Syllabus of Aeronautical Engineering from 5th Semester to 8th Semester

B. Tech. (Fifth Semester) Aeronautical Engineering

Aerodynamics II

ARE-301E

L	T	P
3	1	-

Sessional : 50 Marks
Theory : 100 Marks
Total : 150 Marks
Duration of Exam. : 3 Hrs.

NOTE: In the semester examination, the paper setter will set 8 questions in all, at least two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.

UNIT-I

CONFORMAL TRANSFORMATION

Complex potential function, Blasius theorem, principles of conformal transformation, Kutta - Juokowaski transformation of a circle into flat plate, airfoils & ellipses.

INCOMPRESSIBLE FLOW OVER AIRFOILS

Glauert's thin airfoil theory, symmetrical airfoil, cambered airfoil, flapped airfoil, determination of mean camber line shapes for uniform & linear distribution of circulation. Description of flow about multi-element airfoils.

UNIT-II

INCOMPRESSIBLE FLOW OVER FINITE WINGS

Downwash & induced drag, Biot-Savart's law and Helmholtz's theorem, Prandtl's classical lifting line theory, fundamental equations. Elliptic and general lift distribution over finite unswept wings, effect of aspect ratio, Drag polar ,Correlation of Cl distribution over other aspect ratios, Lifting Surface theory, Formation Flying, Ground effect.

UNIT-III

COMPUTATIONAL AERODYNAMICS OF AIRFOILS AND WINGS

Computation of flow field due to distribution of source doublet and line and horse shoe vortices, vortex lattic method,wing as a planar surface covered with HSVs.

UNIT-IV

DELTA WING AERODYNAMICS

Polhamus theory, leading edge suction analogy, calculations of lift coefficient, flow field, aspect ratio effect, leading edge extension, HAA aerodynamics

Unit-VI COMPRESSIBLE SUBSONIC FLOWS OVER AIRFOILS

The derivation of velocity potential equation. Linearization , Prandtl-Glauert compressibility correction. Karman –Tsien correction, Critical Mach number, Whitcomb's area rule, Super critical airfoil.

TEXT BOOKS:

1. Fundamentals of Aerodynamics : John D.Anderson,2nd Ed. McGrawHill,1991
2. Aerodynamics for Engineers : Bertin and Smith,Prentice Hall,1989

REFERENCES:

1 Aerodynamics for engineering students ; Houghten EL & Brock AE

B. Tech. (Fifth Semester) Aeronautical Engineering

Aircraft Structures-II

ARE 303 E

L	T	P/D	Total	
				Sessional : 50 Marks
				Theory : 100Marks
3	1	-	4	Total : 150 Marks
				Duration of Exam: 03 hours

NOTE: In the semester examination, the paper setter will set 8 questions in all, at least two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.

UNIT I

UNSYMMETRICAL BENDING

Bending stresses in beams of unsymmetrical sections – Bending of symmetric sections with skew loads.

SHEAR FLOW IN OPEN SECTIONS

Thin walled beams, Concept of shear flow, shear centre, Elastic axis. With one axis of symmetry, with wall effective and ineffective in bending, unsymmetrical beam sections.

UNIT II

SHEAR FLOW IN CLOSED SECTIONS

Bredt – Batho formula, Single and multi – cell structures. Approximate methods. Shear flow in single & multicell structures under torsion. Shear flow in single and multicell under bending with walls effective and ineffective**.**

UNIT III

BUCKLING OF PLATES

Rectangular sheets under compression, Local buckling stress of thin walled sections, Crippling stresses by Needham's and Gerard's methods, Thin walled column strength. Sheet stiffener panels. Effective width, inter rivet and sheet wrinkling failures.

UNIT IV

STRESS ANALYSIS IN WING AND FUSELAGE

Procedure – Shear and bending moment distribution for semi cantilever and other types of wings and fuselage, thin webbed beam. With parallel and non parallel flanges, Shear resistant web beams, Tension field web beams (Wagner's).

Text books:

1. Megson, T.M.G., "Aircraft Structures for Engineering Students", Edward Arnold, 1995.
2. Perry, D.J., and Azar, J.J., "Aircraft Structures", 2nd edition, McGraw–Hill, N.Y., 1993.

Reference books

1. Rivello, R.M., "Theory and Analysis of Flight Structures", McGraw-Hill, 1993
2. Bruhn. E.H. "Analysis and Design of Flight vehicles Structures", Tri – state off set company, USA, 1985.

B. Tech. (Fifth Semester) Aeronautical Engineering
Aircraft Materials and Manufacturing Processes

ARE 305 E

L	T	P/D	Total		
				Sessional	: 50 Marks
				Theory	: 100 marks
3	1	-	4	Total	: 150 Marks
				Duration of Exam: 03 hours	

NOTE: In the semester examination, the paper setter will set 8 questions in all, at least two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.

UNIT1

Introduction

Properties of flight vehicle materials, Importance of strength/weight ratio of materials for Aerospace Vehicles: Structures, Importance of temperature variations, factors affecting choice of material for different parts of airplane.

Metallurgy

Alloying Theory, Binary diagrams, iron-carbon diagram, Aluminum-copper diagram, structure- property correlation, General Characteristics of Metallic Materials- Stress- strain curve, fatigue, creep, corrosion and prevention, Surface hardening of metals, weld ability, formability & machineability.

UNIT 2

Aircraft Steels

Classification of alloy steels, Effect of alloying elements, Carbon steels v/s Alloys steels, corrosion resistant steels, Heat treatment, Corrosion prevention methods, Selection and application of steel alloys to aircraft manufacture

Light Metal Alloys

Aluminum alloys, Heat treatment, High strength and high corrosion resistant alloys, Magnesium alloys and their properties, Heat treatment. Application to Aerospace Vehicle of these alloys.

UNIT 3

High Strength and Heat Resistant Alloys

Classification of heat resistant materials and iron, Nickel and cobalt base alloys, Refractory materials:Ceramics, Titanium and its alloys, properties of Inconel, Monal and K-Monal, Nimonic and super alloys: Application to Aerospace vehicles.Transparent Materials, plastic, Rubber,Synthetic Rubber wood, Fabrics.

UNIT 4

COMPOSITE MATERIALS:

Definition-Advantages and Disadvantages-Materials and its Compositions-Types of Moulding-HoneyComb Design –Nomex-Curing Processes-Pre-peg-Vacuum Bagging.

Aircraft Manufacturing Processes

Profiling, Hydro forming, mar forming bending rolls, Spar milling, Spark erosion and Powdered metal parts, integral machining, Contour etching, High energy rate forming, Manufacturing of honeycomb structures, General methods of construction of aircraft and aero engine parts.

Text Books:

1. G.F.Titterton, "Aircraft Materials and Processes", Himalayan Books, New Delhi
2. Cindy Foreman-Advanced Composites-Jeppessen Ltd.

References

1. Chapman WAJ, "Workshop Technology", Vol. I, II, III.
3. G.B.Ashmead, "Aircraft Production Methods". :

4. Lalit Gupta, "Advanced Composite Matertials", Himalayan Books, New Delhi, 1998

Note: Eight questions are to be set two questions from unit-1, 2 & 4 and one from unit-3 & 5. Students have two attempt five questions.

B. Tech. (Fifth Semester) Aeronautical Engineering

Elements of Aeronautics

ARE 307 E

L	T	P/D	Total		
				Sessional	: 50 Marks
				Theory	: 100 marks
3	1	-	4	Total	: 150 Marks
				Duration of Exam: 03 hours	

NOTE: In the semester examination, the paper setter will set 8 questions in all, at least two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.

UNIT-I

HISTORICAL AIRCRAFT DESIGN EVALUATION

Early airplanes, biplanes and monoplanes, Developments in aerodynamics, materials, structures and propulsion over the years. 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-II

INTRODUCTION TO PRINCIPLES OF FLIGHT

Physical properties and structure of the atmosphere, Temperature, pressure and altitude relationships, Evolution of lift, drag and moment. Aerofoils, Mach number, Maneuvers.

UNIT-III

INTRODUCTION TO AIRPLANE STRUCTURES AND MATERIALS

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-IV

POWER PLANTS USED IN AIRPLANES

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.

Text Books:

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

REFERENCES:

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

B. Tech. (Fifth Semester) Aeronautical Engineering

Microprocessor and Interfacing

ECE 311 E

L	T	P/D	Total		
				Sessional	: 50 Marks
				Theory	: 100 marks
4	1	-	5	Total	: 150 Marks
				Duration of Exam: 03 hours	

NOTE: In the semester examination, the paper setter will set 8 questions in all, at least two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.

UNIT-I

INTRODUCTION : Evolution of microprocessors, technological trends in microprocessor development. The Intel family tree. CISC Versus RISC. Applications of Microprocessors. 8086 CPU ARCHITECTURE : 8086 Block diagram; description of data registers, address registers; pointer and index registers, PSW, Queue, BIU and EU. 8086 Pin diagram descriptions. Generating 8086 CLK and reset signals using 8284. WAIT state generation. Microprocessor BUS types and buffering techniques, 8086 minimum mode and maximum mode CPU module.

UNIT-II

8086 INSTRUCTION SET : Instruction formats, addressing modes, Data transfer instructions, string instructions, logical instructions, arithmetic instructions, transfer of control instructions; process control instructions; Assembler directives. 8086 PROGRAMMING TECHNIQUES : Writing assembly Language programs for logical processing, arithmetic processing, timing delays; loops, data conversions. Writing procedures; Data tables, modular programming. Macros.

