SCHEME

&

SYLLABUS

For

B.Tech Aeronautical Engineering
Semester - V &VI

SCHEME B.TECH AERONAUTICAL SEM - V

SUBJECT CODE	SUBJECT
AE-501	PROPULSION I
AE-502	AIRCRAFT STRUCTURES II
AE-503	AERODYNAMICS II
AE-504	FLIGHT DYNAMICS
AE-505	AIRCRAFT MAINTENANCE AND REPAIR
AE-506	INTRODUCTION TO MICROPROCESSOR
AE-507	AIRCRAFT STRUCTURES LAB – II
AE-508	AIRCRFT STRUCTURES REPAIR LAB
AE-509	CAD/CAM LABORATORY
AE-510	ELECTRONICS AND MICROPROCESSOR LAB
AE-511	SELF STUDY (INTERNAL ASSESMENT)
AE-512	SEMINAR / GROUP DISCUSSION (INTERNAL ASSESMENT)

SCHEME OF EXAMINATION

SUBJECT CODE	THEORY				PRACTICAL			CREDIT	TOTAL
	TH	MS	TQ	TW	PR	LW	PQ		
	MAX MIN	MAX MIN	MAX MIN	MAX MIN	MAX MIN	MAX MIN	MAX MIN	TH PR	MAX
AE-501	70 22	20 -	10 -	- -	- -	- -	- -	4 -	100
AE-502	70 22	20 -	10 -	- -	- -	- -	- -	4 -	100
AE-503	70 22	20 -	10 -	- -	- -	- -	- -	4 -	100
AE-504	70 22	20 -	10 -	- -	- -	- -	- -	4 -	100
AE-505	70 22	20 -	10 -	- -	- -	- -	- -	4 -	100
AE-506	70 22	20 -	10 -	- -	- -	- -	- -	4 -	100
AE-507	- -	- -	- -	- -	30 9	20 -	- -	- 2	50
AE-508	- -	- -	- -	- -	30 9	20 -	- -	- 2	50
AE-509	- -	- -	- -	- -	30 9	20 -	- -	- 2	50
AE-510	- -	- -	- -	- -	30 9	20 -	- -	- 2	50
AE-511	- -	- -	- -	- -	- -	- -	50 -	- 2	50
AE-512	- -	- -	- -	- -	- -	- -	50 -	- 2	50

TOTAL 900

TH – THEORY MS – MID SEM TQ – THEORY QUIZ
TW – THEORY TEAM WORK
PR - PRACTICAL LW- LAB WORK
PQ – PRACTICAL QUIZ
G- GRADE GP- GRADE POINT
F$ - ABSENT
- GRACE

SCHEME B.TECH AERONAUTICAL SEM - VI

SUBJECT CODE	SUBJECT
AE-601	Propulsion II
AE-602	Introduction to Heat Transfer
AE-603	Composite Materials and Structures
AE-604	Aircraft Engine and Instrument System
AE-605	Experimental Stress Analysis
AE-606	Flight Stability and Automatic Control
AE-607	Propulsion Laboratory
AE-608	Aircraft Design Project- I
AE-609	Aerodynamics Laboratory
AE-610	Industrial Seminar

