# SWAMIVIVEKANANDUNIVERSITY, SAGAR(M.P.)

# SYLLABUS

**For**
**Diploma**

**Diploma in Aerospace Engineering**
**SubjectCode:DAS**
DepartmentofAerospace Engineering
FacultyofEngineering

DurationofCourse : 3Years

ExaminationMode : Semester

ExaminationSystem : Grading

SwamiVivekanandUniversity, Sagar, Madhya Pradesh

# Swami Vivekanand University, Sagar (M.P)
# SYLLABUS

**DAS-301 THERMODYNAMICS**

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**RATIOANLE**

A diploma holder in this course is supposed to maintain steam generators, turbines, compressors and other power plant equipment. Therefore, it is essential to impart him basic concepts of thermodynamics, steam generators, steam turbines, compressors and about IC engines.

**DETAILED CONTENTS**

**UNIT 1**

1 Fundamental Concepts

Thermodynamic state and system, boundary, surrounding, universe, thermodynamic systems – closed, open, isolated, adiabatic, homogeneous and heterogeneous, macroscopic and microscopic, properties of system – intensive and extensive, thermodynamic equilibrium, quasi – static process, reversible and irreversible processes, Zeroth law of thermodynamics, definition of properties like pressure, volume, temperature, enthalpy, internal energy.

**UNIT 2**

2 Laws of Perfect Gases

Definition of gases, explanation of perfect gas laws – Boyle's law, Charle's law, Avagadro's law, Regnault's law, universal gas constant, Characteristic gas constants, derivation, specific heat at constant pressure, specific heat at constant volume of gas, derivation of an expression for specific heats with characteristics, simple problems on gas equation

3 Ideal and Real Gases

Concept of ideal gas, enthalpy and specific heat capacities of an ideal gas, P – V – T surface of an ideal gas, triple point, real gases, Vander-Wall's equation.

4 Types of thermodynamic processes – isochoric, isobaric, isothermal, hyperbolic, isentropic, polytropic and throttling processes, equations representing the processes, derivation of work done, change in internal energy, change in entropy, rate of heat transfer for the above processes

**UNIT 3**

5 Laws of Thermodynamics

Laws of conservation of energy, first law of thermodynamics (Joule's experiment), application of first law of thermodynamics to non-flow systems – constant volume, constant pressure, adiabatic and polytropic processes, steady flow energy equation, application of

steady flow energy to equation, turbines, pump, boilers, compressors, nozzles, evaporators, limitations, heat source and heat sinks, statement of second laws of thermodynamics: Kelvin Planck's statement, Classius statement, equivalence of statements, Perpetual motion machine of first kind, second kind, Carnot engine, introduction of third law of thermodynamics, concept of irreversibility, entropy.

**UNIT 4**

6 IC Engines

Introduction, working principle of two stroke and four stroke cycle, SI engines and CI engines, otto cycle, diesel cycle and dual cycle, location and functions of various parts of IC engines and materials used for them

7 Air Standard Cycles

Meaning of air standard cycle – its use, condition of reversibility of a cycle, description of carnot cycle, otto cycle, diesel cycle, simple problems on efficiency, calculation for different cycles, comparison of otto, diesel cycles for same compression ratio or same peak pressure developed, reasons for highest efficiency of carnot cycle and all other cycles working between same temperature limits

8 Testing of IC Engines

Engine power - indicated and brake power, efficiency - mechanical, thermal, relative and volumetric, methods of finding indicated and brake power, morse test for petro1 engine, heat balance sheet, concept of pollutants in SI and CI engines, pollution control, norms for two or four wheelers - EURO - 1, EURO - 2, methods of reducing pollution in IC engines, alternative fuels like CNG, LPG, Hydrogen

**UNIT-5**

9 Introduction to Heat Transfer

Modes of heat transfer, Fourier's law, steady state conduction, composite structures, natural and forced convection, thermal radiation

**LIST OF PRACTICALS**

1. Determination of temperature by
   i) Thermocouple
   ii) Pyrometer
   iii) Infrared thermometer
2. Demonstration of mountings and accessories on a boiler.
3. Study of boilers (through industrial visit)
4. Demonstration of air compressors
5. Dismantle a two stroke engine; note the function and material of each part, re-assemble the engine.
6. Dismantle a single cylinder diesel engine. Note the function of each part, re-assemble the engine.
7. Determination of BHP by dynamometer.

**INSTRUCTIONAL STRATEGY**

1. Use computer based learning aids for effective teaching-learning
2. Expose students to real life problems
3. Plan assignments so as to promote problem solving abilities and develop continued learning skills

**RECOMMENDED BOOKS**

1. Engineering Thermodynamics by CP. Arora; Tata McGraw Hill Publishers, New Delhi.
2. Thermal Engineering by RK Purohit; Standard Publishers Distributors, New Delhi.

# Swami Vivekanand University, Sagar (M.P)
# SYLLABUS

**DAS-302 APPLIED MECHANICS**

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**RATIONALE**

The subject Applied Mechanics deals with basic concepts of mechanics like laws of forces, moments, friction, centre of gravity, laws of motion and simple machines which are required by the students for further understanding of other allied subjects. The subject enhances the analytical ability of the students.

**DETAILED CONTENTS**

**UNIT 1**

1. Introduction

1.1 Concept of engineering mechanics definition of mechanics, statics, dynamics, application of engineering mechanics in practical fields. Definition of Applied Mechanics.

1.2 Definition, basic quantities and derived quantities of basic units and derived units

1.3 Different systems of units (FPS, CGS, MKS and SI) and their conversion from one to another for density, force, pressure, work, power, velocity, acceleration

1.4 Concept of rigid body, scalar and vector quantities

**UNIT 2**

2. Laws of forces

2.1 Definition of force, measurement of force in SI units, its representation, types of force: Point force/concentrated force & Uniformly distributed force, effects of force, characteristics of a force

2.2 Different force systems (coplanar and non-coplanar), principle of transmissibility of forces, law of super-position

2.3 Composition and resolution of coplanar concurrent forces, resultant force, method of composition of forces, laws of forces, triangle law of forces, polygon law of forces - graphically, analytically, resolution of forces, resolving a force into two rectangular components

2.4 Free body diagram

2.5 Equilibrant force and its determination

2.6 Lami's theorem (concept only)'

[Simple problems on above topics]

**UNIT 3**

3. Moment

3.1 Concept of moment

3.2 Moment of a force and units of moment

3.3 Varignon's theorem (definition only)
3.4 Principle of moment and its applications (Levers – simple and compound, steel yard, safety valve, reaction at support)
3.5 Parallel forces (like and unlike parallel force), calculating their resultant
3.6 Concept of couple, its properties and effects
3.7 General conditions of equilibrium of bodies under coplanar forces
3.8 Position of resultant force by moment

[Simple problems on the above topics]

**UNIT 4**

4. Friction

4.1 Definition and concept of friction, types of friction, force of friction
4.2 Laws of static friction, coefficient of friction, angle of friction, angle of repose, cone of friction
4.3 Equilibrium of a body lying on a horizontal plane, equilibrium of a body lying on a rough inclined plane.
4.4 Calculation of least force required to maintain equilibrium of a body on a rough inclined plane subjected to a force:
a) Acting along the inclined plane Horizontally
b) At some angle with the inclined plane

5. Centre of Gravity

5.1 Concept, definition of centroid of plain figures and centre of gravity of symmetrical solid bodies
5.2 Determination of centroid of plain and composite lamina using moment method only, centroid of bodies with removed portion
5.3 Determination of center of gravity of solid bodies - cone, cylinder, hemisphere and sphere; composite bodies and bodies with portion removed
*[Simple problems on the above topics]*

**UNIT 5**

6. Simple Machines

6.1. Definition of effort, velocity ratio, mechanical advantage and efficiency of a machine and their relationship, law of machines
6.2. Simple and compound machine (Examples)
6.3. Definition of ideal machine, reversible and self locking machine
6.4. Effort lost in friction, Load lost in friction, determination of maximum mechanical advantage and maximum efficiency
6.5. System of pulleys (first, second, third system of pulleys), determination of velocity ratio, mechanical advantage and efficiency
6.6. Working principle and application of wheel and axle, Weston's Differential Pulley Block , simple screw jack, worm and worm wheel, single and double winch crab. Expression for their velocity ratio and field of their application
[Simple problems on the above topics]

**LIST OF PRACTICALS**

1. Verification of the polygon law of forces using gravesend apparatus.
2. To verify the forces in different members of jib crane.
3. To verify the reaction at the supports of a simply supported beam.
4 To find the mechanical advantage, velocity ratio and efficiency in case of an inclined plane.
5. To find the mechanical advantage, velocity ratio and efficiency of a screw jack.
6. To find the mechanical advantage, velocity ratio and efficiency of worm and worm wheel.
7. To find mechanical advantage, velocity ratio and efficiency of single purchase crab.
8. To find out center of gravity of regular lamina.
9. To find out center of gravity of irregular lamina.
10. To determine coefficient of friction between three pairs of given surface.

**INSTRUCTIONAL STRATEGY**

**RECOMMENDED BOOKS**

1. A Text Book of Applied Mechanics by S Ramamurtham,DhanpatRai Publishing Co. Ltd.
2. Applied Mechanics by, Col. Harbhajan Singh, TL Singla and Parmod Kumar Singla Published By Abhishek Publication, Chandigarh
3. A Text Book of Engineering Mechanics (Applied Mechanics) by RK Khurmi; S Chand and Co. Ltd., New Delhi.
4. A Text Book of Applied Mechanics by RK Rajput; Laxmi Publications, New Delhi..
5. Text Book of Applied Mechanics by Birinder Singh, Kaption Publishing House, New Delhi.

# Swami Vivekanand University, Sagar (M.P)
# SYLLABUS

**DAS 303 ELEMENTS OF ELECTRICAL AND ELECTRONICS ENGINEERING**

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The objective of this subject is to impart fundamental knowledge and skills regarding basic electrical and electronics engineering, which diploma holders will come across in their professional life. This course will provide the students to understand the basic concepts and principles of d.c. and a.c. fundamentals, electromagnetic induction, batteries, transformers, motors distribution system, domestic installation, electrical safety etc. The students will also learn basic electronics including diodes and transistors and their applications.

## DETAILED CONTENTS

**UNIT 1**

1. Application and Advantage of Electricity

   Difference between ac and dc, various applications of electricity, advantages of electrical energy over other types of energy

2. Basic Electrical Quantities
   Definition of voltage, current, power and energy with their units, name of instruments used for measuring above quantities, connection of these instruments in an electric circuit

3. AC Fundamentals
   Electromagnetic induction-Faraday's Laws, Lenz's Law; Fleming's rules, Principles of a.c. Circuits; Alternating emf, Definition of cycle, frequency, amplitude and time period. Instantaneous, average, r.m.s and maximum value of sinusoidal wave; form factor and Peak Factor. Concept of phase and phase difference. Concept of resistance, inductance and capacitance in simple a.c. circuit. Power factor and improvement of power factor by use of capacitors. Concept of three phase system; star and delta connections; voltage and current relationship (no derivation)

**UNIT 2**

4. Transformers

   Working principle and construction of single phase transformer, transformer ratio, emf equation, losses and efficiency, cooling of transformers, isolation transformer, CVT, auto transformer (brief idea), applications.