UNIT-III

MAIN MEMORY SYSTEM DESIGN : Memory devices, 8086 CPU Read/Write timing diagrams in minimum mode and maximum mode. Address decoding techniques. Interfacing SRAMS; ROMS/PROMS. Interfacing and refreshing DRAMS. DRAM Controller – TMS4500.

UNIT-IV

BASIC I/O INTERFACE : Parallel and Serial I/O Port design and address decoding. Memory mapped I/O Vs Isolated I/O Intel's 8255 and 8251- description and interfacing with 8086. ADCs and DACs, - types, operation and interfacing with 8086. Interfacing Keyboards, alphanumeric displays, multiplexed displays, and high power devices with 8086. INTERRRUPTS AND DMA : Interrupt driven I/O. 8086 Interrupt mechanism; interrupt types and interrupt vector table. Intel's 8259. DMA operation. Intel's 8237. Microcomputer video displays.

Text Books:

1. D.V.Hall , Microprocessors and Interfacing , McGraw Hill 2nd ed.
2. J Uffenbeck , The 8086/8088 family , (PHI).
3. Liu,Gibson , Microcomputer Systems – The 8086/8088 family, (2nd Ed-PHI).

B. Tech. (Fifth Semester) Aeronautical Engineering

Propulsion-I

ARE 309E

L	T	P/D	Total		
				Sessional	: 50 Marks
				Theory	: 100 Marks
3	1	-	4	Total	:150 Marks
				Duration of Exam: 03 hours	

NOTE: In the semester examination, the paper setter will set 8 questions in all, at least two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.

UNIT-I

FUNDAMENTALS OF GAS TURBINE ENGINES

Illustration of working of gas turbine engine – The thrust equation – Factors affecting thrust – Effect of pressure, velocity and temperature changes of air entering compressor – Methods of thrust augmentation – Characteristics of turboprop, turbofan and turbojet – Performance characteristics.

SUBSONIC AND SUPERSONIC INLETS FOR JET ENGINES

Internal flow and Stall in subsonic inlets – Boundary layer separation – Major features of external flow near a subsonic inlet – Relation between minimum area ratio and eternal deceleration ratio – Diffuser performance – Supersonic inlets – Starting problem on supersonic inlets – Shock swallowing by area variation – External declaration – Models of inlet operation.

UNIT-II

COMPRESSORS

Principle of operation of centrifugal compressor – Work done and pressure rise – Velocity diagrams – Diffuser vane design considerations – Concept of prewhirl – Rotation stall – Elementary theory of axial flow compressor – Velocity triangles – degree of reaction – Three dimensional – Air angle distributions for free vortex and constant reaction designs – Compressor blade design – Centrifugal and Axial compressor performance characteristics.

UNIT-III

COMBUSTION CHAMBERS

Classification of combustion chambers – Important factors affecting combustion chamber design – Combustion process – Combustion chamber performance – Effect of operating variables on performance – Flame tube cooling – Flame stabilization – Use of flame holders – Numerical problems.

UNIT-IV

NOZZLES

Theory of flow in isentropic nozzles – Convergent nozzles and nozzle choking – Nozzle throat conditions – Nozzle efficiency – Losses in nozzles – Over expanded and under – expanded nozzles – Ejector and variable area nozzles – Interaction of nozzle flow with adjacent surfaces – Thrust reversal

PROPELLERS

Types-uses-Aerodynamics forces acting,, selection of propellers, fixed, variable and constant speed pro pellers, prop-fan, material for propellers, shrouded propellers helicopter ,rotor in hovering performance.

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Text Books:

1. Cohen, H. Rogers, G.F.C. and Saravanamuttoo, H.I.H. "Gas Turbine Theory", Longman, 1989.
2. Oates, G.C., "Aero thermodynamics of Aircraft Engine Components", AIAA Education Series, New York, 1985.
3. "Rolls Royce Jet Engine" – Third Edition – 1983.
4. Mathur, M.L. and Sharma, R.P., "Gas Turbine, Jet and Rocket Propulsion", Standard Publishers & Distributors, Delhi, 1999.

B. Tech. (Fifth Semester) Aeronautical Engineering
Practical Training Report
ARE 309 E

P/D	Total	
-	-	**Sessional : 50 marks**
		Duration of Exams. : 03 hours

Student will submit summer training (about 8 weeks' industrial training) report for his/her assessment.

B. Tech. (Fifth Semester) Aeronautical Engineering
Propulsion Lab
ARE- 313E

L T P
0 0 3

Sessional: 25 Marks
Practical: 25 Marks
Total: 50 Marks
Duration of Exam: 3 Hrs

List of Experiments:

1. Study the constructional details of axial flow compressor
2. Study the constructional details of centrifugal compressor
3. Study of accessory gear box and its construction
4. Study the constructional details of main fuel pump
5. Study the constructional details of combustion chamber
6. Study the constructional details of after burning system
7. Study the constructional details of piston engines
8. Study the functioning of complete jet engine
9. Study the constructional details of propellers

Note: At least Eight Experiments should be performed. Out of that Two Experiments may be performed or designed and set by the concerned institute as per the scope of the syllabus.

B. Tech. (Fifth semester) Aeronautical Engineering
Cad Cam Lab
ARE 315 E

L	T	P/D	Total	
-	-	2	2	Sessional: 25 Marks Practical: 25 marks Duration of Exam: 03 hours

List of Experiments

LIST OF EXPERIMENTS

1. Scaling, rotation, translation, editing, dimensioning – Typical CAD command structure.
2. Wire frame modeling – surface modeling
3. Solid Modeling
4. Taper Turning – Straight Interpolation
5. Taper Turning – Circular Interpolation
6. Incremental programme G 90 operation.
7. Mirroring.
8. Incremental Programme G 91 operation
9. Absolute Programme G 90 operation
10. Absolute Programme G 91 operation.

Note: At least Eight Experiments should be performed. Out of that Two Experiments may be performed or designed and set by the concerned institute as per the scope of the syllabus.

B. Tech. (Sixth Semester) Aeronautical Engineering

Aircraft Engineering Practices

ARE 302 E

L	T	P/D	Total		
				Sessional	: 50 Marks
				Theory	: 100 marks
3	1	-	4	Total	: 150 Marks
				Duration of Exam: 03 hours	

NOTE: In the semester examination, the paper setter will set 8 questions in all, at least two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.

UNIT 1

Mooring, jacking, leveling and towing operations - Preparation - Equipment and precautions - Engine starting procedures - Piston engine, turboprops and turbojets - Engine fire extinguishing - Ground power units.

UNIT 2

Air conditioning and pressurization - Oxygen and oil systems - Ground units and their maintenance. Shop safety - Environmental cleanliness - Precautions. Process - Purpose - Types - Inspection intervals - Techniques - Checklist - Special inspection - Publications,

Bulletins, various manuals - FAR Air worthiness directives - Type certificate Data Sheets - ATA specifications.

UNIT 3

Hand tools - Precision instruments - Special tools and equipments in an airplane maintenance shop - Identification terminology - Specification and correct use of various aircraft hardware (i.e. nuts, bolts, rivets, screws, etc.) - American and British systems of specifications - Threads, gears, bearings, etc. - Drills, tapes & reamers - identification of all types of fluid line fittings. Materials, metallic and non-metallic.

UNIT 4

PLUMBING CONNECTORS:

Cables - Swaging procedures, tests, Advantages of swaging over splicing.

References:

1. KROES WATKINS DELP. “Aircraft Maintenance and Repair ", McGraw Hill, New York 1993.

2. A & P MECHANICS, “Aircraft hand Book - F.A.A. Himalayan Book House ", New Delhi, 1996.

3. A & P MECHANICS, “General hand Book - F.A.A. Himalayan Book House ", New Delhi, 1996.

4. ATA SPECFICATIONS - F.A.A. Himalayan Book House ", New Delhi, 1996

B. Tech. (Sixth Semester) Aeronautical Engineering

Propulsion-II

ARE 304 E

L	T	P/D	Total		
				Sessional	: 50 Marks
				Theory	: 100 marks
3	1	-	4	Total	: 150 Marks
				Duration of Exam: 03 hours	

NOTE: In the semester examination, the paper setter will set 8 questions in all, at least two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.

UNIT-I

AIRCRAFT GAS TURBINES

Impulse and reaction blading of gas turbines – Velocity triangles and power output – Elementary theory – Vortex theory – Choice of blade profile, pitch and chord – Estimation of stage performance – Limiting factors in gas turbine design- Overall turbine performance – Methods of blade cooling – Matching of turbine and compressor.

RAMJET PROPULSION:

Operating principle – Sub critical, critical and supercritical operation – Combustion in ramjet engine – Ramjet performance – Sample ramjet design calculations – Introduction to scramjet – Preliminary concepts in supersonic combustion – Integral ram- rocket

UNIT-II

FUNDAMENTALS OF ROCKET PROPULSION

Operating principle – Specific impulse of a rocket – internal ballistics- Rocket nozzle classification – Rocket performance considerations

UNIT-III

CHEMICAL ROCKETS

Solid propellant rockets – Selection criteria of solid propellants – Important hardware components of solid rockets – Propellant grain design considerations – Liquid propellant rockets – Selection of liquid propellants – Thrust control in liquid rockets – Cooling in liquid rockets – Limitations of hybrid rockets – Relative advantages of liquid rockets over solid rockets.