SCHEME OF EXAMINATION

SUBJECT CODE	THEORY								PRACTICAL						CREDIT		TOTAL	TH – THEORY MS – MID SEM TQ – THEORY QUIZ TW – THEORY TEAM WORK PR - PRACTICAL LW- LAB WORK PQ – PRACTICAL QUIZ G- GRADE GP- GRADE POINT F$ - ABSENT # - GRACE
	TH		MS		TQ		TW		PR		LW		PQ					
	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	TH	PR	MAX	
AE-601	70	22	20	-	10	-	-	-	-	-	-	-	-	-	4	-	100	
AE-602	70	22	20	-	10	-	-	-	-	-	-	-	-	-	4	-	100	
AE-603	70	22	20	-	10	-	-	-	-	-	-	-	-	-	4	-	100	
AE-604	70	22	20	-	10	-	-	-	-	-	-	-	-	-	4	-	100	
AE-605	70	22	20	-	10	-	-	-	-	-	-	-	-	-	4	-	100	
AE-606	70	22	20	-	10	-	-	-	-	-	-	-	-	-	4	-	100	
AE-607	-	-	-	-	-	-	-	-	25	-	25	-	25	-	-	2	75	
AE-608	-	-	-	-	-	-	-	-	25	-	25	-	25	-	-	2	75	
AE-609	-	-	-	-	-	-	-	-	25	-	25	-	25	-	-	2	75	
AE-610	-	-	-	-	-	-	-	-	25	-	25	-	25	-	-	2	75	
															TOTAL		900	

Aeronautical Engineering Syllabus

B TECH (FIFTH SEMESTER)

SVNUAE 501	**Propulsion I**
SVNUAE 502	**Aircraft Structures II**
SVNUAE 503	**Aerodynamics II**
SVNUAE 504	**Flight Dynamics**
SVNUAE 505	**Aircraft maintenance and repair**
SVNUAE 506	**Introduction to MicroProcessor**

B TECH (SIXTH SEMESTER)

SVNUAE 601	**Propulsion II**
SVNUAE 602	**Introduction to Heat Transfer**
SVNUAE 603	**Composite materials and structures**
SVNUAE 604	**Aircraft engine and instrument system**
SVNUAE 605	**Experimental Stress Analysis**
SVNUAE 606	**Fligh stability and automatic control**

FIFTH SEMESTER
501 PROPULSION – I

1. 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.

2. 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.

3. 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.

4. 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.

5. 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.

References

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

502 AIRCRAFT STRUCTURES – II

1. UNSYMMETRICAL BENDING

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

2. 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.

3. 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.

4. 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.

5. 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).

References

1. Peery, D.J., and Azar, J.J., "Aircraft Structures", 2nd edition, McGraw–Hill, N.Y., 1993.
2. Megson, T.M.G., "Aircraft Structures for Engineering Students", Edward Arnold, 1995.
3. Bruhn. E.H. "Analysis and Design of Flight vehicles Structures", Tri – state off set company, USA, 1985.
4. Rivello, R.M., "Theory and Analysis of Flight Structures", McGraw-Hill, 1993.

503 AERODYNAMICS – II

1. ONE DIMENSIONAL COMPRESSIBLE FLOW

Energy, Momentum, continuity and state equations, velocity of sound, Adiabatic steady state flow equations, Flow through converging, diverging passages, Performance under various back pressures.

2. NORMAL, OBLIQUE SHOCKS AND EXPANSION WAVES

Prandtl equation and Rankine – Hugonoit relation, Normal shock equations, Pitot static tube, corrections for subsonic and supersonic flows, Oblique shocks and corresponding equations, Hodograph and pressure turning angle, shock polars, flow past wedges and concave corners, strong, weak and detached shocks, Rayleigh and Fanno Flow. Flow past convex corners, Expansion hodograph, Reflection and interaction of shocks and expansion, waves, Families of shocks, Methods of Characteristics, Two dimensional supersonic nozzle contours.

3. DIFFERENTIAL EQUATIONS OF MOTION FOR STEADY COMPRESSIBLE FLOWS

Small perturbation potential theory, solutions for supersonic flows, Mach waves and Mach angles, Prandtl-Glauert affine transformation relations for subsonic flows, Linearised two dimensional supersonic flow theory, Lift, drag pitching moment and center of pressure of supersonic profiles.

