Sanjay Ghodawat University

Kolhapur

School of Engineering & Technology

Department of Aerospace Engineering

B. Tech. Aeronautical Engineering
(Second Year)

Curriculum Book

(Programme Structure and Course Contents)

Academic Year 2024 -25

Programme Structure for B Tech.: Second Year Aeronautical Engineering

Semester III: Teaching Scheme

Course code	Course name	Teaching scheme (Hrs/week)			Credits assigned			Total credits
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	
U11PC301	Elements of Aeronautical Engineering	3	-	-	3	-	-	3
U11PC302	Aero Thermodynamics	3	-	-	3	-	-	3
U11PC303	Fluid Mechanics	3	-	-	3	-	-	3
UXXMM0XX	Multidisciplinary Minor I	2	-	-	2	-	-	2
UXXOE01X	Open Elective I	2	-	-	2	-	-	2
U02EM001	Engineering Economics	2	-	-	2	-	-	2
U11PC304	Elements of Aeronautical Engineering Lab	-	2	-	-	1	-	1
U11PC305	Fluid Mechanics and Thermal Engineering Lab	-	4	-	-	2	-	2
U01VE003	Environmental Science	2	-	-	2	-	-	2
U11FP001	Field Project		4	-	-	2	-	2
Total		**17**	**10**	**-**	**17**	**5**	**-**	**22**

Semester III: Evaluation Scheme

Course code	Course name	Theory Marks					Practical Marks		Total
		Internal Assessment				ESE	Term work	Practical Oral/POE	
		T1	T2	FET	Total				
U11PC301	Elements of Aeronautical Engineering	10	10	5	25	50	-	-	75
U11PC302	Aero Thermodynamics	10	10	5	25	50	-	-	75
U11PC303	Fluid Mechanics	10	10	5	25	50	-	-	75
UXXMM0XX	Multidisciplinary Minor I	10	-	5	15	35	-	-	50
UXXOE01X	Open Elective I	10	-	5	15	35	-	-	50
U02EM001	Engineering Economics	10	-	5	15	35	-	-	50
U11PC304	Elements of Aeronautical Engineering Lab	-	-	-	-	-	25	-	25
U11PC305	Fluid Mechanics and Thermal Engineering Lab	-	-	-	-	-	25	25	50
U01VE003	Environmental Science	10	-	5	15	35	-	-	50
U11FP001	Field Project	-	-	-	-	-	25	25	50

* Minimum passing is 40% for all courses and evaluation head mentioned above. FET – Faculty evaluation for Theory , T1, T2, Continuous Assessment Test, Term Work , ESE - End Semester Examination, P/F – Pass/ Fail Course, AU – Audit Course

Programme Structure for B Tech.: Second Year Aeronautical Engineering

Semester IV: Teaching Scheme

Course code	Course Name	Teaching scheme (Hrs/week)			Credits assigned			Total credits
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	
U11PC401	Low Speed Aerodynamics	3	-	-	3	-	-	3
U11PC402	Air Breathing Propulsion	3	-	-	3	-	-	3
U11PC403	Mechanics of Materials	2	-	-	2	-	-	2
UXXMM0XX	Multidisciplinary Minor II	2	-	-	2	-	-	2
UXXOE02X	Open Elective II	2	-	-	2	-	-	2
U02EM002	Engineering Management	2	-	-	2	-	-	2
U11VS401	Software Proficiency I (VEC)	- -	4	-	-	2	-	2
U11PC404	Low Speed Aerodynamics Lab	-	2	-	-	1	-	1
U11PC405	Air Breathing Propulsion Lab	-	2	-	-	1	-	1
U03AE003 **U03AE004**	Modern Indian Language – Hindi OR Modern Indian Language – Sanskrit	2	-	-	2	-	-	2
U03VE004	Universal Human Values -II	2	-	-	2	-	-	2
	Total	**18**	**8**		**18**	**4**		**22**

Semester IV: Evaluation Scheme

Course code	Course Name	*Theory Marks*					*Practical Marks*		Total
		Internal Assessment				ESE	Term work	Practical Oral /POE	
		T1	T2	FET	Total				
U11PC401	Low Speed Aerodynamics	10	10	5	25	50	-	-	75
U11PC402	Air Breathing Propulsion	10	10	5	25	50	-	-	75
U11PC403	Mechanics of Materials	10	-	5	15	35	-	-	50
UXXMM0XX	Multidisciplinary Minor II	10	-	5	15	35	-	-	50
UXXOE02X	Open Elective II	10	-	5	15	35	-	-	50
U02EM002	Engineering Management	10	-	5	15	35	-	-	50
U11VS401	Software Proficiency I (VEC)	-	-	-	-	-	25	25	50
U11PC404	Low Speed Aerodynamics Lab	-	-	-	-	-	25	-	25
U11PC405	Air Breathing Propulsion Lab	-	-	-	-	-	25	-	25
U03AE003 **U03AE004**	Modern Indian Language – Hindi OR Modern Indian Language – Sanskrit	10	-	5	15	35	-	-	50
U03VE004	Universal Human Values -II	10	-	5	15	35	-	-	50

* Minimum passing is 40% for all courses and evaluation head mentioned above. FET – Faculty evaluation for Theory , T1, T2, Continuous Assessment Test, Term Work , ESE - End Semester Examination, P/F – Pass/ Fail Course, AU – Audit Course

Exit Option:

- Students will have the flexibility to enter a programme in odd semesters and exit a programme after the successful completion of even semesters as per their future career needs.
- Students exiting the Second Year Programme after securing minimum 80credits will be awarded UG Diploma in the relevant Discipline /Subject provided they secure additional 8 credits in skill-based vocational courses (skill-based courses, internship, mini projects etc) offered during summer vacation after the second year.
- 4 year – Degree programme with Honors and Multidisciplinary Minor with additional 20 Credits from MOOC. These credits are to be earned during the program duration.

Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
U11PC301	Elements of Aeronautical Engineering	03	-	-	03	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					End Semester Exam (ESE)		
		T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
U11PC301	Elements of Aeronautical Engineering	10	10	5	25	40%	50	40%	75

Course Description

This course is at third semester of second year Aeronautical Engineering. It is a foundation course in Aeronautics and may be pre-requisites for other courses and next semester aeronautical/aerospace subjects. It covers History, Classifications of Aircrafts, International Standard Atmosphere, and Basics of Aerodynamics, Structures, Propulsion and Flight Dynamics.

Pre-requisites: 11^{th} and 12^{th} physics.

Course Objectives

- To acquire the knowledge on the historical evaluation of airplanes and standard atmosphere
- To learn the different component systems and functions
- To know the concepts of basic properties and principles behind the flight
- To learn the basics of different structures & construction
- To learn the various types of power plants used in aircrafts

Course Outcomes: After the successful completion of the course students will able to:

- **CO1** **Explain**[2] the history of human Flight and developments over the years
- **CO2** **Explain**[2] the types & classifications of components and control systems
- **CO3** **Describe**[2] the basic concepts of flight & Physical properties of Atmosphere
- **CO4** **Write**[2] the types of fuselage and constructions.
- **CO5** **Discuss**[2] the types of Engines and explain the principles of Rocket

Course Contents

Module	Unit	Description	Hours
1.0		**History of Flight**	**9**
1	1.1	Introduction to Airplanes and Space Vehicles, Balloon Flight, Ornithopter, Early Airplanes By Wright Brothers, Biplanes and Monoplanes	
	1.2	Developments in Aerodynamics, Materials, Structures and Propulsion over the Years.	
2.0		**Aircraft Configurations and its Controls**	**9**
2	2.1	Different types of flight vehicles, Classifications	
	2.2	Components of an airplane and their functions	
	2.3	Conventional control, Powered control	
	2.4	Basic instruments for Flying	
	2.5	Typical systems for control actuation	
3.0		**Basics of Aerodynamics**	**9**
3	3.1	Physical Properties and structures of the Atmosphere	
	3.2	Temperature, pressure and altitude relationships, available and required power and effect of altitude on both	
	3.3	Newton's Law of Motions applied to Aeronautics	
	3.4	Evolution of lift, drag and moment	
	3.5	Aerofoils, Mach number, Manoeuvres	
4.0		**Basics of Aircraft Structures**	**9**
4	4.1	General types of construction	
	4.2	Monocoque, semi-monocoque and geodesic constructions, typical wing and fuselage structure	
	4.3	Metallic and non-metallic materials, Use of Aluminium alloy, titanium, stainless steel and composite materials	
	4.4	Stresses and Strains, Hooke's law, stress-strain diagrams	
	4.5	Elastic Constants, Factor of Safety	

5.0		**Basics of Propulsion**	9
5	5.1	Basic ideas about piston engines, turboprop engines and jet engines	
	5.2	Use of propeller and jets for thrust Production, Comparative merits	
	5.3	Principle of operation of rocket, types of rocket and typical applications, Exploration into space.	