UNIT-IV

ADVANTAGES OF PROPULSION TECHNIQUES

Electric rocket propulsion – Ion propulsion techniques – Nuclear rocket – Types – Solar sail- Preliminary Concepts in nozzleless propulsion**.**

TEXT BOOKS:

11. 1. Cohen, H., Rogers, G.F.C. and Saravanamuttoo, H.I.H., "Gas Turbine Theory", Longman Co., ELBS Ed., 1989.

2. Aircraft Gas Turbine Engine Technology – Treager, IRWIN E

REFERENCE:

1. Jet Aircraft power systems: Casamassa JV & Bent

B. Tech. (Sixth Semester) Aeronautical Engineering
Airplane Stability and Controls

ARE-306E

			Sessional	:	50 Marks
L	T	P	Theory	:	100 Marks
3	1	-	Total	:	150 Marks
			Duration of Exam.	:	3 Hrs.

NOTE: In the semester examination, the paper setter will set 8 questions in all, at least two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.

UNIT-1

Stick Fixed Static Longitudinal Stability Introduction to stability of airplane, stick fixed longitudinal stability, effect of power, Neutral point, Centre of gravity limits. In flight measurement of stick fixed neutral point.

Control Surfaces And Aerodynamic Balancing Control surface hinge moments, floating and restoring tendencies, different types of tabs used on airplanes. Frise Aileron, Spoiler Controls.

UNIT-2

Stick Free Static Longitudinal Stability Effect of free elevator on airplane stability, Elevator Control force, stick force gradients, Neutral point, Controls free center of gravity limit. In flight measurement of stick free neutral point.

Maneuvering Flight) Effect of acceleration on airplane balancing, Elevator angle per g, and stick force per g, Maneuver margins.

UNIT-3

Directional Stability and Controls Assymetric flight, Weather cock stability, contribution of different parts of Airplane, Rudder Fixed and Rudder free static directional stability, rudder lock.

Lateral Stability and Control Dihedral Effect. Contribution of different. Parts of airplane controls in Roll, Aileron control power, cross coupling of lateral and directional effects.

UNIT-4

Dynamic Stability Introduction to dynamics, spring-mass system. Equations of motion without derivation, stability derivatives, Longitudinal Dynamic Stability, Lateral and Directional Dynamic Stability, analysis of different stability modes

Text Books:

1. Airplane Performance Stability and Control :Perkins And Hage, John Wiley, 1949

REFERENCES:

1. Dynamics of flight : Bernard Etkin, John Wiley 1989

B. Tech. (Sixth Semester) Aeronautical Engineering

Aircraft Systems

ARE 308 E

L	T	P/D	Total		
				Sessional	: 50 Marks
				Theory	: 100 marks
4	2	-	6	Total	: 150 Marks
				Duration of Exam: 03 hours	

NOTE: In the semester examination, the paper setter will set 8 questions in all, at least two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.

UNIT-1

Air conditioning and Cabin pressurization - Air Supply – Sources including engine bleed, APU and ground Cart - Air-conditioning System component layout, functioning of individual components & routine checks on the system - Distribution System - Flow temperature and humidity control

UNIT- 2.

Fire protection system - Fire and smoke detection and warning system, Fire Extinguishers system, Portable fire extinguisher type of Fire detectors, standard operating procedures for fire on ground.

UNIT-3

Fuel System – System layout , fuel tanks , supply system, dumping, venting and draining Indications and warning, functioning of various components, checks during routine servicing. Common problems in the system components

UNIT- 4

Hydraulic power – system layout, hydraulic reservoirs and accumulators, pressure Generation , pressure control, indication and warning system functioning of hydraulic pump. Checks on hydraulic oil, layout of hydraulic lab.

Unit-5. Ice protection system – Ice formation classification and detection, anti icing system, deicing system, working of system in general. Effect of ice formation on functioning on various system

.

Unit-6. Oxygen system – system layout, supply regulation, sources, storage charging and distribution. Indications and warning Engine oxygen system, procedures for carrying out oxygen leak check, precaution while working on oxygen system.

Text Books

Airframe and Power plant mechanics FAA 15A – Airframe hand book

Civil Aircraft Injection Procedure

REFERENCES

B. Tech. (Sixth Semester) Aeronautical Engineering

Aeroelasticity

ARE-310E

L	T	P
3	1	-

Sessional	:	50 Marks
Theory	:	100 Marks
Total	:	150 Marks
Duration of Exam.	:	3 Hrs.

Aircraft repair manual – Lary Rethmaier
Light Aircraft Inspection – J E Heywrod

NOTE: In the semester examination, the paper setter will set 8 questions in all, at least two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.

UNIT-1

Introduction

Definition and historical background, Static and dynamic aeroelastic phenomenon, integretion of aerodynamic, elastic and inertia forces, influence of aeroelstic phenomenon on air craft design, comparison of critical speeds.

UNIT-2

Divergence of Lifting Surface

The phenomenon of divergence, divergence of 2-D wing section, divergence of an idealized cantilever wing, solution based on semi-rigid assumptions, solution to generalized co-ordinates Method of successive approximation, use of Numerical Methods.

UNIT-3

Steady State Aero-Elasticity Problems in General

Loss and reversal of aileron Control: 2D case, aileron reversal general case. Lift distribution on a rigid and elastic wing. Effect on Static Longitudinal stability of airplane.

Introduction to Flutter and Buffeting

The phenomenon of flutter, flutter of a cantilever wing. Approximate determination of critical speed by Galerkin's Method, buffeting and stall flutter--an introduction

UNIT-4

Non Aeronautical Problems

Some typical example in civil engineering, Flow around an oscillating circular cylinder applications to H-shaped sections, Prevention of aero-elastic instabilities.

TEXT BOOK:

1. An introduction to the Theory Of Aeroelasticity : Y.C. Fung, Dover Publications 1st Ed.1967

REFERENCES:

1. Aeroelasticity : R.L Bisplinghoff Holt Ashley R.L Halfman Addison –Wesley Publishing Co. Reading Mass ,1st Ed,1965

B. Tech. (Sixth Semester) Aeronautical Engineering

Aircraft Communication and Navigational System

ARE-312E

L	T	P	Total		
4	1		5	Sessional	: 50 Marks
				Theory	: 100 Marks
				Total	: 150 Marks
				Duration of Exam: 3 Hrs.	

NOTE: In the semester examination, the paper setter will set 8 questions in all, at least two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.

UNIT-I

Information : Communication systems: signals, analogue, digital and coded forms, time and frequency representation, signal spectra, types of distortion Information : Nature and measure, influence of bandwidth and signal/noise ratio on channel capacity, elements of Shannon's theorem and its implications. Problems of communicating in presence of noise. Modulation : Amplitude, angle and phase modulations, single and vestigial sideband forms, demodulation, Superheterodyne principle, automatic gain and frequency control, typical circuit arrangements.

UNIT-II

Pulse modulation : sampling principles, sampling criterion, quantisation and quantisation noise, selection of number and distribution of quantisation levels, bandwidth requirements, examples of coding and decoding circuits.

Transmission : Transmission lines and their circuit representation, characteristic impedance, complex propagation constant, standing wave radio, matching and impedance charts. Channel Performance: Amplitude and phase distortion, phase and group delay distortion caused by multiple effects. Noise, origin, measurements, noise figure and noise temperature effect on channel performance. Frequency and time division multiplexing.

UNIT-III

Radiation : Principles: application of basic formulae for unipole and dipole, aerials, effective height, directional, properties, gain, impedance, linear arrays, traveling wave aerials, rhombicas, parasitic elements. Propagation : Principles: influence of ionosphere and troposphere reflection from earth's surface, field strength calculations, fading diversity reception.

UNIT-IV

Special Systems (Principles) : VHF, UHF, Fibre optics and Laser Technology, Satellite communication and related equipment, electronic counter measures, low-level TV and Head-down displays, CR T displays, Direction finding. Air borne telemetry systems. Laser and infrared systems, Air data and flight recording systems.
Satellite communication, spread spectrum technology: satellite transponders, earth terminals.

Text Books:

1. F E Terman, Radio Engineering, McGraw Hill
2. E C Jordon, Electromagnetic Waves and Radiating System, Prentice Hall
3. B P Lathi, Communications Systems, John Wiley and Sons

References:

1. Prasad, Antenna and Propagation
2. Schwattz Bennet MWR and Stein S, Communication Systems and Techniques, McGraw Hill, NY
3. Carlson A. N., Communication Systems - An Introduction to Signals and Noise

B. Tech. (Sixth Semester) Aeronautical Engineering

Aircraft Systems Lab

ARE- 314E

L	T	P
-	-	2

Sessional: 25 Marks
Practical: 25 Marks
Total: 50 Marks
Duration of Exam: 3 Hrs

List of experiments

1 Carry out the functional check of cooling turbine and study the air-conditioning system including cooling turbine, distribution and temperature control system
2 Study of refuelling procedure and precautions during refuelling
3 Carry out jacking up operation of the aircraft
4 Study of hydraulic system internal leak check procedure and precautions
5 Study of oxygen system layout and storage
6 Carry out de fuelling and study the fuel sequencing and its indications
7 Study of various types of fire in aircraft and use of fire extinguisher
8 Study of ground running procedure and precautions during ground run

Note: At least Eight Experiments should be performed. Out of that Two Experiments may be performed or designed and set by the concerned institute as per the scope of the syllabus.

