

Syllabus of  
UNDERGRADUATE DEGREE COURSE

# Aeronautical Engineering



Rajasthan Technical University, Kota

Effective from session: 2018-19



# RAJASTHAN TECHNICAL UNIVERSITY, KOTA

## Syllabus

2<sup>nd</sup> Year - IV Semester: B.Tech. (Aeronautical Engineering)

### 4AN2-01: Data Analytics

**Credit: 2**  
**2L+0T+0P**

**Max. Marks: 100 (IA:20, ETE:80)**  
**End Term Exam: 2 Hours**

SN	Contents	Hours
1	<b>Introduction:</b> Objective, scope and outcome of the course.	1
2	<b>Descriptive and Inferential Statistics:</b> Introduction to the course, Descriptive statistics, Probability distributions, Inferential statistics, Inferential statistics through hypothesis tests, Permutation and randomization test.	4
3	<b>Regression and Machine Learning:</b> Regression, ANOVA (Analysis of Variance), Machine learning: Differentiating algorithmic and model based, frameworks, Regression: Ordinary least squares, Ridge regression, Lasso regression, K-Nearest neighbors, Regression & classification.	5
4	<b>Supervised Learning and Unsupervised Learning:</b> Bias-Variance, Dichotomy, Management, Ensemble methods: Random forest, Neural networks, Deep learning. Clustering, Associative rule mining, Challenges for big data analytics.	5
5	<b>Model Validation Approaches:</b> Logistic regression, Linear discriminant analysis, Quadratic discriminant analysis, Regression and classification trees, Support vector machines.	5
6	<b>Prescriptive Analytics:</b> Creating data for analytics through designed experiments, Active learning, Reinforcement learning.	5
<b>Total</b>		<b>25</b>



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

Credit: 2  
2L+0T+0P

Max. Marks: 100 (IA:20, ETE:80)  
End Term Exam: 2 Hours

SN	Contents	Hours
1	<b>Introduction:</b> Objective, scope and outcome of the course.	1
2	<b>Basic Economic Concepts:</b> 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.	3
3	<b>Demand and Supply analysis:</b> 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
4	<b>Production and Cost analysis:</b> 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
5	<b>Market structure and pricing theory:</b> Perfect competition, Monopoly, Monopolistic competition, Oligopoly.	4
6	<b>Financial statement analysis:</b> 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
<b>Total</b>		<b>26</b>

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2<sup>nd</sup> Year - IV Semester: B.Tech. (Aeronautical Engineering)

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

Credit: 2  
2L+0T+0P

Max. Marks: 100 (IA:20, ETE:80)  
End Term Exam: 2 Hours

SN	Contents	Hours
1	<b>Introduction:</b> Objective, scope and outcome of the course.	1
2	<b>Introduction to Technical Communication-</b> 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.	3
3	<b>Comprehension of Technical Materials/Texts and Information Design &amp; development-</b> Reading of technical texts, Reading and 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
4	<b>Technical Writing, Grammar and Editing-</b> 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
5	<b>Advanced Technical Writing-</b> 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
<b>Total</b>		<b>26</b>

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2<sup>nd</sup> Year - IV Semester: B.Tech. (Aeronautical Engineering)

### 4AN3-03: Introduction to Digital Electronics

Credit: 2  
2L+0T+0P

Max. Marks: 100 (IA:20, ETE:80)  
End Term Exam: 2 Hours

SN	Contents	Hours
1	<b>Introduction:</b> Objective, scope and outcome of the course.	1
2	<b>Introduction:</b> Flight instruments, cockpit layouts; Number systems: decimal, binary, octal, hexadecimal, standard code.	3
3	<b>Data Conversion and Buses:</b> Analog to digital, digital to analog conversion; Bus system, ARINC 429, bus standards.	4
4	<b>Logic Circuits:</b> Logic circuit, Boolean algebra, combinational, tri state, mono stable, bi-stable, logic families.	5
5	<b>Computer System:</b> Computer system, data representation, data storage, program and software, backplane bus system, example of aircraft computer system.	5
6	<b>Integrated Circuits and MSI logic:</b> scale of integration, fabrication, packaging and pin numbering, fan -in and fan-out, coding system, decodes, encodes, multiplexers.	5
7	<b>Large Scale Logic System and VHDL:</b> Hardware description language, entity declaration, behavioral declaration, VHDL design flow, program structure, signal mode and type, operators, simulations and test bench, timing.	5
<b>Total</b>		<b>28</b>