Text Books

1. Anderson, J.D., Introduction to Flight, McGraw-Hill; 8th edition, 2015
2. E Rathakrishnan, "Introduction to Aerospace Engineering: Basic Principles of Flight", John Wiley, NJ, 2021
3. Kermode, A.C., "Mechanics of Flight", Himalayan Books, New Delhi, 2004

References

1. Sadhu Singh, "Internal Combustion Engines and Gas Turbine", SS Kataraia & Sons, 2015
2. Kermode, A.C., "Flight without Formulae", Pearson Education Ltd, 5th Edition, 2007
3. Stephen. A. Brandt, Introduction to aeronautics: A design perspective, 2nd edition, AIAA Education Series, 2004

Internal Assessment (T1, T2 and FET)

1. T1 (Test 1) should be based on first two modules and T2 (Test 2) should be based on next two modules, for 10 marks each.
2. FET shall be assessed for 5 marks separately.

End Semester Examination

1. Question paper will be of 50 marks comprise of 5 questions, each carrying 10 marks.
2. The duration of end semester examination shall be Two hours.
3. The students need to solve all 5 questions.
4. Question No.1 will be compulsory and based on entire syllabus.
5. Remaining question (Q.2 to Q.5) will be selected from all the modules.

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Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
U11PC302	Aero Thermodynamics	03	-	-	03	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					End Semester Exam (ESE)		
		T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
U11PC302	Aero Thermodynamics	10	10	5	25	40%	50	40%	75

Course Description

Thermodynamics is the study of the relationships between properties of heat, temperature, energy, and work. It is crucial for understanding processes like energy conversion, heat engines, phase transitions, and chemical reactions.

Pre-requisites:-

Course Objectives

- Impart knowledge on the basics and application of zeroth and first law of thermodynamics.
- Impart knowledge on availability and applications of second law of thermodynamics.

Course Outcomes: After the successful completion of the course students will able to:

- **CO1** **Apply**[2] the laws of thermodynamics in real time problems
- **CO2** **Demonstrate**[3] the principal operation of piston engine and jet engines
- **CO3** **Demonstrate**[3] the efficiency of different air standard cycles.
- **CO4** **Determine**[3] the heat transfer in different conditions of working medium.
- **CO5** **Solve**[2] heat transfer problems in complex systems, related to conduction convention and radiation

Course Contents

Module	Unit	Description	Hours
1.0		**Fundamental Concept and First Law**	**9**
1	1.1	Concept of continuum, macroscopic approach, thermodynamic systems – closed, open and isolated.	
	1.2	Property, state, path and process, quasi-static process, work, internal energy, enthalpy, specific heat capacities and heat transfer, SFEE, application of SFEE to jet engine components, First law of thermodynamics, relation between pressure, volume and temperature for various processes, Zeroth law of thermodynamics.	
2.0		**Second Law and Entropy**	**9**
2	2.1	Second law of thermodynamics – Kelvin Planck and Clausius statements of second law.	
	2.2	Reversibility and Irreversibility, Thermal reservoir, Carnot theorem. Carnot cycle, Reversed Carnot cycle, efficiency, COP, Thermodynamic temperature scale - Clausius inequality, Concept of entropy, Entropy changes for various processes.	
3.0		**Air Standard Cycles**	**9**
3	3.1	Otto, Diesel, Dual, Ericsson, Atkinson, Stirling and Brayton cycles - Air standard efficiency – Mean effective pressure.	
4.0		**Fundamentals of Vapour Power Cycles**	**9**
4	4.1	Properties of pure substances – solid, liquid and vapour phases, phase rule, p-v, p-T T-v, T-s, h-s diagrams, p-v-T surfaces, thermodynamic properties of steam calculations of work done and heat transfer in non-flow and flow processes standard Rankine cycle, Reheat and Regeneration cycle.	
	4.2	Heat rate, Specific steam consumption, Tonne of refrigeration.	
5.0		**Basics of Propulsion And Heat Transfer**	**9**
5	5.1	Classification of jet engines - basic jet propulsion arrangement	
	5.2	Engine station number, thrust equation – Specific thrust, SFC, TSFC, specific impulse, actual cycles, isentropic efficiencies of jet engine components, polytropic efficiency, conduction in parallel, radial and composite wall, Basics of convective and radiation heat transfer.	

Text Books

1. Nag.P.K., "Engineering Thermodynamics", 6th Edition, Tata McGraw Hill (2017), New Delhi.
2. Natarajan, E., "Engineering Thermodynamics: Fundamentals and Applications", 2nd Edition (2014), Anuragam Publications, Chennai.

References

1. Cengel, Y and M. Boles, Thermodynamics - An Engineering Approach, Tata McGraw Hill,9th Edition, 2019.
2. Chattopadhyay, P, "Engineering Thermodynamics", 2nd Edition Oxford University Press, 2016.
3. Rathakrishnan, E., "Fundamentals of Engineering Thermodynamics", 2nd Edition, Prentice Hall of India Pvt. Ltd, 2006.

Internal Assessment (T1, T2 and FET)

1. T1 (Test 1) should be based on first two modules and T2 (Test 2) should be based on next two modules, for 10 marks each.
2. FET shall be assessed for 5 marks separately.

End Semester Examination

1. Question paper will be of 50 marks comprise of 5 questions, each carrying 10 marks.
2. The duration of end semester examination shall be Two hours.
3. The students need to solve all 5 questions.
4. Question No.1 will be compulsory and based on entire syllabus.
5. Remaining question (Q.2 to Q.5) will be selected from all the modules.

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Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
U11PC303	Fluid Mechanics	03	-	-	03	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					End Semester Exam (ESE)		
		T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
U11PC303	Fluid Mechanics	10	10	5	25	40%	50	40%	75

Course Description

A course in fluid mechanics covers the study of fluid behaviour, including liquids and gases, and their interactions with solid boundaries. Topics typically include fluid statics, fluid dynamics, conservation laws, flow in pipes and ducts, external flow, compressible flow, open channel flow, dimensional analysis. The course aims to provide students with a fundamental understanding of fluid mechanics principles and their applications in engineering and science.

Pre-requisites: 11^{th} and 12^{th} standard Physics and mathematics.

Course Objectives

- To introduce the students about property of the fluids, behaviour of fluids under static conditions.
- To impart basic knowledge of the dynamics of fluids and boundary layer concept.
- To expose to the applications of the conservation laws and significance of boundary layer theory and its thicknesses
- To expose the students to basic principles of working of hydraulic machineries and to design Pelton wheel, Francis and Kaplan turbine, centrifugal and reciprocating pumps.

Course Outcomes: After the successful completion of the course students will able to:

- **CO1** **Explain**^{2} basic concepts of fluid mechanics and fluid properties
- **CO2** **Discuss**^{3} fundamental laws and their applications
- **CO3** **Explain**^{3} significance of dimensionless quantities associated with viscous flow
- **CO4** **Apply**^{4} dimensional analysis to fluid flow problems
- **CO5** **Explain**^{3} working Principle of Turbines and Pumps

Course Contents

Module	Unit	Description	Hours
1.0		**Fluid Properties and Flow Characteristics**	**9**
1	1.1	Properties of fluids – Fluid statics - Pressure Measurements - Buoyancy and floatation - Flow characteristics - Eulerian and Lagrangian approach	
	1.2	Concept of control volume and system - Reynold's transportation theorem - Continuity equation, energy equation and momentum equation - Applications.	
2.0		**Flow Through Pipes and Boundary Layer**	**9**
2	2.1	Reynold's Experiment - Laminar flow through circular conduits - Darcy Weisbach equation	
	2.2	Friction factor - Moody diagram - Major and minor losses - Hydraulic and energy gradient lines	
	2.3	Pipes in series and parallel - Boundary layer concepts - Types of boundary layer thickness	
3.0		**Dimensional Analysis and Model Studies**	**9**
3	3.1	Fundamental dimensions - Dimensional homogeneity	
	3.2	Rayleigh's method and Buckingham Pi theorem - Dimensionless parameters	
	3.3	Similitude and model studies - Distorted and undistorted models	
4.0		**Turbines**	**9**
4	4.1	Impact of jets - Velocity triangles - Theory of Rotary dynamic machines Classification of turbines - Working principles - Pelton wheel	
	4.2	Modern Francis turbine - Kaplan turbine - Work done - Efficiencies - Draft tube	
	4.3	Specific speed - Performance curves for turbines - Governing of turbines.	
5.0		**Pumps**	9
5	5.1	Classification of pumps - Centrifugal pumps - Working principle - Heads and efficiencies– Velocity triangles - Work done by the impeller	
	5.2	Performance curves - Reciprocating pump working principle - Indicator diagram and it's variations - Work saved by fitting air vessels - Rotary pumps	

Text Books

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

References

1. Fox W.R. and McDonald A.T., Introduction to Fluid Mechanics John-Wiley and Sons, Singapore, 2011.
2. Pani B S, Fluid Mechanics: A Concise Introduction, Prentice Hall of India Private Ltd, 2016
3. Cengel Y A and Cimbala J M, Fluid Mechanics, McGraw Hill Education Pvt. Ltd., 2014.
4. S K Som; Gautam Biswas and S Chakraborty, Introduction to Fluid Mechanics and Fluid Machines, Tata McGraw Hill Education Pvt. Ltd., 2012.
5. Streeter, V. L. and Wylie E. B., Fluid Mechanics, McGraw Hill Publishing Co., 2010.

Internal Assessment (T1, T2 and FET)

1. T1 (Test 1) should be based on first two modules and T2 (Test 2) should be based on next two modules, for 10 marks each.
2. FET shall be assessed for 5 marks separately.