B. Tech. (Sixth Semester) Aeronautical Engineering

Aircraft Design Project lab

ARE 316 E

L	T	P/D	Total	
-	-	2	2	Sessional: 25Marks Practical: 25 marks Total : 50 Marks Duration of Exam: 03 hours

Each student is assigned with the design of an Airplane (or Helicopter or any other flight vehicle), for given preliminary specifications. The following are the assignments to be carried out:

EXPERIMENTS

1. Comparative configuration study of different types of airplanes
2. Comparative study on specification and performance details of aircraft
3. Preparation of comparative data sheets
4. Work sheet layout procedures
5. Comparative graphs preparation and selection of main parameters for the design
6. Preliminary weight estimations, selection of main parameters,
7. Power plant selection, Aerofoil selection, Wing tail and control surfaces
8. Preparation of layouts of balance diagram and three view drawings
9. Drag estimation
10. Detailed performance calculations and stability estimates

Note: At least Eight Experiments should be performed. Out of that Two Experiments may be performed or designed and set by the concerned institute as per the scope of the syllabus.

B. Tech. (Sixth Semester) Aeronautical Engineering

Aircraft Structure Repair Lab

ARE 318 E

L	T	P/D	Total
-	-	2	2

Sessional : 50Marks
Practical : 25 marks
Total : 75 Marks
Duration of Exam: 03 hours

LIST OF EXPERIMENTS

1. Aircraft wood gluing
2. Welded patch repair by TIG, MIG, PLASMA ARC.
3. Welded patch repair by MIG
4. Welded patch repair by plasma Arc
5. Fabric Patch repair
6. Riveted patch repairs.
7. Repair of composites
8. Repair of Sandwich panels.
9. Sheet metal forming.
10. Control cable inspection and repair

Note: At least Eight Experiments should be performed. Out of that Two Experiments may be performed or designed and set by the concerned institute as per the scope of the syllabus.

B. Tech. (Seventh Semester) Aeronautical Engineering

Helicopter Dynamics
ARE-401E

L	T	P			
3	1	-	Sessional	:	50 Marks
			Theory	:	100 Marks
			Total	:	150 Marks
			Duration of Exam.	:	3 Hrs.

NOTE: In the semester examination, the paper setter will set 8 questions in all, at least two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.

UNIT-1

ELEMENTARY BLADE MOTION

Historical development of helicopter and overview, Basic concepts, Introduction to hovering and forward flight theory, Rotor blade motion – flapping, feathering and lagging motion, Composite structures.

UNIT-2

AERODYNAMICS OF THE ROTOR IN MOTION

The actuator-disc theory, Working states of rotor, Optimum rotor, Efficiency of rotor, Ground effect on lifting rotor, The effect of finite number of blades, Induced velocity and induced power in forward flight – Mangler and Squire method, flight and wind tunnel test, The vortex wake, Aerofoil characteristics in forward flight.

UNIT-3

HELICOPTER TRIM AND PERFORMANCE IN MOTION

Blade forces and motion in forward flight, Force, torque and flapping coefficient, Helicopter trim analysis, Performance in forward flight.

UNIT-4

DYNAMIC STABILITY AND CONTROL

Longitudinal and lateral stability, Equations of motion, Stability characteristics, Auto stabilization, Control response.

HELICOPTER VIBRATIONS

Exciting forces, Fuselage response, Vibration absorbers, Measurement of vibration in flight.

Text Books:

1. Helicopter Dynamics: Bramwell, A.R.S.
2. Principles of Helicopter Engineering: Jacob Shapiro

References:-

1. Aerodynamics of Helicopter, Gessow, A, and Myers GC

B. Tech. (Seventh Semester)Aeronautical Engineering

Airplane Design

ARE-403E

L	T	P		
3	1	-	Sessional	:50 Marks
			Theory	:100 Marks
			Total	:150 Marks
			Duration of Exam.	: 3 Hrs.

NOTE: In the semester examination, the paper setter will set 8 questions in all, at least two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.

UNIT-I

Introduction

Aircraft design, requirements and specifications, airworthiness requirements. Weight: It's importance. Aerodynamic and structural design considerations. Classifications of airplane, Concept of configuration, features of special purpose airplanes. Unmanned aerial vehicles and their features.

Air Loads in Flight

Classical methods of estimating symmetrical maneuvering loads on a wing in flight, basic flight loading conditions, Load factor, V-n diagram, gust loads, estimation of gust loads, structural effects. use of panel methods to estimate air load distribution on a wing.

UNIT-II

Airplane Weight Estimation

Estimation of airplane weight based on airplane type / mission and material used. trends in wing loading, iterative approach

Wing Design Considerations

Factors influencing selection of airfoil and plan form. Span wise air loads variation with span and planform, stalling, take-off and landing considerations. BM and SF. Design principles for the structure of all metal, stressed skin wing (Civil & Military airplane).estimation of wing drag, effect of flaps.

UNIT-III

Structural Layout And Integration

Structural layout of straight, tapered swept (fwd and aft) wings. fuselage, empennage, Engine locations, Cockpit and passenger cabin layout, layout of flight and engine controls.wing-fuselage jointing methods, all metal airplane considerations, use of composite materials. Preparation of 3- views .CG location.

UNIT-IV

Landing Gears

Requirement of landing gears, different arrangements, mechanism for retraction into fuselage and wing. absorption of landing loads, calculations of loads.

Airframe Power plant integration

Estimation of Horizontal and vertical tail volume ratios, number of engines, location for inlets and considerations their of. Revised CG location.

Text Books:

1. Airplane Design- A Conceptual Approach: Daniel P Raymer.
2. Design of Airplane: D.Stinton

References:

1. Fundamentals of Aircraft Design: L.M.Nikolai

B. Tech. (Seventh Semester) Aeronautical Engineering

Avionics

ARE-405E

L	T	P	Total		
4	1		5	Sessional	: 50 Marks
				Theory	: 100 Marks
				Total	: 150 Marks
				Duration of Exam: 3 Hrs.	

NOTE: In the semester examination, the paper setter will set 8 questions in all, at least two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.

UNIT-I

. **INTRODUCTION TO AVIONICS**

Need for Avionics in civil and military aircraft and space systems – Integrated Avionics and Weapon system – Typical avionics sub systems – Design and Technologies.

UNIT-II

PRINCIPLES OF DIGITAL SYSTEMS

Digital Computers – Microprocessors – Memories

DIGITAL AVIONICS ARCHITECTURE

Avionics system architecture–Data buses MIL–STD 1553 B–ARINC 429–ARINC 629..

UNIT-III

FLIGHT DECK AND COCKPITS

Control and display technologies CRT, LED, LCD, EL and plasma panel - Touch screen - Direct voice input (DVI) - Civil cockpit and military cockpit: MFDS, HUD, MFK, HOTAS

UNIT-IV

INTRODUCTION TO AVIONICS SYSTEMS

Communication Systems - Navigation systems - Flight control systems - Radar electronic warfare - Utility systems Reliability and maintainability - Certification.

Text Books:

1. Malcrno A.P. and Leach, D.P., “Digital Principles and Application”, Tata McGraw-Hill, 1990.
2. Gaonkar, R.S., “Microprocessors Architecture – Programming and Application”, Wiley and Sons Ltd., New Delhi, 1990.

3. Middleton, D.H., Ed., "Avionics Systems, Longman Scientific and Technical", Longman Group UK Ltd., England, 1989.
4. Spitzer, C.R., "Digital Avionic Systems", Prentice Hall, Englewood Cliffs, N.J., USA., 1987.
Brain Kendal, "Manual of Avionics", The English Book HOuse, 3rd Edition, New Delhi, 1993

B. Tech. (Seventh Semester) Aeronautical engineering

Aircraft Maintenance Lab

ARE-407E

			Sessional	:	25 Marks
L	T	P	Practical	:	25 Marks
0	0	3	Total	:	50 Marks
			Duration of Exam.	:	3 Hrs.

List of experiments

1. Study of standard operating procedures of safely in aircraft maintenance.
2. Ground running precautions and carry out checks on gas turbine and air intakes prior and after the ground run with the fibroscope
3. Carry out Engine oil system replenishment.
4. Carry out Hydraulic oil system replenishment / checks by CM-20 and patch kit for contamination.
5. Air / oxygen charging procedure and precautions during charging.
6. Study of Mooring, Lashing and picketing procedures.
7. Crack detection with NDT checks – Magnetic, eddy current and vibro acoustic techniques.
8. Inhibition / deinhibition of Aero engines.

Note: At least Eight Experiments should be performed. Out of that Two Experiments may be performed or designed and set by the concerned institute as per the scope of the syllabus.

B. Tech. (Seventh Semester) Aeronautical engineering

Avionics Lab

ARE-409E

L	T	P
0	0	3

Sessional: 25 Marks
Practical: 25 Marks
Total: 50 Marks
Duration of Exam: 3 Hours

LIST OF EXPERIMENTS

DIGITAL ELECTRONICS

1. Addition/Subtraction of binary numbers.
2. Multiplexer/Demultiplexer Circuits.
3. Encoder/Decoder Circuits.
4. Timer Circuits, Shift Registers, Binary Comparator Circuits.

MICROPROCESSORS

5. Addition and Subtraction of 8-bit and 16-bit numbers.
6. Sorting of Data in Ascending & Descending order.
7. Sum of a given series with and without carry.
8. Greatest in a given series & Multi-byte addition in BCD mode.
9. Interface programming with 4 digit 7 segment Display & Switches & LED's.
10. 16 Channel Analog to Digital Converter & Generation of Ramp, Square, Triangular wave by Digital to Analog Converter.

