

**NSQF ALIGNED CURRICULUM FOR
THREE YEAR (Six Semester) DIPLOMA COURSE IN
AIRCRAFT MAINTENANCE ENGINEERING (AVIONICS)**

For the State of Uttar Pradesh

Effective from Session 2022-23



Prepared by:

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Kanpur-208002

**CORRECTED AND APPROVED BY BOARD OF TECHNICAL EDUCATION U.P., LUCKNOW IN
CDC MEETING HELD ON 11.08.2023**

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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.
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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(AVIONICS)**

- 1) Name of the Programme : Diploma Programme in Aircraft Maintenance Engineering(Avionics)
- 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 IN AIRCRAFT MAINTENANCE ENGINEERING(Avionics)**

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(AVIONICS)

Sr. No.	Learning Outcomes
After due completion of the course, a Diploma Programme in Aircraft Maintenance Engineering(Avionics) 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 (AME Avionics)
14. Aviation legislation-II
15. Airframe & Systems
16. General Aero Engine
17. Aircraft Electrical System-I
18. Aircraft Electronics System
19. Theory of Flight
20. Aircraft Instrumentation-I
21. Auto Flight & Servo Mechanism
22. Aircraft Communication System
23. Computer Theory
24. Aircraft Electrical System-II
25. Aircraft Instrumentation-II
26. Propulsion
27. Aircraft Radio Navigation System
28. Avionics System of Bonanza A-35

e) Industrial Training /Project

29. Project Work
30. Industrial Training

5-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 (AME Avionics)	-	8	-	-	-	-
11.	Aviation legislation-II	-	8	-	-	-	-
12.	Airframe & Systems	-	-	14	-	-	-
13.	General Aero Engine	-	-	10	-	-	-
14.	Aircraft Electrical System-I	-	-	12	-	-	-
15.	Aircraft Electronics System	-	-	11	-	-	-
16.	Theory of Flight	-	-	-	10	-	-
17.	Aircraft Instrumentation-I	-	-	-	10	-	-
18.	Auto Flight & Servo Mechanism	-	-	-	11	-	-
19.	Aircraft Communication System	-	-	-	10	-	-
20.	*Energy Conservation	-	-	-	5	-	-
21.	Computer Theory	-	-	-	-	13	-
22.	Aircraft Electrical System-II	-	-	-	-	15	-
23.	Aircraft Instrumentation-II	-	-	-	-	15	-
24.	*Universal Human Values	-	-	-	-	3	-
25.	*Environmental Studies	-	-	-	-	-	5
26.	Propulsion	-	-	-	-	-	4
27.	Aircraft Radio Navigation System	-	-	-	-	-	15
28.	Avionics System of Bonanza A-35	-	-	-	-	-	13
29.	Project	-	-	-	-	-	6
30.	Industrial Training	-	-	-	-	-	-
31.	Student Centered Activities	2	4	1	2	2	2
	Total	48	44	48	48	48	45

CORRECTED AND APPROVED BY BOARD OF TECHNICAL EDUCATION U.P., LUCKNOW IN
CDC MEETING HELD ON 11.08.2023

**STUDY AND EVALUATION SCHEME FOR
THREE YEAR(SIX SEMESTER) DIPLOMA COURSE IN AIRCRAFT MAINTENANCE ENGINEERING(AVIONICS)**

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	Air Craft 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 be of 5 marks each.

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**STUDY AND EVALUATION SCHEME FOR
THREE YEAR(SIX SEMESTER) DIPLOMA COURSE IN AIRCRAFT MAINTENANCE ENGINEERING(AVIONICS)**

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	Tot	Th	Hrs	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 (AME Avionics)	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.
- (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 be of 5 marks each.

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**STUDY AND EVALUATION SCHEME FOR
THREE YEAR(SIX SEMESTER) DIPLOMA COURSE IN AIRCRAFT MAINTENANCE ENGINEERING(AVIONICS)**

III Semester

Sr. No.	SUBJECTS	STUDYS CHEME Periods/Week			Credits	MARKSINEVALUATIONScheme									Total Marks of Internal & External
		L	T	P		INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT						
						Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot		
3.1	Airframe & Systems	7	2	5	8	20	50	70	50	2 ½	100	3	150	220	
3.2	General Aero Engine	4	-	6	6	20	25	45	50	2 ½	50	3	100	145	
3.3	Aircraft Electrical System-I	5	-	7	6	20	25	45	50	2 ½	50	3	100	145	
3.4	Aircraft Electronics System	6	1	4	7	20	25	45	50	2 ½	50	3	100	145	
#Student Centred Activities		-	-	1	1	-	30	30	-	-	-	-	-	30	
Total		22	3	23	28	80	155	235	200	-	250	-	450	685	

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 be of 5 marks each

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**STUDY AND EVALUATION SCHEME FOR
THREE YEAR(SIX SEMESTER) DIPLOMA COURSE IN AIRCRAFT MAINTENANCE ENGINEERING(AVIONICS)
(To Be Effective From 2022-23)**

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 Instrumentation-I	6	1	3	7	20	25	45	50	2 ½	50	3	100	145	
4.3	Auto Flight & Servo Mechanism	6	2	3	7	20	25	45	50	2 ½	50	3	100	145	
4.4	Aircraft Communication System	5	2	3	6	20	25	45	50	2 ½	50	3	100	145	
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		27	8	13	32	100	135	235	250		200	-	450	685	

*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 be of 5 marks each.

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**STUDY AND EVALUATION SCHEME FOR
THREE YEAR (SIX SEMESTER) DIPLOMA COURSE IN AIR CRAFT MAINTENANCE ENGINEERING (AVIONICS)**

V Semester

Sr. No.	SUBJECTS	STUDYS CHEME			Credits	MARKSINEVALUATIONScheme								Total Marks of Internal & External
		Periods/Week				INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
5.1	Computer Theory	7	-	6	8	20	30	50	50	2 ½	60	3	110	160
5.2	Aircraft Electrical System-II	7	-	8	7	20	30	50	50	2 ½	60	3	110	160
5.3	Aircraft Instrumentation-II	7	-	8	7	20	30	50	50	2 ½	60	3	110	160
5.4	*Universal Human Values	2	-	1	1	-	20	20	-	-	30	3	30	50
#Student Centred Activities		-	-	2	1	-	30	30	-	-	-	-	-	30
Total		23	-	25	24	60	140	200	150		210	-	360	560

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 be of 5 marks each.

**STUDY AND EVALUATION SCHEME FOR
THREE YEAR (SIX SEMESTER) DIPLOMA COURSE IN AIR CRAFT MAINTENANCE ENGINEERING (AVIONICS)**

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	2½	20	3	70	100	
6.2	Propulsion	4	-	-	3	20	-	20	50	2½	-	-	50	70	
6.3	Aircraft Radio Navigation System	7	-	8	8	20	50	70	50	2½	100	2.5	150	220	
6.4	Avionics System of Bonanza A-35	3	-	10	6	20	50	70	50	2½	100	2.5	150	220	
6.5	Project	-	-	6	4	-	50	50	-	-	100	-	100	150	
6.6	Industrial Training	-	-	-	1	-	20	20	-	-	40	-	40	60	
#StudentCentredActivities		-	-	2	1		30	30	-	-	-	-	-	30	
Total		17	-	28	26	80	210	290	200		360	-	560	850	

*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 be of 5 marks each.

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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.

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(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 Cartesian 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.

INSTRUCTIONAL 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

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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 (C_p & C_v) 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, Charles'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. THERMODYNAMICS :

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 SATELLITES - ESCAPE VELOCITY :

- (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-stationary 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 Bhattacharya & Poonam Tandan; Oxford University Press, New Delhi

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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:-

<https://nptel.ac.in/>

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

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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-Differentiate 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

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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

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- Aircraft material & process by Titterson
- 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

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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 an 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.

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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

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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 Organisation; 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 Organisations

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

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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

SUGGESTED DISTRIBUTION 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.

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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 filing technique and methods.
5. Exercise 3 to be filed approximate size to side 2".
6. Filing the above exercise top surface to flat.
7. Filing the sides of above job to make right angle.

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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. Familiarisation 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 sharpening
4. Practice in Grinding and Sharpening of various types of Chisels.
5. Practice of planing.
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

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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. Factors Affecting Performance

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- 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-

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- 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

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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 Scalars 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, Hookes law, different types of elasticity, Poisson ratio, Relation between moduli. Determination of Young's modulus, for a material, numerical.

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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 Reynolds 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 Khurmi
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

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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-Understand basic electrical terminology and their concepts
- 2-Understand electrostatic laws of attraction and repulsion of charge, coulomb's law, Ohm's law
- 3-Understand the Kirchoff'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-Understand 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 Kirchoff's laws.
- 2.2 Simple numerical problems based on Kirchoff's laws.