**UNIT 3**

Distribution System

Difference between high and low voltage distribution system, identification of three-phase wires, neutral wire and earth wire in a low voltage distribution system. Identification of voltages between phases and between one phase and neutral. Difference between three-phase and single-phase supply

6. Electric Motor

Description and applications of single-phase and three-phase motors. Connection and starting of three-phase induction motors by star-delta starter. Changing direction of rotation of a given 3 phase induction motor. Motors used for driving pumps, compressors, centrifuge, dyers etc. Totally enclosed submersible and flame proof motors

**UNIT 4**

7. Domestic Installation

Distinction between light-fan circuit and single phase power circuit, sub-circuits, various accessories and parts of domestic electrical installation. Identification of wiring systems. Common safety measures and earthing

8. Electrical Safety

Electrical shock and precautions against shock, treatment of electric shock, concept of fuses and their classification, selection and application, concept of earthing and various types of earthing, applications of MCBs and ELCBs

9. Batteries
Construction, charging and maintenance of load and batteries, maintenance free batteries

**UNIT 5**

10. Basic Electronics
Basic idea of semiconductors – P and N type; diodes, zener diodes and their applications, transistor – PNP and NPN, their characteristics and uses. Characteristics and applications of a thyristor, characteristics and applications of stepper motors and servo motors in process control.

**LIST OF PRACTICALS**

1. Connection of a three-phase motor and starter with fuses and reversing of direction of rotation
2. Connection of a single-phase induction motor with supply and reversing of its direction of rotation
3. Charging and testing of a lead – acid battery
4. Troubleshooting in domestic wiring system, including distribution board
5. Connection and reading of an electric energy meter
6. Use of ammeter, voltmeter, wattmeter, and multi-meter
7. Measurement of power and power factor in a given single phase ac circuit
8. Study of different types of fuses, MCBs and ELCBs
9. Study of zener as a constant voltage source and to draw its V-I characteristics
10. Study of earthing practices
11. To draw V-I characteristics of a (i) NPN transistor (ii) thyristor (SCR)
12. Study of construction and working of a (i) stepper motor and (ii) servo motor

**INSTRUCTIONAL STRATEGY**

The teacher should give emphasis on understanding of concept and various terms used in the subject. Practical exercises will reinforce various concepts.

**RECOMMENDED BOOKS**

1. Basic Electrical Engineering by PS Dhogal; Tata McGraw Hill Publishers, New Delhi
2. A Text Book of Electrical Technology, Vol. I and II by BL Thareja; S Chand and Co., New Delhi
3. Basic Electricity by BR Sharma; SatyaPrakashan, New Delhi
4. Basic Electrical Engineering by JB Gupta, S Kataria and Sons, Delhi
5. Experiments in Basic Electrical Engineering by SK Bhattacharya and KM Rastogi, New Age International Publishers Ltd., New Delhi
6. Basic Electronics by VK Mehta; S Chand and Co., New Delhi
7. Electrical Machines by SK Bhattacharya; Tata McGraw Hill, New Delhi
8. Basic electronics and Linear circuits by NN Bhargava and Kulshreshta, Tata McGraw Hill New Delhi.
9. Electronic principles by SK Sahdev, DhanpatRai and Sons, New Delhi.
10. Electronic Devices and circuits by Rama RaddyNarora Publishing House Pvt. Ltd. New Delhi.
11. Principles of electrical and electronics Engineering by VK Mehta; S Chand and Co. New Delhi.

# Swami Vivekanand University, Sagar (M.P)

# SYLLABUS

**DAS 304 INTRODUCTION TO AEROSPACE**

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**RATIONALE**

This Course is designed to provide a broad overview of the space technology with regard to rocket propulsion. With respect to this it will provide basic knowledge about satellite orbits, satellite dynamics and orbital elements, To learn different cases of orbit transfer, orbit perturbations, further will provide knowledge to basic rocket flight kinematics

**DETAILED CONTENTS**

**UNIT 1**

1. Introduction

Spaceenvironment, types of spacecraft, presentdaysatellites and launch vehicles.
Fundamentals of orbits, Central motion force , equation of motion ,types of orbit,Newtons law of gravitation, applications of newtons laws in space,

2. Airplane Aerodynamics

Nomenclature used in Aerodynamics, different parts of airplane, Wing as lifting surface, Types of wing plan forms, Aerodynamic features like Aerofoil pressure distribution, Aerodynamic forces and moments, Lift and Drag. Dragpolar, L/Dratio, high lift devices, Airplane performance like Thrust/Power

**UNIT 2**

3. Aircraft Control System

simple pneumatic, hydraulic and thermal systems, series and parallel systems, analogies, mechanical and electrical components. Closed loop control versus open loop control, Feedback control systems.Block diagram representation of control systems, reduction of block diagrams

**UNIT 3**

4. Spacecraft Propulsion

Requirement of power, various means of producing power, Brief description of thermodynamics of engines, Piston engines, Jet engines. Engine airframe combinations of various types, their performance, detailed functioning of components ofa Piston-Prop engine, use of propellers as means of producing forward thrust, functioning of Jet engines.

**UNIT 4**

5. Spacecraft Instruments

Flight instruments, air speed indicators, altimeters, rate of climb/descent meter, gyro based instruments, engine performance measuring instruments, basic instruments in avionics.

6. Aircraft Systems

Elementary ideas about hydraulic and pneumatic systems, pressurization, temperature control and oxygen system, system integration, accessories, aircraft electrical system: generation and distribution of electricity on board the airplane, flight control system temperature / environment, aircraft fuel system, fire protection, ice and rain protection system.

**UNIT 5**

7. Airplane Design, Type Certification and Airworthiness

Basic steps in airplane design, airplane specification, part/component wise specification, design and testing for certification, airworthiness requirements, air safety requirements and standards.

8. Airplane Structure, Materials and Production

Structural arrangement of earlier airplane, developments leading to all metal aircraft, Strength to weight ratio - choice of aircraft materials for different parts, detailed description of wing, tail and fuselage joints, stress-strain diagrams, plane and space, trusses, loads on airplane components, mechanical properties of materials.

**INSTRUCTIONAL STRATEGY**

1. Use computer based learning aids for effective teaching-learning
2. Expose students to real life problems about aeronautics
3. Plan assignments so as to promote problem solving abilities and develop continued learning skills

**RECOMMENDED BOOKS**

1. Fundamentals of FlightbyY R S Shevell; Prentice Hall
2. Aircraft Instrumentsby E H J Pallet; Himalayan Books
3. Introduction to Flight byJohn Anderson Jr.; McGraw Hill
4. Aircraft Electrical Systemsby E H J Pallet; Himalayan Books
5. Jet Engine Manualby E W Somerset Maugham,, BIP Publications
6. Fundamentals of Flight by Dr. O. P. Sharma and Lalit Gupta.

**DAS 305SPACECRAFT MATERIAL & PROCESS**

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**RATIONALE**

The high strength over weight ratio of materials required in Spacecraft Engineering, class for study of such materials by students at this stage. The need for surface treatments against corrosion and for improved strengths is essential.In this regard,various processes of manufacturing are studied in this subject by students.

**DETAILED CONTENTS**

**UNIT 1**

1. Introduction

Properties of flight vehicle materials, importance of strength/weight ratio of materials for aerospace vehicles structures, importance of temperature variations, factors affecting choice of material for different parts of Spacecraft.

**UNIT 2**

2. Light Metal Alloys

Aluminium alloys, heat treatment, high strength and high corrosion alloys. magnesium alloys and their properties, heat treatment, application of these alloys to aerospace vehicles.

3. High Strength and Heat Resistant Alloys

Classification of heat resistant materials, iron, nickel and cobalt base alloys, refractory materials, ceramics, titanium and its alloys, properties of inconelmonal& k-monal, nimonic and super alloys; application to aerospace vehicles

**UNIT 3**

4. Aircraft Steels

classical of alloys steels, effect of alloying elements, carbon steel verses alloys. magnesium alloys and their properties, heat treatment, application to aerospace vehicle of these alloys.

5. Metal Joining Processes

Weldability, standard welding practices e.g. gas welding, resistance welding, welding of light alloys, riveting.

**UNIT 4**

6. Composite Materials

Definition, classification and characteristics of composite materials - fibrous composites, laminated composites, particulate composites, properties and types of reinforcement and matrix materials.

**UNIT 5**

7. Heat Treatment Corrision

Heat treatment of carbon steel, aluminium alloys, magnesium alloys and titanium alloys used in aircraft. Types of corrosions - Effect of corrosion on mechanical properties and Protection against corrosion - Corrosion resistant materials used in aircraft.

**LIST OF PRACTICALS**

1) Heat treatment of steel alloys, study of microstructure before and after heat treatment
2) Exercise in welding, riveting and spot welding
3) Fabrication of fuselage and wing panel/parts
4) Hand lay-up method
5) Sandwich testing for composite
6) Preparation of models on Lathe

**INSTRUCTIONAL STRATEGY**

While imparting instructions, teacher should show various types of engineering materials to the students. Students should be asked to collect samples of various materials available in the market. Visits to industry should be planned to demonstrate use of various types of materials or Heat Treatment Processes in the industry.

**RECOMMENDED BOOKS**

1. Workshop technology by WAJ Chapman;Replika Press Pvt. Ltd.
2. Aircraft Material and Processes by G F Titterton; Himalayan Books, New Delhi
3. Advanced Composite materials byLalit Gupta; Himalayan Books, New Delhi

# Swami Vivekanand University, Sagar (M.P)

# SYLLABUS

## DAS 306 THEORY OFFLUID MECHANICS

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**RATIONAL**

A Spacecarftcapable of flying in spite of its large weight. It has particular shape and becomes air borne with certain speeds. In order to appreciate the principle involved in flying, it is essential to gain knowledge and skill in the area of mechanics of fluids applied to flying

**DETAILED CONTENTS**

**UNIT 1**

1. Basic Concepts and Properties

Fluid – definition, distinction between solid and fluid ,units anddimensions, 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 2**

2. Fluid Statics

Concept of pressure, Pascal's law and its engineering applications, hydrostatic paradox, action of fluid pressure on a plane (horizontal, vertical and inclined) submerged surface, resultant force and center of pressure, force on a curved surface due to hydrostatic pressure. buoyancy and flotation, stability of floating and submerged bodies, metacentre height and its determination, periodic time of oscillation, pressure distribution in a liquid subjected to constan, rotation of liquid in a cylindrical container.

**UNIT 3**

3. Fluid Kinematics

Classification of fluid flows, velocity and acceleration of fluid particle, local andconvective acceleration, normal and tangential acceleration, streamline, path line and streak line, flow rate and discharge mean velocity, continuity equation in Cartesian and cylindrical, polar coordinates, rotational flows, rotation velocity and circulation, stream and velocity potential functions, flow net

4. Fluid Dynamics

Euler's equation, Bernoulli's equation and steady flow energy equation, representation of energy changes in fluid system, impulse momentum equation, kinetic energy and momentum correction factors, flow along a curved streamline, free and forced vortex motions.

