NSQF ALIGNED CURRICULUM FOR
THREE YEAR (Six Semester) DIPLOMA COURSE IN
AIRCRAFT MAINTENANCE ENGINEERING
(HELICOPTER & POWER PLANTS)

For the State of Uttar Pradesh

Effective from Session 2022-23

Prepared by:

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PREFACE

An important issue generally debated amongst the planners and educator's world over is how technical education can contribute to sustainable development of the societies struggling hard to come in the same bracket as that of the developed nations. The rapid industrialization and globalization have created an environment for free flow of information and technology through fast and efficient means. This has led to shrinking of the world, bringing people from different culture and environment together and giving rise to the concept of world turning into a global village .In India, a shift has taken place from the forgettable years of closed economy to knowledge based and open economy in the last few decades. In order to cope with the challenges of handling new technologies, materials and methods, we have to develop human resources having appropriate professional knowledge, skills and attitude. Technical education system is one of the significant components of the human resource development and has grown phenomenally during all these years. Now it is time to consolidate and infuse quality aspect through developing human resources, in the delivery system. Polytechnics play an important role in meeting the requirements of trained technical manpower for industries and field organizations. The initiatives being taken by the Technical Education, UP to revise the existing curricula of diploma programmes as per the needs of the industry and making them NSQF compliant, are laudable.

In order to meet the requirements of future technical manpower, we will have to revamp our existing technical education system and one of the most important requirements is to develop outcome-based curricula of diploma programmes. The curricula for diploma programmes have been revised by adopting time-tested and nationally acclaimed scientific method, laying emphasis on the identification of learning outcomes of diploma programme.

The real success of the diploma programme depends upon its effective implementation. However best the curriculum document is designed, if that is not implemented properly, the output will not be as expected. In addition to acquisition of appropriate physical resources, the availability of motivated, competent and qualified faculty is essential for effective implementation of the curricula.

It is expected of the polytechnics to carry out job market research on a continuous basis to identify the new skill requirements, reduce or remove outdated and redundant courses, develop innovative methods of course offering and thereby infuse the much-needed dynamism in the system

Director
Institute of Research Development &Training.
Kanpur

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5. All the participants from industry/field organizations, engineering colleges, polytechnics and other technical institutions for their professional inputs during curriculum workshops.

6. Faculty/Subject Experts from U.P. Government polytechnics

Coordinator
Institute of Research Development & Training,
Kanpur, U.P.

1. **SALIENT FEATURES OF DIPLOMA PROGRAMME IN AIRCRAFT MAINTENANCE ENGINEERING(HELICOPTER & POWER PLANTS)**

1)	Name of the Programme	:	Diploma Programme in Aircraft Maintenance Engineering(HELICOPTER & POWER PLANTS)
2)	Duration of the Programme	:	Three years (Six Semesters)
3)	Entry Qualification	:	10 + 2 with (Physics, Chemistry and Mathematics) or Equivalent and 50% aggregate in Physics, Chemistry and Math
4)	Intake	:	30
5)	Pattern of the Programme	:	Semester Pattern
6)	NSQF Level	:	Level - 5
7)	Ratio between theory and Practice	:	50:50 (Approx.)

2. **-EMPLOYMENT OPPORTUNITIES FOR DIPLOMA HOLDERS INAIRCRAFT MAINTENANCE ENGINEERING(HELICOPTER & POWER PLANTS)**

The following are the major employment opportunities for diploma holders in AIRCRAFT MAINTENANCE ENGINEERING:

(A) Employment

(B) Entrepreneurship

(C) Free Lancing

(D) Teaching

The detailed job description under each of the above fields may be summarized as below:

(A) Employment: Aircraft mechanics inspect mechanical, hydraulic and structural systems and diagnose malfunctions. They use power and hand tools to repair aircraft parts. For example, they fix broken wings and leaks. Aircraft mechanics also ensure compliance with aviation safety rules and regulations and aircraft's maintenance checks, check, inspection, repair, modification, and testing safety, demonstration, emergency and loose equipment, removal/ installation, repair, overhaul, modification, and refurbishment of all aircraft seats.

(B) Entrepreneurship: Entrepreneurship can play an important role in minimizing the negative impact of aviation companies on the environment, for example by initiating and realization of innovative projects related to environmental protection, dissemination of eco-innovation, clean technologies, more eco-friendly economy. Encourage innovation by bringing new ideas, products, and services to the market. Contribute to social change by developing products or services that reduce people's dependence on outdated technologies.

(C) Free Lancing: An individual who makes money on a per-job basis is a freelancer. They usually earn on a per-task basis and generally work for a short time. In simpler terms, they do not work for a firm. Thus, they enjoy the liberty to work on various jobs for different clients simultaneously. Work as a freelancer, usually called a contractor in Europe but you will have to go through an agency.

3. LEARNING OUTCOMES OF DIPLOMA PROGRAMME **IN AIRCRAFT MAINTENANCE ENGINEERING(HELICOPTER & POWER PLANTS)**

Sr. No.	**Learning Outcomes**
After due completion of the course, a Diploma Programme IN Aircraft Maintenance Engineering(HELICOPTER & POWER PLANTS) will be able to:	
1.	Able to give detailed description of the subject theoretical fundamentals and specific examples
2.	Able to use mathematical formulae related to the subject
3.	Able to read, understand and prepare sketches , simple drawing and schematics describing the subject
4.	Able to apply his knowledge in a practical manner using manufacturer's instructions
5.	Able to interpret results from various sources and measurements and apply corrective action where appropriate
6.	Able to use the tool/equipment/test equipment as specified by manufacturer
7.	Able to use of maintenance manual for carrying out the required inspection and testing without missing any defects
8.	Able to identify the location of component and capable of correct removal/fitment/adjustment of such component
9.	Able to demonstrate a responsible attitude in respect to flight safety and airworthiness of the aircraft
10.	Able to use tools and equipment and working in accordance with maintenance manual

4. DERIVING CURRICULUM AREAS FROM LEARNING OUTCOMES OF THE PROGRAMME

The following curriculum areas/subjects have been derived from learning outcomes:

Sr. No.	Learning Outcomes	Curriculum Area/Subject
1.	Able to give detailed description of the subject theoretical fundamentals and specific examples	All subject
2.	Able to use mathematical formulae related to the subject	Mathematic
3.	Able to read, understand and prepare sketches , simple drawing and schematics describing the subject	Engineering Drawing
4.	Able to apply his knowledge in a practical manner using manufacturer's instructions	Maintenance Practice
5.	Able to interpret results from various sources and measurements and apply corrective action where appropriate	Maintenance Practice
6.	Able to use the tool/equipment/test equipment as specified by manufacturer	Workshop practice
7.	Able to use of maintenance manual for carrying out the required inspection and testing without missing any defects	Aviation Legislation/Human Factors
8.	Able to identify the location of component and capable of correct removal/fitment/adjustment of such component	Practical Work
9.	Able to demonstrate a responsible attitude in respect to flight safety and airworthiness of the aircraft	Practical Work
10.	Able to use tools and equipment and working in accordance with maintenance manual	Practical Work
11.	Develop understanding regarding the size and scale of operations and nature of field-work in which students are going to play their role after completing the courses of study	Project Work
12.	Develop understanding of subject based knowledge given in the classroom in the context of its application at work places.	Project Work

5. ABSTRACT OF CURRICULUM AREAS

a) General Studies

1. Environmental Studies
2. Energy Conservation
3. Universal Human Values

b) Applied Sciences

4. Mathematics
5. Physics

c) Basic Courses in Engineering/Technology

6. Engineering Drawing
7. Workshop Practice
8. Mechanics

d) Applied Courses in Engineering/Technology

9. Air Craft Materials & Material Science
10. Aviation Legislation-I
11. Human factors
12. Basic Electricity And Electronics Engineering
13. General Engineering And Ground Supports
14. Aviation legislation-II
15. General Helicopter Airframe
16. Helicopter Systems
17. Aircraft Electricity
18. Rotors
19. Theory of Flight
20. Aircraft Reciprocating Engines-I
21. Aircraft Instruments
22. Aircraft Compass
23. Aircraft Reciprocating Engines-II
24. Avionics
25. Basic Computer
26. Helicopter Airframe (Chetak)
27. Jet Engines
28. Aero Engine Helicopter

e) Industrial Training /Project

29. Project Work
30. Industrial Training

6-HORIZONTAL AND VERTICAL ORGANISATION OF THE SUBJECTS

Sr. No.	Subjects	Distribution in Periods per week in Various Semesters					
		I	II	III	IV	V	VI
1.	Mathematics	6	-	-	-	-	-
2.	Physics	6	-	-	-	-	-
3.	Air Craft Materials & Material Science	6	-	-	-	-	-
4.	Engineering Drawing	8	-	-	-	-	-
5.	Aviation Legislation-I	8	-	-	-	-	-
6.	Workshop Practice	12	-	-	-	-	-
7.	Human factors	-	6	-	-	-	-
8.	Mechanics	-	6	-	-	-	-
9.	Basic Electricity And Electronics Engineering	-	12	-	-	-	-
10.	General Engineering And Ground Supports	-	8	-	-	-	-
11.	Aviation legislation-II	-	8	-	-	-	-
12.	General Helicopter Airframe	-	-	12	-	-	-
13.	Helicopter Systems	-	-	15	-	-	-
14.	Air Craft Electricity	-	-	10	-	-	-
15.	Rotors	-	-	9	-	-	-
16.	Theory of Flight	-	-	-	10	-	-
17.	Aircraft Reciprocating Engines-I	-	-	-	11	-	-
18.	Aircraft Instruments	-	-	-	9	-	-
19.	Aircraft Compass	-	-	-	9	-	-
20.	*Energy Conservation	-	-	-	5	-	-
21.	Aircraft Reciprocating Engines-II	-	-	-	-	12	-
22.	Avionics	-	-	-	-	14	-
23.	Basic Computer	-	-	-	-	10	-
24.	Helicopter Airframe (Chetak)	-	-	-	-	10	-
25.	*Environmental Studies	-	-	-	-	-	5
26.	Jet Engines	-	-	-	-	-	12
27.	Aero Engine Helicopter	-	-	-	-	-	12
28.	*Universal Human Values	-	-	-	-	-	3
29.	Project	-	-	-	-	-	10
30.	Industrial Training	-	-	-	-	-	-
31.	Student Centered Activities	2	4	2	4	2	2
	Total	**48**	**44**	**48**	**48**	**48**	**44**

7. STUDY AND EVALUATION SCHEME FOR
THREE YEAR(SIX SEMESTER) DIPLOMA COURSE IN AIRCRAFT MAINTENANCE ENGINEERING
(HELICOPTER & POWER PLANTS)
I Semester

Sr. No.	SUBJECTS	STUDYS CHEME Periods/Week			Credits	MARKSINEVALUATIONSCHEME								Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
1.1	Mathematics	4	2	-	5	20	-	20	50	2½	-	-	50	70
1.2	Physics	4	2	-	5	20	-	20	50	2½	-	-	50	70
1.3	Aircraft Materials &Material Science	6	-	-	5	20	-	20	50	2½	-	-	50	70
1.4	Engineering Drawing	-	-	8	4	20	-	20	50	4	-	-	50	70
1.5	Aviation Legislation-I	8	-	-	4	20	-	20	50	2½	-	-	50	70
1.6	Workshop Practice	4	-	8	6	20	50	70	50	2½	100	6	150	220
#StudentCentredActivities		-	-	2	1		30	30	-	-	-	-	-	30
Total		**26**	**4**	**18**	**30**	**120**	**80**	**200**	**300**	**-**	**100**	**-**	**400**	**600**

Student Centred Activities will comprise of co-curricular activities like extension lectures, self-study, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities, disaster management and safety etc.

NOTE:

(1) Each period will be 50 minutes duration.
(2) Each session will be of 16 weeks.
(3) Effective teaching will be at least 14 weeks.
(4) Remaining periods will be utilized for revision etc.
(5) Objective questions in theory examinations will be of 60 questions of 1/2 marks each with reasoning and other 04 questions will beof 5 marks each.

STUDY AND EVALUATION SCHEME FOR
THREE YEAR(SIX SEMESTER) DIPLOMA COURSE INAIRCRAFT MAINTENANCE ENGINEERING (HELICOPTER & POWER PLANTS)
II Semester

Sr. No.	SUBJECTS	STUDYS CHEME Periods/Week			Credits	MARKSINEVALUATIONSCHEME								Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P		Th	Pr	L	T	P	Pr	Hrs	Tot	
2.1	Human factors	4	2	-	5	20	-	20	50	2½	-	-	50	70
2.2	Mechanics	4	2	-	5	20	-	20	50	2½	-	-	50	70
2.3	Basic Electricity And Electronics Engineering	7	2	3	8	20	30	50	50	2½	60	3	110	160
2.4	General Engineering And Ground Supports	5	-	3	6	20	30	50	50	2½	60	3	110	160
2.5	Aviation legislation-II	8	-	-	4	20	-	20	50	2½	-	-	50	70
#StudentCentredActivities		-	-	4	1		30	30	-	-	-	-	-	30
Total		**28**	**6**	**10**	**29**	**100**	**90**	**190**	**250**	**-**	**120**	**-**	**370**	**560**
Grand total Sem I & II														**1160**

Student Centred Activities will comprise of co-curricular activities like extension lectures, self-study, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities, disaster management and safety etc.

NOTE:

(1) Each period will be 50 minutes duration.
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(4) Remaining periods will be utilized for revision etc.
(5) Objective questions in theory examinations will be of 60 questions of 1/2 marks each with reasoning and other 04 questions will beof 5 marks each.

STUDY AND EVALUATION SCHEME FOR
THREE YEAR (SIX SEMESTER) DIPLOMA COURSE IN
AIR CRAFT MAINTENANCE ENGINEERING (HELICOPGTER & POWER PLANTS)
III Semester

Sr. No.	SUBJECTS	STUDYS CHEME Periods/Week			Credits	MARKSINEVALUATIONSCHEME								Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
3.1	General Helicopter Airframe	5	1	6	7	20	30	50	50	2½	60	3	110	160
3.2	Helicopter Systems	7	2	6	8	20	50	70	50	2 ½	100	3	150	220
3.3	Aircraft Electricity	4	1	5	6	20	30	50	50	2½	60	3	110	160
3.4	Rotors	6	3	-	7	20	-	20	50	2½	-	-	50	70
#Student Centred Activities		-	-	2	1	-	30	30	-	-	-	-	-	30
Total		**22**	**7**	**19**	**29**	**80**	**140**	**220**	**200**	**-**	**220**	**-**	**420**	**640**

Student Centred Activities will comprise of co-curricular activities like extension lectures, self-study, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities, disaster management and safety etc.

NOTE:

(1) Each period will be 50 minutes duration.
(2) Each session will be of 16 weeks.
(3) Effective teaching will be at least 14 weeks.
(4) Remaining periods will be utilized for revision etc.
(5) Objective questions in theory examinations will be of 60 questions of 1/2 marks each with reasoning and other 04 questions will beof 5 marks each.

STUDY AND EVALUATION SCHEME FOR
THREE YEAR (SIX SEMESTER) DIPLOMA COURSE IN
AIR CRAFT MAINTENANCE ENGINEERING (HELICOPGTER & POWER PLANTS)
IV Semester

Sr. No.	SUBJECTS	STUDYS CHEME Periods/Week			Credits	MARKSINEVALUATIONSCHEME								Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
4.1	Theory of Flight	7	3	-	8	20	-	20	50	2 ½	-	-	50	70
4.2	Aircraft Reciprocating Engines-I	5	-	6	7	20	30	50	50	2 ½	60	3	110	160
4.3	Aircraft Instruments	5	1	3	7	20	30	50	50	2 ½	60	3	110	160
4.4	Aircraft Compass	5	1	3	6	20	30	50	50	2 ½	60	3	110	160
4.5	*Energy Conservation	3	-	2	3	20	30	50	50	2½	50	3	100	150
#Student Centred Activities		-	-	2	1		30	30	-	-	-	-	-	30
Total		**25**	**5**	**16**	**32**	**100**	**150**	**250**	**250**		**230**	**-**	**480**	**730**

*Common with other engineering diploma courses

Student Centred Activities will comprise of co-curricular activities like extension lectures, self-study, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities, disaster management and safety etc.

*****Minimum 4 Weeks Industrial Training has to be completed by students after 4th semester. The evaluation will be carried out in 6th Semester.*****

NOTE:

(1) Each period will be 50 minutes duration.
(2) Each session will be of 16 weeks.
(3) Effective teaching will be at least 14 weeks.
(4) Remaining periods will be utilized for revision etc.
(5) Objective questions in theory examinations will be of 60 questions of 1/2 marks each with reasoning and other 04 questions will beof 5 marks each.

STUDY AND EVALUATION SCHEME FOR
THREE YEAR (SIX SEMESTER) DIPLOMA COURSE IN
AIRCRAFT MAINTENANCE ENGINEERING (HELICOPGTER & POWER PLANTS)
V Semester

Sr. No.	SUBJECTS	STUDYSCHEME Periods/Week			Credits	MARKSINEVALUATIONSCHEME								Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
5.1	Aircraft Reciprocating Engines-II	5	1	6	7	20	30	50	50	2 ½	60	3	110	160
5.2	Avionics	7	1	6	8	20	30	50	50	2 ½	60	3	110	160
5.3	Basic Computer	4	1	5	6	-	30	30	-	-	60	3	60	90
5.4	Helicopter Airframe (Chetak)	6	-	5	7	20	50	70	50	2 ½	100	3	150	220
#Student Centred Activities		-	-	1	1	-	30	30	-	-	-	-	-	30
Total		**22**	**3**	**23**	**29**	**60**	**170**	**230**	**150**		**280**	**12**	**430**	**660**

Student Centred Activities will comprise of co-curricular activities like extension lectures, self-study, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities, disaster management and safety etc.

NOTE:

(1) Each period will be 50 minutes duration.
(2) Each session will be of 16 weeks.
(3) Effective teaching will be at least 14 weeks.
(4) Remaining periods will be utilized for revision etc.
(5) Objective questions in theory examinations will be of 60 questions of 1/2 marks each with reasoning and other 04 questions will beof 5 marks each.

STUDY AND EVALUATION SCHEME FOR
THREE YEAR (SIX SEMESTER) DIPLOMA COURSE IN
AIRCRAFT MAINTENANCE ENGINEERING (HELICOPGTER & POWER PLANTS)
VI Semester

Sr. No.	SUBJECTS	STUDYS CHEME Periods/Week			Credits	MARKSINEVALUATIONSCHEME								Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
6.1	*Environmental Studies	3	-	2	3	20	10	30	50	2 ½	20	3	70	100
6.2	Jet Engines	7	-	5	8	20	30	50	50	2 ½	60	3	110	160
6.3	Aero Engine Helicopter	6	-	6	8	20	50	70	50	2½	100	2.5	150	220
6.4	*Universal Human Values	2	-	1	1	-	20	20	-	-	30	3	30	50
6.5	Project	-	-	10	4	-	50	50	-	-	100	-	100	150
6.6	Industrial Training	-	-	-	1	-	20	20	-	-	40	-	40	60
#StudentCentredActivities		-	-	2	1		30	30	-	-	-	-	-	30
Total		**18**	**-**	**26**	**26**	**60**	**210**	**270**	**150**	**-**	**350**	**-**	**500**	**770**

*Common with other engineering diploma courses

Student Centred Activities will comprise of co-curricular activities like extension lectures, self-study, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities, disaster management and safety etc.

NOTE:

(1) Each period will be 50 minutes duration.
(2) Each session will be of 16 weeks.
(3) Effective teaching will be at least 14 weeks.
(4) Remaining periods will be utilized for revision etc.
(5) Objective questions in theory examinations will be of 60 questions of 1/2 marks each with reasoning and other 04 questions will beof 5 marks each.

8. GUIDELINES FOR ASSESSMENT OF STUDENT CENTERED ACTIVITIES (SCA)

It was discussed and decided that the maximum marks for SCA should be 30 as it involves a lot of subjectivity in the evaluation. The marks may be distributed as follows:

A) i. 10 Marks for general behavior and discipline
(by HODs in consultation with all the teachers of the department)

ii. 5 Marks for attendance as per following:
(by HODs in consultation with all the teachers of the department)

a)	75 - 80%	2 Marks
b)	80 - 85%	4 Marks
c)	Above 85%	5 Marks

iii. 15 Marks maximum for Sports/NCC/Cultural/Co-curricular/ NSS activities as per following:
(by In-charge Sports/NCC/Cultural/Co-curricular/NSS)

a)	15	-	State/National Level participation
b)	10	-	Participation in two of above activities
c)	5	-	Inter-Polytechnic level participation

Note: There should be no marks for attendance in the internal sessional of different subjects.

I Semester

1.1 MATHEMATICS

L	T	P
4	2	-

RATIONALE:

Contents of this course provide fundamental base for understanding elementary mathematics and their uses in solving engineering problems. Contents of this course will enable students to use basic mathematical function like logarithms, partial fractions, matrices, curves in solving various engineering problems of all fields.

LEARNING OUTCOMES:-

- Apply Binomial theorem to solve engineering problems apply determinants properties to solve engineering problems
- Apply dot & cross product of vectors to find the solution of engineering problems use complex numbers in various engineering problems
- Apply differential calculus and higher order to solve engineering problems
- After undergoing this course, the students will be able to: Calculate simple integration by methods of integration
- Evaluate the area under curves, surface by using definite integrals.
- Calculate the area and volume under a curve along areas
- Solve the engineering problems with numerical methods.
- Understand the geometric shapes used in engineering problems by co-ordinate geometry.

