

**Curriculum for
Diploma Programme in
AIRCRAFT MAINTENANCE ENGINEERING
(AME)
CAMPUS**



FOURTH 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.				
		L	T	P							
4.1	Aircraft Material and Material Science – I	4	-	2	25	25	100	3	50	3	200
4.2	General Airframe and Aero Modeling	4	-	2	25	25	100	3	50	3	200
4.3	Elements of Electrical and Electronics Engineering – II	4	-	2	25	25	100	3	50	3	200
4.4	Aircraft Instruments	4	-	2	25	25	100	3	50	3	200
4.5	Aircraft Reciprocating Engine	3	-	2	25	25	100	3	50	3	200
4.6	Aircraft Rules, Regulations and CAR – I	4	-	-	25	-	100	3	-	-	125
* SOFT SKILL –II		-	-	2	-	25	-	-	-	-	25
Total		23	-	12	150	150	600	-	250	-	1150

* Common with Diploma programme in Mechanical Engineering Industrial Training

After examination of 4th Semester, the students shall go for training in a relevant industry/field organization for a minimum period of 6 weeks up to 8 weeks and will prepare a diary. It shall be evaluated during 5th semester by his/her teachers for 100 marks. The students shall also prepare a report at the end of training and shall present it in a seminar, which will be evaluated for another 100 marks. This evaluation will be done by HOD and lecturer in-charge – training in the presence of one representative from Industry/Sector Skill Council/Training and Placement Officer/Subject Expert from other institution.

4.1 AIRCRAFT MATERIALS AND MATERIAL SCIENCE - I

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4 - 2

RATIONALE

One of the major aims of diploma in Aircraft Maintenance Engineering is to familiarize the students 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. Introduction to Aircraft Materials (Non Metals)

(24 hrs)

- 1.1 Types of Wood-soft, Cross section, Grains defects.
- 1.2 Specification requirements and use of spruce, Walnut, Mahogany, Birch and Ash.
- 1.3 Plywood, its construction and use.
- 1.4 Types of glues for aircraft use. Precautions to be observed storage life.
- 1.5 Fabric types, specifications, requirements.
- 1.6 Reinforcing tapes, edgings, threads and their specification requirement.
- 1.7 Different types of dopes and thinner acetate and nitrocellulose, tautening and non-tautening and their storage life, specification requirements of dopes.

2. Plastics resin plastics, thermo-plastics, thermosetting plastics, Acrylic and Cellulose their use. (10 hrs)

3. Rubber and synthetic rubber natural, Synthetic Buna's Buna-N, Neopren Butyl and thickol and their uses and shelf life and service life.

(12 hrs)

4. Aircraft adhesives, sealants, paints, primers, varnishes and enamels

(18 hrs)

5. Metal and Alloys

a) Ferrous & Non Ferrous Metals :

Introduction to manufacturing, properties and uses of Pigiron, Wrought iron and Cast iron. Difference between iron and steels. Types of steels. SAE and British systems of their classification
Low, medium and high carbon steels, their properties and uses. Introduction to various methods of heat treatment - Hardening, Tempering, Annealing, Normalising, Carburising, Refining processes and temperatures. Temperature colour guides. Case hardening - Different processes. Heat treatment of carbon steels, Critical points in iron-carbon diagram.

Identification of ferrous metals on practical tests

b) Non Ferrous Metals

Alloy Steels: Kinds, composition, properties. Effect of constituents on their properties Definition of light alloys and heavy alloys and their application in air craft's. Magnesium Alloys, Titanium alloys, Inconel alloys and their uses. Identification of non ferrous metals on practical tests.

Heat treatment processes for light alloys - Age hardening.

c) Wrought aluminum alloys indicating their properties - Specifications Duralumin-alclad and its use – identification of those materials in various heat treated states and forms.

