

**HINDUSTAN INSTITUTE OF TECHNOLOGY AND  
SCIENCE**

**SCHOOL OF  
AERONAUTICAL SCIENCES**

**M.TECH AIRCRAFT MAINTENANCE  
ENGINEERING**

**CURRICULUM & SYLLABUS**

**SEMESTER – I**

S.No	Code No.	Course Title	L	T	P	C	TCH
<b>THEORY</b>							
1	MAA3703	Probability and Statistics	3	0	0	3	3
2	AEB3701	Mechanics of Flights	3	0	0	3	3
3	AEB3702	Airframe Maintenance and Repair	3	0	0	3	3
4	DE	Department Elective - I	3	0	0	3	3
5	DE	Department Elective - II	3	0	0	3	3
6	ZZZ3715	Research Methodology & IPR	2	0	0	2	3
<b>PRACTICAL</b>							
7	AEB3791	Non-Destructive Testing Laboratory	0	0	4	2	4
8	AEB3796	Seminar	0	0	3	2	3
<b>TOTAL</b>						<b>21</b>	<b>25</b>

**SEMESTER-II**

S.No	Code No.	Course Title	L	T	P	C	TCH
<b>THEORY</b>							
1	AEB3703	Aero engine Maintenance & Repair	3	0	0	3	3
2	AEB3704	Aircraft Composite Structures and Repair	3	0	0	3	3
3	AEB3705	Civil Aviation Requirements - I	3	0	0	3	3
4	DE	Department Elective - II	3	0	0	3	3
5	OE	Open Elective	3	0	0	3	3
<b>PRACTICAL</b>							
6	AEB3792	Aero Engine Laboratory	0	0	4	2	4
7	AEB3781	Mini Project	0	0	6	2	6
<b>TOTAL</b>						<b>19</b>	<b>25</b>

**SEMESTER – III**

S.No	Code No.	Course Title	L	T	P	C	TCH
<b>THEORY</b>							
1	DE	Department Elective – IV <sup>#</sup>	3	0	0	3	3
<b>PRACTICAL</b>							
2	AEB3797	Internship*	0	0	3	2	3
3	AEB3798	Project Work – Phase I	0	0	24	8	24
<b>TOTAL</b>						<b>13</b>	<b>30</b>

\*Internship to be undergone during vacation between 2<sup>nd</sup> or 3<sup>rd</sup> semesters

# Incorporation of MOOC to be offered for this course.

**SEMESTER – IV**

S.No	Code No.	Course Title	L	T	P	C	TCH
<b>PRACTICAL</b>							
1	AEB3799	Project Work - Phase II	0	0	24	12	24
<b>TOTAL</b>						<b>12</b>	<b>24</b>

**Total No. of Credits: 65**

### Department Electives

<b>S.No.</b>	<b>CODE</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>TCH</b>
1	AEB3721	Aircraft General Engineering & Maintenance Practices	3	0	0	3	3
2	AEB3722	Airlines Operation & Scheduling	3	0	0	3	3
3	AEB3723	Diagnostic Techniques	3	0	0	3	3
4	AEB3724	Airline Marketing Management	3	0	0	3	3
5	AEB3725	Helicopter Maintenance	3	0	0	3	3
6	AEB3726	Aircraft Navigation Systems	3	0	0	3	3
7	AEB3727	Entrepreneurship Development	3	0	0	3	3
8	AEB3728	Aviation Safety Management	3	0	0	3	3
9	AEB3729	System Simulation and Modelling	3	0	0	3	3
10	AEB3730	Advanced Optimization Techniques	3	0	0	3	3
11	AEB3731	Logistics and Supply Chain Management	3	0	0	3	3
12	AEB3732	Aircraft Systems & Instrumentations	3	0	0	3	3
13	AEB3733	Civil Airworthiness Requirements-II	3	0	0	3	3
14	AEB3734	Maintenance and Reliability Engineering	3	0	0	3	3

**SEMESTER – I**

MAA3703	PROBABILITY AND STATISTICS		L T P C 3 0 0 3
<b>GOAL</b>	The course is aimed at developing the Mathematical skills of engineering students that are imperative for effective understanding of engineering subject		
<b>OBJECTIVES</b>		<b>OUTCOMES</b>	
Impart the students <ul style="list-style-type: none"> <li>• To enable the random variables moments.</li> <li>• To enrich idea about the correlation and regression.</li> <li>• To provide the details about the testing of hypothesis methods.</li> <li>• To provide the details about the design experiments.</li> <li>• To enrich idea about the time series</li> </ul>		The student will <ul style="list-style-type: none"> <li>• Be able to understand the random variables, correlation and regression.</li> <li>• Be able to understand the correlation and regression.</li> <li>• Have understood different types of hypothesis testing.</li> <li>• Have understood randomised design.</li> <li>• Be able to understand the Exponential smoothing – Auto Regressive Processes</li> </ul>	
<b>UNIT I - PROBABILITY AND RANDOM VARIABLE</b>			<b>9</b>
Probability – Random variables – Moments – Moment generating function – Standard distributions – Functions of random variables – Two-dimensional R.Vs – Correlation and Regression.			
<b>UNIT II ESTIMATION THEORY9</b>			
Principle of least squares – Regression – Multiple and Partial correlations – Estimation of Parameters – Maximum likelihood estimates – Method of moments.			
<b>UNIT III TESTING OF HYPOTHESIS9</b>			
Sampling distributions – Test based on Normal, t-distribution, chi-square, and F-distributions – Analysis of variance – One-way and two way classifications.			
<b>UNIT IV DESIGN OF EXPERIMENTS9</b>			
Completely Randomized Design – Randomized Block Design – Latin Square Design – 2 Factorial Design.			
<b>UNIT V TIME SERIES9</b>			
Characteristics and Representation – Moving averages – Exponential smoothing – Auto Regressive Processes.			
			<b>TOTAL: 45</b>
<b>TEXT BOOKS</b>			
1. Freund John, E and Miller, Irvin, “Probability and Statistics for Engineering”, 5 <sup>th</sup> Edition, Prentice Hall, 1994. 2. Jay, L. Devore, “Probability and Statistics for Engineering and Sciences”, Brooks Cole Publishing Company, Monterey, California, 1982.			
<b>REFERENCES</b>			
1. Montgomery D.C and Johnson, L.A, “Forecasting and Time series”, McGraw Hill. 2. Anderson, O.D, “Time series Analysis: Theory and Practice”, I.North-Holland, Amsterdam, 1982. 3. Gupta, S.C and Kapoor, V.K., “Fundamentals of Mathematical Statistics”, Sultan Chand and Sons, New Delhi, 1999.			

AEB3702	AIRFRAME MAINTENANCE & REPAIR PRACTICES		L T P C 3 0 0 3
<b>GOAL</b>	To study the maintenance aspect of airframe systems and rectification of snags		
<b>OBJECTIVE</b>		<b>OUTCOME</b>	
<ul style="list-style-type: none"> <li>• To understand the basic steps in welding and soldering, brazing of aircraft components</li> <li>• To depict the composite and plastic components maintenance in aircraft industry</li> <li>• To gain knowledge about rigging, jacking of aircraft in maintenance hangar. To explain the steps involved in the maintenance process</li> <li>• To know about Hydraulic and Pneumatic system.</li> <li>• To understand the safety practices in aircraft maintenance and equipment handling</li> </ul>		<ul style="list-style-type: none"> <li>• Able to explain the welding, brazing process with the requirements of the process and significance of NDT</li> <li>• Able to understand the various maintenance practices in plastic and composite parts of aircraft</li> <li>• Can be clear in the precautionary steps involved in rigging, jacking process</li> <li>• Can be thorough in parts, working methodology of basic aircraft systems</li> <li>• Can get a clear idea about safety practices and troubleshooting of an aircraft.</li> </ul>	
<b>UNIT I CONFIGURATION OF AIRPLANE AND ITS COMPONENTS</b>			<b>9</b>
How an Airplane flies - components of an airplane and their functions - motions of airplane - Pitching, Rolling and Yawing-Banking, skidding and slipping - starting, taxiing - Take-off - landing - stalling, spinning, spirals - cross wind take-off and landings. Different types of flight vehicles.			
<b>UNIT II PROPULSION</b>			<b>9</b>
Aircraft propulsion, Rocket propulsion, power plant classification, principles of Operation and areas of their application.			
<b>UNIT III AERODYNAMICS</b>			<b>9</b>
Airfoils and streamlines bodies - forces acting on an airplane - lift and drag - speed and power – physical properties and structure of atmosphere - theory of flight.			
<b>UNIT IV STABILITY AND CONTROL</b>			<b>9</b>
Introduction to stability and control, Concepts of static and dynamic stability and control, dynamic instability and control, V-n diagram, range and endurance.			
<b>UNIT V AIRCRAFT STRUCTURES</b>			<b>9</b>
Introduction to Aircraft structures - Loads - Types of construction - Design features Aircraft materials.			
			<b>TOTAL: 45</b>
<b>TEXT BOOKS</b>			
<ol style="list-style-type: none"> <li>1. Kermode, A.C, 'Mechanics of Flight' English Book Store, New Delhi, 1992.</li> <li>2. John.D.Anderson.Jr,'Intoduction to flight' TATA McGraw-Hill,2007</li> </ol>			
<b>REFERENCES</b>			
<ol style="list-style-type: none"> <li>1. Van Sickle Neil, D 'Modern Airmanship' VanNostrand Reinhol, New York, 1985.</li> <li>2. Megson T.H. 'Aircraft Structures for Engineering Student's II Edition, Edward Arnold, Kent, U.S.A. 1990</li> </ol>			