DETAILED CONTENTS

1. ALGEBRA

(i) Theory of Equation and symmetric functions of roots.
(ii) Binomial, Logarithmic and Exponential Series, General exponential and logarithmic series (Revision).
(iii)Complex numbers and their applications to engineering problems.
(iv) Vectors and their graphic representation Mathematical operations of vectors.
(v) Matrices and Determinants (Elementary Idea).

2. TRIGNOMETRY

(i) Inverse Circular Functions.
(ii) De Movier's Theorem and its application.

3. DIFFERENTIAL CALCULUS :

(i) Method of finding derivatives of differential coefficient of a function.
(ii) Differentiation of function of function.
(iii)Logarithmic differentiation.
(iv) Successive differentiation.
(v) Partial differentiation.
(vi) Application of findings Tangents and Normal.
(vii) Maxima and Minima

4. INTEGRAL CALCULUS

(i) Methods of indefinite integration.
(ii) Integration by Substitution.
(iii)Integration by parts.
(iv) Application of integration in calculation of Surface, Area and Volumes of cylinder, Cone and Sphere.

5. CO-ORDINATE GEOMETRY :

(i) Cartesian and Polar co-ordinates and their relationship through the system of representation of point in space and in a plane. Inter-relationship between Polar and Cartisian co-ordinates. Polar and Cartesian equation of standard curves.

(ii) (ii) Straight lines, Planes and Sphere in space, distance between two points of space. Findings equations of a straight line and shortest distance between two lines.

(iii) Standard form of curves of parabola, hyperbola, ellipse and tangents and normal.

(iv) Study of general equations of Second Degree for representing of various curves such as a pair of straight line, circle, parabola and ellipse.

INSTRUCTONAL STRATEGY:-

Basic elements of Differential Calculus, Integral Calculus, differential equations, Algebra and Trigonometry can be taught conceptually along with real engineering applications in which particular algorithm and theory can be applied. Numerical examples will be helpful in understanding the content of the subject.

MEANS OF ASSESSMENT :-

- Assignments and Quiz/Class Tests
- Mid-term and End-term Written Tests

RECOMMENDED BOOKS:-

1. Elementary Engineering Mathematics by BS Grewal, Khanna Publishers, New Delhi
2. Engineering Mathematics, Vol I & II by SS Sastry, Prentice Hall of India Pvt. Ltd.,
3 Applied Mathematics-II by Chauhan and Chauhan, Krishna Publications, Meerut.

Website for reference:-

https://nptel.ac.in/

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	16	20
2	16	10
3	16	20
4	16	20
5	20	30
Total	84	100

1.2 PHYSICS

L	T	P
4-	2	-

RATIONALE:
Knowledge and teaching of physics is a foundation course of engineering students, its purpose is to develop proper understanding of physical phenomena and the scientific concepts.

LEARNING OUTCOMES-

- Demonstrate conceptual understanding of fundamental physics principles.
- Communicate physics reasoning in oral and in written form.
- Solve physics problems using qualitative and quantitative reasoning including sophisticated mathematical techniques.
- Conduct independent Research or work successfully in a technical position.

DETAILED CONTENTS

1.A. THERMOMETRY :
(i) Concept of heat and temperature. Units of heat. Basic principles of measurement of temperature.
(ii)Relation between Fahrenheit, Celsius, Kelvin and Rankine's, Scales of temperature and Numericals.

B. CALORIMETRY :
(i) Concept of thermal capacity and specific heat, Effect of temperature on specific heat,
(ii) Latent heat of fusion and vaporization, thermal energy and heat of combustions.
(iii)Specific heat of gases, Specific heat at constant pressure and constant volume (Cp&Cv) and relationship between them. Ratio of two specific heats, specific heat of gas at low temperature, difference between vapour and gas.

2. NATURE OF HEAT :
(i) Concept of mechanical equivalent of heat and its determination by Joule's method.
(ii) Concept of ideal and real gases. Laws governing the behaviour of gases viz. Boyle's Law, Charle's Law. Compression and expansion processes of gases - such as adiabatic, isothermal processes. Work done during these processes, Internal energy of gas.
(iii) Concept of heat transfer by conduction, convection and radiation, Coefficient of thermal conductivity and its determination by Searle's and Lee's methods. Simple
numericals related to above

3. THERMODYNAICS :
First and second law of thermodynamics, Concept of heat engine, heat pump and refrigerator, Carnot cycle, Otto cycle and Diesel cycle and their thermal efficiencies and related numerical
.

4. OPTICS :
Nature of light, Speeds of light, Loss of refraction and reflection at a plane surface by Spherical Mirror and Lenses and Critical angle, Total internal reflection.
Principle of Fibre optics, Optical fibre and their applications.

5. WAVE MOTION AND SOUND :

Mechanical waves, Sinusoidal wave, Interference phenomena and Standing waves. Speed of sound, Production of sounds, Intensity of sound waves, Pitch and quality. Doplar's effects and Ultrasonic waves .

6. KINEMATICS :

(i) Angular velocity, Angular acceleration, Angular momentum.
(ii) Relation between Angular and linear velocity.
(iii)Centrifugal force.
(iv) Motion in a vertical circle.
(v) K.E. of rotation.
(vi)Simple theory of vibrations and harmonic resonances
(vii) Numericals based on above topics.

7. PROJECTILE :

Parabolic motions, Projectile thrown horizontally and at an angle, Problems on time of flight, horizontal range and maximum horizontal range.

8. MOTION OF SETELLITES - ESCAPE VALOCITY :

(i) Orbital speed of satellite.
(ii) Period of revolution of satellite.
(iii) Artificial satellite.
(iv) Weightlessness in satellite.
(v) Binding energy of satellite.
(vi) Max height attained and velocity of satellite.
(vii)Geo-stationery satellites
(viii)Jet propulsion theory.

INSTRUCTIONAL STRATEGY:-

Teacher may use various teaching aids like live models, charts, graphs and experimental kits etc. for imparting effective instructions in the subject. The teacher should explain about field applications before teaching the basics to develop proper understanding of the physical phenomenon. Use of demonstration and animations can make the subject interesting and may develop scientific temper in the students. Teacher must plan a tour of Science Park/planetarium available in nearby areas in order to enhance the interest in this course.

MEANS OF ASSESSMENT:

- Assignment & Quiz,
- Mid-Term and End-Term written test,
- Viva-voce

RECOMMENDED BOOKS / OTHER SOURCES:-

1. Text Book of Physics for Class XI (Part-I, Part-II); N.C.E.R.T., Delhi
2 .Concepts in Physics by HC Verma, Vol. I& II, Bharti Bhawan Ltd. New Delhi
3. Comprehensive Practical Physics, Vol, I & II, JN Jaiswal, Laxmi Publications (P) Ltd., New Delhi
4. B.Sc. Practical Physics by C L Arora, S. Chand Publication..
5. Engineering Physics by PV Naik, Pearson Education Pvt. Ltd, New Delhi
6. Engineering Physics by DK Bhhatacharya & Poonam Tandan; Oxford University Press, New Delhi
7. Modern Engineering Physics by SL Gupta, Sanjeev Gupta, Dhanpat Rai Publications
8. V. Rajendran, physics-I, Tata McGraw-Hill raw Hill publication, New Delhi
9. Arthur Beiser, Applied Physics, Tata McGraw-Hill raw Hill publication, New Delhi
10. Kumar mittal by A. N. Mittal and Ajay Kumar Bhattacharya class XII.

Website for reference:-

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	12	20
2	9	10
3	9	10
4	11	10
5	11	10
6	11	10
7	9	10
8	12	20
Total	84	100

1.3 AIRCRAFT MATERIAL AND MATERIAL SCIENCE

L	T	P
6	-	-

Rationale :
The paper intends to provide acquaintance to the Aircraft Maintenance Engineers with the physical and chemical properties of common materials of aircraft parts, related process involved with and various Aircraft Hardware to facilitate him in his work to meet the desired objectives.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

1-Differntiate between ferrous &nonferrous materials
2-Identify different types of composite materials
3-Identify different types of aircraft hardware & locking devices
4-Differentiate between pipe, hoses & connectors
5-Explain the functions of transmission system

DETAILED CONTENTS

1: **Aircraft Materials —**

(a) Ferrous
Characteristics, properties and identification of common alloy steels used in aircraft;
Heat treatment and application of alloy steels;

(b)Non-Ferrous
Characteristics, properties and identification of common non-ferrous materials used in aircraft;
Heat treatment and application of non-ferrous materials;

(c) Testing of ferrous and non-ferrous material for hardness, tensile strength, fatigue strength and impact resistance.

2: **Aircraft Materials - Composite and Non- Metallic**

Composite and non-metallic other than wood and fabric
(a)Characteristics, properties and identification of common composite and non-metallic materials, other than wood, used in aircraft;

(b) Sealant and bonding agents. Bonding practices, Inspection Methods

3 :**Aircraft Materials –Wooden and Fabric Covering**
3.1 Wooden structures
Construction methods of wooden airframe structures;
Characteristics, properties and types of wood and glue used in aero planes;
3.2 Fabric covering
Characteristics, properties and types of fabrics used in aeroplanes;

4:Corrosion
(a) Chemical fundamentals;
Formation by, galvanic action process, microbiological, stress;
(b) Types of corrosion and their identification;
Causes of corrosion;

5 Fasteners

5.1 Screw threads
Screw nomenclature; Thread forms, Measuring screw threads;
5.2 Bolts, studs and screws
Bolt types: specification, identification and marking of aircraft bolts, international standards;
Nuts: self-locking, anchor, standard types; Machine screws: aircraft specifications;
Studs: types and uses, insertion and removal;
Self-tapping screws, dowels.

6 Locking device
Tab and spring washers, locking plates, split pins, wire locking, quick release fasteners, keys, circlips, cotter pins.

7 Aircraft rivets
Types of solid and blind rivets: specifications and identification, heat treatment.

8 Pipes and Unions
(a) Identification of, and types of rigid and flexible pipes and their connectors used in aircraft;
(b) Standard unions for aircraft hydraulic, fuel, oil, pneumatic and air system pipes.

9 Springs and Bearings
Types of springs, materials, characteristics.
Purpose of bearings, loads, material, construction; Basic types of bearings and their application

10 Transmissions
(a) Gear types and their application; Gear ratios, driven and driving gears, idler gears, mesh patterns;
(b) Belts and pulleys,
(c) Chains and sprockets.

11. Control Cables-
Types of cables; End fittings, turnbuckles and compensation devices; Pulleys and cable system components; Aircraft flexible control systems

INSTRUCTIONAL STRATEGY
1. Focus is given on industrial visit
2. Aircraft visits for demonstration

MEANS OF ASSESSMENT
1. Assignments and quiz/class tests
2. Mid-term and end-term written tests

RECOMMENDED BOOKS

- Aircraft material & process by Titter son
- AMTH General handbook AC65-9A
- Aircraft powerplant AF Handbook Ac65-15A
- Advance composite by Cyndy foreman

Websites for Reference:
https://nptel.ac.in/

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	**12**	**15**
2.	**12**	**15**
3.	**03**	**7**
4.	**04**	**8**
5.	**13**	**15**
6.	**12**	**06**
7.	**05**	**05**
8.	**06**	**07**
9.	**04**	**05**
10.	**09**	**10**
11.	**04**	**07**
Total	**84**	**100**

1.4 ENGINEERING DRAWING

L	T	P
-	-	8

Rationale :
Whether it is production, design or maintenance engineer, Knowledge of engineering drawing is a must to him. From production to assembly and dismantling for maintenance knowledge of engineering drawing is essential.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:
1-Basic Concept of Engineering Drawing
2-By Symbol & shape, students can identify material & equipment
3-Identified the various position
4-Demonstrate the hydraulic system of aircraft

DETAILED CONTENTS

1. INTRODUCTION :

1.1 General Introduction to Engineering Drawing and its meaning.
1.2 Introduction of various drawing materials, instruments and equipment.
1.3 Use of Draughtsman Instruments, Mini drafter and Set of instruments, French curves, their correct use and care.
1.4 Sizes of Drawings sheets and their lay out.

2
A. LETTERING TECHNIQUES :
Printing of vertical and inclined, Normal single stroke capital letters and numbers.

B. INTRODUCTION TO SCALES :
Necessity and use, R.F. types used in general engineering drawing, Plane, Diagonal and Chord scales.

3. CONVENTIONAL REPRESENTATIONS :

3.1 Methods of showing Centre lines, hidden lines, reference lines section lines and dimensional lines a dimensioning.
3.2 Standard material symbols.
3.3 Conventional method of representing threads, nuts, joints and welded parts. Exercises to illustrates the above.

4. Dimensioning Techniques.

5. PRINCIPLE OF PROJECTIONS :
Principle of projections and essential views, orthographic projection and exercises.
5.1 Plan, Elevation, Side views in first angle and third angle projections, simple exercises.

6. ISOMETRIC PROJECTION :
6.1 Isometric Scales.
6.2 Isometric Views.

7. DEVELOPMENT OF SURFACES :

7.1 Parallel line and radial line methods developments, Development of simple and truncated surfaces (Cubes, Prisms, Pyramids, Cylinders & Cones).

8. DRAWING OF TYPICAL AIRCRAFT PARTS :

Study of machine drawing and blue prints.

LIST OF PRACTICAL:

- Based on subject content.

INSTRUCTIONAL STRATEGY

1. By practical presentation
2. By audio visual demonstration

MEANS OF ASSESSMENT

1. Assignments and quiz/class tests
2. Mid-term and end-term written tests

RECOMMENDED BOOKS

1.AMT Handbook Ac -65-9A
2. Engineering drawing by N D Bhatt

Websites for Reference:

https://nptel.ac.in/

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	12	10
2	16	15
3	12	20
4	12	5
5	16	15
6	12	10
7	16	15
8	16	10
Total	**112**	**100**

1.5 Aviation Legislation-I

L	T	P
8	-	-

Rationale : The objective and quality and related responsibility in the work of aircraft maintenance at any level requires some legislation. The paper deals with such things imperative for the knowledge of aircraft maintenance engineer and these are changeable to time to time as DGCA, New Delhi requirements.

Learning Outcomes

After undergoing the subject, the student will able to

1. Know the current aviation legislation and ICAO requirements
2. Understand different Civil Aviation Requirements given by DGCA, MCA.
3. Know the various other aviation regulatory authorities & its regulations
4. Understand the concept of ETOPS,RVSM,RNP,MNPS etc

DETAILED CONTENTS

1 Regulatory Framework:

Role of International Civil Aviation Organization; The Aircraft Act and Rules made there under Role of the DGCA; Relationship between CAR-21, CAR-M, CAR-145, CAR-66, CAR 147
The Aircraft Rules (Applicable to Aircraft Maintenance and Release) Aeronautical Information Circulars (Applicable to Aircraft Maintenance and Release) CAR Sections 1 and 2

2. CAR-145 — Approved Maintenance Organizations
Detailed understanding of CAR-145 and CAR M Subpart F

3. Applicable National and International Requirements

Maintenance Programme, Maintenance checks and inspections; Master Minimum Equipment Lists, Minimum Equipment List, Dispatch Deviation Lists; Airworthiness Directives; Service Bulletins, manufacturers service information; Modifications and repairs; Maintenance documentation: maintenance manuals, structural repair manual, illustrated parts catalogue, etc.;

4. Miscellaneous Requirements:

Continuing airworthiness; Test flights; ETOPS /EDTO , maintenance and dispatch requirements; RVSM, maintenance and dispatch requirements RNP, MNPS Operations All Weather Operations, Category 2/3 operations and minimum equipment requirements.

5. Safety Management System

State Safety Programme Basic Safety Concepts Hazards & Safety Risks SMS Operation SMS Safety performance Safety Assurance

6. Fuel Tank Safety

Special Federal Aviation Regulations (SFARs) from 14 CFR SFAR 88 of the FAA and of JAA TGL 47 Concept of CDCCL, Airworthiness Limitations Items (ALI)

Recommended Books

1. Civil Aviation Requirements, Section-2 ‘Airworthiness’
2. Aircraft Manual vol-I & II
3. Airworthiness Advisory Circular

INSTRUCTIONAL STRATEGY

1. By using Audio visual Demonstration
2. Example is given on aviation industries and different airlines that how they can follow the requirement of DGCA

MEANS OF ASSESSMENT

1. Assignments and quiz/class tests
2. Mid-term and end-term written tests

Websites for Reference: dgca.gov.in

SUGGESTEDDISTRIBUTION OF MARKS

Topic No	Time Allotted (periods)	Marks Allotted (%)
1	**25**	**20**
2	**18**	**15**
3	**18**	**15**
4	**18**	**20**
5	**18**	**20**
6	**15**	**10**
Total	**112**	**100**

1.6 WORKSHOP PRACTICES

L	T	P
4	-	8

Rationale : There are basically 4 shops to workshop practice i.e. Carpentry shop, Fitting shop, Machine shop and Welding shop. The purpose is to familiarization of various machines used in aircraft repair and maintenance.

Learning Outcomes

After undergoing the subject, the student will able to

1. Learn safety and precaution during handling the tools
2. Learn the machine operating skills.
3. Know the tools and its application
4. Learn the welding skills

DETAILED CONTENTS

1. Safety rules and Precautions in workshop- Instructions in the remedial action to be taken in the event of accidents/ human or machines

2. GENERAL WORKSHOP TOOLS :

A. Marking and Measuring tools - Steel scale, Surface gauge, Protector, try square, Scriber, Different types of Punches, Divider, Calipers, surface Plate, Gauges, Vernier Calipers, Micrometer, Combination set, Marking gauges, Bevel square.

B. Cutting Tools - Different types of File, Hacksaw, Chisels Tap and Die, Different types of Drill, Reamer, Different types of saw, Different types of Plainer, Different types of Power tools- lathe, Grinding Machine, Power Hacksaw, Milling Machine, Drilling Machine

C. Holding and Supporting Tools - Different types of vice, Bench hook, Bar clamp, Tongs, Pliers, Jigs and fixtures.

D. Striking Tools - Different types of Hammer.

E. Miscellaneous Tools - Screw Driver, Pincer, Different types of wrench, Keys, File Card, Spanner & drift.

3. Handling and uses of different type of precision measuring tools.

4. Limits fits and allowances. Concept of interchangeability.

5. Working knowledge of Tools used on the following machine tools - Power Hacksaw, Drilling Machine, Lathe (Centre, Capstone and Turret). Grinding Machines

6. Welding

A. Safety precautions observed before and during welding.

B. Different types of welding - Gas welding, Electric arc welding, Seam welding, Spot welding, TIG & MIG, Types of fluxes and its advantages.

(a) Gas welding - Types of gas welding, identification of cylinders pressure regulator (single and double), welding torch and equipment, type of flame and blow pipe.

(b) Electric Arc Welding - Types of arc welding - metallic arc, gas shield arc welding (TIG & MIG), plasma arc welding.

(c) Pressure Welding - Seam, Butt and spot welding.

(d) Types of welded joints and defect analysis

7. Brazing - Al brazing, Cu brazing, Silver brazing and Stainless steel brazing.

LIST OF PRACTICAL

GENERAL

1. Safety precautions to be observed in workshop
2. Familiarization with various tools and equipments in use in the workshop.
3. Workshop, Work materials and Tool materials.

EXERCISE :

FITTING SHOP :

1. Hacksawing procedure, Precautions and Techniques in Hacksawing, Different number of Teeth in Blade, Utility.

2. (a) Making a straight cut with Hacksaw.
   (b) Cutting a Solid block.
   (c) Cutting a Channel.
   (d) Cutting a corner
   (e) Cutting a Conduit.

3. Cutting a square piece of 2" sides with Hacksaw.

4. Practice in the use of different files, precautions in the use of different filling technique and methods.

5. Exercise 3 to be filed approximate size to side 2".

6. Filling the above exercise top surface to flat.

7. Filling the sides of above job to make right angle.

8. Making of "T" fitting.

9. Making Male and Female as per diagram given.

10. Making circular hole by drilling and finishing with file.

11. Making a square hole in a sheet.

12. Making a Diagonal fitting.

13. Practice in riveting and making a riveted joints.

MACHINE SHOP :

1. Familiarization with the Machines in the Machine shop with -

   (a) Lathe
   (b) Drilling Machine.
   (c) Sharpening of Tool Bits.

EXERCISE :

1. Practice of Plain Turning, Facing of a M. S. Rod.

2. Step turning of Rod.

3. Thread Cutting External

4. Taper turning.

5. Internal Turning Procedure.

6. Cutting Threads Internally by tape.

7. Knurling Practice.

AECR CARPENTRY :

1. Familiarization with Tools and Equipments and Safety procedure in Carpentry.

2. Measuring and Making tools.

3. Cutting Tools, Saw, Planes, Chisels etc.,

4. Drilling and Boring Tools : Carpenters Brace Augarbit, Rosebit, Rosebit and Bradwal.

EXERCISE :

1. Procedure of use Saws and setting of the teeth.

2. Practice in Sharpening of Saws Teeth.

3. Practice in use of different types of chisels and shrpening

4. Practice in Grinding and Sharpening of various types of Chisels.

5. Practice of plaining.

6. Procedure of marking different types of cut.

7. Making a Half Lap joints and 'T' joints and Sawing practices as per drawing.

WELDING SHOP :

Familiarization with Tools, equipments used in the welding shop and precautions.

1. Oxygen and acetylene Cylinders.

2. acetylene regulator for Low Pressure.

3. Gas Cutting Equipment and Welding tips.

4. Pressure Regulators, Hose and Hose fitting, Welding Torch, Goggles, Spark, Filler Rod Wire Brush, welding table with fire, Brick to.