LIST OF PRACTICALS

1. Specimen preparation
2. Normalizing of steel specimen and study its microstructure
3. Annealing of steel specimen and study its microstructure
4. Pickling of steel specimen
5. Polishing of steel specimen

INSTRUCTIONAL STRATEGY

The teacher should engage the students in discussion about various topics, so that the students understand the relevant significance and applications.

RECOMMENDED BOOKS

1. Aircraft Materials and Processes by George F Titterton; Pitman Publishing Corporation
2. An Introduction to Material Science and Engineering by William D. Callister; John Wiley and Sons.
3. Material Science by Raghvan V.; Prentice Hall India.
4. Principles of Material Science and Engineering by William F. Smith; McGraw-Hill Publications.
5. Engineering Physical Metallurgy by Lakhtin Y; Mir Publisher.

SUGGESTED DISTRIBUTION OF MARKS Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	24	36
2	10	16
3	12	18
4	18	30
Tot1al	64	100

CAMPUS

4.2 GENERAL AIR FRAME AND AERO MODDLING

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4 - 2

RATIONALE

This subject equips the maintenance engineer with the pre and post requisites of flight to facilitate him in his work to meet the desired objectives.

DETAILED CONTENTS

1. Understanding of aircraft types, roles, structural layout. Classification of Aircraft and different parts, including Windows, Doors and Emergency exits (06 hrs)
2. Loads taken up by Aircraft (03 hrs)
3. General constructions: Composite constructions, Metal construction, Monologue and Semi-monocoque, Stressed construction. (08 hrs)
4. Knowledge of fail-safe and safe-life concept. (03 hrs)
5. Construction of fuselage: Steel Tubular Structure, Light Metal construction, Fabric, Plywood and Metal coverage. (06 hrs)
6. Construction of Wing and types of wings. (04 hrs)
7. Aircraft components construction and utility. (06 hrs)
8. Undercarriage types, Fixed and retractable Tyres, Tubes, Brake system and shock absorbers. (06 hrs)
9. Primary control system, Secondary and Auxiliary control system, Cable testing and rigging of controls. (08 hrs)
10. Fuel tanks - different types, testing and repair of fuel tanks. Use of sealants (03 hrs)
11. Knowledge of minor defects, their reporting, investigation and method of rectification and repair of minor defects rigging of aircraft. Periodical inspection necessary to check the serviceability of the aircraft. Preparation of a brief report with the help of sketches if necessary in case of damage to the aircraft. Symmetry check, Balancing of control surface, duplicate inspection. (08 hrs)
12. Minor structural repairs of metal and composite aircraft. (03 hrs)