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- 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

4.2 Energy stored in a capacitor, dielectric and its influence on capacitance of a capacitor, dielectric constant dielectric breakdown and dielectric strength. Dielectric loss.

4.3 Series and parallel combination of capacitors.

4.4 Variable capacitors.

4.5 Charging and discharging of capacitors.

4.6 Simple problems on capacitors.

5. Electromagnetism

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.

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7.3 Average and RMS value of alternating voltage and current. Importance of RMS value. Simple problems.

7.4 Concept of phase, phase difference and phasor representation of alternating voltage and current.

7.5 A.C. through pure resistance, inductance, capacitance, phasor diagram and power absorbed.

7.6 R-L series circuit, idea of impedance and calculations.

7.7 Apparent power, reactive power and active power, power factor, its importance and simple problems.

7.8 R-C series circuit, simple problems.

7.9 R-L-C series circuit, simple problems.

7.10 Solution of simple parallel A-C circuits by

(a) Phasor diagram method,

(b) Admittance method.

7.11 Solution of AC circuits series/ parallel by j method. (simple problems).

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

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 poly phase 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 100W filament 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.

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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

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2.4 GENERAL ENGINEERING AND GROUND SUPPORT **(AME Avionics)**

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 fits & 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. Aircraft Weight and Balance

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

3 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;

4. 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.

5 Abnormal Events

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

6. Maintenance Procedures

Maintenance planning;
Modification procedures;
Certification/release procedures;

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LIST OF PRACTICALS

1. Familiarization with preparation of aircraft for weighing
2. Familiarization with aircraft towing.
3. Familiarization with jacking of aircraft.
4. Familiarization with dye penetrant method.
5. Familiarization with magnetic particle inspections.
6. Familiarization with Eddy current inspections.
- 7.. Familiarization with inspection followed by heavy landing

INSTRUCTIONAL STRATEGY

- More focus should be given on practical.

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

- AMT General Handbook AC-65-9A
- CAIP 459 Part-I, CAIP 459 Part-II
- Airframe & powerplant Mechanics AC65-15A
- EASA notes for Module 6& 7

Websites for Reference:

dgca.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	10	12
2.	14	16
3.	14	20
4.	18	20
5.	14	16
6.	14	16
Total	84	100

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2.5 Aviation 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

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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

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III Semester
3.1 Airframe & Systems

L	T	P
7	2	5

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 fundamental of aircraft structure
2. Describe the fundamentals of aircraft hydraulic system
3. Explain the fundamentals of aircraft pneumatic system
4. Brief about fundamentals of fire protection system
5. Explain fundamentals of aircraft fuel system

DETAILED CONTENTS

1. General Structural Concepts

- Airworthiness requirements for structural strength & classification as primary, secondary and tertiary and structural strength.
- Fail safe, safe life and damage tolerances.
- Zonal and stations identification system.
- Stress, strain, bending, compression, shear, torsion, tension and fatigue concepts.
- General construction, composite construction, metal construction, monocoque, semi monocoque and stressed skin construction.
- Steel tubular structure, light metal construction, fabric, plywood and metal coverage.
- Construction methods of stressed skin fuselage, formers, stringers, longerons, bulkheads, frames, doublers struts, ties, beams, floor structure, reinforcements, method of coverage fuselage and wing etc., anti-corrosive, treatment.
- Structure assembly methods riveting, bolting and bonding.
- Methods of surface clearing and protection.
- Airframe symmetry, method of alignment and symmetry checks.
- Under carriage types, fixed and retractable, tyres, shock absorb and brake systems.
- Fabrics, surface tapes, reinforcing tape lacing cord, stringing cord, dope and doping procedures.
- Doors construction, mechanism, operation and safety devices, seeking and pressurization construction & pressurization sealing wing, stabilizer, pylon & undercarriage attachment.
- Windows and windscreen construction.
- Cockpit, instruments panel construction.
- Seat installation and safety.
- Fuel storage system.
- Firewall, engine mounts.

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- Drains and ventilation provisions.
- Lightning strike and protections.
- Aircraft Bonding
- Knowledge of general terms such as damage, tolerances, aging of aircraft and SSID etc.
- Flight control, surface construction and balancing etc.

2. **Hydraulic System**

- System layout, fundamental of hydraulic systems and terminology, advantages and disadvantages of hydraulic system.
- Hydraulic fluids.
- Hydraulic rubber seals and packing washers.
- Hydraulic system component : Reservoir, hand pumps, power driven pumps, filters, pressure regulator valve, accumulator, selector valves, pressure relief valves, actuating cylinders, check valves, orifice check valve, restrictor valves, hydraulic fuse, fine disconnect or quick disconnect valve, Emergency pressure generation
- Flexible hydraulic hoses.
- Inspection and pressure testing.
- Indication & warning system

3. **Landing Gear System**

- Construction, shock absorbing.
- Extension & retraction system normal & emergency
- Indication & warning
- Anti-skid system & auto braking.

4. **Pneumatic System**

- Introduction, System Layout advantages and disadvantages of pneumatic system.
- High pressure, medium pressure and low pressure system.
- Pneumatic system components, engine driven compressor, relief valves, control valve, filters, oil separators, air bottle, pressure reducing valves, check valves, restrictors.
- Indication & warning system

5. **De-icing And Anti-icing System**

- Ice prevention: Heating, surfaces using hot air heating by electrical system, breaking of ice formation and alcohol spraying.
- Pneumatic de-icing systems & maintenance.
- Thermal anti-icing control systems.
- Wind shield icing control systems.
- Servicing and maintenance of de-icing system.

6. **Aircraft Environment System**
 - Outflow valves and safety valves.
 - Instruments allied to pressurization systems.
 - Gas vapour cycle air-conditioning system
 - Air cycle air-conditioning system
7. **Aircraft Oxygen Systems**
 - Introduction, systems layout cockpit, cabin sources supply regulation.
 - Charging and purging of oxygen system, oxygen system servicing.
 - General precautions for oxygen system, Indications & warning.
8. **Fuel Systems**
 - System layout, fuel tanks, supply systems, dumping, venting and draining.
 - Cross feed and transfer, indications and warnings, refuelling and defueling, longitudinal balance of fuel system.
9. **Fire Protection System**
 - Fire and smoke detection and warning system.
 - Fire extinguishing system.
 - Systems tests

Airframe & Systems practical

1. Familiarization and inspection of, Wing and fuselage construction, including primary and secondary structures. Forged, extruded, cast and sheet materials used
2. Familiarization and inspection of Main joints: methods of riveting, spot welding, and adhesive bonding.
3. Familiarization and inspection of Doors and cut-outs, positions of inspection panels, removal of fairings, and methods of gaining access to all parts of structure.
5. Familiarization and inspection of interconnections of autopilot to control systems; examination (by visiting airline, if necessary) of power-operated control systems.
6. Preflight inspection of aircraft, starting and running of engine; observation of instrument reading; functional check of electrical components ,stopping of engines
7. Use of grounding equipment for moving lifting or servicing aircraft
8. Familiarization with Identification and operation of hydraulic system trainer.
9. Familiarization with Identification and operation of pneumatic system trainer.
10. Familiarization with Identification and operation of landing gear system.
11. Familiarization with Identification and operation of de-icing and anti-icing system.
12. Familiarization with Identification and operation of Pressurization system.
13. Familiarization with aircraft air-conditioning system
14. Familiarization with Identification and operation of Aircraft oxygen systems.
15. Familiarization with Identification and operation of Fuel systems:
16. Familiarization with Identification and operation of Fire protection:

INSTRUCTIONAL STRATEGY

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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

AMT-A/F H/B -15A(FAA)
 AMR by Kores & McKinley
 CAIP-459 (Part-II)
 AMT-Structure & System by Dale Crane
 EASA-Module-13

Websites for Reference:

- 1 www.amequestionpaper.in
- 2 amefield.com
- 3 www.faa.gov

SUGGESTED DISTRIBUTION OF MARKS

SR NO.	Topics	Time Allotted (T) (Periods)	Marks Allotted (%)
1.	Topics No.1	20	15
2	Topics No.2	12	15
3	Topics No.3	11	10
4	Topics No. 4	9	10
5	Topics No.5	9	10
6	Topics No.6	9	10
7	Topics No.7	6	10
8	Topics No.8	6	10
9	Topics No.9	6	10
	Total	98	100

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3.2 GENERAL AERO ENGINE

L	T	P
4	-	6

RATIONALE: Engine is the source of propulsive force for aircraft and its knowledge, principle of working is must for aircraft maintenance engineer to troubleshoot its working problems.