EXERCISE :

1. Practice of lighting the Gases.

2. Oxidizing, Neutral and Reducing Flames.

3. Practice in making Head welding.

4. Practice a Line Brazing.

5. Practicing a Seam Soldering

6. Practicing a Butt Welding.

INSTRUCTIONAL STRATEGY

1. More focus is given on practical
2. By PowerPoint presentation
3. By audio visual demonstration
4. Preference is given that students use tool and equipment's

MEANS OF ASSESSMENT

1. Assignments and quiz/class tests
2. Mid-term and end-term written tests

RECOMMENDED BOOKS

1. Workshop technology by HAZARA CHAUDHARY Vol-I & II
2. Workshop technology by R S Kurmi

Websites for Reference:
https://nptel.ac.in/

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	6	10
2.	6	15
3.	6	10
4.	6	10
5.	6	20
6.	13	20
7.	13	15
Total	56	100

II Semester
2.1 HUMAN FACTORS

L	T	P
4	2	-

Rationale :

The objective and quality and related responsibility in the work carried out by aircraft maintenance engineers are affected by various human factors at any level. The paper deals with such things imperative for the knowledge of interaction between human and machine interfacing and these are changeable to time to time as incidents occurrence in aviation field with new factors and DGCA, New Delhi requirements .

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

1- To know the factors how it relates with maintenance process
2- To know the human capabilities and limitation in work place
3- To know the social environmental factor that affect the human performance
4- To know the factors related to our fitness, consumption of alcohol , sleep that affect the human performance
5- To know the factors related to physical environment, communication task allotted and errors that affect the human performance

DETAILED CONTENTS

1. General

- The need to take human factors into account; Incidents attributable to human factors/human error; Murphy's law.

2. Human performance and Limitations

- Vision
- Hearing
- Information processing
- Attention and perception
- Memory
- Claustrophobia and physical access

3 Social Psychology

- Responsibility: individual and group
- Motivation and de-motivation
- Peer pressure
- Culture issues
- Team working
- Management, supervision and leadership

4.F**actors 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

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

6. Tasks
- Physical work;
- Repetitive tasks;
- Visual inspection;
- Complex systems

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

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

9. Hazards in the Workplace
- Recognizing and avoiding hazards;
- Dealing with emergencies

INSTRUCTIONAL STRATEGY
1. **By giving the examples of incidents and accident occurred in aviation**
2. **By using audio visual presentation**

MEANS OF ASSESSMENT
1. Assignments and quiz/class tests
2. Mid-term and end-term written tests

RECOMMENDED BOOKS-
- CAP 715, CAP 716, Human Factors document No. 9683

Websites for Reference:
- dgca.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	8	10
2.	10	10
3.	10	5
4.	10	15
5.	10	15
6.	9	10
7.	10	15
8.	10	15
9.	7	5
Total	84	100

2.2 MECHANICS

L	T	P
4	2	-

Rationale : This subject deals with fundamental concepts of mechanics which are useful for the AME students for further understanding the second and final year subject/topic like engine, braking system and in general.

Learning Outcomes:

1. Learn fundamental concept of mechanics
2. Learn different types of load/stress acting on aircraft
3. Learn various type of flow system in aircraft

DETAILED CONTENTS

1. VECTORS AND FORCE ANALYSIS :

Concept of Scalers and Vectors quantities, Graphical representation of vectors, Composition and Resolution of force vectors, Law of Parallelogram of forces and Law of Triangle of forces. Lami's theorem, Conditions for equilibrium of a particle under the action of number of forces, Concept of moment of a force, Resultant of forces and their equilibrant. Condition of equilibrium of a rigid body acted upon by number of forces. Related numerical, Concept of free body diagram.

2. FRICTION :

Static and dynamic friction, Limiting friction. Laws of friction, Angle of friction. Coefficient of friction. Numerical problems. Application of friction in Aircraft/Aviation and its effect in terms of wear, tear and life.

3. WORK, POWER AND ENERGY :

Torque and force, Work done by a force and torque. Kinetic and potential energies. H.P.of an engine and its efficiency. Motion in a straight line subjected to a force.

4. SIMPLE MACHINES :

Introduction, types of pulleys. Mechanical advantage and velocity ratios, Simple wheel and axle, Weston's differential pulley block and their use. Screw Jacks. Numerical problems.

5. MOMENT OF INERTIA :

Moment of inertia of plane areas, Radius of gyration, General theorems on moment of inertia

(i) Theorem of parallel axis.
(ii) Theorem of perpendicular axis.

6. MECHANISMS:

Definition of link, Frame and mechanism, Difference between machine and mechanism, Kinematic pairs, Lower and higher pairs. Introduction to four bar mechanisms, Slider crank mechanism, Introduction to cams and its use.

7. STRENGTH OF MATERIALS : Stress, Strain and Elasticity, Tensile and compressive stress, Hooke's law, different types of elasticity, Poisson ratio, Relation between moduli. Determination of Young's modulous, for a material, numerical.

8. BEAMS AND TRUSSES : Definitions of the terms. Concept of tie and struts, Types of supports. Calculation of reaction and supports of beams trusses and cantilevers. Concept of shear force and bending moment at a section of a beam under various kinds of load. Shear force and bending moment diagram.

9. FLUID MECHANICS: Introduction to fluid mechanics, viscosity, Surface Tension, Importance of their knowledge in engineering field, Various kinds of fluid flows (Open and closed channels) Laminar and turbulent flows, Bernoulli's equation and its application in general and in aeronautics. Introduction to Reynonds numbers.

10. Application of mechanics in Aeronautics (Brief Idea).

INSTRUCTIONAL STRATEGY

- By power point presentation
- By audio visual demonstration
- By U- tube video presentation

MEANS OF ASSESSMENT

1. Assignments and quiz/class tests
2. Mid-term and end-term written tests

RECOMMENDED BOOKS

1. Applied Mechanics by RS Kurmi
2. Engineering Mechanics by SS Bhavikatti and K G Rajashekarappa
3. Fluid Mechanics by RK Rajput

Websites for Reference:

www.nptel.ac.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted(Periods)	Marks Allotted(%)
1.	**9**	**10**
2.	**9**	**10**
3.	**9**	**10**
4.	**9**	**15**
5.	**9**	**10**
6.	**9**	**10**
7.	**9**	**15**
8.	**9**	**10**
9.	**9**	**05**
10.	**3**	**05**
Total	**84**	**100**

2.3 BASIC ELECTRICITY AND ELECTRONICS ENGINEERING

L T P
7 2 3

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, specialized knowledge of concerned field is essential.

However, for acquiring knowledge in any specialized 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.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

1-Understandbasic electrical terminology and their concepts

2-Understand electrostatic laws of attraction and repulsion of charge, coulomb's law, Ohm's law

3-Understand the Kirchhoff's law, Thevenin theorem and superposition theorem and can solve simple numerical problems on these theorems

4-Understand capacitor, capacitor color coding, charging & discharging of capacitor and can solve simple problems on capacitors

5-Understanf electromagnetism and solve simple problems

6-Understand Faraday's Law of electromagnetic induction, Lenz's Law and solve simple problems based on these laws

7-Understand AC circuit and solve simple problems of R-C series circuit, R-L Series circuit and R-L-C Series Circuit

8-Understand polyphase system and solve simple problems based on it.

DETAILED CONTENTS

1. Basic Terminology and their concepts

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).Work ,dissipation of power by resistor

1.4 Calculation involving power, work and energy

1.5 Relationship between electrical, mechanical and thermal SI units of work, power and energy.

1.6 Structure and distribution of electrical charge within atom, molecules, ions compounds

1.7 Static electricity and conduction, Electrostatics laws of attraction and repulsion of charge, unit of charge, coulomb law, conduction of electricity in solid, liquid, gas and vacuum, Generation of electricity by- light, heat, friction, pressure, chemical action, magnetism and motion, Ohms law

2. D.C. Circuits

2.1 Kirchhoff's laws.

2.2 Simple numerical problems based on Kirchhoff'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 Introduction of semiconductor and their application In aviation. Types of semiconductor. Band theory of solids.

4. Capacitors

4.1 Concept of capacitor, capacity of parallel plate capacitor, and effect of physical parameters. Capacitor color coding, time constants, testing of capacitor

4.2Energy 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

5.1 Theory of magnetism, Magnetic material, Magnetism and diamagnetism, 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.

5.7 Magnetic shielding, hand clasp rule to determine; magnetic field around current carrying conductor Hysteresis loop, retentivity, coercivity, saturation point, precautions for care and storage of magnets.

6. Electromagnetic Induction

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.

6.8 Effect of magnetic field strength, rate of change of flux, number of turns on magnitude of induced voltage Factors affecting mutual inductance Back emf, saturation point, principle use of inductors

7. A.C. Circuits

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 sinusoidally.

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).

7.12Resonance (Series and parallel) and practical application, simple problems.

7.13 Triangular/square wave

8. Polyphase System

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 polyphase circuits. Simple problems of balanced circuits only.

BASIC ELECTRICITY & ELECTRONICS LAB

i) To show the variation of resistance of a lamp with temperature by plotting a V-I curve for 100Wfilament lamps.

ii) To study the colour coded resistance and to verify the same by multimeter.

iii) To measure the total or equivalent resistance of colour coded resistors connected in series and parallel and to verify the same by multimeter.

iv) To verify the Ohm's laws.

v) To measure the total or equivalent capacitance of capacitors connected in series and parallel and to verify the same by multimeter.

vi) To find the relationship between voltage and current for R-L series circuit for variable resistances & variable inductance.

vii) To measure the power factor in a single-phase AC circuit by using voltmeter, ammeter &wattmeter.

viii) To study the B-H curve for a ferro-magnetic core.

ix) To study the phenomenon of electromagnetic induction.

x) Verification of voltage and current relations in Star and delta connected systems.

xi) Testing of diodes and transistors.

xii) Soldering Practices.

INSTRUCTIONAL STRATEGY

More focus should be given on practicals.

MEANS OF ASSESSMENT

1. Assignments and quiz/class tests
2. Mid-term and end-term written tests

RECOMMENDED BOOKS

- A textbook of electrical technology(vol-1 & vol-4) by B.L. Theraja& A.K. Theraja
- A Textbook of Electrical Technology (vol-1 & vol-4) by V.K. Mehta
- AC 65-9A Airframe &Powerplant mechanics ,General nand book
- Aircraft Electrical and electronics systems by Thomas & Esmin
- Basic Electrical Engineering by V K Mehta &Rohit Mehta
- Aircraft Electrical System by EHJ Pallett

Websites for Reference:
www.nptel.ac.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	**10**	**8**
2.	**15**	**12**
3.	**16**	**13**
4.	**15**	**13**
5.	**16**	**12**
6.	**20**	**15**
7.	**20**	**15**
8.	**14**	**12**
Total	**126**	**100**

2.4 GENERAL ENGINEERING AND GROUND SUPPORT
(Common with AME)

L	T	P
5	-	3

Rationale :
The paper intends to provide Aircraft maintenance engineers with the basic knowledge related to the topics of General engineering and NDT of aircraft components to facilitate him in his work to meet the desired objectives.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:
1-Learn Aircraft handling
2-Learn NDT
3-Learn fit and clearance between mating parts of aircraft
4-Demonstrate the maintenance procedure of aircraft
5-Explain the information about aircraft documents

DETAILED CONTENTS

1. **Fits and Clearances**

   Classes of fits;
   Common system of fits and clearances;

2 **Riveting**

   Riveted joints, rivet spacing and pitch;
   Tools used for riveting and dimpling;
   Inspection of riveted joints

3 **Pipes and Hoses**

   Bending and belling/flaring aircraft pipes;
   Inspection and testing of aircraft pipes and hoses;
   Installation and clamping of pipes.

4 **Springs and Bearings**

   Inspection and testing of springs
   Testing, cleaning and inspection of bearings;
   Lubrication requirements of bearings;

5 **Transmissions**

   Inspection of gears, backlash;
   Inspection of belts and pulleys, chains and sprockets;
   Inspection of screw jacks, lever devices, push-pull rod systems

6 **Control Cables**

   Swaging of end fittings;
   Inspection and testing of control cables;

7 **Aircraft Weight and Balance**

   (a) Centre of Gravity
   (b) Preparation of aircraft for weighing;
   Aircraft weighing

8.Aircraft Handling and Storage

Aircraft taxiing/towing and associated safety precautions;
Aircraft jacking, chocking, securing and associated safety precautions;
Aircraft storage methods;
Refueling/defueling procedures;

9.Disassembly, Inspection, Repair and Assembly Techniques

Types of defects and visual inspection techniques.
Nondestructive inspection techniques including,
penetrant, radiographic, eddy current, ultrasonic and
borescope methods.

10 **Abnormal Events**

(a) Inspections following lightning strikes
(b) Inspections following abnormal events such as heavy
landings and flight through turbulence

11 **Maintenance Procedures**

Maintenance planning;
Modification procedures;
Certification/release procedures;

LIST OF PRACTICALS

1. Riveting practice e.g., butt joint, lap joint.
2. Inspection of cable system.
3. Familiarization with tube and flexible hose inspection and testing.
4. Familiarization with splicing and swaging operation.
5. Familiarization with Bending and flaring of tube.
6. Familiarization with various kind of union used in fuel, oil and hydraulic system.
7. Familiarization with dye penetrant method.
8. Familiarization with magnetic particle inspections.
9. Familiarization with Eddy current inspections.
10. Familiarization with cable tension adjustment.

INSTRUCTIONAL STRATEGY

More focus should be given on practical's.

MEANS OF ASSESSMENT

1. Assignments and quiz/class tests
2. Mid-term and end-term written test

RECOMMENDED BOOKS

- AMTH general handbook AC-65-9A
- Airframe &powerplant Mechanics AC -65-15A
- CAIP 459 part-I and part-II
- EASA module 6&7

Websites for Reference:

Dgca.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	06	07
2.	07	08
3.	07	08
4.	06	08
5.	10	12
6.	05	06
7.	05	08
8.	08	10
9.	12	15
10.	08	10
11.	10	08
Total	**84**	**100**

2.5Aviation Legislation-II

L T P
8 - -

Rationale: The objective and quality and related responsibility in the work of aircraft maintenance at any level requires some legislation. The paper deals with such things imperative for the knowledge of aircraft maintenance engineer and these are changeable to time to time as DGCA, New Delhi requirements.

Learning Outcomes:
After undergoing the subject, the student will able to

1. Know the requirements of Licensing of Aircraft Maintenance Engineers
2. Understand Civil Aviation Requirements given by DGCA, MCA in various sections
3. Know current and updated Aviation Legislation given by DGCA, MCA
4. Know the various documents related to aircraft and its uses

DETAILED CONTENTS

1. **CAR-66 Certifying Staff – Maintenance**
   Detailed understanding of CAR-66

2. **Aircraft Operations**
   Commercial Air Transport/Commercial Operations Air Operators Certificates; Operators Responsibilities, in particular regarding continuing airworthiness and maintenance; Documents to be carried on board; Aircraft Placarding (Markings);
3. **Aircraft Certification**
   Certification rules: such as FAA & EACS 23/25/27/29; Type Certification; Supplemental Type Certification;
   CAR-21 Design/Production Organisation Approval. Aircraft Modifications and repairs approval and certification permit to fly requirements
4. **Documents**
   Certificate of Airworthiness; Certificate of Registration; Noise Certificate; Weight Schedule; Radio Station Licence and Approval
5. **CAR-M**
   Detail understanding of CAR M provisions related to Continuing Airworthiness,
   Detailed understanding of CAR-M

INSTRUCTIONAL STRATEGY

1. By using Audio visual Demonstration
2. Example is given on aviation industries and different airlines that how they can follow the requirement of DGCA

MEANS OF ASSESSMENT

1. Assignments and quiz/class tests
2. Mid-term and end-term written tests

Recommended Books

1.Civil Aviation Requirements, Section-2 'Airworthiness'

2.Aircraft Manual vol-I & II

3.Airworthiness Advisory Circular

Websites for Reference:
dgca.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No	Time Allotted (periods)	Marks Allotted (%)
1	**28**	**20**
2	**28**	**20**
3	**28**	**20**
4	**28**	**20**
5	**28**	**20**
Total	**140**	**100**

III Semester

3.1 GENERAL HELICOPTER AIRFRAME

L	T	P
5	1	6

Rationale:

This paper equips the Helicopter maintenance engineer with the basic knowledge internal structural information of helicopter to facilitate him in his work to meet the desired objectives.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

1-Explain the basic helicopter structure
2-Understand various Strems working on different parts of helicopter
3-Explain the concepts of equipment of helicopter
4-Describe the sheet metal protection processes
5-Explain the cabin layout of helicopter

DETAILED CONTENTS

1. Airframe Structures — General Concepts

Airworthiness requirements for structural strength, Structural classification, primary, secondary and tertiary, Fail safe, safe life, damage tolerance concepts, Stress, strain, bending, compression, shear, torsion, tension, hoop stress, fatigue,· Drains and ventilation provisions, Lightning strike protection provision, aircraft bonding.

2.Construction methods of: stressed skin fuselage, formers, stringers, longerons, bulkheads, frames, doublers, struts, ties, beams, floor structures, reinforcement, methods of skinning, anti-corrosive protection, wing, empennage and engine attachments;· Structure assembly techniques: riveting, bolting, bonding, Methods of surface protection, such as chromating, anodizing painting, Surface cleaning.· Airframe symmetry: methods of alignment and Symmetry checks

3.Equipment and Furnishings (ATA 25)

(A) Emergency equipment requirements,
Seats, harnesses and belts, Lifting systems

4. (B) Emergency flotation systems, Cabin lay-out, cargo retention, Equipment lay-out, Cabin Furnishing Installation

General Helicopter Airframe Practical

1. Familiarization with different types of helicopter structure.
2. Familiarization with main rotor blades, its different types of hinges and its related control system.
3. Familiarization with tail rotor blades, its hinges and its related control system.
4. Inspection of cables and tension check of tail rotor control system.
5. Rigging of control and symmetry check.

6. Familiarization with Methods of helicopter's surface protection, such as chromating, anodizing painting,.

7. Familiarization with helicopter's Engine mountings.

8. Familiarization with helicopter's undercarriage attachments.

9. Familiarization with various kinds of ground equipment (Chocks, Jacks, Tail support, Trestles, (Rear fuselage and trestles).

10. Familiarization with Emergency equipment requirements, Seats, harnesses and belts, Lifting systems.

INSTRUCTIONAL STRATEGY

Audio visual demonstration
Presentation

MEANS OF ASSESSMENT

1. Assignments and quiz/class tests
2. Mid-term and end-term written tests

RECOMMENDED BOOKS

AMT handbook airframe-15A
Basic Helicopter Aerodynamics by J Seddon
Basic Helicopter Maintenance by Joseph Schafer

Websites for Reference:

https://amemyworld.blogspot.com/
https://www.amequestionpaper.in/
https://www.nasa.gov/

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
Topics No. 1	20	40
Topics No. 2	20	40
Topics No. 3	15	10
Topics No. 4	15	10
Total	**70**	**100**

3.2 HELICOPTER SYSTEMS

L	T	P
7	2	6

Rationale:

Various pneumatic hydraulic and mechanical systems used for smooth operation of aircraft to need proper maintenance. So their knowledge is essential.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:
1-Explain the design fundamental of helicopter and hydraulic system
2-Describe the working of fuel system of helicopter
3-Explain air-conditioning and pressurization system
4-Explain the fire protection system of helicopter
5-Describe the design fundamental of helicopter pneumatic system

DETAILED CONTENTS

1-Hydraulic Power (ATA 29)
System lay-out
Hydraulic fluids
Hydraulic reservoirs and accumulators
Pressure generation: electric, mechanical, pneumatic
Emergency pressure generation
Pressure Control
Power distribution
Indication and warning systems
Interface with other systems

2-Pneumatic/Vacuum (ATA 36)
System lay-out
Sources: engine, compressors, reservoirs, ground supply
Pressure control
Distribution
Indications and warnings
Interfaces with other systems

3-Landing Gear (ATA 32)
Construction, shock absorbing
Extension and retraction systems: normal and emergency
Indications and warning
Wheels, tyres, brakes
Steering Skids, floats

4-Ice and Rain Protection (ATA 30)
Ice formation, classification and detection
Anti-icing and de-icing systems: electrical, hot air and chemical
Rain repellant and removal
Probe and drain heating, wiper system

5-Air Conditioning
Sources of air supply including engine bleed and ground cart
Air conditioning systems
Distribution systems
Flow and temperature control systems
Protection and warning devices

6-Fuel Systems (ATA 28)
System lay-out
Fuel tanks
Supply systems
Dumping, venting and draining
Cross-feed and transfer
Indications and warnings
Refueling and defueling

7-Fire Protection (ATA 26)
Fire and smoke detection and warning systems
Fire extinguishing systems
System tests

8-Lights (ATA 33)
External: navigation, landing, taxiing, ice
Internal: cabin, cockpit, cargo, emergency

Specification of 100 Air transport association (ATA) of America, Aeronautical and other applicable standard including ISO, AN, MS, NAS and MIC

HELICOPTER SYSTEM PRACTICAL

1. Familiarization with the components of basic Hydraulic system
2. Familiarization with the components of Pneumatic system
3. Familiarization with functional check of Landing Gear system
4. Familiarization with Air Conditioning system
5. Familiarization with Fire Control system and its components
6. Familiarization with Deicing system and its components

INSTRUCTIONAL STRATEGY
Audio visual demonstration
Presentation

MEANS OF ASSESSMENT
1. Assignments and quiz/class tests
2. Mid-term and end-term written tests

RECOMMENDED BOOKS
AMT-Airframe Handbook-15A-FAA
Aircraft Maintenance & Repair -Kros & Mckinley

CAIP-459 (Part-II)
AMT-System by Dale Garrce
EASA-Module-12

Websites for Reference:
1 www.amequestionpaper.in
2 amefield.com
3 www.faa.gov

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	14	20
2.	14	15
3.	12	15
4.	12	10
5.	12	15
6.	12	10
7.	10	10
8.	12	05
Total	**98**	**100**

3.3 AIRCRAFT ELECTRICITY
(For AME H&P)

L	T	P
4	1	5

Rationale:
Use of electrical systems in the design of air craft is well known to everyone. Maintenance of these systems is a matter of utmost importance. The purpose is to develop proper understanding of various aspects of phenomenon in the aircraft.