<b>AEB3791</b>	<b>NON-DESTRUCTIVE TESTING LABORATORY</b>	<b>LT P C 0 0 2 1</b>
<b>Goal</b>	To introduce the knowledge about the Non-destructive testing in detail to identify the cracks on the materials	
<b>OBJECTIVES</b>	<b>OUTCOMES</b>	
Impart the students To enable knowledge ultrasonic testing To enrich idea about the Eddy current testing To provide the details about Dye-penetrant Testing To enrich idea about the Magnetic Particle Inspection To provide the details about the defectoscope	The student will  Be able to understand about the working of ultrasonic testing machine Be able to understand about the working of Eddy current testing machine Have understood about the working of Dye-penetrant Testing machine Have understood about the working of Magnetic Particle Inspection machine Have understood about the working of defectoscope machine.	

### LIST OF EQUIPMENTS

*(For a batch of 30 students)*

<b>Sl. No</b>	<b>Equipments</b>	<b>Qty</b>	<b>Experiments No.</b>
1	Ultrasonic Testing	1	1
2	Eddy current testing	1	2
3	Dyepenetrant Testing	1	3
4	Magnetic Particle Inspection	1	4,5
5	Defectoscope	1	6

## **SEMESTER II**

<b>AEB3703</b>	<b>AERO ENGINE MAINTENANCE &amp; REPAIR</b>	<b>L T P C</b> <b>3 0 0 3</b>
<b>GOAL</b>	To study the basic concepts of the maintenance and repair of both piston and jet aero engines and the procedures followed for overhaul of aero engines.	
<b>OBJECTIVE</b>		<b>OUTCOME</b>
<p>The subject should enable the students to</p> <ol style="list-style-type: none"> <li>1. Understand the types of piston engines, principle of operation.</li> <li>2. Know the inspection, maintenance and troubleshooting procedure of aircraft piston engines</li> <li>3. Understand the piston engine overhaul procedure and engine testing procedure.</li> <li>4. Familiarize with 112 types of jet engines and its principle of operations.</li> <li>5. Understand the maintenance troubleshooting, testing procedure of gas turbine engines.</li> <li>6. Understand the overhaul procedure of aircrafts gas turbine engines.</li> <li>7. Familiarize with gas turbine engine, health monitoring and corrective methods.</li> </ol>		<p>The students should be able to</p> <ol style="list-style-type: none"> <li>1. Describe the function of each component in piston engines and its materials.</li> <li>2. Carryout inspections and maintenance checks on aircraft piston engines.</li> <li>3. Describe the piston engine overhaul procedure.</li> <li>4. Know the types and function of each component in gas turbine engines.</li> <li>5. Describe the troubleshooting and rectification procedures of gas turbine engines.</li> <li>6. Know the overhaul procedures and balancing of gas turbine components.</li> <li>7. Describe the detail procedure for gas turbine engine, health monitoring.</li> </ol>

### **UNIT I CLASSIFICATION OF PISTON ENGINE COMPONENTS 9**

Types of piston engines – Principles of operation – Function of components – Materials used – Details of starting the engines – Details of carburetion and injection systems for small and large engines – Ignition system components – Spark plugs– Engine operating conditions at various altitudes – Maintenance and inspection check to be carried out.

### **UNIT II INSPECTION OF PISTON ENGINES 9**

Inspection, maintenance and troubleshooting – Inspection of all engine components – Daily and routine checks – Overhaul procedures – Compression testing of cylinders – Special inspection schedules – Engine fuel, control and exhaust systems – Engine mount and super charger – Checks and inspection procedures.

### **UNIT III OVERHAUL PROCEDURES OF PISTON ENGINES 9**



Symptoms of failure – Fault diagnostics – Case studies of different engine systems –Tools and equipment requirements for various checks and alignment during overhauling – Tools for inspection- destructive testing techniques on engines – Equipment for replacement of part and their repair. Engine testing: Engine testing procedures and schedule preparation – Online maintenance.

**UNIT IV CLASSIFICATION OF JET ENGINE COMPONENTS 9**

Types of jet engines – Principles of operation – Function of components – Materials used – Details of starting and operating procedures – Gas turbine engine inspection & checks – Use of instruments for online maintenance – Special inspection procedures : Foreign Object Damage – Blade damage – etc.

Maintenance procedures of gas turbine engines – Trouble shooting and rectification procedures – Component maintenance procedures – Systems maintenance procedures.

Gas turbine testing procedures – test schedule preparation – Storage of Engines – Preservation and de-preservation procedures.

**UNIT V OVERHAUL PROCEDURES OF JET ENGINES 9**

Engine Overhaul procedures – Inspections and cleaning of components – Repairs schedules for overhaul – Balancing of Gas turbine components.

Trouble Shooting - Procedures for rectification – Condition monitoring of the engine on ground and at altitude – engine health monitoring and corrective methods.

**TOTAL: 45**

**TEXT BOOK**

1. KROES & WILD, “Aircraft Power plants”, 7<sup>th</sup> Edition – McGraw Hill, New York, 1994.

<b>AEB3704</b>	<b>AIRCRAFT COMPOSITE STRUCTURES AND REPAIR</b>	<b>L T P C</b> <b>3 0 0 3</b>
<b>Goal</b>	To introduce the concepts of reliability and diagnostic maintenance techniques	
<b>OBJECTIVES</b>	<b>OUTCOMES</b>	
Impart the students To enable knowledge about introduction to composites To enrich idea about sandwich construction To provide the details about the composite joining To enrich idea about the manufacturing & inspection To provide the details about the repair and application	The student will  Be able to understand about the fibres, matrix and resin. Be able to understand about the honeycomb in detail Have understood about the types of bonded joints.  Have understood about the composite inspection and manufacturing Have understood about repairing methods and its application in aero industry.	

## REFERENCES

1. TURBOMECA, "Gas Turbine Engines", the English Book Store, New Delhi, 1993.
2. UNITED TECHNOLOGIES PRATT & WHITNEY, "The Aircraft Gas turbine Engine and its Operation", (latest edition) The English Book Store, New Delhi.

### **UNIT I MANUFACTURING TECHNIQUES 9**

Definitions and applications, Lay-Up Methods for Fabrics and Tapes, Filament Winding Pultrusion, Resin Transfer Moulding Injection Moulding, Press Moulding, Vacuum Bonding, Autoclave Bonding.

### **UNIT II DAMAGE AND REPAIR ASSESSMENT 9**

Damage Types Sources of Mechanical Damage, Damage Mapping, Assessment of Damage Significance. Visual Inspection, Tap Test, Ultrasonic Inspection, X-Ray Methods, Eddy Current Inspection Thermography, Bond Testers, Moisture Meters, Interferometry/Shearography.

### **UNIT III REPAIR PROCEDURES 9**

Typical Repairs. Reserve factor, Disbonding Methods, Damage Removal, Surface Preparation of Composites-Repair Sanding and Ply Determination.