AVIONICS DATA BUSES

11. Study of Different Avionics Data Buses.
12. MIL-Std – 1553 Data Buses Configuration with Message transfer.
13. MIL-Std – 1553 Remote Terminal Configuration.

Note: Note: At least Eight Experiments should be performed. Out of that Two Experiments may be performed or designed and set by the concerned institute as per the scope of the syllabus.

B. Tech. (Seventh Semester) Aeronautical Engineering
Minor Project
ARE 411 E

P/D	Total
7	7

Practical Viva: 100 Marks
Sessional : 100 Marks
Total : 200 Marks
Duration of Exams. : 03 hours

The students expected to take up a project under the guidance of teacher from the college. The project must be based on mechanical engineering problems, which can be extended up to the full academic session. The students may be asked to work individually or in a group not more than four students in a group. Viva- voce must be based on the preliminary report submitted by students related to the project.

B. Tech. (Seventh Semester) Aeronautical Engineering
Practical Training Report
ARE 413 E

P/D	Total	
-	-	**Sessional : 125 marks**
		Duration of Exams. : 03 hours

Student will submit summer training (about 8 weeks' industrial training) report for his/her assessment.

Electives I and II Seventh Semesters
(Aeronautical Engineering)

ELECTIVE – I
(For Aeronautical Engineering Students)

DEPARTMENT ELECTIVE-I

ARE-415E Aircraft Maintenance of Airframe and Systems.
ARE 417E Fuels & propellant Technology
ARE-419E Compressible Aerodynamics

DEPARTMENT ELECTIVE-II

ARE-421E Aircraft Rules and Regulations
ARE-423E Aircraft Maintenance of Powerplant and Systems

Elective - I & II will be offered as departmental elective for Aeronautical Engineering Students.

DEPARTMENT ELECTIVE-I

B. Tech. (Seventh Semester) Aeronautical Engineering

Aircraft Maintenance of Airframe and Systems.

ARE 415 E

L	T	P	T
3	1	-	4

Sessional: 50 marks
Theory: 100 marks
Total : 150 Marks
Duration of Exam: 3 hrs.

NOTE: In the semester examination, the paper setter will set 8 questions in all, at least two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.

UNIT-I

Airframe Structure: Various types of structures in aiframe construction, tubular, braced monocoque, semimonocoque, etc, longerons, stringers, formers, bulkhead, spars and ribs,

UNIT-II

Honeycomb construction. Airplane controls, ailerons, elevators, rudder, trimming and control tabs, leading and trailing edge flaps, tailplane and fins. Basics of structure and structural components fabricated from metal, glass fibre, vinyl, prespex, composites.

Finishing materials, paints, surface finishes and associated materials.

UNIT-III

Aircraft systems : Flying controls including power operated controls, hydraulic, pneumatic, landing gear various types, shock struts, nose wheel steering, ice and rain protection, fire detection warning and extinguishing, oxygen, air -conditioning and pressurisation systems, wheels, tyres, brakes, antiskid system. Windows, doors and emergency exists. Reliability and redundancy of systems design.

UNIT-IV

Inspection: Basic principles of inspection, inspection gauges, and tools. Standard Inspection techniques and procedures. Go/No go gauges, gauge calibration and maintenance, limits and tolerance. NDT techniques in Airframe maintenance, Major and minor damage, damage tolerance. Corrosion and corrosion prevention. Major and minor defects. Defect reporting, rectification and investigation. Rigging of aircraft,symmetry checks. Balancing of control surfaces, Periodical inspections, heavy landing,overweight landing checks, abnormal flight loads. Aircraft weighing, weight schedule, calculation of centre of gravity.

Text Books:-

1. Aircraft Manual, government of India.
2. Civil Airworthiness requirements CAA, UK.
3. FAR's FAA, U.S.A.
4. Parkinson, Engineering Inspection, Wheeler
5. Michacl J. Kroes and James R Fardn, Aircraft Basic Science, McGraw Hill

References:

1. Michacl J. Kroes and William A watkins, Aircraft Maintenance and Repair, McGraw Hill
2. Civil Aircraft Inspection Procedures (CAP 459) Pt II Aircraft, Himalayan Books
3. Airframe and Power Plant Mechanic (AC 65-15A) Airframe Hand Book, Himalayan Books.1991

B. Tech. (Seventh Semester) Aeronautical Engineering

Fuels & propellant Technology

ARE 417 E

L	T	P	
3	2	-	Sessional: 50 marks Theory : 100 marks Total : 150 Marks Duration of Exam: 3 hrs.

NOTE: In the semester examination, the paper setter will set 8 questions in all, at least two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.

UNIT -I

Properties and tests for petroleum products - Motor gasoline - Aviation gasoline - Aviation turbine fuels - Requirements of aviation turbine fuels of Kerosene type and high flash point type - Requirements for fuel oils Single base propellants - Double base propellants - composite propellants - CMDB propellants – Metalized composite Propellants - Brief introduction to combustion theory of composite and double base propellants

UNIT -II

Various liquid propellants and their properties - Monopropellant and bipropellant systems - Concept of ullage - Ignition studies of liquid propellants - Propellant loading tolerances - Inventory-Volume versus mass loading - Loading measurement and control - Outage control

UNIT -III

Introduction to cryogenic propellants - Liquid Hydrogen, liquid Oxygen, Liquid nitrogen and liquid helium - Theory behind the production of low temperature - Expansion Engine - Cascade process - Joule Thompson Effect - Magnetic effect - Ortho and Para H2 - Hilium4 and Helium3 - Ideal cycles and Efficiency of cryo systems - Storing of cryogenic propellants - Cryogenic loading problems

UNIT -IV

Laboratory testing - Arc Image Furnace - Ignitability studies - Differential Thermal Analysis - Thermo gravimetric analysis - Particle size measurement Micro-merograph - Strand burner tests Impulse Bomb - Performance estimation

Text Books:-

1. Sutton, G.P., rocket Propulsion Elements, John Wiley, 1993.
2. Sharma,S.P. and Mohan.C., Fuels and Combustion, Tata McGraw Hill Publishing Co.,Ltd.,1984

3. Mathur,M. ,and Sharma.R.P., Gas Turbines and Jet and Rocket Propulsion, Standard Publishers,New Delhi,12988

B. Tech. (Seventh Semester) Aeronautical Engineering

Compressible Aerodynamics

ARE 419 E

L	T	P	
3	2	-	Sessional: 50 marks Theory: 100 marks Total : 150 Marks Duration of Exam: 3 hrs.

NOTE: In the semester examination, the paper setter will set 8 questions in all, at least two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.

UNIT – I

Shock Waves

Introductory remarks, point source in a compressible flow,Mach waves and shock waves.

1. Normal Shock waves: equation of motion for a normal shock,normal shock relations for a perfect gas,stagnation conditions,RH relations,propagating shock waves,weak shock, reflected shock wave,centered expansion waves,shock tube. Numerical examples

2. Oblique Sock waves: Introduction, oblique shock relations,M-▪ ▪ ▪ relations, shock polar,supersonic flow over wedge,weak oblique shock,supersonic compression, detached shock. Numerical examples.

UNIT-II

Expansion waves

Supersonic expansion by turning, Prandtl-Meyer flow, Numerical problems. Simple and non simple regions,reflection and intersection of shocks and expansion waves, Mach reflections,Method of characteristics, numerical examples

UNIT-III

Lift and drag in supersonic flows:

Shock –Expansion theory, flow field in supersonic,flowfield in supersonic flows, numerical problems,thin airfoil theory,analytical determination of lift and drag coefficients on flat plate, biconvex, and diamond shaped sections in supersonic flows,numerical problems, supersonic leading and trailing edges.

UNIT-IV

Potential equation for compressible flows:

Introduction, Crocco's theorem, derivation of basic potential equation foe compressible flows, linearization of governing equation, boundary conditions,small perturbation theory, application to wavy wall, bodies of revolution.

Introduction, linearized compressible flow, airfoils in subsonic flow, Prandtl-Glauert ransformation, critical Mach number,supercritical flows,airfoils in transonic flow, governing equations,shock wave boundary layer inter action,stability and control problems.

Rayleigh's supersonic Pitot formula, Equipment used in supersonic flows,supersonic wind tunnels,heat transfer tunnels,shoch tunnels,Aero-ballistic ranges,terminal ballistic range,rocket sled facility,special instrumentation for these types of tunnels.

Text Books:

1. Aerodynamics and thermodynamics of compressible fluid flow: Shapiro A.H., Vols I& II

REFERENCES:

1. Elements of Gas Dynamics : Lieppmann and Rosheko ,John Wiley 1957
2. Modern compressible Flow with historical perspective: John D. Anderson
3. Experimental Methods in Hypersonic flows: J. Lucasiewisz.

DEPARTMENT ELECTIVE-II

B. Tech. (Seventh Semester) Aeronautical Engineering

Aircraft Rules and Regulations

ARE 421 E

L	T	P			
			Sessional	:	50 Marks
3	2	-	Theory	:	100 Marks
			Total	:	150 Marks
			Duration of Exam.	:	3 Hrs.

NOTE: In the semester examination, the paper setter will set 8 questions in all, at least two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.