LEARNING OUTCOMES
After undergoing the subject, the students will be able to:
1-Explain the concepts of Electrical Measures, instruments
2-Describe the electrical wiring, interconnection system(EWIS)
3-Explain electrical power(ATA 24) concepts
4-Understand the static electricity in aircraft
5-Demonstrate the D.C. Generators/A.C. Generators/Alternators working
6-Explain the working of DC & AC motors
7-Describe the principles and operations of Transformers
8-Understand the concepts of lights(ATA 33)
9-Describe the construction, operation & charging methods of DC sources of electricity
10-Articulate the types & operations of rectifiers & filters

DETAILED CONTENTS

1.DC Sources of Electricity
· Construction and basic chemical action of: primary cells,
· Secondary cells, lead acid cells, nickel cadmium cells, other alkaline cells;
· Cells connected in series and parallel
· Internal resistance and its effect on a battery
· Construction, materials and operation of thermocouples
· Battery installation and operation,
•

2. General description of electrical measuring instruments
. Requirement of indicating instruments
. Ammeter, voltmeter, Ohm meter, watt meter, frequency meter,
. Megger, conversion of ammeter to voltmeter and vice versa.
. Knowledge of various AC and DC measuring instruments
. Application of multiplier and shunt

3.Electrical Wiring Interconnection System (EWIS)

-Continuity, insulation and bonding techniques and testing,
-Use of crimp tools: hand and hydraulic operated,
-Crimping, testing of crimp joints, connector type, pin, plugs, sockets, insulator, current and voltage rating, coupling, identification code Connector pin removal and insertion,
-Cable types, construction, characteristics, high tension and Co-axial cable,: testing and installation precautions
-Identification of wire types, their inspection criteria and damage tolerance.

-Wiring protection techniques: Cable looming and loom support, cable clamps, protective sleeving techniques including heat shrink wrapping, shielding
-EWIS installations, inspection, repair, maintenance and cleanliness standards

4. Electronic Displays
Principles of operation of common types of displays used in modern aircraft, including
Cathode Ray Tubes, Light Emitting Diodes and Liquid Crystal Display

5. Lights (ATA 33)
External: navigation, landing, taxiing, ice;
Internal: cabin, cockpit, cargo;
Emergency

6. Electrical Power (ATA 24)
Batteries Installation and Operation, DC power generation, AC power generation, Emergency power generation, Voltage regulation, Power distribution, Circuit protection, External/Ground power

7.D.C. Generator · Basic Generator theory
. construction and purpose of components in DC generator
· Operation of, and factors affecting output power, torque, speed and direction of rotation of DC Generator
· Series wound, shunt wound and compound Generator
. Characteristics of generator, armature reaction, methods to overcome it
. Starter generator construction

8. DC Motor
1· Basic motor theory
2· Operation of, and factors affecting output power, torque, speed and direction of rotation of DC motors
3· Series wound, shunt wound and compound motors

9. Transformers
1. Transformer construction principles and operation
2· Transformer losses and methods for overcoming them
3· Transformer action under load and no-load conditions
4· Power transfer, efficiency, polarity markings
5· Calculation of line and phase voltages and currents
6· Calculation of power in a three phase system
7· Primary and Secondary current, voltage, turns ratio
8· power, efficiency
9· Auto transformers

10. Filters
1. Operation, application and uses of the following filters:
2. low pass, high pass, band pass, band stop.

11. AC Generators
1. Rotation of loop in a magnetic field and waveform produced
2. Operation and construction of revolving armature and revolving field type AC generators
3. Single phase, two phase and three phase alternators

4. Three phase star and delta connections advantages and uses
5. Permanent Magnet Generators, inverters components and function

12. Rectifiers

1. Type of rectifier.
2. Construction of copper oxide
3. Selenium rectifier
4. Half and full wave rectifier

13. AC Motors

1. Construction, principles of operation and characteristics of:
2. AC synchronous and induction motors both single and polyphase
3. Methods of speed control and direction of rotation
4. Methods of producing a rotating field: capacitor, inductor, shaded or split pole

AIRCRAFT ELECTRICITY PRACTICAL

1- Familiarization with the lead acid battery and recognized
2- Familiarization with the Ni-Cd battery and recognized their parts
3- Study and sketch different types of electrical measuring instruments
4- To measure the insulation resistance of cable with the help of megger
5- Practice of making series and parallel circuit.
6- To measure size of wire with the help of wire gauge
7- Practice of soldering, crimping
8- Familiarization with protecting device and their testing
9- Familiarization with various parts of DC motors and function
10. To Study the operation of transformer and testing
11. Familiarization with various parts of AC generators and Function
12. Familiarization with various parts of Voltage regulator And function
13. Familiarization with various parts of Alternator and function
14. Familiarization with various parts of inverter and function
15. Familiarization with various parts of AC motor and function

INSTRUCTIONAL STRATEGY

1. Power point presentation
2. More focus will be given on practical element
3. Audio video demonstration

MEANS OF ASSESSMENT

1. Assignments and quiz/class tests
2. Mid-term and end-term written tests

RECOMMENDED BOOKS

Electrical Technology by B.L Theraja
Basic Electricity for A&P Mechanics by Dale Crane
Aircraft Electrical Systems by EHJ Pallett
Aircraft Electrical & Electronics systems by Mike Tooley& David Wyatt
Electrical Technology by V.K, Mehta

Websites for Reference:

www.dcga.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
Topics No. 1	5	08
Topics No. 2	5	10
Topics No. 3	6	08
Topics No. 4	5	08
Topics No. 5	5	09
Topics No. 6	5	10
Topics No. 7	5	15
Topics No. 8	5	09
Topics No. 9	5	07
Topics No. 10	5	09
Topics No. 11	5	07
Total	**56**	**100**

3.4 ROTORS

L	T	P
6	3	-

Rationale:

Knowledge of aircraft propeller construction, material and various designs is a matter of special interest to aircraft engineers.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

1-Explain the helicopter structure & components
2-Describe aerodynamics & different kind of forces acting on helicopter
3-Explain helicopter maintenance general concepts
4-Differentiate main rotor & tail rotor used in helicopter

DETAILED CONTENTS

1. Main Rotor System

a) Rotors Heads, semi rigid rotor heads
b) Fully articulated rotor heads, rotor blades
c) Rotor head maintenance- blade alignment
d) static main rotor balance, vibration , tracking
e) Span wise dynamic balance, blade sweeping
f) Electronic balancing, dampener maintenance
g) Counter weight adjustment, auto-rotation adjustment
h) Ground resonance

2. Main Rotor Transmissions

a) Engine transmission couplings, driveshaft
b)clutch, freewheeling units, sprag clutch
c) Roller unit, torque meter, rotor brake
d) Vibrations, mounting systems,

3. Tail Rotor system

operation, tail rotor system, servicing, tail rotor track, alignment ,system rigging Static and dynamic balancing, Vibration types, vibration reduction methods,

4. Tail Rotor Transmissions

Gear boxes, main and tail rotors, Clutches, free wheel units and rotor brake Tail Rotor Drive shafts, flexible coupling, bearings, vibration dampers and bearing hangers

Rotors Practical

1. Familiarization with Rotors Heads, semi rigid rotor heads
2. Familiarization with Fully articulated rotor heads, rotor blades
3. Familiarization with Rotor head maintenance- blade alignment
4. Familiarization with static main rotor balance, vibration , tracking

5. Familiarization with Span wise dynamic balance, blade sweeping
6. Familiarization with Electronic balancing, dampener maintenance
7. Familiarization with Counter weight adjustment, auto-rotation adjustment
9. Familiarization with Engine transmission couplings, driveshaft
10. Familiarization with clutch, freewheeling units, sprag clutch
11. Familiarization with Roller unit, torque meter, rotor brake
12. Familiarization with Vibrations, mounting systems
13. Familiarization with operation, tail rotor system, servicing, tail rotor track, system rigging
14. Familiarization with tail rotor transmission

INSTRUCTIONAL STRATEGY
Presentation
Demonstration on live aircraft in hangers

MEANS OF ASSESSMENT
1. Assignments and quiz/class tests
2. Mid-term and end-term written tests

RECOMMENDED BOOKS
Basic helicopter Maintenance -Joseph Schafer
The helicopter & How to fly-John fay
Aviation Maintenance Technician Handbook-FAA
Helicopter Aerodynamics-RW Prouty

Websites for Reference:
www.faa.gov
www.amequestionpaper.in
amefield.com

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	21	25
2	21	25
3	21	25
4	21	25
Total	**84**	**100**

IV Semester
4.1 THEORY OF FLIGHT
(for AME H&P)

L	T	P
7	3	-

Rationale :

This paper equips the maintenance engineer with the insight of pre and post requisites of flight. It will facilitate him in his work to meet the desired objectives of flights.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:
1-Explain aerodynamics of helicopter
2-Explain the types of forces in helicopter
3-Describe different type of flight controls & its uses

DETAILEDCONTENTS

1. Physics of the Atmosphere

International Standard Atmosphere (ISA), application to aerodynamics

2. Aerodynamics

Airflow around a body
Boundary layer, laminar and turbulent flow, free stream flow, relative airflow, upwash and downwash, vortices, stagnation
The terms: camber, chord, mean aerodynamic chord, profile (parasite) drag, induced drag, Centre of pressure, angle of attack, wash in and wash out, fineness ratio, wing shape and aspect ratio
Thrust, Weight, Aerodynamic Resultant
Generation of Lift and Drag: Angle of Attack, Lift coefficient, Drag coefficient, polar curve, stall
Aerofoil contamination including ice, snow, frost
Relationship between lift, weight, thrust and drag
Glide ratio
Steady state flights, performance
Theory of the turn
Influence of load factor: stall, flight envelope and structural limitations
Lift augmentation

3. Flight Stability and Dynamics

Longitudinal, lateral and directional stability (active and passive)

4. Rotary Wing Aerodynamics

Terminology
Effects of gyroscopic precession
Torque reaction and directional control
Dissymmetry of lift, Blade tip stall
Translating tendency and its correction
Coriolis effect and compensation
Vortex ring state, power settling, overpitching
Auto-rotation
Ground effect

5. Flight Control Systems

Cyclic control

Collective control
Swash plate
Yaw control: Anti-Torque Control, Tail rotor, bleed air
Main Rotor Head: Design and Operation features
Blade Dampers: Function and construction
Rotor Blades: Main and tail rotor blade construction and attachment
Trim control, fixed and adjustable stabilizers
System operation: manual, hydraulic, electrical and fly-by wire
Artificial feel Balancing and Rigging

6. Blade Tracking and Vibration Analysis

Rotor alignment
Main and tail rotor tracking
Static and dynamic balancing
Vibration types, vibration reduction methods, Ground resonance

7. Transmissions

Gear boxes, main and tail rotors, Clutches, free wheel units and rotor brake
Tail Rotor Drive shafts, flexible coupling, bearings, vibration dampers and bearing hangers

INSTRUCTIONAL STRATEGY

Presentation
Demonstration

MEANS OF ASSESSMENT

1. Assignments and quiz/class tests
2. Mid-term and end-term written tests

RECOMMENDED BOOKS

Helicopter Aerodynamics-RW Provty
The Helicopter & How to fly-John Fay
Basic Helicopter Maintenance-Joseph Schafer
Aviation Maintenance Tech Handbook -FAA

Websites for Reference:

https://amemyworld.blogspot.com/
https://www.amequestionpaper.in/
https://www.nasa.gov/

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
Topic No. 1	18	20
Topic No. 2	14	20
Topic No. 3	12	10
Topic No. 4	12	10
Topic No. 5	14	15
Topic No. 6	14	15
Topic No. 7	14	10
Total	**98**	**100**

4.2 AIRCRAFT RECIPROCATING ENGINE-I

L	T	P
5	-	6

Rationale :

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

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:
1-Explain the fundamental thermodynamics cycle of internal combustion engine
2-Describe the design concepts of reciprocating engine
3-Perform the troubleshoot of engine components
4-Perform the troubleshoot of engine fuel, lubrication, induction system
5-Perform the engine components/system rectification

DETAILED CONTENTS

1-Fundamentals

Mechanical, thermal and volumetric efficiencies
Operating principles — 2 stroke, 4 stroke, Otto and Diesel
Piston displacement and compression ratio
Engine configuration and firing order

2-Engine Performance

Power calculation and measurement
Factors affecting engine power
Mixtures/leaning, pre-ignition

3-Engine Construction

Crank case, crank shaft, cam shafts, sumps Accessory gearbox
Cylinder and piston assemblies
Connecting rods, inlet and exhaust manifolds
Valve mechanisms
Propeller reduction gearboxes

4-Induction, Exhaust and Cooling Systems

Construction and operation of: induction systems including alternate air systems
Exhaust systems, engine cooling systems — air and liquid

5-Supercharging/Turbocharging

Principles and purpose of supercharging and its effects on engine Parameters, Construction and operation of supercharging/turbocharging systems, System terminology, Control systems, System protection

6-Engine Fuel Systems

Carburetors
Types, construction and principles of operation
Icing and heating

7-Fuel injection systems

Types, construction and principles of operation

8-Electronic engine control
Operation of engine control and fuel metering systems including electronic engine control (FADEC) Systems lay-out and components

9-Lubricants and Fuels
Properties and specifications, Fuel additives, Safety precautions

10-Lubrication Systems
System operation/lay-out and components

AIRCRAFT RECIPROCATING ENGINE-I PRACTICAL

1. Study and sketch of working principle of four stroke engine.
2. Inspection and assembly of intake & exhaust valve.
3. Familiarize with various piston engine constructions.
4. Familiarize with construction of Crankcase.
5. Familiarize with construction of Crank shaft.
6. Familiarize with construction of Cam shafts.
7. Familiarize with construction of Sumps.
8. Familiarize with construction of Accessory gearbox.
9. Familiarize with construction of Cylinder and Piston assemblies.
10. Familiarize with construction of Connecting rods.
11. Familiarize with construction of Inlet and exhaust manifolds.
12. Familiarize with construction of Valve mechanisms.
13. Compression testing of engine cylinder by direct and differential method.
14. Inspection of piston & cylinder assembly.

INSTRUCTIONAL STRATEGY

Presentation
Demonstration

MEANS OF ASSESSMENT
1. Assignments and quiz/class tests
2. Mid-term and end-term written tests

RECOMMENDED BOOKS
AMT-Power plant 12 A-FAA
AMT Powerplant Handbook-JAA
Aircraft Power Plant by-Kores& Wild

Websites for Reference:
https://amemyworld.blogspot.com/

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	7	08
2.	7	08
3.	7	18
4.	7	08
5.	7	08
6.	7	08
7.	7	08
8.	7	08
9.	7	08
10.	7	08
Total	**70**	**100**

4.3 AIRCRAFT INSTRUMENTS (Common to AME)

L	T	P
5	1	3

Rationale :

Knowledge of aircraft instruments for maintenance engineers is no way less important than that of aircraft engine. They are controlling and guiding organs of the aircraft.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

1-Explain the general Aircraft Instruments, Altimeter, Airspeed, Vertical Speed Indicator, Pressure & Temperature gauges and RPM indicator

2-Describe the Gyro Instruments & it's working

3-Explain electrically operated instruments , fuel flow gauge & manifold pressure gauge

4-Demonstrate the procedures of replacement and in site operational tests of all instruments

DETAILED CONTENTS

1. General introduction to aircraft instrument: various instruments and their classification
2. Altimeter, principle, constructional details, types of setting, position error, leak test and periodical inspection
3. Air speed indicator-Pitot and static tube, construction and principle, position error& periodical inspection, leak test
4. Vertical speed indicator, constructional features checks and installation procedure, periodic inspection
5. Pressure gauges, principles of operation types of gauges, periodical inspection
6. Temperature gauge, principle of thermocouple and different type used in aviation, cylinder head temperature gauge, maintenance and periodical inspection.
7. R.P.M. indicator, constructional details types of indicators, maintenance and periodical inspection
8. Gyro instruments, principle of gyro wheel & different types of gyros, constructional details of each i.e. turn & bank indicator, artificial horizon and directional gyro, maintenance and periodical inspection, suction gauge etc, turn coordinator
9. Electrically operated instruments, vibration indication system- HUMS, glass cockpit, other aircraft system indication
10. Fuel flow gauge and content gauges
11. Manifold pressure gauge

12. Detailed knowledge of the procedures of replacement and in site operational tests of all instruments (except where the use of special test instrument/equipment is required)

AIRCRAFT INSTRUMENT PRACTICAL

1. Identification of various parts of an instrument
2. Familiarization with Pitot static system
3. Familiarization with altimeter
4. Familiarization with Air speed Indicator
5. Familiarization with Vertical speed Indicator.
6. Familiarization with pressure gauge
7. Familiarization with Temperature gauge
8. Familiarization with RPM Indicator
9. Study and sketch of an air driven gyroscopic system.
10. Familiarization with Turn & Bank Indicator
11. Familiarization with Artificial Horizon
12. Familiarization with Directional Gyro
13. Familiarization with Electrical type temperature gauge.
14. Familiarization with Fuel flow gauge and content gauges.
15. Familiarization with Manifold pressure gauge

INSTRUCTIONAL STRATEGY
More focus should be given on practicals.

MEANS OF ASSESSMENT
1. Assignments and quiz/class tests
2. Mid-term and end-term written tests

RECOMMENDED BOOKS
Aircraft Instruments by CA Williams
Aircraft Instruments by EHJ Pallet
Aircraft Instruments and Integrated System by EHJ Pallet
Aviation Maintenance Technician Handbook-Airframe -15 A

Websites for Reference:
1) www.amequestionpaper.com

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
Topic No. 1	5	07
Topic No. 2	5	07
Topic No. 3	5	07
Topic No. 4	5	07
Topic No. 5	5	07
Topic No. 6	7	12
Topic No. 7	6	07
Topic No. 8	10	15
Topic No. 9	5	07
Topic No. 10	5	07
Topic No. 11	5	07
Topic No. 12	7	10
Total	**70**	**100**

4.4 AIR CRAFT COMPASS (Common to AME)

L	T	P
5	1	3

Rationale:

Aircraft compass is an important instrument of aircraft. Its proper working and sensitivity is of utmost importance in flight as well as in landing, so the subject cannot be ignore for maintenance engineer.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:
1-Understand the concepts of general properties of permanent magnet and earth's magnetism
2-Differentiate the general principles of construction of D.R. Compass and R.R. compass
3-Explain the general procedure of installation of the compass in aircraft
4-Describe the procedure of compass swinging
5-Check the compass in aircraft by using landing compass

DETAILED CONTENTS

1. Knowledge of general principles of magnetism, magnetic materials and permanent magnets, polarity and strength of bar magnets, the earth as magnet; the magnetism and its relationship to the geographic meridian.

2. Knowledge of general principles of construction for typical aircraft direct reading compasses and remote reading compasses, including the magnet system, damping liquid, verge ring and markings, lubber line, grid wires, shock absorbing suspension and corrector box, the inspection necessary for the detection of common defects that may arise during use.

3. Knowledge of the procedure and points to be observed during installation of the compass in aircraft.

4. Knowledge of the precautions to be observed in the choice of site for swinging and preparation of a "swinging base", checking the base by means of a landing compass.

5. Knowledge of the composition of compasses in the aircraft including the observation of deviations, the calculations and adjustments necessary for corrections for co-efficient A,B, and C, the procedure to be followed after, then, corrections are made and the preparation of deviation cards and graphs.

6. Knowledge of the use of landing compass for checking the compasses in aircraft.

AIR CRAFT COMPASS PRACTICAL

1. Familiarization with P-type compass.
2. Familiarization with B-type compass.
3. Familiarization with Pivot friction test.
4. Familiarization with damping test.
5. Swinging & compensation of compass by synthetic aids
6. Actual swinging & compensation of compass installed in an aircraft.
7. Preparation of log book entries.

.INSTRUCTIONAL STRATEGY

More focus should be given on practical.

MEANS OF ASSESSMENT

1. Assignments and quiz/class tests
2. Mid-term and end-term written tests

RECOMMENDED BOOKS

Aircraft Instruments by E.H.J. Pallett
CAIP II(Civil Aircraft Inspection Procedure-Part II)

Websites for Reference:

www.amequestionpaper.com

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	10	15
2	15	20
3	10	15
4	10	15
5	15	20
6	10	15
Total	**70**	**100**

4.5 ENERGY CONSERVATION

L	T	P
3	-	2

RATIONALE

The requirement of energy has increased manifolds in last two decades due to rapid urbanization and growth in industrial/service sector. It has become challenging task to meet ever increasing energy demands with limited conventional fuels and natural resources. Due to fast depletion of fossil fuels and a tremendous gap between supply and demand of energy, it is essential to adopt energy conservation techniques in almost every field like industries, commercial and residential sectors etc. Energy conservation has attained priority as it is regarded as additional energy resource. Energy saved is energy produced. This course covers the concepts of energy management and its conservation. It gives the insight to energy conservation opportunities in general industry and details out energy audit methodology and energy audit instruments.