### **UNIT IV ADVANCE REPAIR METHODS 9**

Selection of methods - Speed-tape, Resin Sealing , Potted Repairs, Bolted Doublers (Metal Plates) and Bonded Doublers (Composite Patches), Pre-Cured Doublers Versus Co-Cured Doublers Pre-Preg. Repairs, Scarfed and Stepped Lap Repairs.

### **UNIT V MAINTENANCE OF COMPOSITE COMPONENTS 9**

Safety Precautions-composite workshop, Care of tools, use of workshop materials, Maintenance Procedures - Maintenance Planning, stores procedures, maintenance inspection, Tools and consumables, including repair material for composite workshops, maintenance issues during the development of composite structures and the importance of providing maintenance information.

**TOTAL 45**

## TEXT BOOKS

1. Keith B. Armstrong, L. Graham Bevan, William F. Cole. "Care and Repair of Advanced Composites", SAE International; 2 edition, 2005. ISBN-10: 0768010624.

2. Advanced Composites 2nd (second) Edition by Foreman, Cindy published by Jeppesen (2002).

## REFERENCES

1. Lalit Gupta, "Advanced Composite Materials", Himalaya Publishing House, 1998. ISBN-10: 8170020697
2. Murphy, John, "The Reinforced Plastics Handbook", 2nd edition, Elsevier Advanced Technology, London, U.K., ISBN 1-85617-348-8, 1998.
3. Matthews, F.L., and Rawlings, R.D., "Composite Materials-Engineering and Science", Chapman and Hall, London, U.K., ISBN 0-412-55960-9 (hardbound), ISBN 0-412-55970-6, 1994.

## UNIT I

9

Issuance of the Civil Aviation Requirements and revisions thereof etc, Requirements to be complied with, Procedure for holding examinations, proficiency checks etc. for Defence personnel to fulfil the requirements for grant of civil licences, Procedure for an appeal on orders issued under Rule 3B of the Aircraft Rules, 1937, Regulatory Document Management System, advisory circulars & A.M.E. notices (NOTAMS) by DGCA.

Knowledge of aircraft act, 1934, aircraft rules, 1937 as far as they related to airworthiness and safety of aircraft. Knowledge of civil airworthiness requirements, aeronautical information circulars, aeronautical information publications- (relating to airworthiness),

<b>AEB3705</b>	<b>CIVIL AVIATION REQUIREMENTS - I</b>	<b>LT P C</b> <b>3 0 0 3</b>
<b>Goal</b>	To teach civil aviation rules and regulations which are being followed by Directorate General of Civil Aviation	
<b>OBJECTIVES</b>	<b>OUTCOMES</b>	
Impart the students To enable knowledge about Indian aviation rules To enrich idea about the airworthiness series A and B To provide the details about the airworthiness series C and D To enrich idea about the series E To provide the details about the series F	The student will  Be able to understand about the Indian rules and related acts. Be able to understand CAR series A and B, about ownership and MEL. Have understood about the CAR series C and D, about defect and maintenances programme Have understood about the Series E - approval of organisation. Have understood about the <a href="#">Series F – continued aiowrthiness</a>	

**UNIT II C.A.R. SERIES "B "and "C"**

**9**

C.A.R. series "B" – Minimum Equipment List (MEL), preparation and use of cockpit check list and emergency check list.

C.A.R. series 'C' – Defect recording, reporting, investigation, rectification and analysis,

**UNIT IIIC.A.R. SERIES "E"**

**9**

C.A.R. Series E – approval of organizations: Approval in categories E & G; CAR M- Objective, Definitions, Continuing Airworthiness Requirement

**UNIT IV C.A.R. SERIES**

**9**

CAR145-General, Scope, Terms of Approval, Facility Requirement, , Personnel Requirement, Certifying Staff ,Safety and Quality policy, maintenance procedures and quality system.

CAR -21, Type certificate, Noise certificate,

Approval of organizations in categories A, B, C, D, E, F, & G; requirements of infrastructure at stations other than parent base.

**UNIT V C.A.R. SERIES "F "**

**9**

C.A.R. Series "F" airworthiness and continued airworthiness:

Procedure relating to Registration / deregistration of aircraft, , Issue/validation and renewal of Certificate of Airworthiness , Issue/validation and suspension of Certificate of Airworthiness , Special Flight permits, Airworthiness requirements for Gliders , Design, Manufacture, Registration and Operation of Micro light Aircraft., Requirements for manufacture, registration and airworthiness control of hot air balloons, Age of Aircraft to be imported for Scheduled / Non-Scheduled including Charter, General Aviation and other Operations, Load and trim sheet – requirements.

**TOTAL 45**

**TEXT BOOKS**

1. Aircraft manual (India) volume – latest edition, the English book store, 17-l, Connaught circus, New Delhi.
2. Civil aviation requirements with latest amendment (section 2 airworthiness) – published by DGCA, the English book store, 17-l, Connaught circus, New Delhi.

**REFERENCES**

1. Aeronautical information circulars (relating to airworthiness) from DGCA.
2. Advisory circulars from DGCA.

**PRACTICAL**

<b>AEB3792</b>	<b>AERO ENGINE MAINTENANCE AND REPAIR LABORATORY</b>	<b>L T P C 0 0 2 1</b>
<b>GOAL</b>	To introduce the knowledge of the maintenance and repair of both piston and jet aero engines and the procedures followed for overhaul of aero engines.	
<b>OBJECTIVES</b>		<b>OUTCOMES</b>
<p>The course should enable the students to</p> <ol style="list-style-type: none"> <li>1. Understand the procedure for stripping of piston engines</li> <li>2. Know the detailed procedure for cleaning, inspection &amp; NDT checks on Piston engine components.</li> <li>3. Understand the procedure &amp; Precautions of Piston engine Re-assembly.</li> <li>4. Know the detailed procedure for stripping of Aircraft Gas Turbine Engine (APU)</li> <li>5. To familiarise with various checks carried out on A/C Gas Turbine Engine components</li> <li>6. To know the procedure and precautions to be followed for Re-assembly of an APU.</li> <li>7. To study the Piston and Gas Turbine Engine starting procedure.</li> <li>8. Study of different types of propellers and its pitch setting.</li> </ol>		<p>The students should be able to</p> <ol style="list-style-type: none"> <li>1. Carry out stripping of aircraft piston engine as per standard procedure.</li> <li>2. Carry out dimensional check and NDT checks on piston engine components</li> <li>3. Carry out Piston engine Re-assembly as per standard procedure</li> <li>4. Carry out stripping of APU with proper precautions</li> <li>5. Carry out NDT checks and dimensional checks on A/C Gas Turbine Engine components</li> <li>6. Carry out re-assembly of an APU as per standard procedures.</li> <li>7. Understand the precautions of Aero engine with precautions.</li> <li>8. Describe the types of propeller and its pitch setting</li> </ol>

#### LIST OF EXPERIMENTS

1. Stripping of a piston engine
2. Engine (Piston Engine) - cleaning, visual inspection, NDT checks.
3. Piston Engine Components - dimensional checks.
4. Piston - Engine reassembly.
5. Propeller Pitch Setting
6. Stripping of a jet engine
7. Jet Engine - identification of components & defects.
8. Jet Engine - NDT checks and dimensional checks
9. Jet Engine - reassembly.

