UNIT – I
Introduction: Modes and mechanisms of heat transfer – Basic laws of heat transfer – General discussion about applications of heat transfer. Conduction Heat Transfer: Fourier rate equation – General heat conduction equation in Cartesian, cylindrical and Spherical coordinates. Simplification and forms of the field equation – steady, unsteady and periodic heat transfer – Initial and boundary conditions.

UNIT – II
Conduction Heat Transfer: One Dimensional Steady State Conduction Heat Transfer: Homogeneous slabs, hollow cylinders and spheres – overall heat transfer coefficient – electrical analogy – Critical radius of insulation. Variable Thermal conductivity – systems with heat sources or Heat generation.
Extended surface (fins) Heat Transfer – Long Fin, Fin with insulated tip and Short Fin, Application to error measurement of Temperature.
One Dimensional Transient Conduction Heat Transfer: Systems with negligible internal resistance – significance of Biot and Fourier Numbers – Chart solution of transient conduction systems. Concept of Functional Body.

UNIT – III
Convective Heat Transfer: Classification of systems based on causation of flow, condition of flow, configuration of flow and medium of flow – Dimensional analysis as a tool for experimental investigation – Buckingham Pi Theorem and method, application for developing semi – empirical non-dimensional correlation for convection heat transfer – Significance of non-dimensional numbers – Concepts of Continuity, Momentum and Energy Equations.
Forced convection: External Flows: Concepts about hydrodynamic and thermal boundary layers and use of

empirical correlations for convective heat transfer – Flat plates and Cylinders.

UNIT – IV

Forced Convection - Internal Flows: Concepts about Hydrodynamic and Thermal Entry Lengths – Division of internal flow based on this – Use of empirical relations for Horizontal Pipe Flow and annulus flow.

Free Convection: Development of Hydrodynamic and Thermal boundary layer along a vertical plate – Use of empirical relations for Vertical plates and Pipes.

Heat Transfer with Phase Change: Boiling: Pool boiling – Regimes Calculations in Nucleate boiling, Critical Heat Flux and Film boiling Condensation: Film wise and drop wise condensation – Nusselt's Theory of Condensation on a vertical plate – Film condensation on vertical and horizontal cylinders using empirical correlations

UNIT – V

Heat Exchangers: Classification of heat exchangers – overall heat transfer Coefficient and fouling factor – Concepts of LMTD and NTU methods. Problems using LMTD and NTU methods.

Radiation Heat Transfer: Emission characteristics and laws of black body radiation – Irradiation – total and monochromatic quantities – laws of Planck, Wien, Kirchoff, Lambert, Stefan and Boltzmann – heat exchange between two black bodies – concepts of shape factor – Emissivity – heat exchange between grey bodies – radiation shields – electrical analogy for radiation network.

TEXT BOOKS:

1. R.C. SACHDEVA, "Fundamentals of Engineering Heat and Mass Transfer", New Age Publishers, 4th Ed. 2010, ISBN : 978-81-224-2785-1.
2. HOLMAN, "Heat Transfer", TMH 10TH Ed., ISBN Number: 9780071069670.

REFERENCE BOOKS:

1. Yunus A.Cengel, "Heat Transfer: A Practical Approach", Tata McGraw Hill (P) Ltd., 4th Ed., ISBN 13: **9780073398129.**
2. F.P Incropera, "Fundamentals of Heat and Mass Transfer", John Wiley & Sons 6th Ed., ISBN-13: 978-0471457282.
3. R.K. Rajput, "Heat and Mass Transfer", S. Chand & Company Ltd., 5th Edition, *ISBN Number*: 978-8121926171.

BALAJI INSTITUTE OF TECHNOLOGY&SCIENCE
(UGC-AUTONOMOUS)
21ME629PC: CAD/CAM

B.Tech. III Year II Sem.

L	T/P/D	C
3	0/0/0	3

COURSE OBJECTIVES:
Students will be able to

1. Know the computers in industrial manufacturing and use of hardware and software components in CAD/CAM systems.
2. Construct the database models and geometric modeling features- To know the drafting and modeling systems used in CAD/CAM- Solid modeling features and applications.
3. Distinguish between NC (Numerical Control), CNC & DNC in CAD/CAM.
4. State the group technology approaches for manufacturing industries.
5. Interpret the importance of CAQC(Computer Aided Quality Control)

COURSE OUTCOMES:
At the end of the course, the students will develop ability to

1. Solve 2D and 3D transformations problems.
2. Differentiate between NC and CNC.
3. Write the NC program for different geometric models.
4. Analyze the Group Technology methods.
5. Definitions of various computer–based applications in manufacturing system.

UNIT – I
Computers in Industrial Manufacturing: Product cycle, CAD/CAM Hardware, Basic structure, CPU, Memory types, input devices, display devices, hard copy devices, storage devices.
Computer Graphics: Virtual reality, Hidden lines, Hidden surfaces ,Z-buffer, Pointers, Area sub-division, Scan line algorithm, database structure for graphics, modeling, transformation of geometry, 3D transformations, mathematics of projections, clipping,

UNIT – II
Geometric Modeling: Requirements, geometric models, geometric construction models, curve representation methods-Hermite Cubic spline, Bezier curve,B-spline
Surface representation methods-Plane Surface, Surface of evaluation, tabulated cylinder. Solid modeling-Boundary representation, Constructive solid geometry
Drafting and Modeling Systems: Basic geometric commands, layers, display control commands, editing, dimensioning,

UNIT – III
Numerical Control: NC, NC modes, NC elements, NC machine tools, structure of CNC machine tools, features of Machining center, turning center, CNC Part Programming: fundamentals, manual part programming methods, computer aided part programming.

UNIT – IV
Group Tech: Part family, coding and classification, production flow analysis, advantages and limitations.
Computer Aided Quality Control: Terminology in quality control, the computer in QC, contact inspection methods, noncontact inspection methods-optical, noncontact inspection methods- Non-optical, computer aided testing, integration of CAQC with CAD/CAM.

UNIT – V

Computer Aided Process Planning: Retrieval CAPP, Generative CAPP ,Hybrid system

Case Studies- Web Integrated Manufacturing, JIT production control by Kanban, Toyota integrated product development, Indian Manufacturing Scenario

TEXT BOOKS:

1. A Zimmers & P.Groover, "CAD/AM", PE/PHI, 1st Ed., *ISBN Number*: 978-8177584165.
2. Ibrahim Zeid, "CAD/CAM Theory and Practice", TMH, 2nd Ed., *ISBN Number*: 978-0070151345.

REFERENCE BOOKS:

1. Lalit Narayan, "Computer Aided Design and Manufacturing", PHI, ISBN: 978-81-203-3342-0.
2. Radhakrishnan and Subramanian, "CAD/CAM/CIM", New Age, 3rd Ed., 2007, ISBN-13: 9788122412482.

BALAJI INSTITUTE OF TECHNOLOGY&SCIENCE
(UGC-AUTONOMOUS)
21ME626PC: DESIGN OF MACHINE ELEMENTS – II

B.Tech. III Year II Sem.	**L**	**T/P/D**	**C**
	3	**0/0/0**	**3**

Pre-requisite: Engineering Mechanics, Mechanics of Solids.

COURSE OBJECTIVES:
Students will be able to
1. Outline the references that provide tabulated physical and mechanical data that are useful for mechanical design engineers.
2. Select the material and its properties for the optimum design of component.
3. Explain the design principles of various machine members.
4. Apply the design principles in designing new parts as per its functional requirements.
5. Design the various power drives suitable to transfer power requirements.

COURSE OUTCOMES:
At the end of the course, the students will develop ability to
1. Calculate the design parameters of journal and roller bearings.
2. Estimate the design parameters of engine parts like connecting rod, crank shaft, piston and cylinder.
3. Apply the design principles of the springs and gears.
4. Analyze the design of power transmission systems of belt type.
5. Formulate the design of power transmission systems

UNIT – I
Bearings: Types of Journal bearings – Lubrication – Bearing Modulus – Full and partial bearings – Clearance ratio – Bearing Characteristic Number, Heat dissipation of bearings, bearing materials – journal bearing design – Ball and roller bearings – Static of ball and roller bearings – One case study

UNIT – II
Engine Parts: Design of cylinder – Piston – Forces acting on piston – Construction Design and proportions of piston. Connecting Rod: Thrust in connecting rod – stress due to whipping action on connecting rod ends –Crank shafts, design of over hang crank shaft.

UNIT – III
Mechanical Springs: Stresses and deflections of helical springs – Extension and compression springs – Design of springs for fatigue loading – Natural frequency of helical springs – Energy storage capacity – helical torsion springs – Design of co-axial springs, Design of leaf springs – One Case study.

UNIT – IV
Gears: Spur gears and Helical gears – Load concentration factor – Dynamic load factor, surface compressive strength – Bending strength – Design analysis of spur gears – Estimation of centre distance, module and face width, check for plastic deformation.

UNIT – V
Pulleys: Transmission of power by Belt and Rope drives, Transmission efficiencies, Belts – Flat and V types.
Design Of Power Screws: Design of screw, design of nut, design of screw jack, compound screw, differential screw, ball screw

TEXT BOOKS:

1. P. Kannaiah, “Machine Design” Sci-Tech, 4th Ed. 2012, ISBN-13: 978-81-8371-151-7.
2. Pandya and Shah, “Machine Design”, Charotar, 18th Ed.2012, *ISBN*: 978-93-80358-51-2.

