

SEMESTER-III

**MATS UNIVERSITY, RAIPUR (C.G.)
SCHOOL OF ENGINEERING & I.T.**

Semester: 3rd B.Tech

Subject: Engineering Mathematics – III

Total Theory Periods: 48

Total Tutorial Periods: 00

Branch: Aeronautical

Code: BT 350

Total Credits: 03

OBJECTIVES

- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNIT-I FOURIER SERIES

Dirichlet's conditions – General Fourier series – Odd and even functions – Half-range, Sine and Cosine series – Complex form of Fourier Series – Parseval's identity – Harmonic Analysis.

UNIT-II PARTIAL DIFFERENTIAL EQUATIONS

Formation – Solutions of first order equations – Standard types and Equations reducible to standard types – Singular solutions - Lagrange's Linear equation – Integral surface passing through a given curve – Solution of linear equations of higher order with constant coefficients.

UNIT-II APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS

Method of separation of Variables – Solutions of one dimensional wave equation and One-dimensional heat equation – Steady state solution of two-dimensional heat equation – Fourier series solutions in Cartesian coordinates.

UNIT-IV

COMPLEX VARIABLES

Limit and derivative, Analytic functions, Cauchy-Riemann equations, Harmonic functions, Flow problems, Complex integration, Cauchy's theorem, Cauchy integral formula, Taylor & Laurent series, Singularities, Residues, Cauchy's residue theorem, Evaluation of real definite integrals.

UNIT-V Z – TRANSFORM AND DIFFERENCE EQUATION

Z-transform-Elementary properties-Inverse z transform – Convolution theorem-Initial and Final value theorems - Formation of difference equation-Solution of difference equation using z transform.

OUTCOMES

- The understanding of the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.

TEXT BOOK

1. B.S. Grewal, “Higher Engineering Mathematics”, Khanna Publications (2007)

REFERENCES

- 1) Glyn James, “Advanced Modern Engineering Mathematics, Pearson Education (2007)
- 2) B. V. Ramana, “Higher Engineering Mathematics” Tata McGraw Hill 2007.
- 3) N. P. Bali, and Manish Goyal, “A Text Book of Engineering 7th Edition (2007) Lakshmi Publications (P) Limited, New Delhi.

**MATS UNIVERSITY, RAIPUR (C.G.)
SCHOOL OF ENGINEERING & I.T.**

Semester: 3rd B.Tech
Subject: Computer Programming
Total Theory Periods: 48

Total Tutorial Periods: 00

Branch: Aeronautical
Code: BT 351
Total Credits: 03

OBJECTIVES

To make the students aware about programming in C language and its applications.

Unit-1 INTRODUCTION

Introduction to C language: History and development, C compilers, Data types, Identifiers, Constant, Operators, console I/O statements, compilation, flowcharts, debugging and testing of programs.

Unit-2 CONTROL STATEMENTS

Control Statements: if-else, for loop, do-while loop, while loop, nested if-else, Arrays: Syntax and definition, one dimensional, Two Dimensional and multi dimensional arrays, reading and writing an array. Pointers and arrays, array of pointers.

Unit-3 FUNCTIONS

Functions: Declaring and defining functions, storage classes, Function calling ,call by value, call by reference, using library functions in programs.

Unit-4 STINGS

Strings: reading and writing strings, passing a string into a function, using library functions to manipulate strings. Structures: Declaring and using structures. Array of structures, passing structures into function. Unions.

Unit-5 FILE HANDELLING

File Handling: reading and writing text files through C programs. . Working with Binary files , fread and fwrite. Command line arguments. Bitwise operators in C.

OUTCOMES

After completion of this course, students will become aware about programming in C language and its applications.

Text Books:

1. Let us C – Yashwant Kanetkar BPB Publication
2. Programming in ANSI C – E. Balaguruswamy Tata Mc-Graw Hill

**MATS UNIVERSITY, RAIPUR (C.G.)
SCHOOL OF ENGINEERING & I.T.**

Semester: 3rd B.Tech

Subject: Aero Engineering Thermodynamics

Total Theory Periods: 48

Total Tutorial Periods: 12

Branch: Aeronautical

Code: BT 352

Total Credits: 04

OBJECTIVES:

- To achieve an understanding of principles of thermodynamics and to be able to use it in accounting for the bulk behavior of the simple physical systems.
- To provide in-depth study of thermodynamic principles, thermodynamics of state, basic thermodynamic relations, Properties of pure substances
- To enlighten the basic concepts of heat transfer and propulsion cycles.