LEARNING OUTCOMES

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

- define principles and objectives of energy management and energy audit.
- understand Energy Conservation Act 2001 and its features.
- understand various forms & elements of energy.
- identify electrical and thermal utilities. Understand their basic principle of operation and assess performance of various equipments.
- identify areas of energy conservation and adopt conservation methods in various systems.
- evaluate the techno economic feasibility of the energy conservation technique adopted.

DETAILED CONTENTS

1. Basics of Energy
   - 1.1 Classification of energy- primary and secondary energy, commercial and non-commercial energy, non-renewable and renewable energy with special reference to solar energy, Capacity factor of solar and wind power generators.
   - 1.2 Global fuel reserve
   - 1.3 Energy scenario in India and state of U.P. Sector-wise energy consumption (domestic, industrial, agricultural and other sectors)
   - 1.4 Impact of energy usage on climate

2. Energy Conservation and EC Act 2001
   - 2.1 Introduction to energy management, energy conservation, energy efficiency and its need
   - 2.2 Salient features of Energy Conservation Act 2001 & The Energy Conservation (Amendment) Act, 2010 and its importance. Prominent organizations at centre and state level responsible for its implementation.
   - 2.3 Standards and Labelling: Concept of star rating and its importance, Types of products available for star rating

3. Electrical Supply System and Motors

3.1 Types of electrical supply system
3.2 Single line diagram
3.3 Losses in electrical power distribution system
3.4 Understanding Electricity Bill: Transformers Tariff structure, Components of power (kW, kVA and kVAR) and power factor, improvement of power factor, Concept of sanctioned load, maximum demand, contract demand and monthly minimum charges (MMC)
3.5 Transformers: Introduction, Losses in transformer, transformer Loading, Tips for energy savings in transformers

3.6 Electric Motors
Types of motors, Losses in induction motors Features and characteristics of energy efficient motors, Estimation of motor loading, Variation in efficiency and power factor with loading, Tips for energy savings in motors

4. Energy Efficiency in Electrical Utilities

4.1 Pumps: Introduction to pump and its applications, Efficient pumping system operation, Energy efficiency in agriculture pumps, Tips for energy saving in pumps
4.2 Compressed Air System: Types of air compressor and its applications, Leakage test, Energy saving opportunities in compressors.
4.3 Energy Conservation in HVAC and Refrigeration System: Introduction, Concept of Energy Efficiency Ratio (EER), Energy saving opportunities in Heating, Ventilation and Air Conditioning (HVAC) and Refrigeration Systems.

5. Lighting and DG Systems

5.1 Lighting Systems: Basic definitions- Lux, lumen and efficacy, Types of different lamps and their features, Energy efficient practices in lighting
5.2 DG Systems: Introduction, Energy efficiency opportunities in DG systems, Loading estimation

6. Energy Efficiency in Thermal Utilities

6.1 Thermal Basics: Thermal energy, Energy content in fuels, Energy Units and its conversions in terms of Metric Tonne of Oil Equivalent (MTOE)
6.2 Energy Conservation in boilers and furnaces : Introduction and types of boilers, Energy performance assessment of boilers, Concept of stoichiometric air and excess air for combustion, Energy conservation in boilers and furnaces, Do's and Don'ts for efficient use of boilers and furnaces
6.3 Cooling Towers: Basic concept of cooling towers, Tips for energy savings in cooling towers
6.4 Efficient Steam Utilization

7. Energy Conservation Building Code (ECBC)

7.1 ECBC and its salient features
7.2 Tips for energy savings in buildings: New Buildings, Existing Buildings

8. Waste Heat Recovery and Co-Generation

8.1 Concept, classification and benefits of waste heat recovery
8.2 Concept and types of co-generation system

9. General Energy Saving Tips
Energy saving tips in:

9.1 Lighting
9.2 Room Air Conditioner
9.3 Refrigerator
9.4 Water Heater
9.5 Computer
9.6 Fan, Heater, Blower and Washing Machine
9.7 Colour Television
9.8 Water Pump
9.9 Cooking
9.10 Transport

10. Energy Audit

10.1 Types and methodology
10.2 Energy audit instruments
10.3 Energy auditing reporting format

PRACTICAL EXERCISES

1. To conduct load survey and power consumption calculations of small building.
2. To check efficacy of different lamps by measuring power consumption and lumens using lux meter.
3. To measure energy efficiency ratio (EER) of an air conditioner.
4. To measure effect of valve throttling and variable frequency drive (VFD) on energy consumption by centrifugal pump.
5. To measure and calculate energy saving by arresting air leakages in compressor.
6. To measure the effect of blower speed on energy consumed by it.

STUDENT ACTIVITIES ON ENERGY CONSERVATION/ENERGY EFFICIENCY

- Presentations of Case Studies
- Debate competitions
- Poster competitions
- Industrial visits
- Visual Aids

INSTRUCTIONAL STRATEGY

Teachers are expected to lay considerable stress on understanding the basic concepts in energy conservation, principles and their applications. For this purpose, teachers are expected to give simple problems in the class room so as to develop necessary knowledge for comprehending the basic concepts and principles. As far as possible, the teaching of the subject must be supplemented by demonstrations and practical work in the laboratory. Visits to industries must be carried out. Expert from industry must be invited to deliver talks on energy conservation to students and faculty.

RECOMMENDED BOOKS

1. Guide book on General Aspects of Energy Management and Energy Audit by Bureau of Energy Efficiency, Government of India. Edition 2015
2. Guide book on Energy Efficiency in Electrical Utilities, by Bureau of Energy Efficiency, Government of India. Edition 2015
3. Guide book on Energy Efficiency in Thermal Utilities, by Bureau of Energy Efficiency, Government of India. Edition 2015
4. Handbook on Energy Audit & Environmental Management by Y P Abbi & Shashank Jain published by TERI. Latest Edition

Important Links:

(i) Bureau of Energy Efficiency (BEE), Ministry of Power, Government of India. www.beeindia.gov.in.

(ii) Ministry of New and Renewable Energy (MNRE), Government of India. www.mnre.gov.in.

(iii) Uttar Pradesh New and Renewable Energy Agency (UPNEDA), Government of Uttar Pradesh. www.upneda.org.in.

(iv) **Central Pollution Control Board (CPCB),** Ministry of Environment, Forest and Climate Change, Government of India. www.cpcb.nic.in.

(v) Energy Efficiency Services Limited (EESL). www.eeslindia.org.

(vi) Electrical India, Magazine on power and electrical products industry. www.electricalindia.in.

V Semester

5.1 AIRCRAFT RECIPROCATING ENGINE-II

L	T	P
5	16	

Rationale:

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

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

1-Perform troubleshoot in starting and ignition system
2-Perform Engine parameter analysis
3- Perform engine removal and installation
4- Demonstrate engine ground operation
5- Perform engine preservation and de-preservation

DETAILED CONTENTS

1.Starting and Ignition Systems

Starting systems, pre-heat systems
Magneto types, construction and principles of operation;
Ignition harnesses, spark plugs
Low and high tension systems

2.Engine Indication Systems

Engine speed
Cylinder head temperature
Coolant temperature
Oil pressure and temperature
Exhaust Gas Temperature
Fuel pressure and flow
Manifold pressure

3.Powerplant Installation

Configuration of firewalls, cowlings, acoustic panels, engine mounts, anti-vibration mounts, hoses, pipes, feeders, connectors, wiring looms, control cables and rods, lifting points and drains

4.Engine Monitoring and Ground Operation

Procedures for starting and ground run-up
Interpretation of engine power output and parameters
Inspection of engine and components: criteria, tolerances, and data specified by engine manufacturer

5.Engine Storage and Preservation

Preservation and de preservation for the engine and accessories/systems

AIRCRAFT RECIPROCATING ENGINE-II PRACTICAL

1. Familiarise with components layout of piston engine

2. Familiarise with Fuel injection system components and operation, engine control and fuel metering systems

3. Familiarise with starting system, pre-heat system; magneto types, Ignition harnesses, spark plugs; low and high tension systems

4. Familiarise with induction systems including alternate air systems; exhaust systems and engine cooling systems, supercharging / turbo-charging systems

5. Familiarise with Indication Systems

6. Demonstrate power plant removal and installation

7. Perform representative engine systems component removal, fitment, inspection, adjustment, servicing and operational check

8. Applicable standard practices, minor fault diagnosis, differential pressure test and rectification

9. Demonstrate engine starting and ground run-up

INSTRUCTIONAL STRATEGY

Presentation
Demonstration

MEANS OF ASSESSMENT
1. Assignments and quiz/class tests
2. Mid-term and end-term written tests

RECOMMENDED BOOKS
AMT Powerplant 12A by FAA
Aircraft Powerplant by Kroes & Wild
Amt Powerplant by Jeeppessen

Websites for Reference:
https://amemyworld.blogspot.com/

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	12	18
2.	18	25
3.	18	25
4.	11	16
5.	11	16
Total	**70**	**100**

5.2 AVIONICS

L	T	P
7	1	6

Rationale :

The electrical devices used in aviation make good study for aircraft maintenance engineer.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

1-Demonstrate the working of various types of avionics general test equipment
2-Familiarize with avionics system used on aircraft
3-Familiarize with integrated modular avionics(IMA) &it's concepts
4-Know the safety procedures while handing the avionics equipment
5-Explain the electronics & digital terminology
6-Describe the outboard maintenance system, cabin system, information system.

DETAILED CONTENTS

1.Avionics general test equipment:

-operation, function and use of avionics general test equipment Memory associated terms, Operation of typical memory devices, Operation, advantages and disadvantages of various data storage system.

2.Avionic Systems

Fundamentals of system lay-outs and operation of Auto Flight (ATA 22), Communications (ATA 23), Navigation Systems (ATA 34).

3.Electrostatic sensitive devices

special handling of components sensitive to electrostatic discharge, Awareness of risk and possible damage, component and personnel, anti-static protection devices.

4.Software Management Control

Awareness of restrictions, airworthiness requirements and possible catastrophic effects of unapproved changes to software programmes Download and use of software

5.Electromagnetic Environment

Influence of the following phenomena on maintenance practices for electronic system:
EMC-Electromagnetic Compatibility EMI Electromagnetic Interference HIRF High Intensity Radiated Field Lightning/lightning protection

6.Servomechanisms

Understanding of the following terms: Open and closed loop systems, feedback, follow up, analogue transducers Principles of operation and use of the following synchro system components/features: resolvers, differential, control and torque, transformers inductance and capacitance transmitters.
Understanding of the following terms: Open and closed loop, follow up, servomechanism, analogue, transducer, null, damping, feedback, dead band
Construction operation and use of the following synchro system components: resolvers, differential, control and torque, E and I transformers, inductance transmitters, capacitance transmitters, synchronous transmitters
Servomechanism defects, reversal of synchro leads, hunting.

7.Fibre Optics

Advantages and disadvantages of fibre optic data transmission over electrical wire propagation
Fibre optic data bus
Fibre optic related terms
Terminations
Couplers, control terminals, remote terminals
Application of fibre optics in aircraft systems

8.Typical Electronic/Digital Aircraft Systems

General arrangement of typical electronic/digital aircraft systems and associated
BITE(Built In Test Equipment) testing such as:
ACARS-ARINC Communication and Addressing and Reporting System
ECAM-Electronic Centralized Aircraft Monitoring
EFIS-Electronic Flight Instrument System
EICAS-Engine Indication and Crew Alerting System
FBW-Fly by Wire
FMS-Flight Management System
GPS-Global Positioning System
IRS-Inertial Reference System
TCAS-Traffic Alert Collision Avoidance System

9.On Board Maintenance Systems (ATA 45)

Central maintenance computers, Data loading system, Electronic library system, Printing, Structure monitoring (damage tolerance monitoring)

10.Integrated Modular Avionics (ATA42)

Functions that may be typically integrated in the Integrated Modular Avionic (IMA) modules are, among others: Bleed Management, Air Pressure Control, Air Ventilation and Control, Avionics and Cockpit Ventilation Control, Temperature Control, Air Traffic Communication, Avionics Communication Router, Electrical Load Management, Circuit Breaker Monitoring, Electrical System BITE, Fuel Management, Braking Control, Steering Control, Landing Gear Extension and Retraction, Tyre Pressure Indication, Oleo Pressure Indication, Brake Temperature Monitoring, etc.

11.Cabin Systems (ATA44)

The units and components which furnish a means of entertaining the passengers and providing communication within the aircraft (Cabin Intercommunication Data System) and between the aircraft cabin and ground stations (Cabin Network Service), Includes voice, data, music and video transmissions The Cabin Intercommunication Data System provides an interface between cockpit/cabin crew and cabin systems. These systems support data exchange of the different related LRU's and they are typically operated via Flight Attendant Panels, The Cabin Network Service typically consists on a server, typically interfacing with, among others, the following systems
— Data/Radio Communication, In-Flight Entertainment System, The Cabin Network Service may host functions such as:
— Access to pre-departure/departure reports,
— E-mail/intranet/Internet access,
— Passenger database
Cabin Core System, In-flight Entertainment System, External Communication System, Cabin Mass Memory System, Cabin Monitoring System, Miscellaneous Cabin System

12.Information Systems (ATA46)

The units and components which furnish a means of storing, updating and retrieving digital information traditionally provided on paper, microfilm or microfiche. Includes units that are dedicated to the information storage and retrieval function such as the electronic library mass storage and controller. Does not include units or components installed for other uses and shared with other systems, such as flight deck printer or general use display

Typical examples include Air Traffic and Information Management Systems and Network Server Systems, Aircraft General Information System, Flight Deck Information System, Maintenance Information System, Passenger Cabin Information System, Miscellaneous Information System

AVIONICS PRACTICAL

1. Recognition and testing of diodes with AVO meter
2. Recognition and reading the value of resistances with Colour codes
3. Recognition the types of capacitors and reading their values
4. Elementary working principle of simple auto pilot system
5. Different types of auto pilots
6. Components of auto pilot system, description and operation
7. Integration of flight director system and horizontal situation indicator with auto pilot operation
8. Familiarization with Software management control
9. Familiarization with Electromagnetic environment
10. Testing of transistors, Usage of bonding tester on aircraft
11. Familiarization with Integrated Modular Avionics & On Board Maintenance System
12. Familiarization with Cabin System & Information System

INSTRUCTIONAL STRATEGY

Utilize a multimodal approach to cater to different learning styles. Combine various instructional methods, such as lectures, visual aids (diagrams, charts, animations), hands-on activities (simulations, practical exercises), group discussions, and case studies. This approach provides a well-rounded learning experience and encourages active participation.

MEANS OF ASSESSMENT

1. Assignments and quiz/class tests
2. Mid-term and end-term written tests

RECOMMENDED BOOKS

Aircraft Electricity & Electronics (Thomas K Eisonin)
Principle of electronics -V.K. Mehta
Electrical Technology- B.L. Thereja
Manual of avionics-Brain Kendel

Websites for Reference:

https://www.nptel.ac.in
https://www.aircraftmaintenancetechnology.com
https://www.aviationtoday.com

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
Topics No. 1	7	8
Topics No. 2	8	18
Topics No. 3	8	05
Topics No. 4	8	05
Topics No. 5	7	05
Topics No. 6	6	8
Topics No. 7	8	05
Topics No. 8	10	8
Topics No. 9	10	10
Topics No. 10	8	10
Topics No. 11	10	10
Topics No. 12	8	8
Total	**98**	**100**

5.3 BASIC COMPUTER

L	T	P
4	1	5

Rationale:

Computer are being used for management informative. An introduction to the computer system is required to understand and make use of computer in an effective way. This subject is purely designed to make student of ATI to understand computer in the Real Aircraft Maintenance World.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:
1-Explain the basic computer structure
2-Familialize with the overall operation & generation of microprocessor
3-Perform the conversion of various types of Numbering system
4-Explain the ADC & DAC & its application
5-Explain the IC & PCB and its use in aircraft

DETAILED CONTENTS

1.Basic Computer Structure

· Computer terminology (including bit, byte, software, hardware, CPU, IC, and various memory devices such as RAM, ROM, PROM)
· Computer technology (as applied in aircraft systems).
· Computer related terminology

2. Communication and storage

· Operation, layout and interface of the major components in a micro computer including their associated bus systems
· Information contained in single and multi address instruction words
· Memory associated terms, Operation of typical memory devices
· Operation, advantages and disadvantages of the various data storage systems.

3.Microprocessors

· Functions performed and overall operation of a microprocessor;
. Various Types of Microprocessor with Chip number
· Basic operation of each of the following microprocessor elements: control and processing unit, clock, register, arithmetic logic unit.
· Uses of medium, large and very large scale integration.

4.Multiplexing

· Operation, application and identification in logic diagrams of multiplexers and de multiplexers.

5.Numbering Systems

Numbering systems: binary, octal and hexadecimal
· Demonstration of conversions between the decimal and binary, octal and hexadecimal systems and vice versa

6.Data Conversion

· Analogue Data, Digital Data
· Operation and application of analogue to digital, and digital to analogue converters, inputs and outputs, limitations of various types.

7.Data Buses

· Operation of data buses in aircraft systems, including knowledge of ARINC and other specifications.

8.Logic Circuits

· Identification of common logic gate symbols, tables and equivalent circuits;
· Applications used for aircraft systems, schematic diagrams.
· Interpretation of logic diagrams.

9.Integrated Circuits

· Description and operation of logic circuits and linear circuits/operational amplifiers.
· Description and operation of logic circuits and linear circuits
· Introduction to operation and function of an operational amplifier used as: integrator, differentiator, voltage follower, comparator
· Operation and amplifier stages connecting methods: resistive capacitive, inductive (transformer), inductive resistive (IR), direct
· Advantages and disadvantages of positive and negative feedback.

10.Printed Circuit Boards

· Description and use of printed circuit boards.

BASIC COMPUTER PRACTICAL

1. Familiarization with the Basic Computer Structure.
2. Familiarization with the Microprocessor and its operation.
3. Familiarization with identification of Common logic Gates and its application.
4.Use all the features and utilitilization of MS Word.
5. Use all the features and utilities of MS Excel and MS PowerPoint
6. Selection of commands in GUI based operation system(e.g., Windows, Linux)
7. Practices on E-Mail & Websites.
8. Inventory & Preventive Maintenance Package, Written specially for Aircraft Maintenance Organization
9- Familiarization with Internet Application and various types of virus.

INSTRUCTIONAL STRATEGY

Teacher should use following means-

1. Active learning: Encourage active learning through hold-on activities, Problem solving exercise and group discussions
2. Real-World Applications
3. Formative Assessment
4. Integration of Technology

MEANS OF ASSESSMENT

1. Assignments and quiz/class tests
2. Mid-term and end-term written tests

RECOMMENDED BOOKS

Aircraft Digital Electronics System by Mike Tooley
Aircraft Electricity & Electronics by Thomas Keismin
Digital Principle & its application by Malvino and leach

Websites for Reference:

www.w3schools.com
www.tutorialspoint.com

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
Topics No. 1	6	10
Topics No. 2	6	10
Topics No. 3	6	10
Topics No. 4	5	10
Topics No. 5	5	10
Topics No. 6	6	10
Topics No. 7	5	10
Topics No. 8	5	10
Topics No. 9	7	10
Topics No. 10	5	10
Total	**56**	**100**

5.4 HELICOPTER AIRFRAME (CHETAK)

L	T	P
6	-	5

Rationale:

Airframe specifics, provides greater depth of knowledge for helicopter maintenance to Aircraft Maintenance Engineers. The paper projects considerable light on salient points of Chetak.

LEARNING OUTCMES

After undergoing the subject, the students will be able to:

1.Describe the helicopter structure and standard components of Chetak helicopter
2. explain fuel system of Chetak helicopter
3. Explain main rotor and tail rotor operation of Chetak helicopter
4. Describe the process of fault detection of Chetak helicopter
5. Explain the Various function of helicopter Systems

DETAILED CONTENTS

HELICOPTER AIRFRAME

1. Introduction to Chetak helicopter

2. Basic type of construction features; fuselage construction, Tail boom Leak test of body structure materials used in chetak helicopter.

3. Flight controls of chetak helicopter and brief description about movement of controls.

4. Servo System; Hydraulic System and Servo Control Units

5. Cabin Heating system& Purpose, operating and system Inspection.

6. Description & operation of wheel type landing gear, Shock absorbers, parking brake system & wheels

7. Basic knowledge of fuel system

8. Transmission System; Main transmission system, Main drive shaft and free wheel assembly, Main rotor brake, MGB, Main rotor shaft, Main rotor head, Main rotor blades, Tracking of Main Rotor Blades, Inclined Drive shaft, Coupling Shaft, Tail Drive Shafts, Tail Gear Box, Tail Rotor Head, Tail Rotor Blades.

9. Vibration and Vibrex Equipment

10. Optional Equipment; Rescue Hoist, Hoist assembly, Cargo Swing, Float type Landing Gear

11. Bad weather protection; Protection against icing condition, Protection against sand in desert, Protection against salt laden or Tropical weather, Protection against Rain.

HELICOPTER AIRFRAME PRACTICAL

1. Familiarization with leak test of body structure of Chetak helicopter and Pressure drop tell tale indicator.
2. Familiarization with swash plate of chetak helicopter.
3. Familiarization with parking brake system of chetak helicopter.
4. Familiarization with main rotor brake system of chetak helicopter.
5. Familiarization with Main rotor head of chetak helicopter.