LIST OF PRACTICALS

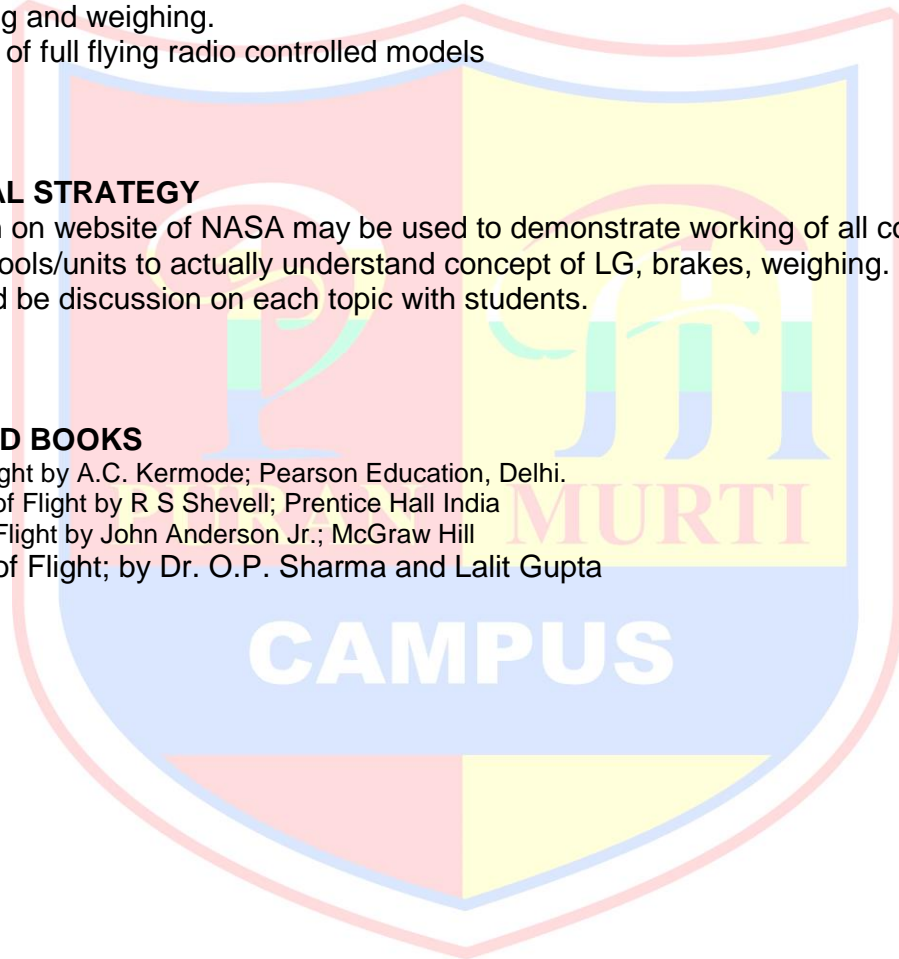
1. Aircraft tire, tube and wheel assembly.
2. Servicing of aircraft brake system.
3. Brake bleeding.
4. Shock strut charging.
5. Landing gear retraction check.
6. Fabric covering, sewing and patching.
7. Doping.
8. Rigging of aircraft controls.
9. Aircraft leveling and weighing.
10. Construction of full flying radio controlled models

INSTRUCTIONAL STRATEGY

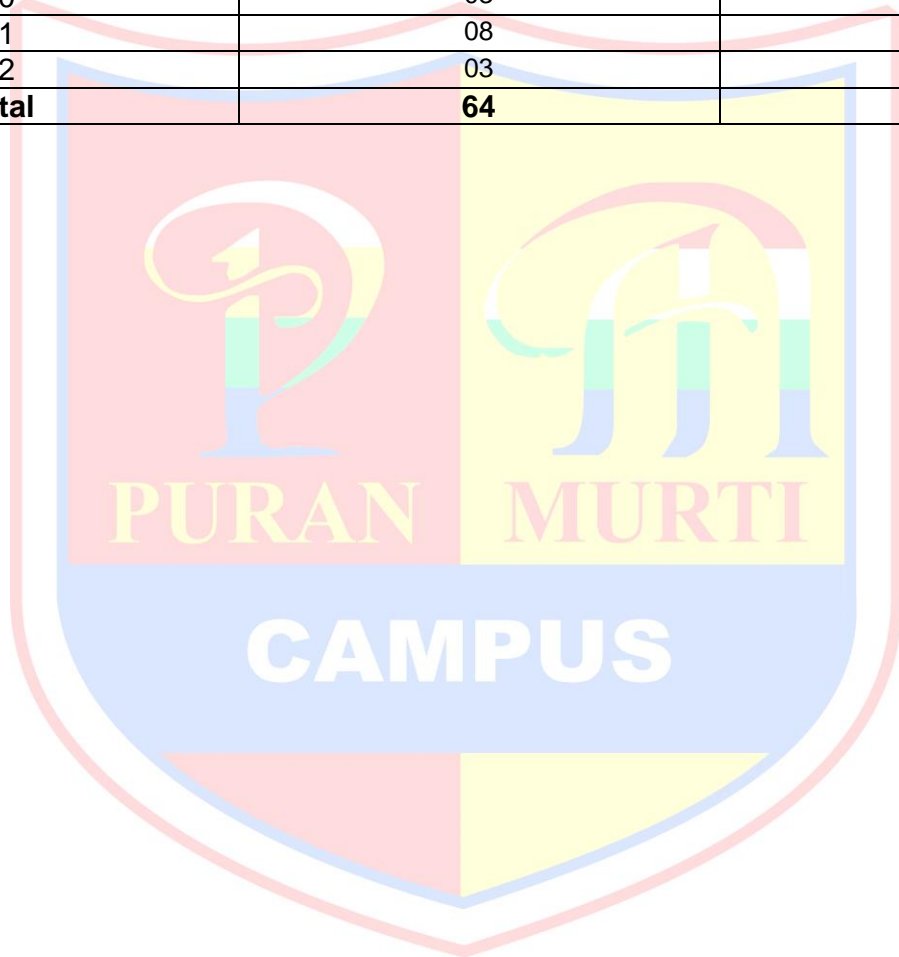
Resources given on website of NASA may be used to demonstrate working of all control surfaces; visit to flying schools/units to actually understand concept of LG, brakes, weighing. Jacking up
Emphasis should be discussion on each topic with students.