UNIT-I BASIC THERMODYNAMICS

Systems, Zeroth law, first law. Steady flow energy equation. Heat and work transfer in flow and non-flow processes. Second law, Kelvin-Planck statement–Clausius statement- Concept of Entropy, Clausius inequality, Entropy change in non-flow processes. Properties of gases and vapours.

UNIT-II AIR CYCLE AND COMPRESSORS

Carnot, Otto, Diesel, Dual combustion and Brayton cycles, Air standard efficiency, Mean effective pressure, reciprocating compressors.

UNIT III STEAM AND JET PROPULSION

Properties of steam – Rankine cycle – Steam Nozzles – Simple jet propulsion system– Thrust rocket motor – Specific impulse.

UNIT-IV REFRIGERATION AND AIR-CONDITIONING

Principles of Psychrometry and refrigeration - Vapour compression – Vapour absorption types - Co-efficient of performance, Properties of refrigerants –Basic Principle and types Air conditioning.

UNIT-V HEAT TRANSFER

Conduction in parallel, radial and composite wall– Basics of Convective heat transfer- Fundamentals of Radiative heat transfer – Flow through heat exchangers.
(Use of standard thermodynamic tables, Mollier diagram and Refrigerant property tables are permitted)

OUTCOMES:

- Apply Mathematical foundations, principles in solving thermodynamics problems.
- Critically analyse the problem, and solve the problems related to heat transfer and propulsion

TEXT BOOKS

1. Nag P. K., “Engineering Thermodynamics”, Tata McGraw-Hill, New Delhi, 2007.
2. Rathakrishnan E., “Fundamentals of Engineering Thermodynamics”, Prentice-Hall India, 2005.

REFERENCES

1. Ramalingam K.K. "Thermodynamics", Sci-Tech Publications, 2006
2. Holman J. P., "Thermodynamics", 3rd Ed. McGraw-Hill, 2007.
3. Venwylen and Sontag, "Classical Thermodynamics", Wiley Eastern, 1987
4. Arora C.P, "Thermodynamics", Tata McGraw-Hill, New Delhi, 2003.
5. Merala C, Pother, Craig W, Somerton, "Thermodynamics for Engineers", Schaum Outline Series, Tata McGraw-Hill, New Delhi, 2004.

**MATS UNIVERSITY, RAIPUR (C.G.)
SCHOOL OF ENGINEERING & I.T.**

Semester: 3rd B.Tech
Subject: Mechanics of Solids
Total Theory Periods: 48

Total Tutorial Periods: 12

Branch: Aeronautical
Code: BT 353
Total Credits: 04

OBJECTIVES:

- To introduce various behavior of structural components under various loading conditions.

UNIT-I SIMPLE STRESSES AND STRAIN

Stresses and strains – Hooke's law – Stress and elongation due to self weight – Stress and strain diagrams – Elastic constants – Poisson's ratio – Relation between the elastic moduli – Statically determinate and indeterminate problems in tension & compression – Thermal stresses – Hoop stress- Impact loading.

UNIT-II PRINCIPAL STRESSES AND STRAINS

Pure tensile and shear stresses – Two mutually perpendicular direct stresses – Principal Planes and Principal Stresses – Two dimensional Stress System – Graphical methods of representation of Principal Stresses (Mohr's Circle), Combined Bending and Torsion, Analysis of Strains, Mohr's Circle of Strains.

UNIT-III DEFLECTION OF BEAMS

Introduction – Double integration method – Macaulay's method – moment area method – conjugate beam method –principle of superposition–Strain Energy in axial, bending, torsion and shear loadings. Castigliano's theorem – Maxwell's theorem and their applications.

UNIT-IV TORSION – SPRINGS – COLUMNS

Torsion of solid and hollow circular shafts – shear stress variation – power transmission in shafts – open and closed coiled helical springs – stresses in helical springs – classification of columns – Euler buckling – columns with different end conditions.