4. AIRFOIL IN HIGH SPEED FLOWS

Lower and upper critical Mach numbers, Lift and drag divergence, shock induced separation, Characteristics of swept wings, Effects of thickness, camber and aspect ratio of wings, Transonic area rule, Tip effects**.**

5. HIGH SPEED WIND TUNNELS

Blow down, in draft and induction tunnel layouts and their design features, Transonic, supersonic and hypersonic tunnels and their peculiarities, Helium and gun tunnels, Shock tubes, Optical methods of flow visualization**.**

References

1. *Rathakrishnan, E., "Gas Dynamics", Prentice Hall of India, 2003.*
2. *Shapiro, A.H., "Dynamics and Thermodynamics of Compressible Fluid Flow", Ronold Press, 1982.*
3. *Zucrow, M.J. and Anderson, J.D., "Elements of gas dynamics", McGraw-Hill Book Co., New York, 1989.*
4. *Mc Cornick. W., "Aerodynamics, Aeronautics and Flight Mechanics", John Wiley, New York, 1979.*
5. *Anderson Jr., D., – "Modern compressible flows", McGraw-Hill Book Co., New York 1999.*

504 FLIGHT DYNAMICS

1. DRAG ON THE AIRPLANE

International Standard Atmosphere - Forces and moments acting on a flight vehicle - Equation of motion of a rigid flight vehicle - Different types of drag - Drag polars of vehicles from low speed to high speeds - Variation of thrust, power and SFC with velocity and altitudes for air breathing engines and rockets - Power available and power required curves.

1. AIRCRAFT PERFORMANCE

Performance of airplane in level flight - Maximum speed in level flight - Conditions for minimum drag and power required - Range and endurance - Climbing and gliding flight (Maximum rate of climb and steepest angle of climb, minimum rate of sink and shallowest angle of glide) -Turning performance (Turning rate turn radius). Bank angle and load factor - Limitations of pull up and push over - V-n diagram and load factor.

3. STATIC LONGITUDINAL STABILITY

Degree of freedom of rigid bodies in space - Static and dynamic stability - Purpose of controls in airplanes -Inherently stable and marginal stable airplanes – Static, Longitudinal stability - Stick fixed stability - Basic equilibrium equation - Stability criterion - Effects of fuselage and nacelle - Influence of CG location - Power effects - Stick fixed neutral point - Stick free stability-Hinge moment coefficient - Stick free neutral points-Symmetric maneuvers - Stick force gradients - Stick _ force per 'g' - Aerodynamic balancing. Determination of neutral points and maneuver points from flight test.

4. LATERAL AND DIRECTIONAL STABILITY

Dihedral effect - Lateral control - Coupling between rolling and yawing moments - Adverse yaw effects - Aileron reversal - Static directional stability - Weather cocking effect - Rudder requirements - One engine inoperative condition - Rudder lock.

5. DYNAMIC STABILITY

Dynamic longitudinal stability: Equations of motion - Stability derivatives - Characteristic equation of stick fixed case - Modes and stability criterion - Effect of freeing-the stick - Brief description of lateral and directional. Dynamic stability - Spiral, divergence, Dutch roll, auto rotation and spin.

References

1. Perkins, C.D., and Hage, R.E., "Airplane Performance stability and Control", John Wiley & Son:, Inc, New York, 1988.
2. Etkin, B., "Dynamics of Flight Stability and Control", Edn. 2, John Wiley, New York, 1982.
3. Babister, A.W., "Aircraft Dynamic Stability and Response", Pergamon Press, Oxford, 1980.
4. Dommasch, D.O., Shelby, S.S., and Connolly, T.F., "Aeroplane Aero dynamics", Third Edition, Issac Pitman, London, 1981.
5. Nelson, R.C. "Flight Stability and Automatic Control", McGraw-Hill Book Co., 1998.
6.

505 AIRCRAFT MAINTENANCE AND REPAIR

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.

506 INTRODUCTION TO MICROPROCESSORS

1. SEMICONDUCTOR DEVICES

PN Junction diodes – Zenor Diodes – Tunnels Diodes- Thermistors – Transistors – FET and MOSFET – Silicon Controlled Rectifiers And Triacs – Their Applications – Half Wave and Full Wave Rectifiers – Filters – Ripple Factor – Zenor Regulators and AC Voltage Regulators – Principles and Types of Transistor Amplifers – RC Coupled, Transformer Coupled, Direct Coupled – Multistage, FET and Power Amplifers.