LEARNING OUTCOMES

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

1. Explain the Fundamental thermodynamics cycle of IC engines
2. Explain the internal and external combustion heat engines
3. Describe the various efficiencies involve in internal combustion Engine
4. Explain jet engines, efficiencies and types of engines

DETAILED CONTENTS

1. FUNDAMENTALS

- 1A Potential energy, kinetic energy, Newton's laws of motion Brayton cycle
- 1B The relationship between force, work, power, energy, velocity, acceleration.
- 1C General knowledge of different thermodynamics Laws, Process, pressure, volume diagram, gas equation and work done during the process.
- 1D General knowledge of thermo-dynamic laws related to internal combustion engines.

- 1E Knowledge of internal and external combustion heat engines.
- 1F General knowledge of otto cycle and the relationship between volume, temperature and pressure.
- 1G A general knowledge of terms used in theory of piston engine such as piston displacement and compression ratio, calculation of parameters from given data.
- 1H Knowledge of various efficiencies involved in internal combustion engines. (Mechanical, thermal and volumetric)

- 1I Operating principle and difference between two stroke & four stroke engines, Otto and diesel engine merits and demerits.
- 1J Introduction, Principle & performances: Introduction to jet engine, working cycle, comparison between PE and JE. Engine performance, thrust calculation, gross thrust, net thrust, choked nozzle, thrust distribution, thrust horse power, ESHP, specific fuel consumption, factors effecting engine performance.
- 1K Constructional arrangement and operation of turbojet turbofan, turbo shaft, turboprop.

2. ENGINE PERFORMANCE

- 2A Knowledge of various factors, affecting the engine performance.
- 2B Classification of I.C. engines, on the basis of cylinder arrangement, cooling systems & no. of strokes per cycle.
- 2C. Identification & designation of reciprocating engines.
- 2D Power calculation and measurement, factors affecting engine power, mixture/leaning, preignition.

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- 2E Gross thrust, net thrust, choked nozzle thrust, thrust distribution
- 2F Resultant thrust, thrust horsepower, equivalent shaft horsepower, specific fuel consumption.
- 2G. Engine efficiencies

- 2H By-pass ratio and engine pressure ratio.
- 2I Engine ratings, static thrust, influence of speed, altitude and hot climate, flat rating, limitations.

GENERAL AERO ENGINE PRACTICAL

- 1. Identification of various engine parts.
- 2. Familiarization with the valve operating mechanism.
- 3. Familiarization with working principle of four stroke engine.
- 4. Inspection and assembly of intake & exhaust valve
- 5. Familiarization with Rigging and propeller control, Compressor washing procedure.
- 6. Familiarization with internal inspection by endoscope/borescope.
- 7. Familiarization with inspection of accessories gear system.
- 8. Familiarization with constructional arrangement of turbojet / turbofan / turbo shaft / turboprop,
- 9. Familiarization with various inlet configurations; engine inlet, Axial and centrifugal types of compressor).
- 10. Engine indicating system, Engine monitoring and ground operation.

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 A&P Powerplant
 Aviation Maintenance Technician Handbook 12 A-FAA
 Aircraft Gas Turbine Engine -Irwin R Traeger
 Aircraft Gas Turbine Powerplant-Otis

Websites for Reference:

Amemyworld.blogspot.com
 www.newworldencyclopedia.org

SUGGESTED DISTRIBUTION OF MARKS

SR NO.	Topics	Time Allotted (T) (Periods)	Marks Allotted (%)
1.	Topics No.1A,1B & 1C	10	16
2	Topics No.1D,1E & 1F	10	16
3	Topics No.1G,1H & 1I	10	16
4	Topics No.1J & 1K	10	16
5	Topics No.2A,2B & 2C	5	14
6	Topics No.2D,2E & 2F	5	14
7	Topics No.2G,2H & 2I	6	8
	Total	56	100

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3.3 AIRCRAFT ELECTRICAL SYSTEM-I

L	T	P
5	-	7

RATIONALE: Use of electrical systems in the design of aircraft 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 understand:

- 1) The basic description and function of DC generator
- 2) Wiring techniques
- 3) The basic description and function of DC motor
- 4) Different measuring instrument

DETAILED CONTENTS

A-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, Operation of photo-cells

B- General description of electrical measuring instruments

Requirement of indicating instruments. Construction & working of moving coil type, moving iron type and dynamometer type 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.

C- 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

D- D.C. Generator:-

Basic Generator theory
Construction and purpose of components in DC generator
Operation of, and factors affecting output, and direction of current flow in DC Generator, starter generator construction

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E- Static electricity in aircraft Potential-static, causes and prevention, corona threshold, bonding, shielding static discharge wicks and null field discharger, Electrostatic laws of attraction and repulsion, units of charge.

F- TEST EQUIPMENTS

- Knowledge of the construction, principle of operation, use and precautions to be observed for aircraft test equipments.

G- BONDING AND SCREENING- Knowledge of purpose of bonding and shielding and difference between the two, precaution, methods employed; minimum acceptable standards for insulation and bonding; and testing.

- Detail knowledge of aircraft wiring system; procedure of laying of electrical cables and precautions to be taken thereof..

H- FILTERS

Operation, application and uses of the following filters ;
Low pass, high pass, band pass, band stop

I. 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

AIRCRAFT ELECTRICAL SYSTEM-I PRACTICAL

1. LEAD ACID BATTERIES

Checking of battery condition, adjustment of specific gravity of electrolyte, battery charging practice; capacity, discharge and insulation test; others

2. NICKEL CADMIUM BATTERIES

A. Checking of battery condition: determining state of charge, cell balancing, charging, etc.

B- Checking of electrolyte level and insulation tests, Safety precautions, Deep cycling of nickel cadmium units.

3. WIRING, CABLING AND SOLDERING TECHNIQUES

Practice in stripping insulation; splicing; wiring to lugs; terminals and tube sockets; and dismantling, soldering and reassembly of connectors. Cables: lacing of wires to form a cable, termination and soldering of cable ends, and serving of coaxial cables. Soldering: practice with different sizes of soldering irons, different grades of solder, fluxes and types of connectors

4. Familiarization with different types of elect. Measuring Instruments.

5. To measure the insulation resistance of a cable with the help of megger.

6. Practice of A.C. and D.C. parallel and series circuit.

7 Familiarization with various parts of generators

8. Bonding, continuity and insulation testing

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- a-Bonding checks: use of bonding tester.
- b-Continuity and insulation tests on aircraft circuit; use of Megger testers.
- c- Millivolt drop checks at cable joints and terminal ends.
- 9- Familiarization with various parts Motors
- 10- familiarization with various parts of Wheatstone bridge and other balancing devices, sensing elements
- 11- Maintenance practices of motors and generators

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

- FAA-9A.
- EASA MODULE-3
- Aircraft Electrical System (E.H.J. Pallet)
- Fundamental of electrical(B.L. Theraja)
- Basic Electrical Engineering by VK Mehta & Rohit Mehta

Websites for Reference:

- 1)www.accessengineeringlibrary.com
- 2)www.electricaleducation.com
- 3)www.amequestionpaper.com

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
A	7	20
B	7	10
C	12	10
D	12	15
E	5	10
F	5	5
G	5	5
H	5	5
I	12	20
Total	70	100

3.4 AIRCRAFT ELECTRONICS SYSTEM

L	T	P
6	1	4

RATIONALE

Electronics system is the subfield of electrical system. It is used by aircraft to maintain safe flight. These systems are robust, reliable and space saving, ensuring enhanced performance and efficient working of devices.

LEARNING OUTCOMES

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

1. Define and explain concept of solid state devices, electrostatic devices, operational amplifier and multiplexing.
2. Demonstrate the terms of servomechanisms.
3. Explain the operation and function of avionics test equipments and electronic displays.

Detailed Content

A. Solid State Devices

1. Semiconductor theory - Conventional and electron flow, voltage and current sources. Diode theory with elementary circuit ideal. Special purpose diodes (Zener), Schottky, varactor etc.
2. Bipolar transistors biasing and classification of Amplifiers
3. Concept of FET & Thyristor family devices.
4. knowledge of Medium, large and very large scale integrated circuits.
5. Microprocessors & Memories
 - Functions performed and overall operation of a microprocessor.
 - Basic operation of each of the following microprocessors, elements-control and processing unit, clock register, arithmetic logic unit. -Memory associated terms
 - Operation of typical memory devices.
 - Operation, advantages and disadvantages of various data storage system.

B. Electrostatic Sensitive Devices

Special handling of components sensitive to electrostatic discharge.

Awareness of risk and possible damage, component and personnel, anti-static protection devices

C. Operational amplifiers, oscillators and multi-vibrators

D. knowledge of the terms used, basic operation, interfacing of the major component of a computer

E. Multiplexing.

- Operation, application, and identification, in logic diagrams of multiplexers and demultiplexers.
- Operation and use of encoders and decoders.
- Function of encoders types.

