Syllabus of

UNDERGRADUATE DEGREE COURSE

Aeronautical Engineering

Rajasthan Technical University, Kota

Effective from session: 2018-19

RAJASTHAN TECHNICAL UNIVERSITY, KOTA

Syllabus

2nd Year - III Semester: B.Tech. (Aeronautical Engineering)

3AN2-01: Advanced Engineering Mathematics

Credit: 3 **Max. Marks: 150 (IA:30, ETE:120)**
3L+0T+0P **End Term Exam: 3 Hours**

SN		Hours
1	**Numerical Methods–1:** Finite differences, Relation between operators, Interpolation using Newton's forward and backward difference formulae. Gauss's forward and backward interpolation formulae. Stirling's Formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae. Numerical Differentiation, Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 *rules*.	**10**
2	**Numerical Methods–2:** Numerical solution of ordinary differential equations: Taylor's series, Euler and modified Euler's methods. Runge- Kutta method of fourth order for solving first and second order equations. Milne's and Adam's predicator-corrector methods. Solution of polynomial and transcendental equations-Bisection method, Newton-Raphson method and Regula-Falsi method.	**08**
3	**Laplace Transform:** Definition and existence of Laplace transform, Properties of Laplace Transform and formulae, Unit Step function, Dirac Delta function, Heaviside function, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs by Laplace transforms method.	**10**
4	**Fourier Transform:** Fourier Complex, Sine and Cosine transform, properties and formulae, inverse Fourier transforms, Convolution theorem, application of Fourier transforms to partial ordinary differential equation (One dimensional heat and wave equations only).	**7**
5	**Z-Transform:** Definition, properties and formulae, Convolution theorem, inverse Z-transform, application of Z-transform to difference equation.	**5**
	Total	**40**

Office of Dean Academic Affairs
Rajasthan Technical University, Kota

3AN1-02/4AN1-02: Technical Communication

Credit: 2 **Max. Marks: 100 (IA:20, ETE:80)**
2L+0T+0P **End Term Exam: 2 Hours**

SN		Hours
1	**Introduction to Technical Communication-** Definition of technical communication, Aspects of technical communication, forms of technical communication, importance of technical communication, technical communication skills (Listening, speaking, writing, reading writing), linguistic ability, style in technical communication.	4
2	**Comprehension of Technical Materials/Texts and Information Design & development-** Reading of technical texts, Readingand comprehending instructions and technical manuals, Interpreting and summarizing technical texts, Note-making. Introduction of different kinds of technical documents, Information collection, factors affecting information and document design, Strategies for organization, Information design and writing for print and online media.	6
3	**Technical Writing, Grammar and Editing**- Technical writing process, forms of technical discourse, Writing, drafts and revising, Basics of grammar, common error in writing and speaking, Study of advanced grammar, Editing strategies to achieve appropriate technical style, Introduction to advanced technical communication. Planning, drafting and writing Official Notes, Letters, E-mail, Resume, Job Application, Minutes of Meetings.	8
4	**Advanced Technical Writing**- Technical Reports, types of technical reports, Characteristics and formats and structure of technical reports. Technical Project Proposals, types of technical proposals, Characteristics and formats and structure of technical proposals. Technical Articles, types of technical articles, Writing strategies, structure and formats of technical articles.	8
	Total	26

Office of Dean Academic Affairs
Rajasthan Technical University, Kota

3AN1-03/ 4AN1-03: Managerial Economics and Financial Accounting

Credit: 2 **Max. Marks: 100 (IA:20, ETE:80)**
2L+0T+0P **End Term Exam: 2 Hours**

SN		Hours
1	**Basic Economic Concepts:** Meaning, nature and scope of economics, deductive vs inductive methods, static and dynamics, Economic problems: scarcity and choice, circular flow of economic activity, national income – concepts and measurement.	4
2	**Demand and Supply analysis:** Demand-types of demand, determinants of demand, demand function, elasticity of demand, demand forecasting –purpose, determinants and methods, Supply-determinants of supply, supply function, elasticity of supply.	5
3	**Production and Cost analysis:** Theory of production-production function, law of variable proportions, laws of returns to scale, production optimization, least cost combination of inputs, isoquants. Cost concepts-explicit and implicit cost, fixed and variable cost, opportunity cost, sunk costs, cost function, cost curves, cost and output decisions, cost estimation.	5
4	**Market structure and pricing theory**: Perfect competition, Monopoly, Monopolistic competition, Oligopoly.	4
5	**Financial statement analysis:** Balance sheet and related concepts, profit and loss statement and related concepts, financial ratio analysis, cash-flow analysis, funds-flow analysis, comparative financial statement, analysis and interpretation of financial statements, capital budgeting techniques.	8
	Total	26

3AN3-03: Engineering Thermodynamics

Credit: 3 **Max. Marks: 150 (IA:30, ETE:120)**
2L+1T+0P **End Term Exam: 3 Hours**