RECOMMENDED BOOKS

1. Mechanics of Flight by A.C. Kermode; Pearson Education, Delhi.
2. Fundamentals of Flight by R S Shevell; Prentice Hall India
3. Introduction to Flight by John Anderson Jr.; McGraw Hill
4. Fundamentals of Flight; by Dr. O.P. Sharma and Lalit Gupta



SUGGESTED DISTRIBUTION OF MARKS Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	06	08
2	03	04
3	08	12
4	03	06
5	06	10
6	04	08
7	06	10
8	06	10
9	08	12
10	03	06
11	08	10
12	03	04
Total	64	100



4.3 ELEMENTS OF ELECTRICAL AND ELECTRONICS ENGINEERING-II

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RATIONALE

An A.M.E. diploma holder is involved in various jobs ranging from preventive maintenance of aircraft to fault location in circuits, commission of new component, selection of suitable component for improvement. In order to carry out these and similar jobs effectively on any equipment circuitry or machinery, specialised knowledge of concerned field is essential.

However, for acquiring knowledge in any specialised field of electrical engineering, a group of certain common fundamental concepts, principles and laws involved and mastering of some manual skills are the pre-requisites to be covered in the subject of basic electricity.

DETAILED CONTENTS

1. Basic Terminology and their concepts

(6 hrs)

- 1.1 Current, EMF, potential difference (Voltage), resistance, resistivity, their units, conductors & insulators.
- 1.2 Effect of temperature on the resistance of conductors, semiconductors (C, Si, Ge) and insulators physical explanation, temperature coefficient of resistance.
- 1.3 Electrical power, energy and their units (SI).
- 1.4 Relationship between electrical, mechanical and thermal SI units of work, power and energy.

2. D.C. Circuits

(8 hrs)

- 2.1 Kirchoff's laws.
- 2.2 Simple numerical problems based on Kirchoff's laws.
- 2.3 Introduction to Thevenin and Superposition theorem.
- 2.4 Operation of photo cells, Construction, Material and operation of thermo-couples.

3. Introduction to Semiconductor Devices

(8 hrs)

Introduction, semiconductor and their applications, Different semiconductor materials used in manufacturing various semiconductor (Si & Ge), Material used for electronic components like resistor, capacitor, diode, transistors, thyristors and inductors.

4. Capacitors

(10 hrs)

- 4.1 Concept of capacitor, capacity of parallel plate capacitor, and effect of physical parameters.
- 4.2 Energy stored in a capacitor, dielectric and its influence on capacitance of a capacitor, dielectric constant dielectric breakdown and dielectric strength. Dielectric loss.
- 4.3 Series and parallel combination of capacitors.
- 4.4 Variable capacitors.
- 4.5 Charging and discharging of capacitors.
- 4.6 Simple problems on capacitors.

