

AFFILIATED INSTITUTIONS
ANNA UNIVERSITY, CHENNAI
CURRICULAM AND SYLLABI – 2010
B.Sc – AERONAUTICAL SCIENCE (3 YEARS)
SEMESTER I

COURSE CODE	COURSE TITLE	L	T	P	C
THEORY					
YEN 005	Technical English – I	3	1	0	4
YMA 008	Applied Mathematics – I	3	1	0	4
YAE 911	Engineering Graphics	1	3	0	4
YAE 99	Fundamentals of Computing	3	0	0	3
YAE 913	Mechanics & Materials	3	1	0	4
YAE 914	Fluid Mechanics	3	0	0	3
PRACTICALS					
YAE 916	Engineering Practices Laboratory	0	0	3	2
YAE 917	Computer Practices Lab	0	0	3	2
TOTAL		16	6	6	26

SEMESTER II

COURSE CODE	COURSE TITLE	L	T	P	C
THEORY					
YMA 009	Mathematics – II	3	1	0	4
YAE 921	Applied Engineering Mechanics	3	1	0	4
YAE 922	Basic Electrical & Electronics Engineering	3	0	0	3
YAE 923	Elements of Aeronautics	3	0	0	3
YAE 924	Aerospace Materials & Composites	3	0	0	3
PRACTICALS					
YAE 926	Strength of Materials Laboratory	0	0	3	2
YAE 927	Composite Lab	0	0	3	2
TOTAL		15	2	6	21

SEMESTER III

COURSE CODE	COURSE TITLE	L	T	P	C
THEORY					
YAE 931	Flight Mechanics and Performance	3	0	0	3
YAE 932	Aircraft Structure	3	0	0	3
YAE 933	Engineering Thermodynamics	3	0	0	3
YAE 934	Fundamentals of Aerodynamics	3	0	0	3
YAE 935	Propulsion Theory	3	0	0	3
PRACTICALS					
YAE 937	Aerodynamics Laboratory	0	0	3	2
YAE 938	CAD Laboratory	0	0	3	2
TOTAL		15	0	6	19

SEMESTER IV

COURSE CODE	COURSE TITLE	L	T	P	C
THEORY					
YCH 003	Environmental Science and Engineering	3	0	0	3
YAE 941	Aircraft Engine and Components	3	0	0	3
YAE 942	Aircraft Design	3	0	0	3
YAE 943	Aircraft Systems and Instrumentations	3	0	0	3
YAE 944	Flight Stability and Control Engineering	3	0	0	3
PRACTICALS					
YAE 946	Aircraft Structure Laboratory	0	0	3	2
YAE 947	Aircraft Design and Drafting Laboratory	0	0	3	2
TOTAL		15	0	6	19

SEMESTER V

COURSE CODE	COURSE TITLE	L	T	P	C
THEORY					
YAE 951	Aviation Legislation	3	0	0	3
YAE 952	Aircraft Rules & Regulations	3	0	0	3
YAE 953	Airframe Repair & Maintenance	3	0	0	3
YAE 954	Modeling & Simulation	3	0	0	3
YAE 955	Aircraft Communication & Navigation	3	0	0	3
PRACTICALS					
YAE 957	Aircraft Systems Laboratory	0	0	3	2
YAE 958	Avionics Laboratory	0	0	3	2
TOTAL		15	0	6	19

SEMESTER VI

COURSE CODE	COURSE TITLE	L	T	P	C
THEORY					
YAE 961	Airport Engineering	3	0	0	3
YAE 962	Ground Handling, Safety & Support Systems	3	0	0	3
YAE 963	Air Transportation & Economy	3	0	0	3
PRACTICAL					
YAE 965	Project Work	0	0	12	6
TOTAL		9	0	12	15

UNIT I FOCUS ON LANGUAGE**12**

Word formation with prefixes and suffixes - synonyms and antonyms - nominal compounds – subject - verb agreement - tenses (simple present, present continuous, present perfect, simple past, past continuous, past perfect, simple future) - impersonal passive - comparative adjectives – purpose and function cause and effect – imperatives – gerund - preposition

Activities Suggested

- Using prefixes and suffixes to change the grammatical functions of words – giving synonyms and antonyms
- Expansion of noun + noun phrases - correction of errors in the given sentences.
- Providing a context for the use of the tenses - rewriting the sentences in the impersonal passive form.
- Using comparative forms of adjectives in sentences giving a pair of purpose and function statements to be linked with expressions like to / in order to / so as to (Eg: He wanted to check the oil in the engine. He used a dipstick. He used a dipstick in order to check the oil in the engine).
- Giving pairs of cause and effect statements to be linked with expressions like as / since / because - rewriting imperative sentences using 'should'- (e.g.: Store the cylinders in upright position. – The cylinders should be stored in upright position).
- Rewriting infinitive forms as gerunds (eg: To modernize sick industries is difficult - Modernizing sick industries is difficult.) - fill in the blanks with appropriate prepositions.

Note: All examples pertaining to this unit should preferably be related to science and technology.

UNIT II READING I**12**

Predicting the content – skimming the text for the gist – identifying the topic sentence – guessing the meaning of words from contexts – scanning for specific information - transfer of information – cloze reading.

Activities Suggested

- Taking a quick glance at the text to predict the content – reading to identify the main content
- Identifying the topic sentence in a paragraph – providing suitable titles for paragraphs – matching the titles with the paragraphs.
- Guessing the contextual meaning of words – comprehending a passage and answering questions of varied kinds.
- Transferring of information from a text to graphical representations like tree diagram / flow chart / bar chart / pie chart/ tables.
- Filling the gaps with appropriate missing words from the given list.

UNIT III READING II**12**

Note – making, guided and open: providing a suitable title – identifying main and supporting ideas – listing ideas using a numbering scheme – understanding the organization of text – understanding discourse coherence – sequencing of sentences.

Activities Suggested

- Making notes based on a passage in the format given.
- Using an appropriate format to make notes from a given passage.
- Providing a suitable title after reading the passage.
- Identifying main and supporting ideas by scanning.
- Sequencing of jumbled sentences using linguistic clues (e.g.: reference words).

UNIT IV WRITING I

12

Writing definitions and descriptions – paragraph writing (topic sentence and its role, unity, coherence and use of cohesive expressions) - Formal letters: seeking permission for practical training, application for a job with biodata, letter to the editor of a newspaper). - Business letters: calling for quotations, asking for clarification, placing order, letter of complaint – sending an E-Mail.

Activities Suggested

- Using appropriate expressions to define / describe an object / device / process.
- Writing paragraphs on different scientific discourse patterns like classification, comparison and problem / solution – identifying the topic sentence.
- Using unity, cohesion and coherence in paragraph writing.
- Writing formal and business letters using the appropriate format.
- Note – taking (guided and open).
- Summarizing and writing paragraphs based on listening tasks in the prescribed textbooks.

UNIT V WRITING II

12

Making recommendations by using modal auxiliary verbs like should, must, ought to etc. – preparation of checklists – giving instructions – essay writing.

Activities Suggested

- Identifying the phrases used for making recommendations in given texts and employing them in making recommendations.
- Writing checklists in the appropriate format.
- Writing instructions for performing tasks at home or at work (use of imperatives).
- Summarizing the discussions and other oral practice activities like role play in the prescribed textbooks.
- Essay writing based on discussion of scientific and technical topics given in the prescribed textbooks.

TOTAL : 60 PERIODS

TEXT BOOK:

1. Department of Humanities and Social Sciences, Anna University, English for Engineers and Technologists, Vols. I & II (Combined Edition), Orient Longman Pvt. Ltd., 2006.

REFERENCE BOOKS:

1. V.R. Narayanaswami, Strengthen Your Writing, 3rd Edition, Orient Longman, 2005.
2. Andrea J. Rutherford, Basic Communication Skills for Technology, 1st Edition, Pearson Education Asia (Singapore) Pvt. Ltd., Bangalore, 2001.
3. Nell Ann Pickett, Ann A. Laster, Katherine E. Staples, Technical English (Writing, Reading and Speaking), 8th Edition, Pearson Education, USA, Addison Wesley Longman Inc., 2001.

UNIT I MATRICES**12**

Rank of a matrix – Consistency of linear system of equations – Eigenvalue problem – Eigenvalues and eigenvectors of a real matrix – Characteristic equation – Properties of eigenvalues and eigenvectors – Cayley –Hamilton theorem (without proof) – Similarity transformation (concept only) – Orthogonal matrices – Orthogonal transformation of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT II THREE DIMENSIONAL ANALYTICAL GEOMETRY**12**

Direction cosines and ratios – Angle between two lines – Equations of a plane –Equations of a straight line – Coplanar lines – Shortest distance between skew lines – Sphere – Tangent plane – Plane section of a sphere – Orthogonal spheres.

UNIT III GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS**12**

Curvature – Cartesian and polar co-ordinates – Centre and radius of curvature – Circle of curvature – Involutives and evolutes – Envelopes – Properties of envelopes and evolutes – Evolute as envelope of normals.