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F. On Board Maintenance system (ATA 45)

Central maintenance computer, printing, structure monitoring, data loading system , Electronics library system

SERVOMECHANISMS

Understanding of the following terms; open and feedback, dead band; construction operation and use of the following synchro system component; resolvers, differential, control and torque, E and I Transformer, inductance transmitter, capacitance transmitters, synchronous transmitters; servomechanism defects, reversal of synchro leads, hunting.

G-Avionics General Test Equipment

- Operation, function and use of avionics general test equipment.
- periodic calibration of test equipment

H-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.

AIRCRAFT ELECTRONICS PRACTICAL

1. Recognition and reading the value of passive devices with Colour codes.
2. Recognition and testing of active devices.
3. Familiarise with Uses of medium, large and very large scale integration.
4. Familiarize with identification, operation and classification of logic gates
5. Familiarise with operation and classification of operational amplifiers
6. Familiarize with operation and classification of oscillators and multi-vibrators
7. Familiarise with Functions and operation of microprocessor.
8. Familiarise with Operation and use of encoders, decoders, multiplexer and demultiplexer

INSTRUCTIONAL STRATEGY

Computer based learning

Online learning via the world wide web

MEANS OF ASSESSMENT

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

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RECOMMENDED BOOKS

1. Modern aviation electronics (Albert)
2. Electrical & electronics technology (Helfrick Edward Hughes)
3. Aviation Electronics (John M Ferrara)
4. Integrated Electronics (Millman Halkias)

Websites for Reference:

nptel.ac.in

SUGGESTED DISTRIBUTION OF MARKS

Topic no.	Time allotted (periods)	Marks allotted (%)
A	15	20
B	12	15
C	9	10
D	9	10
E	12	15
F	9	10
G	9	10
H	9	10
Total	84	100

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IV Semester
4.1 THEORY OF FLIGHT
(For AME Avionics)

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 the basic aerodynamics
2. Describe the flight stability and dynamics
3. Explain the aeroplane aerodynamics and flight controls
4. Describe the concept of supersonic pattern and differentiate between subsonic and Supersonic flow
5. Explain the terminology and operation of rotary wing aerodynamics

DETAILED CONTENTS

1. Basic aerodynamics

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. Aeroplane Aerodynamics and Flight Controls

Operation and effect of:

- roll control: ailerons and spoilers

-pitch control: elevators, stabilators, variable incidence stabilizers and canards

-yaw control, rudder limiters;

-Control using elevons, ruddervators;

-High lift devices: slots, slats, flaps;

-Drag inducing devices: spoilers, lift dumpers, speed brakes

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-Operation and effect of trim tabs, servo tabs, control surface bias.

5. High Speed Aerodynamics

Concept of supersonic pattern

Difference between Subsonic and Supersonic flow

Formation of shockwave.

Speed of sound, subsonic flight, transonic flight,

Mach number, critical Mach number

6. ROTARY WING AERODYNAMICS

Terminology

Operation and effect of cyclic, collective and anti-torque controls

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

Principles of flight(Basic Aerodynamics) by Ryan C. Binns

EASA Module-8

Mechanics of flight by AC Kermode

Helicopter flight by Simon Newman

Rotary Wing aerodynamics by WZ Stapinski

Aircraft Basic Science by Michael J Kores, James R Rardon

Websites for Reference:

1) www.amequestionpaper.com

2) www.aircraftsystemtech.com

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
Topic No. 1	18	15
Topic No. 2	12	12
Topic No. 3	12	10
Topic No. 4	13	10
Topic No. 5	13	10
Topic No. 6	10	10
Topic No. 7	12	10
Topic No. 8	12	13
Topic No. 9	10	10
Total	112	100

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4.2 AIRCRAFT INSTRUMENTATION-I

L	T	P
6	1	3

RATIONALE:

Knowledge of aircraft instruments for aircraft maintenance engineer 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:

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
- 5- Explain the DR Compass and RR compass

DETAILED CONTENTS

1. INSTRUMENT

1A. General introduction to aircraft instrument: various instruments and their classification. Atmosphere ; terminology; instrument pneumatic system

1B. Altimeter, principle, constructional details, types of setting, position error, leak test and periodical inspection.

1C. Airspeed indicator-Pitot and static tube, construction and principle, position error & periodical inspection, leak test. Machmeters

1D. Vertical speed indicator, constructional features checks and installation procedure, periodical inspection.

1E. Pressure gauges, principles of operation types of gauges, periodical inspection.

1F. Temperature gauge, principle of thermocouple and different type used in aviation, cylinder head temperature gauge, maintenance and periodical inspection.

1G. R.P.M. indicator, constructional details types of indicators, maintenance and periodical inspection.

1H. Gyro instruments, principle of gyro wheel & different types of gyros, constructional details of each i.e. turn & bank, artificial horizon and directional gyro, maintenance and periodical inspection, suction gauges etc.

1I. Electrically operated instruments, slip indicator

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- 1J. Fuel quantity measuring system.
- 1K. Fuel flow gauge
- 1L. Manifold pressure gauge.
- 1M. Detailed knowledge of the procedures of replacement and InSite operational tests of all instruments (except where the use of special test instrument/equipment is required)

2. COMPASS

- 2A. 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.

- 2B. Knowledge of general principles of construction for typical aircraft direct 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.

- 2C. Knowledge of the procedure and points to be observed during installation of the compass in aircraft.

- 2D. 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.

- 2E. Knowledge of the compensation 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.

- 2F. Knowledge of the use of landing compass for checking the compasses in aircraft.

AIRCRAFT INSTRUMENTATION-I PRACTICAL

- 1. Familiarization and system lay out and maintenance check of altimeter
- 2. Familiarization and system lay out and maintenance check of airspeed indicator
- 3. Familiarization and system lay out and maintenance check of Mach meter
- 4. Familiarization and system lay out and maintenance check of rate of climb indicator
- 5. Familiarization and system lay out and maintenance check of direct reading Pressure and temperature gauge
- 6. Familiarization and system lay out and maintenance check of fuel quantity indicating System and fuel flow meter
- 7. Familiarization and system lay out and maintenance check of artificial horizon

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8. Familiarization and system lay out and maintenance check of slip indicator
9. Familiarization with mechanically operated gauges and their function
10. Familiarization with pressure transducers, electrically operated transmitters and their Function
11. Familiarization with electrically operated gauges their function
12. Familiarization with swinging & compensation of compass by synthetic aids.
13. Familiarization with magnetic compasses: friction and damping tests, practice compass swing, and compensation
14. Remote compass: examination and demonstration.
15. Familiarization with p-type compass & b type compass.
16. Familiarization with pivot friction test & damping test.

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 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 (%)
1A & 1B	10	11
1C & 1D	14	15
1E & 1F	10	12
1G & 1H	10	11
1I & 1J & 1K	10	11
1L & 1M	10	10
2A & 2B	10	10
2C & 2D	10	10
Total	84	100

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4.3 AUTOFLIGHT & SERVO MECHANISM

L	T	P
6	2	3

RATIONALE

Automatic flight control systems and servomechanisms provide numerous benefits in terms of flight safety, operational efficiency, aircraft stability, workload reduction, and future aviation advancements. By studying and advancing these subjects, aviation professionals can enhance the overall performance, safety, and capabilities of aircraft systems.

LEARNING OUTCOMES

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

1. Understand the fundamental of automatic flight control system
2. Familiarize with auto throttle, auto land system
3. Familiarize with Servo mechanism and synchro system

DETAILED CONTENTS

1. AUTO FLIGHT

Fundamental automatic flight control , working principle and current terminology Command signal processing- Modes of operation roll , pitch yaw and collective channels- Yaw dampers- Stability augmentation system- Automatic trim control- Autopilots navigation aids interface- Auto throttle- Automatic landing system- Mode of operation, approach, glide slope , land , go around- System monitors and failure condition.

2.AUTOPILOT SYSTEM

Knowledge of function and operation of components in a typical Autopilot system, responses of the system in flight and during functional checks on ground

3. SIGNAL

purpose of pullup and feedback signals, causes of hunting and methods of damping, troubleshooting of servo- mechanisms.

4.SOFTWARE MANAGEMENT CONTROL

Awareness of restriction, airworthiness requirement and possible catastrophic effect of unapproved changes to software program.

5.SERVO MECHANISM

Understanding of following terms: open and close loop, follow up, feedback, analogue transducers- Principle of operation and use of a following synchro system, transducer, transformer inductance & capacitance, transmitter component /features, resolver, differential- Construction operation and use of a following synchro system , transducer, transformer, inductance & capacitance, transmitter component/features, resolver, differential- Knowledge of construction, principle and operation of servomotors and rate generators; system response to displacement (position) and rate (velocity) command signals; purpose of pullup and rate feedback signals; causes of hunting and methods of damping; troubleshooting of servomechanism.

