



FIFTH SEMESTER (AIRCRAFT MAINTENANCE ENGINEERING)

Sr. No.	Subject	STUDY SCHEME			EVALUATION SCHEME						Total Marks
					Internal Assessment		External Assessment (Examination)				
					Th	Pr	Th		Pr		
					Max. Marks	Max. Marks	Max. Marks	Hrs.	Max. Marks	Hrs.	
Hrs/Week		L	T	P							
	Industrial Training	-	-	-	-	100	-	-	100	3	200
5.1	Aircraft Material and Material Science – II	4	-	2	25	25	100	3	50	3	200
5.2	Aircraft Rules, Regulations and CAR – II	4	-	-	25	-	100	3	-	-	125
5.3	Aircraft Systems	4	-	2	25	25	100	3	50	3	200
5.4	Turbo Propeller and Turbo Jet Engine – I	5	-	2	25	25	100	3	50	3	200
5.5	Aircraft Electrical Systems	4	-	2	25	25	100	3	50	3	200
	* SOFT SKILL –III	-	-	2	-	25	-	-	-	-	25
	Total	21	-	14	125	225	500	-	300	-	1150

* Common with diploma programme in Mechanical Engineering

5.1 AIRCRAFT MATERIALS AND MATERIAL SCIENCE - II

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RATIONALE

The aim of Aircraft Maintenance Engineering is to familiarize with the material of various parts of Aircraft and to make best use of material available in single form or in combination. For this purpose knowledge of Material Science is essential.

DETAILED CONTENTS

1. Composite Material

(20 hrs)

1.1 Composite, advantages & uses of composite material.

1.2 Reinforcing fibres, type & uses.

1.3 Terms : warp, waft, unidirectional, bidirectional, mats, fabric weaves, satin weaves, hybrids, intraply hybrid, interply hybrid.

1.4 Matrix material, system, thermosets, thermoplastic, epoxy resin, system, working with resin & catalysis, adhesive pre-impregnated materials, fillers, metal matrix composites.

1.5 Core material, honey-comb, foams styrofoam, urethane, PVC, strux.

1.6 Factors considered for manufacturing cost of composite, manufacturing methods, compression moulding, vacuum bagging, filament winding, lay-up, lightning protection & painting of composite part.

1.7 Safety precautions in the use of composite material.

1.8 Curing method of curing composite material in brief autoclave, heating blankets, machining cured composites.

1.9 Detection of defects/deterioration in composite and non-metallic materials.

2. Air-craft Hardwares

(16 hrs)

2.1 Detailed knowledge of identification, terminology, correct use and inspection of Aircraft, nuts, bolts, Studs, Screws, Washers, Locking devices, types of threading of nuts and bolts, Knowledge of their Indian, British and American standards.

2.2 Spring materials : Characteristics and application

3. Corrosion and its Prevention

(12 hrs)

Factors in the choice of materials in various parts of aircraft. Detection of corrosion, special coating, chemical films, special paints like Abrasive Resistant Paint, Heat and corrosive resistant paints and electroplating.

4. High Temperature Materials

(12 hrs)

Sensors materials like Heat sensing, Signal sensing.

5. Metal Joining Processes

(4 hrs)

Welding of light alloys, aircraft steels and high temperature materials. Defects in welding, NDT techniques

LIST OF PRACTICALS

1. Crack detection using dye-penetrant test.
2. Joining Materials using resistance welding.
3. Joining Materials using gas welding.
4. Carry out riveting on thick and thin aluminum sheets.
5. Making specimen of FRP for given drawing.

INSTRUCTIONAL STRATEGY

Teacher should correlate the topics with the latest discoveries in the field; carryout experimental tests to determine mechanical properties of composites. They should give assignments after every session to make student understand pros and cons of using composites in various fields.