**UNIT 4**

5. Dimensional Analysis and Similitude

Fundamental and derived units and dimensions, dimensional homogeneity, Rayleigh's and Buckingham's Pi method for dimensional analysis, dimensionless numbers and their significance, geometric, kinematic and dynamic similarity, model studies, laminar and turbulent flows: flow regimes and reynolds number, critical velocity and critical Reynoldsnumber, laminar flow in circular cross- section pipes,turbulent flows and flow losses in pipes, Darcy equation, minor head losses in pipes and pipe fittings, hydraulic and energy gradient lines.

**UNIT 5**

6. Flow Measurement

Manometers, pitot tubes, venturi meter and orifice meters, orifice, mouthpieces, notches and weirs, rotameter

**LIST OF PRACTICALS**

1) To study the flow through a variable area duct and verify Bernoulli's energy equation
2) To study the transition from laminar to turbulent flow and to ascertain the lower criticalReynolds number
3) To determine the hydraulic coefficients for flow through an orifice
4) To determine the friction coefficients for pipes of different diameters
5) To determine the head loss in a pipe line due to sudden expansion/ sudden contraction/ bend
6) To determine the velocity distribution for pipeline flow with a pitot static probe

**INSTRUCTIONAL STRATEGY**

Hydraulics being a fundamental subject, teachers are expected to lay considerable stress on understanding the basic concepts, principles and their applications. For this purpose, teachers are expected to give simple problems in the class room and provide tutorial exercises so as to develop necessary knowledge for comprehending the basic concepts and principles. As far as possible, the teaching of the subject be supplemented by demonstrations and practical work in the laboratory.

**RECOMMENDED BOOKS**

1. Fundamentals of Aerodynamics by Anderson J.D; McGraw-Hill Book Co., New York, 1985
2. Aerodynamics for Engineering students by Houghton E.L. andCarruthers N.B; Edward Arnold Publishers Ltd., London, 1989.
3. Theoretical aerodynamics by Milne Thomson L.H.; Macmillan, 1985

# Swami Vivekanand University, Sagar (M.P)

# SYLLABUS

## ECOLOGY AND ENVIRONMENTAL AWARENESS CAMP

A diploma holder must have knowledge of different types of pollution caused due to industries and constructional activities so that he may help in balancing the eco system and controlling pollution by pollution control measures. He should also be aware of environmental laws related to the control of pollution.

This is to be organized at a stretch for 3 to 4 days. Lectures will be delivered on following broad topics. There will be no examination for this subject.

1. Basics of ecology, eco system and sustainable development

2. Conservation of land reforms, preservation of species, prevention of advancement of deserts and lowering of water table

3. Sources of pollution - natural and manmade, their effects on living and non-living organisms

4. Pollution of water - causes, effects of domestic wastes and industrial effluent on living and non-living organisms

5. Pollution of air-causes and effects of man, animal, vegetation and non-living organisms

6. Sources of noise pollution and its effects

7. Solid waste management; classification of refuse material, types, sources and properties of solid wastes, abatement methods

8. Mining, blasting, deforestation and their effects

9. Legislation to control environment

10. Environmental Impact Assessment (EIA), Elements for preparing EIA statements

11. Current issues in environmental pollution and its control

12. Role of non-conventional sources of energy in environmental protection

# Swami Vivekanand University, Sagar (M.P)
# SYLLABUS

## DAS 401 GENERIC SKILLS AND ENTREPRENEURSHIP DEVELOPMENT

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**RATIONALE**

Generic Skills and Entrepreneurship Development is one of the courses from "Human Science" subject area. Generic skills have emerged as an important component of employability skills, which enable an individual to become and remain employable over lifetime and to lead happy and prosperous life. Entrepreneurship development aim at developing conceptual understanding for setting-up one's own business venture/enterprise. This aspect of Human Resource Development has become equally important in the era, when wage employment prospects have become meager.

Both the subject areas are supplementary to each other and soft skills are required to be developed in diploma passouts for enhancing their employability and self-confidence.

**DETAILED CONTENTS**

**UNIT 1**

1. Introduction to Generic Skills
   - 1.1 Importance of Generic Skill Development (GSD)
   - 1.2 Global and Local Scenario of GSD
   - 1.3 Life Long Learning (LLL) and associated importance of GSD.

**UNIT 2**

2. Managing Self

2.1 Knowing Self for Self Development
- Self-concept, personality, traits, multiple intelligence such as language intelligence, numerical intelligence, psychological intelligence etc.

2.2 Managing Self - Physical
- Personal grooming, Health, Hygiene, Time Management

2.3 Managing Self – Intellectual development
- Information Search: Sources of information
- Listening: Effective Listening
- Speaking: Effective Oral Communication
- Reading: Purpose of reading, different styles of reading, techniques of systematic reading; Note Taking: Importance and techniques of note taking
- Writing: Correspondence - personal and business

Note: Practical sessions should be coupled with teaching of effective listening, speaking, reading and writing.

2.4 Managing Self – Psychological
- Stress, Emotions, Anxiety-concepts and significance (Exercises related to stress management)
- Techniques to manage the above

**UNIT 3**

3. Managing in Team
   - 3.1 Team - definition, hierarchy, team dynamics
   - 3.2 Team related skills- sympathy, empathy, co-operation, concern, lead and negotiate, work well with people from culturally diverse background
   - 3.3 Communication in group - conversation and listening skills

4 Task Management
   - 4.1 Task Initiation, Task Planning, Task execution, Task close out
   - 4.2 Exercises/case studies on task planning towards development of skills for task management

**UNIT 4**

5. Problem Solving
   - 5.1 Prerequisites of problem solving- meaningful learning, ability to apply knowledge in problem solving
   - 5.2 Different approaches for problem solving.
   - 5.3 Steps followed in problem solving.
   - 5.4 Exercises/case studies on problem solving.

**UNIT 5**

6. Entrepreneurship

6.1 Introduction

- Concept/Meaning and its need
- Competencies/qualities of an entrepreneur
- Entrepreneurial Support System e.g., District Industry Centres (DICs), Commercial Banks, State Financial Corporations, Small Industries Service Institute (SISIs), Small Industries Development Bank of India (SIDBI), National Bank of Agriculture and Rural Development (NABARD), National Small Industries Corporation (NSIC) and other relevant institutions/organizations at State/National level.

6.2 Market Survey and Opportunity Identification (Business Planning)

- How to start a small scale industry
- Procedures for registration of small-scale industry
- List of items reserved for exclusive manufacture in small-scale industry
- Assessment of demand and supply in potential areas of growth.
- Understanding business opportunity
- Considerations in product selection
- Data collection for setting up small ventures.

6.3 Project Report Preparation

- Preliminary Project Report
- Techno-Economic Feasibility Report
- Exercises on Preparation of Project Report in a group of 3-4 students

**INSTRUCTIONAL STRATEGY**

This subject will require a blend of different teaching and learning methods beginning with lecture method. Some of the topics may be taught using question answer, assignment, case studies or seminar. In addition, expert lectures may be arranged from within the institution or from management organizations. Conceptual understanding of Entrepreneurship, inputs by teachers and outside experts will expose the students so as to facilitate in starting ones own business venture/enterprise. The teacher will discuss success stories and case studies with students, which in turn, will develop managerial qualities in the students. There may be guest lectures by successful diploma holding entrepreneurs and field visits also. The students may also be provided relevant text material and handouts.

**RECOMMENDED BOOKS**

1. Soft Skills for Interpersonal Communication by S. Balasubramanian Published by Orient BlackSwan, New Delhi.
2 Generic skill Development Manual, MSBTE, Mumbai.
3 Lifelong learning, Policy Brief (www.oecd.orf)
4 Lifelong learning in Global Knowledge Economy, Challenge for Developing Countries – World Bank Publication
5 Towards Knowledge Society, UNESCO Paris Publication
6 Your Personal Pinnacle of Success by DD Sharma, Sultan Chand and Sons, New Delhi
7 Human Learning, Ormrod
8 A Handbook of Entrepreneurship, Edited by BS Rathore and Dr JS Saini; Aapga Publications, Panchkula (Haryana)
9 Entrepreneurship Development by CB Gupta and P Srinivasan, Sultan Chand and Sons, New Delhi
10. Handbook of Small Scale Industry by PM Bhandari

**DAS 402 MECHANICS OF FLIGHT**

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An aircraft is capable of flying in spite of its large weight. It has particular shape and becomes air borenwith certain speeds. In order to appreciate the principle involved in flying, it is essential to gain knowledge and skill in the area of mechanics of fluids applied to flying.

**UNIT 1**

1. Introduction

Definition and importance of the subject, recapitulation of the names of the major components of the airplane, approach in flight mechanics, forces acting on an airplane in flight, body axes system for an airplane, special features of flight mechanics

2. Airflow

Indicated airspeed, calibrated airspeed, true airspeed, primary flight instruments: altimeter, air speed indicator, turn & bank indicator, head wind, tail wind and cross winds.

**UNIT 2**

3. Atmosphere characteristics

Earth's atmosphere: earth's atmosphere, the troposphere, the stratosphere, the mesosphere, the ionosphere or thermosphere, the exosphere, International standard atmosphere (ISA): need for ISA and agency prescribing it, features of ISA, Variations of properties with altitude in ISA: variations of pressure and density with altitude, variations with altitude of pressure ratio, density ratio speed of sound, geopotential altitude

**UNIT 3**

4. High Lift Systems

Airfoil's maximum lift coefficient, leading and trailing edge high-lift devices, effect of sweepback

5. Airfoil characteristics

Type of airfoil, aerodynamic centre of airfoil, ground effect on airfoil, pressure distribution, airfoil boundary condition

**UNIT 4**

6. Drag estimation

Drag aerodynamics, dimensional analysis, potential flow, induced drag, flow of viscous fluid, parasite drag, and flow of a compressible fluid, aerodynamic data, section characteristics, plan form characteristics, high lift and control devices, determination of three dimensional wing data, estimation of airplane drag, low& high speed drag estimation

**UNIT 5**

7. Airplane performance

Performance computation, generalized performance method, compressibility speed correction, range and endurance, take – off and landing distances, acceleration in climb, turning performance, design performance, power plant type & efficiency, power plant data, reciprocating engine cooling drag, propeller charts

**LIST OF PRACTICALS**

1) Demonstration of location of aerodynamic centre of cambered airfoil and symmetric airfoil
2) Demonstration of the location of various high lifting devices
3) Demonstration of stability and control of aircraft using auto-pilot

**INSTRUCTIONAL STRATEGY**

1. Teachers should lay special emphasis in making the students conversant with concepts, principles, procedures and practices related to various characteristics.
2. Focus should be laid in preparing jobs using various machines/equipment in the workshop.
3. Use of audio-visual aids/video films should be made to show specialized operations.