UNIT IV FUNCTIONS OF SEVERAL VARIABLES**12**

Functions of two variables – Partial derivatives – Total differential – Taylor's expansion – Maxima and minima – Constrained maxima and minima – Lagrange's multiplier method – Jacobians – Differentiation under integral sign.

UNIT V ORDINARY DIFFERENTIAL EQUATIONS**12**

Simultaneous first order linear equations with constant coefficients – Linear equations of second order with constant and variable coefficients- Homogeneous equations of Euler type – Equations reducible to homogeneous form – Method of variation of parameters.

TOTAL : 60 PERIODS**TEXT BOOKS:**

1. Veerarajan, T., "Engineering Mathematics (for First Year)", Second Edition, Tata McGraw–Hill Pub. Co. Ltd., New Delhi, 2002.
2. Venkataraman, M.K., "Engineering Mathematics, Volume I," Fourth Edition, The National Pub. Co., Chennai, 2003.
3. Kreyszig, E., "Advanced Engineering Mathematics", Eighth Edition, John Wiley and Sons (Asia) Ltd., Singapore, 2001.

REFERENCE BOOKS:

1. Grewal, B.S., "Higher Engineering Mathematics", Thirty Sixth Edition, Khanna Publishers, Delhi, 2001.
2. Kandasamy, P., Thilagavathy, K., and Gunavathy, K., "Engineering Mathematics" Volume I, Fourth Revised Edition, S. Chand & Co., New Delhi, 2000.
3. Widder, D.V. "Advanced Calculus", Second Edition, Prentice Hall of India, New Delhi, 2000.

UNIT I PLANE CURVES AND FREE HAND SKETCHING 12**Curves used in engineering practices:**

Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square, pentagon and circle - Drawing of tangents and normal to the above curves.

Free hand sketching:

Representation of Three Dimensional objects – Need for and importance of multiple views and their placement – Developing visualization skills through free hand sketching of multiple views from pictorial views of objects.

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES 12

General principles of orthographic projection – First angle projection – Layout of views – Projection of points, located in all quadrant and straight lines located in the first quadrant – Determination of true lengths and true inclinations and location of traces – Projection of polygonal surface and circular lamina inclined to both reference planes.

UNIT III PROJECTION OF SOLIDS AND SECTION OF SOLIDS 12

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method and change of reference plane (Auxiliary projection method) method.

Sectioning of above solids in simple vertical position by cutting planes inclined to one reference plane – Obtaining true shape of section.

UNIT IV DEVELOPMENT OF SURFACES AND INTERSECTION OF SOLIDS 12

Development of lateral surfaces of simple and truncated solids – prisms, pyramids, cylinders and cones

Development of lateral surfaces of solids with square and cylindrical cutouts, perpendicular to the axis.

Development of lateral surfaces of two Intersecting solids – prism & cylinder, cylinder & cylinder – Axis at right angles with no offset.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 12

Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones. Perspective projection of prisms, pyramids and cylinders by visual ray and vanishing point methods.

Computer Aided Drafting: (Demonstration only)

Demonstration of Computer Aided Drafting and dimensioning using appropriate software.

TOTAL : 60 PERIODS**TEXT BOOKS:**

1. K.V. Natarajan “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2006.
2. M.B. Shah and B.C. Rana, “Engineering Drawing”, Pearson Education, 2005.

REFERENCE BOOKS:

1. N.D. Bhatt “Engineering Drawing” Charotar publishing House 46th Edition, 2003.
2. K.R. Gopalakrishnana. “Engineering Drawing” (Vol. I & II) Subhas Publications – 1998.
3. Luzadder and Duff, “Fundamentals of Engineering Drawing” Prentice Hall of India Pvt Ltd, XI Edition - 2001.
4. K.Venugopal “Engineering Graphics”, New Age International (P) Limited, 2002.

STANDARDS

1. IS10711 – 2001 Technical products Documentation – Size and Layout of Drawing sheets.
2. IS9609 (Parts 0 & 1) – 2001 Technical product Documentation – Lettering.
3. IS11669 – 1986 Dimensioning on Technical Drawings.
4. IS15021 (Parts 1-4) – 2001 Technical Drawings – Projection Methods.

YAE 912

FUNDAMENTALS OF COMPUTING

L T P C
3 0 0 3

UNIT I INTRODUCTION

9

Introduction – Characteristics of Computers – The Evolution of Computers – The Computer Generations - Classification of Computers - Basic Computer organization- Number Systems

UNIT II COMPUTER ARITHMETIC AND SOFTWARE

9

Computer Codes – Computer Arithmetic –Binary Arithmetic – Addition –Subtraction-Multiplication-Division - Computer Software –Types of Software – Logical System Architecture – Software Development Steps.

UNIT III PROBLEM SOLVING AND OFFICE AUTOMATION

9

Planning the Computer Program – Purpose – Algorithm – Flow Charts – Pseudocode - Application Software Packages- Word Processing – Spreadsheet – Graphics – Personal Assistance.

UNIT IV INTRODUCTION TO C

9

Overview of C – Constants, Variables and Data Types – Operators and Expression –Managing Input and Output Operators – Decision Making and Branching – Decision Making and Looping.

UNIT V FUNCTIONS AND POINTERS

9

Arrays – Handling of Character Strings – User-Defined Functions- Structures and Unions – Pointers – The Preprocessor – Developing a C Program: Some Guidelines.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Pradeep K.Sinha and Priti Sinha, “Computer Fundamentals: Concepts, Systems and Applications”, BPB Publications, 2003.
2. E.Balagurusamy, “Programming in ANSI C”, TMH, New Delhi, 2002.

REFERENCE BOOKS:

1. Allen B.Tucker et.al, “Fundamentals of Computing I”, TMH New Delhi, 1998.
2. V.Rajaraman, “Fundamentals of Computers”, Prentice-Hall of India, 2002.
3. Herbert Schidt, “C Made Easy”, McGraw-Hill.

UNIT I STATICS**15**

Introduction - Units and Dimensions - Laws of Mechanics – Parallelogram and triangular Law of forces – Vectorial representation of forces and moments – Vector operations of forces moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moments – Varignon's theorem - Coplanar Forces – Resolution and Composition of forces – Equilibrium of a particle – Forces in space - Equilibrium of a particle in space - Equivalent systems of forces – Principle of transmissibility – Single equivalent force

UNIT II STRESSES & DEFLECTION OF BEAMS**15**

Shear force and bending moment diagrams for simply supported and cantilever beams – Bending stresses in straight beams – Shear Stresses in bending of beams with various cross sections – beams of uniform strength. Double integration method – McCauley's method - Area moment method – Conjugate beam method.

UNIT III AEROSPACE MATERIALS**15**

Crystal solid structure and defects of Crystal structures- Mechanical properties of materials especially pure Metals & Alloys- High temperature properties of Metals & Alloys- Special materials and Super alloys- Aluminum, Titanium, Nickel and Cobalt based alloys

UNIT IV COMPOSITE MATERIALS**15**

Materials used for sandwich construction - Basic design concepts of sandwich construction - Failure modes of sandwich panels - Failure criteria for composites.

TOTAL : 60 PERIODS**TEXT BOOKS:**

1. Streeter, V.L., and Wylie, E.B., "Fluid Mechanics", McGraw-Hill, 1983.
2. Nash William – "Strength of Materials", TMH, 1998
3. Jones, R.M., "Mechanics of Composite Materials", McGraw-Hill, Kogakusha Ltd., Tokyo, 1985.
4. Aircraft Materials & Processes by George F. Titterton
5. Advanced Composites by Sindy Foreman

REFERENCE BOOKS:

1. Bansal, R.K., "Fluid Mechanics and Hydraulics Machines", (5th edition), Laxmi publications (P) Ltd., New Delhi, 1995.
2. Dym C.L. and Shames I.H. – "Solid Mechanics", 1990.
3. Agarwal, B.D., and Broutman, L.J., "Analysis and Performance of Fibre Composites", John Wiley and sons. Inc., New York, 1995.

UNIT I BASIC CONCEPTS AND PROPERTIES**9**

Fluid – definition, distinction between solid and fluid - Units and dimensions - Properties of fluids - density, specific weight, specific volume, specific gravity, temperature, viscosity, compressibility, vapour pressure, capillary and surface tension - Fluid statics: concept of fluid static pressure, absolute and gauge pressures - pressure measurements by manometers and pressure gauges.

UNIT II FLUID KINEMATICS**9**

Fluid Kinematics - Flow visualization - lines of flow - types of flow - velocity field and acceleration - continuity equation (one and three dimensional differential forms)- Equation of streamline - stream function - velocity potential function - circulation - flow net.

UNIT III FLUID DYNAMICS**9**

Fluid dynamics - equations of motion - Euler's equation along a streamline - Bernoulli's equation – applications - Venturi meter, Orifice meter, Pitot tube - dimensional analysis - Buckingham's π theorem- applications - similarity laws and models.