INSTRUCTIONAL STRATEGY

1. By using Audio visual Demonstration
2. Example is given on aviation industries and different airlines
3. Quiz/Assessment Test

MEANS OF ASSESSMENT

1. Assignments and quiz/class tests
2. Mid-term and end-term written tests

RECOMMENDED BOOKS

Aircraft maintenance manual Chetak helicopter
Aviation maintenance technician handbook a f – 15 a
Basic helicopter maintenance by Joseph schafer

Websites for Reference:

https://amemyworld.blogspot.com/
https://www.amequestionpaper.in/
https://www.nasa.gov/

SUGGESTED DISTRIBUTION OF MARKS

Unit	Time Allotted (Periods)	Marks Allotted (%)
1	2	5
2	8	10
3	6	10
4	5	10
5	5	10
6	10	15
7	4	5
8	17	20
9	2	5
10	2	5
11	4	5
Total	**84**	**100**

VI Semester

6.1 ENVIRONMENTALSTUDIES

L	T	P
3	-	2

RATIONALE

A diploma holder must have knowledge of different types of pollution caused due to industries and constructional activities so that he may help in balancing the ecosystem and controlling pollution by various control measures. He should also be aware of environmental laws related to the control of pollution. He should know how to manage the waste. Energy conservation is the need of hour. He should know the concept of energy management and its conservation.

LEARNING OUTCOMES

After undergoing the subject, the student will be able to:

- Comprehend the importance of ecosystem and sustainable
- Demonstrate interdisciplinary nature of environmental issues
- Identify different types of environmental pollution and control measures.
- Take corrective measures for the abatement of pollution.
- Explain environmental legislation acts.
- Define energy management, energy conservation and energy efficiency
- Demonstrate positive attitude towards judicious use of energy and environmental protection
- Practice energy efficient techniques in day-to-day life and industrial processes.
- Adopt cleaner productive technologies
- Identify the role of non-conventional energy resources in environmental protection.
- Analyze the impact of human activities on the environment

DETAILED CONTENTS

1. Introduction (04 Periods)

   1.1 Basics of ecology, eco system- concept, and sustainable development, Resources renewable and nonrenewable.

2. Air Pollution (04 Periods)

   2.1 Source of air pollution. Effect of air pollution on human health, economy, plant, animals. Air pollution control methods.

3. Water Pollution (08 Periods)

   3.1 Impurities in water, Cause of water pollution, Source of water pollution. Effect of water pollution on human health, Concept of dissolved O2, BOD, COD. Prevention of water pollution- Water treatment processes, Sewage treatment. Water quality standard.

4. Soil Pollution (06 Periods)

   4.1 Sources of soil pollution
   4.2 Types of Solid waste- House hold, Hospital, From Agriculture, Biomedical, Animal and human, excreta, sediments and E-waste
   4.3 Effect of Solid waste
   4.4 Disposal of Solid Waste- Solid Waste Management

5. Noise pollution (06 Periods)

Source of noise pollution, Unit of noise, Effect of noise pollution, Acceptable noise level, Different method of minimize noise pollution.

6. Environmental Legislation (08 Periods)

Introduction to Water (Prevention and Control of Pollution) Act 1974, Introduction to Air (Prevention and Control of Pollution) Act 1981 and Environmental Protection Act 1986, Role and Function of State Pollution Control Board and National Green Tribunal (NGT), Environmental Impact Assessment (EIA).

7. Impact of Energy Usage on Environment (06 Periods)

Global Warming, Green House Effect, Depletion of Ozone Layer, Acid Rain. Eco-friendly Material, Recycling of Material, Concept of Green Buildings.

LIST OF PRACTICALS

1. Determination of pH of drinking water
2. Determination of TDS in drinking water
3. Determination of TSS in drinking water
4. Determination of hardness in drinking water
5. Determination of oil & grease in drinking water
6. Determination of alkalinity in drinking water
7. Determination of acidity in drinking water
8. Determination of organic/inorganic solid in drinking water
9. Determination of pH of soil
10. Determination of N&P (Nitrogen & Phosphorus) of soil
11. To measure the noise level in classroom and industry.
12. To segregate the various types of solid waste in a locality.
13. To study the waste management plan of different solid waste
14. To study the effect of melting of floating ice in water due to global warming

INSTRUCTIONAL STRATEGY

In addition to theoretical instructions, different activities pertaining to Environmental Studies like expert lectures, seminars, visits to green house, effluent treatment plant of any industry, rain water harvesting plant etc. may also be organized.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests,
- Mid-term and end-term written tests

RECOMMENDED BOOKS

1. Environmental and Pollution Awareness by Sharma BR; Satya Prakashan, New Delhi.
2. Environmental Protection Law and Policy in India by Thakur Kailash; Deep and Deep Publications, New Delhi.

3. Environmental Pollution by Dr. RK Khitoliya; S Chand Publishing, New Delhi
4. Environmental Science by Deswal and Deswal; Dhanpat Rai and Co. (P) Ltd. Delhi.
5. Engineering Chemistry by Jain and Jain; Dhanpat Rai and Co. (P) Ltd. Delhi.
6. Environmental Studies by Erach Bharucha; University Press (India) Private Ltd., Hyderabad.
7. Environmental Engineering and Management by Suresh K Dhamija; S K Kataria and Sons, New Delhi.
8. E-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	04	10
2	04	10
3	08	20
4	06	14
5	06	14
6	08	20
7	06	12
Total	**42**	**100**

6.2 JET ENGINES
(Common to AME)

L	T	P
7	-	5

Rationale :

Jet engine is also a kind of air craft engine. Knowledge of various kinds of engine used in aircraft and inspection procedure is vary essential for maintenance personals.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:
1-Describe the concepts of internal combustion engine, gas turbine engine
2-Explain the design fundamentals of gas turbine engine
3-Troubleshoot the Gas turbine engine components& systems
4-Perform the engine performance analysis
5-Demonstrate the engine ground operation

DETAILED CONTENTS

1. Fundamentals

Potential energy, kinetic energy, Newton's laws of motion, Brayton cycle;
The relationship between force, work, power, energy, velocity, acceleration;
Constructional arrangement and operation of turbojet, turbofan, turbo shaft, turboprop.

2. Engine Performance

Gross thrust, net thrust, choked nozzle thrust, thrust distribution, resultant thrust,
thrust horsepower, equivalent shaft horsepower, specific fuel consumption;
Engine efficiencies;
By-pass ratio and engine pressure ratio;
Pressure, temperature and velocity of the gas flow;
Engine ratings, static thrust, influence of speed, altitude and hot climate, flat rating, limitations.

3. Inlet

Compressor inlet ducts
Effects of various inlet configurations;
Ice protection.

4. Compressors

Axial and centrifugal types;
Constructional features and operating principles and applications;
Fan balancing;
Operation:
Causes and effects of compressor stall and surge;
Methods of air flow control: bleed valves, variable inlet guide vanes, variable stator
vanes, rotating stator blades;
Compressor ratio.

5 Combustion Section
Constructional features and principles of operation.

6 Turbine Section
Operation and characteristics of different turbine blade types;
Blade to disk attachment;
Nozzle guide vanes;
Causes and effects of turbine blade stress and creep.

7 Exhaust
Constructional features and principles of operation;
Convergent, divergent and variable area nozzles;
Engine noise reduction;
Thrust reversers.

8 Bearings and Seals
Constructional features and principles of operation.

9 Lubricants and Fuels
Properties and specifications;
Fuel additives;
Safety precautions.

10 Lubrication Systems
System operation/lay-out and components.

11 Fuel Systems
Operation of engine control and fuel metering systems
including electronic engine control (FADEC);
Systems lay-out and components.

12 Air Systems
Operation of engine air distribution and anti-ice control systems, including internal cooling, sealing and external air services.

13 Starting and Ignition Systems
Operation of engine start systems and components;
Ignition systems and components;
Maintenance safety requirements.

14 Engine Indication Systems
Exhaust Gas Temperature/Interstage Turbine
Temperature;
Engine Thrust Indication: Engine Pressure Ratio, engine turbine discharge pressure or jet pipe pressure systems;
Oil pressure and temperature;
Fuel pressure and flow;
Engine speed;
Vibration measurement and indication;
Torque;
Power.

15 Power Augmentation Systems
Operation and applications;
Water injection, water methanol;
Afterburner systems.

16 Turbo-prop Engines
Gas coupled/free turbine and gear coupled turbines;
Reduction gears;
Integrated engine and propeller controls;
Overspeed safety devices.

17 Turbo-shaft engines
Arrangements, drive systems, reduction gearing,
couplings, control systems.

18 Auxiliary Power Units (APUs)
Purpose, operation, protective systems.

19 Power plant Installation
Configuration of firewalls, cowlings, acoustic panels, engine mounts, anti-vibration mounts, hoses, pipes, feeders, connectors, wiring looms, control cables and rods, lifting points and drains.

20 Fire Protection Systems
Operation of detection and extinguishing systems.

21 Engine Monitoring and Ground Operation
Procedures for starting and ground run-up;
Interpretation of engine power output and parameters;
Trend (including oil analysis, vibration and borescope) monitoring;
Inspection of engine and components to criteria, tolerances and data specified by engine manufacturer;
Compressor washing/cleaning;
Foreign Object Damage.

22 Engine Storage and Preservation
Preservation and de preservation for the engine and accessories/ systems

LIST OF PRACTICALS

1. Compressor washing procedures.
2. Internal inspection of an engine by endoscope/borescope.
3. Hot section inspection, splitting 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. Inspection of accessories gear system.
5. Functional test of fuel system including fuel nozzle.
6. Functional check of temperature indication system.
7. Rigging procedure of engine and propeller control.
8. Engine removal and installation.
9. Engine ground testing procedure.
10. Engine preservation (Long term and short term).
11. Functional test of ignition ignitor.

INSTRUCTIONAL STRATEGY

Presentation
Demonstration

MEANS OF ASSESSMENT

1. Assignments and quiz/class tests
2. Mid-term and end-term written tests

RECOMMENDED BOOKS

Aircraft Gas Turbine Technology by Irwine Treager
Aircraft A & P Technician Powerplant by Jeeppesen
Aircraft Gas Turbine Powerplant by CW Otis

Websites for Reference:

https://amemyworld.blogspot.com/

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
Topics No. 1	5	5
Topics No. 2	5	5
Topics No. 3	5	5
Topics No. 4	5	5
Topics No. 5	5	5
Topics No. 6	5	5
Topics No. 7	5	5
Topics No. 8	5	5
Topics No. 9	5	5
Topics No. 10	5	5
Topics No. 11	4	5
Topics No. 12	4	5
Topics No. 13	4	5
Topics No. 14	4	5
Topics No. 15	4	5
Topics No. 16	4	5
Topics No. 17	4	3
Topics No. 18	4	3
Topics No. 19	4	3
Topics No. 20	4	3
Topics No. 21	4	4
Topics No. 22	4	4
Total	98	100

6.3 Aero Engine Helicopter

L	T	P
6	-	6

Rationale :
Aero Engine specifics, provides greater depth of knowledge of helicopter aero engine maintenance to Aircraft Maintenance Engineers. The paper projects considerable light on salient points of Aero Engine of Chetak Helicopter.

Learning Outcome:
After undergoing the subject, the students will be able to:
1. Explain the fundamentals of thermodynamics
2. Describe the function of engine components
3. Demonstrate the inspection procedure of engine of same series.
4. Explain the engine starting & stopping procedure
5. Describe the vibration inspection procedure

DETAILED CONTENTS

1. Introduction to Jet Engine Theory, Lethal warning, Safety Precaution.
2. Introduction to ARTOUSTE III B ENGINE (Aero Engine Chetak Helicopter).
3. Accessories of ARTOUSTE III B ENGINE.
4. Construction of ARTOUSTE III B ENGINE
5. Fuel system and its components of ARTOUSTE III B ENGINE.
6. Engine controls and Micro switches of ARTOUSTE III B ENGINE.
7. Engine lubrication system and components of ARTOUSTE III B ENGINE.
8. Engine starting and stopping and ventilation procedure of ARTOUSTE III B ENGINE.
9. Engine trouble shooting.
10. Removal and installation of engine.
11. Preservation and Packing procedure of engine.
12. Vibration and Vibrex Equipment.

PRACTICAL

1. Familiarization with Air intake assembly of chetak helicopter.
2. Familiarization with Compressor assembly of chetak helicopter.
3. Familiarization with combustion chamber of chetak helicopter.
4. Familiarization with turbine assembly of chetak helicopter.
5. Removal and fitment of fuel tank with precautions of chetak helicopter.

INSTRUCTIONAL STRATEGY
Presentation
Demonstration

MEANS OF ASSESSMENT
1. Assignments and quiz/class tests
2. Mid-term and end-term written tests

RECOMMENDED BOOKS
The Development of Jet and Turbine Aero Engines" by Bill Gunston

Websites for Reference:
https://amemyworld.blogspot.com/

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
Topics No. 1	8	5
Topics No. 2	8	7
Topics No. 3	8	7
Topics No. 4	8	15
Topics No. 5	8	15
Topics No. 6	8	5
Topics No. 7	6	10
Topics No. 8	6	10
Topics No. 9	6	7
Topics No. 10	6	7
Topics No. 11	6	5
Topics No. 12	6	7
Total	84	100

6.4 **Universal Human Values**

L-T-P
2-0-1

Course Objectives

This introductory course input is intended

1. To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of Existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature

Thus, this course is intended to provide a much needed orientational input in value education to the young enquiring minds.

Course Methodology

1. The methodology of this course is explorational and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.
2. It is free from any dogma or value prescriptions.
3. It is a process of self-investigation and self-exploration, and not of giving sermons. Whatever is found as truth or reality is stated as a proposal and the students are facilitated to verify it in their own right, based on their Natural Acceptance and subsequent Experiential Validation.
4. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student leading to continuous self-evolution.
5. This self-exploration also enables them to critically evaluate their pre-conditionings and present beliefs.

The syllabus for the lectures is given below:

- After every two lectures of one hour each, there is one hour practice session.
- The assessment for this subject is as follows:
- Sessions Marks (Internal): 20
- Practical Marks (External): 30
- Total Marks: 50

UNIT 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Understanding the need, basic guidelines, content and process for Value Education
2. Self-Exploration–what is it? - its content and process; ‘Natural Acceptance’ and Experiential Validation- as the mechanism for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfill the above human aspirations: understanding and living in harmony at various levels

UNIT 2: Understanding Harmony in the Human Being - Harmony in Myself!

1. Understanding human being as a co-existence of the sentient 'I' and the material the Body'
2. Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha
3. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
4. Understanding the characteristics and activities of 'I' and harmony in 'I'
5. Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail
6. Programs to ensure Sanyam and Swasthya

-Practice Exercises and Case Studies will be taken up in Practice Sessions.

UNIT 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

1. Understanding Harmony in the family – the basic unit of human interaction
2. Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti;
    a. Trust (Vishwas) and Respect (Samman) as the foundational values of relationship
3. Understanding the meaning of Vishwas; Difference between intention and competence
4. Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship
5. Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals
6. Visualizing a universal harmonious order in society- Undivided Society (AkhandSamaj), Universal Order (SarvabhaumVyawastha)- from family to world family!

-Practice Exercises and Case Studies will be taken up in Practice Sessions.

UNIT 4: Understanding Harmony in the Nature and Existence - Whole existence as Co-existence

1. Understanding the harmony in the Nature
2. Interconnectedness and mutual fulfillment among the four orders of nature-recyclability and self-regulation in nature
3. Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space
4. Holistic perception of harmony at all levels of existence

-Practice Exercises and Case Studies will be taken up in Practice Sessions.

UNIT 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics

1. Natural acceptance of human values
2. Definitiveness of Ethical Human Conduct
3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
4. Competence in professional ethics:
    a) Ability to utilize the professional competence for augmenting universal human order
    b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems,
    c) Ability to identify and develop appropriate technologies and management patterns for above production systems.
5. Case studies of typical holistic technologies, management models and production systems
6. Strategy for transition from the present state to Universal Human Order:

a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers
b) At the level of society: as mutually enriching institutions and organizations
7. To inculcate Human Values among Students: The Role of self ,Parents and Teachers
-Practice Exercises and Case Studies will be taken up in Practice Sessions.

Practical Session also Includes Different Yogic Exercises and Meditation Session

INSTRUCTONAL STRATEGY

The content of this course is to be taught on conceptual basis with plenty of real world examples.

MEANS OF ASSESSMENT

– Assignments and quiz/class tests,
– Mid-term and end-term written tests
– Practical assessment

Reference Material

The primary resource material for teaching this course consists of

a. The text book (Latest Edition)

R.R Gaur, R Asthana, G P Bagaria, A foundation course in Human Values and professional Ethics, Excel books, New Delhi.

b. The teacher's manual (Latest Edition)

R.R Gaur, R Asthana, G P Bagaria, A foundation course in Human Values and professional Ethics – Teachers Manual, Excel books, New Delhi.

In addition, the following reference books may be found useful for supplementary reading in connection with different parts of the course:

1. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.
2. PL Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Purblishers.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
4. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA
5. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, limits to Growth, Club of Rome's Report, Universe Books.
6. SubhasPalekar, 2000, How to practice Natural Farming, Pracheen(Vaidik) KrishiTantraShodh, Amravati.
7. A Nagraj, 1998, JeevanVidyaekParichay, Divya Path Sansthan, Amarkantak.
8. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
9. A.N. Tripathy, 2003, Human Values, New Age International Publishers.

Relevant websites, movies and documentaries

1. Value Education websites, http://uhv.ac.in, http://www.aktu.ac.in
2. Story of Stuff, http://www.storyofstuff.com
3. Al Gore, An Inconvenient Truth, Paramount Classics, USA
4. Charlie Chaplin, Modern Times, United Artists, USA
5. IIT Delhi, Modern Technology – the Untold Story
6. Case study Hevade Bazar Movie
7. RC Shekhar , Ethical Contradiction ,Trident New Delhi
8. Gandhi A., Right Here Right Now, Cyclewala Production

SUGGESTED DISTRIBUTION OF MARKS

Unit	Time Allotted (Periods)	Marks Allotted (%)
1	08	20
2	08	20
3	08	20
4	08	20
5	10	20
Total	**42**	**100**

6.5 PROJECT

L	T	P
-	-	10

Student in groups/individually the given maintenance work of major/minor assembly, subassembly of aircraft. They will prepare a report of their work which should contain : Its objective, Identification of work elements, their sequencing, Time schedule, Work procedure facilities/resources wanted. Inspection of parts decision making whether recondition of replace - Manpower wanted, estimated expenditure. Testing after maintenance.

Two periods per week are allotted for this work. The project contains 150 marks, the breakup is as follows

Viva-Voce - 80 Marks

Documentation - 20 Marks

Sessional Marks - 50 Marks

6.6 Industrial Training

It is needless to emphasize further the importance of Industrial Training of students during their 3 years of studies at Polytechnics. It is industrial training, which 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 as diploma engineers in the world of work and enables them to integrate theory with practice. Polytechnicshavebeenarrangingindustrialtrainingofstudentsofvariousdurationstomeettheaboveobjectives.

This document includes guided and supervised industrial training of 4 weeks duration to be organized during the semester break starting after second year i.e. after 4th 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. Students should be encouraged to write daily report in their diary to enable them to write final report and its presentation later on.

An external assessment has been provided in the study and evaluation scheme of 6th 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.

Teachers and students are requested to see the footnote below the study and evaluation scheme of 4th semester for further details.