SN		Hours
1	**Fundamentals**: System &control volume; Property, state &process; Exact &inexact differentials; Thermodynamic definition of work, displacement work, electrical, magnetic, gravitational, spring and shaft work.	4
2	**Zeroth and First Law of Thermodynamics:** Definition of thermal equilibrium and Zeroth law, temperature scales; Definition of heat; Concept of total energy; First law for cyclic & non-cyclic processes; Internal energy and Enthalpy.	6
3	**First Law for Flow Processes**: Derivation of general energy equation for a control volume; Steady state steady flow processes including throttling; Examples of steady flow devices; Unsteady processes.	4
4	**Second law**: Definitions of direct and reverse heat engines; Definitions of thermal efficiency and COP; Kelvin-Planck and Clausius statements; Definition of reversible process; Internal and external irreversibility; Carnot cycle; Absolute temperature scale.	4
5	**Entropy and Exergy:** Clausius inequality; Definition of entropy; Determination of entropy from steam tables; Principle of increase of entropy; Definition of Isentropic efficiency for compressors, turbines and nozzles, irreversibility and availability, availability function for systems and control volumes undergoing different processes; Second law analysis for control volume; Exergy balance equation and exergy analysis.	5
6	**Thermodynamic cycles**: Basic Rankine cycle; Basic Brayton cycle; Basic vapor compression cycle and comparison with Carnot cycle.	2
	Total	25

Office of Dean Academic Affairs
Rajasthan Technical University, Kota

3AN4-04: Incompressible Fluid Mechanics

Credit: 4 **Max. Marks: 200 (IA:40, ETE:160)**
3L+1T+0P **End Term Exam: 3 Hours**

SN		Hours
1	**Fluid Properties:** Concept of fluid and flow. Continuum hypothesis. Definition of fundamental quantities. Newtonian and non-Newtonian fluids.	3
2	**Fluid Statics**: Pascal's law; Hydrostatic equation; Buoyancy.	4
3	**Fluid Kinematics**: Eulerian and Lagrangian description of fluid flow; System and control volume concept; Stream, streak and path line; Conservation of mass in a control volume, differential equation of continuity; Fluid element rotation and vorticity.	4
4	**Fluid Dynamics**: Linear and angular momentum conservation equation in integral form; Euler's equation; Bernoulli's equation; Conservation of energy, applications through flow measuring devices.	7
5	**Viscous Flow**: Flow regimes and Reynolds number; Relationship between shear stress and strain rate; Navier-Stokes equation, Hagen-Poiseuille flow.	7
6	**Introduction to Turbulent Flow**: Reynolds experiment, laminar to turbulent transition; Reynolds decomposition; Shear stress in turbulent flow, eddy viscosity; Flow in hydraulically smooth and rough pipes.	5
7	**Boundary Layer**: Boundary layer concept; Displacement, momentum and energy thickness; Laminar and turbulent boundary layer flows, Boundary layer separation and control, streamlined and bluff bodies.	5
8	**Dimensional Analysis**: Fundamental and derived units and dimensions; Dimensional homogeneity; Dimensional analysis using Rayleigh method & Buckingham-Π theorem; Significance of dimensionless group; Geometric, kinematic and dynamic similarity, model testing; Derivations and applications of important dimensionless numbers.	5
	Total	40

Office of Dean Academic Affairs
Rajasthan Technical University, Kota

3AN4-05: Introduction to Aeronautics

Credit: 2 **Max. Marks: 100 (IA:20, ETE:80)**

2L+0T+0P **End Term Exam: 2 Hours**

SN		Hours
1	**History of aviation:** Brief history of flight vehicle development with emphasis on key ideas; Indian aerospace activities; Different types of flight vehicles.	5
2	**Aerodynamics:** Introduction to principle of flight; Airfoil, airfoil geometry, centre of pressure and aerodynamic centre, NACA airfoil series; Wings, wing planform and orientation, flow over finite wing; Propagation of sound, different flight regimes, critical & drag divergence Mach number, wave drag, swept wing, delta wing; Types of drag, methods to reduce drag	6
3	**Aerospace structures:** Basic function of aircraft structure; Aircraft configuration and principle types of construction; Details of constructional features of conventional aircraft; Use of metallic, non-metallic and composite materials; Introduction to landing gears.	4
4	**Aerospace Propulsion:** Fundamental gas turbine cycle and propulsion techniques; Mechanism of thrust production in propellers and jet engines, comparative merits; Different types of aircraft engines; Principles of operation of rocket.	5
5	**Flight Mechanics:** Forces and moments on airplane; Significance of L/D ratio; Aircraft Drag Polar; High lift devices; Concepts of stability & control; Primary and secondary control surfaces; Basic maneuvers.	5
	Total	25