End Semester Examination

1. Question paper will be of 50 marks comprise of 5 questions, each carrying 10 marks.
2. The duration of end semester examination shall be Two hours.
3. The students need to solve all 5 questions.
4. Question No.1 will be compulsory and based on entire syllabus.
5. Remaining question (Q.2 to Q.5) will be selected from all the modules.

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Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
U02EM001	Engineering Economics	02	-	-	02	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					End Semester Exam (ESE)		
		T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
U02EM001	Engineering Economics	-	10	5	15	40%	35	40%	50

Course Description

The course focuses on economic of engineering projects, giving insights on different techniques and methods used on economic feasibility studies relating to design and implementation of engineering projects. The basic purpose of this course is to provide a sound understanding of concepts and principles of engineering economy and to develop proficiency with methods for making rational decisions regarding problems likely to be encountered in professional practice.

Pre-requisites: - Mathematics

Course Objectives

- Understand the importance of economy in engineering field.
- Apply knowledge of economic comparisons for selecting best alternative
- Understand the concept of depreciation
- Explain importance of working capital management
- **Course Outcomes:** After the successful completion of the course students will able to:

- **CO1** Explain importance of economy in engineering field.
- **CO2** Correlate knowledge of economy in decision making
- **CO3** Correlate knowledge of deprecation for engineering field
- **CO4** Explain importance of working capital management in business.

Course Contents

Module	Unit	Description	Hours
1.0		**Fundamentals Economy**	**06**
1	1.1	Introduction to Engineering Economy, Time value of money, Cash flow, cash flow diagrams, simple Interest and compound Interest, inflation, economic factors.	
2.0		**Comparisons of Alternatives**	**06**
2	2.1	Present worth comparisons, Comparisons of assets with equal, unequal lives, comparison of deferred investments , Equivalent uniform annual cost (EUAC) method , Rate of return method , Future worth method, NPV method.	
3.0		**Comparisons of Alternatives**	**06**
3	3.1	Payback period method- conventional and discounted payback period method, Benefit cost ration methods , break even analysis method.	
4.0		**Depreciation and Inflation**	**06**
4	4.1	Definition method for calculating depreciation straight line method., constant percentage method, sinking fund method, Switching between different depreciation methods, inflation effect of inflation.	
5.0		**Working capital management**	**06**
5	5.1	Introduction, need of working capital management, financial ratio, Income statement, Financial statements	

References

1. Leland Blnak, Anthony Tarquin, Engineering Economy , Tata McGraw Hill Publishing Company, New Delhi,
2. Jha, Kumar Neeraj., Construction Project management, Theory & Practice, Pearson Education India, 2015.
3. Panneer Selvam, R, “Engineering Economics”, Prentice Hall of India Ltd, New Delhi, 2001
4. Degarmo, E.P., Sullivan, W.G and Canada, J.R, “Engineering Economy”, Macmillan, New York, 2011

Internal Assessment (T1, T2 and FET)

1. T2 should be based on First to Fourth modules, for 10 marks.
2. FET shall be assessed for 5 marks separately.

End Semester Examination

1. Question paper will be of 35 marks comprise of 5 questions, each carrying 07 marks
2. The duration of end semester examination shall be Two hours.
3. The students need to solve all questions.
4. Question No.1 will be compulsory and based on entire syllabus.
5. Remaining question (Q.2 to Q.5) will be selected from all the modules

Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
U01VE003	Environmental Science	02	-	-	02	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					End Semester Exam (ESE)		
		T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
U01VE003	Environmental Science	T1	-	5	15	40%	35	40%	50

Course Description

This course will focus on basic concepts of Environmental components and basic concepts in the field. There will be a discussion about all the environmental conditions, problems, their Solutions, and policies regarding public awareness.

Pre-requisites: - Mathematics

Course Objectives

- To Study of factors affecting the availability of natural resources, their conservation and management.
- Develop a critical understanding of the environmental issues of concern
- Study of the sectoral effects on the local, regional, and global environmental issues
- Study of the concepts of eco systems, bio diversity and conservation.
- Study of factors impacting biodiversity loss and ecosystem degradation in India and the world.
- Study of sources of different kinds of pollution and their adverse health impacts.
- Study of the complexity of environmental management
- Study of major international institutions and programmes and the inrole played

Course Outcomes: After the successful completion of the course students will able to:

- **CO1** Classify natural resources and their conditions in local area.
- **CO2** Interpret local Environmental issues
- **CO3** Describe and modify solution on local environmental issues
- **CO4** Develop a critical understanding of the complexity of environmental management.
- **CO5** Understand local common biodiversity

Course Contents

Module	Unit	Description	Hours
1.0		**Humans and the Environment**	**06**
1	1.1	• Multidisciplinary nature of environmental studies; Scope and importance • UN Conference on Human Environment 1972; World Commission on Environment and Development, the concept of sustainable development	
	1.2	**Natural Resources and Sustainable Development** • Land resources and land use change; Land degradation, soil erosion and desertification. • Deforestation: Causes and impacts due to mining, dam building on environment and forests • Water: Use and over-exploitation of surface and ground water, floods, droughts • Energy resources: Renewable and non renewable energy sources, use of alternate energy sources, growing energy needs, case studies	
2.0		**Environmental Issues: Local, Regional and Global**	**06**
2	2.1	Global issues: Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture.	
	2.2	**Conservation of Biodiversity and Ecosystems:** • Levels of biological diversity: genetic, species and ecosystem diversity; • Global biodiversity hot spots. India as a mega-biodiversity nation; Endangered and endemic species of India • Threats to biodiversity: Habitat loss, poaching of wildlife, man wildlife conflicts, biological invasions • Conservation of biodiversity In-situ and Ex-situ conservation of biodiversity. • Ecosystem and biodiversity services: Ecological, economic, social, ethical, Aesthetic, and Informational value	
3.0		**Climate Change: Impacts, Adaptation and Mitigation**	**06**
3	3.1	• Environmental pollution: types, causes, effects and controls; Air, water, Noise pollution • Nuclear hazards and human health risks	

		• Solid waste management: Control measures of urban and industrial waste	
	3.2	Structure of atmosphere; Anthropogenic climate change from greenhouse gas emissions– past, present and future; Mitigation of climate change	
4.0		**Environmental Management**	**06**
4	4.1	• Environment Laws: Environment Protection Act; Air (Prevention & control of Pollution) Act; Water (Prevention and control of Pollution) Act;Wildlife Protection Act • Environmental management system: ISO 14001, Environmental audit and impact assessment; Ecolabeling /Ecomark scheme.	
	4.2	**Environmental Treaties and Legislation:** • Major International organizations and initiatives: United Nations • Environment Programme (UNEP), International Union for • Conservation of Nature (IUCN), Intergovernmental Union panel on climate change (IPCC)	
5.0		**Case Studies and Field Work**	**06**
5	5.1	• Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan, Bhopal Disaster	
	5.2	• Field visits to identify local/regional environmental issues, make observations including data collection and prepare a brief report.	
	5.3	• Documentation of campus biodiversity.	
	5.4	• Campus environmental management activities such as solid waste disposal, water management, and sewage treatment.	

Text Books

1. Gadgil, M., & Guha, R. 1993. This Fissured Land: An Ecological History of India. Univ. of California Press.
2. Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Rout- ledge.
3. Gleick, P. H. 1993. Water in Crisis. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
4. Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi

References

1. Harper, Charles L. (2017) Environment and Society, Human Perspectives on environmental Issues 6th Edition. Routledge.
2. Jackson, A. R., & Jackson, J. M. (2000). Environmental Science: The Natural Environment and Human Impact. Pearson Education.
3. Pittock, Barrie (2009) Climate Change: The Science, Impacts and Solutions. 2nd Edition. Routledge.
4. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
5. Chiras, D. D and Reganold, J. P. (2010). Natural Resource Conservation: Management for a Sustainable Future.10th edition, Upper Saddle River, N. J. Benjamin/Cummins/Pearson.

Internal Assessment (T1, T2 and FET)

1. T1 should be based on First to Two modules, for 10 marks.
2. FET shall be assessed for 5 marks separately.

End Semester Examination

1. Question paper will be of 35 marks comprise of 5 questions, each carrying 07 marks
2. The duration of end semester examination shall be Two hours.
3. The students need to solve all questions.
4. Question No.1 will be compulsory and based on entire syllabus.
5. Remaining question (Q.2 to Q.5) will be selected from all the modules

Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
U11PC304	Elements of Aeronautical Engineering Lab	-	02	-	-	01	-

Evaluation Scheme

Course Code	Course Name	In Semester Evaluation		End Semester Exam (OE/POE)		
		Term work	Min pass	Marks	Min pass	Total (Marks)
U11PC304	Elements of Aeronautical Engineering Lab	25	40%	-	-	25

Course Outcomes: After the successful completion of the course students will able to:

- **CO1** **Explain**[2] the fundamental principles and characteristics of different aircraft components and systems.
- **CO2** **Discuss**[3] the design considerations and performance implications of various aircraft configurations and systems

List of Experiments

All the experiments will be based on the course content of **Elements of Aeronautical Engineering, U11PC301**

Ex.No	Experiment Name
1	Study about aircraft fuselage configurations
2	Study about aircraft wing configurations
3	Study of the aircraft Instruments
4	Detail study about aircraft Landing Gear
5	Study about the aircraft control surfaces
6	Study about aircraft tail configurations
7	Study the components of aircraft Piston engine
8	Study the components of aircraft Jet engine

References

1. Daniel P. Raymer, Aircraft Design: A Conceptual Approach, AIAA (American Institute of Aeronautics and Astronautics), 2012
2. Brian L. Stevens and Frank L. Lewis, Aircraft Control and Simulation, Wiley, 2003
3. Irwin E. Treager, Aircraft Gas Turbine Engine Technology, McGraw-Hill, 2000

Evaluation Scheme

1. TERM WORK assessment shall be based on the overall performance of the student with every assignment graded from time to time.
2. The grades will be converted to marks as per 'credit and grading system' manual and should be added and averaged.
3. Based on above scheme grading and TERM WORK assessment should be done.