UNIT IV INCOMPRESSIBLE FLUID FLOW**9**

Viscous flow - Navier - Stoke's equation (Statement only) - Shear stress, pressure gradient relationship - laminar flow between parallel plates - Laminar flow through circular tubes (Hagen poiseuille's) - Hydraulic and energy gradient - flow through pipes - Darcy -weisback's equation - pipe roughness -friction factor- Moody's diagram-minor losses - flow through pipes in series and in parallel - power transmission

UNIT V BOUNDARY LAYER**9**

Boundary layer flows, boundary layer thickness, boundary layer separation - drag and lift coefficients.

TOTAL : 45 PERIODS**TEXT BOOKS:**

1. Streeter, V.L., and Wylie, E.B., “Fluid Mechanics”, McGraw-Hill, 1983.
2. Kumar, K.L., “Engineering Fluid Mechanics”, Eurasia Publishing House (P) Ltd., New Delhi (7th edition), 1995.
3. Vasandani, V.P., “Hydraulic Machines - Theory and Design”, Khanna Publishers, 1992.

REFERENCE BOOKS:

1. Bansal, R.K., “Fluid Mechanics and Hydraulics Machines”, (5th edition), Laxmi publications (P) Ltd., New Delhi, 1995.
2. White, F.M., “Fluid Mechanics”, Tata McGraw-Hill, 5th Edition, New Delhi, 2003.
3. Ramamirtham, S., “Fluid Mechanics and Hydraulics and Fluid Machines”, Dhanpat Rai and Sons, Delhi, 1998.
4. Som, S.K., and Biswas, G., “Introduction to fluid mechanics and fluid machines”, Tata McGraw-Hill, 2nd edition, 2004.

OBJECTIVES

To provide exposure to the students with hands on experience on various basic engineering practices in Mechanical, Electrical and Electronics Engineering.

I MECHANICAL ENGINEERING PRACTICE**20****Welding**

- (a) Preparation of arc welding of butt joints, lap joints and tee joints.
- (b) Gas welding practice.

Basic Machining

- (a) Simple Turning and Taper turning
- (b) Drilling practice

Machine assembly practice

- (a) Study of centrifugal pump
- (b) Study of air conditioner

Demonstration on

- (a) Smithy operations, upsetting, swaging, setting down and bending. Example - Exercise – production of hexagonal headed bolt.
- (b) Foundry operations like mould preparation for gear and step cone pulley.

II ELECTRICAL ENGINEERING PRACTICE**20**

- a. Stair-case wiring
- b. Fluorescent lamp wiring
- c. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
- d. Calibration of ammeter and voltmeter.
- e. Measurement of power using watt meter
- f. Measurement of energy using single phase energy meter.

III ELECTRONICS ENGINEERING PRACTICE**20**Any **SIX** Experiments

- 1. (a) Study of Electronic components and equipment
 - (i) Resistor colour coding (ii) usage of CRO & Multimeter.
 - (b) Soldering of simple electronic components and checking the continuity.
 - (c) Assembling electronic components on a PCB.
- 2. Characteristics of PN & Zener Diodes.
- 3. Measurement of ripple factor for HWR & FWR.
- 4. Input and output characteristics of CE transistor.
- 5. Characteristics of JFET.
- 6. Applications of operational amplifier – Inverter, adder and subtractor.
- 7. Study of digital circuits – logic gates, adder and decade counter.

TOTAL : 45 PERIODS

**LIST OF EQUIPMENT AND COMPONENTS:
(For a Batch of 30 Students)**

Mechanical

- | | |
|---|-----------|
| 1. Arc welding transformer with cables and holders | 5 Nos. |
| 2. Welding booth with exhaust facility | 5 Nos. |
| 3. Welding accessories like welding shield, chipping hammer, wire brush, etc. | 5 Sets. |
| 4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit. | 2 Nos. |
| 5. Centre lathe | 2 Nos. |
| 6. Hearth furnace, anvil and smithy tools | 2 Sets. |
| 7. Moulding table, foundry tools | 2 Sets. |
| 8. Study-purpose items: centrifugal pump, air-conditioner | One each. |

Electrical

- | | |
|---|----------|
| 1. Assorted electrical components for house wiring | 15 Sets |
| 2. Electrical measuring instruments | 10 Sets |
| 3. Study purpose items: Iron box, fan and regulator, emergency lamp | One each |

Electronics

- | | |
|---|---------|
| 1. Soldering guns | 10 Nos. |
| 2. Assorted electronic components for making circuits | 50 Nos. |
| 3. Small PCBs | 10 Nos. |
| 4. Multimeters | 10 Nos. |
| 5. Study purpose items: Telephone, FM radio, low-voltage power supply | 2 each. |

YAE917

COMPUTER PRACTICE LAB

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LIST OF EXPERIMENTS

UNIT I

a) Word Processing

1. Document creation, Text manipulation with Scientific notations.
2. Table creation, Table formatting and Conversion.
3. Mail merge and Letter preparation.
4. Drawing - flow Chart

b) Spread Sheet

5. Chart - Line, XY, Bar and Pie.
6. Formula - formula editor.
7. Spread sheet - inclusion of object, Picture and graphics, protecting the document and sheet.
8. Sorting and Import / Export features.

UNIT II Simple C Programming

- 9. Data types, Expression Evaluation, Condition Statements.
- 10. Functions, Recursion and parameter passing mechanisms.
- 11. Arrays

UNIT III

- 9. Structures and Unions
- 13. Pointers and Functions
- 14. File Processing
- 15. Dynamic allocation & Linked List

TOTAL : 45 PERIODS

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS

Hardware

- LAN System with 36 nodes (OR) Standalone PCs – 36 Nos.
- 1 Printer

Software

- OS – Windows / UNIX Clone
- Application Package – Office suite
- Compiler – C

YMA009

MATHEMATICS - II

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UNIT I MULTIPLE INTEGRALS

12

Double integration_ Cartesian and polar co-ordinates- change of order of integration- Area as a double integral – Triple integration in Cartesian co-ordinates- change of variables between Cartesian and polar co-ordinates and between Cartesian and cylindrical / spherical polar co-ordinates.

UNIT II VECTOR CALCULUS

12

Gradient, divergence and curl – Line, surface and volume integrals – green's Gauss divergence and stroke theorems (with out proof) – Verification of the above theorems and evaluation of integrals using them.

UNIT III ANALYTIC FUNCTIONS

12

Functions of a complex variable – analytic function- Necessary conditions – Cauchy- Riemann equations in Cartesian co-ordinates – Sufficient conditions (with out proof)- Properties of analytic function- determination of harmonic conjugate by Milne – Thomson method – conformal mapping – $w = z + a$, az , $1/z$, z^2 and bilinear transformation

UNIT IV COMPLEX INTEGRATION

12

Statement and application of Cauchy's theorem and Cauchy's integral formula – Taylor and Laurent expansion – Singularities – Classification – Residues – Cauchy's residue theorem – Contour integration – Unit circle and semi circular contours (excluding poles on real axis)

UNIT V LAPLACE TRANSFORM**12**

Laplace Transform- Sufficient conditions – Transforms of elementary functions – Basic properties – Inverse transforms – Derivatives and integrals of transforms – Transforms of derivatives and integrals – Convolution theorem – Transform of periodic functions – Application to solution of linear ordinary differential equations up to second order with constant coefficients.

TOTAL : 60 PERIODS**TEXT BOOKS:**

1. Grewal. B.S., “ Higher Engineering Mathematics”, Thirty sixth edition, Khanna Publishers, Delhi, 2001
2. Kreyzig. E., “ Advanced Engineering Mathematics”, Eighth edition, John Wiley & sons (Asia) Pte. Ltd., Singapore , 2001

REFERENCE BOOK:

1. Narayanan, S. Manicavachagom Pillay, T.K, and Ramaniah,G., “ Advanced Mathematics for Engineering students”, Volume I and III, S. Viswanathan (Printers and publishers) Pvt. Ltd., Chennai, 2002

YAE921**APPLIED ENGINEERING MECHANICS****L T P C
3 1 0 4****UNIT I BASICS & STATICS OF PARTICLES****12**

Introduction - Units and Dimensions - Laws of Mechanics – Parallelogram and triangular Law of forces – Vectorial representation of forces and moments – Vector operations of forces moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moments – Varignon’s theorem - Coplanar Forces – Resolution and Composition of forces – Equilibrium of a particle – Forces in space - Equilibrium of a particle in space - Equivalent systems of forces – Principle of transmissibility – Single equivalent force

UNIT II EQUILIBRIUM OF RIGID BODIES**12**

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions – Examples

UNIT III PROPERTIES OF SURFACES AND SOLIDS**12**

Determination of Areas and Volumes – First moment of area and the Centroid of sections – Rectangle, circle, triangle areas from integration – T section, I section, Angle section, Hollow section from primary simpler sections – second moments of plane area – Rectangle, triangle, circle from integration - T section, I section, Angle section, Hollow sections – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia - Mass moment of inertia – Derivation of mass moment of inertia for, prism, cylinder and sphere from first principle – Relation to area moments of inertia.