**RECOMMENDED BOOKS**

1) Airplane Performance Stability and Control by Perkins C.D. and Hage, R.E.; John Wiley & son Inc., New York, 1988
2) Principle of Helicopter Aerodynamics, by Leishman, J.G.; Cambridge Aerospace
3) Aircraft Dynamic Stability and Response by Babister, A.W.;Pergamon Press, Oxford, 1980.
4) Aeroplane Aero dynamics, Third Edition by Dommasch D.O., Shelby S.S. and Connolly, T.F.

# Swami Vivekanand University, Sagar (M.P)

# SYLLABUS

**DAS 403 AEROSPACE PROPULSION**

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 2 | 6 |

**RATIONAL**

The diploma holders in aerospace engineering must have knowledge and skill about the propulsion system of an aircraft. This subject has been designed for the full basics about the knowledge of different types of engines which are used in aircraft system.

**DETAILED CONTENTS**

**UNIT 1**

1. Introduction to aircraft propulsion

Introduction to propulsion, basic thermodynamics, fundamental equations, types of aircraft engines,performance parameters, thrust equation, factors affecting thrust and efficiencies.

2. Compressor

Introduction of compressor, types of compressor, centrifugal compressor,axial flow compressor, defects occured in compressor, advantage and disadvantages of centrifugal and axial flow compressor

**UNIT 2**

3. Steady 1-Dimensional flow

One dimensional flow of a perfect gas, isentropic flow, non-isentropic flow, frictionless constantarea flow, constant area flow with friction and without friction, normal shock and oblique shocks

4. Fundamentals of Gas Turbine Engines

Working principle of gas turbine engine, gas turbine cycle, turboprop, turbofan and turbojetengines, thrust and efficiency, methods of thrust augmentation, engine performancecharacteristics

**UNIT 4**

5. Aircraft Gas Turbine Engine

Compressor and turbine work, compressor and turbine efficiencies, general layout, gas flow diagram, engine intake and exhaust nozzles, after burner arrangements for thrust augmentation

6. Gas Turbine Systems and Components

Fuel system components, various types of fuel systems, lubricating oils and lubricating systems, secondary air systems, arrangements of bleeding of compressor air for aircraft pressurization and oxygen systems, engine starting systems

**UNIT 5**

7. Introduction to Rocket Propulsion

Distinctive features of rocket propulsion vis-à-vis other forms of propulsion, the rocket equation, multi-staging of rockets, definitions of thrust specific impulse, mass ratio, mass fraction, discharge coefficient, thrust coefficient, exhaust velocity, effective exhaust velocity, characteristic velocity. Thrust equation and the flow equation. Flow through a convergent/divergent nozzle, the conical nozzle and the contoured or bell-shaped nozzle.

**LIST OF PRACTICALS**

1) Demonstration of an aircraft JET engine
2) Demonstration of forced convective heat transfer over a flat plate
3) Cascade testing of a model of axial compressor blade row
4) Demonstration of performance of a propeller
5) Measurement of nozzle flow
6) Demonstrationof fuel-injection characteristics

**INSTRUCTIONAL STRATEGY**

1. Teaches should take the students to industry and explain the details of propulsion systems and their components.
2. While imparting instructions, focus should be on conceptual understanding.
3. Training slides of“Carrier Fundamentals of Aircraft propulsion” to be shown to students.

**RECOMMENDED BOOKS**

1) Gas Turbine, Jet and Rocket Propulsion byMathur M.L. and Sharma, R.P; Standard Publishers & Distributors, Delhi, 1999
2) Mechanics and Thermodynamics of Propulsion by Hill P.G. and Peterson, C.R. Addison;WesleyLongman INC, 1999
3) Gas Turbine Theory by Cohen, H. Rogers, G.F.C. and Saravanamuttoo; H.I.H Longman, 1989.
4) Aero thermodynamics of Aircraft Engine Components by Oates G.C; AIAA Education Series, New York, 1985

# Swami Vivekanand University, Sagar (M.P)

# SYLLABUS

**DAS 404 STRENGTH OF MATERIALS**

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 2 | 6 |

Diploma holders in this course are required to analyze reasons for failure of different components and select the required material for different applications. For this purpose, it is essential to teach them concepts, principles, applications and practices covering stress, strain, bending moment, shearing force, shafts, columns and springs. It is expected that efforts will be made to provide appropriate learning experiences in the use of basic principles in the solution of applied problems to develop the required competencies.

## DETAILED CONTENTS

**UNIT 1**

1. Stresses and Strains
   - 1.1. Concept of load, stresses and strain
   - 1.2. Tensile compressive and shear stresses and strains
   - 1.3. Concept of Elasticity, Elastic limit and limit of proportionality.
     - 1.3.1. Hook's Law
     - 1.3.2. Young Modulus of elasticity
     - 1.3.3. Nominal stress
     - 1.3.4. Yield point, plastic stage
     - 1.3.5 Ultimate strength and breaking stress
     - 1.3.6. Percentage elongation
     - 1.3.7. Proof stress and working stress
     - 1.3.8. Factor of safety
     - 1.3.9 Shear modulus
   - 1.4. Longitudinal and circumferential stresses in seamless thin walled cylindrical shells (derivation of these formulae not required)

**UNIT 2**

2. Resilience
   - 2.1 Resilience, proof resilience and modulus of resilience
   - 2.2 Strain energy due to direct stresses
   - 2.3 Stresses due to gradual, sudden and falling load.

3. Moment of Inertia
   - 3.1. Concept of moment of inertia and second moment of area
   - 3.2 Radius of gyration
   - 3.3 Theorm of perpendicualr axis and parallel axis (without derivation)
   - 3.4 Second moment of area of common geometrical sections :Rectangle, Triangle, Circle (without derivation); Second moment of area for L,T and I section
   - 3.5 Section modulus

**UNIT 3**

4. Bending Moment and Shearing Force
   - 4.1 Concept of beam and form of loading
   - 4.2 Concept of end supports-Roller, hinged and fixed

4.3 Concept of bending moment and shearing force
4.4 B.M. and S.F. Diagram for cantilever and simply supported beams with and without overhang subjected to concentrated and U.D.L.

5. Bending stresses

5.1 Concept of Bending stresses
5.2. Theory of simple bending
5.3. Use of the equation f/y = M/I = E/R
5.4. Concept of moment of resistance
5.5. Bending stress diagram
5.6. Calculation of maximum bending stress in beams of rectangular, circular, and T section.
5.7 Permissible bending stress Section modulus for rectangular, circular and symmetrical I section.

**UNIT 4**

6 Columns

6.1. Concept of column, modes of failure
6.2. Types of columns
6.3. Buckling load, crushing load
6.4. Slenderness ratio
6.5. Factors effecting strength of a column
6.6 End restraints
6.7 Effective length
6.8 Strength of column by Euler Formula without derivation
6.9. RankineGourdan formula ( without derivation)

*7.* Torsion

7.1. Concept of torsion- difference between torque and torsion.
7.2. Use of torque equation for circular shaft
7.3. Comparison between solid and hollow shaft with regard to their strength and weight.
7.4. Power transmitted by shaft
7.5. Concept of mean and maximum torque

**UNIT 5**

8. Springs

8.1. Closed coil helical springs subjected to axial load and impact load
8.2 Stress deformation
8.3 Stiffness and angle of twist and strain energy
8.4 Proof resilience
8.5 Laminated spring (semi elliptical type only)
8.6 Determination of number of plates

LIST OF PRACTICALS

1. Tensile test on bars of Mild steel and Aluminium.
2. Bending tests on a steel bar or a wooden beam.
3. Impact test on metals
   a) Izod test
   b) Charpy test
4. Torsion test on specimens of different metals for determining modulus of rigidity.
5. To determine the stiffness of a helical spring and to plot a graph between load and extension.
6. Hardness test on different metals.

**INSTRUCTIONAL STRATEGY**

1. Expose the students to real life problems.
2. Plan assignments so as to promote problem solving abilities and develop continued learning skills.

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**RECOMMENDED BOOKS**

1. SOM by Birinder Singh,; Katson Publishing House, New Delhi.
3. SOM by RS Khurmi; S.Chand& Co; New Delhi
4. Elements of SOM by D.R. Malhotra&H.C.Gupta; SatyaPrakashan, New Delhi.

# Swami Vivekanand University, Sagar (M.P)

# SYLLABUS

**DAS405 SPACECRAFT TESTING & MEASUREMENT**

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 2 | 6 |

**RATIONALE**

Diploma holder in aerospace engineering must have a sound knowledge of variousSpacecraft Testing & Measurement system. This subject is designed to give them an insight into typical system so that they understand their principles of working.

## DETAILED CONTENTS

**UNIT 1**

1. Introduction

Definition of metrology, standard of measurement, types of errors - controllable and random errors, precision, accuracy, sensitivity, hystersis, response time, repeatability, calibration, uncertainty of measurement, interchangability, standardization and standardizing organizations.

**UNIT 2**

2. Linear Measurement

Construction features and use of instruments for non-precision linear measurement: steel rule, callipers, surface plate, angle plate, V-block, construction features and use of instruments for precision measurements : verniercalipers, vernier height and depth gauges, micrometers, Slip gauges, Indian standards of slip gauges, sets of slip gauges, use of slip gauges, cylinder bore gauges, feeler and wire gauges, checking flatness, roundness and squareness.

**UNIT 3**

3. Measurements of Screw Threads and Gauges

Measurement of screw threads- Introduction, measurements of external and core diameters, checking of pitch and angle of threads with gauges, Measurements of gears (spur) – Measurement of tooth thickness, pitch, Profile projector, Coordinate Measuring Machine (CMM), Tool maker's microscope.

**UNIT 4**

4. Angular Measurement

Comparators – Characteristics, uses, working principles of different types of comparators: mechanical, electrical, electronics and pneumatic, construction and use of instruments for angular measurements: bevel protector, sine bar, angle gauges, and clinometer, angle dekker. Optical instruments for angular measurement, auto collimator.

**UNIT 5**

5. Study of pitot tubes

History, types of pitot tubes, working of pitot tubes, calculation of velocity, implementation of pitot tube, applications.

**LIST OF PRACTICALS**

1. Internal and external measurements with verniercalliper and microscope
2. Study of various types of flight instruments
3. Use of strain gauges
4. Measurement of force, torque and power
5. Measurement of flow
6. Measurement of pressure
7. Measurement of acoustics
8. Measurement of temperature
9. Measurement of velocity

**INSTRUCTIONAL STRATEGY**

1. Demonstrate use of various measuring instruments while imparting theoretical instructions.
2. Stress should be laid on correct use of various instruments.

**RECOMMENDED BOOKS**

1. Engineering Metrology by RK Jain; Khanna Publishers, New Delhi.
2. A Text Book of Production Engineering by RC Sharma; S Chand and Company, New Delhi.
3. Metrology Laboratory Manual by M Adithan and R Bahl; NITTTR, Chandigarh.
4. Engineering Metrology by RK Rajput; SK Kataria and Sons, Ludhiana

# Swami Vivekanand University, Sagar (M.P)

# SYLLABUS

**DAS 406 SPACECRAFT SYSTEMS**

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 2 | 6 |

**RATIONAL**

Diploma holder in aerospace engineering must have a sound knowledge of various mechanical and electrical systems which go in the airframe. This subject is designed to give them an insight into typical system so that they understand their principles of working

**DETAILED CONTENTS**

**UNIT 1**

1. Flight Control Systems

Primary and secondary flight controls, flight control linkages, cable and pulley system, push-pull control rod system, flight control actuators such as mechanical actuators, electro-mechanical actuators, electro-hydraulic actuators, fly-by-wire actuators, typical aileron and elevator control systems.