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2<sup>nd</sup> Year - IV Semester: B.Tech. (Aeronautical Engineering)

### 4AN4-04: Gas Dynamics

Credit: 4  
3L+1T+0P

Max. Marks: 200 (IA:40, ETE:160)  
End Term Exam: 3 Hours

SN	Contents	Hours
1	<b>Introduction:</b> Objective, scope and outcome of the course.	1
2	<b>Basic Concepts:</b> Compressibility; Laws of thermodynamics, perfect gas, internal energy, enthalpy, entropy; Mach number; Governing equations for compressible flows	5
3	<b>Steady One-Dimensional Isentropic Flow:</b> Continuity, momentum and energy conservation equations; Stagnation temperature and pressure; Expression for speed of sound; Characteristics speeds of gas dynamics, dynamic pressure and pressure coefficients; Normal shock waves, Rankine-Hugoniot equations, Rayleigh flow, Fanno flow	10
4	<b>Quasi-one dimensional flows:</b> Governing equations; Area-velocity relations; Isentropic flow through variable-area ducts, convergent-divergent (or De Laval) nozzles, over-expanded and under-expanded nozzles, diffusers	9
5	<b>Two-dimensional flows:</b> Oblique shock wave and its governing equations, $\theta$ -B-M relations, Supersonic flow over wedges and cones, Mach line, attached and detached shock; Expansion waves, Prandtl-Meyer flow and its governing equations, Supersonic flow over convex and concave corners	10
6	<b>Unsteady wave motions:</b> Physical features of wave propagation; Moving normal shock waves, reflected shock waves, Incident and reflected expansion waves.	5
<b>Total</b>		<b>40</b>



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### 4AN4-05: Aircraft Structures-I

**Credit: 4**  
**3L+1T+0P**

**Max. Marks: 200 (IA:40, ETE:160)**  
**End Term Exam: 3 Hours**

SN	Contents	Hours
1	<b>Introduction:</b> Objective, scope and outcome of the course.	1
2	<b>Introduction:</b> Features of aircraft structures, monocoque and semi-monocoque structures, idealization, nomenclature & layout, functions; Static equilibrium, statically determinate and indeterminate structures.	6
3	<b>Statically Determinate Structures:</b> Analysis of framed structures; Planar truss analysis.	5
4	<b>Statically Indeterminate Structures:</b> Degree of indeterminacy; Fixed beams– bending & tension, composite beam, stress resultants, modulus weighted section properties; Clapeyron's three moment equation method	6
5	<b>Deformations due to loading:</b> Differential equation of the elastic curve due to composite loading; Macaulay's method; Principle of superposition	7
6	<b>Energy Methods:</b> Work and energy principles, strain energy and complementary strain energy; Principal of virtual work, Principal of virtual displacement; Maxwell's Reciprocal theorem; Potential and complementary potential theorems; Castigliano's theorem, unit load method, application of energy principles in analysis of determinate and indeterminate structures	10
7	<b>Failure Theories:</b> Maximum principle stress theory; Maximum principle strain theory; Distortion Theory; Maximum strain energy theory; Octahedral shear stress theory; Fatigue; Creep; Application to aircraft structural problems	5
<b>Total</b>		<b>40</b>





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### 4AN4-06: Aircraft Materials and Processes