AUTOFLIGHT & SERVO MECHANISM PRACTICAL

1. Familiarize with the automatic flight control system component and lay-out and demonstrate functional test
2. Familiarize with Modes of operation: roll, pitch and yaw channels; Yaw dampers; Stability Augmentation System in helicopters;
3. Familiarize with Automatic trim control;
4. Familiarize with Autopilot navigation aids interface;
5. Familiarize with Auto throttle systems.
- 6.. Familiarize with the Automatic Landing Systems component and lay-out and demonstrate functional check of modes of operation, approach, glide slope, land, go-around, system monitors and failure conditions.
7. Elementary working principle of simple auto pilot system.
8. Different types of auto pilots.

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

Automatic Flight Control (EHJ Pallett)
EASA Module 13 (Aircraft Tech Book co)

Websites for Reference:

<https://www.nptel.ac.in>
<https://www.aircraftmaintenancetechnology.com>
<https://www.faa.gov>
<https://www.aviationtoday.com/aviation-maintenance-magazine>

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	20	20
2.	20	20
3.	12	20
4.	12	20
5.	20	20
Total	84	100

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4.4 AIRCRAFT COMMUNICATION SYSTEM

L	T	P
5	2	3

RATIONALE

The rationale for studying aircraft communication systems is grounded in the critical role they play in aviation safety, operational efficiency, emergency management, passenger services, regulatory compliance, and technological advancements. By understanding and improving these systems, the aviation industry can continue to ensure safe and efficient air transportation.

LEARNING OUTCOMES

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

- 1 Understand electronics Communication terminology
- 2 Familiarize with radio band spectrum & its application
- 3 Familiarize with antenna system & its types
- 4 Explain the transmission line-coaxial & waveguide
- 5 Describe transmitter, receiver & modulation

DETAILED CONTENTS

A. GENERAL

Knowledge of the theory of operation, performance level and specifications of an Audio Integration System.

Knowledge of classification, use and wave propagation characteristics of the radio frequencies and their spectrum.

Knowledge of terms connected with, construction and identification for various types of antennas; the voltage and current distribution along antenna of various length.

Detailed knowledge of radio frequency transmission lines, coaxial cables, current and voltage distribution, impedance of lines, standing waves, standing wave ratio, matching, tuning stubs, waveguides, attenuation in waveguides, resonant cavities

Filter- low pass, high pass, band pass and band stop

Knowledge of modulation and demodulation, amplitude, frequency and phase modulation, AM and FM receivers, transmitter, superheterodyne principle; balanced modulator.

Emergency locator transmitter

Cockpit voice recorder

Cabin Entertainment equipment

B. FIBER OPTICS

Advantages and disadvantage of fiber optic data transmission over electrical wire propagation

Fiber optic data bus

Fiber optic related terms

Termination

Coupler, control terminals, remote terminals

Application of Fiber optics in aircraft system

C. SATELLITE COMMUNICATION

-Elementary principle of satellite Communication and its application to aircraft.

-Knowledge of construction and principles of operation of saturable reactors and magnetic amplifiers; bias; phase sensitive half wave and inputs and outputs, polarity sensitive inputs and outputs, push pull outputs and effects of stage gains and cascading on time response.

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AIRCRAFT COMMUNICATION SYSTEM PRACTICAL

FUNDAMENTAL TECHNIQUES

Familiarize with safety precautions associated with radio equipment hazards: high voltages, radio frequency (RF) emissions and microwave emissions, electrostatic discharge, etc.

Wiring and cabling: demonstration and practice in wiring and soldering radio circuits.

Multimeters, Megger and bonding testers / milli ohm meter: demonstrations and practice.

Identification and inspection of antenna: external wire aerials, blade, rod aerials, D/F loops, and suppressed aerials; viewing on aircraft, and inspection for physical condition.

Aerial masts, static dischargers, etc.: inspection and servicing.

Familiarize with the following system elements' receiver

Intermediate frequency amplifier

Frequency converter

Superheterodyne receiver

Buffer-doubler amplifier

RF amplifier

Modulation

Transmission lines

DEMONSTRATION OF TEST PROCEDURES ON AIRBORNE EQUIPMENT

Identification: identity and location of principal types of airborne communication and navigation equipment: racking systems, power supplies, antennae and other interconnections.

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

Electronics Communication System (Kennedy)

Principle of electronics (VK Mehta)

Electrical Technology (BL Thereja)

Aviation Electronics (Keith W Bose)

Websites for Reference:

<https://www.nptel.ac.in>

<https://www.faa.gov/aircraft>

<https://aviationweek.com>

<https://www.aea.net>

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SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
A	38	50
B	16	25
C	16	25
Total	70	100

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4.5 ENERGY CONSERVATION **(Common with Other Engineering Diploma Courses)**

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.

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- 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

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- 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.
1. To check efficacy of different lamps by measuring power consumption and lumens using lux meter.
2. To measure energy efficiency ratio (EER) of an air conditioner.
3. To measure effect of valve throttling and variable frequency drive (VFD) on energy consumption by centrifugal pump.
4. To measure and calculate energy saving by arresting air leakages in compressor.

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5. 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 COMPUTER THEORY

L	T	P
7	-	6

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 structure of computer
- 2 Familiarize with the overall operation & generation of microprocessor
- 3 Perform the conversion of numbering system
- 4 Describe the ADC & DAC and its application
- 5 Explain the IC & PCB and its use in aircraft

DETAILED CONTENTS

1 Introduction

1A -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).

1B. 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.

2. Numbering Systems

Numbering systems: binary, octal and hexadecimal

- Demonstration of conversions between the decimal and binary, octal and hexadecimal systems and vice versa

3. 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.

4. Data Buses

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

5. Logic Circuits

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

6.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.

7.Printed Circuit Boards

- Description and use of printed circuit boards.

8.Microprocessors

- Functions performed and overall operation of a microprocessor;
- Various Types of Microprocessor with Chip no.
- 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.

9.Multiplexing

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

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 utilization 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(eg. 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-

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

MEANS OF ASSESSMENT

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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 (%)
Topic No. 1	14	15
Topic No. 2	10	10
Topic No. 3	12	15
Topic No. 4	12	10
Topic No. 5	12	10
Topic No. 6	12	10
Topic No. 7	10	10
Topic No. 8	10	10
Topic No. 9	6	10
Total	98	100

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5.2 AIRCRAFT ELECTRICAL SYSTEM-II

L	T	P
7	-	8

RATIONALE

Use of electrical systems in the design and maintenance of aircraft is well known to everyone. Maintenance of these systems is 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 fundamental principle of power generation in aircraft
2. Distinguish the function of AC/ DC Motors of AC generator
3. Explain the basic function of different aircraft system
4. Describe the function of Transformer
5. Explain the working of inverter and converter

DETAILED CONTENTS

1- Aircraft power Generation and Distribution

- Batteries installation and operation
- DC Power generation
- AC Power generation
- Emergency Power generation
- Voltage regulation
- Power distribution
- Circuit Protection
- External/Ground Power

2-AC Generators

- Rotation of loop in a magnetic field and waveform produced
- Operation and construction of revolving armature and revolving field type AC generators
- Single phase, two phase and three phase alternators
- Three phase star and delta connections advantages and uses
- Permanent Magnet Generators
-

3-AC Motors

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

4-Transformers

- Transformer construction principles and operation
- Transformer losses and methods for overcoming them
- Transformer action under load and no-load conditions
- Power transfer, efficiency, polarity markings
- Calculation of line and phase voltages and currents
- Calculation of power in a three phase system
- Primary and Secondary current, voltage, turns ratio

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- power, efficiency
- Auto transformers
- Current transformer

5-Invertors and Convertors

-Knowledge of the operation and construction of static inverters, rotary inverters and transformer rectifier units

6-AIRCRAFT ELECTRICAL SYSTEM

Operation, inspection & troubleshooting of electrical system

- Knowledge of principle of operation, inspection and troubleshooting of aircraft galley equipment, aircraft lights, and electrical components and indicating circuits for Landing Gear, Flap System and Airconditioning system etc.
- Knowledge of operation and inspection of Aircraft Fire and Smoke Detection and Protection System.