2. LINEAR AND DIGITAL ICS

IC Technology – Elements of Fabrication of Linear and Digital IC's – D/A and A/D Converters – Comparison Between Analog and Digital Systems – Number Representation – Binary, Octal and Hexadecimal Number Systems – Logic Families and Logic Gates – Flip – Flops – Multi Vibrations Using IC's – Half and full Adder – Registers – Counters – Multiplexers- Demultiplexers – Decoders – Encoders.

3. MICROPROCESSORS

Block Diagram of Microprocessors – Architecture of Intel 8085 – Importance of Data, Address and Control Buses – Instruction Formats – Addressing Modes and Types of Intel 8085 – Instruction Set For 8085 – Development of Simple Language Assembly Programs – Architecture and Functioning of Processors like Z80, M6800 and Intel Family of 80 X86 Processors.

4. MICROPROCESSOR MEMORY DEVICES

RAM, ROM, EPROM – magnetic Bubble Memory – Floppy and Hard Disc – Interfacing of Memory Chips – CRT Terminals – Printers, Keyboards and their Interfacing – Parallel and Series Communication – Synchronous and Asynchronous Data Transfer – DMA Data Transfer.

5. APPLICATIONS

Microprocessor Applications in aerospace – Case study.

References

1. "Computer principles of architecture", Tata McGraw-Hill, New Delhi. 4th Edition 2002.
2. Goankar. R.S., "Microprocessors, Programming to Architecture 8085", Penram International publishing PVT Ltd, New Delhi. 5th Edition 2002
3. V.K. Mehta, "Principles of Electronics", S. Chand & Co, New Delhi, 2nd Edition 2002
4. Malvino A.P. Leach, D.P., "Digital Principles & Applications", Tata McGraw– Hill, 1990.
5. Goankar R.S., "Microprocessors Architecture. Programming and Applications", Wiley Eastern, 1992.
6. Ajit Pal., "Microprocessors", Tata McGraw-Hill, Revised Edition 1995.
7. Douglas, Hall, "Microprocessors and Interfacing", Tata McGraw–Hill, Revised Edition 1990.
8. Mathur A.P., "Introduction to Microprocessors", Tata McGraw–Hill, Revised Edition 1995.

PRACTICAL V SEM
501 AIRCRAFT STRUCTURES LAB – II

LIST OF EXPERIMENTS

1. Unsymmetrical bending of beams
2. Shear centre location for open sections
3. Shear centre location for closed sections
4. Constant strength beam
5. Flexibility matrix for cantilever beam
6. Beam with combined loading
7. Calibration of Photo- elastic materials
8. Stresses in circular discs and beams using photoelastic techniques
9. Vibrations of beams
10. *Wagner beam – Tension field beam*

502 AIRCRAFT STRUCTURES REPAIR LAB

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.

503 CAD / CAM LABORATORY

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

504 Electronics & Microprocessor Lab

LIST OF EXPERIMENTS

1. Plot V-I characteristic of P-N junction diode & calculate cut-in voltage, reverse Saturation current and static & dynamic resistances.
2. Plot V-I characteristic of zener diode and study of zener diode as voltage regulator. Observe the effect of load changes and determine load limits of the voltage regulator.
3. Plot frequency response curve for single stage amplifier and to determine gain bandwidth product.
4. Study all types of rectifier and measure the effect of filter network on D.C. voltage output & ripple factor.
5. Op-Amp in inverting and non-inverting modes.
6. Op-Amp as scalar, summer and voltage follower.
7. .Design LPF and HPF using Op-Amp 741
8. Design Oscillators using Op-Amp (i) RC phase shift (ii) Hartley (iii) Colpitts

USING MICROCONTROLLER

9. Programme to multiply two 8-bit numbers.
10. Programme to generate and sum 15 fibanocci numbers.
11. Transfer of a block of data in memory to another place in memory in the direct and reverse order.
12. Searching a number in an array and finding its parity.