**UNIT 2**

2. Hydraulic system

Typical system layout, hydraulic reservoirs and accumulators, pressure generation, pressure control, indication and warning system functioning of hydraulic pump; checks on hydraulic oil; elementary flight controls including power operated / assisted flight controls; pneumatic system; landing gear; brakes; nose wheel steering; main wheels; tyres; antiskid devices;

3. Fuel System

System layout , fuel tanks , fuel supply system, dumping, venting and draining; indications and warnings, functioning of various components, checks during routine servicing; common problems in the system components.

**UNIT 3**

4. Air conditioning and Cabin pressurization

Air supply sources including engine bleed, APU and ground cart; air-conditioning system - component layout, functioning of individual components and routine checks on the system; distribution system, flow temperature and humidity control.

**UNIT 4**

5. Oxygen system

Oxygen system layout, supply regulation, sources, storage charging and distribution; engine oxygen system indications and warnings, procedures for carrying out oxygen leak check, precaution while working on oxygen system.

**UNIT 5**

6. Fire protection and Icing Protection systems

Fire/smoke detection and warning system; fire extinguishers system, standard operating procedures for fire fighting on ground; life saving equipment such as inflatable slides, life jackets etc., emergency exits. Ice formation and its effect on functioning on various systems, anti-icing system, deicing system.

**LIST OF PRACTICALS**

Study and demonstration of the following aircraft systems:

1. Hydraulic system
2. Mechanical system
3. Pneumatic system
4. Electrical system
5. Fly-by-wire system
6. Fuel system
7. Air conditioning system

**INSTRUCTIONAL STRATEGY**

1. Teaches should take the students to industry and explain the details of hydraulic systemand air-conditioning systems and their components.
2. While imparting instructions, focus should be on conceptual understanding.
3. Training slides of “Carrier Fundamentals of Refrigeration Air Conditioning” to be shown to students.

**RECOMMENDED BOOKS**

1. Hydraulic System by Dr. Lalit Gupta
2. Pneumatic System by Dr. Lalit Gupta
3. Aircraft systems by Ian Moir and Allan Seabridge
4. Aircraft instruments by E H J Pallet

# Swami Vivekanand University, Sagar (M.P)
# SYLLABUS
## ENTREPRENEURIAL AWARENESS CAMP

This is to be organized at a stretch for two to three days during fourth semester. Lectures will be delivered on the following broad topics. There will be no examination for this subject

1. Who is an entrepreneur?
2. Need for entrepreneurship, entrepreneurial career and wage employment
3. Scenario of development of small scale industries in India
4. Entrepreneurial history in India, Indian values and entrepreneurship
5. Assistance from District Industries Centres, Commercial Banks. State Financial Corporations, Small industries Service Institutes, Research and Development Laboratories and other financial and development corporations
6. Considerations for product selection
7. Opportunities for business, service and industrial ventures
8. Learning from Indian experiences in entrepreneurship (Interaction with successful entrepreneurs)
9. Legal aspects of small business
10. Managerial aspects of small business

# Swami Vivekanand University, Sagar (M.P)

# SYLLABUS

## INDUSTRIAL TRAINING

Industrial Training aims at exposing the students to field practices, size and scale of operation and work culture at practical sites. For this purpose, students at the end of fourth semester are required to be sent for a period of 4 weeks to industry.

Each student is supposed to study the material and technology used at site and prepares a detailed report of the observation of process seen by him/her. These students should be supervised and guided by respective subject teachers. Each teacher may guide a group of four to five students.

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

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

# Swami Vivekanand University, Sagar (M.P)

# SYLLABUS

## DAS 501 AERODYNAMICS

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 2 | 6 |

**RATIONALE**

An aircraft is capable of flying in spite of its large weight. It has particular shape and becomes air borne beyond certain speeds. In order to appreciate the principles involved in flying it is essential to gain knowledge and skill in the area of mechanics of air applied to flying.

**DETAILED CONTENTS**

**UNIT 1**

1. Introduction to Viscous Flow

Qualitative aspects of viscous flows, viscosity and thermal conductivity. Phenomenon of separation; viscous flow energy equation. laminar flow and turbulent flow,poiseuille flow, couette flow, hagen-poiseuille flow and hele-shaw flow.

**UNIT 2**

2. Effects of Compressibility

Critical Mach number; drag-divergence mach number, sound barrier, transonic area rule, introduction to shock-free airfoils.

**UNIT 3**

3. Incompressible Flows over Finite Wings

Downwash, induced drag, vortex filament, the biot-savart law, prandtl's lifting line theory and its limitations, elliptic lift distribution.

4. Inviscid Incompressible Flow

Condition on velocity for incompressible flow. Laplace's equations. Potential function, stream function. Basic elementary flows: Uniform flows, source flow, doublet flow and vortex flow. Superimposition of elementary flows, non lifting and lifting flow over a circular cylinder, comparison with real flow over circular cylinder.

**UNIT 4**

5. Subsonic Linearized Flow over Airfoils

Full velocity potential equation, linearized velocity potential equation and boundary condition, prandtl-glauret compressibility correction.

**UNIT 5**

6. Applications of Finite Wing Theory

Simplified horse-shoe vortex model, formation flight, influence of downwash on tail plane, ground effects.

**LIST OF PRACTICALS**

1. Smoke flow visualization studies on a two-dimensional circular cylinder at low speeds.
2. Smoke flow visualization studies on a two dimensional airfoil at different angles of incidence at low speeds.
3. Tuft flow visualization on a wing model at different angles of incidence at low speeds: identify zones of attached and separated flows.
4. Surface pressure distributions on a two-dimensional symmetric airfoil at zero incidence at low speeds.
5. Surface pressure distributions on a two-dimensional cambered airfoil at different angles of incidence and calculation of lift and pressure drag.
6. Calculation of total drag of a two-dimensional symmetrical airfoil at low speeds at incidence using pitot-static probe wake survey.

**INSTRUCTIONAL STRATEGY**

1. Power point presentation for making students understand the theoretical concept.
2. Derivation and numericals will be solve on board.
3. For promoting the solving abilities different assignment will be plan.

**RECOMMENDED BOOKS**

1. Fundamentals of Aerodynamics byAnderson, Jr. J.D; Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 2007. (Special Indian Edition).
2. Aerodynamics for Engineering Students byHoughton E.L and Carpenter P.W; CBS Publications and Distributors, 1993. (4th Edition).

**DAS 502 AIRCRAFT STRUCTURES**

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 2 | 6 |

**RATIONALE**

In aircraft structures the diploma holders must have knowledge of strength of materials so that students will understand the concept of structures. This knowledge will be helpful in doing the structural analysis.

## DETAILED CONTENTS

**UNIT 1**

1. Energy Methods

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 2**

2. Shear Flow in Open Sections

Thin walled beams, concept of shear flow, shear centre, elastic axis. With one axis of symmetry, with wall effective and ineffective in bending, unsymmetrical beam sections.

3. Shear Flow in Closed Sections

Bredt – Batho formula, SinGle and multi – cell structures, approximate methods, shear flow in single & multi-cell structures under torsion. Shear flow in single and multi-cell under bending with walls effective and ineffective.

**UNIT 3**

4. Unsymmetrical Bending

Bending stresses in beams of unsymmetrical sections – Bending of symmetric sections with skew loads.

**UNIT 4**

5. Failure Theory

Maximum stress theory, maximum strain theory, maximum shear stress theory, distortion theory, maximum strain energy theory, application to aircraft structural problems.

**UNIT 5**

6. Buckling of Plates

Rectangular sheets under compression, local buckling stress of thin walled sections, crippling stresses by Needham's and Gerard's methods, thin walled column strength. Sheet – stiffener panels. Effective width, inter rivet and sheet wrinkling failures.

7. Joints & Fittings and Introduction to Post Buckling

General theory for the design of fittings, estimation of fitting design loads, design of riveted, bolted and welding joints, post buckling of structures, concept of effective width.

**LIST OF PRACTICALS**

1. Verification of Maxwell's Reciprocal theorem & principle of superposition
2. Deflection of beams with various end conditions.
3. Calculation of shear center of open and closed section.
4. Torsional rigidity of open and closed section
5. Column – Testing and south well plot
6. Tensile test, tear test, shear test and bearing test of riveted/screwed/bolted joints.

**INSTRUCTIONAL STRATEGY**

1. Initially some of the concept related to strength of materials will be looked at.
2. Expose students to real life problem.
3. Power point presentation for making students understand the theoretical concept.

**RECOMMENDED BOOKS**

1. Aircraft Structures by Dr.Lalit Gupta
2. Analysis of Aircraft Structures – An Introduction by Donaldson, B.K; McGraw-Hill, 1993.
2. Aircraft Structures for Engineering Students by Megson, T.M.G; Edward Arnold, 1995.
3. Aircraft Structures byPeery, D.J., and Azar, J.J; 2nd edition, McGraw–Hill, N.Y., 1993.

## DAS 503 AIRCRAFT INSTRUMENTATION

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 2 | 6 |

**RATIONALE**

The subject aims at development of knowledge and skills regarding various measuring and testing instruments and inspection techniques as applied to general aeronautical practise.

**DETAILED CONTENTS**

**UNIT 1**

1. Electronic and Flight Instruments

Display -units, presentation, failure, and annunciation. Display of air data.

**UNIT 2**

*2* Communication

HF, U/VHF, satellite communication , air traffic control (ATC) transponder, traffic collision & avoidance system (TCAS)

**UNIT 3**

3. Pitot Static Instruments System

Pitot static system, air speed indicator, altimeter, mach meter, mach/airspeed indicator, vertical speed indicator

**UNIT 4**

4. Gyroscopic instruments

Gyroscope and its properties, gyro horizon, turn and bank indicator, turn coordinator, direct reading magnetic compass, directional gyroscope

**UNIT 5**

5. Navigational Instruments

Very high and ultra high frequency radio aids, VOR, TACAN,VORTAC, VHF direction finding, instrument landing system , microwave landing system

**LIST OF PRACTICALS**

1. Study and fabrication of flight instruments
2. Study and demonstration of instrument related to pitot static tube for calculation of altimeter, air speed and RPM
3. Study and demonstration of stall warning instruments and angle of attack indicator
4. Study and demonstration of fuel system and fuel flow indicator.
5. Study of Auto pilot , automatic control CVR, CDR and FDR

**INSTRUCTIONAL STRATEGY**

1. The design of cockpit is initially shown so that student will understand the where which instrument is present.
2. Power point presentation for making students understands the theoretical concept.
3. For promoting the solving abilities different assignment will be plan.