10. Engine starting procedures.

**LIST OF EQUIPMENTS**

*(for a batch of 30 students)*

<b>Sl.No</b>	<b>Equipments</b>	<b>Qty</b>	<b>Experiments No.</b>
1	Piston Engines	2	1,2,3,4
2	Jet Engines	2	6,7,8,9
3	Propeller pitch setting stand	1	5
4	Aircraft with serviceable stand	1	1 to 10
5	Precision instruments (Vernier Caliper, Micro meter, Cylinder bore gauge, depth gauge, Bevel Protector and DTI	2 each	3,5,8
6	NDT Equipments (Defectoscope, Dyepenetrant method, Hot oil Chalk Method	1 each	2,8

<b>AEB3721</b>	<b>AIRCRAFT GENERAL ENGINEERING &amp; MAINTENANCE PRACTICES</b>	<b>LT P C 3 0 0 3</b>
<b>Goal</b>	To teach the students about the basic concept of Aircraft general engineering and maintenance practices.	
<b>OBJECTIVES</b>	<b>OUTCOMES</b>	

**ELECTIVES**

<p>Impart the students</p> <p>To enable knowledge about the aircraft maintenance practices</p> <p>To enrich idea about the aircraft tools</p> <p>To provide the details about the aircraft materials</p> <p>To enrich idea about the NDT and welding</p> <p>To provide the details about the electrical related systems.</p>	<p>The student will</p> <p>Be able to understand about the tools and maintenance practices</p> <p>Be able to understand the aircraft fastening devices and bearing</p> <p>Have understood about the composites and aircraft materials</p> <p>Have understood about the NDT methods and welding techniques</p> <p>Have understood about the Electrical Cables and Connectors ,Weight and Balance Control</p>
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**UNIT I AIRCRAFT MAINTENANCE PRACTICES 9**

Standard Maintenance Practices - Aircraft Maintenance Practices - General Purpose Tools - Measuring Tools - Torque Wrenches and Torque Loading Practices

**UNIT II TOOLS 9**

Aircraft Fastening Devices – Bolts ,Screws, Nuts and Washers, Locking Devices and Springs, Engineering Drawings and Diagrams, Bearings and Gears.

**UNIT III AIRCRAFT MATERIALS 9**

Aircraft Materials – Ferrous, Non-Ferrous ,Composite and Non-Metallic Materials Corrosion ,Corrosion Control and Protection Techniques

**UNIT IV NON-DESTRUCTIVE TESTING (NDT) AND WELDING 9**

Various Non-Destructive Testing Techniques,Dye Penetrant,Magnetic Particle, Radiography, Ultrasonic, Eddy Current,etc,. Various welding procedures and techniques used in aircraft and case studies .

**UNIT V AIRCRAFT MISCELLANEOUS 9**

Electrical Cables and Connectors, Usage of Electrical Instruments and Equipment, Testing and Calibration Methods, Pipes, Hoses and Control Cables, Aircraft Weight and Balance Control, Quality System and Procedures.

**TOTAL: 45**

**TEXT BOOKS**

1. Civil Aircraft Inspection Procedures (CAP 459-Part I, Basic)
2. Airframe & Powerplant Mechanics (General Handbook EA-AC 65-9A)



3. Shop Theory by James Anderson Earl E. Tatro,2005.

**REFERENCES**

1. Training Manual General Section Book 1 thru 7 by Dale Crane,2000
2. Aircraft Materials & Processes by Titterton.2004.
3. Machine Drawing by AC Parkinsons,2006.
4. Advanced Composites (EA-358) by Cindy Foreman ,2004
5. Digital Fundamentals by Malvino and Leech,2002.
6. Standard Aviation Maintenance Handbook EA-282-0,2000.
7. Standard Aircraft Handbook (5th Edition) -Larry Reithmaier,2002.

<b>AEB3722</b>	<b>AIRLINE OPERATION AND SCHEDULING</b>	<b>L T P C</b>  <b>3 0 0 3</b>
<b>GOAL</b>	Explores a variety of model and optimization techniques for the solution of airline schedule planning and operation	
<b>OBJECTIVES</b>		<b>OUTCOME</b>

The course should enable the student to :	The student should be able to understand :
Know about optimizing flow of networks	The airline scheduling and networks in operations.
Understand about the fleet assignment	The Fleet assignment modeling and solutions
Understand the about crew Scheduling	The crew allotment, pairing etc.
To Study about the operations recovery.	The operations control and challenges in it.
To study robust scheduling	The robust and Degradable Schedule

**UNIT I OPTIOMIZING FLOW OF NETWORKS**

**9**

Airline Schedule Planning - links to Operations - Time space networks - Constrained Shortest Path - Multi Commodity Flow Models - Column and Row Generation Techniques - Branch and Bound - Branch and Price cut - Computational Exercises - Passenger Mix Model

**UNIT II FLEET ASSIGNMENT PROBLEM**

**9**

Basic Models and Solutions - Approaches - Shortcomings Itinerary based Fleet Assignment Model - Sub network based Fleet - Assignment Model and Solution Approach - Fleet Assignment Model Extensions

**UNIT III CREW SCHEDULING**

**9**

Crew pairing problem - Bidline Generation/ Rostering - Crew Pairing problem Models and solutions - Branch on Follow ons - Review of Results of Barnhat - Aircraft Routing Problem Models - Solutions - Approaches - Constrained Shortest Path - Branch and Price - Integrated Crew Paring - Aircraft routing

**UNIT IV OPERATIONS RECOVERY**

**9**

Overview of Operation Control Centre - Aircraft Passenger Delays - Flight Postponement and Cancellation Model- Airline Operation Recovery - Challenges- - Role of Simulation

**UNIT V ROBUST SCHEDULING**

**9**

Robust Crew Scheduling - Robust Aircraft Routing - Degradable Schedule Design,2000.

**TEXT BOOKS**

1. Barnhart, C., F. Lu, and R. Sheno. "Integrated Airline Scheduling." In Operations Research in the Air Industry,1996..

**REFERENCES**

1. Barnhart, C., and K. Talluri. "Airline Operations Research.",1998.
2. Chebalov, S., and D. Klabjan. "Robust Airline Crew Scheduling: Move-up Crews.",1998.

<b>AEB3723</b>	<b>DIAGNOSTIC TECHNIQUES</b>	<b>L T P C</b> <b>3 0 0 3</b>
<b>GOAL</b>	To study the importance and the different approaches to achieve the diagnostic algorithm	
<b>OBJECTIVES</b>		<b>OUTCOME</b>
The course should enable the student to :		The student should be able to understand :
Know about the defects and failure analysis		The defect generation, defect analysis, failure types and analysis.
Understand about the maintenance system		The types of maintenance as per need.
Understand about the systematic maintenance		How to work and document the maintenance operation
To Study about the computer management in maintenance		The operations control and challenges in it.
To study about the conditioning monitoring		Condition monitoring techniques & operation

Defect generation-types of failures-Defects reporting and recording-Defect analysis-Failure analysis-Equipment down time analysis-Breakdown analysis-TA,FMEA,FMECA.

**UNIT II MAINTENANCE SYSTEMS 9**

Planned and unplanned maintenance-Breakdown maintenance-Corrective Maintenance-Opportunistic maintenance-Routine maintenance-Preventive maintenance, Predictive maintenance-Condition based maintenance system-Design out maintenance-selection of maintenance system.

**UNIT III SYSTEMATIC MAINTENANCE 9**

Codification and Cataloguing-Instruction manual and operating manual-Maintenance manual and Departmental manual-Maintenance time standard-Maintenance work order and work permit -job monitoring-Feedback and control-Maintenance records and documentation.

**UNIT IV COMPUTER MANAGED MAINTENANCE SYSTEM 9**

Selection and scope of computerization-Equipment classification-Codification of breakdown, material and facilities-Job sequencing-Material management module-Captive Engineering module

**UNIT V CONDITION MONITORING 9**

Condition monitoring techniques-Visual monitoring-Temperature monitoring-vibration monitoring-Lubricant monitoring-Cracks monitoring-Thickness monitoring-Noise and sound monitoring-condition monitoring of hydraulic system. Machine diagnostics-Objectives-Monitoring strategies-Examples of monitoring and Diagnosis - Control structures for machine diagnosis. **TOTAL : 45**

**TEXT BOOKS**

1. SUSHIL KUMAR SRIVASTAVA - "Industrial Maintenance Management", S.Chand & company Ltd., NewDelhi-1998.
2. MANFRED WECK, H.BIBRING - "Hand Book of Machine Tools,Vol 3.", John Wiley & Sons.