REFERENCE BOOKS:

1. Schaum Series, “Machine deign”, Mc.Graw Hill, 1st Edition, ISBN-13: 9780070255951.
2. R. S. Kurmi, J.K.Gupta, “Machine design”, S. Chand, 14th Ed, ISBN Number-13: 9788121925372.
3. S. Md. Jalaludeen, “Machine Design”, Anuradha Publications, 14th Ed., ISBN-13: 9788189638214.

BALAJI INSTITUTE OF TECHNOLOGY&SCIENCE
(UGC-AUTONOMOUS)
21ME637PE : REFRIGERATION AND AIR CONDITIONING (PE-II)

B.Tech. III Year II Sem.	**L**	**T/P/D**	**C**
	3	**0/0/0**	**3**

Pre-requisite: Thermodynamics.

COURSE OBJECTIVES:

Students will be able to

1. Discuss the fundamentals, nature and role of refrigeration and air-conditioning
2. Explain the working principle of Air refrigeration, vapour compression refrigeration and vapour absorption refrigeration systems.
3. Illustrate different types of expansion valves, evaporators and refrigerants.
4. Apply psychometric chart to solve the practical problems.
5. Summarize various filters, grills, fans, registers, blowers and different heat pump circuits.

COURSE OUTCOMES:

At the end of the course, the students will develop ability to

1. Exemplify the working principle of various refrigeration systems.
2. Summarize the desirable properties of refrigerants
3. Illustrate different types of evaporators and expansion valves.
4. Compare different types of refrigeration systems.
5. Categorize various heat pump circuits.

UNIT – I

Introduction to Refrigeration: Necessity and applications – Unit of refrigeration and C.O.P. – Mechanical Refrigeration – Types of Ideal cycles of refrigeration.

Air Refrigeration: Bell Coleman cycle, Open and Dense air systems – Actual air refrigeration system problems – Refrigeration needs of Air crafts.

UNIT – II

Vapour Compression Refrigeration: Working principle and essential components of the plant – simple vapour compression refrigeration cycle – COP – Representation of cycle on T-S and p-h charts – effect of subcooling and super heating – cycle analysis – Actual cycle Influence of various parameters on system performance – Use of p-h charts – numerical problems.

Principles of Evaporators: Classification – Working principles expansion devices – Types – Working principles theory.

Refrigerants – Desirable properties – classification refrigerants used – Nomenclature – Ozone Depletion – Global Warming.

UNIT – III

Vapour Absorption Refrigeration System: Calculation of max COP – description and working of NH3 – water system and Li Br – water (Two shell & Four shell) System. Principle of operation of Three Fluid absorption system, salient features theory.

Steam Jet Refrigeration System: Working principles and Basic Components, Principles and operation of (i) Thermoelectric refrigerator (ii) Vortex tube or Hilsch tube theory.

UNIT – IV

Introduction to Air Conditioning: Psychrometric Properties & Processes – Characterization of Sensible and latent heat loads – Need for Ventilation, consideration of infiltration – Load concepts of RSHF, GSHF – Problems, Concept of ESHF and ADP.

Requirements of human comfort and concept of effective temperature – Comfort chart – Comfort Air conditioning – Requirements of Industrial air conditioning, Air conditioning Load calculations.

UNIT – V

Air Conditioning Systems: Classification of equipment, cooling, heating humidification and dehumidification, filters, grills and registers, fans and blowers, Heat pump – Heat sources – different heat pump circuits.

TEXT BOOKS:

1. CP Arora, "Refrigeration and Air Conditioning", TMH, 2nd Edition, ISBN *Number*: 978-0074630105.
2. SC Arora & Domkundwa, "A Course in Refrigeration and Air conditioning", Dhanpatrai, *ISBN*: 9780000229663.

REFERENCE BOOKS:

1. P.I. Bellaney, "Refrigeration and Air Conditioning", Jain Book Depot. 2nd Ed., ISBN Number: 817409136X.

R.S.Khurmi & J.K.Gupta, "Refrigeration and Air conditioning", S.Chand, Eurasia Publishing House (P) Ltd., 1st Edition, ISBN No. 9788121927819.

BALAJI INSTITUTE OF TECHNOLOGY&SCIENCE
(UGC-AUTONOMOUS)
21ME638PE: UNCONVENTIONAL MACHINING PROCESS (PE-II)

B.Tech. III Year II Sem.	**L**	**T/P/D**	**C**
	3	**0/0/0**	**3**

Pre-requisite: Production Technology, Machine Tools.

COURSE OBJECTIVES:
Students will be able to
1. Differentiation between convention and unconventional machining process and need of unconventional machining in the current scenario.
2. State the modern machining process and process selection.
3. Discuss the Metal Removal Rate and surface finish of different materials using different process parameters.
4. Classify the various thermal & non thermal machining processes.
5. Justify the conventional machining process.

COURSE OUTCOMES:
At the end of the course, the students will develop ability to
1. Identify the selection of processes.
2. Design the components of Abrasive Jet machining process.
3. Analyze surface properties after machining without destructing the material.
4. Develop the economic aspects of the different unconventional machining process.
5. Explain the basic principle of conventional machining process.

UNIT – I
Introduction: Need for non-traditional machining methods-Classification of modern machining processes – considerations in process selection of materials and applications.
Ultrasonic machining – Elements of the process, mechanics of metal removal, process parameters, economic considerations, applications and limitations, recent development.

UNIT – II
Abrasive Jet Machining: Water jet machining and abrasive water jet machine. Basic principles, equipments, process variables, mechanics of metal removal, MRR, applications and limitations.
Electro–Chemical Processes: Fundamentals of electro chemical machining, electrochemical grinding, electro chemical honing and deburring process, metal removal rate in ECM, Tool design, Surface finish and accuracy, economic aspects of ECM – Simple problems for estimation of metal removal rate. Fundamentals of chemical, machining, advantages and applications.

UNIT – III
Thermal Metal Removal Processes: General Principle and applications of Electric Discharge Machining, Electric Discharge Grinding and electric discharge wire cutting processes – Power circuits for EDM, Mechanics of metal removal in EDM, Process parameters, selection of tool electrode and dielectric fluids, methods surface finish and machining accuracy, characteristics of spark eroded surface and machine tool selection. Wire EDM, principle, applications.

UNIT – IV
Generation and Control of Electron Beam for Machining: Theory of electron beam machining, comparison of thermal and non-thermal processes –General Principle and application of laser beam machining – thermal features, cutting speed and accuracy of cut.

UNIT – V

Application of Plasma For Machining: Metal removal mechanism, process parameters, accuracy and surface finish and other applications of plasma in manufacturing industries.

Magnetic abrasive finishing, Abrasive flow finishing, Electro stream drilling, shaped tube electrolytic machining.

TEXT BOOKS:

1. Pandey P.C. and Shah H.S., "Modern Machining Process", TMH, 2008, 1st Edition, *ISBN*: 9780070965539.
2. Serope Kalpakjian and Steven R. Schmid, "Manufacturing Engineering and Technology", Pearson Publications, 5th Ed. 2009, *ISBN*: 0132272717.

REFERENCE BOOKS:

1. V. K. Jain, "Advanced Manufacturing Process", Allied publishers, Edition: 2012, ISBN-13: 978-1439852903.
2. Bhattacharya A, "New Technology", The Institution of Engineers, India 1984.
3. C. Elanchezhian, B.Vijaya Ramnath and M.Vijayan, "Unconventional Machining Processes", Anuradha Publications, 2005, *ISBN* Number: 9788120319585.

BALAJI INSTITUTE OF TECHNOLOGY&SCIENCE
(UGC-AUTONOMOUS)
21ME639PE: INTERNAL COMBUSTION AND GAS TURBINES (PE-II)

B.Tech. III Year II Sem.	**L**	**T/P/D**	**C**
	3	**0/0/0**	**3**

Pre-requisites - Basic Thermodynamics

Course Objectives:

1 Acquire knowledge about the IC engine cycles, classification and working Principles.
2 Describe the testing and performance parameters along with heat balance Sheet.
3 Explain different alternate fuels, gas turbines and about jet propulsion

Course Out Comes:

1 Explain basic concepts of actual cycles with analysis and to describe the fundamentalconcepts of IC engines along with its working principles.
2 Describe the combustion phenomenon in SI and CI engines.
3 Evaluate the performance of IC engines and the importance of alternate fuels.
4 Classify the essential components of gas turbine along with its performanceImproving methods.
5 Illustrate the working principle of different types of Jet propulsive engines andRockets.

UNIT - I

Introduction: Basic Engine components and Nomenclature, Classification of Engines, The working principle of Engines, Comparison of 2-Stroke and 4-Stroke Engines; CI, and SIEngines, Ideal and Actual Working Cycles and their analysis, Valve timing Diagram.

Fuels: Fossil fuels, Chemical structure of Petroleum, Properties of SI and CI Engine Fuels, Fuel Ratings; Octane Number, Cetane Number.

UNIT - II

Carburetors & Fuel Injection: Air Fuel Mixture Requirements, Construction and Workingof Simple Carburetor, Calculation of Air-Fuel Ratio, Parts of Carburetor. Requirement ofInjection Systems, Classification of Injection Systems, Fuel Feed pump, Injection Pumps,Working principles of Governors, Nozzles and Fuel Injector, Injection in SI and CI Engines. **Combustion and Ignition Systems in SI and CI Engines:** Normal and AbnormalCombustion in SI and CI Engines, Stages of Combustion, Detonation and Knocking.