UNIT IV FRICTION AND DYNAMICS OF PARTICLES 12
Surface Friction – Law of dry friction – Sliding friction – Static and Kinetic friction – Rolling resistance – Belt friction – Rectilinear motion of particles - Relative motion – Curvilinear motion – Newton’s law – Energy and momentum Equation of particles – Impulse – Impact of elastic bodies – Motion of connected particles.

UNIT V ELEMENTS OF RIGID BODY DYNAMICS 12
Translation and Rotation of Rigid Bodies – Velocity and acceleration – Plane motion of rigid bodies – Forces and acceleration.

L: 45, T: 15, TOTAL: 60 PERIODS

TEXT BOOK:

1. Beer, F.P and Johnson Jr. E.R, “Vector Mechanics for Engineers”, Vol. 1 Statics and Vol. 2 Dynamics, McGraw-Hill International Edition, 1997.

REFERENCE BOOKS:

1. Hibbeler, R.C., Engineering Mechanics, Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., 2000
2. Ashok Gupta, Interactive Engineering Mechanics – Statics – A Virtual Tutor (CDROM), Pearson Education Asia Pvt. Ltd., 2002
3. Palanichamy, M.S., Nagan, S., Engineering Mechanics – Statics & Dynamics, Tata McGraw-Hill, 2001.
4. Irving H. Shames, Engineering Mechanics - Statics and Dynamics, IV Edition - Pearson Education Asia Pvt. Ltd., 2003
5. Rajasekaran, S, Sankarasubramanian, G., Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt. Ltd., 2000

YAE922 BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING L T P C
3 0 0 3

UNIT I ELECTRICAL CIRCUITS & MEASUREMENTS 9

Ohm’s law – Kirchoff’s laws – Steady state solution of DC Circuits - Introduction to AC Circuits – Waveforms and RMS Value – Power and power factor – Single phase and three phase balanced circuits

Operating principles of moving coil and moving iron instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters

UNIT II ELECTRICAL MACHINES 9

Construction, Principle of operation, Basic equations and applications of DC Generators, DC Motors, Single phase transformer, Induction Motors and stepper motors

UNIT III SEMICONDUCTOR DEVICES AND APPLICATIONS 9

Characteristics of PN Junction Diodes - Zener Effect – Zener Diode and its characteristics- half wave and full wave rectifiers – Voltage regulation.

Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics- Necessity of Biasing- Principles of biasing circuits – Elementary treatment of small signal amplifier. Characteristics and Simple Applications of SCR, DIAC, TRIAC and UJT.

UNIT IV DIGITAL ELECTRONICS 9
 Binary number system – Logic gates – Boolean Algebra – Half and full adders – Flip – Flops - Registers and Counters – A/D and D/A Conversions

UNIT V FUNDAMENTALS OF COMMUNICATION ENGINEERING 9
 Types of Signals: Analog and digital Signals- Modulation and Demodulation; Principles of Amplitude and Frequency modulations.
 Communication systems; Radio, TV, Fax, Micro wave, Satellite and optical fibre (Block diagram approach only)

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Muthusubramanian R, Salivahanan S and Muraleedharan K.A. “ Basic Electrical, Electronics and Computer Engineering”, TMH, Second Edition, 2006
2. Nagsarkar T.K. and Sukhija M.S., “ Basics of Electrical Engineering” Oxford press, 2005
3. Mehta V.K. “Principles of Electronics”, S.Chand & Company Ltd., 1994
4. Mahmood Nahvi and Joseph A. Edminister, “ Electric Circuits”, Schaum Outline Series, McGraw Hill, 2002.
5. Premkumar N, “Basic Electrical Engineering” Anuradha Publishers, 2003

**YAE923 ELEMENTS OF AERONAUTICS L T P C
 3 0 0 3**

UNIT I EVALUATION OF AIRCRAFTS AND DEVELOPMENTS 5
 Early airplanes, biplanes and monoplanes, Developments in aerodynamics, materials, structures and propulsion over the years.

UNIT II AIRCRAFT CONFIGURATIONS 8
 Classifications. Components of an airplane and their functions. Components of Helicopter. Conventional control, Powered control, Typical systems for control actuation. Basic instruments for flying.

UNIT III INTRODUCTION TO PRINCIPLES OF FLIGHT 9
 Physical properties and structure of the atmosphere, Temperature, pressure and altitude relationships, Evolution of lift, drag and moment. Aerofoils, Mach number, Steady Level Flight, Takeoff and landing.

UNIT IV INTRODUCTION TO AIRPLANE STRUCTURES AND MATERIALS 10
 General types of construction, Monocoque, semi-monocoque and geodesic construction, Typical wing and fuselage structure. Metallic and non-metallic materials, Use of aluminium alloy, titanium, stainless steel and composite materials.

UNIT V POWER PLANTS USED IN AIRPLANES 10
 Basic ideas about piston, turboprop and jet engines, Use of propeller and jets for thrust production. Comparative merits, Principles of operation of rocket, types of rockets and typical applications, Exploration into space.

TOTAL : 45 PERIODS

TEXT BOOK:

1. Anderson, J.D., "Introduction to Flight", McGraw-Hill, 1995.

REFERENCE BOOKS:

1. Kermode, A.C., "Mechanics of flight", Longman Group, 1996.
2. Airframe and Powerplant Mechanics AIRFRAME HANDBOOK, Federal Aviation Administration, 2005

YAE924**AEROSPACE MATERIALS & COMPOSITES****L T P C
3 0 0 3****UNIT I FERROUS AND NON FERROUS MATERIALS 9**

Properties and uses of carbon steel, nickel steel, chromium steel, Aluminium, Copper, Zinc, Magnesium, Titanium and Molybdenum, chrome- molybdenum, chrome –vanadium alloys and its applications

Properties of super alloys and its uses in aerospace, SAE numbering system

UNIT II NON METALS 9

Classification of Plastics -Thermoplastics and thermosetting Classification of Resins- Natural resins, cellulose & Synthetic resins Manufacturing process of plastics

UNIT III WOOD AND GLUE 9

General uses of wood- classification of wood, Structure and strength of wood, Types of wood and plywood used in aircraft industry, characteristics, defects and prevention. Glue and glueing, paints, Varnishes, Thinners and primers. Uses and storages. Procedure of painting

UNIT IV FABRIC MATERIALS 9

Terms, Types of fabrics, defects, deterioration, procedure for testing the soundness of fabric materials, procedure of fabric covering. Dopes- Types, purpose and procedure for doping

UNIT V COMPOSITE MATERIALS 9

Advantages of composite materials, Various utilization in Aircraft structure

Composite structure, reinforcing fibres such as fiberglass, Aramid, Carbon, Boron & ceramic. Hybrids, Matric materials, Prepregs materials, Filler materials, Honey comb. Application of composites in aerospace components and parts.

TOTAL : 45 PERIODS**TEXT BOOKS:**

1. Aircraft General Engineering by Lalith Gupta, Himalaya Book House, Delhi
2. Workshop Technology- Vol I & II by Hajira Chowdhry, Media Promoters, Mumbai
3. Aircraft Material & Process by Titterton
4. Advanced Composite Materials by Lalith Gupta, Himalaya Book House, Delhi

OBJECTIVE

To develop the knowledge in testing the materials for hardness, fatigue, impact, tension and torsion.

LIST OF EXPERIMENTS:

1. Hardness test - a) Vickers b) Brinell c) Rockwell d) Shore
2. Tension test
3. Torsion test
4. Impact test – a) Izod b) Charpy
5. Fatigue test - a) Reverse plate bending b) Rotating Beam
6. Testing of springs
7. Block Compression Test

TOTAL : 45 PERIODS**LIST OF EQUIPMENTS:**

(for a batch of 30 students)

SI.No	Details of Equipments	Qty Required	For Experiments
1.	Vickers Hardness Testing Machine	1	1
2.	Brinell Hardness Testing Machine	1	1
3.	Rockwell Hardness Testing Machine	1	1
4.	Shore Hardness Testing Machine	1	1
5.	Universal Testing Machine	1	2,3,7
6.	Izod Impact Testing Machine	1	4
7.	Charpy Impact Testing Machine	1	4
8.	Fatigue tester- Rotating Beam	1	5
9.	Fatigue tester –Reverse plate bending	1	5

OBJECTIVE

To understand the fabrication, analysis and design of composite materials & structures.

