# MATS UNIVERSITY

## Raipur (C.G.)

# Syllabus Scheme

**(3rd Semester)**

**For**

**Bachelor of Engineering**

**In**

**AERONAUTICAL**

## MATS School of Engineering & Technology

**ARANG, RAIPUR (C.G.)**

# MATS UNIVERSITY

## ARANG, RAIPUR

### Subject Code for MATS School of Engineering & Technology

### 3rd Semester (AERONAUTICAL)

| S. No. | Subject Code | Subject Name |
|---|---|---|
| 1 | **BE350** | Engineering Mathematics-III |
| 2 | **BE351** | Elements of Aeronautics |
| 3 | **BE352** | Fluid Mechanics |
| 4 | **BE353** | Mechanics of Solid |
| 5 | **BE354** | Aero Engineering Thermodynamics |
| 6 | **BE355** | Computer Programming |
| 7 | **BE356** | Thermodynamics Lab |
| 8 | **BE357** | Fluid Mechanics Lab |
| 9 | **BE358** | Mechanics of Solid Lab |
| 10 | **BE359** | Computer Programming Lab |

# MATS UNIVERSITY

## ARANG, RAIPUR

### Scheme of Teaching & Examination
### B.E. III SEMESTER AERONAUTICAL ENGINEERING

| S.N. | code | Subject | Periods per week | | | Scheme of marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | ESE | IM | |
| 1. | BE350 | Engg. Mathematics – III | 4 | 1 | - | 70 | 30 | 100 |
| 2. | BE351 | Elements Of Aeronautics | 4 | 1 | - | 70 | 30 | 100 |
| 3. | BE352 | Engg. Fluid Mechanics | 4 | 1 | - | 70 | 30 | 100 |
| 4. | BE353 | Mechanics of Solid | 4 | 1 | - | 70 | 30 | 100 |
| 5. | BE354 | Aero Engineering Thermodynamics | 4 | 1 | - | 70 | 30 | 100 |
| 6. | BE355 | Computer Programming | 4 | 1 | - | 70 | 30 | 100 |
| 7. | BE356 | Thermodynamics Lab | - | | 3 | 20 | 30 | 50 |
| 8. | BE357 | Fluid Mechanics Lab | - | | 3 | 20 | 30 | 50 |
| 9. | BE358 | Mechanics Of Solid Lab | - | | 3 | 20 | 30 | 50 |
| 10. | BE359 | Computer Programming Lab | - | | 3 | 20 | 30 | 50 |
| | | **Total** | **24** | **6** | **12** | **500** | **300** | **800** |

L – Lecture, T – Tutorial, ESE – End Semester Examination,

P – Practical, IM – Internal Marks (Include Class Test & Teacher's Assessments)

# MATS UNIVERSITY, RAIPUR

| | | |
|---|---|---|
| Semester | : | 3rd BE Course |
| Branch | : | Aeronautical |
| Subject | : | Engineering Mathematics - III |
| Total Theory Periods | : | 40 |
| Total Tutorial Periods | : | 15 |
| Code | : | BE 350 |

**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 FOURIER TRANSFORM**

Fourier integral theorem – Fourier transform pair-Sine and Cosine transforms –Properties – Transform of simple function – Convolution theorem - Parseval's identity.

**UNIT-III 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-IV APPLICATIONS OF PARTIAL DIFFERENTIALEQUATIONS**

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-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.

**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

| | | |
|---|---|---|
| Semester | : | 3rd BE Course |
| Branch | : | Aeronautical |
| Subject | : | Elements of Aeronautics |
| Total Theory Periods | : | 40 |
| Total Tutorial Periods | : | 15 |
| Code | : | BE 351 |

**UNIT-I AIRCRAFT CONFIGURATIONS**

Brief History-Components of an airplane and their functions. Different types of flight vehicles, classifications. Basic instruments for flying.

**UNIT-II INTRODUCTION TO PRINCIPLES OF FLIGHT**

Physical properties and structure of the atmosphere. Temperature, pressure and altitude relationships, Evolution of lift, drag and moment. Different types of drag.

**UNIT-III INTRODUCTION TO AERODYNAMICS**

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

**UNIT-V POWER PLANTS USED IN AIRPLANES**

Basic ideas about piston, turboprop and jet engines, Use of propeller and jets for thrust production, Principles of operation of rocket, types of rockets.

**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

| | | |
|---|---|---|
| Semester | : | 3rd BE Course |
| Branch | : | Aeronautical |
| Subject | : | Engineering Fluid Mechanics |
| Total Theory Periods | : | 45 |
| Total Tutorial Periods | : | 15 |
| Code | : | BE 352 |

**UNIT-I BASIC CONCEPTS**

Introduction – Fluid properties – Newton's viscosity law – Classification of fluids and fluid motion – Fluid statics – Hydrostatic force on submerged surfaces – stability of floating bodies – Dimensional analysis – The Buckingham-Pi theorem – Significant dimensionless groups – Flow similarity and model studies.

**UNIT-II BASIC EQUATIONS OF FLUID FLOW ANALYSIS**

Basic laws for a system in integral form – Conservation of mass – Newton's 2nd law –Laws of thermodynamics – Application of the basic laws for a control volume –Kinematics – Motion of a fluid particle – Fluid deformation –Differential analysis of fluid motion – Continuity equation – Differential momentum equation – The Navier Stokes equations.