UNIT-V STRESSES IN BEAMS

Introduction – Classification of beams –Shear force & bending moment diagrams – Points of contraflexure – Bending equation – Neutral Axis, Section modulus – Combined direct and bending stresses – Shear stress variation in beams of symmetric sections – Beams of uniform strength.

OUTCOMES:

- Solve the problems related to the structural components under various loading conditions.

TEXT BOOK

1. Gere & Timoshenko, 'Mechanics of Materials', McGraw Hill, 1993
2. William Nash, Strength of Materials, Tata McGraw Hill, 2004.

REFERENCES:

1. Dym, C. L., and Shames, I. H., 'Solid Mechanics', McGraw Hill, Kogakusha, Tokyo, 1973.
2. Stephen Timoshenko, 'Strength of Materials', Vol I & II, CBS Publishers and Distributors, Third Edition.

**MATS UNIVERSITY, RAIPUR (C.G.)
SCHOOL OF ENGINEERING & I.T.**

Semester: 3rd B.Tech

Branch: Aeronautical

Subject: Engineering Fluid Mechanics and Machinery

Code: BT 354

Total Theory Periods: 48 Total Tutorial Periods: 12

Total Credits: 04

OBJECTIVES:

- The applications of the conservation laws to flow through pipes and hydraulic machines are studied
- To understand the importance of dimensional analysis.
- To understand the importance of various types of flow in pumps and turbines.

UNIT-I FLUID STATICS

Introduction, Fluid properties, Newton's viscosity law, Classification of fluids, Surface Tension and Capillarity, Compressibility and Bulk Modulus, Thermodynamic Properties, Vapour pressure and Cavitation. Pascal's Law, Hydrostatic Law, Pressure and its measurement, Hydrostatic force on surfaces.

UNIT-II KINEMATICS AND DYNAMICS OF FLOW

Kinematics of Flow- Description of Fluid Motion, Types of Fluid Flows, Continuity Equation, Continuity equation in 3D, Velocity and Acceleration of Fluid Particles, Velocity Potential function and Stream function, Streamlines, Pathline and Streakline, Types of Motion, Vortex Flow.

Dynamics of Flow - Introduction, Equations of Motion, Euler's Equation, Bernoulli's Equation, Practical application of Bernoulli's Equation in Venturimeter, Orificemeter, Pitot tube, Momentum Equation, Free liquid Jets.

UNIT-III LAMINAR - TURBULENT FLOW AND DIMENSIONAL - MODEL ANALYSIS

Laminar Flows: Viscous flow through circular pipe and parallel plates, Loss of head due to friction in viscous flow.

Turbulent Flow: Frictional Losses in pipe flow, Shear stress and Velocity Distribution in Turbulent flow in pipes.

Dimensional and model Analysis : Introduction, Derived Quantities, Dimensional Homogeneity, Methods of dimensional analysis- Rayleigh's and Buckingham Pi Method, Types of forces acting on moving fluid, Dimensionless numbers, Laws of Similarity- Reynold's, Froude's, Euler's, Weber's, Mach Model Law, Prototype and Model.

UNIT-IV FORCES ON FLOATING AND SUBMERGED BODIES

Buoyancy, Centre of Buoyancy, Metacentre, Metacentric- Height, Stability of Submerged and Floating Bodies, Forces exerted by flowing fluid on a stationary bodies – Drag and Lift, Streamline bodies, Bluff bodies, Drag on Sphere and Cylinder, Development of Lift on a circular Cylinder.

UNIT-V INTRODUCTION TO FLUID MACHINERY

Impact of Jet and Jet Propulsion, Classification of Turbines, Impulse and Reaction Turbine- Pelton Wheel, Francis Turbine and Kaplan Turbine, Velocity Triangles and Problems based on Turbines, Centrifugal and Reciprocating Pumps.

OUTCOMES:

- Upon completion of this course, the students can able to apply mathematical knowledge to predict the properties and characteristics of a fluid.
- Can critically analyse the performance of pumps and turbines.

TEXT BOOKS

1. Shames I H, 'Mechanics of Fluids', Kogakusha, Tokyo, 1998
2. Robert W Fox & Alan T McDonald, 'Introduction to fluid Mechanics', John Wiley and Sons, 1995.
3. Bansal, R K, Fluid Mechanics and Hydraulic Machines, Laxmi Publications, 2005.