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Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
U11PC305	Fluid Mechanics and Thermal Engineering Lab	-	02	-	-	01	-

Evaluation Scheme

Course Code	Course Name	In Semester Evaluation		End Semester Exam (OE/POE)		
		Term work	Min pass	Marks	Min pass	Total (Marks)
U11PC305	Fluid Mechanics and Thermal Engineering Lab	25	40%	-	-	25

Course Outcomes: After the successful completion of the course students will be able to:

- **CO1** Verify and apply Bernoulli equation for flow measurement like Orifice/ Venturi meter.
- **CO2** Measure friction factor in pipes and compare with Moody diagram and verify momentum conservation law.
- **CO3** Determine the performance characteristics of Rotary dynamic pumps and positive displacement pumps turbines
- **CO4** Perform test on diesel/petrol engine and properties of the fuels.
- **CO5** Analyze the heat transfer properties of solid and composite walls

List of Experiments

All the experiments will be based on the course content of **Fluid Mechanics and Thermal Engineering** U11PC303

Ex. No	Experiment Name
Fluid mechanics	
1.	Verification of Bernoulli's theorem
2.	Flow through Orifice/ Venturi meter.
3.	Friction factor for flow through pipes
4.	Determination of metacentric height
5.	Characteristics of Centrifugal pump
6.	Characteristics of Gear oil pump
7.	Characteristics of Submersible pump

8.	Characteristics of Reciprocating pump
9.	Characteristics of pelton wheel/Francis turbine
Thermodynamics	
10.	Performance test on a 4-stroke engine
11.	Valve timing of a 4 – stroke engine and port timing of a 2-stroke engine
12.	Determination of effectiveness of a parallel flow heat exchanger
13.	Determination of effectiveness of a counter flow heat exchanger
14.	Determination of heating value of a fuel
15.	Determination of thermal conductivity of solid.
16.	Determination of thermal resistance of a composite wall.
17.	COP test on a vapour compression refrigeration test rig 1
18.	COP test on a vapour compression air-conditioning test rig

References

1. Hydraulic Laboratory Manual, Centre for Water Resources, Anna University, 2015
2. Modi P.N. and Seth S.M., Hydraulics and Fluid Mechanics. Standard Book House. NewDelhi, 2017
3. Subramanya K, Fluid Mechanics and Hydraulic Machines, Tata McGraw Hill Edu. Pvt. Ltd., 2011

Evaluation Scheme

1. TERM WORK assessment shall be based on the overall performance of the student with every assignment graded from time to time.
2. The grades will be converted to marks as per 'credit and grading system' manual and should be added and averaged.
3. Based on above scheme grading and TERM WORK assessment should be done.

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Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
U11FP001	Field Project I	-	04	-	-	02	-

Evaluation Scheme

Course Code	Course Name	In Semester Evaluation		End Semester Exam (OE/POE)		
		Term work	Min pass	Marks	Min pass	Total (Marks)
U11FP001	Field Project I	25	40%	25	40%	50

Course Description:

The Field Project in Artificial Intelligence and Machine Learning provides students with an opportunity to apply their knowledge and skills in a real-world setting. Working under the guidance of faculty advisors, students will engage in a practical project that addresses a relevant problem or explores a specific application area within AI and ML. Through this project, students will gain hands-on experience in project management, problem-solving, data analysis, and model implementation.

Pre-requisites: -Completion of core courses in Artificial Intelligence and Machine Learning.

Course Objectives:

- Apply theoretical knowledge and practical skills acquired in AI and ML courses to solve real-world problems.
- Gain experience in project planning, execution, and management within the context of AI and ML projects.
- Develop proficiency in data collection, preprocessing, analysis, and interpretation.
- Implement and evaluate machine learning models to address specific tasks or challenges.

Communicate project findings effectively through written reports and oral presentations

Course Outcomes: After the successful completion of the course students will be able to:

- **CO1** **Identify**[2], analyze, and solve real-world problems within their chosen field of study or industry through the application of relevant theories, methodologies, and techniques.
- **CO2** **Develop**[2] research skills such as literature review, data collection, analysis, and interpretation, enabling them to make informed decisions and draw meaningful conclusions in the context of their project
- **CO3** **Apply**[1] technical skills relevant to their field of study or industry,

Course Structure:

1. **Project Proposal:** Students will submit a project proposal outlining the problem statement, objectives, methodology, and expected outcomes of their field project. Proposals will be reviewed and approved by the faculty advisor. Resources for writing effective project proposals will be provided, including sample proposals and guidelines for proposal writing.

2. **Project Implementation:** Students will work on their projects under the guidance of their faculty advisors. This phase involves data collection, preprocessing, model development, experimentation, and evaluation. Regular progress updates and consultations with advisors will be scheduled. Resources for project implementation will include tutorials on data preprocessing, model development, and experimental design, as well as access to relevant datasets and computing resources.

3. **Project Documentation:** Students will prepare a comprehensive report documenting their project, including background, methodology, results, and conclusions. The report should adhere to academic standards and include relevant citations. Guidelines for writing technical reports and templates for structuring project documentation will be provided.

4. **Final Presentation:** Each student group will deliver a final presentation summarizing their project work, key findings, and implications. Presentations will be followed by Q&A sessions with faculty and peers. Resources for preparing effective presentations will include tips for public speaking, presentation design, and handling questions from the audience.

Here are detailed instructions for the Field Project

- For this course students will need to form group of 4-5 Members
- Project Selection: identify a project topic that aligns with real word problems
- Follow the timeline and milestones outlined in your project proposal.

Evaluation Scheme:

1. TERM WORK assessment must be based on the overall performance of the student with every assignment graded from time to time.
2. The grades will be converted to marks as per ‘credit and grading system’ manual and should be added and averaged.
3. Based on above scheme grading and TERM WORK assessment should be done.

Programme Structure for B Tech.: Second Year Aeronautical Engineering

Semester IV: Teaching Scheme

Course code	Course Name	Teaching scheme (Hrs/week)			Credits assigned			Total credits
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	
U11PC401	Low Speed Aerodynamics	3	-	-	3	-	-	3
U11PC402	Air Breathing Propulsion	3	-	-	3	-	-	3
U11PC403	Mechanics of Materials	2	-	-	2	-	-	2
UXXMM0XX	Multidisciplinary Minor II	2	-	-	2	-	-	2
UXXOE02X	Open Elective II	2	-	-	2	-	-	2
U02EM002	Engineering Management	2	-	-	2	-	-	2
U11VS401	Software Proficiency I (VEC)	- -	4	-	-	2	-	2
U11PC404	Low Speed Aerodynamics Lab	-	2	-	-	1	-	1
U11PC405	Air Breathing Propulsion Lab	-	2	-	-	1	-	1
U03AE003 **U03AE004**	Modern Indian Language – Hindi OR Modern Indian Language – Sanskrit	2	-	-	2	-	-	2
U03VE004	Universal Human Values -II	2	-	-	2	-	-	2
	Total	**18**	**8**		**18**	**4**		**22**

Semester IV: Evaluation Scheme

Course code	Course Name	*Theory Marks*					*Practical Marks*		Total
		Internal Assessment				ESE	Term work	Practical Oral /POE	
		T1	T2	FET	Total				
U11PC401	Low Speed Aerodynamics	10	10	5	25	50	-	-	75
U11PC402	Air Breathing Propulsion	10	10	5	25	50	-	-	75
U11PC403	Mechanics of Materials	10	-	5	15	35	-	-	50
UXXMM0XX	Multidisciplinary Minor II	10	-	5	15	35	-	-	50
UXXOE02X	Open Elective II	10	-	5	15	35	-	-	50
U02EM002	Engineering Management	10	-	5	15	35	-	-	50
U11VS401	Software Proficiency I (VEC)	-	-	-	-	-	25	25	50
U11PC404	Low Speed Aerodynamics Lab	-	-	-	-	-	25	-	25
U11PC405	Air Breathing Propulsion Lab	-	-	-	-	-	25	-	25
U03AE003 **U03AE004**	Modern Indian Language – Hindi OR Modern Indian Language – Sanskrit	10	-	5	15	35	-	-	50
U03VE004	Universal Human Values -II	10	-	5	15	35	-	-	50

* Minimum passing is 40% for all courses and evaluation head mentioned above. FET – Faculty evaluation for Theory , T1, T2, Continuous Assessment Test, Term Work , ESE - End Semester Examination, P/F – Pass/ Fail Course, AU – Audit Course

Exit Option:

- Students will have the flexibility to enter a programme in odd semesters and exit a programme after the successful completion of even semesters as per their future career needs.
- Students exiting the Second Year Programme after securing minimum 80credits will be awarded UG Diploma in the relevant Discipline /Subject provided they secure additional 8 credits in skill-based vocational courses (skill-based courses, internship, mini projects etc) offered during summer vacation after the second year.
- 4 year – Degree programme with Honors and Multidisciplinary Minor with additional 20 Credits from MOOC. These credits are to be earned during the program duration.

Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
U11PC401	Low Speed Aerodynamics	03	-	-	03	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					End Semester Exam (ESE)		
		T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
U11PC401	Low Speed Aerodynamics	10	10	5	25	40%	50	40%	75

Course Description

Aerodynamics course focuses on the study of the flow of air about a body, and the body can be an airplane, but many of the concepts explored are relevant to a wide variety of applications from sailboats, automobiles and birds. This course will enable learners to gain a fundamental understanding of concepts and models used to aerodynamically analyze and some classical theories which are useful for design of aircraft components. As this course is an introduction to aerodynamics, it is prerequisite course for high speed aerodynamics as well as can be an advanced subject for students with aerodynamics as specialization.

Pre-requisites: 11th and 12th standard Mathematics.

Course Objectives

- The fundamental knowledge on basics of aerodynamics and aerodynamic characteristics of wings, airfoils.
- The mathematical model for lift and drag coefficient of finite wing and wing of infinite aspect ratio.
- The flow over non-lifting bodies from method of singularities and investigate the interference effect.

Course Outcomes: After the successful completion of the course students will able to:

- **CO1** **Solve**[3] the lift characteristics of wing of infinite aspect ratio from classical thin airfoil for selecting suitable airfoil
- **CO2** **Identify**[2] the effect of wing twist, wing taper and wing sweep for perceiving the aerodynamic characteristics of finite wing.
- **CO3** **Develop**[2] the mathematical model of non-lifting, lifting flow over circular cylinder for identifying relation between lift and circulation
- **CO4** **Examine**[3] the flow over finite wing using the concept of Prandtl's lifting line theory for determining the effect of span wise flow on the lift distribution.

Course Contents

Module	Unit	Description	Hours
1.0		**Introductory Topics for Aerodynamics**	**9**
1	1.1	Fundamental Aerodynamic Variables & Units, Aerodynamic Forces and Moments, Pressure Coefficient, Center of Pressure, Dimensional Analysis: The Buckingham Pi Theorem	
	1.2	Flow Similarity, Fluid Statics : Buoyancy Force, Types of Flow : Continuum Flow ,Free Molecule Flow, Inviscid Flow, Viscous Flow, Incompressible Flow, Compressible Flow, Mach Number Regimes.	
2.0		**Aerodynamics Fundamental Principles and Equations**	**9**
2	2.1	Models of the Fluid : Control Volumes and Fluid Elements, Finite Control Volume Approach, Infinitesimal Fluid Element Approach, Molecular Approach.	
	2.2	Continuity Equation, Momentum Equation, Drag of a Two-Dimensional Body Energy Equation.	
	2.3	Pathlines, Streamlines, and Streaklines of a Flow, Angular Velocity, Vorticity, and Strain, Circulation, Stream Function, Velocity Potential, Relationship Between the Stream Function and Velocity Potential.	
3.0		**Inviscid, Incompressible Flow**	**9**
3	3.1	Bernoulli's Equation, Flow in a Duct, Measurement of Airspeed, Condition on Velocity for Incompressible Flow, Laplace's Equation.	
	3.2	Uniform Flow, Source Flow, Combination of a Uniform Flow with a Source and Sink, Doublet Flow, Non lifting and Lifting Flow over a Circular Cylinder, Vortex Flow.	
	3.3	The Kutta-Joukowski Theorem and the Generation of Lift.	
4.0		**Incompressible Flow Over Airfoil**	**9**
4	4.1	Aerofoil nomenclature, aerodynamic characteristics, The Kutta Condition, Circulation Theorem, Starting Vortex.	

	4.2	Classical Thin Airfoil Theory, Cambered Airfoil, Aerodynamic Centre, Vortex Panel Numerical Method, Modern Low-Speed Airfoils.	
	4.3	Viscous Flow: Introduction to Boundary Layers, Airfoil Drag.	
5.0		**Finite Wing Theory**	**9**
5	5.1	Downwash and Induced Drag, The vortex filament, Biot-Savart Law, Helmholtz Theorem, Prandtl's Classical Lifting Line theory, Elliptical Lift Distribution, General Lift Distribution, Effect of aspect ratio, The Delta Wing, Three-Dimensional Source and Doublet, flow over a sphere.	

Text Books

1. J. D. Anderson, "Fundamentals of Aerodynamics", McGraw Hill Book Co., New York, 5th Edition, 1985.
2. John D. Anderson, Jr., "INTRODUCTION TO FLIGHT" McGraw Hill Book Co., New York, 3rd Edition

References

1. Clancey, L J.," Aerodynamics", Pitman, 1986.
2. John J Bertin., "Aerodynamics for Engineers", Pearson Education Inc, 2002.
3. Kuethe, A.M and Chow, C.Y, "Foundations of Aerodynamics", Fifth Edition, John Wiley & Sons, 2000.

Internal Assessment (T1, T2 and FET)

1. T1 (Test 1) should be based on first two modules and T2 (Test 2) should be based on next two modules, for 10 marks each.
2. FET shall be assessed for 5 marks separately.

End Semester Examination

1. Question paper will be of 50 marks comprise of 5 questions, each carrying 10 marks.
2. The duration of end semester examination shall be Two hours.
3. The students need to solve all 5 questions.
4. Question No.1 will be compulsory and based on entire syllabus.
5. Remaining question (Q.2 to Q.5) will be selected from all the modules.

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Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
U11PC402	Air Breathing Propulsion	03	-	-	03	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					End Semester Exam (ESE)		
		T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
U11PC402	Air Breathing Propulsion	10	10	5	25	40%	50	40%	75

Course Description

This course is at second semester of second year Engineering. It examines gas turbine engine design methodology. Covers aerodynamics or gas dynamics of air breathing engine components: inlets, compressors, turbines, and nozzles. Studies the on-design and off-design performance of gas turbine engines. Includes combustion, emissions, noise, and advanced air breathing propulsion systems.

Pre-requisites: Aero Thermodynamics Fluid Mechanics, Basic Compressible flows

Course Objectives

- To establish fundamental approach and application of jet engine components.
- To learn about the analysis of flow phenomenon and estimation of thrust developed by jet engine.
- To introduce about the application of various equations in Gas Turbine Engines.
- To learn the concepts of jet engine combustion chambers.
- To acquire knowledge on compressors and turbines.

Course Outcomes: After the successful completion of the course students will able to:

- **CO1** **Apply**[4] control volume and momentum equation to estimate the forces produced by aircraft propulsion systems
- **CO2** **Describe**[2] the principal figures of merit for aircraft engine
- **CO3** **Describe**[2] the principal design parameters and constraints that set the performance of gas turbine engines.
- **CO4** **Apply**[4] ideal and actual cycle analysis to a gas turbine engine to relate thrust and fuel burn to component performance parameters.
- **CO5** **Estimate**[4] the performance of a compressor or turbine stage.

Course Contents

Module	Unit	Description	Hours
1.0		**Principles of Air Breathing Engines**	**6**
1	1.1	Illustration of working of gas turbine engine - Thrust equation - Factors affecting thrust. Effect of pressure, velocity and temperature changes of air entering compressor. Methods of thrust augmentation. Characteristics of turboprop, turbofan and turbojet - Performance characteristics.	
2.0		**Jet Engine Intakes and Exhaust Nozzles**	**12**
2	2.1	Ram effect, Internal flow and Stall in subsonic inlets – relation between minimum area ratio and eternal deceleration ratio – diffuser performance – modes of operation - supersonic inlets – starting problem on supersonic inlets – shock swallowing by area variation	
	2.2	Real flow through nozzles and nozzle efficiency – losses in nozzles – ejector and variable area nozzles - interaction of nozzle flow with adjacent surfaces – thrust reversal.	
3.0		**Jet Engine Combustion Chamber**	**6**
3	3.1	Classification of combustion chambers - Important factors affecting combustion chamber design - Combustion process - Combustion chamber performance - Effect of operating variables on performance - Flame tube cooling - Flame stabilization - Use of flame holders.	
4.0		**Jet Engine Compressors**	**12**
4	4.1	Euler's turbo machinery equation, Principle operation of centrifugal compressor, Principle operation of axial flow compressor– Work done and pressure rise – velocity diagrams – degree of reaction	
	4.2	Free vortex and constant reaction designs of axial flow compressor – performance parameters axial flow compressors– stage efficiency.	
	4.3	Compressor blade design - Centrifugal and Axial compressor performance characteristics.	

5.0		**Jet Engine Turbines**	**9**
5	5.1	Principle of operation of axial flow turbines– limitations of radial flow turbines- Work done and pressure rise – Velocity diagrams – degree of reaction – constant nozzle angle designs.	
	5.2	Performance parameters of axial flow turbine– turbine blade cooling methods – stage efficiency calculations – basic blade profile design considerations – matching of compressor and turbine.	