UNIT - III

Performance parameters for IC Engines: Engine Power, Engine Efficiencies, Performance Characteristics, Variables Effecting Performance Characteristics, Methods of Improving Engine Performance, Heat Balance.

Modern Automotive Engines*:* Changes in Fuel injection Methods in S.I and C.I engines, Common Rail Direct Injection System, Gasoline Direct Injection, Variable Valve Technology, A brief review of Design changes to achieve high efficiency.

UNIT - IV

Gas Turbine: Introduction to Gas Turbines, Development, Classification and Application of Gas Turbines, Ideal and Actual Cycles; Effect of Inter cooling, Reheating, Regeneration, Combined cycle, and Cogeneration.

UNIT - V

Gas Turbine Cycles for Aircraft Propulsion: Criteria of performance, Intake, and propelling nozzle efficiencies, Simple Turbojet Cycle, The turboprop engine, Thrust augmentation, Gas turbine combustion systems, Combustion chamber designs, Gas Turbine Emissions.

TEXT BOOKS:

1. I.C. Engines/ Gas Turbines / V. Ganesan- Mc Graw Hill
2. Internal Combustion Engines /Colin R. Ferguson /Wiley

REFERENCE BOOKS:

1. Fundamentals of Internal Combustion Engines / H.N Gupta / PHI
2. Gas Turbine Theory/ HIH Saravanamuttoo, Cohen, Rogers/ Pearson

BALAJI INSTITUTE OF TECHNOLOGY&SCIENCE

(UGC-AUTONOMOUS)

21ME628PC: HEAT TRANSFER LAB

B.Tech. III Year II Sem.

L	T/P/D	C
0	0/3/0	3

Pre-requisites: Thermodynamics

Course Objectives: To enable the student to apply conduction, convection and radiation heat transfer concepts to practical applications

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

1. Perform steady state conduction experiments to estimate thermal conductivity of different materials Perform transient heat conduction experiment
2. Estimate heat transfer coefficients in forced convection, free convection,
3. condensation and correlate with theoretical values Obtain variation of temperature along the length of the pin fin under forced and free convection Perform radiation experiments
4. Determine surface emissivity of a test plate and Stefan Boltzmann's constant and compare with theoretical value

Experiments:

1. Composite Slab Apparatus – Overall heat transfer co-efficient.
2. Heat transfer through lagged pipe.
3. Heat Transfer through a Concentric Sphere
4. Thermal Conductivity of given metal rod.
5. Heat transfer in pin-fin
6. Experiment on Transient Heat Conduction
7. Heat transfer in forced convection apparatus.
8. Heat transfer in natural convection
9. Parallel and counter flow heat exchanger.
10. Emissivity apparatus.
11. Stefan Boltzman Apparatus.
12. Critical Heat flux apparatus.
13. Study of heat pipe and its demonstration.
14. Film and Drop wise condensation apparatus

BALAJI INSTITUTE OF TECHNOLOGY&SCIENCE

(UGC-AUTONOMOUS)

21ME630PC: COMPUTER AIDED ENGINEERING LAB

B.Tech. III Year II Sem.

L	T/P/D	C
0	0/3/0	1.5

Course Objectives:

1. Know the part drawings for various components.
2. Draw the part modeling using Auto CAD software package.
3. Draw various components using CATIA.
4. Develop different modeling components using pro-E.
5. Develop the NC program for CNC milling and turning operations by using CADEM package.

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

1. Analyze 2D and 3D part drawings using AutoCAD, Pro-E software packages.
2. Develop and understand the NC part program generation by using CADEM packages.
3. Calculation of deflection and stresses in 2D and 3D tresses and beams.
4. Estimation of natural frequencies and mode shapes of 2D beam.
5. Study the Machining of simple components on NC lathes from CAM package.

Experiments:

1. Drafting: Development of part drawings for various components in the form of orthographic and isometric. Representation of Dimensioning and tolerances scanning and plotting.

2. Part Modeling: Generation of various 3D Models through protrusion, revolve, shell sweep. Creation of various features. Study of parent child relation. Feature based and Boolean based modeling surface and Assembly Modeling. Study of various standard Translators. Design simple components.

3. a) Determination of deflection and stresses in 2D and 3D trusses and beams.
   b) Determination of deflections of component and principal and von-mises stresses inplane stress, plane strain and axisymmetric components.
   c) Determination of stresses in 3D and shell structures (at least one example in each case)
   d) Estimation of natural frequencies and mode shapes, Harmonic response of 2D beam.
   e) Steady state heat transfer Analysis of plane and Axisymmetric components.

BALAJI INSTITUTE OF TECHNOLOGY&SCIENCE

(UGC-AUTONOMOUS)

21ME631PC: COMPUTER AIDED MANUFACTURING LAB

B.Tech. III Year II Sem.

L	T/P/D	C
0	0/3/0	1.5

Pre-requisites: Thermodynamics

Course Objectives: To enable the student to apply conduction, convection and radiation heat transfer concepts to practical applications

Course Outcomes:

1. Draw the part drawings which are utilized in real time applications.
2. Memorize the dimension, tolerances, isometric projects.
3. Analyze 2D and 3D part drawings using AutoCAD, Pro-E software packages.
4. Develop and understand the NC part program generation by using CADEM packages.
5. Explain the different types of stress analysis, load calculations by using ANSYS software.

List of Expériments :

1. a) Development of process sheets for various components based on tooling machines.
2. b) Study of various post processors used in NC Machines
3. c) Development of NC codes by using CAM packages.
4. d) Machining of simple components on NC lathe by transferring NC code / From a CAM package.

TEXT BOOKS:

1. Zimmers & P.Groover, "CAD/CAM", APE/PHI 1st Ed., *ISBN Number*: 978-8177584165.
2. Ibrahim Zeid, "CAD/CAM Theory and Practice", TMH 2nd Ed., *ISBN Number*: 978-0070151345.

REFERENCE BOOKS:

1. Groover, "Automation, Production systems & Computer integrated Manufacturing", Pearson Education, 3rd Edition, *ISBN*: 0132393212.
2. Lalit Narayan, etal, "Computer Aided Design and Manufacturing", PHI, ISBN: 978-81-203-3342-0.
3. Farid Amirouche, "Principles of Computer Aided Design and Manufacturing", Pearson Education, 2nd Edition, ISBN Number: 978-0130646316.

BALAJI INSTITUTE OF TECHNOLOGY&SCIENCE

(UGC-AUTONOMOUS)

21ME624PC: **MECHANICAL DRAWING LAB USING CAD**

B.Tech. III Year II Sem.

Pre-requisites: Engineering graphics

L	T/P/D	C
0	0/3/0	1.5

Course Outcomes:

1 Preparation of engineering and working drawings with dimensions
2 Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs.
3 Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and tapered features.
4 Title boxes, their size, location and details - common abbreviations and their liberal usage
5 Developing assembly drawings using part drawings of machine components.

Drawing of Machine Elements and simple parts by using CAD software

Selection of Views, additional views for the following machine elements and parts with every drawing proportion.

1. Geometric Modeling: Basic cad commands ,Transformation of geometry, 3D transformations, mathematics of projections. Geometric models, geometric construction models,
2. Solid modeling: Boundary representation, Solid Representation, Constructive solid geometry, Revolve, Loft, Sweep, Rib, and Shell Process and its applications
3. Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws.
4. Keys, Cottered joints and knuckle joint.
5. Rivetted joints for plates
6. Shaft coupling, spigot and socket pipe joint.
7. Journal, pivot and collar and foot step bearings.

Assembly Drawings:

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

1. Steam engine parts – stuffing boxes, cross heads, Eccentrics.
2. Machine tool parts: Tail stock, Tool Post, Machine Vices.
3. Other machine parts - Screws jacks, Petrol engine connecting rod, Plummer block, Fuel Injector
4. Valves - Steam stop valve, spring loaded safety valve, feed check valve and air cock.

NOTE: First angle projection only.

TEXT BOOKS:

1. Machine Drawing / N.D. Bhatt / Charotar
2. Machine Drawing with Auto CAD / Goutham Pohit, Goutam Ghosh / Pearson

REFERENCE BOOKS:

1. Machine Drawing by / Bhattacharyya / Oxford
2. Machine Drawing / Ajeet Singh / Mc Graw Hill

BALAJI INSTITUTE OF TECHNOLOGY&SCIENCE

(UGC-AUTONOMOUS)

***21MC605: ENVIRONMENTAL SCIENCE**

B.Tech. III Year II Sem.

L	T/P/D	C
3	0/0/0	0

Course Objectives:

- Understanding the importance of ecological balance for sustainable development.
- Understanding the impacts of developmental activities and mitigation measures.
- Understanding the environmental policies and regulations

Course Outcomes:

- Based on this course, the Engineering graduate will understand /evaluate / develop technologies on the basis of ecological principles and environmental regulations which in turn helps in sustainable development

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 using mineral resources, **Land resources:** Forest resources, **Energy resources:** growing energy needs, renewable and non-renewable energy sources, use of alternate energy source, case studies.