REFERENCE BOOKS

1. Yuan S W, 'Foundations of fluid Mechanics', Prentice-Hall, 1987.
2. Milne Thompson L M, 'Theoretical Hydrodynamics', MacMillan, 1985.
3. Rathakrishnan, E, 'Fundamentals of Fluid Mechanics', Prentice-Hall, 2007

**MATS UNIVERSITY, RAIPUR (C.G.)
SCHOOL OF ENGINEERING & I.T.**

Semester: 3rd B.Tech
Subject: Elements of Aeronautics
Total Theory Periods: 60

Total Tutorial Periods: 00

Branch: Aeronautical
Code: BT 355
Total Credits: 04

OBJECTIVES:

- To introduce the concepts of flying, International standard atmosphere, structural aspects of airplanes, brief description of systems, instruments and power plants used in airplanes.

UNIT-I AIRCRAFT CONFIGURATIONS

Brief History of Aviation, Components of an airplane and their functions, Different types of flight vehicles- Classifications & Details. Basic Flight instruments.

UNIT-II INTRODUCTION TO PRINCIPLES OF FLIGHT

Physical properties and structure of the atmosphere, Temperature, pressure and altitude relationships, Stability of Atmosphere. Evolution of lift, drag and moments. Different types of forces and moments.

UNIT-III INTRODUCTION TO AERODYNAMICS

Aerodynamic forces on aircraft – classification of NACA aerofoils, aspect ratio, wing loading, Mach number, centre of pressure and aerodynamic centre-aerofoil characteristics- lift, drag curves.

UNIT-IV INTRODUCTION TO AIRPLANE STRUCTURES AND MATERIALS

General types of Aircraft construction- Monocoque, semi-monocoque. Typical wing and fuselage structure. Metallic & non-metallic materials, aluminum alloy, titanium, stainless steel and composite materials.

UNIT-V POWER PLANTS USED IN AIRPLANES

Introduction to piston, turboprop and jet engines, Principle of propeller and jets for thrust production, Principles of operation of rocket, types of rockets.

OUTCOMES:

- Identify the component of Flight
- Identify suitable materials for Aircraft structure
- Perform basic calculation on Mechanics using Newton law for lift, drag and moment.

TEXT BOOKS

1. Anderson, J.D., “Introduction to Flight”, McGraw-Hill, 1995.

REFERENCE

1. Kermode, A.C., “Flight without Formulae”, McGraw-Hill, 1997.

**MATS UNIVERSITY, RAIPUR (C.G.)
SCHOOL OF ENGINEERING & I.T.**

Semester: 3rd B.Tech
Subject: Computer Programming Laboratory
Total Practical Periods: 28

Branch: Aeronautical
Code: BT 356
Total Credits: 01

OBJECTIVES:

To give the students hands on practise of programming in C language.

LIST OF EXPERIMENTS

1. To write a C program to prepare the electricity bill.
2. * Functions
 - a) Call by value, b) Call by reference
3. To write a C program to print the Fibonacci series for the given number.
4. To write a C program to find the factorial of number using recursion.
5. To write a C program to implement the basic arithmetic operations using switch case statement.
6. To write a C program to check whether the given number is an Armstrong number.
7. To write a C program to check whether the given string is a Palindrome.
8. To write a C program to create students details using Structures.
9. To write a C program to demonstrate the command line arguments.
10. To write a C program to implement the Random Access in files.
11. To write a C program to solve some of the Engineering applications.

LIST OF EQUIPMENTS

(For a batch of 30 students)

S. No.	Details of Equipments	Qty Req.	Expt. No.
1	Computers	30	1 to 10
2	UPS 10 KV _a 3 Phase	1	1 to 10
3	C Program	1	1 to 10

OUTCOMES:

Students will get hands on practise of programming in C language.