Text Books

1. Hill, P.G. & Peterson, C.R. "Mechanics & Thermodynamics of Propulsion" Pearson education (2009)

References

1. Cohen, H. Rogers, G.F.C. and Saravanamuttoo, H.I.H. "Gas Turbine Theory", Pearson Education Canada; 6th edition, 2008.
2. Mathur, M.L. and Sharma, R.P., "Gas Turbine, Jet and Rocket Propulsion", Standard Publishers & Distributors, Delhi, 2nd edition 2014.
3. Oates, G.C., "Aero thermodynamics of Aircraft Engine Components", AIAA Education Series, New York, 1985.

Internal Assessment (T1, T2 and FET)

1. T1 (Test 1) should be based on first two modules and T2 (Test 2) should be based on next two modules, for 10 marks each.
2. FET shall be assessed for 5 marks separately.

End Semester Examination

1. Question paper will be of 50 marks comprised of 5 questions, each carrying 10 marks.
2. The duration of end semester examination shall be Two hours.
3. The students need to write all 5 questions.
4. Question No.1 will be compulsory and based on entire syllabus.
5. Remaining question (Q.2 to Q.5) will be selected from all the mod

Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
U11PC403	Mechanics of Materials	03	-	-	03	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					End Semester Exam (ESE)		
		T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
U11PC403	Mechanics of Materials	10	10	5	25	40%	50	40%	75

Course Description

This course is at first semester of first year Engineering. It is a foundation course in Mathematics and may be pre-requisites for other courses and next semester Mathematical subjects. It covers matrices, expansions of functions, partial derivatives and applications of partial derivatives.

Pre-requisites: 11th and 12th standard Mathematics.

Course Objectives

- Ability to think, Analyse and solve Engineering Problems expected from the course.
- Ability to understand stress and strain concepts related to deformable bodies.
- To enable understanding of the behaviour and response of materials and to allow the student to carry out easy and moderate level structural analysis of basic structural members.
- To familiarize with the different methods used for beam deflection analysis.
- To impart knowledge to the students on how structural elements are sized and to enable the student to gain knowledge in how stresses are developed and distributed internally.

Course Outcomes: After the successful completion of the course students will able to:

- **CO1** **Clear**[1] understanding of mechanical behaviour of materials.
- **CO2** **Knowledge**[3] of different structural members and load types.
- **CO3** **Design**[2] members under axial loading.
- **CO4** **Design**[2] member under torsion loading.
- **CO5** **Calculate**[2] beams deflections.

Course Contents

Module	Unit	Description	Hours
1.0		**Basics and Axial Loading**	**8**
1	1.1	Stress and Strain – Hooke's Law – Elastic constants and their relationship– Statically determinate cases - statically indeterminate cases –composite bar.	
	1.2	Thermal Stresses – stresses due to freely falling weight.	
2.0		**Stresses in Beams**	**10**
2	2.1	Shear force and bending moment diagrams for simply supported and cantilever beams-	
	2.2	Bending stresses in straight beams-Shear stresses in bending of beams with rectangular, I& T etc cross sections-beams of uniform strength.	
3.0		**Deflection of Beams**	**10**
3	3.1	Double integration method – McCauley's method - Area moment method	
	3.2	Conjugate beam method-Principle of super position-Castigliano's theorem and its application.	
4.0		**Torsion**	**8**
4	4.1	Torsion of circular shafts - shear stresses and twist in solid and hollow circular shafts – closely coiled helical springs.	
5.0		**Bi Axial Stresses**	**9**
5	5.1	Stresses in thin circular cylinder and spherical shell under internal pressure – volumetric Strain.	
	5.2	Combined loading – Principal Stresses and maximum Shear Stresses – Analytical and Graphical methods.	

Text Books

1. Nash William – "Strength of Materials", TMH, 1998
2. Timoshenko.S. and Young D.H. – "Elements of strength materials Vol. I and Vol. II"., T. Van Nostrand Co-Inc Princeton-N.J. 1990.

References

1. Dym C.L. and Shames I.H. – "Solid Mechanics", 1990.

Internal Assessment (T1, T2 and FET)

1. T1 (Test 1) should be based on first two modules and T2 (Test 2) should be based on next two modules, for 10 marks each.
2. FET shall be assessed for 5 marks separately.

End Semester Examination

1. Question paper will be of 50 marks comprise of 5 questions, each carrying 10 marks.
2. The duration of end semester examination shall be Two hours.
3. The students need to solve all 5 questions.
4. Question No.1 will be compulsory and based on entire syllabus.
5. Remaining question (Q.2 to Q.5) will be selected from all the modules.

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Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
U02EM002	Engineering Management	02	-	-	02	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					End Semester Exam (ESE)		
		T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
U02EM002	Engineering Management	-	10	5	15	40%	35	40%	50

Course Description

This course presents the principles and techniques of managing engineering projects from the initiation phase, through planning, execution, control and closeout. Students will develop the analytical skills and awareness necessary on the management side of engineering projects.

Pre-requisites: -

Course Objectives

- Understand the importance of management in engineering field.
- Apply knowledge of project management
- Understand the concept of material management.
- Explain importance of quality management

Course Outcomes: After the successful completion of the course students will able to:

- **CO1** **Explain**[1] function of principles of management.
- **CO2** **Correlate**[2] knowledge of project management to various engineering project
- **CO3** **Apply**[2] knowledge of material management
- **CO4** **Explain**[1] importance of quality management in engineering field.

Course Contents

Module	Unit	Description	Hours
1.0		**Introduction to Management**	**06**
1	1.1	Principles of Management (Henry Fayol) Functions of Management: Planning- Organizing ,Staffing Directing Supervision, Co-ordination, Communication, Motivation, Leading Controlling – Decision Making: Process, introduction to decision tree	
2.0		**Project Management**	**06**
2	2.1	Introduction, Need for Project Management, , The Project Life Cycle, Phases of Project Management, need of project management , Role of Project Manager (PM), Work Breakdown Structure (WBS)	
	2.2	Project Planning- Time Management, Tools for time management Bar Chart/ Gantt Charts, Mile stone chart- representation, uses, progress monitoring.	
3.0		**Project Control-**	**06**
3	3.1	Network analysis- Basic definition application, rules for drawing networks Critical Path Method (CPM)-Development of CPM Network Time Estimates, Calculations of Floats, Critical Path.	
	3.2	Programme Evaluation Review Techniques (PERT)- Time Estimates, Slack calculation , Probability of Project Completion.	
4.0		**Project Monitoring**	**06**
4	4.1	Project Network Updating, - introduction, process, data required for updating, steps in updating application	
	4.2	Cost Control- introduction, project cost. Crashing/compression of network. Application	
5.0		**Material Management and Quality Control**	**06**
5	5.1	Objectives, Need for Inventory Control, EOQ Analysis, ABC analysis, Safety Stock, Purchase Procedure, Stores Record , site layout	
	5.2	Quality Management: Importance, Quality Circle, ISO 9000, QA, QC, QMS – Purpose	

References

1. Chitkara, K.K. Construction Project Management: Planning, Scheduling and Control, McGraw Hill Publishing Company, New Delhi, 1998.
2. Jha, Kumar Neeraj., Construction Project management, Theory & Practice, Pearson Education India, 2015.
3. Punmia, B.C., Khandelwal, K.K., Project Planning with PERT and CPM, Laxmi Publication

Internal Assessment (T1, T2 and FET)

1. T2 should be based on First to Fourth modules, for 10 marks.
2. FET shall be assessed for 5 marks separately.

End Semester Examination

1. Question paper will be of 35 marks comprise of 5 questions, each carrying 07 marks
2. The duration of end semester examination shall be Two hours.
3. The students need to solve all questions.
4. Question No.1 will be compulsory and based on entire syllabus.
5. Remaining question (Q.2 to Q.5) will be selected from all the modules

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Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
U11VS401	Software Proficiency I	-	04	-	-	02	-

Evaluation Scheme

Course Code	Course Name	In Semester Evaluation		End Semester Exam (OE/POE)		
		Term work	Min pass	Marks	Min pass	Total (Marks)
U11VS401	Software Proficiency I	25	40%	25	40%	50

Course Description

A CATIA course typically covers the fundamentals and advanced features of CATIA software, which is a powerful 3D modeling, design, and simulation tool used primarily in the aerospace, automotive, and manufacturing industries.

Pre-requisites: -

Course Objectives

- Develop Proficiency in CATIA: The primary objective is to equip participants with the skills and knowledge needed to proficiently navigate and utilize CATIA software for 3D modeling, design, and simulation tasks.
- Understand Basic Concepts: Ensure that participants have a solid understanding of fundamental concepts such as sketching, part modeling, assembly design, and drawing creation within the CATIA environment.