**RECOMMENDED BOOKS**

1. Aircraft Systems by Ian Moir and Allan Seabridge
2. Aircraft Instruments by E H J Pallet

# Swami Vivekanand University, Sagar (M.P)

# SYLLABUS

**DAS 504 ENVIRONMENTALSCIENCE**

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | - | 4 |

**RATIONALE**

Adiplomaholdermusthaveknowledgeofdifferenttypesofpollutioncausedduetoindustries and constructionalactivitiessothathemayhelpinbalancingtheecosystemandcontrollingpollutionby pollutioncontrolmeasures.Heshouldalsobeawareofenvironmentallawsrelatedtothecontrolofp ollution.

## DETAILEDCONTENTS

**UNIT 1**

1. Basics ofecology,ecosystem andsustainabledevelopment

2. Conservationoflandreforms,preservationofspecies,preventionofadvancementofdeserts andloweringof watertable

**UNIT 2**

3. Sourcesofpollution -naturaland manmade,theireffectson livingandnon-livingorganisms,Pollutionofwater-causes,effectsofdomesticwastesandindustrialeffluent onlivingandnon-livingorganisms,Pollutionofair-causesandeffectsofman,animal,vegetationandnon-livingorganisms, Sourcesofnoisepollutionanditseffects

**UNIT 3**

4. Solidwastemanagement;classificationofrefusematerial,types,sourcesandproperties of solidwastes,abatementmethods

5. Mining,blasting,deforestationandtheireffects

**UNIT 4**

6. Legislation tocontrolenvironment

7. Environmental ImpactAssessment(EIA),Elementsfor preparingEIAstatements

**UNIT 5**

8. Current issues in environmental pollution and its control, role of non-conventionalsources ofenergyinenvironmentalprotection

**INSTRUCTIONAL STRATEGY**

Some experts from the field may be invited for extension lectures, video films on

environment, may be shown to explain the importance of environment protection.

**RECOMMENDED BOOKS**

1. EnvironmentalandPollutionAwareness bySharmaBR;SatyaPrakashan, NewDelhi.
2. EnvironmentalProtectionLawandPolicyinIndiabyThakurKailash;DeepandDeepPublications,NewDelhi.
3. EnvironmentalEngineeringandManagementbySureshK Dhamija;SKKatariaand Sons, NewDelhi.
4. EnvironmentalSciencebyDeswalandDeswal;DhanpatRaiandCo. (P)Ltd.Delhi.

# Swami Vivekanand University, Sagar (M.P)
# SYLLABUS

**DAS 505 THEORY OF MACHINES**

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | - | 4 |

**RATIONALE**

A diploma holder in this course is required to assist in the design and development of prototype and other components. For this, it is essential that he is made conversant with the principles related to design of components of machine and application of these principles for designing. The aim of the subject is to develop knowledge and skills about various aspects related to design of machine components.

**DETAILED CONTENTS**
**THEORY**

**UNIT 1**

1. Simple Mechanisms

   1.1 Introduction to link, kinematic pair, lower and higher pair, Kinematic chain, mechanism, Inversions.
   1.2 Different types of mechanisms ( with examples )

2. Friction
   2.1 Definition and its necessity
   2.2 Horizontal force required to move a body on an inclined plane both upward and downward
   2.3 Frictional torque in screws , both for square and V threads
   2.4 Screw jack ( Derivation and Numericals)
   2.5 Different types of bearings and their application

**UNIT 2**

3. Power Transmission

   3.1 Introduction to Belt and Rope drives
   3.2 Types of belt drives and types of pulleys
   3.3 Concept of velocity ratio, slip and creep; crowning of pulleys (simple numericals)
   3.4 Flat and V belt drive: Ratio of driving tensions, power transmitted, centrifugal tension, and condition for maximum horse power (simple numericals)
   3.5 Different types of chains and their terminology
   3.6 Gear terminology, types of gears and their applications; simple and compound gear trains; power transmitted by simple spur gear

**UNIT 3**

4. Flywheel
   4.1 Principle and applications of flywheel
   4.2 Turning - moment diagram of flywheel for different engines

   4.3 Fluctuation of speed and fluctuation of energy - Concept only
   4.4 Coefficient of fluctuation of speed and coefficient of fluctuation of energy

**UNIT 4**

5. Governor

5.1 Principal of governor

5.2 Simple description and working of Watt, Porter and Hartnel governor (simple numerical based on watt and porter governor)

5.3 Hunting, isochronism, stability, sensitiveness of a governor

6. Balancing

6.1 Concept of balancing

6.2 Introduction to balancing of rotating masses (simple numericals)

**UNIT 5**

7. Vibrations

7.1 Types-longitudinal, transverse and torsional vibrations (simple numericals)

7.2 Dampening of vibrations

7.3 Causes of vibrations in machines, their harmful effects and remedies

## INSTRUCTIONAL STRATEGY

1. Use teaching aids for classroom teaching
2. Give assignments for solving numerical problems
3. Arrange industry visits to explain the use of various machine components like belt, rope, chain, gear drives, action due to unbalanced masses, brake clutch, governors, fly wheels, cams and gear drives
4. Video films may be used to explain the working of mechanisms and machine components like clutch, governors, brake etc.

## RECOMMENDED BOOKS

1. Theory of Machines by D.R. Malhotra; SatyaPrakashan, New Delhi.
2. Theory of Machines by V.P Singh; DhanpatRai and sons, New Delhi.
3. Theory of Machines JagdishLal; Metropolitan Publishers, New Delhi.

# Swami Vivekanand University, Sagar (M.P)

# SYLLABUS

## DAS 506 COMPUTER AIDED DRAFTING

**L T P C**

**RATIONALE**

Computer applications play a very vital role in the professional life of diploma holder. This subject offers applications of various computer software in aeronautical engineering.

**DETAILED CONTENTS**

**UNIT 1**

1. Introduction to AutoCAD commands (6 drawing sheets)

   1.1 Concept of AutoCAD, Tool bars in Auto CAD, coordinate system, snap, grid, and ortho mode (Absolute, Relative and Polar)
   1.2 Drawing commands – point, line, arc, circle, ellipse,
   1.3 Editing commands – scale, erase, copy, stretch, lengthen and explode.
   1.4 Dimensioning and placing text in drawing area
   1.5 Sectioning and hatching
   1.6 Inquiry for different parameters of drawing entity

**UNIT 2**

2. Detail and assembly drawing of the following using AUTOCAD (4 sheets)

   2.1 Plummer Block
   2.2 Wall Bracket
   2.3 Stepped pulley, V-belt pulley
   2.4 Flanged coupling
   2.5 Machine tool Holder (Three views)
   2.6 Screw jack or knuckle joint

**UNIT 3**

3. Isometric Drawing by CAD using Auto CAD (one sheet)

   Drawings of following on computer:
   - Cone
   - Cylinder
   - Isometric view of objects

**UNIT 4**

4. Modelling (01 sheet)

   3D modelling, Transformations, scaling, rotation, translation

**UNIT 5**

5. Introduction to other CAD softwares;

   (Pro Engineer/CATIA / Inventor/Unigraphics/Solid Work: Salient features, simple drawing of components (2 D and 3D)(At least one software)

## INSTRUCTIONAL STRATEGY

1. Teachers should show model or realia of the component/part whose drawing is to be made.

2. Emphasis should be given on cleanliness, dimensioning, & layout of sheet.

3. Teachers should ensure use of IS codes related to drawing.

## RECOMMENDED BOOKS

1. Engineering Drawing with AutoCAD 2000 by T. Jeyapooran; Vikas Publishing House, Delhi.
2. AutoCAD for Engineering Drawing Made Easy by P. NageswaraRao; Tata McGraw Hill, New Delhi.
3. AutoCAD 2000 for you by UmeshShettigar and Abdul Khader; Janatha Publishers, Udupi.
4. Auto CAD 2000 by Ajit Singh, TMH, New Delhi.
5. Designing with Pro Engineer, Sham Tickoo by Dream Tech Publications, New Delhi.
6. Designing with CATIA, by Sham Tickoo, Dream Tech. Publications, New Delhi.

# Swami Vivekanand University, Sagar (M.P)

# SYLLABUS

## PERSONALITY DEVELOPMENT CAMP

This is to be organized at a stretch for two to three days during fifth or sixth semester. Extension Lectures by experts or teachers from the polytechnic will be delivered on the following broad topics. There will be no examination for this subject.

1. Communication Skills
2. Correspondence and job finding/applying/thanks and follow-up
3. Resume Writing
4. Interview Techniques: In-Person Interviews; Telephonic Interview' Panel interviews; Group interviews and Video Conferencing etc.
5. Presentation Techniques
6. Group Discussions Techniques
7. Aspects of Personality Development
8. Motivation
9. Leadership
10. Stress Management
11. Time Management
12. Interpersonal Relationship
13. Health and Hygiene

# Swami Vivekanand University, Sagar (M.P)
# SYLLABUS

**DAS 601 BASICS OF MANAGEMENT**

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | - | 4 |

## RATIONALE

The diploma holders are generally expected to take up middle level managerial positions, their exposure to basic management principles is very essential. Topics like Structure of Organization, Leadership, Motivation, Ethics and Values, Customer Relationship Management (CRM), Legal Aspects of Business, Total Quality Management (TQM), Intellectual Property Rights (IPR) etc. have been included in the subject to provide elementary knowledge about these management areas.

### *DETAILED CONTENTS*

**UNIT 1**

1. Principles of Management

1.1. Introduction, definition and importance of management.

1.2. Functions of Management
Planning, Organizing, Staffing, Coordinating, Directing, Motivating and Controlling.

1.3. Concept and Structure of an organization

Types of industrial organization
a) Line organization
b) Functional organization
c) Line and Functional organization

1.4. Hierarchical Management Structure
Top, middle and lower level management

1.5. Departmentalization
Introduction and its advantages.

**UNIT 2**

2. Work Culture

2.1. Introduction and importance of Healthy Work Culture in organization
2.2. Components of Culture
2.3. Importance of attitude, values and behaviour
Behavioural Science – Individual and group behaviour
2.4. Professional ethics – Concept and need of Professional Ethics

**UNIT 3**

3. Leadership and Motivation

3.1. Leadership
- 3.1.1. Definition and Need of Leadership
- 3.1.2. Qualities of a good leader
- 3.1.3. Manager vs. leader

3.2. Motivation
- 3.2.1. Definition and characteristics of motivation
- 3.2.2. Factors affecting motivation
- 3.2.3. Maslow's Need Hierarchy Theory of Motivation

3.3. Job Satisfaction

4. Legal Aspects of Business: Introduction and need

4.1. Labour Welfare Schemes
- 4.1.1. Wage payment : Definition and types
- b) Incentives: Definition, need and types

4.2. Factory Act 1948

4.3. Minimum Wages Act 1948

**UNIT 4**

5. Management Scope in different Areas

5.1. Human Resource Development

- 5.1.1. Introduction and objective
- 5.1.2. Manpower Planning, recruitment and selection
- 5.1.3. Performance appraisal methods

5.2. Material and Store Management

a) Introduction, functions and objectives of material management
b) Purchasing: definition and procedure
c) Just in time (JIT)

5.3. Marketing and Sales

a) Introduction, importance and its functions
b) Difference between marketing and selling
c) Advertisement- print media and electronic media
d) Market-Survey and Sales promotion.

