UNIVERSITY DEPARTMENTS
ANNA UNIVERSITY CHENNAI :: CHENNAI 600 025
REGULATIONS – 2008
CURRICULUM FROM III & IV SEMESTERS FOR
B.E. AERONAUTICAL ENGINEERING

SEMESTER – III

<table>
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SEMESTER – IV

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MA9211 MATHEMATICS III
(Common to all branches of BE / B.Tech)

UNIT I  FOURIER SERIES
9+3
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
9+3
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 III  APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS
9+3
Method of separation of Variables – Solutions of one dimensional wave equation -
One-dimensional heat equation – Steady state solution of two-dimensional heat
equation – Fourier series solutions in Cartesian coordinates.

UNIT IV  FOURIER TRANSFORM
9+3
Fourier integral theorem – Fourier transform pair-Sine and Cosine transforms –
Properties – Transform of simple function – Convolution theorem - Parseval’s
identity.

UNIT V  Z – TRANSFORM AND DIFFERENCE EQUATION
9+3
Z-transform-Elementary properties-Inverse z transform – Convolution theorem-
Formation of difference equation-Solution of difference equation using z transform.

TOTAL: 45+15=60

TEXT BOOK

REFERENCES
1) Glyn James, “Advanced Modern Engineering Mathematics, Pearson
   Education (2007)
   Lakshmi Publications (P) Limited, New Delhi.
AIM: To introduce the concepts of Fluid Mechanics.
Pre-requisite: Basics of Physics

OBJECTIVE: To introduce the concepts of fluid statics viscosity and buoyancy. To make the student understand the basic laws namely, mass momentum and energy. To give an introduction on fluid machinery.

UNIT I  BASIC CONCEPTS


UNIT II  BASIC EQUATIONS OF FLUID FLOW ANALYSIS


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


L = 45, T = 15, Total = 60

TEXT BOOKS

REFERENCE BOOKS
OBJECTIVE
To introduce fundamental concepts in thermodynamics, heat transfer, propulsion and refrigeration and air conditioning.

UNIT I  BASIC THERMODYNAMICS  16

UNIT II  AIR CYCLE AND COMPRESSORS  12
Otto, Diesel, Dual combustion and Brayton cycles. Air standard efficiency. Mean effective pressure, Reciprocating compressors.

UNIT III  STEAM AND JET PROPULSION  12

UNIT IV  REFRIGERATION AND AIR-CONDITIONING  10
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  10

L = 45, T = 15, TOTAL = 60

(Use of standard thermodynamic tables, Mollier diagram and Refrigerant property tables are permitted)

TEXT BOOKS

REFERENCES
UNIT I  AXIAL 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  


UNIT IV  TORSION – SPRINGS – COLUMNS  


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  


REFERENCES:  

UNIT – I  ELECTRONIC COMPONENTS AND DEVICES  10

UNIT – II ANALOG CIRCUITS  10
Rectifier and Power Supply Circuits, clipper, clamper using diodes, Operational Amplifiers (Ideal) – properties and typical circuits like differentiator, integrator, summer, comparator, single-stage BJT’s and FET’s amplifiers – Multistage Amplifier Principles(Qualitative Treatment only).

UNIT – III  DIGITAL CIRCUITS  10

UNIT – IV MEASUREMENTS AND INSTRUMENTS  7
Definitions of Accuracy, Precision, Sensitivity, Resolution, Linearity, Range, Measurement of Electrical Quantities – Voltmeter, Ammeter, Watt-Meter, DMM, CRO, DSO, Transducers and signal conditioning systems for pressure, temperature, acceleration measurements (Qualitative Treatment only).

UNIT – V MICROPROCESSORS AND APPLICATIONS  8
Architecture of 8085 processors, Address Modes, Instruction set, simple programming like addition, subtraction, multiplication, logical operation, Peripherals and Interfacing – 8255, 8251. Applications like motor control, keyboard and PC interface, Introduction to Microcontrollers.

TOTAL:45

TEXT BOOK

REFERENCES
OBJECTIVE
To introduce the basic concepts of aerospace engineering and the current developments in the field.

UNIT I HISTORICAL EVALUATION 8
Early airplanes, biplanes and monoplanes, Developments in aerodynamics, materials, structures and propulsion over the years.

UNIT II AIRCRAFT CONFIGURATIONS 5
Components of an airplane and their functions. Different types of flight vehicles, classifications. Conventional control, Powered control, Basic instruments for flying, Typical systems for control actuation.

UNIT III INTRODUCTION TO PRINCIPLES OF FLIGHT 10
Physical properties and structure of the atmosphere, Temperature, pressure and altitude relationships, Evolution of lift, drag and moment. Aerofoils, Mach number, Maneuvers.