LIST OF PRACTICAL'S

- 1- Familiarization with DC power generation
- 2- Familiarization with AC power generation and emergency power generation
- 3- Familiarization with power distribution
- 4- Familiarization with component and lay-out and perform functional check of external light: navigation, landing, taxiing, ice
- 5- Familiarization with component and lay-out and perform functional check of Internal light: cabin, cockpit, cargo and instrument lights
- 6- Familiarization with component and lay-out and perform functional check of Emergency light
- 7- Familiarization with various parts of Voltage regulators
- 8- Familiarization with various parts of battery cut outs and reverses current relays
- 9- Familiarization with various parts of thermal circuit breakers and function

INSTRUCTIONAL STRATEGY

1. PowerPoint presentation method
2. Audio video demonstration
3. Utilize a multimodal approach to cater to different learning styles

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

1. FAA-9A, 15A
2. Aircraft electrical system(pallet)- BL Thereja

Websites for Reference:

www.nptel.ac.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	24	25
2	13	20
3	13	10
4	16	20
5	18	15
6	14	10
Total	98	100

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5.3 Aircraft Instrumentation-II

L **T** **P**
7 **-** **8**

RATIONALE

Knowledge of aircraft instruments for aircraft maintenance engineer 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 understand:

- 1 Instrument system
- 2 Software Management Control
- 3 Electromagnetic Environment
- 4 Electronics Instrument System

DETAILED CONTENTS

A. INSTRUMENT SYSTEM

- Temperature indicating system
- Tachometer
- Air data computer/Air data sensor
- Stall warning system and angle of attack indicating system
- Vibration measurement and indication
- RR compass system
- Electronic flight instrument system (ADI , HSI,CDI,RMI and EFIS)
- Ground proximity warning system/EGPWS
- Warning system including master warning , Centralize warning system, annunciators and EICAS
- Altitude reporting /alerting system
- Engine thrust indication – EPR , or Jet pipe pressure system
- Exhaust gas temperature/interstage turbine temperature

B. Software Management Control

Awareness of restrictions, airworthiness requirements and possible catastrophic effects of unapproved

Changes to software programmes

C. 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

D. ELECTRONICS INSTRUMENT SYSTEM

- Typical system arrangement of glass Cockpit
 - Knowledge of the types and operation of displays (LED, Liquid Crystal etc.), CRTs and its application.
- Flight data Recorder

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AIRCRAFT INSTRUMENT SYSTEM-II PRACTICAL

- 1-Familiarisation and system lay out and maintenance check of ground proximity warning Systems
- 2-Familiarisation and system lay out and maintenance check of flight data recording Systems
- 3-Familiarisation and system lay out and maintenance check of electronic flight instrument systems
- 4-Familiarisation and system lay out and maintenance check of instrument warning system including master warning system
- 5-Familiarisation and system lay out and maintenance check of stall warning and angle of attack indicating systems
- 6-Familiarisation and system lay out and maintenance check of vibration measurement and indication
- 7- Familiarization and system lay out and maintenance check of Altitude reporting/alerting systems, air data computer.
- 8-Familiarisation with tachogenerator/Indicator (DC and AC types)
- 9- Engine speed synchronizing gear: examination and demonstration and principles
- 10-Engine temperature thermocouples: demonstration of cylinder head, Jet-pipe temperature and other types
- 11-Familiarisation with Ratio-meter temperature gauges
- 12-Familiarisation with various kinds of temperature sensing units (e.g. fire and overheating detectors, cabin air-duct stats, and inching controls for cooler shutters)

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

- 1) Aircraft Instrument and Integrated System (E.H.J. Pallet)
- 2) Aircraft Instrument (C.A. Williams)

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Websites for Reference:

1) www.amequestionpaper.com

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
A	62	65
B	10	10
C	14	15
D	12	10
Total	98	100

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5.4 Universal Human Values

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2-0-1

Course Objectives

This introductory course input is intended

- 1 To help the students appreciate the essential complementarity 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

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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 (Sarvabhaum Vyawastha)- 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

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- 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

INSTRUCTIONAL 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) 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) 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 Publishers.
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. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) Krishi TantraShodh, Amravati.
7. A Nagraj, 1998, Jeevan Vidyaek Parichay, 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>

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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

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 non-renewable.
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

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- 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,

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- 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 ErachBharucha; 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

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6.2 PROPULSION

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4	-	-

RATIONALE

Propulsion lies in its critical role in ensuring flight's safety, optimizing performance & efficiency, meeting power & thrust requirement & addressing environmental concerns.

LEARNING OUTCOMES

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

1. Define & explain the characteristics of different types of turbine engine & its constructional arrangements.
2. Explain the characteristics of aircraft engine Indicating System & components.

DETAILED CONTENTS

1. Turbine Engines Constructional arrangement and operation of turbojet, turbofan, turbo shaft and turbo propeller engines.
2. Electronic Engine control and fuel metering system (FADEC)
3. Fire detection and extinguishing system
4. Engine Indicating Systems Exhaust gas temperature / Interstate turbine temperature Power Indicating System Engine speed; Engine Thrust Indication : Engine Pressure Ratio, Engine turbine discharge pressure or jet pipe pressure systems; Oil pressure and temperature;
5. Fuel pressure , temperature and flow;
Manifold pressure; Engine torque; Propeller speed.

INSTRUCTIONAL STRATEGY

1. Computer based learning
2. Online learning via the world wide web.

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

EHJ Pallet, aircraft Instrument
EHJ Pallet, aircraft Instrument & integrated system
FAA Aviation Maintenance Tech Handbook-Powerplant-12A
FAA-8083-32 Aviation Maintenance Technician Handbook Powerplant (VOL-II)

Websites for Reference:

onlinecourses.nptel.ac.in

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SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	9	15
2	9	15
3	9	15
4	15	30
5	14	25
Total	56	100

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6.3 AIRCRAFT RADIO NAVIGATION SYSTEM

L	T	P
7	-	8

RATIONALE

Studying aircraft radio navigation systems is essential for aviation professionals to ensure safe and efficient air travel. By understanding these systems' principles, capabilities, and limitations, pilots, navigators, air traffic controllers, and aviation engineers can make informed decisions, utilize the available resources effectively, and contribute to the overall success of aviation operations.

LEARNING OUTCOMES

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

1. Explain basic communication and navigation system
2. Describe the avionics component and its functionality
3. Familiarize with theoretical study about Aircraft radio navigation system
4. Demonstrate the basic working of avionics system

DETAILED CONTENTS

1. Knowledge of terms used, principle, operation, characteristics, installation and maintenance:
Automatic Direction Finder (ADF) Systems. Very High Frequency (VHF) Omni Directional Range System
Instrument Landing Systems
Localizer, glideslope and marker system Microwave landing system
2. Long range navigation system
Very Low Frequency (VLF)/omega Navigation Systems LORAN/DECCA/DOPPLER Navigation Systems
3. Area navigation/RNAV system
4. Performance based navigation (PBN) Inertial navigation system Global positioning system(WAAS, IGNOUS,SBAS,GAGAN) Flight management system
5. Radar Equipment
Review of microwave theory Primary and secondary radar weather radar Distance measuring equipment. Air Traffic Control (ATC) Transponder System/SSR Radio Altimeter System ACAS/TCAS
6. A. TERRAIN Avoidance and warning system
B. ADSB surveillance system
7. Storm scope, electronic chart and map, ACARS (Data Link Communication)
8. Digital a/c system
 - EFIS – Electronic Flight Instrument System
 - EICAS – Engine Indication and Crew Alerting System
 - FBW – Fly By Wire
 - IRS – Inertial Reference System

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AIRCRAFT RADIO NAVIGATION PRACTICAL

1. Familiarise with component and demonstrate functional check of Automatic Direction Finder (ADF) Systems.
2. Familiarise with component and demonstrate functional check of Very High Frequency (VHF) Omni Directional Range System
3. Familiarise with component and demonstrate functional check of Instrument Landing Systems
4. Familiarise with component and demonstrate functional check of Weather Radar Systems.
5. Familiarise with component and demonstrate functional check of Air Traffic Control (ATC) Transponder System.
6. Familiarise with component and demonstrate functional check of Radio Altimeter Systems
7. Familiarise with component and demonstrate functional check of Distance Measuring Equipment
8. Familiarise with component and demonstrate functional check of Global positioning system
9. Familiarise with component and demonstrate functional check of flight director 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

AC Radio System (J Powell)

Avionics Navigation System (Kayton/fried)

Websites for Reference:

<https://www.nptel.ac.in>

<https://www.aircraftmaintenancetechnology.com>

<https://www.faa.gov>

<https://www.aviationtoday.com/aviation-maintenance-magazine>

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SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	14	15
2.	14	15
3.	08	05
4.	14	15
5.	16	15
6.	10	10
7.	10	10
8.	12	15
Total	98	100

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6.4 AVIONICS SYSTEM OF BONANZA A-35 AIRCRAFT

L	T	P
3	-	10

RATIONALE

Studying the avionics system of the Bonanza A-35 aircraft in an AME course is crucial for ensuring safety, regulatory compliance, effective troubleshooting, integration with other aircraft systems, staying abreast of technological advancements, and enhancing career prospects in the aviation industry.