**REFERENCES**

1. Garg H.P, "Industrial Maintenance", S.Chand & company Ltd., NewDelhi-2000.

<b>AEB3724</b>	<b>AIRLINES MARKETING MANAGEMENT</b>	<b>L T P C</b> <b>3 0 0 3</b>
<b>GOAL</b>	To enable students understand the principles of marketing and the ways in which these principles can be applied in today's airline industry, the air transport market and its environment	
<b>OBJECTIVES</b>		<b>OUTCOME</b>
<p>The course should enable the student to :</p> <p>Know about the airline marketing.</p> <p>Understand about the marketing of air transport services.</p> <p>Understand about the product analysis</p> <p>To Study about the market research</p> <p>To study about the IT impact in decision making</p>		<p>The student should be able to understand :</p> <p>The marketing environment and principles.</p> <p>The analysis and types of marketing related air transport services</p> <p>Product life cycle in airline marketing in detail</p> <p>The tools involved in the market research</p> <p>How online and IT enabled marketing played role</p>

## **UNIT I INTRODUCTION**

**5**

Marketing conceptual frame work - marketing environment - customer oriented organization - marketing interface with other functional areas marketing in a globalised environment Marketing Mix - Stages in the Application of Marketing Principles to Airline Management

## **UNIT II MARKET OF AIR TRANSPORT SERVICES**

**10**

Customer - Definition - Apparent and True Needs - Industrial Buying Behaviour - Customer in the Business Air Travel Market - Customer in Leisure Air Travel Market - Customer in the Air Freight Market - Market Segmentation in Air Passenger & Air Freight Market - Marketing Environment - Theoretical Basis of PESTE Analysis - Building Customer Satisfaction

## **UNIT III PRODUCT ANALYSIS IN AIRLINE MARKETING**

**10**

Product - definition - Product Life Cycle - Product Life Cycles in Aviation Industry - Managing Product Portfolio - Balancing Risk and Opportunity - Fleet & Schedules related Product Features - Customer Service Related Product Features - Pricing Decisions - Building Blocks in the Airline Pricing Policy - Uniform and Differential Pricing - Distribution Channel Strategies - Travel Agency Distribution System - Global Distribution System - promotion methods. Advertisement and personal selling, public relations.

## **UNIT IV MARKETING RESEARCH**

**10**

Types, process - tools and techniques - application of marketing research - product launching, demand estimation, advertising, brand preferences, customer satisfaction, retail stores image, customer perception, distribution, customer relationship, competitor analysis and related aspects - preparation of marketing research report - sample case studies.

## **UNIT V INFORMATION TECHNOLOGY IMPACT ON MARKETING DECISIONS**

**10**

Online marketing - web based marketing programmes - emerging now trends and challenges to marketers.

**TOTAL : 45**

## **TEXT BOOK**

1. Stephen Shaw "Airline Marketing and Management " Ashgate Sixth Edition,2000.

## **REFERENCES**

1. Philip Kotler: Marketing management (Millennium edition), prentice hall of India P (ltd), New Delhi 2001.

2. Micheal R.Czinkota & Masaaki Kotabe, Marketing management, Vikas Thomson learning 2000.
3. Douglas, J.Darymple marketing management John Wiley & Sons, 2000
4. NAG, marketing successfully A professional perceptive, macmilan 2001.
5. Boyd Walker, Marketing Management, McGraw Hill, 2002
6. Aakar Day, Kumar, Essential of Marketing Research Keith Flether, Marketing Management and Information Technology Prentice Hall, 1998.

<b>AEB3725</b>	<b>HELICOPTER MAINTENANCE</b>	<b>L T P C</b> <b>3 0 0 3</b>
<b>GOAL</b>	To make the students to understand the basic concepts of Helicopter maintenance and repair procedures followed for overhauling.	
<b>OBJECTIVE</b>	<b>OUTCOME</b>	
<p>The subject should enable the students to</p> <ol style="list-style-type: none"> <li>1. Fundamentals of Helicopter and ground handling of bearings</li> <li>2. Basic concepts of Head maintenance, vibration tracking of helicopter blades. Flight control systems and mast adjustment concepts</li> <li>3. Concept of main rotor transmission, spray clutch with importance of torque meter maintenance</li> <li>4. Importance of power plants and tail rotors servicing and system rigging is executed</li> <li>5. Basic fuselage maintenance and special hardware requirements</li> </ol>	<p>The students should be able to</p> <ol style="list-style-type: none"> <li>1. Helicopter basics are clearly understood and various maintenance procedures are followed</li> <li>2. Get a clear idea about Head maintenance with flight and mast control systems</li> <li>3. Understand the transmission process in helicopter rotor and torque meter working</li> <li>4. Power plant rotors and tail rotor working is studied. Concept of rigging is clearly understood</li> <li>5. Get an idea about fuselage maintenance procedures with special hardware requirements</li> </ol>	

**UNIT I      HELICOPTER FUNDAMENTALS**

**5**

Basic directions - Ground handling, bearings - Gears.

**UNIT II      MAIN ROTOR SYSTEM**

**9**

Main Rotor Head maintenance - blade alignment - Static main rotor balance - Vibration - Tracking - Span wise dynamic balance - Blade sweeping -Electronic balancing - Dampener maintenance - Counter weight adjustment - Auto rotation adjustments - Mast & Flight Control Rotor - Mast - Stabilizer, dampeners - Swash plate flight control systems collective - Cyclic - Push pull tubes - Torque tubes - Bell cranks - Mixer box - Gradient unit control boosts - Maintenance & Inspection control rigging.

**UNIT III      MAIN ROTOR TRANSMISSIONS**

**12**

Engine transmission coupling - Drive shaft - Maintenance clutch - Free wheeling units - Spray clutch - Roller unit - Torque meter - Rotor brake - Maintenance of these components - vibrations - Mounting systems - Transmissions.



**UNIT IV POWER PLANTS & TAIL ROTORS****12**

Fixed wing power plant modifications – Installation – Different type of power plant maintenance. Tail rotor system – Servicing tail rotor track – System rigging.

**UNIT V AIRFRAMES AND RELATED SYSTEMS****7**

Fuselage maintenance – Airframe Systems – Special purpose equipment.

**TOTAL : 45****TEXT BOOK**

1. JEPPESEN, “Helicopter Maintenance”, Jeppesons and Sons Inc., 2000.

**REFERENCES**

1. “Civil Aircraft Inspection Procedures”, Part I and II, CAA, English Book House, New Delhi -16.
2. LARRY REITHMIER, “Aircraft Repair Manual”, Palamar Books Marquette, 1992.

<b>AEB3726</b>	<b>AIRCRAFT NAVIGATION SYSTEMS</b>	<b>L T P C</b> <b>3 1 0 4</b>
<b>GOAL</b>	To study the different types and techniques of navigation systems	
<b>OBJECTIVES</b>		<b>OUTCOME</b>
The course should enable the student to :		The student should be able to understand :
Know about the radio navigation		The types of radio navigation
Understand about the approach and landing aid		The types of system in approach and landing
Understand about the inertial sensors		The gyros and accelerometers

To Study about the inertial navigation systems	
To study about the satellite & hybrid navigation	The INS, gimbal and other related devices.
	Advance GPS and INS systems

**UNIT I RADIO NAVIGATION**

**9**

Different types of radio navigation- ADF, VOR/DME- Doppler -LORAN and Omega

**UNIT II APPROACH AND LANDING AID**

**9**

ILS, MLS, GLS - Ground controlled approach system - surveillance systems-radio altimeter

**UNIT III INERTIAL SENSORS**

**9**

Gyroscopes-Mechanical-electromechanical-Ring Laser gyro- Fibre optic gyro, Accelerometers

**UNIT IV INERTIAL NAVIGATION SYSTEMS**

**9**

INS components: transfer function and errors-The earth in inertial space, the coriolis effect-Mechanisation. Platform and Strap down, INS system block diagram, Different co-ordinate systems, Schuler loop, compensation errors, Cross coupling, Gimbal lock, Alignment.

**UNIT V SATELLITE NAVIGATION & HYBRID NAVIGATION**

**9**

Introduction to GPS -system description -basic principles -position and velocity determination-signal structure-DGPS, Introduction to Kalman filtering-Estimation and mixed mode navigation-Integration of GPS and INS-utilization of navigation systems in aircraft

**TOTAL: 45**

**TEXT BOOK**

1. Nagaraja, N.S. "Elements of Electronic Navigation", Tata McGraw-Hill Pub. Co., New Delhi, 1975.
2. Slater, J.M. Donnel, C.F.O and others, "Inertial Navigation Analysis and Design", McGraw-Hill Book Company, New York, 1964.