3AN4-06: Mechanics of Solids

Credit: 3 **Max. Marks: 150 (IA:30, ETE:120)**
3L+0T+0P **End Term Exam: 3 Hours**

SN		Hours
1	**Introduction:** Concept of Stress, stress components under axial loading; Concept of strain, normal strain under axial loading; Stress-strain diagrams; Hooke's law for 2D and 3D cases; Modulus of elasticity, Poisson's ratio, bulk modulus, modulus of rigidity, shearing strain; Thermal stresses.	7
2	**Transformation of Stress and Strain:** Principal stresses, maximum shearing stress; Mohr's circle for stress and strain.	5
3	**Stresses in Beams:** Shear force and bending moment diagrams for simply supported and cantilever beams with concentrated, uniformly distributed and variable loads; Theory of pure bending; Bending stress variation in cross-section; Transverse shear stress and its distribution in different sections; Composite beam.	8
4	**Deflection of Beams:** Deflection in simply supported beams and cantilever with concentrated loads, uniformly distributed loads and their combination.	5
5	**Columns:** Buckling of columns, differential equation approach, energy approach, approximate techniques; Euler's formula for pin-ended columns and its extension to columns with other end conditions, concept of equivalent length; Rankine formula and other empirical relations.	8
6	**Torsion:** Deformation in a circular shaft, angle of twist; Stresses due to torsion; Torsion in composite shafts; Saint-Venant's theorem.	7
	Total	40

3AN4-21: Incompressible Fluid Mechanics Lab

Credit: 1 **Max. Marks: 50 (IA:30, ETE:20)**
0L+0T+2P

SN	
1	Determination of meta-centric height of a given body
2	Determination of C_d, C_v& C_c for given orifice
3	Calibration of contracted Rectangular Notch and Triangular Notch and determination of flow rate
4	Determination of velocity of water by Pitot tube
5	Verification of Bernoulli's theorem
6	Calibration and flow rate determination using venturimeter and orificemeter
7	Determination of head loss in given length of pipe
8	Determination of the Reynolds number for laminar, turbulent and transient flow in pipe
9	Determination of coefficient for minor losses in pipes
10	To study the velocity distribution in a pipe and also to compute the discharge by integrating the velocity profile
11	To study the boundary layer velocity profile over a flat plate and to determine the boundary layer thickness
12	Study of flow pattern using Hele-Shaw apparatus.

3AN4-22: Introduction to Aeronautics Lab

Credit: 1 **Max. Marks: 50 (IA:30, ETE:20)**
0L+0T+2P

SN	
1	Smoke visualization over cylinder and airfoil section to show boundary layer separation.
2	To acquaint with aircraft fuselage constructional details and types.
3	Study of fuselage structure i.e. Longerons, bulk head stringes etc.
4	To acquaint with aircraft wing constructional details and types.
5	To acquaint with aircraft primary control surfaces along with their locations on aircraft.
6	To acquaint with aircraft secondary flight control surfaces along with their locations on aircraft
7	Study of Piston engine and its components like; cylinder block, piston, camshaft, crank- shaft, piston rod, valves etc.
8	Study of Jet Engine and its components like inlet, compressors, combustion chambers, turbine exhaust cone etc.
9	To acquaint with different types of Jet Engine; Turbo-jet, Turbo-prop, Turbo-shaft etc.

3AN4-23: Mechanics of Solids Lab

Credit: 1 **Max. Marks: 50 (IA:30, ETE:20)**
0L+0T+2P

SN	
1	Introduction to Universal Testing Machine
2	Use of Izod Impact Tester to measure impact loads
3	Testing torsion load using Torsion Tester
4	Compression Calculation of hardness using Rockwell Hardness Tester
5	Calculation of hardness using Brinell hardness Tester
6	Calculation of hardness using Vickers Hardness Tester VM-50
7	Column testing for buckling
8	Tensile test
9	Testing
10	Shear testing.

3AN4-24: Object Oriented Programming Lab

Credit: 1.5 **Max. Marks: 75 (IA:45, ETE:30)**
0L+0T+3P

SN	
1	Use of functions, arrays, strings etc.
2	Use of nested loops in applications
3	Brief introduction to pointers and referencing
4	Defining class and objects; use of objects as function parameters; friend functions
5	Different types of inheritance
6	Constructors and destructors
7	Function and operator overloading
8	Introduction to algorithms such as searching algorithms (linear search and binary search) and sorting algorithms

3AN4-25: CAD Lab

Credit: 1.5 **Max. Marks: 75 (IA:45, ETE:30)**
0L+0T+3P

SN	
1	Introduction and different features of the CAD Software (AutoDesk Inventor/ Solid Works/ CATIA)
2	2-D Drafting
3	3-D Modelling
4	Assembly Modelling
5	Feature Modification and Manipulation
6	Detailing
7	Surface Modelling