UNIT - III

Biodiversity And Biotic Resources: Introduction, Definition, genetic, species and ecosystem diversity. Value 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. **Water pollution:** Sources and types of pollution, drinking water quality standards. **Soil Pollution:** Sources and types, Impacts of modern agriculture, degradation of soil. **Noise Pollution:** Sources and Health hazards, standards, **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: C**limate 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, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Overview on Impacts of air, water, biological and Socio- economical aspects. Strategies for risk assessment, Concepts of Environmental Management Plan

(EMP). **Towards Sustainable Future:** Concept of Sustainable Development Goals, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Human health, Environmental Ethics, Concept of Green Building, Ecological Foot Print, 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, BS Publications.
6. Introduction to Environmental Science by Y. Anjaneyulu, BS. Publications.

BALAJI INSTITUTE OF TECHNOLOGY&SCIENCE

(UGC-AUTONOMOUS)

21MC605: ARTIFICIAL INTELLIGENCE

B.Tech. III Year II Sem.

L	T/P/D	C
3	0/0/0	0

Course Objectives: To train the students to understand different types of AI agents, various AI search algorithms, fundamentals of knowledge representation, building of simple knowledge-based systems and to apply knowledge representation, reasoning. Study of Markov Models enable the student ready to step into applied AI.

UNIT - I

Introduction: AI problems, Agents and Environments, Structure of Agents, Problem Solving Agents

Basic Search Strategies: Problem Spaces, Uninformed Search (Breadth-First, Depth-First Search, Depth-first with Iterative Deepening), Heuristic Search (Hill Climbing, Generic Best-First, A*), Constraint Satisfaction (Backtracking, Local Search)

UNIT - II

Advanced Search: Constructing Search Trees, Stochastic Search, A* Search Implementation, Minimax Search, Alpha-Beta Pruning

Basic Knowledge Representation and Reasoning: Propositional Logic, First-Order Logic, Forward Chaining and Backward Chaining, Introduction to Probabilistic Reasoning, Bayes Theorem

UNIT - III

Advanced Knowledge Representation and Reasoning: Knowledge Representation Issues, Nonmonotonic Reasoning, Other Knowledge Representation Schemes

Reasoning Under Uncertainty: Basic probability, Acting Under Uncertainty, Bayes' Rule, Representing Knowledge in an Uncertain Domain, Bayesian Networks

UNIT - IV

Learning: What Is Learning? Rote Learning, Learning by Taking Advice, Learning in Problem Solving, Learning from Examples, Winston's Learning Program, Decision Trees.

UNIT - V

Expert Systems: Representing and Using Domain Knowledge, Shell, Explanation, Knowledge Acquisition.

TEXT BOOK:

1. Russell, S. and Norvig, P, Artificial Intelligence: A Modern Approach, Third Edition, Prentice-Hall, 2010.

REFERENCE BOOKS:

1. Artificial Intelligence, Elaine Rich, Kevin Knight, Shivasankar B. Nair, The McGraw Hill publications, Third Edition, 2009.
2. George F. Luger, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Pearson Education, 6th ed., 2009.

BALAJI INSTITUTE OF TECHNOLOGY&SCIENCE
(UGC-AUTONOMOUS)
21SM701MS: BUSINESS ECONOMICS AND FINANCIAL ANALYSIS

B.Tech. IV Year I Sem.	**L**	**T/P/D**	**C**
	3	**0/0/0**	**3**

Course Objective:

Students will be able to

To learn the basic Business types, impact of the Economy on Business and Firms specifically. To analyze the Business from the Financial Perspective.

Course Outcomes: At the end of the course students develop ability to

The students will understand the various Forms of Business and the impact of economic variables on the Business. The Demand, Supply, Production, Cost, Market Structure, Pricingaspects are learnt. The Students can study the firm's financial position by analysing the Financial Statements of a Company.

UNIT – I: Introduction to Business and Economics

Business: Structure of Business Firm, Theory of Firm, Types of Business Entities, Limited Liability Companies, Sources of Capital for a Company, Non-Conventional Sources of Finance.

Economics: Significance of Economics, Micro and Macro Economic Concepts, Concepts and Importance of National Income, Inflation, Money Supply in Inflation, Business Cycle, Features and Phases of Business Cycle. Nature and Scope of Business Economics, Role of Business Economist, Multidisciplinary nature of Business Economics.

UNIT – II: Demand and Supply Analysis

Elasticity of Demand: Elasticity, Types of Elasticity, Law of Demand, Measurement and Significance of Elasticity of Demand, Factors affecting Elasticity of Demand, Elasticity of Demand in decision making, Demand Forecasting: Characteristics of Good Demand Forecasting, Steps in Demand Forecasting, Methods of Demand Forecasting.

Supply Analysis: Determinants of Supply, Supply Function & Law of Supply.

UNIT – III: Production, Cost, Market Structures & Pricing

Production Analysis: Factors of Production, Production Function, Production Function with one variable input, two variable inputs, Returns to Scale, Different Types of Production Functions.

Cost analysis: Types of Costs, Short run and Long run Cost Functions.

Market Structures: Nature of Competition, Features of Perfect competition, Monopoly, Oligopoly, Monopolistic Competition.

Pricing: Types of Pricing, Product Life Cycle based Pricing, Break Even Analysis, Cost Volume Profit Analysis.

UNIT – IV: Financial Accounting: Accounting concepts and Conventions, Accounting Equation, Double-Entry system of Accounting, Rules for maintaining Books of Accounts, Journal, Posting to Ledger, Preparation of Trial Balance, Elements of Financial Statements, Preparation of Final Accounts.

UNIT – V: Financial Analysis through Ratios: Concept of Ratio Analysis, Liquidity Ratios, TurnoverRatios, Profitability Ratios, Proprietary Ratios, Solvency, Leverage Ratios (simple problems). Introduction to Fund Flow and Cash Flow Analysis (simple problems).

TEXT BOOKS:

1. D. D. Chaturvedi, S. L. Gupta, Business Economics - Theory and Applications, International Book House Pvt. Ltd. 2013.
2. Dhanesh K Khatri, Financial Accounting, Tata McGraw Hill, 2011.
3. Geethika Ghosh, Piyali Gosh, Purba Roy Choudhury, Managerial Economics, 2e, Tata McGrawHill Education Pvt. Ltd. 2012.

BALAJI INSTITUTE OF TECHNOLOGY&SCIENCE
(UGC-AUTONOMOUS)
21ME732PC: FINITE ELEMENT METHODS

B.Tech. IV Year I Sem.	**L**	**T/P/D**	**C**
	3	**0/0/0**	**3**

Pre-requisite: Mechanics of Solids, Design of Machine Members.

Course Objective:

Students will be able to

1. Describe various engineering objects by deserting them in to small elements.
2. Analyze complicated objects and to find stresses, strains, deflection slopes under various loads.
3. Recognize potential energy, approach and boundary conditions.
4. Estimate stiffness matrix of components to know various parameters objects.
5. Analyze two dimensional elements by using constant strain triangles methods.

Course Outcomes:

At the end of the course students develop ability to

1. Distinguish real time engineering objects and to present a well-designed structures.
2. Analyze bars, beams, shafts and axi- symmetric solids.
3. Design uniform, stepped and tapered bars subjected to mechanical and thermal loads with FEM.
4. Generalize Element stiffness matrix for entire domain
5. Analyze any complicated structure by utilizing the computer software like ANSYS instead of analytical methods
6. Extend Finite element modeling to Axi-symmetric solids subjected to Axi-symmetric loading.
7. Analyze one dimensional heat transfer problems like thin plates.
8. Evaluate Eigen values of stepped bar and beams.

UNIT – I

Introduction to Fem: Basic concepts, historical back ground, application of FEM, general description, comparison of FEM with other methods. Basic equations of elasticity, Stress – Strain and strain –displacement relations. Rayleigh – Ritz method, weighted residual methods.

One Dimensional Problems: Stiffness equations for a axial bar element in local coordinates using Potential energy approach and Virtual energy principle – Finite element analysis of uniform, stepped and tapered bars subjected to mechanical and thermal loads – Assembly of Global stiffness matrix and load vector – Quadratic shape functions – properties of stiffness matrix.

UNIT – II

Stiffness equations for a truss bar element oriented in 2D plane – Finite Element Analysis of Trusses – Plane Truss and Space Truss elements – methods of assembly.

Analysis of Beams: Hermite shape functions – Element stiffness matrix – Load vector – Problems.

UNIT – III

2-D Problems: CST – Stiffness matrix and load vector – Isoperimetric element representation – Shape functions – convergence requirements – Problems.

Two dimensional four nodded isoparametric elements – Numerical integration – Finite element modeling of Axisymmetric solids subjected to Axisymmetric loading with triangular elements – 3-D problems – Tetrahedran element.

UNIT – IV

Scalar Field Problems: 1-D Heat conduction – 1-D fin elements – 2D heat conduction – analysis of thin plates – Composite slabs – problems.

UNIT – V

Dynamic Analysis: Dynamic equations – Lumped and consistent mass matrices – Eigen values and Eigen vectors – mode shapes – modal analysis for bars and beams.

TEXT BOOKS:

1. Tirupathi K.Chandrapatla and Ashok D.Belagundu, "Introduction to finite elements in engineering", Mc.Graw Hill, 4th Ed., Oct. 2011, 4th Ed., *ISBN*-13: 978-0132162746.
2. S.S.Rao, "The finite element methods in Engineering", Elsevier, 5th edition, 2012, ISBN-13: 978-1856176613.