5.4. Financial Management – Introduction

5.4.1. Concept of NPV, IRR, Cost-benefit analysis

5.4.2. Elementary knowledge of Income Tax, Sale Tax, Excise duty, Custom duty, Provident Fund

5.5 Maintenance Management

5.5.1 Concept

5.5.2 Preventive Maintenance

**UNIT 5**

6. Miscellaneous topics

6.1. Customer Relationship Management (CRM)

a) Definition and Need

b) Types of CRM

c) Customer satisfaction

6.2. Total Quality Management (TQM)

a) Inspection and Quality Control

b) Concept of Quality Assurance

c) TQM

6.3. Intellectual Property Rights ( IPR)

3.3.1. Introduction, definition and its importance

3.3.2. Infringements related to patents, copyright, trade mark

**INSTRUCTIONAL STRATEGY**

It is observed that the diploma holders generally take up middle level managerial positions, therefore, their exposure to basic management principles is very essential. Accordingly students may be given conceptual understanding of different functions related to management. Some of the topics may be taught using question answer, assignment or seminar method. The teacher will discuss success stories and case studies with students, which in turn, will develop appropriate managerial qualities in the students. In addition, expert lectures may also be arranged from within the institutions or from management organizations. Appropriate extracted reading material and handouts may be provided.

**RECOMMENDED BOOKS**

1. Principles of Management by Philip Kotler TEE Publication
2. Principles and Practice of Management by ShyamalBannerjee: Oxford and IBM Publishing Co, New Delhi.
3. Financial Management by MY Khan and PK Jain, Tata McGraw Hill Publishing Co., 7, West Patel Nagar , New Delhi.
4. Modern Management Techniques by SL Goel: Deep and Deep Publications Pvt Limited , RajouriGarden, New Delhi.
5. Management by James AF Stoner, R Edward Freeman and Daniel R Gilbert Jr. : Prentice Hall of India Pvt Ltd, New Delhi.
6. Essentials of Management by H Koontz, C O' Daniel , McGraw Hill Book Company, New Delhi.
7. Marketing Management by Philip Kotler, Prentice Hall of India, New Delhi
8. Total Quality Management by DD Sharma, Sultan Chand and Sons, New Delhi.
9. Intellectual Property Rights and the Law by Dr. GB Reddy.
10. Service Quality Standards, Sales & Marketing Department, MarutiUdyog Ltd.
11. Customer Relationship Management: A step-by-step approach, Mohamed &Sagadevan Oscar Publication, Delhi
12. Customer Relation Management, Sugandhi RK, Oscar Publication, Delhi.

# Swami Vivekanand University, Sagar (M.P)
# SYLLABUS
## DAS 602 ELEMENTS OF AVIONICS

**L T P C**
**3 1 2 6**

**RATIONALE**

An aircraft is capable of flying in spite of bad weather and several unfavourable conditions with the help of various instruments. In order to appreciate the principle involved in flying it is essential to gain knowledge and skill in the area of all the instruments and equipments applied to flying.

**DETAILED CONTENTS**

**UNIT 1**

1Introduction to Avionics and Digital Systems

Typical avionics subsystems, amplifier, oscillator, aircraft communication system, transmitter, receiver, antenna, Digital Computers – microprocessors – memories

**UNIT 2**

2 Navigation System and Radar

Bus bar, split bus bar system, special purpose cables, electrical diagram and identification scheme, circuit controlling devices, power utilisation-typical application to avionics, need for avionics in civil and military aircraft, gyroscopic versus inertial platform, structure of stable platform, inertial navigation units, inertial alignment, inertial interface system, importance of compass swing

**UNIT 3**

3 Electronic Flight Control System

Fly-by-wire system: - basic concept and features. Pitch and Roll rate: - command and response, control laws, frequency response of a typical FBW actuator, cooper harper scale, redundancy and failure survival, common mode of failures and effects analysis

4 Flight Deck and Cockpits

Control and display technologies CRT, LED, LCD, EL and plasma panel - Touch screen - Direct voice input (DVI) – Civil cockpit and military cockpit: MFDS, HUD, MFK, HOTAS

**UNIT 4**

5 Avionics Systems Integration

Avionics equipment fit. Electrical data bus system. communication systems, navigation systems, flight control systems, radar, electronic warfare, and fire control system. avionics system architecture–data buses MIL–STD 1553 B.

**UNIT 5**

6. Automatic Flight Control System

Auto Pilot, Pitch Orientational Control System, Acceleration Control System, Instrument landing system, Yaw Orientational Control System

## LIST OF PRACTICALS

1. Study and demonstration of electronics flight system
2. Study and demonstration of fly by wire system
3. Study and demonstration of Pitch and roll system
4. Study and demonstration of amplifiers and oscillator of aircraft
5. Study and demonstration of transmitter & antenna

## INSTRUCTIONAL STRATEGY

1. Use computer based learning aids for effective teaching-learning
2. Expose students to real life problems
3. Plan assignments so as to promote problem solving abilities and develop continued learning skills

## RECOMMENDED BOOKS

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

# Swami Vivekanand University, Sagar (M.P)

# SYLLABUS

## DAS 603 AIRCRAFT SAFETY & MANAGEMENT

**L T P C**
**3 1 - 4**

**RATIONALE**

The subject deals with the safety concepts and practices in general and as applicable to aeronautical field and labs.The students will acquire knowledge and skill in the management of aircraft and its system, organization required controls and economics of management. The teaching is to be practice- oriented.

**DETAILED CONTENTS**

**UNIT 1**

1. Human Factors

Human Information Processing, Situation Awareness, Mental Workload and Stress, Human Error, Error Classification and Reduction, Measuring Human Error, Workload and Fatigue, Human Computer Interaction and Human Errors in Flight Operations.

1. Air Traffic Control

Principles of air Navigation and Air Traffic Control (ATC), overview of CNS &ATM,separation standards, radar and non radar separation, wake turbulence longitudinal separation minima, precision approaches for landing, radar system for ATCquality and airworthiness assurance

**UNIT 2**

2. Airlines and Airport Management

Introduction to airline industry and economics, determination of operating costs, Airline route selection and scheduling, planning of flight operations, wind rose diagram and geometric design of the airfield.

4. Current Issues and Trends in Air Transportation

Modeling and simulation of ATC system, estimation of airway capacity an delay,human factors and controller workload, performance based navigation, free flight, conflict detection and resolution, environmental effects of aviation, modeling air transport system.

**UNIT 3**

5. Maintenance Schedules

Maintenance of aircraft, its components, system and sub-system, types of maintenance schedules, mandatory schedules, inspection of aircraft and components: types of inspections, various aircraft manuals, service letter and service bulleting, advisory circulars, repair, modifications, alteration, reconditioning, history record sheet

6. Maintenance of Structure and Various Systems

Maintenance of aircraft structure, propeller, power-plant, undercarriage, hydraulic system, fuel system, air- conditioning system

**UNIT 4**

7. Aircraft Assembly and Rigging

Aircraft assembly,rigging, alignment of fixed surfaces and flight controls and system in detail, balancing, inspection and maintenance, flight control system of helicopter

**UNIT 5**

8. Quality and Airworthiness Assurance

Zero defect analogy, FMECA, fault tree analysis, bench marking, quality circles, quality audit. Quality standards: ISO 9000,TQM,CMM, Six sigma, quality organizational set up in production/repair/operational set up.

## INSTRUCTIONAL STRATEGY

It is observed that the diploma holders generally take up middle level managerial positions and aircraft safety, therefore, their exposure to basic management principles and knowledge of safety is very essential. Accordingly students may be given conceptual understanding of different functions related to management and safety. Some of the topics may be taught using question answer, assignment or seminar method.

## RECOMMENDED BOOKS

1. Quality planning and analysis byJ M Juran, Frank M Gryna; TMH publications, 2005
2. Fundamental of air traffic control, 4th edition by Michael S Nolan; Thomson Brooks/Cole, USA, 2004
3. Planning and Design of Airports, 4th edition by Robert Horonjeff& Francis X Mckelvey;Mcgraw Hill Professional Publishing, 1993

# Swami Vivekanand University, Sagar (M.P)
# SYLLABUS

## DAS 604 AIRCRAFT MAINTENANCE, REPAIR AND OVERHAULING

**L T P C**
**3 1 2 6**

**RATIONALE**

The subject deals with the maintenance concepts and practices in general and as applicable to aeronautical field.The students will acquire knowledge and skill in the maintenance of aircraft and its system, controls and economics of maintenance. The teaching is to be practice- oriented.

**DETAILED CONTENTS**

**UNIT 1**

1. Maintenance Of Radio and Communication Systems

a) Basics of the application and identification of electrical cables used in Aircraft radio installation, crimping and soldering techniques, bonding continuity and insulation tests.
b) Composition, performance (stability and tolerance) and limitations of the fixed resistors and varistors (carbon composition, carbon film, wire wound and metallic film).
c) AC and DC measuring instruments:

- Electrical power distribution systems, the operation and construction of static inverters, rotary inverters and transformer rectifier units.
- Basics of interference caused by electrical and ignition system to radio apparatus, methods of minimizing or suppressing such interference, bonding and screening.
- Construction and Identification of various types of antennas; the voltage and current distribution along antenna of various length; characteristics of ground planes.
- Very high frequency (VHF) and high frequency (HF) airborne communications; frequency bands allocation; the methods of propagation and the ranges expected, both day and night; calculation of approximate range of communication (line of sight) with given data.
- The performance levels expected and specifications of typical airborne HF and VHF communication systems; the principle of operation, installation practices and procedures, functioning of the operating controls and indications and maintenance of typical HF and VHF communication transceivers.
- Theory of operation, performance level and specifications of an Audio Integration System.
- Working principles and testing of Lead Acid and Nickel Cadmium and Silver Zinc batteries Principles, Characteristics and operation of the under mentioned systems:
  - Automatic Direction Finder (ADF) Systems,
  - Very High Frequency (VHF) Omn, Directional Range System.
  - Instrument Landing Systems,

- Weather Radar Systems.
- Air Traffic Control (ATC) Transponder System.
- Omega Navigation System.
- Radio Altimeter Systems
- Cockpit Voice Recorder.
- Distance Measuring Equipment
- Doppler Navigation System.
- Microwave Landing System
- Emergency Locator Transmitters.
- Computers
- Simulators.
- Flight Control Systems.
- Basics of state-of-the-art communication and navigation systems. Principles of Satellite Communications and its application to aircraft.

d) Engine Maintenance

Piston/Gas Turbines: Periodical servicing procedures, engine installation checks, control rigging, ground running checks, priming, bleeding and performance checks. Engine on condition maintenance.Trouble shooting and rectification.Inspection after shock landing. Crack detection. Procedure for long and short terms storage of engine and accessories, engine preservation and depreservation.