Course Outcomes: After the successful completion of the course students will able to:

- **CO1** **Demonstrate**[3] competency with multiple drawing and modification commands in CATIA
- **CO2** **Create**[2] three-dimensional solid models.
- **CO3** **Create**[2] three-dimensional assemblies incorporating multiple solid models

List of Experiments

Module	Contents
Introduction	**CATIA as a CAD software: -** Concept of Parametric Modeling, Feature Based Modeling, User Interface, Mouse operations, File types and Management, drawing profiles. Major user industries of Catia. WhyCatia is preferred?
Sketcher	**Sketcher**: Profile toolbar, operation (corner, chamfer,relimitations, transformations, project 3D element), constraints, types of constraints, workbench.
	Sketcher:- sketch tools, tools(Sketch solving status, sketch analysis, output feature), visualization toolbar, user selection filter.
Modelling of Machined Component (Part Modelling)	**Modeling of Machined component**, Material Addition and Removal (Pad, Pocket, Shaft, Groove), Sketch and Positioned Sketch, Types of Fillets, Types of Chamfer, Types of Hole.
	Modeling of Machined component - 2. Pattern (Rectangular, Circular, User) , Thread/Tap, Datum Features (Plane, Axes, Points),Simple Draft. Frequently used commands for Machined components in Catia / Creo
	Advance Design features :- Axis System, Types of draft, Shell, Stiffener, rib slot, **Multi section solid, Removed multi sectionsolid**, Apply Material, Measure, Render.
	Introduction To Multi body concept:- Copy Paste, Paste special, Insert body, Boolean Operations (Add,remove,Intersect), **Transformation** (Translation, Mirror, Scaling, Affinity).
	Multi body concept:- Standard example , Negative body concept (Boolean Operations)
	Advance Features:- Parameters, Formula,Relations, Design Table.
Drafting	**Introduction To Drafting & Detailing Theory:-** (types Generative – Interactive), Initial Drafting setting, Sheet Background, Views (ortho, ISO), Dimensions (Types- Generate Dimension & Create Dimension).
	Views:- (Aux, Section, Details, Clipping, Broken), View properties, DATUMS & Tolerance
	Annotations:- GD & T, Symbols, Note, Leaders, Table, Symbols (Machining, Roughness, Welding, Custom), Dress-upToolbar.
	Surfacing Modeling based Plastic Component:- Environment, Tool bars, Surface Creation (Extrude, Revolve, Sphere, Cylinder), Surface Modification, Surface Editing (Trim, Split, Shape Fillet, Close Surface, Thickness).
	Surfacing:- Offset(All 3 types), Fill, Blend,Join, healing, Project-Combine.
	Advanced Surfacing:- Adaptive Sweep,Sweep(ALL), Multi section Surface.

Wire-frame Modeling	**Wire-frame Modeling:-** Point, Line, Planes, Curves, Circle-Conic, STANDARD EXAMPLES. Use of wire frame modeling,
BIW Templates	**BIW Templates:-** What is BIW, Junction, Diabolo, Hole, Mating Flange, Bead, Blend Corner.
Assembly & Mechanism	**Introduction to Assembly:-** Types of assembly approach, Types of Constrains and DOF, placement of components in the Assembly, Manipulating Components, **BOTTOM UP Approach**
	TOP DOWN Approach:- Part, Product, Component, Space Analysis, Reuse Pattern, Save management.
	Assembly Drafting:- Scene(Exploded View), Bill of material, Ballon creation, Graph Tree Reordering.

References

1. CADFolks, CATIA V5-6R2014 For Beginners, CreateSpace Independent Publishing Platform
2. CAD Desk,CATIA REFERENCE GUIDE BOOK, January 2019
3. Kirstie Plantenberg, An Introduction to CATIA V5 Release 16

Evaluation Scheme

1. TERM WORK assessment shall be based on the overall performance of the student with every assignment graded from time to time.
2. The grades will be converted to marks as per 'credit and grading system' manual and should be added and averaged.
3. Based on above scheme grading and TERM WORK and POE assessment should be done.

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Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
U11PC404	Low Speed Aerodynamics Lab	-	02	-	-	01	-

Evaluation Scheme

Course Code	Course Name	In Semester Evaluation		End Semester Exam (OE/POE)		
		Term work	Min pass	Marks	Min pass	Total (Marks)
U11PC404	Low Speed Aerodynamics Lab	25	40%	-	-	25

Course Outcomes: After the successful completion of the course students will able to:

- **CO1** Understand the behaviour of flow properties over different models using subsonic wind tunnel.
- **CO2** Demonstrate experimentally the pressure distribution over circular, symmetric and cambered airfoils and evaluate lift and drag.

List of Experiments

All the experiments will be based on the course content of Low **Speed Aerodynamics Lab**

Ex.No	Experiment Name
1.	Preparation of NACA series Airfoil
2.	Calibration of subsonic wind tunnel
3.	Lift and Drag Estimation of symmetrical Airfoil
4.	Lift and Drag Estimation of Cambered Airfoil
5.	Pressure Distribution over symmetrical Airfoil
6.	Pressure Distribution over Cambered Airfoil
7.	Variation of Cl with AOA and estimation of Stalling AOA for symmetrical Airfoil
8.	Variation of Cl with AOA and estimation of Stalling AOA for Cambered Airfoil
9.	Estimation of Drag Polar for symmetrical Airfoil
10.	Estimation of Drag Polar for Cambered Airfoil

References

1. L. J. Clancy, "Aerodynamics", Pitman, 1st Edition, 1986.
2. Alan pope, "Low Speed Wind Tunnel Testing", John Wiley, 2nd Edition, 1999.
3. N. M. Komerath, "Low Speed Aerodynamics", Extrovert, 1st Edition, 2012.

Evaluation Scheme

4. TERM WORK assessment shall be based on the overall performance of the student with every assignment graded from time to time.
5. The grades will be converted to marks as per 'credit and grading system' manual and should be added and averaged.
6. Based on above scheme grading and TERM WORK assessment should be done.

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Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
U11PC405	Air Breathing Propulsion lab	-	02	-	-	01	-

Evaluation Scheme

Course Code	Course Name	In Semester Evaluation		End Semester Exam (OE/POE)		
		Term work	Min pass	Marks	Min pass	Total (Marks)
U11PC405	Air Breathing Propulsion lab	25	40%	-	-	25

Course Outcomes: After the successful completion of the course students will able to:

- **CO1** Identify components and information of piston and gas turbine.
- **CO2** Visualize flow phenomenon in supersonic flow.
- **CO3** Analyze the behaviour of flow through ducts and jet engine components.

List of Experiments

All the experiments will be based on the course content of **Air Breathing Propulsion U11PC405**

Ex.No	Experiment Name
1.	Study of gas turbine engines and its components
2.	Determine the velocity profiles of free jets
3.	Determine Velocity profiles of wall jets.
4.	Nozzle / Diffuser Flow Measurement
5.	Fuel Injection Characterization Test
6.	Performance test of propeller
7.	Performance test of Ramjet Engine
8.	Demonstration of Aircraft engines models/cut section
9.	Preparation of Solid propellant
10.	Determine pressure/velocity distribution using Supersonic free jet apparatus
11.	Study of aircraft piston and its components.

References

1. "Rolls Royce Jet Engine", Rolls Royce; 4th revised edition, 1986
2. Oates, G.C., "Aero thermodynamics of Aircraft Engine Components", AIAA Education Series, New York, 1985.
3. Ltd Mathur, M.L. and Sharma, R.P., "Gas Turbine, Jet and Rocket Propulsion", Standard Publishers & Distributors, Delhi, 2nd edition 2014

Evaluation Scheme

1. TERM WORK assessment shall be based on the overall performance of the student with every assignment graded from time to time.
2. The grades will be converted to marks as per 'credit and grading system' manual and should be added and averaged.
3. Based on above scheme grading and TERM WORK assessment should be done.

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Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
U03AE003	Modern Indian Language – Hindi	Theory	Practical	Tutorial	Theory	Practical	Tutorial
		02	-	-	02	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					End Semester Exam (ESE)		
U03AE003	Modern Indian Language – Hindi	T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
		-	10	5	15	40%	35	40%	50

Course Description:

पाठ्यक्रम विवरण:

यह पाठ्यक्रम छात्रों के आधुनिक भारतीय भाषा हिंदी में दक्षता विकसित करने का उद्देश्य रखता है. जो उन्हें लिखित और बोली गई रूपों में प्रभावी रूप से संवाद करने की क्षमता प्रदान करता है। यह पाठ्यक्रम आपसी शिक्षण विधियों, सांस्कृतिक अन्वेषण और व्यापार दुनिया के संदर्भ में व्यावसायिक अनुप्रयोगों को मजबूती देने पर ध्यान केंद्रित करता है। छात्रों को विभिन्न गतिविधियों और असाइनमेंट्स में भाग लेने के लिए प्रोत्साहित किया जाएगा जो उन्हें व्यापारिक और पेशेवर वातावरण से संबंधित वास्तविक जीवन की स्थितियों में हिंदी का प्रयोग करने के लिए प्रोत्साहित करते हैं।.