REFERENCE BOOKS:

1. J.N.Reddy, "An Introduction to Finite Element Methods", Mc.Grawhill, 2005, 3rd Ed. *ISBN*-13: 978-0072466850.
2. O.C. Zienkowitz, "The Finite Element Method in engineering science", McGrawhill, 2nd Ed., *ISBN*-13: 978-0070941380.
3. S.Md.Jalaludeen, "Introduction of Finite Element Analysis", Anuradha publications, *ISBN*-13: 9788184720983.

BALAJI INSTITUTE OF TECHNOLOGY&SCIENCE
(UGC-AUTONOMOUS)
21ME740PE: ARTIFICIAL INTELLIGENCE AND ROBOTICS (PE-III)

B.Tech. IV Year I Sem.	**L**	**T/P/D**	**C**
	3	**0/0/0**	**3**

Course Objective:

Students will be able to

1. Learn the concepts of robotics – classification by coordinate system and control system.
2. Identify the degrees of freedom, end effectors, electric hydraulic and pneumatic devices.
3. Analyze the kinematics of robot with homogeneous transformations.
4. Understand the Jacobians, Newton – Euler formations.
5. Know about the actuators and feedback components, resolvers, encoders - velocity sensors.

Course Outcomes:

At the end of the course students develop ability to

1. Apply the knowledge of robotics in real time human life applications.
2. Implement the concept of CAD/CAM and automation to the robotics.
3. Demonstrate D-H Notation to analyze the end position of robotic arm
4. Synthesis the robot dynamics with Newton – Euler formulations
5. Illustrate the various actuators for the industrial robots

UNIT – I

Introduction: Automation and Robotics – An over view of Robotics – classification by coordinate system and control systems – Components of the Industrial Robotics: Degrees of freedom – End effectors: Mechanical gripper – Magnetic – Vacuum cup and other types of grippers – General consideration on gripper selection and design

UNIT – II

Motion Analysis: Basic rotation matrices – Composite rotation matrices – Euler Angles – Equivalent Angle and Axis – Homogeneous transformation – Problems.

Manipulator Kinematics: D-H Notations – Joint coordinates and world coordinates – Forward and inverse kinematics – problems.

Differential Kinematics: Differential kinematics of planar and spherical manipulators – Jacobians – Problems.

UNIT – III

Robot Dynamics: Lagrange – Euler formulations – Newton – Euler formulations – Problems on planar two link manipulators.

UNIT – IV

Trajectory Planning: Joint space scheme – cubic polynomial fit – Avoidance of obstacles – Types of motion – Slew motion – Joint interpolated motion – straight line motion – problems.

UNIT – V

Robot Actuators and Feed Back Components: Actuators: Pneumatic and Hydraulic actuators. Electric Actuators: DC servo motors – stepper motors. Feed back components: position sensors – potentiometers, resolvers and encoders – Velocity sensors – Tactile sensors.

Robot Application in Manufacturing: Material handling – Assembly and Inspection.

TEXT BOOKS:

1. Groover M P, "Industrial Robotics", Pearson Edu., 2012 1st Edition, *ISBN Number*: 0070265097, 9780070265097, 978-0070265097.
2. JJ Craig, "Introduction to Robotic Mechanics and Control", Pearson, 2008 3rd edition. ISBN-13: 978-0201543612

REFERENCE BOOKS:

1. Fu K S, "Robotics", McGraw Hill, 1st Ed., 2008, ISBN 13: **9780070226258.**
2. Richard D.Klafter, "Robotic Engineering", Prentice Hall, 1st Ed., 1989, ISBN-13: *9780137820535.*

BALAJI INSTITUTE OF TECHNOLOGY&SCIENCE
(UGC-AUTONOMOUS)
21ME741PE: PRODUCTION PLANNING AND CONTROL (PE-III)

B.Tech. IV Year I Sem.	**L**	**T/P/D**	**C**
	3	**0/0/0**	**3**

Course Objective:

Students will be able to

1. Ensure efficient utilization of production facilities and to coordinate the production activities of different departments.
2. Maintain adequate but not excessive stock of raw materials; work in process and of finished goods to meet production requirements.
3. Plan delivery schedules at the most economical level.
4. Establishing targets and checking it against performance.
5. Ensure production of right product in right quality at the right time

Course Outcomes:

At the end of the course students develop ability to

1. Design and plan an economical production system.
2. Learn about effective utilization of plant resources
3. Provide alternate production strategies
4. Guide shop floor people for manufacturing products of required quantity and required quality in right time.
5. Provide alternative production strategies in case of emergencies. Have better control over stocks of raw material, Work in process and finished goods.

UNIT – I

Introduction: Definitions – Objectives of Production Planning and Control – Functions of production planning and control – Elements of production control - Types of production - Organization of production planning and control, Internal organizations department.

Forecasting: Definition- importance of forecasting - factors affecting the forecast- types of forecasting and their uses-demand patterns - general principles of forecasting techniques- quantitative techniques- qualitative techniques- measures of forecasting errors.

UNIT – II

Inventory Management: Functions of inventories – relevant inventory costs – ABC analysis – VED analysis – Basic EOQ model- Inventory control systems –continuous review systems and periodic review systems, MRP, ERP, JIT Systems-basic treatment only.

Aggregate planning: Definition – aggregate planning strategies – aggregate planning methods – transportation model.

UNIT – III

Line Balancing: Terminology, Methods of Line Balancing, RPW method-Largest Candidate rule method.
Routing – Definition – Routing procedure – Factors affecting routing procedure, Route Sheet.

UNIT – IV

Scheduling: Definition – Scheduling Policies – types of scheduling methods – difference with loading – flow shop scheduling **–** job shop scheduling, line of balance(LOB)-objectives-steps involved.

UNIT – V

Dispatching: Definition – activities of dispatcher – dispatching procedures – various forms used in dispatching.
Follow up: definition – types of follow up – expediting – definition – expediting procedures-Applications of computers in planning and control.

TEXT BOOKS:

1. Samuel Eilon, “Elements of Production Planning and Control”, Universal Book Corporation.
2. R K Jain, “Production Planning and Control”, Khanna Publishers.

REFERENCE BOOKS:

1. Ravi Shankar, “Industrial Engineering and Management”, Galgotia Publishers, 2nd Edition.
2. Panner Selvam, “Production Operation Management”, PHI Publishers, 2nd Edition.
3. G Moore, “Production Control”, McGraw Hill.
4. Joseph S. Martinich, “Production and Operations Management”, John Willey and Sons, 1st Edition.

BALAJI INSTITUTE OF TECHNOLOGY&SCIENCE
(UGC-AUTONOMOUS)
21ME742PE: FLUID POWER SYSTEM (PE-III)

B.Tech. IV Year I Sem.	**L**	**T/P/D**	**C**
	3	**0/0/0**	**3**

Course Outcomes:

At the end of the course students develop ability to

1. Understand the Properties of fluids,
2. Governing laws. distribution of fluid power,
3. Design and analysis of typical hydraulic circuits.
4. Know accessories used in fluid power system,
5. Filtration systems and maintenance of system.

UNIT- I Introduction to oil hydraulics and pneumatics, their structure, advantages and limitations. ISO symbols, energy losses in hydraulic systems. Applications, Basic types and constructions of Hydraulic pumps and motors. Pump and motor analysis. Performan curves and parameters.

UNIT- II Hydraulic actuators, types and constructional details, lever systems, control elements – direction, pressure and flow control valves. Valve configurations, General valve analysis, valve lap, flow forces and lateral forces on spool valves. Series and parallel pressure compensation flow control valves. Flapper valve Analysis and Design.

UNIT- III Proportional control valves and servo valves. Nonlinearities in control systems (backlash, hysteresis, dead band and friction nonlinearities). Design and analysis of typical hydraulic circuits. Regenerative circuits, high low circuits, Synchronization circuits, and accumulator sizing.

UNIT- IV Intensifier circuits Meter-in, Meter-out and Bleed-off circuits; Fail Safe and Counter balancing circuits, accessories used in fluid power system, Filtration systems and maintenance of system. Components of pneumatic systems; Direction, flow and pressure control valves in pneumatic systems. Development of single and multiple actuator circuits. Valves for logic functions; Time delay valve; Exhaust and supply air throttling;

UNIT- V Examples of typical circuits using Displacement – Time and Travel-Step diagrams. Will-dependent control, Travel-dependent control and Time dependent control, combined control, Program Control, Electropneumatic control and air-hydraulic control, Ladder diagrams. Applications in Assembly, Feeding, Metal working, materials handling and plastics working.

TEXT BOOKS: 1. Fluid Power Control systems/ Pippenger, J.J., and R. M. Koff/ New York: McGraw Hill. 2. “Fluid Power Systems: modeling, simulation and microcomputer control”/ John Watton/ Prentice Hall International.

REFERENCE BOOKS: 1. Fundamentals of Fluid Power Control. / John Watton/ 1 st Ed. Cambridge University Press, 2009 2. “Fluid Power with applications”/ Anthony Esposito / Pearson Education.