The teacher along with field supervisors will conduct performance assessment of students. The components of evaluation will include the following:

Punctuality and regularity	15%
Initiative in learning new things	15%
Presentation and VIVA	15%
Industrial training report	55%

STAFF REQUIREMENT

S.No.	Name of Post	Qualification	Requirement
1	Principal lecturer	(a) BAMEL in a stream related to the scope of the approval or degree in engineering or equivalent qualification in the field of Aeronautical / Mechanical / Electrical / Electronics / Instrument engineering. He should also have passed Paper I (Regulations) of AME license examination. (b) For BAMEL holders, ten years practical experience in aviation industry out of which a minimum two years in the field of instruction. For engineering graduates, two years practical experience in aviation industry out of which a minimum of one year in the field of instruction. (c) Knowledge of Hindi.	01
2	Chief Lecturer	(a) BAMEL in a stream related to the scope of the approval or degree in engineering or equivalent qualification in the field of Aeronautical / Mechanical / Electrical / Electronics / Instrument engineering. He should also have passed Paper I (Regulations) of AME license examination (b) For BAMEL holders, five years practical experience in aviation industry out of which a minimum two years in the field of instruction. For engineering graduates, two years practical experience in aviation industry out of which a minimum of one year in the field of instruction. (c) Knowledge of Hindi.	01
3	Lecturer (Aero.)	(1) BAMEL in any category (LA,PE,HA & JE) OR. Degree in Engineering in Aeronautical/Mechanical/Electrical/Electronics/ Instrumentation Engineering OR. Diploma in any of the above disciplines OR Bachelor of Science with Physics, Chemistry and Maths/Bachelor of Science (Electronics). (2) One year Practical/Instructional experience for holders of Engineering degree OR BAMEL and three years practical/Instructional experience in aviation industry for others. (3) Instructors assigned to teach paper-I (Air Law, airworthiness Requirements and Human Performance) should have passed paper-I of AME License Examination. (4) Instructors teaching Paper-III subject should have passed paper-III of the relevant category OR have adequate maintenance experience in the relevant category. (5) Knowledge of Hindi.	02
4	Lecturer (Avionics)	(1) BAMEL in any category (ES,IS & RN) OR. Degree in Engineering in Aeronautical/Mechanical/Electrical/Electronics/Instrumentation engineering OR. Diploma in any of the above disciplines OR Bachelor of Science with Physics, Chemistry and Maths/Bachelor of Science (Electronics).	02

		(2) One year Practical/Instructional experience for holders of Engineering degree OR BAMEL and three years practical/Instructional experience in aviation industry for others. (3) Instructors assigned to teach paper-I (Air Law, airworthiness Requirements and Human Performance) should have passed paper-I of AME License Examination. (4) Instructors teaching Paper-III subject should have passed paper-III of the relevant category OR have adequate maintenance experience in the relevant category. (5) Knowledge of Hindi.	
5	Lecturer (Mechanical)	(1) Degree in Mechanical or Automobile Engineering or its equivalent with at least 55% marks. (2) Five years practical/instructional experience in appropriate field. (3) Knowledge of Hindi	02
6	Lecturer (Electrical)	(1) Degree in Electrical or Electronics Engineering or equivalent with at least 55% marks (2) Five years practical/instructional experience in appropriate field. (3) Knowledge of Hindi.	01
7	Lecturer (Science)	(1) At least second-class Master degree in Physics or Maths with at least 55% marks. Weightage will be given to B.Ed. or its equivalent degree holder (2) Five years practical/instructional experience in appropriate field. (3) Knowledge of Hindi	01

S.No.	Name of Post	Qualification	Requirement
1.	Instructors		
	1. Instructor (Aero.)	(1) Diploma/AME course in Aircraft Maintenance Engineering Mechanical stream (Aeroplane & Powerplants) issued by any Director General of Civil Aviation, Government of India recognized institute. (2) Three years practical/instructional experience in appropriate field (3) Knowledge of Hindi. OR (1) BAMEL in any category in mechanical stream (Aeroplane & Powerplants) (2) Two years practical/instructional experience in appropriate field (3) Knowledge of Hindi.	01
	2. Instructor (Avionics)	(1) Diploma/AME course in Aircraft Maintenance Engineering in Avionics Stream, issued by any Director General of Civil Aviation, Government of India recognized institute. (2) Three years practical/instructional experience in appropriate field (3) Knowledge of Hindi. OR (1) BAMEL in any category in Avionics stream (ES,IS & RN) (2) Two years practical/instructional experience in appropriate field (3) Knowledge of Hindi	01
	3.Instructor/ Demonstrator (Workshop)	(1) Diploma in Mechanical./Aircraft Maintenance Engineering issued by State board of Technical Education. (2) Three years practical/instructional experience in appropriate field (3) Knowledge of Hindi.	02
2.	Technician		
	Electrician	1) High School Passed (2) Two years certificate in electrician trade from Industrial Training Institute (I.T.I.).	01
	2. Welder :	(1) High School passed. (2) One Year certificate in welding trade from Industrial Training Institute (I.T.I.)	01
	3. Machinist/Fitter / Carpenter	(1) High School passed. (2) One Year certificate in welding trade from Industrial Training Institute (I.T.I.)	01

Note- At least two guest lecturers be arranged every month from the person in the respective field

SPACE REQUIREMENT

S.No	Room Requirements	Qty.	Area (Sq.m.)
Administrative Block			
1	Principal Room	1	30
2	Chief lecturer Room	1	20
3	Lecturer Room	1	70
4	Office Room	1	60
Teaching Staff			
1	Class Room	9	33 each or more
2.	Drawing Hall	1	120
3.	Conference A.V Aids room	1	120
4	Library cum Computer lab	1	120
Work Shop Block			
1.	General fitting shop	1	50
2.	Carpentry shop	1	40
3.	Machine shop	1	120
4.	Welding shop	1	40
5.	Engine shop	1	40
6.	Airframe shop	1	40
7.	Instrument shop	1	40
8.	Electrical shop	1	50
9.	Battery charging shop (Lead Acid + Ni-Cd Battery)	2	50
10.	Radio shop	1	60
11.	Composite shop	1	10
12.	Hanger for parking of aircrafts	1	200
13.	Helicopter shop	1	40
14.	Computer Shop	1	50
Store for miscellaneous items		1	30

S.No.	List of Tools &Equipments	
A.	General fitting shop	Qty.
1.	Fitter/ carpentry Bench Vices	36
2.	Hacksaw with frame	11
3.	Power hacksaw	01
4.	Ball peen Hammers	06
5.	Cross peen Hammers	06
6.	Straight peen Hammer	06
7.	Soft head Hammer	06
8.	Files set	06
9.	Steel rule	06 sets
10.	Fitter squares	12
11.	Punches (set)	06
12.	Calipers (set containing internal external & hermaphrodite)	06
13.	Scribing block	06
14.	Vee block	06 pairs
15.	Surface plates (cast iron)	04
16.	Surface plates (granite)	01
17.	Hand drill machines	06
18.	Power drill machines (bench)	01
19.	Drill bits	15 sets
20.	Reamers	10 sets
21.	Taps	02 sets
22.	Dies	03 sets
23.	Micrometer English (external)	06
24.	Micrometer English (internal)	02
25.	Micrometer Metric (external)	03
26.	Micrometer Metric (internal)	02
27.	Vernier Calipers	08
28.	Screw thread gauge	05 sets
29.	Bench grinder	02
30.	Screw driver sets	06 sets
31.	Sheet cutter	06
32.	Pliers	06
33.	Electric drill machine	05
34.	Hammer drill machine	01
35.	Cordless drill machine	01
B.	Carpentry Shop :	
1.	Carpenter's saw	06
2.	Jack planes wooden	06
3.	Jack planes metal	06
4.	Chisels firmer	08
5	Chisels mortise	08
6	Auger bit	08
7	Measuring & marking tools	06
8	Circular saw machine	01
9	Carpenter's bench vice	07
10	Wood turning lathe	01

C.	Machine Shop	
1.	Lathe machine (3 ft. bed)	01
2.	SS & SC lathe	02
3.	All geared lathe	02
4.	Capstan lathe	01
5.	Sheet metal guillotine	06
6.	Arbor press	01
7.	Combination set	01
8.	Milling machine	02
9.	Brinell hardness tester	01
10.	Rockwell hardness tester	01
11.	Large surface table	01
12.	Power Hacksaw	01
13.	Power Grinding and buffing machine	01
14.	Power drill machines (bench)	01
D.	Welding Shop :	
		02
1.	Gas welding set	01
2.	Electric resistance welder for Spot welding	02
3.	Arc Welding Machine (Transformer type)	01
4.	TIG Welding Machine	06
5.	Goggles, gloves (Gas welding)	02
6.	Spark lighter	06
7.	Wire brush	06
8.	Eye shield for electric arc welding	06
9.	Solder iron	02
10.	Blow lamp	
E.	Engine Shop :	01
1.		01
2.	Mock up of fuel system	01
3.	Mock up of ignition system	01
4.	Exploded view of engine	
5.	Continental A-65 engine	01
6.	Continental 0-450 engine for imparting training & associated	01
7.	tools for carrying out job	01
8.	Turbine engine	01
9.	Spanners set (ring)	01 set
10.	Spanners set (open)	01 set
11.	Deep socket (3/8" square head)	01 set
12.	Socket (1/4" square head)	01
13.	Extensions	
14.	T-handle	01
15.	Ratchet handle	01
16.	Cylinder mercer gauge	04 set
17.	Pin hole gauge	04 set
18.	Telescopic gauge	03
19.	Depth gauge (vernier)	
	Height gauge (vernier)	04
	Depth gauge micrometer type	01

20.	Dial test indicator	02
21.	Compressor	01
22.	Feeler gauge (in thou.)	06
23.	Bomb tester	01
24.	Megger	01
25.	Torque spanner (dial type)	01
26.	Torque spanner ratchet type	01
27.	Piston spanner ratchet type	01
28.	Mallet	01
F.	Airframe Shop :	
1.	Mock up of pneumatic system	01
2.	Mock up of hydraulic system	01
3.	Working model of hydraulic brake	01
4.	One complete aircraft	01
5.	Circlip pliers (internal)	02 sets
6.	Circlip pliers (external)	02 sets
7.	Grease gun	01
8.	Portable magna flux equipment	01
9.	De-magnetisation rig	01
10.	Fluorescent inspection equipment	01
11.	Cherry rivet gun	03
12.	Cleco fasteners pliers	02 sets
13.	Tyre pressure gauge	02
14.	Pneumatic riveting gun	02
15.	Snap and dolly	06 sets
16.	Ezy out extractor	02
17.	Mouly tester	02
18.	Cable tensiometer	02
19.	Fabric stitching needles	05 sets
20.	Straight edge	02
21.	Spirit level	02
22.	Plumb bob	02
23.	Avary scales (consisting of 3 scales)	01 set
24.	Trammel	02
25	Allen key set	02
26	Adjustable spanner	04
27	"C" spanner	02
28	Grip pliers	02
29	Universal testing machine	01
30	Working model of flap operating system	01
31	Air Conditioning machine with cooling effect	01
G.	Composite shop	01
1	Laying up tables	01 each
2	brushes and spatulas	01 each
3	Scissors and Cutter	

4.	Epoxy resin, Hardener, activator	01each
5.	Measuring cup, Pot and Tray	01each
6.	Video CDs of composite repair	03
7.	Sanders	01
8.	Fibers	01
9.	Many examples of composite materials	01each
10.	Heat Lamp and hot Blower	01each
11.	Digital thermometer	01
H.	Electrical Shop	
1	Length of Aircraft cabling with typical plugs, sockets, Bulkhead sealing bungs, grommet	01set each
2	Junction Boxes, switches, fuses, thermal circuit breakers, wire connecting device	01 set each
3	AC Generators (constant speed drives) test bench	01 set
4	DC Generators (constant speed drives) test bench	01 set
5	Voltage regulators, generator control units	01seteach 01
6	Current limiting devices vibrator type	set
7	Current limiting devices variable resistance type	01 set
8	DC motor 28 V	01 No
9	AC motor 28 V	01 No
10	Continuously rated motors	01 No
11	Engine starter	01 No
12	Rotary actuator	01 No
13	Linear actuator	01 No
14	Static invertor & specimens of other types of current conversion devices such as transformer current rectifier units Rotary invertors	03 set
15	Electrical heating device thermal de-icing shoes etc.	01 No.
16	Electrical heating device pitot heads.	01 No
17	Fluorescent lamps, Navigation lights ,Landing lamp	01 set
18	Electrical machine unit for testing motor & Generator	01 set
19	Voltmeter	01 set
20	Ammeter	01 No
21	Ohmmeter	01 No
22	Wheatstone bridge	01 No
23	Thermocouple	02 No
24	Ratio meter	01 No
25	Servos and synchros	01 No
26	Generator	01 No
27	Electrical Landing Light	01 No
28	CRT	01No
29	Multimeter	01 No
30	Mockup of Smoke detector	03 No
31	Mockup of Cabin lighting system	01 set
32		01 set
33	Mockup of Thermocouple principle	01 set
34	Electrical Test Panel	01 set
35	Electrical 5mm point temperature-controlled soldering Iron	01 No

36	One wire stripper for removing insulation A selection of small screw drivers(including a phillips) One adjustable hook wrench(18 to 50mm) one set of Allen keys	01 set
37	Display Board	01 set
38	Cabin Lighting System Mockup	01 set
I.	Instrument Shop	
1.	Pitot Static Head	01 No
2.	Jet Pipe thermocouple	01 No
3.	Magnetic Compass	01 No
4.	Fuel content Gauge (Capacitance type)	01 No
5.	Fuel content Gauge (Float Operated type)	01 No
6.	Cylinder Head thermocouple	01 No
7.	Oil thermometer (Electrical type)	01 No
8.	Oil thermometer (Physical type)	01 No
9.	Engine Speed Indicator (AC type)	01 No
10.	Engine Speed Indicator (DC type)	01 No
11 12 13 14 15 16 17 18. 19. 20. 21 22	Simple type Autopilot Engine Oil Pressure Gauge (Bourdon tube type) Engine Oil Pressure Gauge (Electrical type) Cabin Temperature Controller Mockups of Altimeter Test Chamber Mockup of Airspeed indicator for Leak test Gyroscopic Instrument Test table Mockup for compass swinging practice Mockup for RPM indicator One set of watch screw drivers One set of miniature spanners One set of Allen keys(aooropriate sized) One set of Bristol spine keys One electric temperature controlled soldering iron with fine point. Bonding tester(lead battery operated) Dead Weight Tester	01 set 01 No 01 No 01 No 01 No 01 No 01 No 01 No 01 No 01 set each

J.	Radio Shop	
1.	Variable stabilized power supply unit Variable suppy 0-28V	01 N0
2.	Signal generator (High Grade) RF	01 N0
3.	Signal generator for bench work (20-2000 Hz)AF	01 N0
4.	Signal generator (VHF)	01 N0
5.	Audio frequency oscillators	01 N0
6.	Frequency meter 0-1999.99 Hz	01 N0
7.	Cathode ray oscilloscopes	01 N0

8.	Moving coil Volt-Ohm-milliam meter multi meter (0-1000m V/O-2000m V/O-500m V/O-500µA)	01 N0
9.	Variac 5 Amp.	01 N0
10.	Spectrum analyzer - 1090 MHz	01 N0
11.	Digital Battery analyzer	01 N0
12.	IC/Microprocessor	01 N0
13.	Digital Volt meter/Ohm-O-2000 OHM meter/Ammeter	01 N0
14.	Search radar/Weather Radar	01 N0
15	Electronics Amplifiers (e.g. Capacitance type fuel content gage, Cabin temperature controllers automatic pilots)	01 No
16	Logic probe	01 No
17	RLC Bridge	01 No
18	Voltage standing Wave meter 0-50W	01 No
19	Absorption and thermocouple watt meter	01 No
20	Distance measuring equipment system	01 No
21	Air traffic control transponder system	01 No
22	Distance measuring Mockup	01 set
23	Automatic pilots Mockup	01 set
24	VHF Transmitter and Receiver RT 241A	01 No
25	HF Transmitter and Receiver DX10-DA	01 No
26	HF Transceiver	01 No
27	VOR ILS receiver Type 51RV-1	01 No
28	Marker Receiver KMA-20	01 No
29	Altimeter RX TX KRA-10A	01 No
30	ADF Receiver KR-85	01 No
31.	Horizontal Situation Indicator HIS-651	01 No
32.	(RMI) ADF Indicator Type KI-225	01 No
33.	RMI Radio Magnetic Indicator	01 No
34.	Radio Altitude Indicator IND-021	01 No
35.	Course Selector Indicator KI-211C	01 No
36.	Cage (screen Room)	01 No
37.	Glide Path receiver	01 No
K.	Battery Charging Shop:	
1.	Battery Discharging unit for each type	01 No
2.	Battery charging plant (series type suitable for charging several batteries at different rates)	01 No
3.	Constant current charger for charging the Ni-cd batteries	03 No
4.	Battery analyzer	01 No
5.	Lead acid battery (Commercial)	02 No each
6.	Lead acid battery (Aircraft battery)	01 No
7.	Ni-cd battery (Aircraft battery serviceable)	01 No
8.	Charger for lead acid battery	01 No
9.	Hydrometer	03 No

Sl. No.	Equipment	Qty.	Price
1.	Ammeter -dynamometer type portable, moving coil, permanent magnet 150 mm uniform scale		
	a. Range 0 - 2.5 - 5 Amp.	2	1200
	b. Range 0 - 50 m A	1	500
	c. Range 0 - 500 mA	2	1000
2.	Ammeter - moving iron type Portable moving iron permanent magnet, 150 mm uniform scale		
	a. Range 0 - 5 Amp.	2	1000
	b. Range 0 - 10/20 Amp.	2	1000
	c. Range 0 - 500 mA/1000 mA	2	1000
3.	Voltmeter dynamometer type portable moving coil permanent magnet 150 mm uniform scale		
	a. Range 0 - 5/10 V	2	1000
	b. Range 0 - 15/30 V	1	1000
	c. Range 0 - 50 mv/100 mv	1	1000
	d. Range 0 - 125/500 V	1	1000
	e. Range 250/500 V		
4.	Digital multimeter 3.5 digit - display D.C. voltage 0 - 1000 V in 5 steps A.C. voltage 0 - 750 V in 5 steps Resistance 0 - 20 M ohm in 6 steps D.C. 0 - 10 A in 6 steps A.C. 0 - 10 A in 6 steps Power supply 9 V.	1	3000
5.	Analog multimeter (Portable) D.C. Voltage 0 0 1000 V AC Voltage 0 2/5/10/25/100/250/1100 V. Resistance 0 200 M ohm DC 0 - 50 micro Amp./1 mA/10 mA/100mA/1A/10A AC 0 - 100 mA/1A/25 A/10A	1	1000
6.	Wattmeter single phase (LPF= 0.2) portable dynamometer type, scale 150 mm current range 0 - 5/10 Amps voltage Range 0 - 250/500 V	2	5000
7.	Decade resistance box constantan coils, single dial 10x10, 10x100, 10x1000, 10x10,000 ohms	1	1000
8.	Continuously variable 0 - 1000 micro farad, 250 V	1	1000
9.	Energymeter single phase induction type, industrial grade 5 A or 10 A, 250 V, 50 Hz.	1	2000

10. Energymeter (Substandard) phase, induction type 5 A/10A, 250 V, 50 Hz.	1		3000single
11. Power factor meter dynamometer type, eddy current damping, 50 Hz, scale length 150 mm range up to 20-amp, voltage range 300 V 10 F. range 0.5 log, unity 0.5 load.	1	5000	
12. Frequency meter (Reed type) 230 V, range for having 21 reeds for 40-60 Hz range.	1	500	
13. Rheostat sliding rheostats wound with evenly oxidized iron free nickel copper on vitreous enameled round steel tube 150 ohms 2 Amps.	1	600	
110 ohms 2.5 Amps.	1	600	
14. Variable inductor single phase, 250 V, 2.5 KVAr continuously variable	1	2000	
15. Cathode ray oscilloscope 10 MHz dual beam oscilloscope vertical defection band width DC-10 MHz (-3db) rise time 30 ms defection coefficient 12 horizontal defection band width 1 MHz (+6db)	1	10,000	
16. Battery charger 12 V silicon bridge rectifier AC input 230 V, DC output suitable for charging 6 V And 12 V batteries provided with MC voltmeter 0 - 20 V and ammeter 0 - 5 A	1	1000	
17. Capacitors 2.5 microfarad, electrolytic type	4	200	
18. Q Meter frequency 0 - 30 MHz Q 0 to 500	1	4000	
19. LCR meter (digital) 3.5 digit display capacitance 0 to 20,000 microfarad inductance 0 to 200 Henry resistance 0 to 20 M ohms	1	8000	

20. LCR/Q bridge capable of measuring resistance, inductance and capacitance of range 8 amps, 0.012 to 10 M ohms, 4 to 10,000 H, 0.5 pico farad to 10 F.		1	5000
21. Kelvin double bridge 10 x 0.1 ohms circular slide wire divided into 200 equal parts			
22. Energy meter 3 phase induction type, 4 wire, industrial grade, 50 Hz, 10 A, 440 Volt		1	5000
24. Energy meter (Substandard) 3 phase, 4 wire, 440 V, 10A, 50 Hz induction type.			
25. Transformer single phase core type, 230/110 V, 1 KVA, 50 Hz.		1	5000
26. Universal shunt 0 - 75 A		1	2000
27. Current transformer 10/25/50/5A as per IS 4201/1967 and 2705/1981		1	2000
28. Potential transformer 10 VA, 415/110 V as per IS 4201/1967 and 2705/1981		1	2000
29. Strain gauge	1	1000	
30. Maxwells bridge		1	1000
31. Wein's bridge		1	1000
32. Schering bridge		1	1000
33. Single Phase AC Watt Hour Meter (Electronic Energy Meter) 240V,50 C/s 10 Amp.,		1	1200
34. 3 Phase Four Wire (3X240V1 between Line to Neutral) AC static Watt Hour Meter (Electronic Energy Meter) 10A		2500	
35. Tri vector Meter		1	5000

Helicopter Lab

Sl. No.	Equipment	Qty.
1.	Mockup of functioning of Swashplates of helicopter systems	1 Set
2.	Helicopter landing light system mock up	1 Set
3.	Mockup of functioning of collective and cyclic mixing unit etc. of helicopter system	1 Set
4.	Helicopter fuel quantity and fuel flow indication principle mockup	1 Set
5.	Helicopter lifting principle mockup	1 Set
6.	Medium landing compass	01
7.	Helicopter main rotor torque neutralizing principle and Turning principle mock ups	1 Set
8.	Helicopter instrument panel mockup	1 Set
9.	Main Rotor blade	02
10.	Tail Rotor Blade	04
11.	Turboshaft engine	01
12.	Swash plate	01

BASIC COMPUTER
COMPUTER CENTRE

Sr. No.	Description	Qty	Total Price (Rs)
1.	Computer System with latest configuration Intel i5 or latest processor , 12th Generation or Latest 8GB RAM or higher SSD-256GB, 1TB HDD 19.5inch Full HD Monitor B/Q Chipset Series Wi-fi Enabled, in built speakers Pre-loaded Windows 11 Pro or Latest	15	10,00,000
2.	Computer Server	1	1,50,000
3.	Printer (MFP)	1	25,000
4.	Printer (Laser)	1	35,000
5.	Antivirus Software	LS	10,000
6.	Internet Facility on Computers	LS	2,00,000
7.	LCD Projector	1	50,000
8.	Sine wave input UPS 5KVA with min. 30 minutes backup	1	1,50,000
9.	Software (latest windows, latest MS Office, Windows Server)	1	2,00,000
10.	Scanner	1	10,000
11.	Network Switch 24 port	1	15,000
12.	Wi-fi Router Dual Band	1	5,000
13.	Air Conditioner 1.5 Ton capacity with stabilizer	4	1,20,000
14.	Miscellaneous	LS	5,000
15.	Room Preparation and furniture	LS	-

LEARNING RESOURCE MATERIALS			
Sr. No.	**Description**	**Qty**	**Total Price (Rs)**
1.	Computer System with latest configuration Intel i7 or latest processor , 12th Generation or Latest 8GB RAM or higher SSD-256GB, 1TB HDD 21.5inch Full HD Monitor B/Q Chipset Series Wi-fi Enabled, in built speakers Pre-loaded Windows 11 Pro or Latest	1	80,000
2.	LCD Projector with Screen	1	60,000
3.	Handicam	1	50,000
4.	Home Theater Support Disc type CD, CDR/CDRW DVDR/DVDRW, VCD, Blue Ray Supported with USB Port Support-DIVX/JPEG/MP3	1	50,000
5.	Commercial P A System 20W-220W output, AC & 24V DC Operated, 5 Mic. & 2 Auxiliary input, Speaker output 4 Ohm, 8 Ohm, 17 V & 100 V	1	40,000
6.	Interactive Touch Panel Board 75 Inch, Dual Input, 10 Point touch Support	1	2,50,000
7.	Miscellaneous	LS	5,000
8.	Room Preparation and furniture	LS	-

* This center will be only one at the institute level irrespective of all branches.

