SCHEME OF EXAMINATION
B.TECH. 3rd Year Aeronautical Engineering -5th Semester

Course No.	Course Title	Teaching Schedule				Examination schedule			Total Marks	Duration of Exam
		L	T	P/D	Total	Theory	Sessional	Practical Viva		
ARE-301E	Aerodynamics II	3	1	-	4	100	50	-	150	3
ARE 303 E	Aircraft Structures-II	3	1	-	4	100	50	-	150	3
ARE-305E	Aircraft Materials and Manufacturing Processes	3	1	-	4	100	50	-	150	3
ARE-307E	Elements of Aeronautics	3	1	-	4	100	50	-	150	3
ECE-311E	Microprocessor and Interfacing	4	1	-	5	100	50	-	150	3
ARE-309E	Propulsion-I	3	1	-	4	100	50	-	150	3
ARE-311 E	Training Report Practical	-	-	-	-	-	50	-	50	3
ARE-313 E	Propulsion Lab	-	-	3	3	-	25	25	50	3
ARE-315E	Cad Cam Lab	-	-	2	2	-	25	25	50	3
	TOTAL	19	6	5	30	600	400	50	1050	-

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

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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 & [illegible] 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
3	1	-	4

Sessional : 50 Marks
Theory : 100 Marks
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-311-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.