BALAJI INSTITUTE OF TECHNOLOGY&SCIENCE
(UGC-AUTONOMOUS)
21ME743PE: PLANT LAYOUT AND MATERIAL HANDLING (PE-IV)

B.Tech. IV Year I Sem.	**L**	**T/P/D**	**C**
	3	**0/0/0**	**3**

Course Objective:

Students will be able to

1. Define the various types of plant layouts.
2. Design the plant layouts for different type of industries.
3. Stat the importantance of material handling in the overall production cost.
4. Predict the bottlenecks in material handling systems.
5. Enumerate various safety measures to be taken in material handling systems.

Course Outcomes:

At the end of the course students develop ability to

1. Identify the various types of plant layouts.
2. Design material handling in production.
3. Categorize the various types of Assembly systems.
4. Estimate the bottlenecks in material handling systems.
5. Observe the various safety measures to be taken in material handling system.

UNIT – I

Introduction: Selection of territory, Choice of site, Pitfalls in selection of site location, Economic versus social significance, Optimum production – distribution cost, Plant location analysis for different types of industries.

UNIT – II

Plant Layout

Objectives of plant layout, Types of plant layout, Factors influencing layout plants, Basic principles of plant layout prerequisite to plant layout process, Workstation layout, Use of travel chart in plant layout, Symptoms of poor layout, Technique and procedure to determine plant layout.

UNIT – III

Heuristics for Plant Layout: ALDEP, CORELAP, CRAFT.

Group Layout: Fixed position layout – Quadratic assignment model, Branch and bound method.

UNIT – IV

Material Handling Systems: Material Handling principles, Classification of Material Handling equipment, Relationship of material handling to plant layout.

Basic Material Handling Systems: Selection, Material Handling method path, Equipment, function oriented systems.

UNIT – V

Methods to Minimize Cost of Material Handling: Maintenance of Material Handling equipments, Safety in handling.

Ergonomics of Material Handling Equipment: Design, Miscellaneous equipments.

TEXT BOOKS:

1. PB Mahapatra, "Operations Management", PHI, 2nd Ed. 2010, *ISBN* 13: 9788120339262.
2. Dr. KC Arora & Shinde, "Aspects of Material handling", Lakshmi Publications, 2007,s *ISBN*-13: 9789381159262.

REFERENCE BOOKS:

1. RI, Francis, LF Mc Linnis Jr. White, "Facility Layout & Location an analytical approach", PHI, 2nd Ed. 2000, ISBN-13: 978-0132992312.
2. R Panneerselvam, "Production and Operations Management", PHI 2nd Edition, *ISBN,* 8120327675, 9788120327672.
3. Ray, Siddhartha, "Introduction to Material handling", New Age 2010 / ISBN No.: 9788122420999 / 8122420990.

BALAJI INSTITUTE OF TECHNOLOGY&SCIENCE
(UGC-AUTONOMOUS)
21ME744PE: DESIGN OF TRANSMISSION SYSTEMS (PE-IV)

B.Tech. IV Year I Sem.	**L**	**T/P/D**	**C**
	3	**0/0/0**	**3**

Course Objective:

Students will be able to

1. Gain knowledge on the principles and procedure for the design of Mechanical power Transmission components.
2. Understand the standard procedure available for Design of Transmission of Mechanical elements
3. Learn to use standard data and catalogues (Use of P S G Design Data Book permitted)

Course Outcomes: At the end of the course students develop ability to

1. Design to belts, chains and rope drives
2. Design to spur, helical gears.
3. Design to worm and bevel gears.
4. Design to gear boxes
5. Design to cams, brakes and clutches

UNIT- I

DESIGN OF FLEXIBLE ELEMENTS

Design of Flat belts and pulleys – Selection of V belts and pulleys – Selection of hoisting wire ropes and pulleys – Design of Transmission chains and Sprockets.

UNIT – II: SPUR GEARS AND PARALLEL AXIS HELICAL GEARS

Speed ratios and number of teeth-Force analysis -Tooth stresses – Dynamic effects – Fatigue strength – Factor of safety – Gear materials – Design of straight tooth spur & helical gears based on strength and wear considerations – Pressure angle in the normal and transverse plane- Equivalent number of teeth-forces for helical gears.

UNIT – III: BEVEL, WORM AND CROSS HELICAL GEARS

Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of pair of straight bevel gears. Worm Gear: Merits and demeritsterminology. Thermal capacity, materials-forces and stresses, efficiency, estimating the size of the worm gear pair. Cross helical: Terminology-helix angles-Estimating the size of the pair of cross helical gears.

UNIT – IV: GEAR BOXES :

Geometric progression – Standard step ratio – Ray diagram, kinematics layout -Design of sliding mesh gear box – Design of multi speed gear box for machine tool applications – Constant mesh gear box – Speed reducer unit. – Variable speed gear box, Fluid Couplings, Torque Converters for automotive applications.

UNIT – V: CAMS, CLUTCHES AND BRAKES

Cam Design: Types-pressure angle and under cutting base circle determination-forces and surface stresses. Design of plate clutches –axial clutches-cone clutches-internal expanding rim clutches- Electromagnetic clutches. Band and Block brakes – external shoe brakes – Internal expanding shoe brake.

TEXT BOOKS:

1 Bhandari V, "Design of Machine Elements", 4th Edition, Tata McGraw-Hill Book Co, 2016.

2 Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical Engineering Design", 8th Edition, Tata McGraw-Hill, 2008.

BALAJI INSTITUTE OF TECHNOLOGY&SCIENCE
(UGC-AUTONOMOUS)
21ME745PE: ADDITIVE MANUFACTURING AND PROTOTYPING(PE-IV)

B.Tech. IV Year I Sem.	**L**	**T/P/D**	**C**
	3	**0/0/0**	**3**

Pre-requisite: Production Technology, Machine Tools & Metrology.

Course Objective:

Students will be able to

1. Identify the need of AM systems and impact of Additive manufacturing.
2. Summarize the classification of different AM process.
3. Apply the knowledge of Reverse engineering and CAD modeling for different applications.
4. Classify different AM processes based on the manufacturing technique.
5. Design a model using 3D printing technique.

Course Outcomes:

At the end of the course students develop ability to

1. Recall the importance and development of AM systems.
2. Explain the concepts used in different modeling techniques.
3. Develop the concepts used in liquid based and solid based AM systems.
4. Evaluate the AM systems based on their process variables.
5. Formulate the techniques and principles of different AM process.

UNIT I

INTRODUCTION: Need - Development of AM systems – AM process chain - Impact of AM on Product Development - Virtual Prototyping- Rapid Tooling – RP to AM -Classification of AM processes-Benefits-Applications.

UNIT II

REVERSE ENGINEERING AND CAD MODELING: Basic concept- Digitization techniques – Model reconstruction – Data Processing for Rapid

Prototyping: CAD model preparation, Data requirements – Geometric modeling techniques: Wire frame, surface and solid modeling – data formats - Data interfacing, Part orientation and support generation, Support structure design, Model Slicing, Tool path generation-Software for AM- Case studies.

UNIT III

LIQUID BASED AND SOLID BASED ADDITIVE MANUFACTURING SYSTEMS

Stereolithography Apparatus (SLA): Principle, pre-build process, part-building and post-build

processes, photo polymerization of SL resins, part quality and process planning, recoating issues, materials, advantages, limitations and applications.

Solid Ground Curing (SGC): working principle, process, strengths, weaknesses and applications.

Fused deposition Modeling (FDM): Principle, details of processes, process variables, types, products, materials and applications. Laminated Object Manufacturing (LOM): Working Principles, details of processes, products, materials, advantages, limitations and applications -

Case studies.

UNIT IV

POWDER BASED ADDITIVE MANUFACTURING SYSTEMS: Selective Laser Sintering (SLS): Principle, process, Indirect and direct SLS- powder structures, materials, post processing, surface deviation and accuracy, Applications. Laser Engineered Net Shaping (LENS): Processes, materials, products, advantages, limitations and applications– Case Studies.

UNIT V

OTHER ADDITIVE MANUFACTURING SYSTEMS: Three dimensional Printing (3DP): Principle, basic process, Physics of 3DP, types of printing, process capabilities, material system. Solid based, Liquid based and powder based 3DP systems, strength and weakness, Applications and case studies. Shape Deposition Manufacturing (SDM), Ballastic Particle Manufacturing (BPM), Selective Laser Melting, Electron Beam Melting.

TEXT BOOKS:

1. Gibson, I., Rosen, D.W. and Stucker, B., "Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010.
2. Chua, C.K., Leong K.F. and Lim C.S., "Rapid prototyping: Principles and applications", second edition, World Scientific Publishers, 2010.
3. Gebhardt, A., "Rapid prototyping", Hanser Gardener Publications, 2003.