**UNIT 2**

3. Maintenance of Fuel System and Control Surface Systems

- Control Surface Systems

Airplane controls, ailerons, elevators, rudder, trimming and control tabs, leading and trailing edge flaps, tailplane and fins. Maintenance of Fuel System and Lubrication System.

- Aircraft systems

Flying controls including power operated controls, hydraulic, pneumatic, landing gear various types, shock struts, nose wheel steering, ice and rain protection, fire detection warning and extinguishing, oxygen, air -conditioning and pressurization systems, wheels, tyres, brakes, antiskid system. Windows, doors and emergency exists. Reliability and redundancy of systems design.

- Inspection

Basic principles of inspection, inspection gauges, and tools. Standard inspection techniques and procedures. Go/No go gauges, gauge calibration and maintenance, limits and tolerance. NDT techniques.

Major and minor damage, damage tolerance.Corrosion and corrosion prevention. Major and minor defects. Defect reporting, rectification and investigation. Rigging of aircraft, symmetry checks. Balancing of control surfaces, Periodical inspections,

heavy landing, overweight landing checks, abnormal flight loads. Aircraft weighing, weight schedule, calculation of centre of gravity.

- Electrostatic Sensitive Devices
- Electromagnetic Environment

Typical Electronics/ Digital Aircraft Systems

- Electronic Centralised Aircraft Monitoring (ECAM)
- Electronic Flight Instrument Systems (EFIS)
- Engine Indicating & Crew Alert Systems (EICAS)
- Fly by Wire (FBW)
- Flight Management Systems (FMS)

**UNIT 3**

4. Maintenance of Electrical and Instrument Systems

- Group 'A' Instruments

Principle of operation of rate of climb and descent indicators and their design requirements. The use of variable leak and theory of equation of constant 'n' of the instrument.

Theoretical basis of airspeed and Mach number measurement. Mathematical derivation of formula for indicated airspeed, Machmeter calibration and maximum safe airspeed indicator, design details of airspeed indicators, Machmeter and safe airspeed indicator

Theory of operation of an accelerometer, constructional details, accuracy of measurement.

Measurement of total and static pressure - design of a pressure head, accuracy of measurement of static and pilot pressure for subsonic and supersonic speed.

Transmission of the measured pressure to the instruments and effect of errors in pressure measurement to the indicators.

Definition of a gyroscope and the effect of external torques on the gyroscopic system: -

i) Effect of earth's rotation, Gyro wander and gimbal lock, Toppling of a gyroscope.
ii) Monitored gyroscope and restrained gyroscope.
iii) Design criteria of gyroscopic instruments and their errors.

Construction and Principle of operation of a Bourdon tube. Construction and operation characteristic of diaphragms and bellows under pressure reversals.

Theory of magnetism, magnetic moment, magnetic potential, terrestrial magnetism and description and constructional details of direct reading compass:

i) Acceleration error and turning error.
ii) Construction and working of a compass.
iii) Installation and compensation of DR Compass.

**UNIT 4**

- Group 'B' Instruments:

Thevenins theorem as applied to DC Circuits. The unit exponential functioning.Transient response of RC circuits.Decible conversion, converting ammeter to voltmeter. Input resistance of a voltmeter and voltmeter loading error. Construction of an ohm meter and volt ohm millimeter.

Construction and operation of Deflection type instruments Permanent magnet moving coil types: Moving iron type-electrodynamic type - induction and electrostatic type.

Temperature measurement in a fluid in motion: Construction and working principle of

i) Electrical transmitting thermometers.
ii) Resistance thermometers.
iii) Thermoelectric thermometers and their cold junction compensation by bimetallic and resistance element.

Working principle ofelectric tachometer and synchroscope. The theory and working principle of the following remote indicating systems :

Desyn, autosyn, selsyn and magnesyn.

**UNIT 5**

Theory and construction of electromechanical fluid flow indicators - positive displacement type and inferential type.

Measurement of fuel contents - Theory and working principle of ' Pacitron' systems developed by Honeywell and Smith.

**LIST OF PRACTICALS**

Aircraft maintenance and overhaul lab experiments:

1. Maintenance of landing gear, removal and installation of tires.
2. Maintenance of spark plugs
3. Removal and inspection of inspection plates.
4. Maintenance of Aircraft instruments-CVR, FDR etc.
5. Servicing of hydraulic system, pneumatic systems and electronic devices.

**INSTRUCTIONAL STRATEGY**

1. Use experimental based learning aids for effective teaching-learning
2. Expose students to real life problems
3. Plan assignments so as to promote problem solving abilities and develop continued learning skills

**RECOMMENDED BOOKS**

1. Radio Aids to Civil Aviation by RF Hansforde; Heywood and Company London
2. Electronic Communication Systemby George Kannedy; McGraw Hill
3. Manual of Avionicsby Brian Kendal; Blackwell
4. Electronic Communication byDennis Reddy and John Cooler; Prentice Hall of India, New Delhi.
5. Aircraft Radio Systemsby J. Powell; Himalayan Books
6. Aviation Electronics by Keith W. Bose; Jespersen
7. Aircraft Basic Science by Michacl J. Kroes and James R Fardn; McGraw Hill
8. Aircraft Maintenance and Repair by Michacl J. Kroes and William A Watkins; McGraw Hill
9. Aircrarft Instruments by E H J Pallet; Himalayan Book, New Delhi 1981
10. Aircraft Instruments by C A Williams; Galgotia Publications, New Delhi 1973.
11. Aircraft Instruments by C A Williams, E W Knott and E Sloley; Himalayan Books
12. Instruments by R W Sloley and Coulthard
13. Civil Airworthiness requirements CAA, UK. FAR's FAA, U.S.A.
14. Aircraft Manual, government of India.
15. Parkinson, Engineering Inspection, Wheeler
16. Civil Aircraft Inspection Procedures (CAP 459) Pt II Aircraft, Himalayan Books
17. Airframe and Power Plant Mechanic (AC 65-15A) Airframe Hand Book, Himalayan Books.

# Swami Vivekanand University, Sagar (M.P)

# SYLLABUS

## DAS 605 SPACECRAFT POWER PLANT

**L T P C**
**3 1 2 6**

**RATIONALE**

The diploma holders in aeronautical engineering must have required knowledge and skill about the power plant system. This subject has been designed for the full basics about the knowledge of different types of engines which are used in aircraft system.

**DETAILED CONTENTS**

**UNIT 1**

1. Piston Engines

Two and four stroke engines. Efficiency, factors affecting engine performance. Knowledge of the function and construction of various parts and accessories of the engine including induction, exhaust and cooling system, engine mounting. Engine fire detection and protection systems.

**UNIT 2**

2. Propellers

Knowledge of purpose and functioning of parts of constant speed, variable pitch and feathering propellers and associated control system components.

3. Engine Fuel and Oil System

Construction, features of carburettors, engine fuel and oil systems. Characteristics of aviation fuel and oil, common sources of contamination, methods of checking contamination

**UNIT 3**

4. Engine Instruments

Principle of operation. Superchargers-constructional features and principles of operation and function of various types of superchargers and its related component.

**UNIT 4**

5. Gas Turbine

Principle of operation, general constructional details and function of various type of gas turbine engines such as turbojet, turbo fan and by-pass engine. Theory of gas turbine engines, advantages and disadvantages of each type. Induction, exhaust and cooling systems, anticing of engine, engine mountings, thrust augmentation. Compressor surge and stall, bleed control system. Principles of operation, general constructional details and functions of fuel and oil systems, ignition and starting systems and their components. Engine controls of various types, including full authority digital electronic control engine instruments. power augmentation devices, thrust reversers and auxiliary power units.

**UNIT 5**

6. Introduction to Rocket Propulsion

   Early history of Rocket Flights, Classification of Rockets, Applications of Rocket Propulsion, Definitions and Fundamentals and Rocket Motor.

7. Design of Rocket Motor

   Motor case and Design of Solid, Liquid and Hybrid Propellant Rocket motors in Nozzle designs.

**LIST OF PRACTICALS**

1. Study and demonstration of two and four stroke aircraft piston engine
2. Study and demonstration of forced convective heat transfer over combustion chamber
3. Cascade testing of a model of axial compressor blade row
4. Study and demonstration of performance of a turbojet
5. Study and demonstrationof measurement of nozzle flow
6. Study and demonstrationof fuel-injection characteristics

**INSTRUCTIONAL STRATEGY**

1. Teachers should take the students to industry and explain the details of power plant systems and their components.
2. While imparting instructions, focus should be on conceptual understanding.
3. Training slides of “Carrier Fundamentals of Aircraft power plant” to be shown to students.

**RECOMMENDED BOOKS**

1. Jet Engine Manual byE Mangham and A Peace; Himalayan Books
2. Jet Engines, Rolls Royce Ltd. 1992
3. Civil Aircraft Inspection Procedures (CAP 459), Himalayan Books
4. Gas Turbine Engineby Pratt and Whitney

**DAS 606 PROJECT WORK**

**L T P C**

**RATIONALE**

The practical training cum project work is intended to place students for project oriented practical training in actual work situations for the stipulated period with a view to:

i) Develop understanding regarding the size and scale of operations and nature of field work in which students are going to play their role after completing the courses of study.

ii) Develop understanding of subject based knowledge given in the class room in the context of its application at work places.

iii) Develop first hand experience and confidence amongst the students to enable them to use and apply polytechnic/institute based knowledge and skills to solve practical problems in the world of work.

iv) Develop special skills and abilities like interpersonal skills, communication skills, attitudes and values.

This practical training cum project work should not be considered as merely conventional industrial training in which students are sent at work places with minimal supervision. This experience is required to be planned and supervised on regular basis by the polytechnic faculty. For the fulfillment of above objectives, polytechnic may establish close linkage with 8-10 relevant organization for providing such an experience. It is necessary that each organisation is visited well in advance and activities to be performed by students are well defined. The chosen activities should be such which are of curricular interest to students and of professional value to industrial/field organisations. Each teacher is expected to supervise and guide 5-6 students.

Effort should be made to identify actual field problems as project work for the students. Project selected should not be too complex which is beyond the level of the students. The placement of the students for such a practical cum project work should match with the competency profile of students and the project work assigned to them. Students may be assessed both by industry and polytechnic faculty. The suggested performance criteria is given below :

(1) Punctuality and regularity
(2) Initiative in learning/working at site
(3) Level/proficiency of practical skills acquired
(4) Ability of solve live practical problems
(5) Sense of responsibility
(6) Self expression/communication skills
(7) Interpersonal skills/Human Relation
(8) Report Writing Skills
(9) Viva Voce

The projects given to students should be such for which some one is waiting for solution. Some of the suggested project activities are given below:

1. Projects connected with repair and maintenance of machines .
2. Estimating and costing projects.
3. Design of jigs / fixtures.
4. Projects related to quality control.
5. Project work related to increasing productivity.
6. Projects relating to installation, calibration and testing of machines.
7. Projects related to wastage reduction.
8. Project, related to fabrication.
9. Energy efficiency related projects.
10. Projects related to improving an existing system

Note:
1. Students are required to prepare working drawings of the projects and will prepare the estimate, material lists as required, and carry out market survey etc.
2. Students will specify various processes involved in the project