

SCHEME OF EXAMINATION

B.TECH. 3rd Year Aeronautical Engineering -6th Semester

Course No.	Course Title	Teaching Schedule				Examination Schedule			Total Marks	Duration of Exam
		L	T	P/D	Total	Theory	Sessional	Practical/ Viva		
ARE 302E	Aircraft Engineering Practices	3	1	-	4	100	50	-	150	3
ARE 304E	Propulsion-II	3	1	-	4	100	50	-	150	3
ARE 306E	Airplane Stability and Controls	3	1	-	4	100	50	-	150	3
ARE 308E	Aircraft Systems	4	2	-	6	100	50	-	150	3
ARE 310E	Aeroelasticity	3	1	-	4	100	50	-	150	3
ARE-312E	Aircraft Communication and Navigational System	3	1	-	4	100	50	-	150	3
ARE-314E	Aircraft Systems Lab	-	-	2	2	-	25	25	50	3
ARE-316E	Aircraft Design Project lab	-	-	2	2	-	25	25	50	3
ARE-318E	Aircraft Structure Repair Lab	-	-	2	2	-	50	25	75	3
	TOTAL	19	7	6	32	600	400	75	1075	-

B. Tech. (Sixth Semester) Aeronautical Engineering
Aircraft Engineering Practices
ARE 302 E

L	T	P/D	Total	Sessional	: 50 Marks
3	1	-	4	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 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 SPECIFICATIONS - F.A.A. Himalayan Book House ", New Delhi, 1996

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B. Tech. (Sixth Semester) Aeronautical Engineering

Propulsion-II

ARE 304 E

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

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 supersonic 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 sails – Concepts in nozzleless propulsion.



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

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-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 Assymmetric 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:

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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
4	2	-	6	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-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

L	T	P	Sessional	:	50 Marks
3	1	-	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, integration of aerodynamic, elastic and inertia forces, influence of aeroelastic 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 ratio, 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, aeriels, effective height, directional, properties, gain, impedance, linear arrays, traveling wave aeriels, rhombicas, parasitic elements. Propagation : Principles: influence of ionosphere and troposphere reflection from earth's surface, field strength calculations, fading diversity reception.

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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	Sessional: 25Marks
-	-	2	2	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.