RECOMMENDED BOOKS

1. Advanced Composites by Cindy Foreman Jeppesen; 2nd edition (2002)
2. Mechanics of Composite Materials by Daniel Ishai; Ooxford University Press, 1994
3. Mechanics of Composite Materials by Autar K Kaw; CRC Press, 1997.
4. Mechanics of Composite Materials and Structures by Madhuji Mukhapadhyay; University Press,2004
5. Analysis and Performance of Fibre Composites by Agarwal, B.D., and Broutman, L.J.; John Wiley and sons. Inc., New York, 1995.
6. Handbook on Advanced Plastics and Fibre Glass by Lubin, G.; Von-Nostrand Reinhold Co., New York, 1989.
7. The Analysis of laminated Composite Structures by Calcote, L R.; Von-Nostrand Reinhold Company, New York 1998.
8. Composite Materials for Aircraft Structures by Allen Baker; AIAA Series, II Edition, 1999.

SUGGESTED DISTRIBUTION OF MARKS Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	20	30
2	16	24
3	12	20
4	12	20
5	04	06
Total	64	100

5.2 AIRCRAFT RULES, REGULATIONS AND CAR - II

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RATIONALE

The quality and related responsibility in the work of aircraft maintenance at any level requires some knowledge of legislations. The subject deals with such topics as are imperative for the knowledge of aircraft maintenance engineer and these are changeable from time to time, as per DGCA, New Delhi requirements.

DETAILED CONTENTS

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- 1. Requirement for flight testing of aircraft. (2 hrs)**
 - 2. Storage of Aeronautical Parts (2 hrs)**
Bonded and Quarantine stores, storage of various aeronautical products including rubber goods, various fluids.
 - 3. Operational Requirements of Aircraft (6 hrs)**
Knowledge of various terms such as Certificate of Flight Release, Certificate of Maintenance, Approved Certificates.
 - 4. Installation and maintenance requirement of Air burning, commercial/navigation and radio equipments systems (6 hrs)**
 - 5. Registrations, markings, weight and balance control, load and trim sheets (4 hrs)**
 - 6. Minimum equipments, instruments required for various types of operation (4 hrs)**
 - 7. Modification, Concession, Airworthiness Directive, Service Bulletins. (4 hrs)**
 - 8. Approval of organisation. (4 hrs)**
 - 9. Registration markings. (4 hrs)**
 - 10. Documents required to be carried on board. (4 hrs)**
 - 11. Issue of Type approval. (4 hrs)**
 - 12. Issue of C of A. (4 hrs)**
 - 13. Defects recording, Monitoring, reporting and investigation. (4 hrs)**
 - 14. Requirements of A/c fuels, refuelling of A/c and calibration of a/c fuel tanks (4 hrs)**
 - 15. Human Performance (8 hrs)**
 - a. General - The need to take human factors into account. Incidents attributable to human factors/human error. Murphy's Law.
 - b. Human Performance and Limitations - Vision, Hearing, Information processing, Attention and perception, Memory, Claustrophobia and physical access.
 - c. Social Psychology - Responsibility : Individual and group, Motivation and demotivation, Peer pressure, Culture issues, Team working, Management, supervision and leadership.

d. Factors Affecting Performance - Fitness/health; Stress : domestic and work related; Time pressure and deadlines; Workload : Overload and underload; Sleep and fatigue, shift work; Alcohol, medication, drug abuse.

e. Physical Environment - Noise and fumes; Illumination; Climate and temperature; Motion and vibration; Working environment.

f. Tasks - Physical work; Repetitive tasks; Visual inspection; Complex system.

g. Communication - Within and between teams; Work logging and recording; Keeping up to date, currency; Dissemination of information.

h. Human Error - Error models and theories; types of error in maintenance tasks; Implications of errors (i.e. accidents), Avoiding and managing errors.

i. Hazards in the workplace - Recognising and avoiding hazards; Dealing with emergencies

INSTRUCTIONAL STRATEGY

This being a subject for Aircraft Maintenance Engineer, the teachers should lay emphasis on various basic procedures for Civil Aviation and Civil Airworthiness requirements, as given by DGCA from time to time. Some actual maintenance worksheets may be shown to the students.