LIST OF EXPERIMENTS:

1. Study of Stress – Strain relationship of composites
2. Determination of elastic constant of
3. Anisotropic material
4. Orthotropic material
5. Isotropic material
6. Study of laminates (single ply and multiply)
7. Study of sandwich construction
8. Study of Honey comb structure

TOTAL : 45 PERIODS**LIST OF EQUIPMENTS:**

(for a batch of 30 students)

SI.No	Details of Equipments	Qty Required	For Experiments
1	Universal Testing Machine , 5 ton capacity	1	1,2,3,4,5

YAE931

FLIGHT MECHANICS AND PERFORMANCES
(Common to B.Sc – Aeronautical Science &
B.Sc - Aircraft Maintenance Science)

L T P C
3 0 0 3

UNIT I INTRODUCTION

9

Physical properties of air - atmosphere, pressure, temperature, density and humidity. Bernoulli's principles and application of Newton's law of motion.

UNIT II AIRFLOW AND AEROFOIL

9

Aerofoil profile and terminology. Aerofoil in motion, angle of attack and factors contributing lift generation. Skin friction, Boundary layer, and Reynold's number. Drag type and its description. Relative wind , lift, drag and their relation; centre of pressure.

UNIT III AIRFOIL AND ITS APPLICATION

9

Aerofoil characteristics and symbols. Fundamental equation for lift and drag and L/D ratio. Shape and dimension of aerofoil. Aspect ratio of its effects. Mean aerodynamic chord and airflow control devices- wing flaps, leading edge flaps, slots, slats, spoilers and their aerodynamic characteristics.

UNIT IV FORCES ACTING IN FLIGHT

9

Lift and weight; Drag and thrust; Load and load factor. Longitudinal, lateral and directional stability. Fixed surfaces and movable aircraft controls and their function.

UNIT V PERFORMANCE

9

Aeroplane take off and climbing process. Factors affecting take off and climb. Minimum and maximum speed of horizontal flight. Effects of changes of engine power, altitude and weight. Directional, longitudinal and lateral stability and their control.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Kores & Rardon., " Aircraft Basic Science"
2. Khermode.A.C., " Mechanics of Flight"
3. William E.Wiesel "Space flight Dynamics", 2nd edn., Tata-McGraw-Hill Book Co., 2007.

YAE932

AIRCRAFT STRUCTURE

L T P C
3 0 0 3

OBJECTIVE

To study different types of beams and columns subjected to various types of loading and support conditions with particular emphasis on aircraft structural components.

UNIT I STATICALLY DETERMINATE STRUCTURES

9

Analysis of plane truss – Method of joints – 3 D Truss - Plane frames

UNIT II STATICALLY INDETERMINATE STRUCTURES

9

Composite beam - Clapeyron's Three Moment Equation - Moment Distribution Method.

UNIT III	ENERGY METHODS	9
Strain Energy due to axial, bending and Torsional loads - Castigliano's theorem - Maxwell's Reciprocal theorem, Unit load method - application to beams, trusses, frames, rings, etc.		
UNIT IV	COLUMNS	9
Columns with various end conditions – Euler's Column curve – Rankine's formula - Column with initial curvature - Eccentric loading – South well plot – Beam column.		
UNIT V	FAILURE THEORY	9
Maximum Stress theory – Maximum Strain Theory – Maximum Shear Stress Theory – Distortion Theory – Maximum Strain energy theory – Application to aircraft Structural problems.		

TOTAL : 45 PERIODS

TEXT BOOK:

1. Donaldson, B.K., "Analysis of Aircraft Structures – An Introduction", McGraw-Hill, 1993.

REFERENCE BOOK :

1. Timoshenko, S., "Strength of Materials", Vol. I and II, Princeton D. Von Nostrand Co, 1990.

YAE933	ENGINEERING THERMODYNAMICS	L T P C
		3 0 0 3

OBJECTIVE

To give a brief background of application of various laws of thermodynamics and its application in heat transfer, refrigeration and air-conditioning, jet propulsion system.

UNIT I	BASIC THERMODYNAMICS	9
Systems, Zeroth Law, First Law - Heat and work transfer in flow and non-flow processes, Second law, Kelvin- Planck statement - Clausius statement - concept of entropy - Clausius inequality - entropy change in non-flow processes.		
UNIT II	AIR CYCLES	9
Otto, Diesel, Dual combustion and Brayton combustion cycles – Air standard efficiency - Mean effective pressure – Actual and theoretical PV diagrams of four stroke and two stroke IC Engines.		
UNIT III	THERMODYNAMICS OF ONE DIMENSIONAL FLUID FLOW	9
Application of Continuity and energy equations- Properties of steam - Rankine cycle - Isentropic flow of ideal gases through nozzles - Simple jet propulsion system - Thrust rocket motor – Specific impulse.		
UNIT IV	PROPERTIES OF GASES AND GAS MIXTURES	9
Avagadro's law. Ideal gases, gas compression, Properties of mixture of gases- Dalton's law of partial pressures, internal energy, enthalpy and specific heats of gas mixtures. Types of fuels- calorific values of fuels- combustion of fuels- calculation of minimum air required for combustion- Determination of excess air supplied.		

UNIT V GAS TURBINES**9**

Classification of gas turbines- constant pressure closed cycle gas turbines- open cycle gas turbines- Advantages and disadvantages of closed cycle- thermal efficiency of gas turbines- Jet propulsion- Rocket propulsion.

TOTAL : 45 PERIODS**TEXT BOOKS:**

1. Rathakrishnan, E, "Fundamentals of Engineering Thermodynamics", Prentice – Hall, India, 2000
2. Nag. P.K., "Engineering Thermodynamics", Tata McGraw-Hills Co., Ltd., Seventh Edn., 1993
3. Yunus A.Cengal. "Thermodynamics an Engineering Approach", Tata McGraw-Hill Co. Ltd., 3rd Edition, 2002.

YAE934**FUNDAMENTALS OF AERODYNAMICS****L T P C
3 0 0 3****OBJECTIVE**

To understand the behaviour of airflow over bodies with particular emphasis on airfoil sections in the incompressible flow regime.

UNIT I BASIC FLUID MECHANICS**9**

Continuity, momentum and energy equations.

UNIT II TWO DIMENSIONAL FLOWS**9**

Basic flows – Source, Sink, Free and Forced vortex, uniform parallel flow. Their combinations, Pressure and velocity distributions on bodies with and without circulation in ideal and real fluid flows. Kutta Joukowski's theorem.

UNIT III CONFORMAL TRANSFORMATION**9**

Joukowski transformation and its application to fluid flow problems, Kutta condition, Blasius theorem.

UNIT IV AIRFOIL AND WING THEORY**9**

Joukowski, Karman - Trefftz, Profiles - Thin aerofoil theory and its applications. Vortex line, Horse shoe vortex, Biot and Savart law, Lifting line theory and its limitations.

UNIT V VISCOUS FLOW**9**

Newton's law of viscosity, Boundary Layer, Navier-Stokes equation, displacement, Momentum thickness, Flow over a flat plate.

TOTAL : 45 PERIODS**TEXT BOOKS**

1. Anderson, J.D., "Fundamentals of Aerodynamics", McGraw-Hill Book Co., New York, 1985.

REFERENCE BOOKS :

1. Houghton, E.L., and Carruthers, N.B., "Aerodynamics for Engineering students", Edward Arnold Publishers Ltd., London, 1989.
2. Milne Thomson, L.H., "Theoretical aerodynamics", Macmillan, 1985.
3. Clancey, L.J., "Aerodynamics", Pitman, 1986.

OBJECTIVE

To understand the principles of operation and design of aircraft and spacecraft power plants.

UNIT I FUNDAMENTALS OF GAS TURBINE ENGINES 9

Illustration of working of gas turbine engine – The thrust equation – Factors affecting thrust – Effect of pressure, velocity and temperature changes of air entering compressor – Methods of thrust augmentation – Characteristics of turboprop, turbofan and turbojet – Performance characteristics.

UNIT II SUBSONIC AND SUPERSONIC INLETS FOR JET ENGINES 9

Internal flow and Stall in subsonic inlets – Boundary layer separation – Major features of external flow near a subsonic inlet – Relation between minimum area ratio and external deceleration ratio – Diffuser performance – Supersonic inlets – Starting problem on supersonic inlets – Shock swallowing by area variation – External deceleration – Models of inlet operation.

UNIT III COMBUSTION CHAMBERS 9

Classification of combustion chambers – Important factors affecting combustion chamber design – Combustion process – Combustion chamber performance – Effect of operating variables on performance – Flame tube cooling – Flame stabilization – Use of flame holders – Numerical problems.

UNIT IV NOZZLES 9

Theory of flow in isentropic nozzles – Convergent nozzles and nozzle choking – Nozzle throat conditions – Nozzle efficiency – Losses in nozzles – Over expanded and under expanded nozzles – Ejector and variable area nozzles – Interaction of nozzle flow with adjacent surfaces – Thrust reversal.

UNIT V COMPRESSORS 9

Principle of operation of centrifugal compressor – Work done and pressure rise – Velocity diagrams – Diffuser vane design considerations – Concept of prewhirl – Rotation stall – Elementary theory of axial flow compressor – Velocity triangles – degree of reaction – Three dimensional – Air angle distributions for free vortex and constant reaction designs – Centrifugal and Axial compressor performance characteristics.