UNIT IV INTRODUCTION TO AIRPLANE STRUCTURES AND MATERIALS 12
General types of construction, Monocoque, semi-monocoque and geodesic construction, Typical wing and fuselage structure. Metallic and non-metallic materials, Use of aluminium alloy, titanium, stainless steel and composite materials.

UNIT V POWER PLANTS USED IN AIRPLANES 10
Basic ideas about piston, turboprop and jet engines, Use of propeller and jets for thrust production. Comparative merits, Principles of operation of rocket, types of rockets and typical applications, Exploration into space.

TOTAL : 45

TEXT BOOKS

REFERENCE
OBJECTIVE

To impart skills in construction of machine elements and assembly drawing. Also to train the students to read and represent a geometrical tolerances in part drawing.

1. Instruction to machine drawing & production drawing classification of drawing-BIS conventions – Orthographic and sectional views. Reviews of the concepts of limits, tolerance, fits, surface roughness, and symbols terminology used in Production drawing.


3. Computer Aided Production Drafting
   Detailed part drawing and assembly drawings (with suitable tolerances, machine symbols, specification of fit).
   1) Screw jack
   2) Shaper tool head
   3) Non return valve
   4) Plummer block
   5) Foot step drawing
   6) Machine vice
   7) Four jaw chuck of lathe
   8) Lathe tail stock
   9) Square tool post
   10) Universal coupling
   11) Hydraulic & Pneumatic Assembly
OBJECTIVE

To train the students in testing and quantifying the mechanical properties of Engineering Materials, Engines and Heat Exchangers

LIST OF EXPERIMENTS

Tension Test
Torsion Test
Testing of springs
Impact test i) Izod, ii) Charpy
Hardness test i) Vickers, ii) Brinell, iii) Rockwell, iv) Shore
Deflection of Beams
Dye Penetrant Test
Performance test on a 4 stoke engine
Viscosity determination of the given fluid
Moment of inertial of connecting rod
Determination of Effectiveness of a parallel and counter flow heat exchangers
Valve timing of a 4 stroke engine and port timing of a 2 stroke engine
UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS (10 +3)

UNIT II INTERPOLATION AND APPROXIMATION (8 +3)
Interpolation with unequal intervals - Lagrange interpolation – Newton’s divided difference interpolation – Cubic Splines - Interpolation with equal intervals - Newton’s forward and backward difference formulae.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION (9 +3)

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS (9 +3)

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS (9 +3)
Finite difference methods for solving two-point linear boundary value problems. Finite difference techniques for the solution of two dimensional Laplace’s and Poisson’s equations on rectangular domain – One dimensional heat-flow equation by explicit and implicit (Crank Nicholson) methods - One dimensional wave equation by explicit method.

TEXT BOOKS

REFERENCE BOOKS
OBJECTIVE
To understand basic concepts of kinematic and dynamic mechanism of various machine elements.

UNIT I MECHANISMS

UNIT II FRICTION

UNIT III GEARING AND CAMS

UNIT IV BALANCING
Static and dynamic balancing – single and several masses in different planes – primary and secondary balancing of reciprocating masses – balancing single and multi cylinder Engines – Governors and Gyroscopic effects.

UNIT V VIBRATION

TOTAL:60

TEXT BOOK

REFERENCES:
UNIT I  STATICALLY DETERMINATE STRUCTURES  12
Statically determinate frames – plane truss analysis – method of joints – method of
sections – 3-D trusses – the landing gear tripod – beams of two materials.

UNIT II  STATICALLY INDETERMINATE STRUCTURES  12
Propped cantilevers – fixed-fixed beams – Clapeyron’s 3 moment equation – moment
distribution method.

UNIT III  ENERGY METHODS  12
Strain energy evaluation in structural members – energy theorems – dummy load &
unit load methods – Maxwell’s reciprocal theorem – energy methods applied to
statically determinate and indeterminate beams, frames, rings & trusses.

UNIT IV  COLUMNS  12
Euler’s column curve – inelastic buckling – effect of initial curvature – the Southwell
plot – columns with eccentricity – use of energy methods – theory of beam columns –
beam columns with different end conditions – stresses in beam columns.

UNIT V  FAILURE THEORIES  12
Ductile and brittle materials – maximum principal stress theory - maximum principal
strain theory - maximum shear stress theory - distortion energy theory – octahedral
shear stress theory.