LEARNING OUTCOMES

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

- 1 Understand the avionics system of bonanza A-35 aircraft
- 2 Explain the operation ,installation& maintenance of bonanza A-35 aircraft
- 3

DETAILED CONTENTS

1. Knowledge of terms used, principle, operation, characteristics, installation and maintenance of operation of very high frequency communication equipment's
2. Knowledge of terms used, principle, operation, characteristics, installation and maintenance of operation VOR/ILS equipment's
3. Knowledge of terms used, principle, operation, characteristics, installation and maintenance of operation of Automatic Direction Finder
4. Knowledge of terms used, principle, operation, characteristics, installation and maintenance of operation of Global Positioning System
5. Knowledge of terms used, principle, operation, characteristics, installation and maintenance of operation of Transponder
6. Knowledge of terms used, principle, operation, characteristics, installation and maintenance of operation of Emergency Locator transmitter
7. Knowledge of terms used, principle, operation, characteristics, installation and maintenance of operation of Distance Measuring Equipment
8. Knowledge of terms used, principle, operation, characteristics, installation and maintenance of operation of Audio Amplifier
9. Knowledge of terms used, principle, operation, characteristics, installation and maintenance of Autopilot& Flight Director system

AVIONICS SYSTEM OF BONANZA A-35 AIRCRAFT practical

1. Familiarize with component and lay-out and demonstrate functional check of very high frequency communication equipment's
2. Familiarize with component and lay-out and demonstrate functional check of operation of VOR/ILS equipment's

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3. Familiarize with component and lay-out and demonstrate functional check of Automatic Direction Finder
4. Familiarize with component and lay-out and demonstrate functional check of Global Positioning System
5. Familiarize with component and lay-out and demonstrate functional check of Transponder
6. Familiarize with component and lay-out and demonstrate functional check of Emergency Locator transmitter
7. Familiarize with component and lay-out and demonstrate functional check of Distance Measuring Equipment
8. Familiarize with component and lay-out and demonstrate functional check of Audio Amplifier
9. Familiarize with component and lay-out and demonstrate functional check of Autopilot& Flight Director 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

Manual of bonanza A-35/36 aircraft

Websites for Reference:

<https://www.nptel.ac.in>

<https://www.aircraftmaintenancetechnology.com>

<https://www.faa.gov>

<https://www.aviationtoday.com/aviation-maintenance-magazine>

<https://www.beechtalk.com>

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	5	25
2.	5	10
3.	5	10
4.	5	10
5.	5	10
6.	5	10
7.	5	10
8.	5	10
9.	2	05
Total	42	100

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6.5 PROJECT

L	T	P
-	-	6

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.

Polytechnics have been arranging industrial training of students of various durations to meet the above objectives.

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	<p>(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.</p> <p>(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.</p> <p>(c) Knowledge of Hindi.</p>	01
2	Chief Lecturer	<p>(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</p> <p>(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.</p> <p>(c) Knowledge of Hindi.</p>	01
3	Lecturer (Aero.)	<p>(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).</p> <p>(2) One year Practical/Instructional experience for holders of Engineering degree OR BAMEL and three years practical/Instructional experience in aviation industry for others.</p> <p>(3) Instructors assigned to teach paper-I (Air Law, airworthiness Requirements and Human Performance) should have passed paper-I of AME License Examination.</p> <p>(4) Instructors teaching Paper-III subject should have passed paper-III of the relevant category OR have adequate maintenance experience in the relevant category.</p> <p>(5) Knowledge of Hindi.</p>	02
4	Lecturer (Avionics)	<p>(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</p>	02

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

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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

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S.No. A.	List of Tools & Equipments 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

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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.	Mock up of fuel system	01
2.	Mock up of ignition system	01
3.	Exploded view of engine	01
4.	Continental A-65 engine	
5.	Continental 0-450 engine for imparting training & associated	01
6.	tools for carrying out job	01
7.	Turbine engine	01
8.	Spanners set (ring)	01
9.	Spanners set (open)	01 set
10.	Deep socket (3/8" square head)	01 set
11.	Socket (1/4" square head)	01 set
12.	Extensions	01
13.	T-handle	
14.	Ratchet handle	01
15.	Cylinder mercer gauge	01
16.	Pin hole gauge	04 set
17.	Telescopic gauge	04 set
18.	Depth gauge (vernier)	03
19.	Height gauge (vernier)	04
	Depth gauge micrometer type	01

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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 inverter & 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

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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	Simple type Autopilot	01 set
12	Engine Oil Pressure Gauge (Bourdon tube type)	
13	Engine Oil Pressure Gauge (Electrical type)	01 No
14	Cabin Temperature Controller	
15	Mockups of Altimeter Test Chamber	01 No
16	Mockup of Airspeed indicator for Leak test	
17	Gyroscopic Instrument Test table	01 No
18.	Mockup for compass swinging practice	
19.	Mockup for RPM indicator	01 No
20.	One set of watch screw drivers	
	One set of miniature spanners	01 No
	One set of Allen keys(aooropriate sized)	
	One set of Bristol spine keys	01 No
	One electric temperature controlled soldering iron with fine point.	
21	Bonding tester(lead battery operated)	01 No
22	Dead Weight Tester	
		01 No
		01 set each

J.	Radio Shop	
1.	Variable stabilized power supply unit Variable supply 0-28V	01 NO
2.	Signal generator (High Grade) RF	01 NO
3.	Signal generator for bench work (20-2000 Hz)AF	01 NO

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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

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8.	Moving coil Volt-Ohm-milli am meter multi meter (0-1000m V/O-2000m V/O-500m V/O-500 μ A)	01 NO
9.	Variac 5 Amp.	01 NO
10.	Spectrum analyzer - 1090 MHz	01 NO
11.	Digital Battery analyzer	01 NO
12.	IC/Microprocessor	01 NO
13.	Digital Volt meter/Ohm-O-2000 OHM meter/Ammeter	01 NO
14.	Search radar/Weather Radar	01 NO
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

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8.	Charger for lead acid battery	01 No
9.	Hydrometer	03 No

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BASIC ELECTRICITY AND ELECTRONICS ENGINEERING LAB

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

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10. Energymeter (Substandard) phase, induction type 5 A/10A, 250 V, 50 Hz.	1	3000	single
11. Power factor meter dynamometer type, eddy current damping, 50 Hz, scale length 150 mm range upto 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 oxidised iron free nickel copper on vitreous enamelled 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 KVA 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 devided 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 (Sub standard) 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 guage	1	1000
30. Maxwells bridge	1	1000
31. Weins 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 Nuetral) AC static Watt Hour Meter (Electronic Energy Meter) 10A	2500	
35. Trivector Meter	1	5000

**BASIC COMPUTER
COMPUTER CENTRE**

Sr. No.	Description	Qty	Total Price (Rs)
1.	Computer System with latest configuration Intel i5 or latest processor , 12 th 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	-

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LEARNING RESOURCE MATERIALS			
Sr. No.	Description	Qty	Total Price (Rs)
1.	Computer System with latest configuration Intel i7 or latest processor , 12 th 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

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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

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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
41.	AUTO CAD 2002	FREY	487
42.	AUTOMATIC CONTROL SYSTEM	BENJAMIN	189
43.	AVIATION ELECTRONICS	KW BOSE	371
44.	AVIATION ELECTRONICS	JOHN. M. FERARRA	379
45.	AVIATION ELECTRONICS	KW BOSE	407
46.	BASIC ELECT. FOR A &P MACHS.	DALE CRANE	415
47.	BASIC ELECT. FOR A &P MACHS.	DALE CRANE	416
48.	BASIC ELECTRICITY	JB GUPTA	331
49.	Basic Electronics	BernardGrob	353
50.	Basic Electronics	BernardGrob	477
51.	GROB'S BASIC ELECTRONICS	MITCHEL E. SCHULT Z.	645
52.	GROB'S BASIC ELECTRONICS	MITCHEL E. SCHULT Z.	646
53.	GROB'S BASIC ELECTRONICS	MITCHEL E. SCHULT Z.	647
54.	CAD/CAM	MIKELL P GROVER	442
55.	COMPUTER AIDED DESIGN	RADHAKRISHAN	560
56.	COMPUTER AIDED DESIGN	CS KRISNAMOORTI	466
57.	COMPUTER AIDED DESIGN	KR NAMIBIAR	464
58.	COMPUTERS FOR BEGINNERS	R. THIGARAJAN	103
59.	COMPUTERS FOR BEGINNERS	R. THIGARAJAN	104
60.	COMPUTERS FOR BEGINNERS	R. THIGARAJAN	105
61.	COMPUTERS FOR BEGINNERS	R. THIGARAJAN	106
62.	COMPUTER SYSTEM ARCHITECTURE	M. MORRIS MANO.	338
63.	CONTROL OF ELECT. MECHS.	SK BHATTACHARYA	557
64.	D.C. CIRCUITS	S. ROSEN	361
65.	DIGITAL ELECTRONICS	TOKHEIN	341
66.	DIGITAL PRINCIPLES & APPLICATIONS	AP MALVINO	339