5. Electromagnetism

(8 hrs)

- 5.1 Theory of magnetism, Magnetic material, Magnetism and demagnetism, Electromagnetic waves.
- 5.2 Concept of magnetic flux, flux density, magnetic field intensity, permeability and their units.
- 5.3 Magnetic circuits, concept of reluctance and mmf and simple problems.
- 5.4 Analogy between electric and magnetic circuits.
- 5.5 B-H curve and magnetic hysteresis (No mathematical derivation).
- 5.6 Elementary ideas about hysteresis loss.

6. Electromagnetic Induction**(8 hrs)**

- 6.1 Faraday's laws of electromagnetic induction. Lenz's law, simple problem. Dynamically induced emf.
- 6.2 Self induced emf, inductance, its role in electrical circuits. Simple problems.
- 6.3 Mutually induced emf, mutual inductance, its role in electrical circuits. Simple problems.
- 6.4 Energy stored in magnetic circuit.
- 6.5 Rise and decay of current in inductors.
- 6.6 Force on a current carrying conductor placed in a magnetic field and its applications.
- 6.7 Elementary idea about eddy current loss.

7. A.C. Circuits**(10 hrs)**

- 7.1 Recapitulation of terminology, instantaneous value, maximum (peak) value, cycle, frequency, alternate current and voltage. Difference between AC and DC, Static electricity and conduction.
- 7.2 Equation of an alternating voltage and current and wave shape varying sinusoid ally.
- 7.3 Average and RMS value of alternating voltage and current. Importance of RMS value. Simple problems.
- 7.4 Concept of phase, phase difference and phasor representation of alternating voltage and current.
- 7.5. A.C. through pure resistance, inductance, capacitance, phasor diagram and power absorbed.
- 7.6 R-L series circuit, idea of impedance and calculations.
- 7.7 Apparent power, reactive power and active power, power factor, its importance and simple problems.
- 7.8 R-C series circuit, simple problems.
- 7.9 R-L-C series circuit, simple problems.
- 7.10 Solution of simple parallel A-C circuits by
 - (a) Phasor diagram method,
 - (b) Admittance method.
- 7.11 Solution of AC circuits series/parallel by j method. (simple problems).
- 7.12 Resonance (Series and parallel) and practical application, simple problems.

8. Polyphase System**(6 hrs)**

- 8.1 Introduction to polyphase system. Advantage of three phase system over single phase system.
- 8.2 Star and Delta connections. Relationship between phase and line value of currents and voltage. Power in polyphase circuits. Simple problems of balanced circuits only.

LIST OF PRACTICALS

1. To show the variation of resistance of a lamp with temperature by plotting a V-I curve for 60W and 100W filament lamps.
2. To verify the Kirchhoff's laws.
3. To observe the B-H curve for a ferro-magnetic core on CRO.
4. To find the relationship between voltage and current for R-L series circuit for variable resistances & variable inductance.
5. To determine the variation in the values of inductance of a coil for different positions of the movable iron core.
6. To measure the power factor in a single phase AC circuit by using voltmeter, ammeter & wattmeter.
7. To charge and discharge a capacitor and to show the graph on C.R.O.
8. Verification of voltage and current relations in Star and delta connected systems.
9. To study the phenomenon of electromagnetic induction.
10. To measure the total or equivalent resistance to verify the same by calculation method.
11. To study the colour coded resistance and to verify the same by millimeter.
12. To study and sketch diodes, transistors, thyristors, IC and PCB.

INSTRUCTIONAL STRATEGY

Teacher should lay emphasis on fundamentals related to electrical and electronics. They should also discuss with the students the significance and application of various topics in aircraft maintenance engineering.