**MATS UNIVERSITY, RAIPUR (C.G.)
SCHOOL OF ENGINEERING & I.T.**

Semester: 3rd B.Tech
Subject: Thermodynamics Laboratory
Total Practical Periods: 28

Branch: Aeronautical
Code: BT 357
Total Credits: 01

OBJECTIVES:

- To enhance the basic knowledge in applied thermodynamics

LIST OF EXPERIMENTS

1. Performance test on a 4-stroke engine
2. Valve timing of a 4 – stroke engine and port timing of a 2 stroke engine
3. Determination of effectiveness of a parallel flow heat exchanger
4. Determination of effectiveness of a counter flow heat exchanger
5. Determination of heating value of a fuel
6. COP test on a vapour compression refrigeration test rig
7. COP test on a vapour compression air-conditioning test rig
8. Determination of specific heat of solid
9. Determination of Thermal Conductivity of solid.
10. Determination of Thermal Resistance of a Composite wall.

LIST OF EQUIPMENTS

(For a batch of 30 students)

S. No.	Details of Equipments	Qty Req.	Expt. No.
1	4 stroke twin cylinder diesel engine	1	1
2	section model of 4 stroke diesel engine and cut section model of 2 stroke petrol engine	1	2
3	Parallel and counter flow heat exchanger test rig	1	3, 4
4	Bomb Calorimeter	1	5
5	Vapour compression refrigeration test rig	1	6
6	Vapour compression air-conditioning test rig	1	7
7	Conductive Heat Transfer set up	1	9
8	Composite wall	1	10

OUTCOMES:

- Ability to perform test on diesel/petrol engine
- Ability to explain the characteristics of the diesel/Petrol engine
- Ability to determine the properties of the fuels.

**MATS UNIVERSITY, RAIPUR (C.G.)
SCHOOL OF ENGINEERING & I.T.**

Semester: 3rd B.Tech
Subject: Mechanics of Solids Laboratory
Total Practical Periods: 28

Branch: Aeronautical
Code: BT 358
Total Credits: 01

OBJECTIVES:

- To supplement the theoretical knowledge gained in Mechanics of Solids with practical testing for determining the strength of materials under externally applied loads.
- This would enable the student to have a clear understanding of the design for strength and stiffness.

LIST OF EXPERIMENTS

1. Brinell Hardness test
2. Rockwell Hardness test
3. Tension test
4. Torsion test
5. Izod Impact test
6. Charpy Impact test
7. Reverse plate bending Fatigue test
8. Rotating Beam Fatigue test
9. Testing of springs
10. Block Compression Test

LIST OF EQUIPMENTS

(For a batch of 30 students)

S. No.	Details of Equipments	Qty Req.	Expt. No.
1	Hardness Testing Machine	1	1, 2
2	Universal Testing Machine	1	1, 2, 3, 9, 10
3	Impact Testing Machine	1	5, 6
4	Fatigue tester- Rotating Beam	1	8
5	Fatigue tester –Reverse plate bending	1	7

OUTCOMES:

- Ability to perform different destructive testing.
- Ability to characteristic materials.

**MATS UNIVERSITY, RAIPUR (C.G.)
SCHOOL OF ENGINEERING & I.T.**

Semester: 3rd B.Tech
Subject: Fluid Mechanics and Machinery Laboratory
Total Practical Periods: 28

Branch: Aeronautical
Code: BT 359
Total Credits: 01

OBJECTIVES:

Upon Completion of this subject, the students can able to have hands on experience in flow measurements using different devices and also perform calculation related to losses in pipes and also perform characteristic study of pumps, turbines etc.,

LIST OF EXPERIMENTS

1. Calibration of Venturimeter
2. Pressure measurement with Pitot static tube
3. Determination of pipe flow losses.
4. Verification of Bernoulli's theorem
5. Flow visualization by Heleshaw apparatus
6. Performance test on centrifugal pumps
7. Performance test on reciprocating pumps
8. Performance test on piston wheel turbine
9. Performance test on Francis turbine
10. Determination of Viscosity of a Fluid

LIST OF EQUIPMENTS

(For a batch of 30 students)

S. No.	Details of Equipments	Qty Req.	Expt. No.
1	Venturimeter setup	1	1,3
2	Pipe friction set up	1	3
3	Pitot tube set up	1	2,4
4	Jet pump	1	6
5	Submersible pump	1	6
6	Centrifugal pump	1	6
7	Reciprocating pump	1	7
8	Pelton wheel turbine and Francis turbine	1	8,9
9	Viscosity Meter	1	10
10	Heleshaw apparatus	1	5

OUTCOMES:

- Ability to use the measurement equipments for flow measurement.
- Ability to do performance trust on different fluid machinery.