LIST OF LABORATORY EQUIPMENT(Energy Conservation)

Sr. No	Particulars	Qty	Estimated Cost (Rs)
1.	Multimeter	1	17,000
2.	Power Analyzer	1	20,000
3.	Luxmeter	1	5,000
4.	Black Box (for checking lamp efficacy including stand and luxmeter)	1	25,000
5.	Centrifugal pump, 1 kW	1	15,000
6.	Variable Frequency drive	2	50,000
7.	Water Flow meter	1	10,000
8.	Pressure Gauge	1	2,000
9.	Experimental Set up for Valve Throttling vs VFD	1	50,000
10.	Compressor, 20 cfm, single-stage	1	50,000
11.	Air leakage meter	1	18,000
12.	Blower (2 HP)	1	8,000

AVIONICS (REFERENCE BOOKS)

SL.NO	NAME OF BOOK/DVD	AUTHOR/PUB	BOOK/DVD NO.
1.	A COURSE IN CONTROL ENGG.	RAO D. TANDON	318
2.	A T/B OF ELECT. ENGG. MATH.	KK SALHOTRA	195
3.	A T/B OF LABO. COURSE IN ELECT. ENGG.	SG TARANKAR	201
4.	A/C BATTERIES	JEPPESEN	292
5.	A/C ELECT. & ELECTRONICS	B. MCKINLEY	5
6.	A/C ELECT. & ELECTRONICS	B. MCKINLEY	6
7.	A/C ELECT. & ELECTRONICS	B. MCKINLEY	307
8.	A/C ELECT. & ELECTRONICS	EISMIN	481
9.	A/C ELECTRICAL SYSTEM	B.MCKINLEY	147
10.	A/C ELECTRICAL SYSTEM	EHJ PALLETT	373
11.	A/C ELECTRICAL SYSTEM	EHJ PALLETT	9-C
12.	A/C ELECTRICAL SYSTEM	EHJ PALLETT	9-D
13.	AIRCRAFT ELECTRICAL SYSTEMS	E.H.J. PALLETT	727
14.	AIRCRAFT ELECTRICAL SYSTEMS	E.H.J. PALLETT	728
15.	AIRCRAFT ELECTRICAL SYSTEMS	E.H.J. PALLETT	729
16.	A/C IGNITION ELECT. POWER SYSTEM	JEPPESEN	289
17.	A/C INSTRUMENTS	EHJ PALLETT	125
18.	AIRCRAFT INSTRUMENTS	E.H.J.PALLETT	747
19.	AIRCRAFT INSTRUMENTS	E.H.J.PALLETT	748
20.	AIRCRAFT INSTRUMENTS	E.H.J.PALLETT	749
21.	AIRCRAFT INSTRUMENTS	E.H.J.PALLETT	750
22.	AIRCRAFT INSTRUMENTS	E.H.J.PALLETT	751
23.	AIRCRAFT INSTRUMENTS	WILLIAM	11-C
24.	AIRCRAFT INSTRUMENTS	WILLIAM	11-E
25.	AIRCRAFT INSTRUMENTS	WILLIAM	11-F
26.	AIRCRAFT INSTRUMENTS	SLOLEY	15-B
27.	AIRCRAFT INSTRUMENTS	SLOLEY	15-C
28.	AIRCRAFT INSTRUMENTS	SLOLEY	15-D
29.	AIRCRAFT INSTRUMENTS & AVIONICS	MAX F HENDERSON	452
30.	AIRCRAFT INSTRUMENTS & AVIONICS	MAX F HENDERSON	539
31.	A/C RADIO SYSTEMS	JAMES POWELL	8-A
32.	A/C RADIO SYSTEMS	JAMES POWELL	8-B
33.	A/C RADIO SYSTEMS	JAMES POWELL	8-C
34.	A/C RADIO SYSTEMS	JAMES POWELL	609
35.	A/C RADIO SYSTEMS	JAMES POWELL	610

36.	A/C RADIO SYSTEMS	JAMES POWELL	611
37.	ADVANCED ELECT. TECHNOLOGY	H. COTTON	322
38.	AME AVIO. COMPASS COMPEN.7 B.	ATC	275
39.	AME AVIO. SERVO MECHANISMS.6. B.	ATC	269
40.	AME AVIO. A/P SYSTEMS PRINCIPLES	ATC	286
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78.	ELECTRICAL ENGINEERING	B.L.THEREJA	694
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80.	ELECTRICAL ENGINEERING	B.L.THEREJA	696
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83.	ELECTRONICS FUND. & APPLICATION	D. CHATTOPADHYAY	559
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100.	INTRODUCTION TO WORD STAR	NARIMAN	335
101.	LEARING C+++	ERIC NEGLER	516
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125.	WORLD TRANS. VOL.-1	BPB PUB.	473
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139.	AME AVIONICS GYROSCOPE	ATC	270
140.	AIRCRAFT COMMUNICATION & NAVIGATION SYSTEM : PRINCIPLES, MAINTENANCE & OPERATION	WYATT	800
141.	AIRCRAFT ENGINEERS HANDBOOK NO. 4 INSTRUMENT	R.W. SLOLEY & W.H. COULTHARD	819
142.	AIRCRAFT ENGINEERS HANDBOOK NO. 4 INSTRUMENT	R.W. SLOLEY & W.H. COULTHARD	820
143.	AIRCRAFT ENGINEERS HANDBOOK NO. 4 INSTRUMENT	R.W. SLOLEY & W.H. COULTHARD	821
144.	AIRCRAFT INSTRUMENTS	C.A. WILLIAMS	824
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147.	AVIATION ELECTRONICS	KEITH W. BOSE	833
148.	AVIATION ELECTRONICS	KEITH W. BOSE	834
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156.	ELECTRONIC COMMUNICATION SYSTEM 5/ED	GEORGE KENNEDY	859
157.	ELECTRONIC COMMUNICATION SYSTEM 5/ED	GEORGE KENNEDY	860
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160B.	INTEGRATED ELECTRONICS ANALOG & DIGITAL CIRCUIT & SYSTEM	MILLMAN & HALKIAS	870
161.	MANUAL OF AVIONICS	BRIAN KENDA	888
162.	MANUAL OF AVIONICS	BRIAN KENDA	889
163.	C# 2008 & 2005 THREADED PROGRAMMING BEGINNER`S GUIDE	HILLAR	849
164.	C# 3.0 COOK BOOK	HILYARD	850

165.	CICS HOW TO FOR COBOL PROGRAMMING & OPERATIONS	KIRK	853
166.	COMPLETE CL DEFINITIVE CONTROL LANGUAGE PROGRAMMING GUIDE	HOLT	855
167.	COMPUTER SYSTEM & DATA ANALYSIS	D K BASU	856
168.	DB2 9 FOR LINUX, UNIX & WINDOWS DATABASE ADMINISTRATION CERTIFICATION STUDY GUIDE	SANDERS	857
169.	INTRODUCTION TO COMPUTERS	N. PETER	871
170.	PRACTICAL UNIX & INTERNAL SECURITY	GARFINKEL	879
171.	TCP/IP COMPANION – A GUIDE FOR THE COMMON USER	ARICK	883
172.	DATABASE IN DEPTH: THE RELATIONAL MODEL FOR PRACTITIONERS	C.J. DATE	886
173.	OPERATING SYSTEMS	SUMITRADEVI	890
174.	PRACTICAL C++ PROGRAMMING	OUALINE	891
175.	PRINCIPLES OF COMPUTER INTEGRATED MANUFACTURING	S K VAJPAYEE	892
176.	COMPUTER FUNDAMENTALS & INFORMATION TECHNOLOGY	RAMESH BANGIA	893

STUDENT ACTIVITIES ON ENERGY CONSERVATION/ENERGY EFFICIENCY

1. Presentations of Case Studies
2. Debate competitions
3. Poster competitions
4. Industrial visits
5. Visual Aids

COURSE OUTCOMES

After studying this course, a student will be able to co-relate and apply fundamental key concepts of energy conservation and energy management in industry, commercial and residential areas. A student will be able to:

Define principles and objectives of energy management and energy audit.
Understand Energy Conservation Act 2001 and its features.
Understand various forms & elements of energy.
Identify electrical and thermal utilities. Understand their basic principle of operation and assess performance of various equipments.
Identify areas of energy conservation and adopt conservation methods in various systems.
Evaluate the techno economic feasibility of the energy conservation technique adopted.

INSTRUCTIONAL STRATEGY

Teachers are expected to lay considerable stress on understanding the basic concepts in energy conservation, principles and their applications. For this purpose, teachers are expected to give simple problems in the class room so as to develop necessary knowledge for comprehending the basic concepts and principles. As far as possible, the teaching of the subject must be supplemented by demonstrations and practical work in the laboratory. Visits to industries must be carried out. Expert from industry must be invited to deliver talks on energy conservation to students and faculty.

REFERENCE BOOKS

- Guide book on General Aspects of Energy Management and Energy Audit by Bureau of Energy Efficiency, Government of India. Edition 2015
- Guide book on Energy Efficiency in Electrical Utilities, by Bureau of Energy Efficiency, Government of India. Edition 2015
- Guide book on Energy Efficiency in Thermal Utilities, by Bureau of Energy Efficiency, Government of India. Edition 2015
- Handbook on Energy Audit & Environmental Management by Y P Abbi & Shashank Jain published by TERI. Latest Edition

Important Links:

- Bureau of Energy Efficiency (BEE), Ministry of Power, Government of India.www.beeindia.gov.in.
- Ministry of New and Renewable Energy (MNRE), Government of India.www.mnre.gov.in.
- Uttar Pradesh New and Renewable Energy Agency (UPNEDA), Government of Uttar Pradesh.www.upneda.org.in.
- Central Pollution Control Board (CPCB), Ministry of Environment, Forest and Climate Change, Government of India. www.cpcb.nic.in.
- Energy Efficiency Services Limited (EESL). www.eeslindia.org.
- Electrical India, Magazine on power and electrical products industry. www.electricalindia.in.

10. **EVALUATION STRATEGY**

10.1 INTRODUCTION

Evaluation plays an important role in the teaching-learning process. The major objective of any teaching-learningendeavor is to ensure the quality of the product which can be accessed through learner's evaluation.

The purpose of student evaluation is to determine the extent to which the general and the specific objectives of curriculum have been achieved. Student evaluation is also important from the point of view of ascertaining the quality of instructional processes and to get feedback for curriculum improvement. It helps the teachers in determining the level of appropriateness of teaching experiences provided to learners to meet their individual and professional needs. Evaluation also helps in diagnosing learning difficulties of the students. Evaluation is of two types: Formative and Summative (Internal and External Evaluation)

Formative Evaluation

It is an on-going evaluation process. Its purpose is to provide continuous and comprehensive feedback to students and teachers concerning teaching-learning process. It provides correctivesteps to be taken to account for curricular as well as co-curricular aspects.

Summative Evaluation

It is carried out at the end of a unit of instruction like topic, subject, semester or year. The main purpose of summative evaluation is to measure achievement for assigning course grades, certification of students and ascertaining accountability of instructional process. The student evaluation has to be done in a comprehensive and systematic manner since any mistake or lacuna is likely to affect the future of students.

In the present educational scenario in India, where summative evaluation plays an important role in educational process, there is a need to improve the standard of summative evaluation with a view to bring validity and reliability in the end-term examination system for achieving objectivity and efficiency in evaluation.

10.2 STUDENTS' EVALUATION AREAS

The student evaluation is carried out for the following areas:

Theory
Practical Work (Laboratory, Workshop, Field Exercises)
Project Work
Professional Industrial Training

A. Theory

Evaluation in theory aims at assessing students' understanding of concepts, principles and procedures related to a course/subject, and their ability to apply learnt principles and solve problems. The formative evaluation for theory subjects may be caused through sessional /class-tests, home-assignments, tutorial-work, seminars, and group discussions etc. For end-term evaluation of theory, the question paper may comprise of three sections.

Section-I

It should contain objective type items e.g. multiple choice, matching and completion type. Total weightage to Section-1 should be of the order of 20 percent of the total marks and no choice should be given in this section. The objective type items should be used to evaluate students' performance in knowledge, comprehension and at the most application domains only.

Section-II

It should contain short answer/completion items. The weightage to this section should be of the order of 40 percent of the total marks. Again, no choice should be given in section-II

Section-III

It may contain two to three essay type questions. Total weightage to this section should be of the order of 40 percent of the total marks. Some built-in, internal choice of about 50 percent of the questions set, can be given in this section

Table II : Suggested Weightage to be given to different ability levels

Abilities	Weightage to be assigned
Knowledge	10-30 percent
Comprehension	40-60 percent
Application	20-30 percent
Higher than application i.e. Analysis, Synthesis and Evaluation	Upto 10 percent

B. Practical Work

Evaluation of students performance in practical work (Laboratory experiments, Workshop practicals/field exercises) aims at assessing students ability to apply or practice learnt concepts, principles and procedures, manipulative skills, ability to observe and record, ability to interpret and draw conclusions and work related attitudes. Formative and summative evaluation may comprise of weightages to performance on task, quality of product, general behaviour and it should be followed by viva-voce.

C. Project Work

The purpose of evaluation of project work is to assess students ability to apply, in an integrated manner, learnt knowledge and skills in solving real life problems, manipulative skills, ability to observe, record, creativity and communication skills. The formative and summative evaluation may comprise of weightage to nature of project, quality of product, quality of report and quality of presentation followed by viva-voce.

D. Professional Industrial Training

Evaluation of professional industrial training report and viva-voce/ presentation aims at assessing students' understanding of materials, industrial processes, practices in the industry/field and their ability to engage in activities related to problem-solving in industrial setting as well as understanding of application of learnt knowledge and skills in real life situation. The formative

and summative evaluation may comprise of weightages to performance in testing, general behaviour, quality of report and presentation during viva-voce.

10.3 ASPECTS OF QUESTION PAPER SETTING

Validity and reliability are the most important considerations in the selection and construction of evaluation procedures. First and foremost are the evaluation tools to measure the specific outcomes for which they are intended to measure. Next in importance is reliability, and followingthat is a host of practical features that can be classified under the heading of usability.

For weightage of marks assigned to formative (internal) and summative (external) evaluation and duration of evaluation has been given in the study and evaluation scheme of the curriculum document. Teachers/Paper-setters/Examiners may use Manual for Students' Evaluation developed by IRDT U.P. Kanpur to bring objectivity in the evaluation system. The working group found it very difficult to detail out precisely the contents of subject on languages and therefore teachers may send guidelines to respective examiners for paper setting to maintain objectivity in evaluation.

11. RECOMMENDATIONS FOR EFFECTIVE CURRICULUM IMPLEMENTATION

This curriculum document is a Plan of Action (POA) and has been prepared based on exhaustive exercise of curriculum planning and design. The representative sample comprising selected senior personnel (lecturers and HODs) from various institutions and experts from industry/field have been involved in curriculum design process.

The document so prepared is now ready for its implementation. It is the faculty of polytechnics who have to play a vital role in planning instructional experiences for the courses in four different environments viz. class-room, laboratory, library and field and execute them in right perspective. It is emphasized that a proper mix of different teaching methods in all these places of instruction only can bring the changes in stipulated students behaviour as in the curriculum document. It is important for the teachers to understand curriculum document holistically and further be aware of intricacies of teaching-learning process (T-L) for achieving curriculum objectives. Given below are certain suggestions which may help the teachers in planning and designing learning experiences effectively. These are indicative in nature and teachers using their creativity can further develop/refine them. The designers of the programme suggest every course teacher to readthem carefully, comprehend and start using them.

(A) Broad Suggestions:

1. Curriculum implementation takes place at programme, course and class-room level respectively and synchronization among them is required for its success. The first step towards achieving synchronization is to read curriculum document holistically and understand its rationale and philosophy.

2. State Board of Technical Education (BTE) may make the academic plan available to all polytechnics well in advance. The Principals have a great role to play in its dissemination and, percolation upto grass-root level. Polytechnics in turn are supposed to prepare institutional academic plan by referring state level BTE plan.

3. HOD of every Programme Department along with HODs and in charges of other departments viz. English, Maths, Physics, Chemistry etc. are required to prepare academic plan at department level referring institutional academic plan.

4. All lecturers/Senior lecturers are required to prepare course level and class level lesson plans referring departmental academic plan.

(B) Course Level Suggestions

Teachers are educational managers at class room level and their success in achievingcourse level objectives lies in using course plan and their judicious execution which is very important for the success of programme by achieving its objectives.

Polytechnic teachers are required to plan various instructional experiences viz. theory lecture, expert lectures, lab/workshop practicals, guided library exercises, field visits, study tours, camps etc. In addition, they have to carry out progressive assessment of theory, assignments,

library, practicals and field experiences. Teachers are also required to do all these activities within a stipulated period of 16 weeks which is made available to them in the academic plan at BTE level. With the amount of time to their credit, it is essential for them to use it judiciously by planning all above activities properly and ensure execution of the plan effectively.

Following is the gist of suggestions for subject teachers to carry out T-L process effectively:

1. Teachers are required to prepare a course plan, taking into account departmental academic plan, number of weeks available, course to be taught, different learning experiences required to be developed etc.

2. Teachers are required to prepare lesson plan for every theory class. This plan may comprise of content to be covered, learning material (transparencies, VCDs, Models etc.) for execution of a lesson plan. They may follow steps for preparing lesson plan e.g. drawing attention, state instructional objectives, help in recalling pre-requisite knowledge, deliver planned subject content, check desired learning outcome and reinforce learning etc.

3. Teachers are required to plan for expert lectures from field/industry. Necessary steps are to plan in advance, identify field experts, make correspondence to invite them, take necessary budgetary approval etc.

4. Teachers are required to plan for guided library exercises by identification of course specific experience requirement, setting time, assessment, etc. The tutorial, assignment and seminar can be thought of as terminal outcome of library experiences.

5. Concept and content-based field visits with appropriate releases (day-block) may be planned and executed for such content of course which otherwise is abstract in nature and no otherrequisite resources are readily available in institute to impart them effectively.

6. There is a dire need for planning practical experiences in right perspective. These slots in a course are the avenues to use problem-based learning/activity learning/ experiential learning approach effectively. The development of lab instruction sheets for the course is a good beginning to provide lab experiences effectively.

7. Planning of progressive assessment encompasses periodical assessment in semester, preparation of proper quality question paper, assessment of answer sheets immediately and giving constructive explicit feedback to every student. It has to be planned properly; otherwise very purpose of the same is lost.

8. The co-curricular activities like camp, social gathering, study tour, hobby club etc. may be used to develop generic skills like task management, problem solving, managing self, collaborating with others etc.

9. Where ever possible, it is essential to use activity based learning rather than relyingon delivery based conventional teaching all the time.

10. While imparting instructions, emphasis may be laid on the development of cognitive, psychomotor, reactive and interactive skills in the students.

11. Teachers may take working drawings from the industry/field and provide practices in reading these drawings.

12. Considerable emphasis should be laid in discipline specific contracting and repair and maintenance of machines, tools and installations.

13. Teachers may take initiative in establishing liaison with industries and field organizations for imparting field experiences to their students.

14. Case studies and assignments may be given to students for understanding of Enterprise Resource Management (ERM).

15. Students be made aware about issues related to ecology and environment, safety, concern for wastage of energy and other resources etc.

16. Students may be given relevant and well thought out minor and major project assignments, which are purposeful and develop practical skills. This will help students in developing creativity and confidence for their gainful employment (wage and self).

17. A Project bank may be developed by the concerned department of the polytechnics in consultation with related Industry, Research Institutes and other relevant field organizations in the state.

List of Participants:

The following experts have participated in workshop for Developing the Curricula Structure and Contents of Three-year Diploma Programme in Aircraft Maintenance Engineering(Helicopter & Power Plant) for UP State ,workshop held on 05th August 2022, 30th December 2022, 02nd and 03rd June 2023 at Aeronautical Training Institute, Lucknow:

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