3. Sen, A.K. & Bhattacharya, A.B. "Radar System and Radar Aids to Navigation", Khanna Publishers, 1988.

**REFERENCES**

1. Albert Helfrick, 'Practical Aircraft Electronic Systems', Prentice Hall Education, Career & Technology, 1995
2. Albert D. Helfrick, 'Modern Aviation Electronics', Second Edition, Prentice Hall Career & Technology, 1994
3. George M Siouris, 'Aerospace Avionics System; A Modern Synthesis', Academic Press Inc., 1993
4. Myron Kyton, Walfred Fried, 'Avionics Navigation Systems', John Wiley & Sons, 1997

<b>AEB3727</b>	<b>ENTREPRENEURSHIP DEVELOPMENT</b>	<b>L T P C</b> <b>3 0 0 3</b>
<b>GOAL</b>	To provide the theoretical foundation of entrepreneurship development	
<b>OBJECTIVES</b>		<b>OUTCOME</b>
<p>The course should enable the student to :</p> <p>Know about the entrepreneurial competence</p> <p>Understand about the entrepreneurial environment</p> <p>Understand about the business plan preparation</p> <p>To Study about the launching of small business</p> <p>To study about the management of small business</p>		<p>The student should be able to understand :</p> <p>The concept, personality, knowledge, skills required</p> <p>The role of family &amp; society, rules and regulations of government</p> <p>The sources, criteria, capital, budget, feasibility</p> <p>The finance, human resource, growth strategy</p> <p>monitoring and evaluation of Business -</p>

	rehabilitation of business units and effective management of small business
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**UNIT I ENTREPRENEURIAL COMPETENCE 6**

Entrepreneurship concept – Entrepreneurship as a Career – Entrepreneur – Personality  
 Characteristics of Successful. Entrepreneur – Knowledge and Skills Required for an  
 Entrepreneur.

**UNIT II ENTREPRENEURIAL ENVIRONMENT 12**

Business Environment - Role of Family and Society - Entrepreneurship Development  
 Training and Other Support Organisations Services - Central and State Government  
 Industrial Policies and Regulations - International Business.

**UNIT III BUSINESS PLAN PREPARATION 12**

Sources of Product for Business - Prefeasibility Study - Criteria for Selection of Product -  
 Ownership - Capital - Budgeting Project Profile Preparation - Matching Entrepreneur with  
 the Project - Feasibility Report Preparation and Evaluation Criteria.

**UNIT IV LAUNCHING OF SMALL BUSINESS 10**

Finance and Human Resource Mobilization Operations Planning - Market and Channel  
 Selection - Growth Strategies - Product Launching.

**UNIT V MANAGEMENT OF SMALL BUSINESS 5**

Monitoring and Evaluation of Business - Preventing Sickness and Rehabilitation of  
 Business Units. Effective Management of small Business.

**TOTAL: 45**

**TEXT BOOKS:**

1. Hisrich, 'Entrepreneurship', Tata McGraw Hill, New Delhi, 2001.
2. P. Saravanavel, 'Entrepreneurial Development', Ess Pee kay Publishing House, Chennai -1997.
3. S.S.Khanka, 'Entrepreneurial Development', S.Chand and Company Limited, New Delhi, 2001.

<b>AEB3728</b>	<b>AVIATION SAFETY MANAGEMENT</b>	<b>L T P C 3 0 0 3</b>
<b>GOAL</b>	To teach the students an understanding of flight safety and other key safety issues in the aviation industry	
<b>OBJECTIVES</b>		<b>OUTCOME</b>
The course should enable the student to: <ul style="list-style-type: none"> <li>• Know about the Aviation safety</li> <li>• Understand about the human factors in aviation safety</li> <li>• Understand about aviation safety program elements</li> <li>• To Study about the aircraft maintenance safety</li> <li>• To study about the airports and heliports</li> </ul>		The student should be able to understand: <ul style="list-style-type: none"> <li>• The concept of safety, accident causes, prevention methodology and risk management</li> <li>• The risk theory, Human difficulties, training, performance and its factors</li> <li>• Internal Reporting Systems, Aviation Safety Committees, Inspection Programs and Evaluation, Flight Operation Safety Inspection and Format - Aviation Safety Education and Training and Safety Awards Programs</li> <li>• Aircraft Discrepancies, Configuration Control, Maintenance Engine Runs and Taxiing, Maintenance Test Flights, maintenance Analysis, Tool Control. Hazardous Waste Disposal – Bogus parts</li> <li>• Airport Certification Manual, Emergency Plan, Airports/Heliports criteria , Foreign Object Control and maintenance of airports</li> </ul>

## **UNIT I INTRODUCTION**

**12**

Aviation safety – Meaning – Need – Economic of Aviation Safety – Safety Vs Mission – Randomness of Damage and Injury – Zero Accident Rate – Accident causes – Multiple Vs Single Cause – Aircraft Accident - Aircraft Mishap – Aircraft Incident - Building Aviation Safety Program – Prevention Methodology – Risk Management

## **UNIT II HUMAN FACTORS IN AVIATION SAFETY**

**8**

Theory of Risk – Changing the Behaviour of the risk takers – Attitudes – Discipline – Punishment – Protection of Safety - Motivating Safe Behaviour – Human factors difficulties – Training involving human factors – Human Performance Concerns – Human Performance Factors

## **UNIT III AVIATION SAFETY PROGRAM ELEMENTS**

**10**

Internal Reporting Systems - Information Distribution systems – Aviation Safety Committees – Aviation Safety Inspection Programs - Aviation safety program Evaluation – Flight Operation Safety Inspection – Safety Inspection report Format - Aviation Safety Education and Training – Aviation Safety Awards Programs – Accident Preparation and Investigation

**UNIT IV AIRCRAFT MAINTENANCE SAFETY**

**8**

Aircraft Discrepancies - Delayed and Deferred Discrepancies - Training - Configuration Control - Maintenance Engine Runs and Taxiing - Maintenance Test Flights - maintenance Analysis - Tool Control - Hazardous Waste Disposal - Bogus parts - Technical Data - maintenance Inspections - Flight Line Practices - Maintenance Safety Programs - Maintenance Safety Inspections

**UNIT V AIRPORTS AND HELIPORTS**

**7**

Airport Certification Manual - Airport Emergency Plan - Airports/Heliports criteria - Airfield Criteria - Airspace Criteria - Foreign Object Control - Bird Hazards - Snow and Ice Removal - Fuel Handling - Vehicle Control - Airport and Heliport Safety Inspections

**TOTAL: 45**

**TEXT BOOKS**

1. Aviation Safety Programs - A Management Handbook - Richard H. Wood.

<b>AEB3729</b>	<b>SYSTEM SIMULATION AND MODELLING</b>	<b>L T P C</b> <b>3 0 0 3</b>
<b>GOAL</b>	To introduce the concepts of systems simulation design and modeling techniques	
<b>OBJECTIVES</b>		<b>OUTCOME</b>
The course should enable the student to :		The student should be able to understand :
Know about the fundamentals of simulation		The simulation concept, modeling, various types, usage as a tool
Understand about the random numbers		The pseudo random numbers and its generation and testing of random numbers
Understand about the design of simulation experiments		The formulation, data collection experimental considerations, flow chart, output and results interpretation
To Study about the simulation languages		The study of GPS and its applications
To practice case studies and carry out mini projects		Application of simulation language studied and doing a project involving systems like, queuing, production, inventory, maintenance and replacement systems

**UNIT I INTRODUCTION: 9**

Systems, modeling, general systems theory, concept of simulation, simulation as a decision making tool, types of simulation.

**UNIT II RANDOM NUMBERS: 9**

Pseudo random numbers, methods of generating random varieties, discrete and continuous distributions, testing of random numbers.

**UNIT III DESIGN OF SIMULATION EXPERIMENTS: 9**

Problem formulation, data collection and reduction, time flow mechanism, key variables, logic flow chart, starting condition, run size, experimental design consideration, output analysis and interpretation validation.



**UNIT IV SIMULATION LANGUAGES:**

9

Simulation languages - study of GPSS and Applications.

**UNIT V CASE STUDIES/MINI PROJECT**

9

Development of simulation models using the simulation language studied for systems like, queuing systems, production systems, inventory systems, maintenance and replacement systems, investment analysis and network in aviation industry.