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67.	DIGITAL PRINCIPLES & APPLICATIONS	AP MALVINO	538
68.	DIGITAL PRINCIPLES & APPLICATIONS	LEACH & MALVINO	636
69.	DIGITAL PRINCIPLES & APPLICATIONS	LEACH & MALVINO	637
70.	DIGITAL PRINCIPLES & APPLICATIONS	LEACH & MALVINO	638
71.	ELECT. MEASU. & MEASURINGQ	GOLDING & WIDDS	193
72.	ELECTRICAL ENGG. DRAWING	SK BHATTACHARYA	530
73.	ELECTRICAL MEASUREMENTS	REISSLAND	522
74.	ELECTRICAL TECHNOLOGY	B. L. THERAJA	323
75.	ELECTRICAL TECHNOLOGY	B. L. THERAJA	324
76.	ELECTRICAL TECHNOLOGY	B. L. THERAJA	413
77.	ELECTRICAL TECHNOLOGY	B. L. THERAJA	414
78.	ELECTRICAL ENGINEERING	B.L.THEREJA	694
79.	ELECTRICAL ENGINEERING	B.L.THEREJA	695
80.	ELECTRICAL ENGINEERING	B.L.THEREJA	696
81.	ELECTRONIC CIRCUIT DEVICES	FRANK DELP	363
82.	ELECTRONICS COMMUNI. SYSTEM	G.KENNEDY	342
83.	ELECTRONICS FUND. & APPLICATION	D. CHATTOPADHYA Y	559
84.	ELECTRONICS FUND. & APPLICATION	D. CHATTOPADHYA Y	531
85.	ELEMENTARY COMPUTING	ANU DHAWAN	99
86.	ELEMENTARY COMPUTING	ANU DHAWAN	100
87.	ELEMENTARY COMPUTING	ANU DHAWAN	101
88.	ELEMENTARY COMPUTING	ANU DHAWAN	102
89.	ENGG. DRAWING & COMP. GRAPH	K. VENUGOPAL	555
90.	ENGG. DRAWING & COMP. GRAPH	K. VENUGOPAL	515
91.	EXP. IN BASIC ELECT. ENGG.	SK BHATTACHARYA	534
92.	EXP. IN BASIC ELECT. ENGG.	SK BHATTACHARYA	565
93.	FUNDAMENTAL OF ELETRIC MACHINES	BR GUPTA	523
94.	HARDWARE & SOFTWARE OF PC	SK BOSE	558
95.	HIGH VOLTAGE ENGG.	CL. WADHWA	535
96.	HOW TO USE INTERNET	G. JONES	510
97.	INTEGRATED ELECTRONICS	J MILAN	343

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98.	INTERNET & JAVA PROGRAMMING	R. KRISNAMOORTI	561
99.	INTRODUCTION TO COMPUTERS	ROBERT SHEPHARE	520
100.	INTRODUCTION TO WORD STAR	NARIMAN	335
101.	LEARNING C++	ERIC NEGLER	516
102.	LINEAR PROGRAMMING METHODS	GVS SHENOG	550
103.	LOTUS 1-2-3	HOSSEIN BIDGOH	333
104.	MANUAL OF AVIONICS	BRIAN KENDAL	7
105.	MANUAL OF AVIONICS	BRIAN KENDAL	8
106.	MANUAL OF AVIONICS	BRIAN KENDAL	9
107.	MANUAL OF AVIONICS	BRIAN KENDAL	406
108.	MANUFACTURING TECHNOLOGY	M. ADITHAN	527
109.	MASTERING AUTO CAD RELEASE	JEORGE OMURA	336
110.	MICRO ELECTRIC DEVICES & CIRCUIT	BP SINGH	529
111.	MICROPROCESSORS INTEGRATING TECH.	-----	194
112.	MICROSOFT MS DOS USER'S GUIDE & REF.	-----	236
113.	OBJECTIVE Q. ELECT. ELECTS., TELECOM	GK MITTAL	417
114.	PROD.AUTO. SYSTEMS	P. GROVER	441
115.	PROGRAMMING FOR BASIC	N SUBRAMANYM	190
116.	PROGRAMMING FOR BASIC	N SUBRAMANYM	191
117.	THE ILLUSTRATED D BASE III PLUS WORK	RUSSEL STULZ	337
118.	THE SPIRIT OF 'C'	MUKLISH COPRER	518
119.	UNDERSTANDING & USING D BASE III PLUS	STEVAN C ROSE	332
120.	USE OF COMPU. IN MAKING MECH. ENGG.	I.R.D.T.	392
121.	USING UNIX	ROBERT MARTIN	514
122.	WINDOWS-95	SCRAWFORD	340
123.	WORLD TRANS. DIODES & IC'S COMP.VOL.-	BPB PUB.	476
124.	WORLD TRANS. DIODES & IC'S VOL.-1	BPB PUB.	475
125.	WORLD TRANS. VOL.-1	BPB PUB.	473
126.	WORLD TRANS. VOL.-1	BPB PUB.	474
127.	AUTOMATIC FLIGHT CONTROL	EHJ PALLETT	16
128.	AUTOMATIC FLIGHT CONTROL	EHJ PALLETT	17
128.	AUTOMATIC FLIGHT CONTROL	EHJ PALLETT	306
129.	AUTOMATIC FLIGHT CONTROL	EHJ PALLETT	626
130.	AUTOMATIC FLIGHT CONTROL	EHJ PALLETT	627

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131.	AUTOMATIC FLIGHT CONTROL	EHJ PALLETT	628
132.	OPERATING SYSTEM PRINCIPLES	HANSON	334
133.	ELECTRICS JAA ATPL TRAINING VOL. 6	JEPPESEN	639
134.	ELECTRICS JAA ATPL TRAINING VOL. 6	JEPPESEN	640
135.	ELECTRICS JAA ATPL TRAINING VOL. 6	JEPPESEN	641
136.	MODERN AVIATION ELECTRONICS	ALBERT D. HELFRICK	670
137.	MODERN AVIATION ELECTRONICS	ALBERT D. HELFRICK	671
138.	MODERN AVIATION ELECTRONICS	ALBERT D. HELFRICK	672
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
145.	AIRCRAFT INSTRUMENTS	C.A. WILLIAMS	825
146.	AIRCRAFT INSTRUMENTS	C.A. WILLIAMS	826
147.	AVIATION ELECTRONICS	KEITH W. BOSE	833
148.	AVIATION ELECTRONICS	KEITH W. BOSE	834
149.	AVIONICS FUNDAMENTALS	JEPPESEN	835
150.	AVIONICS VOL. 1 : AVIATION ELECTRONICS	JOHN M. FERRARA	836
151.	AVIONICS VOL. 1 : AVIATION ELECTRONICS	JOHN M. FERRARA	837
152.	AVIONICS VOL. 1 : AVIATION ELECTRONICS	JOHN M. FERRARA	838
153.	BASIC SYNCHROS & SERVOMECHANISM PART -1 & 2	VALKENBERG	846
154.	BASIC SYNCHROS & SERVOMECHANISM PART -1 & 2	VALKENBERG	847
155.	BASIC SYNCHROS. & SERVOMECHANISM PART -1 & 2	VALKENBERG	848
156.	ELECTRONIC COMMUNICATION SYSTEM 5/ED	GEORGE KENNEDY	859
157.	ELECTRONIC COMMUNICATION SYSTEM 5/ED	GEORGE KENNEDY	860
158.	ELECTRONIC COMMUNICATION SYSTEM 5/ED	GEORGE KENNEDY	861

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159.	INTEGRATED ELECTRONICS ANALOG & DIGITAL CIRCUIT & SYSTEM	MILLMAN & HALKIAS	868
160A.	INTEGRATED ELECTRONICS ANALOG & DIGITAL CIRCUIT & SYSTEM	MILLMAN & HALKIAS	869
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

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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.

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10. EVALUATION STRATEGY

10.1 INTRODUCTION

Evaluation plays an important role in the teaching-learning process. The major objective of any teaching-learning endeavor 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 corrective steps 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 carried through sessional /class-

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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 following that 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 read them 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 achieving course 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,

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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 other requisite 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 relying on 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.

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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(Avionics) for UP State ,workshop held on 05th August 2022, 30th December 2022, 02nd and 03rd June 2023 at Aeronautical Training Institute, Lucknow:

1. Smt. Aradhana Singh, Principal Lecturer, Aeronautical Training Institute, Lucknow.
2. Shri Anand Kumar, HOD, Electrical Engineering, Govt. Polytechnic Lucknow.
3. Shri Pradeep Kumar, HOD, Mechanical Engineering, Govt. Polytechnic Lucknow.
4. Shri BK Verma, Chief Lecturer, Aeronautical Training Institute, Lucknow.
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