SIXTH SEMESTER
601 PROPULSION – II

1. 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 – Numerical problems.

2. 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- Numerical problems.

3. FUNDAMENTALS OF ROCKET PROPULSION

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

4. 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- Numerical Problems.

5. ADVANTAGES OF PROPULSION TECHNIQUES

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

References

1. *Sutton, G.P., "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 5th Edn., 1993.*
2. Hill, P.G. & Peterson, C.R. "Mechanics & Thermodynamics of Propulsion" Addison – Wesley Longman INC, 1999.
3. *Cohen, H., Rogers, G.F.C. and Saravanamuttoo, H.I.H., "Gas Turbine Theory", Longman Co., ELBS Ed., 1989.*
4. *Gorden, C.V., "Aero thermodynamics of Gas Turbine and Rocket Propulsion", AIAA Education Series, New York, 1989.*
5. *Mathur, M., and Sharma, R.P., "Gas Turbines and Jet and Rocket Propulsion", Standard Publishers, New Delhi, 1988.*

602 INTRODUCTION TO HEAT TRANSFER

1. HEAT CONDUCTION

Basic Modes of Heat Transfer – One dimensional steady state heat conduction: Composite Medium – Critical thickness – Effect of variation of thermal Conductivity – Extended Surfaces – Unsteady state.

Heat Conduction: Lumped System Analysis – Heat Transfer in Semi infinite and infinite solids – Use of Transient – Temperature charts – Application of numerical techniques.

2. CONVECTIVE HEAT TRANSFER

Introduction – Free convection in atmosphere free convection on a vertical flat plate – Empirical relation in free convection – Forced convection – Laminar and turbulent convective heat transfer analysis in flows between parallel plates, over a flat plate and in a circular pipe. Empirical relations, application of numerical techniques in problem solving.

3. RADIATIVE HEAT TRANSFER

Introduction to Physical mechanism – Radiation properties – Radiation shape factors – Heat exchange between non – black bodies – Radiation shields.

4. HEAT EXCHANGERS

Classification – Temperature Distribution – Overall heat transfer coefficient, Heat Exchange Analysis – LMTD Method and E-NTU Method.

5. HEAT TRANSFER PROBLEMS IN AEROSPACE ENGINEERING

High-Speed flow Heat Transfer, Heat Transfer problems in gas turbine combustion chambers – Rocket thrust chambers – Aerodynamic heating – Ablative heat transfer.

References

1. Yunus A. Cengel., “Heat Transfer – A practical approach”, Second Edition, Tata McGraw-Hill, 2002.
2. Incropera. F.P.and Dewitt.D.P. “ Introduction to Heat Transfer”, John Wiley and Sons – 2002.
3. Lienhard, J.H., “A Heat Transfer Text Book”, Prentice Hall Inc., 1981.
4. Holman, J.P. “Heat Transfer”, McGraw-Hill Book Co., Inc., New York, 6th Edn., 1991.
5. Sachdeva, S.C., “Fundamentals of Engineering Heat & Mass Transfer”, Wiley Eastern Ltd., New Delhi, 1981.
6. Mathur, M. and Sharma, R.P. “Gas Turbine and Jet and Rocket Propulsion”, Standard Publishers, New Delhi 1988.

603 COMPOSITE MATERIALS AND STRUCTURES

UNIT 1

Advantages and applications of composite materials - Reinforcements and matrices. Isotropic, orthotropic and anisotropic materials Transformation of material properties for arbitrary fibre orientation.

UNIT 2

Micromechanics - Macromechanics - Netting analysis
Governing differential equation for a general laminate - Angle ply and cross ply laminates, Failure criteria for composites.

UNIT 3

Basic design concepts of sandwich construction - Materials used for sandwich construction - Failure modes of sandwich panels.