RECOMMENDED BOOKS

1. Civil Aircraft Inspection Procedures (CAP 459-Part I, Basic) published by DGCA, New Delhi
2. Civil Aircraft Inspection Procedure (CAP 459) Part II Aircraft published by DGCA, New Delhi
3. Aircraft Maintenance and Repair By Kroes, Watkin and Delp
4. Acceptable Methods, Techniques and practices (FAA)-EA-AC 43.13-1 A&2A
5. Aircraft Construction Repair and Inspection by Joe Christy
6. Light Aircraft Maintenance by J.E. Heywood
7. Light Aircraft Inspection by J.E. Heywood
8. Aircraft repair Manual by Larry Reithmaier
9. Aviation Maintenance Technician Hand book by FAA

SUGGESTED DISTRIBUTION OF MARKS Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	02	04
2	02	04
3	06	08
4	06	08
5	04	06
6	04	06
7	04	06
8	04	04
9	04	04
10	04	06
11	04	06
12	04	04
13	04	06
14	04	06
15	08	22
Total	64	100

5.3 AIRCRAFT SYSTEMS

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RATIONAL

Diploma holder in aircraft maintenance engineering must have a sound knowledge of various mechanical and electrical systems which go in the airframe. This subject is designed to give them an insight into typical systems so that they understand their principles of working

DETAILED CONTENTS

1. Hydraulic system: (10 hrs)

Advantages and disadvantages, types of circuit, flow through pipes, pumps and motors, static performance, actuators, seals and backup rings, reservoirs, accumulators, contamination control filters, tubings and hose pipes, indicating and warning systems, emergency and redundant systems valves, flow dividers and integraters, cooling systems

2. Servo-Control System: (8 hrs)

Stability and response, electro-hydraulic servo systems, position and force feedback, frequency response, principles of automatic control

3. Pneumatic Systems: (8 hrs)

Airconditioning and pressurisation systems, de-icing systems, heat loads, plumbing, cold air units, compact heat exchangers, valves, filters, air bottles, capsules and bellows, indication and warnings

4. Oxygen Systems: (8 hrs)

Gaseous and liquid oxygen systems, breathing masks, oxygen regulators, oxygen bottles, liquid to gas converters, emergency systems, pressure suits, indication and warnings

5. Landing Gear Systems: (8 hrs)

Types of landing gears and their design principles, shock absorbing devices, retracting mechanisms, wheels and brakes, antiskid system, steering systems, indications and warnings.

6. Fuel Systems: (6 hrs)

Types of fuels, their properties and testing, colour codes, fuel requirements, pumps, fuel transfer systems, fuel tanks, plumbing, valves, indications and warnings.

7. Lubrication Systems: (4 hrs)

Types of lubrication systems, lubricants, cleaning agents

8. Fire Protection Systems: (6 hrs)

Types of systems, Flame proofing, Fire walls, Fire detection systems, Fire extinguishing systems.

9. Seat Safety Systems: (6 hrs)

Ejection seats, Survival packs, Parachutes, Pilot's personal equipment, life rafts, Doors, Windows and Emergency exits, Seat belts.

LIST OF PRACTICALS

Study and demonstration of the following aircraft systems:

1. Study and demonstration of hydraulic system
2. Study and demonstration of Pneumatic system
3. Study and demonstration of Electrical system
4. Study and demonstration of basic control system
5. Study and demonstration of Fuel system

INSTRUCTIONAL STRATEGY

Teacher should take the students to industry and explain the details of hydraulic system and air-conditioning systems and their components. While imparting instructions, focus should be on conceptual understanding. Training slides of "Carrier Fundamentals of Refrigeration Air Conditioning" to be shown to students.