**TOTAL: 45****TEXT BOOKS**

1. Jerry Banks and John S.Carson, Barry L Nelson, David M.Nicol, Discrete event system simulation, Prentice Hall, India, 2002.
2. Shannon, R.E. Systems simulation, The art and Science, Prentice Hall, 1975. Thomas J.Schriber, Simulation using GPSS, John Wiley, 1991

**REFERENCES**

1. Narsingh Deo, "System Simulation with Digital Computer", PHI, 1979.
2. Subramanian KRV and Sundaresan R Kadayam, "System Simulation - An Introduction to GPSS", CBS Publishers, New Delhi, 1993.
3. Zaven A. Karian and Edward J. Dudewicz, "Modern Statistical, Systems, and GPSS Simulation", CRC Press, Washington D C, 1999.

<b>AEB3730</b>	<b>ADVANCED OPTIMIZATION TECHNIQUES</b>	<b>L T P C</b> <b>3 0 0 3</b>
<b>GOAL</b>	To know the various aspects of optimization problems and its application	
<b>OBJECTIVES</b>		<b>OUTCOME</b>

<p>The course should enable the student to :</p> <p>Know about the fundamentals of optimization</p> <p>Understand about different methods of optimization</p>	<p>The student should be able to understand :</p> <p>The classification and application of optimization</p> <p>Karmakars method, Quadratic programming, non-linear programming, unconstrained optimization techniques, basics of constrained optimization</p> <p>Integer and non linear programming methods and application and basics of geometric programming</p> <p>Multi-objective optimization methods and application, separable programming and stochastic programming</p> <p>Introduction to Genetic algorithms, neural network based optimization and optimization of fuzzy systems</p>
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**UNIT I INTRODUCTION 9**

Classification of optimization problems, Applications of optimization, concepts of design vector, Design constraints, constrains surface, objective function surfaces and multi-level optimization.

**UNIT II OPTIMIZATION - I 9**

Karmakars method of solving L.P.problem, Quadratic programming, non-linear programming - unconstrained optimization techniques, Basics of constrained optimization.

**UNIT III OPTIMIZATION - II 9**

Integer linear programming methods and application, Introduction to integer non-linear programming, Basics of geometric programming.

**UNIT IV OPTIMIZATION - III 9**

Multi-objective optimization methods and application, Formulation of problems - Separable programming and stochastic programming.

**UNIT V OPTIMIZATION - IV 9**

Introduction to Genetic algorithms, Simulated Annealing, neural network based optimization and optimization of fuzzy systems.

**TOTAL: 45**

**TEXT BOOKS**

1. Fredrick S.Hillier and G.J.Liberman, "Introduction to Operations Research", McGraw Hill Inc. 1995.

**REFERENCES**

1. Singiresu S.Rao, "Engineering optimization - Theory and practices", John Wiley and Sons, 1996.
2. Ravindran - Phillips -Solberg, "Operations Research - Principles and Practice", John Wiley and Sons, 1987.

<b>AEB3731</b>	<b>LOGISTICS AND SUPPLY CHAIN MANAGEMENT</b>	<b>L T P C 3 0 0 3</b>
<b>GOAL</b>	To know the importance and the role of logistical management in the aviation industry	
<b>OBJECTIVES</b>		<b>OUTCOME</b>
The course should enable the student to :		The student should be able to understand :
Know about the overview of supply chain management		The role and scope of supply chain management. customer driver, logistics and competitive strategy
Understand about co-ordination and management of transportation		The inventory, order processing, purchasing, ware housing, Materials handling packaging and customer service management
Understand about the interfaces with other area		The marketing. finance and supply chain interface. distribution planning and warehouse location, distribution policies and plans The finance, human resource, growth strategy
		Ocean Carrier Management, Import-Export Logistic

<p>To understand about international logistics</p> <p>To study about the management of small business</p> <p>To understand decision models</p>	<p>Management- case study in the airline industry</p> <p>Decision support models, Transportation Systems, Warehouse Design, Distribution Inventory Policies, Transshipment and information Systems</p>
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**UNIT I OVERVIEW OF SUPPLY CHAIN MANAGEMENT 9**

Role of Supply Chain Management: Scope and Importance, Customer Driver Strategies, Logistics and Competitive Strategy: Systems view.

**UNIT II CO-ORDINATION AND MANAGEMENT OF TRANSPORTATION 9**

Inventory, Order Processing, Purchasing, Warehousing, Materials Handling, Packaging, Customer Service Management.

**UNIT III INTERFACES WITH OTHER AREA 9**

Marketing and Supply Chain Interface, Finance and Supply Chain Interface. Distribution Network Planning and Warehouse Location, Integrated Supply, Production, distribution Policies and Plans.

**UNIT IV INTERNATIONAL LOGISTICS 9**

Ocean Carrier Management, Import-Export Logistic Management- case study in the airline industry

**UNIT V DECISION MODELS 9**

Decision support models of supply chain management: Transportation Systems, Warehouse Design, Distribution Inventory Policies, Transshipment, etc. Information Systems.

**TOTAL: 45**

## TEXT BOOKS

1. Donald J. Bowersox & David J. Closs, Logistical Management, Tata McGraw-Hill Editions, New Delhi, 2000.
2. Jeremy F. Shapiro, Modelling and Supply Chain, Thomson Learning, 2001.
3. Martin Christopher, Logistics and supply chain management, financial times management, 2000.

## REFERENCES

1. David Taylor and David Brunt, Manufacturing Operations and Supply Chain Management, Vikas Thomson Learning, 2001.
2. Philippe - Pierre Dornier, Global operations & logistics, John Wiley & sons Inc, New York,

<b>AEB3732</b>	<b>AIRCRAFT SYSTEMS AND INSTRUMENTATIONS</b>	<b>LT P C</b> <b>3 0 0 3</b>
<b>Goal</b>	To describe the principle and working of Aircraft systems and Instruments	

2002.

3. Monczka / Trend / Handfiled, Purchasing and Supply chain management, Thomson south- western college publishing, 2000.
4. B.S. Sahay, Supply chain management for global competitiveness, Macmillan India Ltd, Delhi, 2000.
5. David Hutchins, Just in Time, Jaico Publishing House, Mumbai, 2001
6. David Simchi - Levi & Philip Kaminsk, Designing and managing the supply chain, McGraw-Hill Companies Inc., 2000.

OBJECTIVES	OUTCOMES
Impart the students To enable knowledge about airplane control systems To enrich idea about the aircraft systems To provide the details about the engine systems To enrich idea about the aircraft auxiliary systems To provide the details about the aircraft instruments	The student will  Be able to understand about the flight controls and communication & Navigation systems Be able to understand about the hydraulic and pneumatic systems. Have understood about the piston and jet engine systems Have understood about the oxygen, icing system  Have understood about the Flight and Navigation Instruments and engine instruments

## UNIT I AIRPLANE CONTROL SYSTEMS

9

Conventional Systems - Power assisted and fully powered flight controls - Power actuated systems - Engine control systems - Push -pull rod system, flexible push -pull rod system - Components - Modern control systems - Digital fly by wire systems - Auto pilot system active control technology, Communication and Navigation systems, Instrument landing systems, VOR - CVR case studies.

## UNIT II AIRCRAFT SYSTEMS

9

Hydraulic systems - Study of typical Hydraulic systems- components - Hydraulic system controllers - Modes of operation - Pneumatic systems - Advantages - Working principles - Typical air pressure system - Brake system - Typical pneumatic power system - Components, Landing Gear systems - Classification - Shock absorbers - Retractive mechanism.

## UNIT III ENGINE SYSTEMS

9

Fuel systems for Piston and jet engines - Components of multi engines. Lubricating systems for piston and jet engines - Starting and Ignition systems - Typical examples for piston and jet engines

## UNIT IV AUXILLIARY SYSTEM

9

Basic Air cycle systems - Vapour Cycle systems, Boost-Strap air cycle system - Evaporative vapour cycle systems - Evaporative air cycle systems - Oxygen systems - Fire protection systems, Deicing and anti- icing systems.

## UNIT V AIRCRAFT INSTRUMENTS

9

Flight and Navigation Instruments - Gyroscope - Accelerometers, Air speed Indicators - TAS, EAS- Mach Meters - Altimeters - Principles and operation - Study of various types of

engine instruments - Tachometers - Temperature gauges - Pressure gauges - Operation and Principles of Inertial navigation system-GPWS-GPS.