UNIT 4

Open and closed mould processes. Filament winding and on-line production method. Manufacture of fibers and properties.

References

1. Calcote, L.R, " The Analysis of Laminated Composite Structures ", Von-Noastrand Reinhold Company, New York, 1998.
2. Jones, R.M., " Mechanics of Composite Materials ", McGraw Hill Kogakusha Ltd., Tokyo, 1985.
3. Agarwal, B.D., and Broutman, L.J., " Analysis and Performance of Fibre Composites ", John wiley and sons Inc., New York, 1980.
4. Lubin, G., " Handbook on Advanced Plastics and Fibre Glass ", Von Nonstrand Reinhold Co.

604 AIRCRAFT ENGINE AND INSTRUMENT SYSTEM

UNIT 1

Ignition and starting - Fuels and their characteristics for IC engines, contamination of fuels and prevention - Instruments for reciprocating engines.

UNIT 2

Fuels - Characteristics - Fuel Systems - Lubricant and Lubricant systems - Ignition and starting systems - Electronic Engine controls - Full Authority Digital Engine Control (FADEC) - engine Indicating, warning and control systems - Instruments for gas turbine engine - Fire warning systems - Aircraft Instruments systems.

UNIT 3

Location, visibility and grouping of Instrument, Panels, Basic Instrument elements and Mechanism, Instrument Panels - Displays - Layouts - Grouping details of:

i) Pitot instrument & systems.
ii) Primary flight instruments.
iii) Heading indicating instruments.
iv) Remote indicating systems.
v) Synchronous data transmission systems.
vi) Flight director & Flight data recording systems.
vii) ECAM/EICAS/EFIS - Their concepts, detailed description maintenance and practices.
ECAM - Electronic Central Aircraft Monitor.
EICAS - Engine Indicator Crew Alert Systems.
EFIS - Electronic Flight Instruments Systems.

UNIT 4

Basic Principles - Equipment - Power Sources - Airborne Navigational Equipment - VHF - ILS - DME - ADF - Radar & Doppler Navigation - Inertial Navigation, VOR, MLS (Microwave Landing System) Cockpit Voice Recorder (CVR), ELT (Emergency Locator Transmitter).

UNIT 5

Source of power - DC and AC generators - Inverters, rectifiers, transformers, batteries - Airplane lighting - Power utilisation in airplanes.

References

1. Bent R.D. Mickinely, " Aircraft Maintenance and Repair ", 2nd Edition - McGraw Hill Inc., New York, 1978.
2. Casamassa J.V. & Bent R., " Jet Aircraft Power Systems ", McGraw Hill Book Co., New York, 1975.
3. Adams H.W., " Aircraft Hydraulic ", McGraw Hill Book Co. Inc., New York, 1943

605 EXPERIMENTAL STRESS ANALYSIS

MEASUREMENTS

Principles of measurements, Accuracy, Sensitivity and range of measurements.

1. **EXTENSOMETERS**

Mechanical, Optical Acoustical and Electrical extensometers and their uses, Advantages and disadvantages.

2. **ELECTRICAL RESISTANCE STRAIN GAUGES**

Principle of operation and requirements, Types and their uses, Materials for strain gauge. Calibration and temperature compensation, cross sensitivity, Rosette analysis, Wheastone bridge and potentiometer circuits for static and dynamic strain measurements, strain indicators.

4. **PHOTOELASTICITY**

Two dimensional photo elasticity, Concept of light – photoelastic effects, stress optic law, Interpretation of fringe pattern, Compensation and separation techniques, Photo elastic materials. Introduction to three dimensional photo elasticity.

1. **NON – DESTRUCTIVE TESTING**

Fundamentals of NDT, Radiography, ultrasonic, magnetic particle inspection, Fluorescent penetrant technique, Eddy current testing, Acoustic Emission Technique, Fundamentals of brittle coating methods, Introduction to Moiré techniques, Holography, ultrasonic C- Scan, Thermograph, Fiber – optic Sensors.