REFERENCES BOOKS:

1. Liou, L.W. and Liou, F.W., "Rapid Prototyping and Engineering applications : A tool box for prototype development", CRC Press, 2011.
2. Kamrani, A.K. and Nasr, E.A., "Rapid Prototyping: Theory and practice", Springer, 2006.
3. Hilton, P.D. and Jacobs, P.F., Rapid Tooling: Technologies and Industrial Applications, CRC press, 2005

BALAJI INSTITUTE OF TECHNOLOGY&SCIENCE
(UGC-AUTONOMOUS)
21ME733PC: 3D PRINTING LAB

B.Tech. IV Year I Sem.	**L**	**T/P/D**	**C**
	3	**0/0/0**	**3**

BALAJI INSTITUTE OF TECHNOLOGY&SCIENCE
(UGC-AUTONOMOUS)
21ME846PE: POWER PLANT ENGINEERING (PE – V)

B.Tech. IV Year II Sem.	**L**	**T/P/D**	**C**
	3	**0/0/0**	**3**

Pre-requisite: Engineering Chemistry and Physics

Course Objective:

Students will be able to

1. List out the sources of energy and explain the working principle of steam power plant, coal and ash handling systems.
2. Apply the knowledge in working of diesel and gas turbine power plants.
3. Classify the components of hydroelectric power plant, dams and typical layouts.
4. Evaluate the performance of various types of nuclear reactors.
5. Formulate the principles of power plant economics based on environmental standards.

Course Outcomes:

At the end of the course students develop ability to

1. Memorize different layouts of power generation units.
2. Illustrate different types of handling systems used in thermal power.
3. Develop the concepts used in working of DEPP, GTPP
4. Analyze different types of hydel power plants based on their performance.
5. Recommend types of layouts based on plant operation.
6. Classify different types of reactors based on the nuclear fuels used.
7. Elaborate on different types of loads of power distribution.
8. Build the opportunities in contributing towards solving of energy crisis.

UNIT – I

Introduction to the Sources of Energy: Resources and Development of Power in India.

Steam Power Plant: Plant Layout, Working of different Circuits, Fuel and handling equipments, types of coals, coal handling, choice of handling equipment, coal storage. Ash handling systems.

Steam Power Plant: Combustion process: Properties of coal – overfeed and underfeed fuel beds, traveling grate stokers, spreader stokers, retort stokers, pulverized fuel burning system and its components, combustion needs and draught system, cyclone furnace, design and construction. Dust collectors, cooling towers and heat rejection. Corrosion and fed water treatment.

UNIT – II

Internal Combustion Engine Plant: DIESEL POWER PLANT: Introduction – IC Engines, types, construction – Plant layout with auxiliaries.

Gas Turbine Plant: Introduction – classification – construction – Layout with auxiliaries – Principles of working of closed and open cycle gas turbines. Combined Cycle Power Plants and comparison.

UNIT – III

Hydro Electric Power Plant: Water power – Hydrological cycle/flow measurement – drainage area characteristics – Hydrographs – storage and Pondgage – classification of dams and spill ways.

Hydro Projects and Plant: Classification – Typical layouts – plant auxiliaries – plant operation pumped storage plants.

UNIT – IV

Nuclear Power Station: Nuclear fuel – breeding and fertile materials – Nuclear reactor – reactor operation.

Types of Reactors: Pressurized water reactor, Boiling water reactor, sodium-graphite reactor, fast Breeder Reactor, Homogeneous reactor, Gas cooled reactor, Radiation hazards and shielding – radioactive waste disposal.

Introduction to alternate energy sources.

UNIT – V

Power Plant Economics And Environmental Considerations: Capital cost, investment of fixed charges, operating costs, general arrangement of power distribution. Load curves, load duration curve. Definitions of connected load. Maximum demand, demand factor, average load, load factor, diversity factor – related exercises. Effluents from power plants and Impact on environment – Pollutants and pollution standards – Methods of Pollution control.

TEXT BOOKS

P.C.Sharma, "Power Plant Engineering", S.K.Kataria Publication, 2013, ISBN-13: 9788189757205.
Arora and S.Domkundwar, "A course in Power Plant Engineering", 2nd Edition TMH, *ISBN:* 9780070435995.

REFERENCE BOOKS

Rajput, "A text book of Power Plant Engineering", Laxmi Publications, ISBN No.: 978-81-318-0255-7.
Ramalingam, "Power Plant Engineering", SciTech Publishers, ISBN-13: 9788183710626.
P.K.Nag, "Power Plant Engineering": II Edition, TMH, *ISBN* Number: 978-0070648159.
Elanchezhian, "Power Plant Engineering", I.K. International Publications, *ISBN*-13: 978-8189866303.

BALAJI INSTITUTE OF TECHNOLOGY&SCIENCE
(UGC-AUTONOMOUS)
21ME847PE-PRODUCT LIFE CYCLE MANAGEMENT (PE-V)

B.Tech. IV Year II Sem.	**L**	**T/P/D**	**C**
	3	**0/0/0**	**3**

UNIT-I:

Introduction to Java Technology (FA1): Introduction to Enterprise Application Development, Developing Business tier of an EA using POJO

UNIT-II:

Enterprise Application Development (FA2): Developing Persistence Tier of an EA using JPA, Developing Presentation Tier of an EA using JSP, Developing Presentation Tier of an EA using JSF

UNIT-III:

PLM Domain & Package (FA3): Industry Processes, types of Industries current challenge The Product Life Cycle and BOM, BOM Management, Views etc.Product Data Management, Document Management, Change Management Overview, PLM Implementation Process, Data Migration Process, PLM Integration with CRM / SCM / MES.

UNIT-IV:

PLM Domain & Package (FA3): PLM case study and Compliance, PLM and Compliance Installation, System Admin and Architecture,Change Management and Configuration Management, Customization and Implementation.

UNIT-V:

PLM Domain & Package (FA3): Product Structure Editor and Type Manager, Integration Methods, Overview of other Adv modules.

Project execution covering the topics of FA1 + FA2 + FA3.

TEXT BOOKS:

1. Product Life Cycle Management – John Stark, Springer Series
2. Product Life Cycle Management – Michael Grieves

REFERENCE BOOKS:

1. Virtual Perfect – Michael Grieves
2. Introduction to Java Programming – Daniel Liang
3. J2EE Programming – Marty Hall

BALAJI INSTITUTE OF TECHNOLOGY&SCIENCE
(UGC-AUTONOMOUS)
21ME848PE: TRIBOLOGY (PE – V)

B.Tech. IV Year II Sem.	**L**	**T/P/D**	**C**
	3	**0/0/0**	**3**

Pre-requisites:, Design of machine members

Course Outcomes:

1. Expose the student to different types of bearings, bearing materials,
2. Understand friction characteristics and power losses in journal bearings.
3. Learn theory and concepts about different types of lubrication.
4. Understanding friction characteristics in journal bearings.
5. Knowledge about different theories of lubrication to reduce friction and wear.

UNIT – I

Study of various parameters: Viscosity, flow of fluids, viscosity and its variation, absolute and kinematic viscosity, temperature dependent variation, viscosity index, determination of viscosity, different viscometers used.

Hydrostatic lubrication: Hydrostatic step bearing, application to pivoted pad thrust bearing and other applications, hydrostatic lifts, hydrostatic squeeze films and its application to journal bearing.

UNIT – II

Hydrodynamic theory of lubrication: Various theories of lubrication, petroffs equation, Reynold's equation in two dimensions -Effects of side leakage - Reynolds equation in three dimensions, Friction in sliding bearing, hydro-dynamic theory applied to journal bearing, minimum oil film thickness, oil whipand whirl anti -friction bearing.

UNIT – III

Friction and power losses in journal bearings: Calibration of friction loss, friction in concentric bearings, bearing moduIus, Sommer-field number, heat balance, practical considerations of journal bearing design

UNIT – IV

Air lubricated bearing: Advantages and disadvantages, application to Hydrodynamic journal bearings, hydrodynamic thrust bearings. Hydrostatic thrust bearings. Hydrostatic bearing Analysis including compressibility effect. Study of current concepts of boundary friction and dry friction.

UNIT- V

Types of bearing oil pads: Hydrostatic bearing wick oiled bearings, oil rings, pressure feed bearing, partial bearings -externally pressurized bearings. Bearing materials: General requirements of bearing materials, types of bearing materials.

TEXT BOOK:

1. Engineering Tribology/ Gwidon W. Stachowiak & Andrew W. Batchelor/ Elesevier
2. Engineering Tribology/ Prasanta Sahoo / PHI

REFERENCE BOOKS:

1. Tribology – B.C. Majumdar
2. Fundamentals of Tribology, Basu, Sen Gupta and Ahuja/PHI
3. Tribology in Industry: Sushil Kumar Srivatsava, S. Chand &Co.

BALAJI INSTITUTE OF TECHNOLOGY&SCIENCE
(UGC-AUTONOMOUS)
21ME849PE: COMPUTATIONAL FLUID DYNAMICS (PE – VI)

B.Tech. IV Year II Sem.	**L**	**T/P/D**	**C**
	3	**0/0/0**	**3**

Pre-requisite: Heat Transfer and Fluid Mechanics

Course Objective: To apply the principles of Heat Transfer and Fluid Mechanics to formulate governing equations for physical problems and to solve those using different numerical techniques

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

1. Differentiate between different types of Partial Differential Equations and to know andunderstand appropriate numerical techniques.
2. Solve the simple heat transfer and fluid flow problems using different numerical techniques,viz., FDM.
3. Understand and to appreciate the need for validation of numerical solution.