UNIT-I

C.A.R. SERIES 'A' – PROCEDURE FOR CIVIL AIR WORTHINESS REQUIREMENTS AND RESPONSIBILITY OPERATORS Vis-à-vis AIR WORTHINESS DIRECTORATE

Responsibilities of operators / owners- Procedure of CAR issue, amendments etc., Objectives and targets of airworthiness directorate; Airworthiness regulations and safety oversight of engineering activities of operators.

C.A.R. SERIES 'B' – ISSUE APPROVAL OF COCKPIT CHECK LIST, MEL, CDL: Deficiency list (MEL & CDL); Preparation and use of cockpit checklist and emergency list.

UNIT-II

C.A.R. SERIES 'C' – DEFECT RECORDING, MONITORING, INVESTIGATION AND REPORTING

Defect recording, reporting, investigation, rectification and analysis; Flight report; Reporting and rectification of defects observed on aircraft; Analytical study of in-flight readings & recordings; Maintenance control by reliability Method.

UNIT-III

C.A.R. SERIES 'D' – AND AIRCRAFT MAINTENANCE PROGRAMMES

Reliability Programmes (Engines); Aircraft maintenance programme & their approval; On condition maintenance of reciprocating engines; TBO – Revision programme; Maintenance of fuel and oil uplift and consumption records – Light aircraft engines; Fixing routine maintenance periods and component TBOs – Initial & revisions.

C.A.R. SERIES 'E' – APPROVAL OF ORGANISATIONS

Approval of organizations in categories A, B, C, D, E, F, & G - Requirements of infrastructure at stations other than parent base.

C.A.R. SERIES 'F' – AIR WORTHINESS AND CONTINUED AIR WORTHINESS: Procedure relating to registration of aircraft; Procedure for issue / revalidation of Type Certificate of aircraft and its engines / propeller; Issue / revalidation of Certificate of Airworthiness; Requirements for renewal of Certificate of Airworthiness.

UNIT-IV

C.A.R. SERIES 'L'&'M'

Issue of AME Licence, its classification and experience requirements, Mandatory Modifications / Inspections.

C.A.R. SERIES 'T'&'X'

Flight testing of (Series) aircraft for issue of C of A; Flight testing of aircraft for which C of A had been previously issued.

Registration Markings of aircraft; Weight and balance control of an aircraft; Provision of first aid kits & Physician's kit in an aircraft; Use furnishing materials in an aircraft; Concessions; Aircraft log books; Document to be carried on board on Indian registered aircraft; Procedure for issue of tax permit; Procedure for issue of type approval of aircraft components and equipment including instruments.

Text Books:

1. "Civil Aviation Requirements with latest Amendment (Section 2 Airworthiness)" – Published by DGCA, The English Book Store, 17-1, Connaught Circus, New Delhi 2000.
2. Aeronautical Information Circulars (relating to Airworthiness) from DGCA 2000.
3. "Aircraft Manual (India) Volume" – Latest Edition, The English Book Store, 17-1, Connaught Circus, New Delhi.
4. Advisory Circulars from DGCA 2003.

B. Tech. (Seventh Semester) Aeronautical Engineering

Aircraft Maintenance of Powerplant and Systems

ARE-423E

L	T	P		
3	2		Sessional	: 50 Marks
			Theory	: 100 Marks
			Total	: 150 Marks
			Duration of Exam: 3 Hrs.	

NOTE: In the semester examination, the paper setter will set 8 questions in all, at least two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.

UNIT-I

Piston Engines: Two and four stroke engines. Efficiency, factors affecting engine performance. Knowledge of the function and construction of various parts and accessories of the engine including induction, exhaust and cooling system, engine mounting. Engine fire detection and protection systems.

UNIT-II

Propellers: Knowledge of purpose and functioning of parts of constant speed, variable pitch and feathering propellers and associated control system components.
Engine fuel and Oil System: Construction, features of carburettors, engine fuel and oil systems. Characteristics of aviation fuel and oil.

UNIT-III

Common methods of checking contamination. Sources of contamination, Ingition and starting systems : Magnetos and ignition system components, various types of engine starters. Engine Instruments: Principle of operation. Superchargers-constructional features and principles of operation and function of various types of superchargers and its related component.

Gas Turbine : Principle of operation, general constructional details and function of various type of gas turbine engines such as turbojet, turbo fan and by-pass engine.
Theory of gas turbine engines, advantages and disadvantages of each type. Induction,exhaust and cooling systems, anticing of engine, engine mountings, thrust

augmentation. Compressor surge and stall, bleed control system. Principles of operation,

UNIT-IV

General constructional details and functions of fuel and oil systems, ignition and starting systems and their components. Engine controls of various types, including Full Authority Digital Electronic Control Engine instruments. Power augmentation devices, thrust reversers and auxiliary power units.
Engine Maintenance : Piston/Gas Turbines: Periodical servicing procedures, engine installation checks, control rigging, ground running checks, priming, bleeding and performance checks.Engine on condition maintenance.Trouble shooting and rectification. Inspection after shock landing. Crack detection. Procedure for long and short terms storage of engine and accessories, engine preservation and depreservation.

Text Books :

1. E Mangham and A Peace, Jet Engine Manual, Himalayan Books
2. Jet Engines, Rolls Royce Ltd. 1992
3. Casamassa and Bent, Jet Aircraft Power Systems, Tata McGraw Hill
4. Civil Aircraft Inspection Procedures (CAP 459), Himalayan Books

References:

1. Pratt and Whitney, Gas Turbine Engine
2. Michacl J. Krose Thomas W.Wild, Bent, Aircraft Power Plants, McGraw Hill 1994
3. H Cohen, G F C Rogers and H I H Sarvanmutto, Gas Turbine Theory, John Wiely
4. Irvine Treager, Aircraft Gas Turbine Engine Technology, Tata McGraw Hill

B. Tech. (Eighth Semester) Aeronautical Engineering

Computational Fluid Dynamics

ARE -402 E

L	T	P			
			Sessional	:	50 Marks
3	1	-	Theory	:	100 Marks
			Total	:	150 Marks
			Duration of Exam.	:	3 Hrs.

NOTE: In the semester examination, the paper setter will set 8 questions in all, at least two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.

UNIT I

Methods of prediction: comparison of experimental investigation Vs theoretical calculation; Mathematical description of physical phenomena; significance of governing differential equations; the general form of governing differential equation. Classification of problems: Physical classification: Equilibrium problems and Marching problems; Mathematical classification: Elliptic, parabolic and hyperbolic partial differential equations; Nature of co-ordinates; one way and two-way co-ordinates; Proper choice of co-ordinates.

UNIT II

The concept of discretisation; Finite differences; Taylor series formulation; Finite difference discretisation of ordinary and partial derivatives; Truncation error, round-off error, discretisation error; Consistency and stability of numerical schemes; Variation formulation; Method of weighted Residuals, control volume formulation.

UNIT III

Steady one- dimensional Conduction, The inter-face conductivity, Non linearity, Source-Term Linearization, Types of Boundary Conditions. Unsteady one-dimensional Conduction: Explicit, Crank-Nicolson and Fully Implicit scheme's Discretisation of two and threedimensional problems, Stability analysis.

UNIT IV

Steady one dimensional convection and diffusion, The up wind scheme, Generalized Formulation, Discretisation equation for two and three dimensional problems, The outflow Boundary condition, false Diffusion. Basic difficulty, Vorticity Based methods, Representation of the continuity

equation, the staggered grid: the momentum equations, the pressure velocity corrections, and SIMPLE algorithm.

Text Books:

1. Computational Fluid Dynamics - By Anderson, McGraw-Hill
2. Numerical Heat Transfer and fluid flow- By Patankar, McGraw-Hill

B. Tech. (Eighth Semester) Aeronautical Engineering

Air Transportation and Aircraft Maintenance Management

ARE-404E

L	T	P		
3	1		Sessional	: 50 Marks
			Theory	: 100 Marks
			Total	: 150 Marks
			Duration of Exam: 3 Hrs.	

NOTE: In the semester examination, the paper setter will set 8 questions in all, at least two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.

UNIT -I

Development of air transporation, comparison with other modes of transport - Role of IATA, ICAO – The general aviation industry airline - Factors affecting general aviation, use of aircraft, airport: airline management and organisation - levels of management, functions of management, Principles of organisation planning the organisation - chart, staff departments & line departments.

UNIT -II

Forecasting - Fleet size, Fleet planning, the aircraft selection process, operating cost, passenger capacity, load factor etc. - Passenger fare and traiffs - Infuence of geographical, economic & political factors on routes and route selection.

UNIT -III

FLEET PLANNING: The aircraft selection process - Fleet commonality, factors affecting choice of fleet, route selection and Capitol acquisition - Valuation & Depreciation - Budgeting, Cost planning - Aircrew evaluation - Route analysis - Aircraft evaluation.

Equipment maintenance, Flight operations and crew scheduling, Ground operations and facility limitations equipments and types of schedule - hub & spoke scheduling, advantages / disadvantages & preparing flight plans Aircraft scheduling in line with aircraft maintenance practices.Aircraft reliability - The maintenance schedule & its determinations - Condition monitoring maintenance - Extended range operations (EROPS) & ETOPS - Ageing aircraft maintenance production.