Credit: 3  
3L+0T+0P

Max. Marks: 150 (IA:30, ETE:120)  
End Term Exam: 3 Hours

SN	Contents	Hours
1	<b>Introduction:</b> Objective, scope and outcome of the course.	1
2	<b>Elements of Aerospace Materials:</b> Structure, Requirements of materials for aerospace applications, Properties of materials, Environmental degradation and protective coatings, Mechanical behaviour of materials: Linear and non-linear elastic properties, Bauchinger's effect, Notch effect, Creep and fatigue, Comparative study of metals.	7
3	<b>Ceramics and Composites:</b> Powder metallurgy, Modern ceramic materials, Cutting tools, Metal matrix composites, Polymer based composites, Ceramic based composites, Carbon-carbon composites, Shape memory alloys, Applications in aircraft design.	7
4	<b>Corrosion and High Temperature Materials Characterization:</b> Types of corrosion, Effect of corrosion on mechanical properties, Corrosion resistance materials, Production and characteristics, Methods and testing, Determination of mechanical and thermal properties of materials at elevated temperatures, Application in thermal protection systems of aircraft.	10
5	<b>Conventional Manufacturing processes:</b> Casting and Moulding, Introduction to bulk and sheet metal forming, Fundamentals of hot and cold working processes, Metal cutting: turning, drilling, milling and finishing processes, Introduction to CNC machining, Rapid prototyping, Joining/fastening processes, Physics of welding, brazing and soldering.	8
6	<b>Unconventional Machining Processes:</b> Abrasive jet machining, Water jet machining, Ultrasonic machining, Electrical discharge machining, Electro chemical machining, Laser beam machining, Plasma arc machining and Electron beam machining.	7
<b>Total</b>		<b>40</b>

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### 4AN4-21: Gas Dynamics Lab

**Credit: 1**  
**OL+OT+2P**

**Max. Marks: 50 (IA:30, ETE:20)**

SN	
1	Study of components of supersonic wind tunnel and its calibration
2	Measurement of nozzle wall static pressure at varying total pressures
3	Force measurement on models using strain guage balance
4	Visualization of shocks using Schlieren and Shadowgraph techniques
5	Pressure measurement using ESP sensors
6	Characterization of subsonic and supersonic jets
7	Study of effect of flow controls in enhancing jet mixing



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### 4AN4-22: Manufacturing Processes Lab

**Credit: 1.5**  
**OL+OT+3P**

**Max. Marks: 75 (IA:45, ETE:30)**

SN	
1	Lathe machine: Step turning, Taper turning, Eccentric turning, Grooving, Drilling.
2	External threading, Gear hobbing: Helical gear.
3	Milling: Polygon/Spur gear
4	Drilling, reaming, counter boring
5	Shaping-V-Block
6	Grinding-Cylindrical/Surface/Tool.
7	Planning/Capstan lathe/Burnishing process.
8	Machining operations applied in typical engineering/aerospace applications.
9	CNC simulation training, CNC machine tool exercises.
10	Metal forming practice: welding exercises, NDT of weld joints.

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### 4AN4-23: Programming with MATLAB

**Credit: 2**  
**OL+OT+4P**

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

SN	
1	Basics of MATLAB computer programming
2	Use of formulae and inbuilt functions
3	MATLAB scripts and functions (m-files)
4	Loops and nested loops
5	Array, vector and matrices
6	Plotting functions and vector plots
7	Solving differential equations using MATLAB
8	Reading and writing data, file handling
9	Using MATLAB toolboxes
10	MATLAB graphic functions

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### 4AN4-24: Professional Communication Skills Lab

**Credit: 1.5**  
**OL+OT+3P**

**Max. Marks: 75 (IA:45, ETE:30)**

SN	
1	<b>Introduction:</b> Importance of communication, seven C's of effective communication; Barriers to communication and measures to overcome them.
2	<b>Language for Communication:</b> Language and communication; Essentials of good style, expressions and words to be avoided, grammar and usage.
3	<b>Oratory Skills:</b> Public speaking, voice modulation; Practice of appreciation, motivation, criticism
4	<b>Business Communication:</b> Writing business letters, structure and format of business letters and their features such as style, effectiveness, promptness; Email communication; Notice Agenda and Minutes of Meeting; Writing applications
5	<b>Presentation skills:</b> Importance of giving presentations, features of a good presentation; Strategies to give an effective presentation, analysing audience, organizing content and preparing an outline, use of visual aids such as handouts, transparencies and presentation software; Importance of body language.
6	<b>Technical report writing:</b> Differences between technical and literary style; Types of reports and different formats; Structure of report; Features of effective writing such as clarity, brevity, appropriate tone, balance etc.; Synopsis and thesis writing.
7	<b>Employment Communication:</b> Writing cover letter; Differences between bio-data, CV and resume, contents of good resume, guidelines for writing resume, different types of resumes; Group discussion skills, difference between group discussion and debate; Interview skills, manners and etiquettes to be maintained during an interview, sample questions commonly asked during interview

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