**UNIT-III INCOMPRESSIBLE INVISCID FLOW**

Euler's equations of motion – Bernoulli's equations – Applications – Methods of pressure measurement – Flow measurement – Orifice plate – Venturi meter – Irrotational flow – Stream function and velocity potential – Laplace equation – Elementary plane flows.

**UNIT-IV INCOMPRESSIBLE VISCOUS FLOW**

Fully developed laminar flow between infinite parallel plates – Laminar and turbulent flow through pipes – Velocity profiles – Energy considerations in pipe flow –Calculation of head loss Pipe flow problems – Hydraulic and energy grade lines –Moody's diagram

**UNIT-V FLUID MACHINERY**

Introduction and classification of fluid machines – Turbo machinery analysis – The angular momentum principle – Euler turbo machine equation – Velocity triangles –Application to fluid systems – Working principle of turbines, fans, blowers, pumps and compressors.

**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.

**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

| | | |
|---|---|---|
| Semester | : | 3rd BE Course |
| Branch | : | Aeronautical |
| Subject | : | Solid Mechanics |
| Total Theory Periods | : | 45 |
| Total Tutorial Periods | : | 15 |
| Code | : | BE 353 |

**UNIT-I AXIAL LOADING**

Stresses and strains – Hooke's law – stress and strain diagrams-elastic constants – statically determinate and indeterminate problems in tension & compression – thermal stresses – impact loading.

**UNIT-II STRESSES IN BEAMS**

Shear force & bending moment diagrams – bending stresses – shear stress variation in beams of symmetric sections – beams of uniform strength.

**UNIT-III DEFLECTION OF BEAMS**

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 theorems 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 BIAXIAL STRESSES**

Stresses in thin-walled pressure vessels – combined bending, torsion and axial loading of circular shafts – Mohr's circle and its construction – determination of principal stresses.

**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.
3. R. K. Rajput, 'Strength of Materials', S. Chand and Co., 1999.
4. Timoshenko, S. and Young, D. H., Elements of Strength of Materials, T. Van Nostrand Co. Inc., Princeton, N.J., 1977.

# MATS UNIVERSITY, RAIPUR

| | | |
|---|---|---|
| Semester | : | 3rd BE Course |
| Branch | : | Aeronautical |
| Subject | : | Aero Engineering Thermodynamics |
| Total Theory Periods | : | 45 |
| Total Tutorial Periods | : | 15 |
| Code | : | BE 354 |

**UNIT-I BASIC THERMODYNAMICS**

Systems, Zeroth low, 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)

**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

| | | |
|---|---|---|
| Semester | : | 3rd BE Course |
| Branch | : | Aeronautical |
| Subject | : | Computer Programming |
| Total Theory Periods | : | 45 |
| Total Tutorial Periods | : | 15 |
| Code | : | BE 355 |

**UNIT-I**

Introduction to programming, programming languages, algorithms, flowcharts. C: Data types, Identifiers, Storage class, Constant, Operators, expression, Statements, console I/O statements, Selection statements: if-else, switch, Iteration Statements: for, while, do-while, Jump statements: return, go to, break, continue, comments.

**UNIT-II**

Function, Call by value, Call by reference, calling functions with arrays, arguments to main(), return statements, recursion, function prototypes, inline keyword, preprocessor directives. Pointers: pointer variables, pointer operator, pointer expression, array of pointers, multiple indirection, pointers to functions, dynamic allocation functions.

**UNIT-III**

Arrays: single dimensional arrays, two dimensional arrays, multidimensional arrays, variable length arrays. Strings, array of strings.

**UNIT-IV**

Structures: array of structures, passing structure to function, structure pointers, structure within structures. Unions, bit-fields, enumerations, size of, type def.

**UNIT-V**

File I/O: Streams and files, file system basics, fread, fwrite, fseek, random access I/O, fprintf(), fscanf(), standard streams.

**TEXT BOOKS:**


1. The Complete Reference C ( 4th Edition) : Herbert Schildt [ TMH]
2. C How to Program, 4th Edition by H. M. Deitel & P. J. Deitel, Pearson Education.
3. Writing TSRs through C: Yashwant Kanetkar ( BPB)


**REFERENCES**


1. The C Programming Language: Dennis Ritchie & Brain Kernighan [Pearson].
2. Programming with C: K. R. Venugopal & S. R. Prasad [TMH]
3. Let Us C: Yashwant Kanetkar [BPB]

# MATS UNIVERSITY, RAIPUR

Semester : 3rd BE Course
Branch : Aeronautical
Subject : Thermodynamics Lab
Code : BE 356

## 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 |

# MATS UNIVERSITY, RAIPUR

Semester : 3rd BE Course
Branch : Aeronautical
Subject : Fluid Mechanics Lab
Code : BE 357

## 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 |

# MATS UNIVERSITY, RAIPUR

Semester : 3rd BE Course
Branch : Aeronautical
Subject : Mechanics of Solid Lab
Code : BE 358

## 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 |

# MATS UNIVERSITY, RAIPUR

Semester : 3rd BE Course
Branch : Aeronautical
Subject : Computer Programming Lab
Code : BE 359

## 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 KVa 3 Phase | 1 | 1 to 10 |
| 3 | C Program | 1 | 1 to 10 |