RECOMMENDED BOOKS

1. Basic Electrical Engineering by V.N. Mittle; Tata McGraw Hill Edition, New Delhi, 1990.
2. Applied Electronics by R.S. Sedha; S. Chand & Co., 2006.
3. Basic Electrical, Electronics and Computer Engineering by Muthusubramanian R, Salivahanan S and Muraleedharan K A; Tata McGraw Hill, Second Edition, (2006).
4. Basics of Electrical Engineering by Nagsarkar T K and Sukhija M S; Oxford press (2005).
5. Principles of Electronics by Mehta V K; S.Chand & Company Ltd, (1994).
6. Electric Circuits by Mahmood Nahvi and Joseph A. Edminister; 'Schaum' Outline Series, McGraw Hill, (2002).
7. Basic Electrical Engineering by Premkumar N; Anuradha Publishers, (2003).

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



4.4 AIRCRAFT INSTRUMENTS

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RATIONALE

Knowledge of aircraft instruments for maintenance engineer is no way less important than that of aircraft engine. They are controlling and guiding organs of the aircraft. Hence, this subject is included in the curriculum.

DETAILED CONTENTS

1. General introduction to Aircraft instrument, Various instruments and classification. (4 hrs)
2. Altimeter, Principle, Constructional details, Types of setting, Position error leak test and periodical inspection. (4 hrs)
3. Airspeed indicator, Pitot and Static Tube Construction and Principle, Position Error, Construction and periodical inspection, lead test . (6 hrs)
4. Vertical speed indicator, Constructional features checks and Installation procedure, Periodical inspection. (4 hrs)
5. Pressure gauge: Principle of operation, types of gauges, Periodical inspection. (6 hrs)
6. Temperature Gauge; Principle of thermocouple and different types of thermometer used in Aviation. Cylinder Head Temperature Gauge, Maintenance and Periodical inspection. (6 hrs)
7. R. P. M. Indicator; Mechanical construction details types of indicator maintenance and periodical inspection. (4 hrs)
8. Gyro Instruments; Principle of Gyro Wheel and different types of gyres; Constructional details of each i.e. Turn & Bank, Artificial Horizon and Directional gyro; Maintenance and periodical inspection, Suction gauge etc., (6 hrs)
9. Electrically operated instruments. (6 hrs)
10. Fuel flow gauge and content gauges. (4 hrs)
11. Main fold Pressure Gauge. (4 hrs)
12. Detailed knowledge of the procedures of replacement and insite operational tests of all instruments (except the engine related instruments) and equipment (except where the use of special test instrument//equipment is required). (6 hrs)
13. Introduction to Total Quality Management (TQM) as applicable to aviation industry with reference to ISO9000/IS14000/AS9100-Issue Certificate, quality system standards. (4 hrs)

LIST OF PRACTICALS

1. Leak testing of pitot and static system.
2. Identification of various parts of instruments.
3. Calibration and testing of fuel quantity gauges.
4. Periodical maintenance of gyro instruments.

INSTRUCTIONAL STRATEGY

The teacher should give due emphasis on the basics, significance and application of various topics included in the subject. They should discuss and demonstrate various aircraft instruments in the class.

RECOMMENDED BOOKS

1. Introduction to Avionics Systems by R P G Collinson; Kulwar Academic Publishers, 2003
2. Aircraft Electrical System by E H J Pallett; Pitman Publishers, 1976.
3. Avionics Systems by Middleton, D.H., Ed.; Longman Scientific and Technical Longman Group UK Ltd., England, 1989.
4. Digital Avionic Systems by Spitzer C.R.; Prentice Hall, Englewood Cliffs, N.J., USA, 1987.
5. Navigation by R.B. Underdown and Tony Palmer; Black Well Publishing 2001.
6. Aircraft Instruments by E.H.J. Pallet.