UNIT -IV

Airlines scheduling (with reference to engineering) - Product support and spares - Maintenance sharing - Equipments and tools for aircraft maintenance - Aircraft weight control - Budgetary control. On board maintenance systems - Engine monitoring - Turbine engine oil maintenance - Turbine engine vibration monitoring in aircraft - Life usage monitoring - Current capabilities of NDT - Helicopter maintenance - Future of aircraft maintenance.

Text Books:

1. Fedric J.H., " Airport Management ", English Book House, New Delhi-I.

2. Gene Krope, " Airline Procedures ", English Book House, New Delhi-I.

3. Wilson & Bryon, " Air Transportation ", English Book House, New Delhi-I.

4. Philip Lockin D, " Economics of Transporation ", English Book House, New Delhi-I.

5. " Indian Aircraft manual ", Published by DGGA, English Book House, New Delhi-I.

6. Alexander T Wells, " Air Transporation ", Wadsworth Publishing Company, California, 1993.

7. C.H. Friend, " Aircraft Maintenance Management ", English Book House, New Delhi.

B. Tech. (Eighth Semester) Aeronautical Engineering

Rockets and Missiles

ARE-406E

L	T	P		
4	2		Sessional	: 50Marks
			Theory	: 100 Marks
			Total	: 150 Marks
			Duration of Exam: 3 Hrs.	

NOTE: In the semester examination, the paper setter will set 8 questions in all, at least two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.

UNIT-1

1. Classification of Rockets and Missiles-Differences-Uses-Advantages and Disadvantages.

Ignition system in Rockets - Types of igniters - Igniter design considerations – Design consideration of liquid rocket combustion chamber, injector propellant feed lines, valves, Propellant tanks outlet and helium Pressurized and turbine feed systems - Propellant slosh and propellant hammer - Elimination of geysering effect in missiles .

2. Combustion system of solid rockets.

Airframe components of rockets and missiles - Forces acting on a missile while passing through atmosphere -

- Method of describing aerodynamic forces and moments - Lateral aerodynamic moment - Lateral Damping moment and longitudinal moment of a rocket - Lift and drag forces – Drag

UNIT-1I

3. Estimation - body up wash and downwash in missiles - rocket dispersion – Numerical problems. One dimensional and two dimensional rocket motions in free space and homogeneous gravitational fields - Description of vertical, inclined and gravity turn trajectories - Determination of range and altitude Simple

4. Approximations to burnout velocity:-

Rocket vector control - Methods - Thrust termination - SITVC - Multistage of rockets – Vehicle optimization - Stage separation dynamics - Separation techniques.

UNIT-1II

5. Selection of materials - Special requirements of materials to perform under adverse conditions.

6. Solid Rocket Motors: General description, interior ballistics component design Techniques.

UNIT-1V

7. Liquid Rocket Engines: General description, engine cycles, power balance calculation , component design fundamentals.

8. Electric Propulsion : Classification of electric propulsion systems.

9. Trajectory Analysis : The rocket equation , vertical trajectories, multistage rockets, generalized 2D trajectory.

Text Books:

1. Sutton, G.P., et al., " Rocket Propulsion Elements " John Wiley & Sons Inc., NewYork, 1993.
2. Mathur, M., and Sharma, R.P., " Gas Turbines and Jet and Rocket Propulsion ", Standard Publishers, New Delhi, 1998.

References:

1. Cornelisse, J.W.., " Rocket Propulsion and Space Dynamics ", J.W., Freeman & Co., Ltd., London, 1982.
2. Parket, E.R., " Materials for Missiles and Spacecraft ", McGraw Hill Book Co., Inc., 1982

B. Tech. (Eight Semester) Aeronautical Engineering
Major Project
ARE 408 E

P/D	Total
4	4

Practical Viva : 100 Marks
Sessional : 100 Marks
Total : 200 Marks
Duration of Exams. : 03 hours

The students expected to take up a project under the guidance of teacher from the college. The project must be based on mechanical engineering problems, which can be extended up to the full academic session. The students may be asked to work individually or in a group not more than four students in a group. Viva- voce must be based on the preliminary report submitted by students related to the project.

B. Tech. (Eighth Semester) Aeronautical Engineering
Seminar
ARE 410 E

P/D	Total	
2	**2**	**Sessional: 25 marks**

Student will give a talk on some technical topics.

Note: The seminar will continue in eighth semester and will be evaluated in eighth semester.

Electives III and IV Eighth Semester
(Aeronautical Engineering)

ELECTIVE – III
(For Aeronautical Engineering Students)

DEPARTMENT ELECTIVE-III

ARE-414E Space Dynamics
ARE-416E Modern Manufacturing Processes
ARE-418E Boundary Layer Theory

DEPARTMENT ELECTIVE-IV

ARE-420E Principles of Environmental Science and Engineering
ARE - 422 E Management Information System
ARE-424E Control Theory & Practice

Elective - III & IV will be offered as departmental elective for Aeronautical Engineering Students.

DEPARTMENT ELECTIVE-III

B. Tech. (Eighth Semester) Aeronautical Engineering

Space Dynamics

ARE-414E

			Sessional	:	50 Marks
L	T	P	Theory	:	100 Marks
3	1	-	Total	:	150 Marks
			Duration of Exam.	:	3 Hrs.

NOTE: In the semester examination, the paper setter will set 8 questions in all, at least two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.

UNIT- I

INTRODUCTION

Initial works in Germany for space travel.russian and American campaigns, man in space, profile of flight from earth to a destination in space and back. The space shuttle.

PARTICLE DYNAMICS

Introduction, Newton's laws, velocity and acceleration, coordinates and rotation, the spherical pendulum, energy for one particle, angular momentum, energy for systems of particles, angular momentum , the N-body problem.

UNIT-II

THE TWO–BODY PROBLEM

Introduction , the two body problem, energy and angular momentum, orbit equation, Kepler's laws, orbit determination and satellite tracking.

THE EARTH SATELLITE OPERATIONS

The Hohmann transfer, inclination-change maneuver, launch to rendezvous, decay life time, earth oblations effect

UNIT-III

RIGID BODY DYNAMICS Introduction, choice of origin, angular momentum and energy, principal-body-axis frame, particle axis theorem, Euler's equations, Orientational angle, the simple Top.

SATELLITE ATTITUDE DYNAMICS

Torque –Free-axisymmetric Rigid body, The general torque free rigid body, semi-rigid space craft, attitude control: Spinning and Non spinning space craft. The Yo-Yo mechanism, gravity gradient satellite, the dual spin spacecraft.

UNIT-IV

RE-ENTRY

Introduction, ballistic re-entry, skip re-entry, double dip re-entry, Aero braking, lifting re-entry.

THE SPACE ENVIRONMENT

Introduction, The atmosphere, Light and space craft temperature, charged particle motion, magnetic mirrors, The van-atten Belts, radiation effects, Meteors, Meteorites and impact. Our local neighborhood

BOOK:

1. Space Flight Dynamics : William E. Wiesel , Mcgraw Hill 1989

B. Tech. (Eighth Semester) Aeronautical Engineering

Modern Manufacturing Processes

ARE-416E

			Sessional	:	50 Marks
L	T	P	Theory	:	100 Marks
3	1	-	Total	:	150 Marks
			Duration of Exam.	:	3 Hrs.

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UNIT- I

Mechanical Processes: Ultrasonic Machining- Elements of process, cutting tool system design, effect of parameters, economic considerations, applications, limitations of the process, advantages and disadvantages. Abrasive Jet Machining- Variables in AJM, metal removal rate in AJM. Water Jet Machining- Jet cutting equipments, process details, advantages and applications.

UNIT- II

Electrochemical and Chemical Metal Removal Processes: Electrochemical Machining- Elements of ECM process, tool work gap, chemistry of the process, metal removal rate, accuracy, surface finish and other work material characteristics, economics, advantages, applications, limitations. Electrochemical Grinding - Material removal, surface finish, accuracy, advantages, applications.

UNIT- III

Thermal Metal Removal Processes: Electric Discharge Machining (EDM) or spark erosion machining processes, mechanism of metal removal, spark erosion generators, electrode feed control, dielectric fluids, flushing, electrodes for spark erosion, selection of electrode material, tool electrode design, surface finish, machining accuracy, machine tool selection, applications. Wire cut EDM. Laser beam machining (LBM)- Apparatus, material removal, cutting speed and accuracy of cut, metallurgical effects, advantages and limitations.

UNIT- IV

Plasma Arc Machining (PAM): Plasma, non thermal generation of plasma, mechanism of metal removal, PAM parameters, equipments for D.C. plasma torch unit, safety precautions, economics, other applications of plasma jets. Electron Beam Machining (EBM) - Generation and control of electron beam, theory of electron beam machining, process capabilities and limitations.

Text Books:

1. Modern Machining Processes – P.C.Pandey, H.S.Shan, Tata McGraw Hill
2. Machining Science- Ghosh and Malik, Affiliated East-West Press

References:

1. Non Traditional Manufacturing Processes- Benedict G.F, Marcel Dekker
2. Advanced Methods of Machining- Mc Geongh J.A, Chapman and Hall

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B. Tech. (Eighth Semester) Aeronautical Engineering

Boundary Layer Theory

ARE-418E

			Sessional	:	50 Marks
L	T	P	Theory	:	100 Marks
3	1	-	Total	:	150 Marks
			Duration of Exam.	:	3 Hrs.