TOTAL : 60

TEXT BOOK
   Company, USA, 1985

REFERENCES
2. Megson T M G, ´Aircraft Structures for Engineering students’ Edward Arnold
   Publishers.
AIM: To introduce the fundamental principles of theoretical low speed aerodynamics.
Pre-requisite: Basics of Fluid Mechanics

OBJECTIVE: To introduce the concepts of mass, momentum and energy conservation relating to aerodynamics. To make the student understand the concept of vorticity, irrotationality, theory of airfoils and wing sections. To introduce the basics of viscous flow.

UNIT I REVIEW OF BASIC FLUID MECHANICS 10

UNIT II TWO DIMENSIONAL INVISCID INCOMPRESSIBLE FLOW 8
Ideal Flow over a circular cylinder, D'Alembert's Paradox, Magnus effect, Kutta Jonkowski's Theorem, Starting Vortex, Kutta condition, Real flow over smooth and rough cylinder.

UNIT III AIRFOIL THEORY 9

UNIT IV SUBSONIC WING THEORY 8
Vortex Filament, Biot and Savart Law, Bound Vortex and trailing Vortex, Horse Shoe Vortex, Lifting Line Theory and its limitations.

UNIT V INTRODUCTION TO LAMINAR AND TURBULENT FLOW 10
Boundary layer and boundary layer thickness, displacement thickness, momentum thickness, Energy thickness, Shape parameter, Boundary layer equations for a steady, two dimensional incompressible flow, Boundary Layer growth over a Flat plate, Critical Reynolds Number, Clasius solution, Basics of Turbulent flow, Prandtl's mixing length hypothesis, Free shear layers.

TEXT BOOK

REFERENCES
1. Milne Thomson, L.H., Theoretical Aerodynamics, Macmillan, 1985
OBJECTIVE
To understand the principles of operation and design of aircraft and spacecraft power plants.

UNIT I FUNDAMENTALS OF GAS TURBINE ENGINES 8

UNIT II SUBSONIC AND SUPERSONIC INLETS FOR JET ENGINES 8

UNIT III COMBUSTION CHAMBERS 8

UNIT IV NOZZLES 8

UNIT V COMPRESSORS 13

TOTAL : 45

TEXT BOOKS

REFERENCES
AIM: To introduce the types of instruments and systems used in Aircraft.
Pre-requisite: Basics of Aeronautics
OBJECTIVE: To introduce the hydraulic and pneumatic systems components and operate, types of instruments and its operation including navigational instruments

UNIT I  AIRCRAFT SYSTEMS  8

UNIT II  AIRPLANE CONTROL SYSTEMS  12
Conventional Systems – Power assisted and fully powered flight controls – Power actuated systems – Engine control systems – Push pull rod system – operating principles – Modern control systems – Digital fly by wire systems – Auto pilot system, Active Control Technology

UNIT III  ENGINE SYSTEMS  8
Fuel systems – Piston and Jet Engines – Components - Multi-engine fuel systems, lubricating systems - Piston and jet engines – Starting and Ignition systems – Piston and Jet engines

UNIT IV  AIRCONDITIONING AND PRESSURIZING SYSTEM  8

UNIT V  AIRCRAFT INSTRUMENTS  9

TOTAL : 45

TEXT BOOKS

REFERENCES
LIST OF EXPERIMENTS

1. Deflection of a Simply-Supported Beam
2. Verification of Maxwell’s Reciprocal Theorem
3. Tensile testing using the UTM
4. Poisson Ratio Determination
5. Verification of the Superposition Theorem
6. Buckling Load of Slender Eccentric Columns
7. Construction of a Southwell Plot
8. Non-Destructive Testing Procedures
9. Shear Failure of Bolted and Rivetted Joints
10. Bending Modulus of a Sandwich Beam

P : 60  TOTAL :60
1. Application of Bernoulli’s Equation – Venturimeter and Orifice meter.

2. Frictional Loss in laminar flow through pipes.

3. Frictional Loss in turbulent flow through pipes.


5. Determination of lift for the given airfoil section.

6. Pressure distribution over a smooth circular cylinder.

7. Pressure distribution over a rough circular cylinder.

8. Pressure distribution over a symmetric aerofoil.

9. Pressure distribution over a cambered aerofoil.

10. Flow visualization studies in subsonic flows.
1. Load test on separately excited DC shunt generator
2. Load test on DC shunt motor
3. Load test on Sφ Transformer
4. Load test on Induction motor
5. Regulation of 3φ Alternator
6. Study of CRO
7. Logic gates
8. Operational amplifiers
9. Time constant of RC circuit
10. Characteristics of LVDT
11. Calibration of Rotometer
12. RTD and thermistor
13. Flapper Nozzle system