RECOMMENDED BOOKS

1. Jet Aircraft Power Systems by J V Casamassa and RD Bent; McGraw Hill.
2. Automatic Flight Control by E H J Pallet; BSP Profession Books.1993
3. Hydraulic System by Dr. Lalit Gupta
4. Pneumatic System by Dr. Lalit Gupta

SUGGESTED DISTRIBUTION OF MARKS Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	10	16
2	08	12
3	08	12
4	08	12
5	08	12
6	06	10
7	04	06
8	06	10
9	06	10
Total	64	100

5.4 TURBO PROPELLER AND JET ENGINE - I

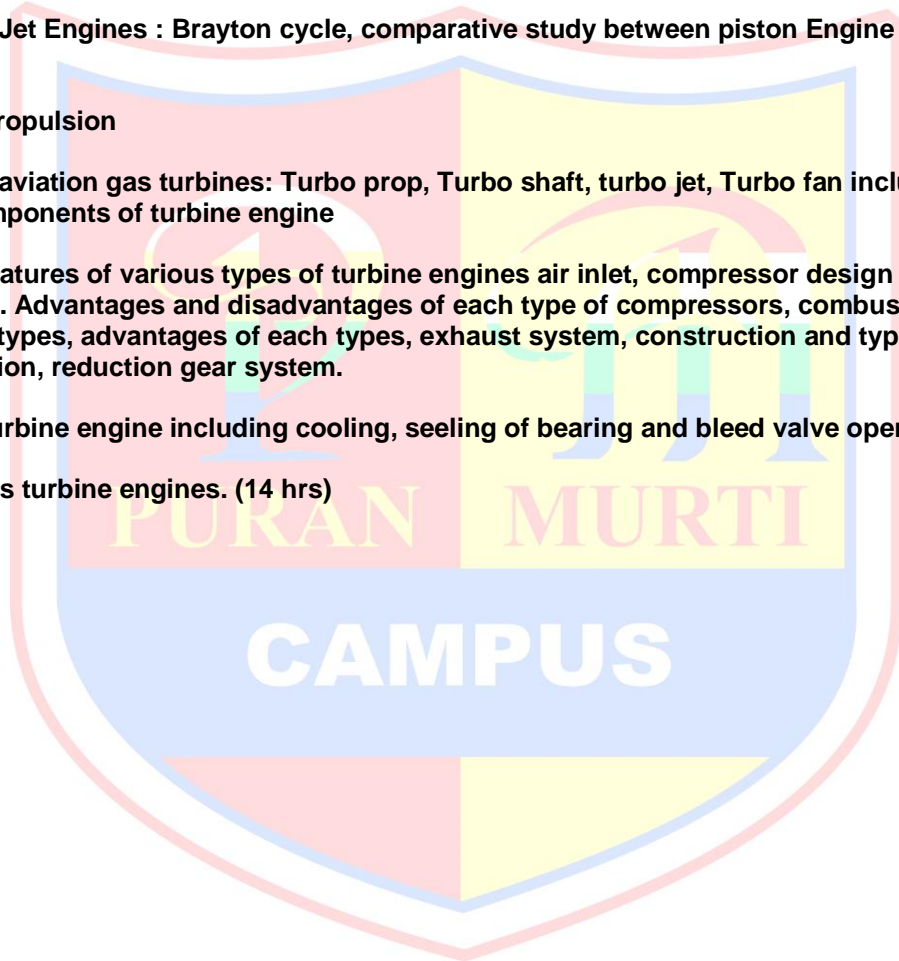
L T P
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RATIONALE

Engine is the source of propulsive force for the of aircraft and its knowledge, principle of working is must for aircraft maintenance engineer.

DETAILED CONTENTS

1. Introduction to Jet Engines : Brayton cycle, comparative study between piston Engine & Turbine engine (10 hrs)
2. Theory of Jet Propulsion (10 hrs)
3. Introduction to aviation gas turbines: Turbo prop, Turbo shaft, turbo jet, Turbo fan including by pass engine. Major components of turbine engine (16 hrs)
4. Construction features of various types of turbine engines air inlet, compressor design and construction and various types. Advantages and disadvantages of each type of compressors, combustion chambers, construction and types, advantages of each types, exhaust system, construction and type, accessory gear section-construction, reduction gear system. (22 hrs)
5. Air system of turbine engine including cooling, sealing of bearing and bleed valve operation. (8 hrs)
6. Materials for gas turbine engines. (14 hrs)



LIST OF PRACTICALS

1. Compressor washing procedures.
2. Internal inspection of an engine by endoscope/boroscope.
3. Hot section inspection, stripping of engine, inspection of combustion chamber, nozzle guide vane and turbine, inspection of turbine tip clearance, inspection of hot section using modern non-destructive testing techniques.
4. Engine removal and installation.
5. Engine ground testing procedure.
6. Engine preservation (Long term and short term).