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

4.6 AIRCRAFT RULES, REGULATIONS AND CAR - I

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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

- | | |
|--|-----------------|
| 1. I. A. R.
Knowledge of Aircraft Rules in relation to airworthiness and safety of an aircraft. | (8 hrs) |
| 2. C.A.R, A/C, Advisory Circulars
Knowledge of "Civil Airworthiness Requirements", "Aeronautical Information Circulars (Relating to Airworthiness)", "Advisory Circulars" and AME notice(s) issued by DCCA. Familiaration with C.A.R. 145 and C.A.R. 21. | (12 hrs) |
| 3. Privileges of AME's
Knowledge of Privileges and responsibility of the various categories of AME Licence and approved persons. Requirements and procedure for issue/ extension/endorsement/renewal of various category of AME license/ approvals/authorization. | (8 hrs) |
| 4. Airworthiness and Confirmed Airworthiness
Knowledge of various mandatory documents like Certificate of Registration, Certificate of Airworthiness, Flight Manual, Export Certificate of Airworthiness. Types of certificates like requirements for Aging Aircraft, Requirements procedures and conditions for issuance of special flight permits. | (14 hrs) |
| 5. Aircraft Maintenance
Requirements for storage, quality control, checks, distribution. Aircraft instruments, equipments and accessories, general requirements for maintenance and certifications of aircraft, including Gliders, Microlight, Aircraft, Hot Air balloons. Duplicate inspection of controls. | (14 hrs) |
| 6. Log Books
Various log books required to be maintained for Aircraft. Method of maintaining the log book. Procedure for making entries in Log books, Journey log books, Technical log book etc. | (8 hrs) |

INSTRUCTIONAL STRATEGY

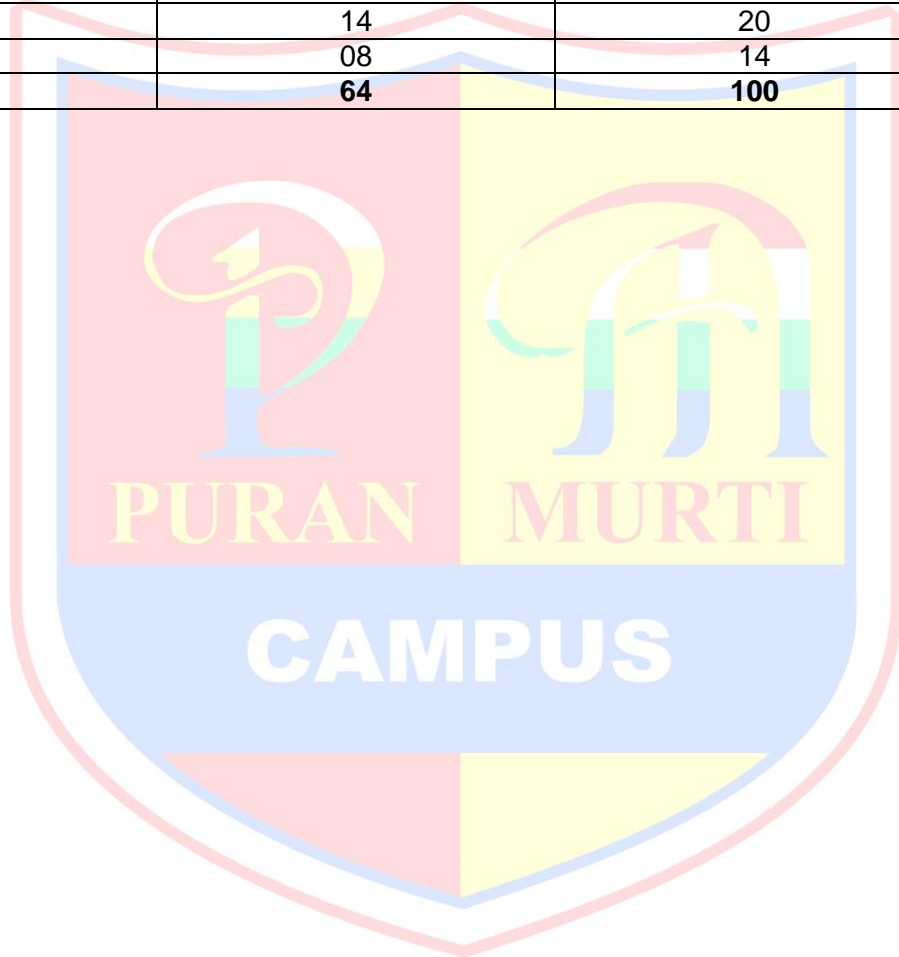
This being an important and elementary subject for Aircraft Maintenance Engineer, the teachers should lay emphasis on various basic procedures for Civil Aviation and Civil Airworthiness requirements, as given by DGCA from time to time. Some actual maintenance worksheets may be shown to the students.