UNIT - I:

Basic Aspects of the Governing Equations – Physical Boundary Conditions – Methods of solutions of Physical Problems – Need for Computational Fluid Dynamics – Different numerical/CFD techniques – FDM, FEM, FVM etc., - Main working principle - CFD as a research and design tool – Applications in various branches of Engineering

Mathematical behavior of Partial Differential Equations (Governing Equations): Classification of linear/ quasi linear PDE – Examples - Physical Processes: Wave Equations and Equations of Heat Transfer and Fluid Flow – Mathematical Behavior - General characteristics – Its significance in understanding the physical and numerical aspects of the PDE – One way and Two Way variables – Well posed problems – Initial and Boundary Conditions

Solution of Simultaneous Algebraic Equations: Direct Method – Gauss Elimination – LU Decomposition – Pivoting – Treatment of Banded Matrices – Thomas Algorithm Iterative Method: Gauss Seidel and Jordan Methods - Stability Criterion

UNIT - II:

Finite Difference Method: Basic aspects of Discretization – Finite Difference formulae for first order andsecond order terms – Solution of physical problems with Elliptic type of Governing Equations for different boundary conditions - Numerical treatment of 1D and 2D problems in heat conduction, beams etc., - Solutions –Treatment of Curvelinear coordinates – Singularities – Finite Difference Discretization – Solution of 1D heat conduction problems in Heat conduction in curve linear coordinates

UNIT - III:

FDM: Solution of physical problems with Parabolic type of Governing Equations – Initial Condition – Explicit, implicit and semi implicit methods – Types of errors – Stability and Consistency – Von Neumann Stability criterion– Solution of simple physical problems in 1D and 2D – Transient Heat conduction problems- ADI scheme - Simple Hyperbolic type PDE - First order and Second order wave equations – Discretization using Explicit method - Stability criterion – Courant Number – CFL Condition - Its significance - Treatment of simple problems

UNIT - IV:

Finite Difference Solution of Unsteady Inviscid Flows: Lax – Wendroff Technique – Disadvantages – Maccormack's Technique

Fluid Flow Equations – Finite Difference Solutions of 2D Viscous Incompressible flow problems – Vorticity and Stream Function Formulation – Finite Difference treatment of Lid Driven Cavity Problem - Application to Cylindrical Coordinates with example of flow over infinitely long cylinder and sphere – ObtainingEllipticEquation

UNIT - V:

Finite Difference Applications in Fluid flow problems: Fundamentals of fluid Flow modeling using Burger's Equation – Discretization using FTCS method with respect to Upwind Scheme and Transport Property – Upwind Scheme and Artificial Viscosity

Solutions of Navier Stokes Equations for Incompressible Fluid Flows: Staggered Grid – Marker and Cell (MAC) Formulation – Numerical Stability Considerations – Pressure correction method - SIMPLE Algorithm

TEXT BOOKS:

1. Computational Fluid Dynamics: The basics with applications/ John D Anderson/McGraw HillPublications
2. Numerical Heat Transfer and Fluid Flow/ S.V. Patankar/ Mc Graw Hill

REFERENCE BOOKS:

1. Computational Fluid Flow and Heat Transfer / K Muralidharan and T Sudarajan/ NarosaPublishers.
2. Computational Methods for Fluid Dynamics / Firziger & Peric/ Springer

BALAJI INSTITUTE OF TECHNOLOGY&SCIENCE
(UGC-AUTONOMOUS)
21ME850PE: COMPOSITE MATERIALS (PE – VI)

B.Tech. IV Year II Sem.	**L**	**T/P/D**	**C**
	3	**0/0/0**	**3**

Course Objective:

Students will be able to

1. Develop understanding of the structure of ceramic materials on multiple length scales.
2. To describe key processing techniques for producing metal, ceramic-, and polymer-matrix composites.
3. To demonstrate the relationship among synthesis, processing, and properties in composite materials..

Course Outcomes:

At the end of the course students develop ability to

1. Knowledge of the crystal structures of a wide range of ceramic materials and glasses.
2. Develop knowledge of point defect generation in ceramic materials, and their impact on transport properties.
3. Explain how common fibers are produced and how the properties of the fibers are Related to the internal structure.
4. Describe key processing methods for fabricating composites.
5. Select matrices for composite materials in different applications.

UNIT - I Introduction: Definition, Classification of Composite materials based on structure, based on matrix, Advantages of composites, Applications of composites, Functional requirements of reinforcement and matrix.

UNIT - II Types of reinforcements and their properties: Fibers: Carbon, Boron, Glass, Aramid, Al2O3, SiC, Nature and manufacture of glass, carbon and aramid fibres, Comparison of fibres. Role of interfaces: Wettability and Bonding, The interface in Composites, Interactions and Types of bonding at the Interface, Tests for measuring Interfacial strength.

UNIT - III Fabrication of Polymeric Matrix Composites, Structure and properties of Polymeric Matrix Composites, Interface in Polymeric Matrix Composites, Applications; Fabrication of Ceramic Matrix Composites, Properties of Ceramic Matrix Composites, Interface in Ceramic Matrix Composites, Toughness of Ceramic Matrix Composites Applications of Ceramic Matrix Composites.

UNIT - IV Fabrication of Metal Matrix Composites: Solid state fabrication, Liquid state fabrication and In-situ fabrication techniques; Interface in Metal Matrix Composites: Mechanical bonding, Chemical bonding and Interfaces in In-situ Composites; Discontinuously reinforced Metal Matrix Composites, Properties and Applications. Fabrication of Carbon fiber composites, properties, interface and applications.

UNIT - V :Micromechanics of Composites: Density, Mechanical Properties: Prediction of Elastic constants, Micro mechanical approach, Halpin-Tsai equations, Transverse stresses; Thermal properties: Hydrothermal stresses and Mechanics of Load transfer from matrix to fiber.

TEXTS BOOKS: 1. Composite Materials – Science & Engineering, K.K. Chawla, Springer-Verlag, New York, 1987. 2. An Introduction to Composite Materials, Hull, Cambridge, 2nd Edt. 1997. R18 B.Tech. Mechanical Engg. Syllabus JNTU HYDERABAD 117

REFERENCE BOOKS: 1. Composites, Engineered Materials Handbook, Vol. 1, ASM International, Ohio, 1988.
2. Structure and Properties of Composites, Materials Science and Technology, Vol. 13, VCH, Weinheim, Germany, 1993 3. Composite Materials: Engineering and Science, F.L. Matthews and R.D. Rawlings, Chapman & Hall, London, 1994

BALAJI INSTITUTE OF TECHNOLOGY&SCIENCE
(UGC-AUTONOMOUS)
21ME850PE: MECHANICAL VIBRATION (PE – VI)

B.Tech. IV Year II Sem.	**L**	**T/P/D**	**C**
	3	**0/0/0**	**3**

COURSE OUTCOMES:

At the end of the course, the students will get ability to

1. Explain the need and importance of vibration analysis in mechanical design of machine parts that operate in vibratory conditions.
2. Analyze the mathematical model of a linear vibratory system to determine its response.
3. Summarize vibratory responses of SDOF and MDOF systems to harmonic, periodic and non-periodic excitation.
4. Examine vibratory control absorbers control of vibrations.
5. Classify different sensors and distinguishes the different models instruments.

UNIT I

FUNDAMENTALS OF VIBRATION: Introduction -Sources Of Vibration-Mathematical Models-Displacement, velocity and Acceleration- Review Of Single Degree Freedom Systems -Vibration isolation Vibrometers and accelerometers -.Response To Arbitrary and non- harmonic Excitations – Transient Vibration –Impulse loads-Critical Speed Of Shaft-Rotor systems.

UNIT II

TWO DEGREE FREEDOM SYSTEM : Introduction-Free Vibration OfUndamped And Damped-Forced Vibration With Harmonic Excitation System –Coordinate Couplings And Principal Coordinates

UNIT III

MULTI-DEGREE FREEDOM SYSTEM AND CONTINUOUS SYSTEM : Multi Degree Freedom System –Influence Coefficients and stiffness coefficients- Flexibility Matrix and Stiffness Matrix – Eigen Values and Eigen Vectors-Matrix Iteration Method –Approximate Methods: Dunkerley, Rayleigh's, and Holzer Method -Geared Systems-Eigen Values & Eigen vectors for large system of equations using sub space, Lanczos method - Continuous System: Vibration of String, Shafts and Beams

UNIT IV

VIBRATION CONTROL : Specification of Vibration Limits –Vibration severity standards- Vibration as condition Monitoring tool-Vibration Isolation methods- -Dynamic Vibration Absorber, Torsional and Pendulum Type Absorber- Damped Vibration absorbers-Static and Dynamic Balancing-Balancing machines-Field balancing – Vibration Control by Design Modification- - Active Vibration Control

UNIT V

EXPERIMENTAL METHODS IN VIBRATION ANALYSIS : Vibration Analysis Overview - Experimental Methods in Vibration Analysis.-Vibration Measuring Instruments - Selection of Sensors-Accelerometer Mountings. -Vibration Exciters-Mechanical, Hydraulic, Electromagnetic And Electrodynamics –Frequency Measuring Instruments-. System Identification from Frequency Response - Testing for resonance and mode shapes

TEXT BOOKS:

1. Thomson, W.T. – "Theory of Vibration with Applications", CBS Publishers and Distributors, New Delhi, 1990
2. S. Graham Kelly &Shashidar K. Kudari, "Mechanical Vibrations", Tata McGraw–Hill Publishing Com. Ltd New Delhi,2007

REFERENCES BOOKS:

1. Rao, S.S.," Mechanical Vibrations," Addison Wesley Longman, 1995.
2. Ramamurti. V, "Mechanical Vibration Practice with Basic Theory", Narosa, New Delhi, 2000.