पाठ्यक्रम के उद्देश्य / **Course Objectives**

1. व्यक्तित्व विकास और भाषा के बीच सहसंबंध के बारे में जागरूकता पैदा करके छात्रों के व्यक्तित्व का विकास करना।
2. विद्यार्थियों में भाषाई कौशल का विकास करना।
3. विद्यार्थियों में साक्षात्कार कौशल का विकास करना।
4. छात्रों में कार्यालय पत्र लेखन कौशल विकसित करना।
5. छात्रों में ई-प्रौद्योगिकी आधारित भाषा कौशल विकसित करना।

पाठ्यक्रम सीखने के परिणाम / Course Learning Outcomes

At the end of the course students will be able to -
पाठ्यक्रम के अंत में, छात्र निम्नलिखित क्षमताएँ प्रदर्शित करेंगे-

CLO1 व्यावसायिक संदर्भों में लिखित और मौखिक हिंदी में प्रवीणता प्रदर्शित करेंगे ।
CLO2 हिंदी बोलने वाले क्षेत्रों में ग्राहकों, सहकर्मियों और साथियों के साथ प्रभावी संवाद करेंगे ।
CLO3 छात्र हिंदी कहानी साहित्य का अध्ययन कर वर्तमान समाज एवं साहित्य से अवगत होगे ।
CLO4 छात्र राजनीतिक, सामाजिक, सांस्कृतिक पृष्ठभूमि में कहनी का अध्ययन कर विश्लेषण करेगे।

Course Contents

Module	Unit	Description	Hours
1.0		आधुनिक भारतीय भाषा हिंदी का परिचय	
1	1.1	हिंदी भाषा का परिचयः	7
	1.2	इतिहास, लिपि, और ध्वनिकी,	
	1.3	हिंदी का सामान्य रूप मातृभाषा, राजभाषा, राष्ट्रभाषा	
	1.4	हिंदी के महत्व की समझ	
2.0		पठित बोध - काव्यखण्ड	
2	2.1	दिन जल्दी जल्दी ढलता है -हरिवंशराय बच्चन	7
	2.2	कमरे में बंद अपाहिज- रघुवीर सहाय	
	2.3	दुख का अधिकार- यशपाल	
	2.4	कविता के बहाने - कुंवर नारायण	
3.0		पठित बोध -गद्य खंड	
3	3.1	शिरीष के फूल- हजारी प्रसाद द्वीवेदी	7

	3.2	पंच परमेश्वर -प्रेमचंद	
	3.3	बाजार दर्शन - जैनेंद्र कुमार	
	3.4	काळा मेघा पानी दे धर्मवीर भारती	
4.0		हिंदी में लेखन	
4	4.1	संवाद लेखन	7
	4.2	कार्यालयीन पत्र लेखन	
	4.3	हिंदी में पेशेवर ईमेल	
	4.4	आवेदन पत्र	
5.0		व्यावसायिक लेखन	
5	5.1	व्यावसायिक दस्तावेज़ और प्रस्ताव	7
	5.2	विभिन्न प्रकार के पत्रों का व्यावहारिक अभ्यास	
	5.3	व्यावसायिक शब्दावली	
	5 .4	कार्यालयीन शब्दावली	

संदर्भ ग्रंथ सूची / **List of Reference Books**

1. हिंदी कहानी का विकास (भाग १ और २)- गोपाल राय, राधाकृष्ण प्रकाशन, नई दिल्ली
2. हिंदी साहित्य का दूसरा इतिहास- बच्चन सिंह
3. हिंदी कहानीः स्वरूप और संवेदना – राजेंद्र यादव
4. विज्ञापन पत्रकारिता – एन.सी.पंत, इंद्रजीत सिंह, कनिष्क पब्लिशर्स, नई दिल्ली
5. आधुनिक विज्ञापन और जनसंपर्क-डॉ.यू.सी.गुप्ता, लोक संस्कृति प्रकाशन, नई दिल्ली
6. प्रयोजनमूलक हिंदी- डॉ. माधव सोनटक्के, लोकभारती प्रकाशन, इलाहाबाद
7. अनुवाद विज्ञान – डॉ. भोलानाथ तिवारी, किताबघर प्रकाशन, दिल्ली
8. प्रयोजनमूलक हिंदीः प्रयुक्ति और अनुवाद, वाणी प्रकाशन, नई दिल्ली

Internal Assessment (T1, T2 and FET)

1. T2 should be based on First to Fourth modules, for 10 marks.
2. FET shall be assessed for 5 marks separately.

End Semester Examination

1. Question paper will be of 35 marks comprise of 5 questions, each carrying 07 marks
2. The duration of end semester examination shall be Two hours.
3. The students need to solve all questions.
4. Question No.1 will be compulsory and based on entire syllabus.
5. Remaining question (Q.2 to Q.5) will be selected from all the modules

Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
U03VE004	Universal Human Values II	02	-	-	02	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					End Semester Exam (ESE)		
		T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
U03VE004	Universal Human Values II	-	10	5	15	40%	35	40%	50

Course Description

Human civilization is known for the values that it cherishes and practices. Across various times and places, sages, saints, and seers, drawing on their experience, developed practices that placed central importance on values, though the names used by them differed, as their languages varied the spirit was the same. Universal human values are values that human beings cherish and hold in common consciously and otherwise in most places and times and practice them.

Pre-requisites: -

Course Objectives

- Describe the meaning, purpose, and relevance of universal human values.
- Understand the importance of values in individual, social, career, and national life.
- Learn from the lives of great and successful people who followed and practiced human values and achieved self-actualization.

Course Outcomes: After the successful completion of the course students will able to:

- **CO1** Become conscious practitioners of values.
- **CO2** Realize their potential as human beings and conduct themselves properly in the ways of the world.
- **CO3** Develop integral life skills with values.
- **CO4** Inculcate and practice them consciously to be a good human being
- **CO5** Realize one's potential as a human being.

Course Contents

Module	Unit	Description	Hours
1.0		**Love & Compassion (Prem and Karuna)**	**05**
1	1.1	What is love and its forms: love for self, parents, family, friend, spouse, community, nation, humanity and other beings—living and non-living.	
	1.2	Love and compassion and inter-relatedness: The facilitator needs to explain the Relationship between love and compassion and other related feelings and emotions like empathy, sympathy and non-violence.	
	1.3	Individuals who are remembered in history or in collective memory for practicing compassion and love: (e.g., Buddha, Christ)	
	1.4	Narratives and Anecdotes from history, literature including local folklore	
2.0		**Truth (Satya)**	**05**
2	2.1	What is truth? Universal truth, truth as value (arth), truth as fact (saty) (veracity,sincerity, honesty among others	
	2.2	Individuals who are remembered in history for practicing this value (Raja Harishchandra, Dharmaraj Yudhishthara, Mahatma Buddha, Socrates, Mahatma Gandhi	
	2.3	Narratives and Anecdotes from about truth history, collective memory and literature including local folklore	
3.0		**Non-Violence (Ahimsa)**	**05**
3	3.1	What is non-violence? Its need. Love, compassion, empathy and sympathy for others as pre-requisites for non-violence	
	3.2	Ahimsa as non-violence and non-killing	
	3.3	Individuals and organizations that are known for their commitment to nonviolence	
	3.4	Narratives and Anecdotes about non-violence from history, literature including local folklore	

4.0		**Righteousness (Dharma) , Service (Seva)**	**08**
4	4.1	What is righteousness? Righteousness and dharma, Righteousness and Propriety	
	4.2	Individuals who are remembered in history for practicing righteousness, Narratives and Anecdotes from history, literature including local folklore.	
	4.3	What is service? Forms of service, for self, parents, spouse, family, friend, community, persons in distress or disaster, nation, humanity, and otherliving beings and non-living things.	
	4.4	Individuals who are remembered in history for practicing this value. Narratives and Anecdotes dealing with instances of service from history, literature including local folklore.	
5.0		**Peace (Shanti), Renunciation (Sacrifice) Tyag**	**07**
5	5.1	What will learners learn/gain if they practice peace? What will learners lose if they don't practice it? Sharing learner's individual and/or group experience(s) about peace, Simulated Situations, Case studies	
	5.2	What is renunciation? Renunciation and sacrifice. Greed is the main obstruction in the path of renunciation. Self-restraint and Ways of overcoming greed. Renunciation with action as true renunciation	
	5.3	Individuals who are remembered in history for practicing this value. (Rama, Bhishma, Buddha, Mahavira, Christ, Guru Govind Singh, Bhagat Singh, and Mahatma Gandhi)	
	5.4	Narratives and Anecdotes from history and literature, including local folklore about individuals who are remembered for their sacrifice and renunciation.	

References

1. Radha Kumud Mookerji (1989). Ancient Indian Education, Motilal Banarasidass.
2. Swami Satyananda Saraswati (2008). Asana Pranayama Mudra Bandha, Bihar School ofyoga.
3. Kireet Joshi (1997). Education for Character Development, Dharma Hinduja Center ofIndic Studies.
4. A.L. Basham (1954). The Wonder That Was India, London: Picador Press.
5. Rokeach Milton (1973). The Nature of Human Values. New York: The Free Press.
6. Ghosh, Sri Aurobindo (1998). The Foundations of Indian Culture. Pondicherry: SriAurobindo Ashram.

Internal Assessment (T1, T2 and FET)

1. T2 should be based on First two modules, for 10 marks.
2. FET shall be assessed for 5 marks separately.

End Semester Examination

1. Question paper will be of 35 marks comprise of 5 questions, each carrying 07 marks
2. The duration of end semester examination shall be Two hours.
3. The students need to solve all questions.
4. Question No.1 will be compulsory and based on entire syllabus.
5. Remaining question (Q.2 to Q.5) will be selected from all the modules