INSTRUCTIONAL STRATEGY

Introduce basic concepts and salient features of engine components of turbo and jet propelled engines which are operated in atmosphere to students. Familiarize students with advanced jet propulsion methods like hypersonic propulsion. Use simulation methods to demonstrate actual working of an engine. Discuss actual jet engine problems and their impact on engine performance.

RECOMMENDED BOOKS

1. General Hand Books of Airframe and Power Plant Mechanics, U.S. Dept. of Transportation, Federal Aviation Administration, The English Book Store, New Delhi, 1995.
2. Aircraft Power Plants by Mekinley, J.L. and Bent, R.D; McGraw-Hill, 1993.
3. Gas Turbine Technology by Treager, S.; McGraw-Hill, 1997.
4. Airframe and Power Plant Mechanics (EA-AC 65-9A)-General Hand Book.
5. Mechanics & Thermodynamics of Propulsion by Hill, P.G. & Peterson, C.R.; Addison – Wesley Longman INC, 1999.
6. Aerospace Propulsion System by James Award
7. Gas Turbine Theory by Cohen, H. Rogers, G.F.C. and Saravana muttoo, H.I.H.; Longman, 1989.
8. Aero thermodynamics of Aircraft Engine Components by Oates, G.C.; AIAA Education Series, New York, 1985.
9. Jet Engine, 5th Edition by Rolls Royce; Rolls Royce Technical Publications, 2005.
10. Gas Turbine, Jet and Rocket Propulsion by Mathur, M.L. and Sharma, R.P.; Standard Publishers & Distributors, Delhi, 1999.
11. Aerospace Propulsion System by James Award.

SUGGESTED DISTRIBUTION OF MARKS Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	10	12
2	10	12
3	16	20
4	22	28
5	08	10
6	14	18

Total	80	100
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5.5 AIRCRAFT ELECTRICAL SYSTEMS

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RATIONALE

Use of electrical systems in the design of air craft is well known to every one. Maintenance of these systems is a matter of utmost importance. The purpose of this subject is to develop proper understanding among the students about various aspects of phenomenon occurring in the aircraft.

DETAILED CONTENTS

- 1. Electrical Measuring Instruments (8 hrs)**
 - 1.1 General description and types of measuring instruments.
 - 1.2 Requirement of indicating instrument.
 - 1.3 Different type of instruments - Moving coil type, Moving Iron type dynamometer type, construction and working.
 - 1.4 A meter, voltmeter, wattmeter, frequency meter.
- 2. Electrical, Cables and wires and terminals : Nomenclature (6 hrs)**
Current Capacity; Lacing, Clamping and Routing of wire bundles, Various terminals and constructions; Different types of connectors; Switches.
- 3. Protective devices : Fuses; Relays; Circuit breaker; Over voltage; Under voltage; Reverse current breaker; Current limiter. (6 hrs)**
- 4. Static electricity in aircraft: Corona threshold, P- static-cause and prevention, Bonding; Static discharge wick and null discharges; Shielding. (6 hrs)**
- 5. D. C. generators: Different parts; Theory different types and types of armature winding, armature reaction, magnetic neutral axis angle of lead types of generator and their uses. Inter poles, voltage regulators, vibrating type, Carbon pile, three unit control pannel, Paralleling of generators, Static generator and contraction, repair and maintenance. (6 hrs)**
- 6. A. C. generators: Theory, construction, single phase, multi-phase generator, static inverter, types voltage regulation, magnetic amplifier regulator, transistorized voltage regulator, parallel operation maintenance. Operation and construction of revolving armature and revolving field type of AC generators. (6 hrs)**
- 7. Motors : D. C. motors, Theory, Types, A. C. motor; Theory, multi-phase, Induction motor, Starters, Different types of A.C. motors, Induction motors (Single Phase) split phase motor, Repulsion motors, Series motors, Starter motors. (6 hrs)**
- 8. Transformers : Types of transformers, Principles of operation construction - Transformer ratio cooling device uses and efficiency. Rectifiers, current transformer, potential xmer, auto xmer. (6 hrs)**
- 9. Aircraft typical electrical system : Aircraft wiring system, Various circuits of aircraft electrical system. Landing gear circuits, Generator circuit, Battery and starter circuits, Flap circuits, Landing light circuits, CHT circuit, O/T circuit, Fuel content, Electrical gauges circuits. (6 hrs)**
- 10. Batteries (4 hrs)**