RECOMMENDED BOOKS

1. Aircraft Manual Published by DGCA, New Delhi
2. Civil Aviation Requirements (Section 2- Airworthiness) Published by DGCA, New Delhi
3. Aeronautical Information Circulars (relating to Airworthiness) Published by DGCA, New Delhi
4. Airworthiness Advisory Circulars Published by DGCA, New Delhi
5. Human Factor Guidelines DOC 9806 Published by DGCA, New Delhi
6. Civil Aircraft Inspection Procedures (CAP 459-Part I, Basic) Published by DGCA, New Delhi
7. Civil Aircraft Inspection Procedure (CAP 459) Part II Aircraft Published by DGCA, New Delhi
8. Aircraft Maintenance and Repair by Kroes, Watkin and Delp

9. Acceptable Methods, Techniques and Practices (FAA)-EA-AC 43.13-1 A&2A published by DGCA, New Delhi
10. Aircraft Construction Repair and Inspection by Joe Christy
11. Light Aircraft Maintenance by J.E. Heywood
12. Light Aircraft Inspection by J.E. Heywood.

SUGGESTED DISTRIBUTION OF MARKS Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	08	14
2	12	18
3	08	14
4	14	20
5	14	20
6	08	14
Total	64	100



SOFT SKILLS – II

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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
- Work in a team
- Learn to resolve conflict by appropriate method
- Identify leadership traits and learn self motivation
- Follow ethics

DETAILED CONTENTS

- Concept of team building, behavior in a team
- Developing Interpersonal Relations- empathy, sympathy
- Communication skills - improving non-verbal communication
- Conflict Management
- Motivation
- Leadership
- Professional Ethics and Values
- Health, Hygiene, Cleanliness and Safety

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

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

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

INDUSTRIAL TRAINING

Industrial training provides an opportunity to students to experience the environment and culture of industrial production units and commercial activities undertaken in field organizations. It prepares student for their future role as diploma engineers in the world of work and enables them to integrate theory with practice.

For this purpose, students at the end of fourth semester need to be sent for industrial training for a minimum of 6 weeks upto 8 weeks duration to be organized during the semester break starting after IV Semester examinations. The concerned HODs along with other teachers will guide and help students in arranging appropriate training places relevant to their specific branch. It is suggested that a training schedule may be drawn for each student before starting of the training in consultation with the training providers. Students should also be briefed in advance about the organizational setup, product range, manufacturing process, important machines and materials used in the training organization.

Equally important with the guidance is supervision of students training in the industry/organization by the teachers. A teacher may guide a group of 4-5 students. A minimum of one visit per week by the teacher is recommended. Students should be encouraged to write daily report in their diary to enable them to write final report and its presentation later on.

An internal assessment of 100 and external assessment of 100 marks have been provided in the study and evaluation scheme of V Semester. Evaluation of professional industrial training report through viva-voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations. The formative and summative evaluation may comprise of weightage to performance in testing, general behavior, quality of report and presentation during viva-voce examination. It is recommended that such evaluations may be carried out by a team comprising of concerned HOD, teachers and representative from industry. The components of evaluation will include the following.

- a) Punctuality and regularity 15%
- b) Initiative in learning new things 15%
- c) Relationship with workers 15%
- d) Industrial training report 55%