TOTAL : 45 PERIODS

TEXT BOOK:

1. Hill, P.G. & Peterson, C.R. "Mechanics & Thermodynamics of Propulsion" Addison – Wesley Longman INC, 1999.

REFERENCE BOOKS :

1. Cohen, H. Rogers, G.F.C. and Saravanamuttoo, H.I.H. "Gas Turbine Theory", Longman, 1989.
2. Oates, G.C., "Aero thermodynamics of Aircraft Engine Components", AIAA Education Series, New York, 1985.
3. "Rolls Royce Jet Engine" – Third Edition – 1983.
4. Mathur, M.L. and Sharma, R.P., "Gas Turbine, Jet and Rocket Propulsion", Standard Publishers & Distributors, Delhi, 1999.

OBJECTIVE

To study experimentally the aerodynamic forces on different bodies at low speeds.

LIST OF EXPERIMENTS

1. Calibration of subsonic wind tunnel.
2. Pressure distribution over smooth and rough cylinder.
3. Pressure distribution over symmetric airfoils.
4. Pressure distribution over cambered airfoils & thin airfoils.
5. Force measurement-using wind tunnel balancing set up.
6. Force measurement on symmetric airfoil.
7. Force measurement on cambered airfoil.
8. Flow over a flat plate at different angles of incidence
9. Flow visualization studies in low speed flows over cylinders
10. Flow visualization studies in low speed flows over airfoil with different angle of incidence

TOTAL : 45 PERIODS

LIST OF EQUIPMENT

SL.NO.	ITEMS	QUANTITY	EXPERIMENT NO.
1.	Wind Tunnel test section size around 300 x 300 mm with test section flow speed of 70 m/s.	1 No.	1, 2,3,4,5
2.	Wings of various airfoil sections (Symmetrical & cambered airfoils)	2 Nos. each	3, 4
3.	Angle of incidence changing mechanism	1 No.	3, 4
4.	Multiple Manometer stands with 20 – 30 manometer tubes	4 Nos.	2,3,4
5.	U-Tube Manometer	1 No.	1,2,3,4
6.	Static Pressure Probes	4 Nos.	1,2,3,4
7.	Total Pressure Probest	4 Nos.	1,2,3,4
8.	Pitot-Static Tubes	4 Nos.	1,2,3,4
9.	Wooden Models of Three Dimensional bodies (eg. Cylinder etc.,)	2 Nos. each	2
10.	Wind Tunnel balances (3 or 5 or 6 components)	1 No.	5
11.	Pressure Transducers with digital display	1 No.	1,2,3,4
9.	Hele-Shaw apparatus, Smoke Tunnel, Water flow channel	1 each	6,7,8

OBJECTIVE

To introduce the basic concept of Autocad design and drawing procedure

LIST OF EXPERIMENTS

1. Study of basic command
2. Simple exercises on 2d drawings such as Dimensioning, Knuckle joint, Gibb and Cotter joint, Universal coupling and Oldham' coupling
3. Study of 3-D commands such as Revolve, Extrude, Union, Subtract, Array, Align, Box, UCS, View types.
4. Assembly of 3-D drawings such as Screw jack, Machine vice, Piston head and swivel bearing

TOTAL : 45 PERIODS

LIST OF EQUIPMENT

SL.NO	EQUIPMENTS	QUANTITY	EXPERIMENTS NO.
1	Computer and modeling software	Pentium IV PC's, - 30 Nos. License of Software – 30	6, 7

OBJECTIVES

- To create an awareness on the various environmental pollution aspects and issues.
- To educate the ways and means to manage waste, Social issues and Global warming.
- To impart some fundamental knowledge on human welfare measures.

UNIT I ENVIRONMENTAL POLLUTION 9

Definition – causes, effects and control measures of: (a) air pollution (b) water pollution (c) soil pollution (d) marine pollution (e) noise pollution (f) thermal pollution (g) nuclear hazards .

UNIT II WASTE MANAGEMENT 9

Solid waste management: causes, effects and control measures of urban and industrial wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.

UNIT III SOCIAL ISSUES AND THE ENVIRONMENT 9

Unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – environmental ethics: issues and possible solutions – climate change,

UNIT IV TURBINE ENGINES 9
Principles of Jet propulsion, Types of gas turbine engines- turbojet, turbofan, turboprop engines and its differences in construction. Description of thrust and effect of altitude, ram air. Descriptions of factors affecting thrust and performances.

UNIT V ENGINE SYSTEMS 9
Fuel system- types of fuel, fuel control units and their operation, lubrication system and lubricants, Construction features- air intake, compressor, diffuser, combustion chamber, turbine, exhaust system, after burner and thrust reverser.

TOTAL : 45 PERIODS

TEXT BOOKS :

1. Kroes Wild., " Aircraft Power Plants",
2. Magumdar. "Understanding of Aerospace propulsion systems"
3. W.R.Sears. "Airplane and its components", 19

**YAE942 AIRCRAFT DESIGN LT P C
3 0 0 3**

OBJECTIVE

To describe the basic methodology of designing aircrafts taking into account all necessary parameters in to account.

UNIT I WEIGHT ESTIMATION 9
Determination of takeoff weight, empty weight and fuel weight for a given mission specification. Derivation and discussion of takeoff weight sensitivities to range, endurance, lift-to-drag ratio, specific fuel consumption and empty weight.

UNIT II PERFORMANCE 9
Derivation and discussion of performance constraints for stall speed, takeoff and landing field length, carrier compatibility, climb to altitude, climb with all engines operational and one engine out, specific excess power, cruise speed, maximum speed. The performance constraint plot and selection of takeoff wing landing and takeoff thrust-to-weight ratio.

UNIT III CONFIGURATION 9
Selection of the overall configuration. Design of cockpit, fuselage, wing, high lift devices, propulsion system, empennage, landing gear. Procedure for analysis, design and re-design to meet mission, air worthiness and environmental regulations.

UNIT IV SYSTEMS & ELEMENTS 9
Fuel systems- reversible and irreversible, hydraulic systems, electrical and avionic systems, water and waste system, Air-conditioning system, anti- and de-icing system.

UNIT V COSTING 9
Manufacturing cost, direct operating cost for civil aircraft, indirect operating cost, life cycle cost, typical cost breakdown for aircraft, estimation of aircraft net worth.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. J. Roskam "Airplane Design", Part 1 through VII , 1990.
2. JD.Mattingly., WH.Heiser., DT Pratt. "Aircraft Design", 2002, Aiaa
3. Daniel. P.Raymer,"Aircraft Design - A Conceptual approach" 4th Ed., 2006.

YAE943**AIRCRAFT SYSTEMS AND INSTRUMENTATIONS****L T P C****3 0 0 3****OBJECTIVE**

To describe the principle and working of aircraft systems and 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 full 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 - CCV case studies.

UNIT II AIRCRAFT SYSTEMS**9**

Hydraulic systems - Study of typical workable system - 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 Instruments 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.

TOTAL : 45 PERIODS**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.

REFERENCE BOOKS :

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.

OBJECTIVE:

To understand the basic concepts of flight stability and control.

UNIT I CONCEPT OF STABILITY**9**

Necessary and sufficient conditions, Routh- Hurwitz criteria of stability, Root locus and bode techniques, concept and construction, frequency response

UNIT II HISTORICAL REVIEW**9**

Simple pneumatic, hydraulic and thermal systems, Series and parallel systems, Analogies – Mechanical and electrical components, Development of flight control systems.

UNIT III OPEN AND CLOSED LOOP SYSTEMS**9**

Feedback control systems – Block diagram representation of control systems, reduction of block diagrams, output to input ratios, Signal flow graph.

UNIT IV CHARACTERISTIC EQUATION AND FUNCTIONS**9**

Laplace transformation, Response of systems to different inputs viz. step input, impulse, ramp, parabolic and sinusoidal inputs, Time response of first and second order systems, steady state errors and error constants of unity feedback circuits.

UNIT V SAMPLED DATA SYSTEMS**9**

Introduction of digital control system, Fly by wire system, digital controllers and digital PID controllers.

TOTAL : 45 PERIODS**TEXT BOOKS:**

1. Ogato, " Modern Control Engineering", Prentice-Hall of India Pvt. Ltd., New Delhi , 1998.
2. Gopal.M. " Control Systems – Principles and Design", Tata-McGraw Hill Publication, New delhi, 2000.

REFERENCE BOOKS :

1. Azzo, J.J.D. and Houpis. C.H., " Feedback Control System Analysis and Synthesis", McGraw Hill International, 3rd Ed, 1998.
2. Kuo.B.C., " Automatic Control Systems", ", Prentice-Hall of India Pvt. Ltd., New Delhi , 1998.
3. Houpis.C.H., and Lamont.G.B., " Digital Control Systems", McGraw Hill Book co, New York, USA, 1995.
4. Naresh K. Sinha, " Control Systems", New age international Publishers, New Delhi.