- a. General description and general precaution lead Nickel-Cadmium batteries (Aircraft batteries).
- b. Construction of lead acid batteries.
- c. Battery rating, Battery testing, Effect of temp. Thermal runaway, cold weather operation.
- d. Charging of lead acid battery.
- e. Construction of Nickel-Cadmium battery.
- f. Charging of Ni-Cd. Battery.

- g. Inspection and testing of Ni-Cd. Battery.
- h. Installation of lead acid and Ni-Cd. Battery.
- i. Maintenance of installed batteries.
- j. Battery record, storage & transportation procedure.

11. Filters : Application and uses of flow pass, high pass, bend pass and bend stop.

(4 hrs)



LIST OF PRACTICALS

1. Open lead acid battery and know the construction and assembly.
2. Transformer : Operation and Testing.
3. A. C. & D. C. Motors : Dismantle, Know the parts and service and reassemble.
4. Study Thermo-couple function.
5. Solenoid, Dismantling, inspecting and parts checking and its function.
6. Voltage regulator : Dismantle, inspecting the parts preparing wiring diagram and checking its function.
7. Straters: Dismantling, cleaning, inspection, know the parts, function of parts and assembly.
8. Reading and connecting the different circuit diagrams.
9. Wiring practice in double wire and single wire system of basic circuits.
10. Charging of batteries.

INSTRUCTIONAL STRATEGY

Teacher should use demonstration and discussion methods to explain various aspects of aircraft electrical systems to the students.

RECOMMENDED BOOKS

1. Aircraft Systems by Ian Moir and Allan Seabridge; John Wiley & Sons
2. Electrical Measurements and Measuring Instruments by AK Sawhney; Dhanpatrai & sons
3. Aircraft Instruments by C.A. Williams; Galgotia publishing house
4. Civil, Aircraft Inspection Procedures (CAP459) Two Volumes, Himalayan Books
5. Electrical Technology by B L Threja
6. Digital Principles and Applications by Leach Malvino; Tata McGraw Hill
7. Aviation Electronics by Keith W Bose
8. Aircraft Electrical System by E.H.J. Pallett
9. Aircraft Electricity and electronics by Bent Mekinley
10. Aircraft Electrical Systems by J E Bygate

SUGGESTED DISTRIBUTION OF MARKS Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	08	10
2	06	10
3	06	10
4	06	10
5	06	10
6	06	10
7	06	10
8	06	10
9	06	10
10	04	06
11	04	04
Total	64	100

SOFT SKILLS – III**L T P**
- - 2**RATIONALE**

The present day world requires professionals who are not only well qualified and competent but also possess good communication skills. The diploma students not only need to possess subject related knowledge but also soft skills to get good jobs or to rise steadily at their work place. The objective of this subject is to prepare students for employability in job market.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:

- Develop communication skills.
- Learn how to speak without fear and get rid of hesitation
- Use effective presentation techniques
- Understand entrepreneurial traits
- Exhibit attitudinal changes

DETAILED CONTENTS

- Communication Skills – Handling fear and phobia
- Resume Writing
- Applying for job through email/job portal
- Interview preparation : Mock Interview, Group Discussions and Extempore
- Presentation Techniques
- Developing attitude towards safety. Disaster management.

In addition, the students must participate in the following activities to be organized in the institute

- Sports
- NCC/NSS
- Camp – Entrepreneurial awareness
- Cultural Event

Note: Extension Lectures by experts may be organized. There will be no examination for this subject.