References

1) Srinath, L.S., Raghava, M.R., Lingaiah, K., Garagesha, G., Pant B., and Ramachandra, K., “Experimental Stress Analysis”, Tata McGraw-Hill, New Delhi, 1984.
2) Dally, J.W., and Riley, W.F., “Experimental Stress Analysis”, McGraw-Hill Inc., New York, 1998.
3) Hetyenyi, M., “Hand book of Experimental Stress Analysis”, John Wiley and Sons Inc., New York, 1972.
4) Pollock A.A., “Acoustic Emission in Acoustics and Vibration Progress”, Ed. Stephens R.W.B., Chapman and Hall, 1993.

606 FLIGH STABILITY AND AUTOMATIC CONTROL

Unit 1
Degrees of freedom of a system, Static and dynamic stability, Need for stability in an airplane, Purpose of controls, Inherently and marginally stable airplanes.

Unit 2
Stick Fixed:Basic equations of equilibrium, Stability criterion, Wing and tail moments, Effects of fuselage and nacelles, Effects of c.g.location, Power effects, Stabiliser setting and c.g.location, Elevator effects, Stick fixed neutral point. Stick Free: Hinge moment coefficients, Stick free neutral point symmetric maneuvers, Stick force gradients and stick force per g.Aerodynamic balancing of control surfaces.

Unit 3
Dihedral effect, Coupling between rolling moment and yawing moment, Adverse yaw, Aileron power, Aileron reversal.

UNIT 4
Weathercocking effect, Rudder requirements. One engine inoperative conditions, Rudder lock.

Unit 5
Equations of motion, Stability derivatives, Routh's discriminant, solving the stability quartic, Phugoid motion, Factors affecting the period and damping.
Dutch roll and spiral instability Auto rotation and spin, Two control airplane.

REFERENCES:
1. Perkins C.D., & Hage, R.E. " Airplane perofrmance, stability and control ", Wiley Toppan 1974.
2. Babister, A.W. " Aircraft stability and response ", Pergamon Press, 1980.
3. McCormic, B.W., " Aerodynamic, Aeronautics and Flight Mechanics ", John Wiely, 1995.
4. Nelson, R.C. " Fligh Stability & Automatic Contro ", McGraw Hill, 1989.

PRACTICAL VI SEM
601 PROPULSION LABORATORY

LIST OF EXPERIMENTS

1. Study of an aircraft piston engine. (Includes study of assembly of sub systems, various components, their functions and operating principles)
2. Study of an aircraft jet engine (Includes study of assembly of sub systems, various components, their functions and operating principles)
3. Study of forced convective heat transfer over a flat plate.
4. Study of free convective heat transfer over a flat plate
5. Cascade testing of a model of axial compressor blade row.
6. Study of performance of a propeller.
7. Determination of heat of combustion of aviation fuel.
8. Combustion performance studies in a jet engine combustion chamber.
9. Study of free jet.
10. Study of wall jet.

602 AIRCRAFT DESIGN PROJECT – I

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

603 AERODYNAMICS LABORATORY

1. Fluid flow studies using a blower
2. Drags of different bodies
3. Lift of flat and curved plates and wings
4. Experiments in a small low speed wind tunnel
5. Pressure distribution studies on two-dimensional models.
6. Pressure distribution studies in Swept wings.
7. Calibration of subsonic wind tunnel

604 INDUSTRIAL SEMINAR

The objective of 'Comprehension' is to provide opportunity for the student to apply the knowledge acquired during the academic programme to real-life problems which he/she may have to face in future as an engineer.

Three period per week shall be allotted in the time table for this activity and this time shall be utilised by the students to receive guidance from the members of faculty on solving real-life problems, practice solving these problems and on group discussions, seminar presentations, library reading as assigned by the faculty member incharge.

For internal assessment, there will be 3 or 4 written tests covering all the courses studied in previous semesters.

The written tests may be of objective type of questions, short answer questions, etc.