OBJECTIVE

To study experimentally the load deflection characteristics structural materials under different types of loads.

LIST OF EXPERIMENTS

1. Determination of Young's modulus of steel using electronic extensometers
2. Determination of Young's modulus of aluminum using electronic extensometers
3. Determination of fracture strength and fracture pattern of ductile materials
4. Determination of fracture strength and fracture pattern of brittle materials
5. Preparation of Stress Strain curve for various engineering materials
6. Deflection of beams with various end conditions using Bend Test set up.
7. Verification of Maxwell's Reciprocal theorem & principle of superposition
8. Determination of buckling of metals using column test apparatus
9. Preparation of South – well's plot.
10. Preparation of Riveted Joints and testing for joint efficiency.

TOTAL : 45 PERIODS

LIST OF EQUIPMENTS

SL. NO.	EQUIPMENTS	QTY	EXPERIMENTS NO.
1.	Universal Testing Machine	1	1,2,3,4,5,10
2.	Mechanical Extensometer	1	1
3.	Electrical stain gauge	10	2
4.	Stain indicator	1	2
5.	Dial Gauges	9	3,4
6.	Beam Test set up with various end conditions	2	3,4
7.	Weight 1 Kg	10	3,4
8.	Weight 2 Kg	10	3,4
9.	Weight Pans	6	3,4
10.	Column Test Apparatus	1	5,6
11.	Rivet	30	10

OBJECTIVE

To introduce the concept of design of basic structural components and to draft both manually and using modelling package.

LIST OF EXERCISES

1. Design of riveted joints (Lap joint).
2. Design of riveted joints (Butt joint with single and double straps).
3. Design of welded joints.
4. Layout of typical wing structure.
5. Layout of typical fuselage structure.
6. Computer aided modeling of typical aircraft wing.
7. Computer aided modeling of typical fuselage structure.
8. Computer aided modeling of landing gear
9. Three view diagram of a typical aircraft
10. Layout of control systems

TOTAL : 45 PERIODS**LIST OF EQUIPMENT****(FOR A BATCH OF 30 STUDENTS)**

SL.NO	EQUIPMENTS	QUANTITY	EXPERIMENTS NO.
1	Drawing Boards, Drafting machines	30	1, 5
2	Computer and modeling software	Pentium IV PC's, - 30 Nos. License of Software – 30	6, 7

UNIT I**9**

Indian Aircraft Act 1934 and Aircraft rules related to registration, airworthiness, maintenance and operation of aircraft. Civil Aviation requirements – Sections and their subjects, procedures of issues and its revision.

UNIT II**9**

Type of certificate, Type of approval, Modification and concession- Description and applicability. Log book and its recording

UNIT III**9**

Registration of Aircraft- Category, procedure and validity. Registration markings, identification plate and change of ownership. Certificate of airworthiness – requirements for issue, renewal and validity.

UNIT IV **9**
Approval of organization- categories, minimum requirements for grant of approval, validity, manuals, Quality control procedures and documentations

UNIT V **9**
Fuel, Oil and Lubricants – quality control during storage and supply. Documentation and responsibility of vendors. Fueling equipment and its requirements. Precaution and Procedure of aircraft fueling.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Aircraft Manual of India
2. Civil Aviation Policy, Govt. of India, April, 2000
3. Civil Aviation requirements Sec. II (as per latest compilation)

REFERENCES:

1. Civil Aviation Policy (CAP – 459) Part – I, basic

YAE952 **AIRCRAFT RULES & REGULATIONS** **L T P C**
3 0 0 3

UNIT I **AIRCRAFT INSTRUMENTS AND EQUIPMENTS** **9**
Requirement for different type of aircraft operations, Viz. Day/Night/High altitude/ Over water etc. Requirement with regard to installation of Cockpit Voice Recorder (CVR)- Flight Data Recorder (FDR)- Ground Proximity Warning System (GPWS) – Traffic Collision Avoidance System (TCAS)- Emergency Locator Transmitter (ELT).

UNIT II **LICENSING OF PERSONNEL** **9**
Aircraft maintenance engineers, Pilots & Flight Engineers, Categories, condition for issue/ renewal and privileges. Issue renewal of approval, authorization and certificate of competency- validity and privileges

UNIT III **AIRCRAFT MAINTENANCE AND CERTIFICATION** **9**
Types of maintenance, defect recording, rectification, analysis, investigation and documentation. Certificates related to maintenance, fitness for flight and flight permits. Weighment of aircraft and preparation of weight schedule.

UNIT IV **TEST FLIGHT AND PERFORMANCE EVALUATION** **9**
Requirements for test flight, test flight data and evaluation of climb performance. Qualification and experience of pilots carrying out test flight.

UNIT V **AIRCRAFT OPERATIONS** **9**
Crew composition, Flight manual, Documents to be carried. Check list, Minimum equipment list. Aerodrome & Air traffic services. Airport Fire Station. Aircraft incidents and accidents- reporting and investigation. Requirement on exit row seating in passenger aircraft and operation manual for all operations. Requirement of aero mobile and RTR licence for use and operation of radio equipment.

TOTAL : 45 PERIODS

TEXT BOOKS :

1. Aircraft Manual of India
2. Civil Aviation Policy, Govt. of India, April, 2000
3. Civil Aviation requirements Sec. II (as per latest compilation)

REFERENCE BOOKS :

1. Civil Aviation Authority: Civil Aircraft Inspection procedure (CAP 459) Part-II,

YAE953**AIRFRAME REPAIR & MAINTENANCE****L T P C
3 0 0 3****UNIT I GENERAL****9**

Introduction to maintenance, components and types of maintenance. Manufacturer's publication and identification leaf lets. Inspection schedules and its use. Description of lifed components. Certification and documerntation.

UNIT II INSPECTION TECHNIQUES**9**

Discription of disassembly, Inspection and testing of system and components. Defects due to aging, fatigue, corrosion and their impact. Special tools and equipment used.

UNIT III FUSELAGE AND WINGS**9**

Structural inspection and methods of repair. Inspection of honey comb structure and transport acrylic panels. Inspection of riveted joints. Alignment checks- distortion and symmetry

UNIT IV PRIMARY AND SECONDARY CONTROLS**9**

Inspection and servicing of control lay out- cables, finish full rods, pulleys, fairleads, turbulence and their attachment. Inspection of control surfaces and their attachment. Rigging of flying controls.

UNIT V LANDING GEAR ASSEMBLY**9**

Inspection of landing gear and its attachment to the aircraft including retraction test. Inspection carried out on wheels. Brake units, tires and steering mechanism.

TOTAL : 45 PERIODS**TEXT BOOKS:**

1. Aircraft maintenance & Repair – Kores – Delp
2. Airframe and Power plant mechanic- General- FAA- AC 65 – 15 A

REFERENCES:

1. Airframe and Powerplant Mechanics (EA-AC 65-15A)- Airframe Handbook
2. Acceptable Methods, Techniques and Practices (FAA)–EA- AC-43-13-1 A & 2A

UNIT I INTRODUCTION**9**

System and its model, simulation, basic nature of simulation, numerical sequential simulation, simulation for engineers and scientist, simulation in soft sciences, simulation for business, simulation of a pure pursuit problem and business inventory problem.

UNIT II SIMULATION IN CONTINUOUS SYSTEM**9**

Types of system, continuous system, discrete system, continuous dynamic system and examples, integration formula, Runge-Kutta integration formula, analog versus digital simulation, block diagram, examples of various systems.

UNIT III SIMULATION IN DISCRETE SYSTEMS**9**

Fixed time step versus event to event model, random numbers, generation of random numbers, simulating randomness, tests for randomness, frequency test, non uniformly distributed random numbers, inverse transformation method, exponential distribution function, rejection method, normal distribution, multiple sources of randomness, Monte- Carlo computation versus Stochastic simulation

UNIT IV SIMULATION OF BUSINESS SYSTEMS**9**

Simulation of queueing systems, queueing theory, simple models, simulation of more general queues, arrival and service pattern, network model of a project, analysis and critical path computation, resource allocation and cost considerations, simple inventory control and forecasting.

UNIT V SIMULATION LANGUAGES**9**

Classification of simulation languages, types of simulation languages, SIMSCRIPT, GPSS, SIMULA, MATLAB AND SIMULINK, factors in selecting simulation languages.

TOTAL : 45 PERIODS**TEXT BOOK:**

1. System Simulation with Digital Computer by Narsingh deo, Prentice-Hall of India private Limited, New Delhi, 2001,

REFERENCE BOOKS :

1. The art of simulation by Tocher .K.D. Van nostrand co., Princeton, N.J., 1963.
2. Computer simulation model by Smith.J Hafner publishing company, New york, N.Y, 1968.

UNIT I GENERAL 9

Description of Radio Waves, Frequency and wave length, frequency bands and type of waves. Types of antenna and its functions. Functions of transmitter and receiver.