**TOTAL: 45**

**TEXT BOOKS**

1. McKinley, J.L., and Bent, R.D., "Aircraft Maintenance & Repair", McGraw-Hill, 1993.
2. "General Hand Books of Airframe and Powerplant Mechanics", U.S. Dept. of Transportation, Federal Aviation Administration, The English Book Store, New Delhi 1995.

**REFERENCES**

1. Mekinley, J.L. and Bent, R.D., "Aircraft Power Plants", McGraw-Hill, 1993.
2. Pallet, E.H.J., "Aircraft Instruments & Principles", Pitman & Co., 1993.
3. Treager, S., "Gas Turbine Technology", McGraw-Hill, 1997.

<b>AEB3733</b>	<b>CIVIL AVIATION REQUIREMENTS –II</b>	<b>L T P C</b> <b>3 0 0 3</b>
<b>GOAL</b>	To teach a civil aviation rules and regulations which are being followed by directorate general of civil aviation	
<b>OBJECTIVE</b>		<b>OUTCOME</b>

The subject should enable the students to	The students should be able to
<ol style="list-style-type: none"> <li>1. Understand the aircraft fuelling procedure and its precaution while fuelling.</li> <li>2. Know the storage, handling and quality control of aviation fuel.</li> <li>3. Know the overall and periodical inspection various aircraft instruments and equipments.</li> <li>4. Conceive the significance of carrying out mandatory modifications and inspections.</li> <li>5. Know the operational requirement to be compiled by operators for various operations.</li> <li>6. Know the installation and maintenance procedure of various communication and navigation equipment.</li> <li>7. Know about the storage condition and storage service life of aircraft components containing rubber parts.</li> <li>8. Understand the significance and the procedure of flight test.</li> <li>9. Know the various log books, documents, used in aircrafts and its importance to ensure air worthiness.</li> </ol>	<ol style="list-style-type: none"> <li>1. Carrying out fuelling and de-fuelling of modern aircrafts</li> <li>2. Understand the handling and quality control procedure of aviation fuel.</li> <li>3. Describe the overhaul and inspection procedure of various instruments</li> <li>4. Know the importance of carrying out modifications and its procedure in detail</li> <li>5. Understand the minimum operational requirement for aircrafts and helicopters</li> <li>6. Describe the installation and maintenance procedure of various communication, navigation and radar equipment.</li> <li>7. Store the aircraft components containing rubber parts as per CAR</li> <li>8. Describe the detail procedure of flight test</li> <li>9. Understand the log book entry procedure and various documents to be on board during various phases of flight</li> </ol>

**UNIT I C.A.R. SERIES " H, & I "**

**9**

Aircraft fuelling procedures, Aviation fuel at airport - Storage, handling and quality control, Aircraft equipment and instruments for flying training organisations and aerial work operations, Flight Data Recorders, Combination Recorders, Data-link Recorders, Airborne Image Recorders, Airborne Image Recording System and Aircraft Data Recording System , Cockpit voice recorders and Cockpit Audio Recording System, Ground Proximity Warning Systems (GPWS), Installation of Airborne Collision Avoidance System.

**UNIT II C.A.R. SERIES " L& M"**

**9**



<b>AEB3734</b>	<b>MAINTENANCE AND</b>	<b>LT P C</b>
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of authorisation to Aircraft Maintenance Engineer's/Approved personnel, Approval of Flight Engineer Examiners and Check Flight Engineers, Procedure for issue/renewal/extension of Student Flight Engineer/Flight Engineer's licence, Validation of Foreign Licences of Aircraft Maintenance Engineers, Series M-Mandatory Modifications/ Inspections

**UNIT III C.A.R. SERIES " O & R " 9**

Manufacture, Registration and Operation of Powered Hang Gliders, Requirements for preparation of operations manual, Airworthiness and Maintenance Requirements for Cat II and Cat IIIA operations. Series 'R'- Installation of Communication, Navigation and Radar equipment, Installation of Mode 'A/C' and Mode 'S' Transponders,

**UNIT IV C.A.R. SERIES " T " 9**

C.A.R. series T:

Flight testing of aircraft for which a C of A had been previously issued

**UNIT-V CAR X 9**

**C.A.R. series X – miscellaneous requirements:**

Weight and balance control of an aircraft, Provision of Medical Supplies in Aircraft, Use of furnishing materials in aircraft, Flammability requirements for furnishing materials to be used in aircraft, Aircraft Log Books, Document to be carried on board by Indian registered aircraft , Procedure for issue of taxi permit , Requirements for issue of taxi permit ,

Provision of first aid kits & physician's kit in an aircraft; concessions; procedure for issue of type approval of aircraft components and equipment including instruments. Civil Aviation Requirement - 145

**TOTAL 45 HOURS**

**TEXT BOOKS**

1. Aircraft manual (India) volume – latest edition, the English book store, 17-l, Connaught circus, New Delhi.
2. Civil aviation requirements with latest amendment (section 2 airworthiness) – published by DGCA, the English book store, 17-l, Connaught circus, New Delhi.

**REFERENCE**

1. Aircraft manual (India) -latest edition, the English book store, 17-l, Connaught circus, New Delhi.
2. Civil Aviation Requirements with latest amendment (section 2 Airworthiness) – published by DGCA, the English book store, 17-l, Connaught circus, New Delhi.
3. Aeronautical information circulars / Advisory circulars (relating to airworthiness) from DGCA.

	<b>RELIABILITY ENGINEERING</b>	<b>3 0 0 3</b>
<b>Goal</b>	To introduce the concepts of reliability and diagnostic maintenance techniques	
<b>OBJECTIVES</b>	<b>OUTCOMES</b>	
Impart the students To enable knowledge about maintenance management To enrich idea about the types of maintenance. To provide the details about the diagnostic maintenance To enrich idea about the concept of reliability To provide the details about design of reliability	The student will  Be able to understand about the objective and concepts in maintenance management. Be able to understand about the types, advantages and limitations of maintenance Have understood about the types of different diagnostic maintenance. Have understood about the methodology and calculating methods. Have understood about different analysis methods.	

#### **UNIT I MAINTENANCE MANAGMENT**

**9**

Need for maintenance-Objective- Concepts-Types of maintenance-Organization-Trade force mix, type and location-Maintenance costs-Benefits-Computer Aided Maintenance management-Total productive maintenance.

#### **UNIT II TYPES OF MAINTENANCE**

**9**

Breakdown and Preventive maintenance-Advantages and Limitations-Maintenance prevention-Diagnostic maintenance-Design out maintenance-Opportunity maintenance

#### **UNIT III DIAGNOSTIC MAINTENANCE**

**9**

Leak detection-wear monitoring-Temperature monitoring-Vibration monitoring-Signature analysis-Shock monitoring-Lubricant-Analysis-Methodology-Equipments-Applications

#### **UNIT IV CONCEPTS OF RELIABILITY**

**9**

Elements of Probability-Reliability Definition-Measures of Reliability-Failures-Classification of failures-Failure data analysis-Availability-Criticality matrix-Event tree analysis-Utilization factor-Factors affecting reliability.

#### **UNIT V DESIGN FOR RELIABILITY**

**9**

Analysis of reliability data-Weibull analysis-Design and manufacture for Reliability-Reliability of parts and components-Design for system reliability-Economics of standby or redundancy in a production system-reliability testing-Types.

**TOTAL: 45**

### **TEXT BOOKS**

1. HIGGINS and MORROW,-" Maintenance Engineering Handbook ", Tata McGraw Hill,1985.
2. COLLECT, " Mechanical Fault Diagnosis and Condition monitoring "- McGraw Hill-1985.
3. MILLER & BLOOD .- " Modern maintenance Management " -Tarapooriwala & sons,1976.

### **REFERENCES**

1. JENTRY EJ and KUMAMOTO,H, " Reliability Engineering and Test assessment ", Prentice Hall,1992.
- 2.CARTER,A.D.S. " Mechanical Reliability ",-Macmillan,1984.
3. NAKAJIMA.S.. ," Introduction to TPM - Total Productive Maintenance", Productivity Press-1995.
4. O'CONNOR,P.D.T', " Practical Reliability Engineering ", John Wiley-1994.
5. KELLEY.A.& M.J.HARRIS,-" Management of Industrial Maintenance" , Newnes-Butter worth.