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UNIT-I

BASICS

Basic laws of fluid flow- Continuity, momentum and energy equations as applied to system and control volume –Concept of flow fields- Viscous fluid flow with historical out lines of viscous flow, Boundary conditions for viscous flow problems, Development of boundary layer- Prandtl's hypothesis, Estimation of boundary layer thickness- Displacement thickness, momentum and energy thickness for two-dimensional flows. Viscosity and thermal conductivity, thermodynamic properties.

UNIT-II

DERIVATION OF THE NAVIER-STOKES EQUATIONS

General stress system in a deformable body, the rate at which the fluid element is strained in a flow, Relation between stress and rate of deformation, Stoke's hypothesis, bulk viscosity and thermodynamic properties, The Navier – Stokes Equation (N-S) –General properties of Navier – Stokes Equation.

SOLUTIONS OF THE NAVIER-STOKES EQUATIONS

Two dimensional flow through a straight channel. Hagen- Poiseulle flow, Suddenly accelerated plane wall, Stagnation in plane flow (Hiemenz problem), Flow near a rotating disk, Very slow motion, Parallel flow past a sphere.

UNIT-III

LAMINAR BOUNDARY LAYER

Analysis of flow past a flat plate and a cylinder, Integral relation of Karman, Integral analysis of energy equation, Laminar boundary layer equations, Flow separation. Similarity solutions for steady two dimensional flows; Blasius solution for flat- plate flow, Boundary layer temperature profiles for constant wall temperature, Falkner-Skan Wedge flows, Free shear flows- plane laminar jet, plane laminar wake. Integral equation of Boundary layer, Karman-Pohlhausen method.Digital computer solutions. Thermal boundary layer calculations- One parameter (Uo) and two parameters (U0 and □T) integral methods. Stability of laminar flows.

UNIT-IV

TURBULENT BOUNDARY LAYER:

Two dimensional turbulent boundary layer equations, Integral relations, Eddy-Viscosity theories, Velocity profiles; The law of the wall, The law of the wake. Turbulent flow in pipes and channels.- Turbulent boundary layer on a flat pate, Boundary layers with pressure gradient.

COMPRESSIBLE BOUNDARY LAYER FLOWS

Introduction to the compressible boundary layer on a flat plate, shock wave boundary layer interaction.

Text Books:

1. Viscous Fluid Flow 3rd Ed. Frank M White McGraw Hill 2006
2. Boundary Layer theory 6th Ed. H. Schlichting McGraw Hill 1968

REFERENCES:

1 Aerodynamics for Engineers 4th Ed. John Bertin Pearson 2004

DEPARTMENT ELECTIVE-IV

B. Tech. (Eighth Semester) Aeronautical Engineering

Principles of Environmental Science and Engineering

ARE 420 E

L	T	P			
			Sessional	:	50 Marks
3	2	-	Theory	:	100 Marks
			Total	:	150 Marks
			Duration of Exam.	:	3 Hrs.

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UNIT-I

INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES

Definition, scope and importance – need for public awareness – forest resources: use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their ground water, floods, drought, conflicts over water, dams-benefits and problems – mineral resources: use effects on forests and tribal people – water resources: use and over-utilization of surface and exploitation, environmental effects of extracting and using mineral resources, case studies – food resources: world food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – energy resources: growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case_studies – land resources: land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – equitable use of resources for sustainable lifestyles.

UNIT-II

ECOSYSTEMS AND BIODIVERSITY

Concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – introduction to biodiversity – definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity:

consumptive use, productive use, social, ethical, aesthetic and option values – biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

UNIT-III

ENVIRONMENTAL POLLUTION

Definition – causes, effects and control measures of: (a) air pollution (b) water pollution (c) soil pollution (d) marine pollution (e) noise pollution (f) thermal pollution (g) nuclear hazards – solid waste management: causes, effects and control measures of urban and industrial wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – urban / rural / industrial / agricultural

UNIT-IV

SOCIAL ISSUES AND THE ENVIRONMENT

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – environmental ethics: issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies – wasteland reclamation – consumerism and waste products – environment protection act – air (prevention and control of pollution) act – water (prevention and control of pollution) act – wildlife protection act – forest conservation act – issues involved in enforcement of environmental legislation – public awareness

Text Books:-

1. Gilbert M.Masters, “Introduction to Environmental Engineering and Science”, pearson education Pvt., Ltd., second edition, ISBN 81-297-0277-0, 2004.
2. Miller T.G. jr., “Environmental Science”, Wadsworth publishing co.
3. Townsend C., Harper J and Michael Begon, “Essentials of Ecology”, Blackwell science.
4. Trivedi R.K. and P.K. Goel, “Introduction to air pollution”, techno-science publications.
5. Bharucha erach, “The Biodiversity of India”, mapin publishing Pvt. Ltd., Ahmedabad India,
6. Trivedi R.K., “Handbook of Environmental Laws”, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro media.
7. Cunningham, W.P.Cooper, T.H.Gorhani, “Environmental Encyclopedia”, Jaico Publ., House, Mumbai, 2001.

8. Wager K.D., "Environmental Management", W.B. Saunders Co., Philadelphia, USA, 1998

B. Tech. (Eighth Semester) Aeronautical Engineering

Management Information System
ARE 422 E

			Sessional	:	50 Marks
L	T	P	Theory	:	100 Marks
3	2	-	Total	:	150 Marks
			Duration of Exam.	:	3 Hrs.

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UNIT I

What is MIS? Decision support systems, systems approach, the systems view of business, MIS, MIS organization within the company management organizational theory and the systems approach. Development of organizational theory, management and organizational behavior, management information and the system approach. Evolution of an information systems, basic information systems, decision making and MIS, MIS as a technique for making programmed decision assisting information systems (r) strategic and project planning for MIS : General business planning, appropriate MIS Planning-general, MIS planning -details.

UNIT II

Define the problems, set system objectives, establish system constraints, determine information needs, determine information sources, develop alternative conceptual; designs and select one document the system concept, prepare the conceptual ;design report.

UNIT III

Inform and involve the organization, aim of detailed design, project management of MIS detailed design, identify dominant and trade off criteria, define the subsystems, Sketch the detailed operating subsystems and information flow. Determine the degree of automation of each operation, inform and involve the organization again, inputs, and processing, early system testing, software, hardware and tools, propose an organization to operate the system, document the detailed design, revisit the manager -user.

UNIT IV

Plan the Implementation , acquire floor space and plan space layouts, organize for implementation, develop, procedures for implementation, train (ho operating personnel, computer related acquisitions, develop forms for data collection and information dissemination, develop the files, test the system, cutover, document the system, evaluate the MIS control and maintain the

system (r). Pitfalls in MIS development: Fundamental weakness, soft spots in planning, design problems, implementation: The TARPIT.

Text Books:

1. Management Information system by W.S. JawadeKar - Tata McGraw Hill.

B. Tech. (Eighth Semester) Aeronautical Engineering

Control Theory & Practice

ARE-424E

			Sessional	:	50 Marks
L	T	P	Theory	:	100 Marks
3	2	-	Total	:	150 Marks
			Duration of Exam.	:	3 Hrs.

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UNIT-I

Introduction to Laplace transform, Fourier transforms, Definition of feedback terms, symbols to represent feedback control variables, characteristics of basic feedback loop.

UNIT-II

Introduction to dynamics of stable and unstable vehicles. Definition of Aerodynamic coefficients, force and moment equations, definition of relaxed static stability , CCV concept in modern flight control system. .

UNIT-III

Models of Components and Systems : Its variables and equations, modeling of passive electrical components and systems, static and dynamic variables, modeling of DC motors and servo systems, transducer, sensors and actuators, transport delay.
Frequency response analysis :

a) Open loop and closed loop poles and zeros
b) Nyquist diagram
c) Nyquist stability criterion
d) Stability margins, illustration of phase margin and gain margins

The BODE magnitude plot: Studies on BODE phase plot, stability margins on the BODE plot, Time delay effects. The root locus method: the locus equations, properties and sketching rules, loci for systems.

UNIT-IV

Time Response: Steady state error, transient response to a input, performance measures. System design: (a) Signal conversion and processing: Digital signals and coding, data conversions and quatization sample and hold devices, digital to analog conversion, analog to digital conversion, the sampling theorem, reconstruction of sampled signals. (b)Compensation networks, system effects of offset and noise. (c) Servo components: Synchros, Sensors, actuators, computers (d) Electronic design aspects: rating, time delays, reasonable values, etc. proportional controller, proportional integral controller, proportional integral differential controller (PID) The Z-Transform: (a) Definition of Z Transform (b) Evaluation of Z Transform (c) Mappling between s-plane and the z-plane (d) the inverse Z transform (e) Theorems of Z transform. The State Variable Technique : (a) State equations and state transition equations of continuous data system (b) State transition equations of digital systems (c) Relation between state equation and transfer function (d) Characteristic equation, eigen values and eigen vectors (e) Diagonalisation of A matrix (f) Methods of computing the state transition of A matrix. Stability of digital control system, time domain analysis, frequency domain analysis.

Text Books:

1. Katsuhiko Ogata, Modern Control Engineering, Prentice Hall of India
2. Robert C Nelson, Flight Stability and Automatic Control, McGrawHill, New York.
3. B Etkin, Dynamics of Aircraft, McGraw Hill, New York

References:

1. Duglas B Miron, Design of Feed Back Systems, Harcourt Brace Jovanovic Publications, and NY
2. Benjamin C Kuo, Digital Control Systems
3. Mc Ruer, Ashkenaus and Graham, Aircraft Dynamics and Controls, Prinston Univ.Press, NJ