UNIT II COMMUNICATION SYSTEMS 9

Description and theory of operation of High Frequency (HF), Very High Frequency (VHF) and satellite communication. Selcal decoder and its function. Testing of communication system operation.

UNIT III NAVIGATION SYSTEM 9

Description, theory of operation of Automatic Direction Finder (ADF) Radio magnetics indicator, VHF Omni Range (VOR) – Instrument Landing System (ILS), Distance measuring Equipment, Marker Beacons and function of its various units. Principle of operation of Inertial Navigation System, Global Positioning System (GPS) , Doppler Navigation System and their advantages

UNIT IV RADIO EQUIPMENT (OPERATIONS) 9

Description, theory of operation of traffic Alert and Collision Avoidance System, Radar Altimeter, Emergency Location Transmitter and mode A, C and S transponders. Installation features of radio equipment

UNIT V RADAR SYSTEMS 9

Radar and its application. Description of Radar bands, Flat Plate Antenna, Wave guide and Radomes. Type of Indicators(Display). Principle of operation of weather radar and its associated units. Safety precaution around a radar installation.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Aircraft Radio System by J. Powell
2. Electronic Communication System by George Kennedy
3. Communication principles Vol-I by Ashok Raj

REFERENCE BOOKS :

1. Aircraft –Electricity and Electronics (5th edition) by Thomas K.Eismin
2. Manual Avionics by Brian Kendal

OBJECTIVE

This laboratory is divided into parts to train the students to learn about basic Aircraft systems, its circuits, and remote control configuration and their importance in different applications in the Aircraft operation and maintenance.

LIST OF EXPERIMENTS

1. Study of difference between hydraulic and pneumatic systems and its circuits.
2. Study of system components such as supply sources, seals, regulators and fluid lines etc.
3. Hands on practice of Flaring and bending of fluid lines in aluminum and steel
4. Experiment on Elongation check on control chain
5. Construction of simple Trans –Receiver circuits
6. Calibration of pressure gauges by dead weight tester
7. Study of pressurisation and air conditioning systems in Aircrafts
8. Study of pneumatic and thermal anti icing and de-icing systems
9. Study of fuel supply system, components and their functions
10. Calibration of fuel filling and replenishing of fuel tanks

TOTAL : 45 PERIODS**LIST OF EQUIPMENTS****(FOR A BATCH OF 30 STUDENTS)**

SL.NO	EQUIPMENTS	QTY	EXPERIMENTS NO.
1	Piston Engine aircraft	1	1,2
2	Turbine Engine aircraft	1	9, 10
3	Aircraft with serviceable stand	1	7,8,9
5	Precision instruments (Vernier Caliper, Micro meter, Cylinder bore gauge, depth gauge, Bevel Protector, Dead weight tester and Feeler gauge)	2 each	3, 4, 6
6	Electrical measurement and check instruments, multimeter etc.	2 each	5

OBJECTIVE

This laboratory is divided into three parts to train the students to learn about basic digital electronics circuits, programming with microprocessors, design and implementation of data buses in avionics with MIL – Std. 1553B and remote terminal configuration and their importance in different applications in the field of Avionics.

LIST OF EXPERIMENTS**DIGITAL ELECTRONICS**

1. Addition/Subtraction of binary numbers.
2. Multiplexer/ Demultiplexer Circuits.
3. Encoder/Decoder Circuits.
4. Timer Circuits, Shift Registers, Binary Comparator Circuits.

MICROPROCESSORS

1. Addition and Subtraction of 8-bit and 16-bit numbers.
2. Sorting of Data in Ascending & Descending order.
3. Sum of a given series with and without carry.
4. Greatest in a given series & Multi-byte addition in BCD mode.
5. Interface programming with 4 digit 7 segment Display & Switches & LED's.
6. 16 Channel Analog to Digital Converter & Generation of Ramp, Square, Triangular wave by Digital to Analog Converter.

AVIONICS DATA BUSES

1. Study of Different Avionics Data Buses.
2. MIL-Std – 1553 Data Buses Configuration with Message transfer.
3. MIL-Std – 1553 Remote Terminal Configuration.

TOTAL : 45 PERIODS**UNIT I AIRPORT GENERAL****9**

Airport configuration and principles of airport layout. Location, relationship between Airport and aircraft. Environmental factors, Aerodrome reference point. ICAO and its functions

UNIT II RUNWAY AND TAXIWAYS**9**

Runway configuration and orientation, Dimension and strength, Load classification Number (LCN) Length requirements, stop ways and clear ways. Taxiway system its dimension and layout. Runway and taxiway markings

UNIT III APRON**9**

Layout of apron, Holding apron and terminal apron, Aircraft parking configuration, space requirements for ground servicing arrangements, precautions during positioning of ground equipment and taxing out of apron, ramp safety requirements.

UNIT IV BRIEF DESCRIPTION AND USE OF 9
Visual approach slope indicator (VASI), precision approach path indicator(PAPI); Approach lighting system (ALS), Runway centre line and touch zone lightings, Runway edge, Threshold and end lighting, Taxiway end and center lights, obstruction light and airport beacon.

UNIT V SECURITY AND SAFETY SYSTEM 9
Airport security system and x-ray units, Airport fuel station, Composition of airport fire and rescue services and their function, Goods prohibited for carriage by air.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Airport Planning & Design , Khanna.S.k., Arora.M.G. 3rd edition., 1988,New Chand & brothers, New Delhi
2. Airport Engineering by Norman Ashford & Paul Wright, 2nd edition
3. Airport Engineering, Rangwala, 3rd Edition, 2007, New Chand & Brothers, New Delhi

REFERENCE BOOKS :

1. ICAO – Annexure 11 and 14
2. Aerodrome Design Manual (Doc 9137) Part 1
3. Airport Services manual (Doc 9137) Part 8 & 9
4. From the Ground up – Himalayan Book

YAE962 GROUND HANDLING, SAFETY & SUPPORT SYSTEMS L T P C
3 0 0 3

UNIT I GENERAL 9
Aircraft parking and picketing for single and multi-engined aero-planes and helicopters. Use of blanking and covers on aircraft. Precaution against storm damage

UNIT II MOVEMENT OF AIRCRAFT 9
Description of towing equipments and procedure of towing aircraft. Aircraft taxing operation, description of taxing track and runway. Marshalling signals for aeroplane and helicopter during day / night.

UNIT III FIRE & SAFETY 9
Types and classification of fire. Fire extinguishing agents and its properties. Airborne and ground fire extinguishers and their use. Safety precaution while ground running of engines

UNIT IV GROUND SUPPORT EQUIPMENT 9
Description and use of ground support electrical power units, Hydraulic power unit, Air conditioning & heating unit, Air starter unit and engine pre-oiling unit. Operation of aircraft jacks and jacking procedure.

UNIT V FUELING 9
Description of of mobile refueler and fueling operation. Identification of various grades of fuel and checks for evidence of water and other contaminants in the fuel. Precaution during fueling operation.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Safety is No Accidents, William H. Tench,1985, Collins
2. Managing the Risk of Organisation Accidents, James Reason,2000, Ashgate

REFERENCE BOOK :

1. A & P Mechanics Hand book- AC- 65-9A (FAA Publication)

YAE963

AIR TRANSPORTATION & ECONOMY

**L T P C
3 0 0 3**

UNIT I INTRODUCTION

9

Introduction to Air Transport system, Law and Policy of National Air Transportation and International Transportation law and agreement. Role of FAA , ICAO and different National authorities.

UNIT II AIRLINE BUSINESS

9

Scopes and potentials of air transportation , Low cost carrier services, Market study and Forecasting of airline business.

UNIT III AIRCRAFT AND FLIGHT PLANNING

9

Selection of aircraft fleet, air-route planning, flight monitoring, airport, air traffic services and management of Operational and Maintenance,

UNIT IV ECONOMY

9

Airline business strategies, Airline economics, Airline planning, Economic cost estimation and analysis, break-even analysis, Load factor estimation and analysis, Aircraft operational economy, long haul and short haul flight operational economies.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Manual on the Regulation of International Air Transport. Anon, 1996, ICAO, Doc- 9626
2. Engineering Economics and Cost Analysis by R. Panneerselvam
3. Aircraft Maintenance & Repair – Kores – Delp

REFERENCE BOOK:

1. Aircraft Operation Manual, Anon: B737-200 Volume-I,II dan III

YAE965

PROJECT WORK

**L T P C
0 0 12 6**

Students in batches not more than four in number are to prepare a project report after carrying out an on the spot study of the activities related to aircraft and its maintenance including operation, based on the knowledge acquired during the course of instructions in the college. A total of 3 weeks will be earmarked during the final semester for this purpose followed by one week for the preparation and submission of the project report. The student shall obtain a certificate for the bonafide work done by him/ her from the organization chosen for the study and submit the same along with the project report.

While the internal assessment of the project report will be made after conducting a Viva-Voce examination of each student, the external examiner appointed by the university will evaluate the report and allot marks accordingly.